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Attachment 1 contain PROPRIETARY information.

GNRO-2011/00032

May 3, 2011

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

SUBJECT: Responses to NRC Requests for Additional Information Pertaining to License Amendment Request for Power Range Neutron Monitoring System (TAC No. ME2531)

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

REFERENCES:

1. Entergy Operations, Inc. letter to the NRC (GNRO-2009/00054), *License Amendment Request – Power Range Neutron Monitoring System Upgrade*, November 3, 2009 (ADAMS Accession No. ML093140463)

2. NRC e-mail to Entergy Operations, Inc., *Grand Gulf Request for Additional Information Regarding Power Range Neutron Monitoring System License Amendment Request (TAC No. ME2531)*, April 27, 2011 (ADAMS Accession Nos. ML111170424 and ML111170432)

Dear Sir or Madam:

In Reference 1, Entergy Operations, Inc. (Entergy) submitted to the NRC a license amendment request (LAR), which proposes to revise the Grand Gulf Nuclear Station (GGNS) Technical Specifications (TS) to reflect the installation of the digital General Electric-Hitachi (GEH) Nuclear Measurement Analysis and Control (NUMAC) Power Range Neutron Monitoring (PRNM) System.

In Reference 2, the NRC staff transmitted 29 Requests for Additional Information (RAIs) to support their review and approval of Reference 1. Responses to RAIs 4, 7, 11, 13, 16, 17, 25, and 26 are provided in Attachment 1.

GEH considers certain information contained in Attachment 1 to be proprietary and, therefore, requests it be withheld from public disclosure in accordance with 10 CFR 2.390. The associated affidavit is also provided in Attachment 1. A non-proprietary, redacted version of Attachment 1 is provided in Attachment 2.

When Attachment 1 is removed from this letter, the entire document is NON-PROPRIETARY.

The No Significance Hazards Determination and the Environmental Consideration provided in Reference 1 are not impacted by these responses.

This letter contains no new commitments.

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

I declare under penalty of perjury that the foregoing is true and correct; executed on May 3, 2011.

Sincerely,

MAK/ghd

Attachments:
1. Responses to NRC Requests for Additional Information Pertaining to License Amendment Request – Power Range Neutron Monitoring System Upgrade with Affidavit Supporting Request to Withhold Information from Public Disclosure (Proprietary Version)
2. Responses to NRC Requests for Additional Information Pertaining to License Amendment Request – Power Range Neutron Monitoring System Upgrade (Non-Proprietary Version)

cc: Mr. Elmo E. Collins, Jr.
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NRC Senior Resident Inspector
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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, GG-PRNM-168777-EC130, "NRC Instrumentation and Controls Branch RAIs 4, 7, 11, 13, 16, 17, & 26," dated April 28, 2011. The GEH proprietary information in Enclosure 1, which is entitled "GEH Responses to GGNS NRC I&CB RAIs 4, 7, 11, 13, 16, 17, & 26" is identified by a dotted underline inside double square brackets. [[This sentence is an example.{3}]] Figures and large equation objects containing GEH proprietary information are identified with double square brackets before and after the object. 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 instrumentation and control equipment used in the design and analysis of the power range neutron monitoring system 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.

GE-Hitachi Nuclear Energy Americas LLC

(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 April 2011.

Edward D. Schrull, PE
Vice President, Regulatory Affairs
Services Licensing
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ATTACHMENT 2

GNRO-2011/00032

RESPONSES TO NRC REQUESTS FOR ADDITIONAL INFORMATION PERTAINING TO LICENSE AMENDMENT REQUEST POWER RANGE NEUTRON MONITORING SYSTEM UPGRADE

(NON-PROPRIETARY VERSION)

NON-PROPRIETARY INFORMATION

RESPONSES TO NRC REQUESTS FOR ADDITIONAL INFORMATION PERTAINING TO LICENSE AMENDMENT REQUEST POWER RANGE NEUTRON MONITORING SYSTEM UPGRADE

By application dated November 3, 2009, Entergy Operations, Inc. (Entergy) requested NRC staff approval of an amendment to the Grand Gulf Nuclear Station, Unit 1 (GGNS) Technical Specifications (TS) to reflect installation of the digital General Electric - Hitachi (GEH) Nuclear Management Analysis and Control (NUMAC) Power Range Neutron Monitoring (PRNM) System.[1]

Entergy received an e-mail from the NRC GGNS Project Manager on April 27, 2011 requesting additional information needed to support their review and approval of the proposed amendment.[2] Responses to Requests for Additional Information (RAIs) 4, 7, 11, 13, 16, 17, 25, and 26 are provided in this attachment.

NRC RAI 4

BTP 7-14 Acceptance Criteria for Design Outputs identifies for Correctness that "Unused or unneeded functions and code should not be in the safety-related software, even if the software developer wishes to include them for ease of use, future development, or other reasons. The system and software requirements and the final code should be examined to insure that only those features need to implement the safety functions and to perform system and software testing are included."

Describe the operation of the safety-related software when the jumper is present in sufficient detail for evaluation to satisfy the above criteria or to determine the approach to be an acceptable alternative. The description should include, but is not limited to, a discussion of the method used to jumper out the Detect and Suppress Solution - Confirmation Density (DSS-CD) trip—a 4th Oscillating Power Range Monitor (OPRM) function—and the means to verify the jumper's presence.

The following further clarifies the rationale for this RAI but does not include additional information requests. RAI #3's response in Attachment 1 to GNRO-2010-00035 (ML101410094) identified the existence of this jumper but it neither explained the rationale for installing it nor did it provide sufficient detail to allow an evaluation of the implementation and verification of this jumper's presence (or future absence) to determine that it cannot cause an adverse affect on PRNMS safety functions and does not result in unused code (the DSS-CD function) within the PRNMS when the jumper is present.

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[1] Entergy Operations, Inc. letter to the NRC, *License Amendment Request – Power Range Neutron Monitoring System Upgrade*, dated November 3, 2009 (ADAMS Accession No. ML093140463)

[2] NRC e-mail to Entergy Operations, Inc., *Grand Gulf Request for Additional Information Regarding Power Range Neutron Monitoring System License Amendment Request (TAC No. ME2531)*, April 27, 2011 (ADAMS Accession Nos. ML111170424 and ML111170432)

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Response

Overview

As discussed in the response to the previous RAI #3 in Attachment 1 to GNRO-2010-00035 (ML101410094), Entergy is seeking approval to install PRNMS as part of a phased approach to increase plant power output and improve operational flexibility at GGNS. Initially, PRNMS will support Extended Power Uprate (EPU) operations, for which Entergy has already requested approval in a separate license amendment request (LAR). Later, Entergy intends to submit a separate LAR for Maximum Extended Load Line Limit Analysis Plus (MELLLA+) operations.

To support this approach, Entergy will install two sets of jumpers to disable the OPRM outputs to RPS for specific periods of times. One set will be used to disable the outputs to RPS based on the three Option III algorithms during the 90-day OPRM Monitoring Period. The second set will be used to disable the outputs to RPS based on the DSS-CD algorithm until Entergy obtains NRC approval for MELLLA+ operations.

The jumpers disable the OPRM outputs from PRNMS to RPS, but do not have any effect on the PRNMS hardware or software. There is no PRNMS hardware or software feature to detect the presence of the jumpers. Similarly, the Option III and DSS-CD OPRM algorithms do not affect each other.

The remainder of this response provides additional details about various aspects of the jumpers and the OPRM functions.

Jumpers

Figure 4-1 provides a sketch of the interface between the NUMAC APRM/OPRM Channel 1 and the RPS Trip System at GGNS, which is typical for the system. The relevant portions of PRNMS and RPS are shown to the left and right of Terminal Board #5 (TB5), respectively. The DSS-CD and Option III trip relays and associated contacts are shown within the 2-Out-Of-4 Logic Module. The jumper wires are shown installed on TB5 terminals across the RPS trip relay contacts for both functions: DSS-CD jumpers TB5-29 to 38 and TB5-32 to 40; and Option III jumpers TB5-30 to 39 and TB5-33 to 41.

The presence of these jumpers has no effect on the system; the software execution is the same whether or not the jumpers are installed.

OPRM Monitoring Period

The OPRM Monitoring Period is discussed in detail in Section 3.3.3 of Reference 1 with the NRC's acceptance documented in Section 1.0 of Reference 2. Its application to GGNS is documented in Section 3.3 of Attachment 1 to Reference 3.

Entergy will temporarily remove the traditional Option III output trips from the RPS logic by installing electrical jumper wires (shown for Channel 1 on Figure 4-1, TB5-30 to 39, and TB5-33 to 41), bypassing the OPRM Option III trip relay contacts. After completing the OPRM Monitoring Period, Entergy will place the Option III algorithms in service by removing this set of jumpers. The benefit of this approach is that no accompanying change to any NUMAC

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equipment is required since the presence of these jumpers does not affect the system's ability to perform its function. This is the standard approach that has been implemented successfully at other plants where NUMAC PRNMS is installed.

DSS-CD

The DSS-CD function is the fourth stability solution algorithm installed in each APRM/OPRM channel module. Reference 4 documents DSS-CD in detail. As discussed in the response to the previous RAI #3 in Attachment 1 to GNRO-2010-00035 (ML101410094), GGNS is not requesting approval to enable the DSS-CD function at this time. Therefore, the DSS-CD jumper set will remain in place as part of the PRNMS design until GGNS receives approval from the NRC to operate with DSS-CD and they are removed via an engineering change to the system.

The advantage to this approach is that no change to PRNMS will be required beyond removing the jumpers. It also provides a period during which the DSS-CD algorithm may be observed at GGNS while it operates in the background at the plant.

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Jumper Operations and Installation Control

To illustrate how the jumper sets will prevent a trip output from reaching RPS, assume the conditions for a DSS-CD trip are met for at least two unbypassed APRM/OPRM channels when the system is configured as per Figure 4-1. The response may be understood by tracing the signals and automatic actions, going from left to right on the diagram.

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The Option III and DSS-CD jumpers are to be installed properly in the terminal boards in accordance with the connection diagram furnished by the vendor. This diagram shows the correct connection of the jumper wires on the terminal boards, as well as all cables that are provided with the NUMAC equipment. During installation, an electrical scheme check and a functional test are required to ensure correct installation of the jumpers and operation of the equipment. These actions provide adequate assurance that the jumpers are installed correctly and serve their intended purpose.

References

1. NEDC-32410P-A Volume 1, "Nuclear Measurement Analysis and Control Power Range Neutron Monitor (NUMAC PRNM) Retrofit Plus Option III Stability Trip Function," October 1995

2. NRC Letter to Mr. David W. Reigel, "Acceptance of Licensing Topical Report NEDC-32410P, Nuclear Measurement Analysis and Control Power Range Neutron Monitor. (NUMAC-PRNM) Retrofit Plus Option III Stability Trip Function (TAC No. M90616)," September 1995

3. Entergy Letter to the NRC, *License Amendment Request – Power Range Neutron Monitoring System Upgrade*, November 3, 2009 (Accession No. ML093140463)

4. NEDC-33075P-A, "General Electric Boiling Water Reactor Detect and Suppress Solution – Confirmation Density (DSS-CD)," January 2008

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Figure 4-1

APRM/OPRM Channel 1 interface to the RPS

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NRC RAI 7

Regulatory Guide 1.152, "Criteria for Use of Computers in Safety Systems of Nuclear Power Plants" (ML053070150), endorses IEEE Std. 7-4.3.2-2003, and IEEE Std. 7-4.3.2 clause 5.11, Identification, states that "Means shall be included in the software such that the identification may be retrieved from the firmware using software maintenance tools."

Describe the characteristics of the identification used for microprocessor and PLD firmware in sufficient detail for evaluation to satisfy the above criteria or to determine them to be acceptable alternatives.

The following further clarifies the rationale for this RAI but does not include additional information requests. RAI #1's response in Table 1-11 of Attachment 2 to GNRO-2010/00051 (ML102150028) does not identify the degree, if any, that firmware version information can be retrieved by maintenance tools.

Response

The NUMAC Software Configuration Management Plan (SCMP) specifies revision (including version) controls on an instrument, project, and firmware release basis. The PRNM software is released as hardware with an issued part number for identification.

Any changes in the software, either revision or version, would be released with a new part number. Therefore, the retrieval of the software identification can be accomplished without the use of software maintenance tools.

For each instrument application, the firmware programming is burned into the EPROM or PLD, which is non-alterable. The EPROM and PLD are treated as a hardware assembly with the firmware as one of its parts. An assembly part number is assigned to each EPROM or PLD. The assembly parts list includes the blank EPROM or PLD and the document for the software programming, which includes the software or location where the software is archived and the checksum for the software. The checksum is used to confirm the correct software is burned into the EPROM or PLD. A label of the part number is then placed on the EPROM or PLD for the unique identification of the corresponding firmware. Both firmware and software are maintained in the GEH product management system (e.g., eMatrix) as an issued part with configuration control.

As an issued part, the firmware is also maintained in the GEH quality system and can be retrieved without the need for any tools. The issuance of the part number is performed in accordance with the GEH Engineering Operating Procedures. Compliance with IEEE Standard 7-4.3.2-2003, clause 5.11 is discussed below, based on the requirements of NUREG-0800 Standard Review Plan, Appendix 7.1-D, "Guidance for Evaluation of the Application of IEEE Standard 7-4.3.2." In the discussion, each requirement is followed by an explanation of how it is met.

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From Appendix 7.1-D of NUREG-0800:

5.11 Identification (IEEE Standard 7-4.3.2-2003 Clause 5.11)

To provide assurance that the required computer system hardware and software are installed in the appropriate system configuration, the following identification requirements specific to software systems should be met:

i. Firmware and software identification should be used to assure the correct software is installed in the correct hardware component.

This requirement is met by the issuance of a part number for the firmware and by placing the part number label on the EPROM or PLD. The part number identifies both the type of IC being used and the software that is embedded into the EPROM or PLD.

ii. Means should be included in the software such that the identification may be retrieved from the firmware using software maintenance tools.

NUMAC firmware/software does not require the use of software maintenance tools like a PLC based system for maintenance. It is maintained within GEH quality system and can be retrieved as needed based on the issued part number. Any changes in the software would result in the issuance of a new part number.

iii. Physical identification requirements of the digital computer system hardware shall be in accordance with the identification requirements in IEEE Standard 603-1991.

This requirement is met by the issuance of a part number for the firmware and by placing the part number label on the EPROM or PLD.

iv. The identification should be clear and unambiguous. The identification should include the revision level, and should be traceable to configuration control documentation which identifies the changes made by that revision.

This requirement is met in that each EPROM or PLD has a unique part number. Any revision or version change of the software would result in a change in the part number.

An example of the EPROM identification is as follows: The ASP EPROM is identified as 148C6123G00x. The parts list for 148C6123G00x would identify the EPROM assembly 265A3025G00x, where the group numbers are determined by the project application. The parts list for 265A3025 specifies the IC for the EPROM as 265A1404P004 and the software programming as 265A3028P001 for Group 1 application. The same structure applies to the identification of a PLD.

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NRC RAI 11

Describe in detail the analysis performed to evaluate any potential common-cause programming failure of the PCI that could adversely affect safety functions performed by the Rod Control & Indication System (RC&IS).

The following further clarifies the rationale for this RAI but does not include additional information requests. The PCI is a new component that had not been previously analyzed in the LTR, the PCI provides a non-safety interface with the RC&IS, and GGNS UFSAR Section 7.7.1.2.1.3 states that "the rod control and information system is an operational system with some safety function." RAI #3's response in Attachment 1 to GNRO-2010/00051 (ML102150028) references a prior SER statement that "GE performed equipment failure analyses to evaluate the effects of module level failures on critical system functions, and to assess qualitatively the defense-in-depth of the PRNMS;" however, it has not been demonstrated that this prior analyses remains sufficient, a PCI to RC&IS interface was not previously identified. Therefore, it has not been demonstrated that failures of this interface were previously analyzed to address potential adverse effects on the RC&IS.

Response

A postulated common-cause programming failure of the PCI cannot adversely affect the functions of the Rod Control and Information System (RC&IS) that are required for safety.

As documented in the GGNS UFSAR (Reference 1, Section 7.7.1.2.1.3), RC&IS is an operational system with some safety functions. RC&IS does not include any of the circuitry or devices used to automatically or manually trip the reactor. Certain portions of RC&IS pertaining to rod blocks and pattern control are, however, classified as required for safety. The Rod Pattern Controller (RPC) instrumentation and Rod Action Control Subsystem (RACS) of RC&IS perform the rod pattern control and rod block functions.

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Additional information pertaining to the rod pattern control and rod block functions of RC&IS along with the diversity of RC&IS and PRNM hardware and firmware are provided below.

Rod Pattern Control Functions

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Figure 11-2

Rod Pattern Control Simplified Block Diagram

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Table 11-1

Rod Pattern Controller Input Parameters

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Rod Block Functions

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Table 11-2

RC&IS Rod Insert Permissive Input Parameters

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Table 11-3

RC&IS Rod Withdraw Permissive Input Parameters

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Table 11-3

RC&IS Rod Withdraw Permissive Input Parameters

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Refuel-Mode Rod Withdrawal Permissive

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Diversity of RC&IS and PRNM Hardware/Firmware

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Conclusion

RC&IS does not utilize inputs from the PCI for performance of rod pattern control and rod block functions, which are the only RC&IS functions required for safety. The only inputs from PRNMS utilized in RC&IS rod pattern control and rod block functions are transmitted from PRNMS to RC&IS, using safety-related 2-Out-Of-4 logic module relay outputs, independently of the PCI. Data provided by the PCI to RC&IS is used only to provide LPRM status indications on the display portion of the legacy operator control module. Portions of the BWR-6 RC&IS architecture that perform the rod pattern control and rod block functions are diverse from the NUMAC PCI. A common-cause failure of firmware installed on one or more PCI instruments, therefore, cannot adversely impact the ability of RC&IS to perform the rod pattern control and rod bock functions. Hardware and firmware, which performs the rod pattern control and rod block functions in the BWR-6 RC&IS architecture is diverse from that of the PCI. Thus, failure of one or more PCI instruments, including postulated common-cause software failures of the PCI instruments, has no adverse impact on RC&IS functions that are classified as required for safety in the GGNS UFSAR.

References

1. Entergy Grand Gulf Nuclear Station Updated Final Safety Analysis Report (UFSAR), dated August 2009, Section 7.7.1.2.1.3

2. Power Range Neutron Monitoring System Elementary Drawing, 105E1503WA Revision 3, sheets 19, 20, 21, 22, 25, and 31

3. Reactor Protection System Elementary Drawing, 828E531BA Revision 27, sheets 2, 3, 5, and 6

4. Rod Control and Information System Block Diagram, 865E910 Revision 0, sheet 1

5. Rod Control and Information System Elementary Drawing, 851E478BA Revision 12, sheets 2, 3, and 4

6. Rod Control and Information System (RC&IS) Performance Specification, 22A4548, Revision 1, sheets 3-102, 6-3, 6-12, 6-13, 6-14, 6-54, 6-114, 6-117, and 6-123

7. Operation & Maintenance Manual for the Rod Pattern Controller, General Electric File No. 442X561-014, sheets 1-7, C-1

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NRC RAI 13

Staff Position 1.8 of DI&C-ISG-04 states that "Data exchanged between redundant safety divisions or between safety and nonsafety divisions should be processed in a manner that does not adversely affect the safety function of the sending divisions, the receiving divisions, or any other independent divisions."

Describe in detail each of the following four (4) interfaces to satisfy the above criteria or to determine the proposed approach is an acceptable alternative:

i) Interface(s) between the PCI and the RC&IS

ii) Interface(s) between the two-out-of-four voter and the RC&IS

iii) Inter-divisional interfaces between PCIs

iv) Inter-divisional interfaces between two-out-of-four voters

For each interface describe:

(e) whether it is an interface between non-safety and safety, or non-safety and non-safety;

(f) how independence among safety-divisions is maintained through an explanation of the protocol, data and signal format, data flow, and isolation provided;

(g) the evaluation of the interface to satisfy DI&C-ISG-04 and BTP 7-19 or the justification why the criteria does not apply;

(h) the corresponding section(s) of the PRNMS LTR that describes the interface.

The following further clarifies the rationale for this RAI but does not include additional information requests. These interfaces were first depicted in replacement Figure E.2.1 of Attachment 6 to GNRO-2010/00040 (ADAMS Accession No, ML101790438). The NRC staff currently understands that this PCI to RC&IS interface corresponds to the replacement Section 5.3.17.3.4 of Attachment 6 to GNRO-2010/00040; however, this remains unclear. No subsection under 5.3.17 could be identified for the two-out-of-four voter and RC&IS interface. The DI&C-ISG-04 compliance matrix in Attachment 6 to GNRO-2010/00040 (ML101790438) has limited focus on the non-safety to safety interfaces between the PCI and APRM/OPRM and the inter-divisional safety to safety interface between each APRM/OPRM and all four 2-out-of-4 voters. The information provided did not address design features that would prevent data from one safety division to pass through a PCI and potentially defeat APRM/OPRM channel redundancy.

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Response

1. Interface(s) between the PCI and RC&IS

(a) Interface Classification

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(b) Safety System Independence

Because this is a non-safety-to-non-safety interface, the safety system independence requirement does not apply.

(c) DI&C-ISG-04 and BTP 7-19 Requirements

The criteria for DI&C-ISG-04 and BTP 7-19 do not apply for the PCI-to-RC&IS interface because it is a non-safety-to-non-safety interface.

(d) PRNMS LTR Sections

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2. Interface(s) between the 2-Out-Of-4 Logic Module and RC&IS

(a) Interface Classifications

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These signals are processed by RC&IS to generate rod blocks (See Section 3.3.1 of Reference 1). The 2-Out-Of-4 logic module is safety-related. The inputs from PRNMS go into the Rod Action Control System (RACS) of RC&IS. The RACS is classified as a non-safety-related system (see Chapter 7.7.1.2 of UFSAR (Reference 3)). The APRM rod block signals are not credited by any safety analysis in Reference 3. Therefore, this is a safety-to-non-safety interface.

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This interface is the same as the existing APRM-to-RC&IS interface. The implementation of PRNMS at GGNS only changes the equipment that provides the relay output signals.

(b) Safety System Independence

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]] Existing isolators are provided at the RACS in RC&IS so that a failure in the equipment in the RACS will not affect the safety-related PRNMS equipment.

(c) DI&C-ISG-04 and BTP 7-19

This interface meets the criteria of DI&C-ISG-04 as described in Item 8 (Staff Position 1.8) of Attachment 3 to Reference 2. [[

]] Isolators are provided at the RACS in RC&IS so that a failure in the equipment in the RACS will not affect the safety-related PRNMS equipment.

(d) PRNMS LTR Sections

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3. Interdivisional Interfaces between PCIs

(a) Interface Classification

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(b) Safety System Independence

Because this is a non-safety-to-non-safety interface, the independence among safety system requirement does not apply.

(c) DI&C-ISG-04 and BTP 7-19

The criteria for DI&C-ISG-04 and BTP 7-19 do not apply for the PCI-to-PCI interface because it is a non-safety-to-non-safety interface.

(d) PRNMS LTR Sections

[[

]]

4. Inter-divisional interfaces between 2-Out-Of-4 Logic Modules

(a) Interface Classification

[[

]] Therefore, this is a safety-to-safety interface among safety channels.

(b) Safety System Independence

[[

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(c) PRNMS LTR Sections

[[ ]]
Therefore, the criteria for DI&C-ISG-04 and BTP 7-19 do not apply for the interdivisional interfaces between the 2-Out-Of-4 logic modules.

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(d) PRNMS LTR Sections

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Figure 13-1

Interface between 2-Out-Of-4 Logic Modules and RC&IS

References

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

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2. M. A. Krupa (Entergy Operations, Inc.) to U.S. Nuclear Regulatory Commission Document Control Desk, "Responses to NRC Requests for Additional Information Pertaining to License Amendment Request for Power Range Neutron Monitoring System (TAC No. ME2531)," GNRO-2010/00040, dated June 3, 2010 (ADAMS Accession No. ML101790436)

3. Entergy Grand Gulf Nuclear Station Updated Final Safety Analysis Report (UFSAR)

NRC RAI 16

Staff Position 1.10 of DI&C-ISG-04 governs communications of a safety division with maintenance and monitoring equipment.

Describe in detail the communications used in performance of maintenance and monitoring to completely address Staff Position 1.10 of DI&C-ISG-04, including the following to satisfy the above criteria or to determine the proposed approach is an acceptable alternative:

(a) whether the dedicated division's local front panel is required to be used to confirm gain adjustments prior to use and without regard to the method used to provide gains to the APRM;

(b) whether only one division's gains may be confirmed/accepted at a time;

(c) whether the communication path that provides gains to the APRM via the NUMAC Interface Computer is connected and active at all times; and

(d) whether the restriction to adjust only one division's gains at a time is by means of physical cable disconnect, or by means of keylock switch that either physically opens the data transmission circuit or interrupts the connection by means of hardwired logic (versus reliance upon a combination of firmware enable, password and/or reading keylock position, and administrative controls).

The following further clarifies the rationale for this RAI but does not include additional information requests. The RAI response DI&C-ISG-04 compliance matrix in Attachment 3 to GNRO-2010/00040, items #39 through #41, did not address all of Staff Position 1.10.

Response

The PRNM system architecture does not allow software changes online. [[

]] This satisfies the DI&C-ISG-04 Staff Position 1.10 requirements, "Safety division software should be protected from alteration while the safety division is in operation. On-line changes to safety system software should be prevented by hardwired interlocks or by physical disconnection of maintenance and monitoring equipment."

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Changes to parameters and setpoints, including the gains, in a given APRM channel can only be made from the front panel display of the master APRM instrument or LPRM instrument in that channel. [[

]] Further discussion about the communication over the dedicated serial data link is presented below in the response to (c). This is an alternative to the DI&C-ISG-04 Staff Position 1.10 requirement, "A workstation (e.g. engineer or programmer station) may alter addressable constants, setpoints, parameters, and other settings associated with a safety function only by way of the dual-processor / shared memory scheme described in this guidance, or when the associated channel is inoperable."

There is no common maintenance workstation that could be used to accept pending gains or alter any addressable constants, setpoints, parameters, or other settings in more than one channel at a time. This meets the DI&C-ISG-04 Staff Position 1.10 requirement, "Such a workstation should be physically restricted from making changes in more than one division at a time. The restriction should be by means of physical cable disconnect, or by means of keylock switch that either physically opens the data transmission circuit or interrupts the connection by means of hardwired logic."

The two types of gains specifically discussed in this response are APRM gain (based on core thermal power) and LPRM detector gains (based on LPRM gain adjustment factors). The pending APRM gain and pending LPRM detector gain adjustment data can be downloaded from the plant process computer, but must still be accepted at the master APRM instrument or LPRM instrument front panel display. The pending APRM and LPRM gains for the LPRM detectors processed at the master APRM instrument are accepted at the master APRM instrument front panel display, not at the LPRM instrument front panel display. The pending gains for LPRM detectors processed at the LPRM instrument are accepted at the LPRM instrument front panel display, not at the master APRM instrument front panel display. The high level communication path for pending gains downloaded from the plant process computer is shown below in Figure 16-1.

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Figure 16-1

High Level Communication Path for Pending Gain Download from Plant Process Computer

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Additional information about changing APRM gain and LRPM detector gains is discussed below.

(a) As stated above, the front panel display of the master APRM instrument or LPRM instrument within an APRM channel must be used to confirm the pending APRM gain adjustment and pending LPRM detector gain adjustments for that APRM channel, regardless of the method used to provide the pending gains to the APRM channel.

[[

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(b) Each master APRM instrument and LPRM instrument in each of the four APRM channels has its own front panel display. As stated above, the pending gains for a given APRM channel can only be accepted from the front panel display of the master APRM instrument or LPRM instrument in that APRM channel.

(c) The communication path that provides pending gains to the master APRM instrument and LPRM instrument from the NUMAC Interface Computer (NIC) is connected and active at all times. The communication path has been analyzed and demonstrated not to impact the APRM's ability to perform its safety function, as discussed below.

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(d) As stated above, there is no common maintenance workstation that could be used to accept pending gains in more than one APRM channel at a time. Therefore, the requirement to physically restrict connection of such a workstation to only one APRM channel at a time as described in DI&C-ISG-04 Staff Position 1.10 is met. A combination of security features in conjunction with administrative controls are used to restrict access to the setup screens that allow gain adjustments to be made, as described above in the discussion about the different security levels.

References

1. NEDC-32410P-A, "Nuclear Measurement Analysis and Control Power Range Neutron Monitor (NUMAC PRNM) Retrofit Plus Option III Stability Trip Function," October 1995

2. GEH NUMAC PRNM Requirements Specification, 24A5221WA

3. GEH PRNMS FDDI Protocol Specification, 26A7529WA

4. GEH APRM COMMBLOCKS Performance Specification, 26A8217

5. GEH APRM Functional Software Design Specification, 26A7523

NRC RAI 17

With respect to maintenance and monitoring, describe the administrative controls using terminology consistent with the LTR and in full consideration of the response to RAI #16 above sufficiently to address:

(a) Whether the activities associated with use of the OPERATE-SET mode are achieved at the local channel's front panel;

(b) How the OPERATE-SET mode is entered; and

(c) To explicitly map the description to the three levels of security that are identified in the LTR paragraph 5.3.13.

The following further clarifies the rationale for this RAI but does not include additional information requests. RAI #9's response in Attachment 1 to GNRO-2010/00040 (ML101790436) does not use the same terminology as the LTR and is difficult to correlate with the response provided for Staff Position 1.10 of DI&C-ISG-04 or key switch position/features that may be built into a NUMAC instrument.

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Response

The following is a description of the administrative controls, using terminology consistent with the LTR, Section 5.3.13 of NEDC-32410P-A (Reference 1), to address items a, b, and c above:

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The key for the keylock switch and password will be controlled by GGNS Operations in accordance with plant procedures.

References

1. NEDC-32410P-A, "Nuclear Measurement Analysis and Control Power Range Neutron Monitor (NUMAC PRNM) Retrofit Plus Option III Stability Trip Function," October 1995

2. NUMAC PRNM Requirements Specification, 24A5221WA

3. APRM User Manual, 26A8196

NRC RAI 25

Describe whether a licensing commitment or condition is intended to address the statements that Entergy will complete actions to establish the as-found and as-left tolerances and to reflect them in the associated surveillance test procedures prior to startup.

The following further clarifies the rationale for this RAI but does not include additional information requests. RAI #10 response in Attachment 1 to GNRO-2010/00040 (ML101790436) appears to contain statements that create either licensing commitment or condition.

Response

Entergy made the following commitment as part of the response to RAI 10 in Attachment 1 to GNRO-2010/00040:

> "Per the guidance provided in TSTF-493, Rev. 4, Entergy will set the as-found tolerance equal to the Square Root Sum of the Squares (SRSS) combination of as-left tolerance and the projected drift. The as-found and as-left tolerances will be reflected in the associated surveillance test procedures."

The scheduled completion date for this commitment is denoted as "Prior to startup from the 2012 refueling outage."

NRC RAI 26

Describe the number and nature of APRM channel-to-PCI interfaces in sufficient detail to establish whether the LPRM-to-PCI interfaces represent four of eight APRM channel-to-PCI interfaces, whether inter-divisional communications among all four PCI channels is required to produce a valid Recirculation Flow channel check alarm, and the expected behavior of the Recirculation Flow channel check alarm when either an inter-divisional communication between PCI channel is unavailable or the APRM channel is INOP.

The following further clarifies the rationale for this RAI but does not include additional information requests. RAI #6's response in Attachment 6 to GNRO-2010/00040 (ML101790438) discusses eight APRM channel-to-PCI interfaces (eight are described in the modifications for paragraphs 3.2.3.2.2 and 5.3.17.3.3). However, only four APRM-to-PCI interfaces are shown in replacement Figures E.1.7 and E.2.1 of Attachment 6 to

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GNRO-2010/00040. The affect that communication failures may have on Recirculation Flow channel check alarms has not been fully described.

Response

NEDC-32410P-A Section 2.3.3.1.2 describes the APRM/LPRM instrument configuration in PRNMS for plants with 35 or more LPRM detector strings, where each of the four APRM channels consists of one APRM instrument and one LPRM instrument. The GGNS core design has 44 LPRM detector strings; as such there are a total of four APRM instrument and four LPRM instrument in PRNMS. This is consistent with the overall system configuration in replacement Figure E.1.7 of Attachment 6 to GNRO-2010/00040.

This response provides details of the communication interfaces among the four APRM instrument, four LPRM instrument and four PCI instrument, a description of the recirculation flow check logic among the four APRM channels, as well as how recirculation flow inputs are checked for validity before being used for the flow check calculation.

The communication interfaces among the instrument are illustrated in Figure 26-1.

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Figure 26-1

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