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MFN 07-285, Supplement 2

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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 143 Related to ESBWR Design Certification Application - RAI Number 7.2-2 Supplement 2**

The purpose of this letter is to submit the GE Hitachi Nuclear Energy (GEH) response to the U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) sent by NRC letter dated January 31, 2008. The RAI response is included in Enclosure 1.

If you have any questions or require additional information, please contact me.

Sincerely,

James C. Kinsey

James C. Kinsey
Vice President, ESBWR Licensing

D068
NRO

Reference:

1. MFN 08-097, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, GE, *Request For Additional Information Letter No. 143 Related To ESBWR Design Certification Application*, dated January 31, 2008

Enclosure:

1. Response to Portion of NRC Request for Additional Information Letter No. 143 Related to ESBWR Design Certification Application - RAI Number 7.2-2, Supplement 2

cc:

AE Cubbage	USNRC (with enclosure)
GB Stramback	GEH/San Jose (with enclosure)
RE Brown	GEH/Wilmington (with enclosure)
DH Hinds	GEH/Wilmington (with enclosure)
eDRF	0000-0083-3103 (RAI 7.2-2 Supplement 2)

Enclosure 1

MFN 07-285, Supplement 2

Response to Portion of NRC Request for Additional Information Letter No. 143 Related to ESBWR Design Certification Application –

RAI Number 7.2-2, Supplement 2

For historical purposes, the original text of NRC RAIs 7.2-2 and 7.2-2 Supplement 1 with the GE response are included.

NRC RAI 7.2-2

Please provide detailed interface information for each of these systems, listed in Section 7.2.1.2.1, including logic diagrams to indicate signal paths, physical, electrical, and communication independence, channel separation, isolation between safety-related and nonsafety-related portions of the various systems as listed in the DCD:

- *Essential Distributed Control and Information System (E-DCIS)*
- *Safety System Logic and Control (SSLC)*
- *Neutron Monitoring System (NMS)*
- *Nuclear Boiler System (NBS)*
- *Control Rod Drive System (CRDS)*
- *Containment Monitoring System*
- *Suppression Pool Temperature Monitoring (SPTM) function*
- *Rod Control and Information System (RC&IS)*
- *Leak Detection and Isolation System (LDIS)*
- *Isolation Condenser System (ICS)*
- *Steam Bypass and Pressure Control (SBPC)*
- *Plant Automation System (PAS)*
- *Main Control Room Panel*
- *Non-Essential DCIS (NE-DCIS)*
- *Uninterruptible AC Power Supply*
- *Instrumentation and Control Power Supply*
- *DC Power Supply*
- *Raceway System*

GE Response

GE letter MFN-06-240 recently transmitted NEDO-33251,"ESBWR I&C Defense-In- Depth and Diversity Report." This reports discusses the requested interface information available at this phase of the design process.

Specifically, NEDO-33251, Section 2.1 discusses the physical arrangement of the above systems as they relate to functional separation and diversity. Sections 2.2 and 2.3 further describe the remaining interface information requested. Section 3.3 provides information related to I&C fault tolerant design features (separation, isolation, asynchronous operation and other features.)

In addition to NEDO-33251, the detailed design information requested for the Suppression Pool Temperature Monitoring System is described in Subsection

7.2.3.2 of DCD Tier 2, and the onsite power supply systems (including the DC Power Supply system) are described in Section 8.3.

Preliminary logic diagrams for the above systems continue to be developed. They will be available for review in accordance with the agreed upon schedule.

DCD Impact

No DCD change is required by this response.

NRC RAI 7.2-2 S01

The response provides that NEDO-33251,"ESBWR I&C Defense-In-Depth and Diversity Report." discusses the requested interface information available "at this phase" of the design process. This report does not provide, nor should it, the necessary interface information between these systems and the RPS. This report only references "isolation" between safety divisions and safety to non-safety communication. The report offers that ESBWR power and DCIS are "functionally" separated and division 1 & 2 HCU solenoid circuits are "further subdivided" without providing procedure or hardware information. If this information will not be included in the DCD, this item should remain open until sufficient ITAAC(s) are developed.

GEH Response

The original RAI requested information pertaining to the proper isolation and separation between the RPS and its interfacing systems. These requirements are addressed by ensuring that there are sufficient ITAAC to validate the isolation and separation requirements of IEEE Std. 603, Section 5.6 and RG 1.75.

This response consists of three sections: (1) An updated list of systems from DCD Tier 2, Rev. 4, Subsection 7.2.1.2.1; (2) Location of general information in DCD Tier 2, Rev. 4 related to IEEE Std. 603, Section 5.6 and RG 1.75; and (3) Discussion of ITAAC used to validate the requirements of IEEE Std. 603, Section 5.6 and RG 1.75.

(1) Updated List of Systems from DCD Tier 2, Rev. 4, Section 7.2.1.2.1

- Safety-related Distributed Control & Information System (Q-DCIS)
- Safety System Logic and Control / Engineered Safety Features (SSLC/ESF)
- Neutron Monitoring System (NMS)
- Nuclear Boiler System (NBS)

- Control Rod Drive System (CRDS)
- Containment Monitoring System (CMS) (including Suppression Pool Temperature Monitoring [SPTM] function)
- Rod Control and Information System (RC&IS)
- Leak Detection and Isolation System (LD&IS)
- Isolation Condenser System (ICS)
- Steam Bypass and Pressure Control (SB&PC) System
- Plant Automation System (PAS)
- MCR Panels
- N-DCIS
- DPS
- Uninterruptible AC Power Supply
- Direct Current (DC) Power Supply
- Raceway System

(2) Location of General Information in DCD Tier 2 Rev. 4 Related to IEEE Std. 603 Section 5.6 and RG 1.75.

The Q-DCIS and N-DCIS functions are implemented with diverse power and sensors as indicated in DCD Tier 2, Figure 7.1-3 and diverse hardware and software architectures as indicated in Figure 7.1-4. As described in Subsection 7.1.2.8.1, the RPS sensors, hardware, and logic are diverse from SSLC/ESF logic, ATWS mitigation logic, and Diverse Protection System logic.

DCD Tier 2, Subsection 7.2.1.2.4.1, "Arrangement," provides arrangement information on the RPS related equipment. This subsection discusses independence and physical separation of the RPS sensor channels and communication between RPS and other systems through optical isolation devices (IEEE Std. 603 Section 5.6). Figure 7.2-1 is a functional block diagram of the RPS, and Figure 7.2-2, "RPS Interfaces and Boundaries Diagram," provides general information on the RPS equipment boundaries and locations.

DCD Tier 2, Subsection 7.2.1.2.4.2, "Initiating Circuits," provides information on the individual sensor channels as well as the interfacing system where the sensor is located. RPS inputs are from dedicated sensors from the interfacing system, e.g., RPS uses dedicated NBS sensors. These sensors are not shared with other functions.

DCD Tier 2, Subsection 7.2.1.2.4.3, "Reactor Protection System Outputs to Interfacing Systems," provides information on RPS outputs to interfacing systems.

DCD Tier 2, Subsection 7.2.1.3, "Safety Evaluation," addresses RPS conformance with IEEE Std. 603, Section 5.6 and RG 1.75.

DCD Tier 2, Subsection 7.1.6.6.1.7, "Independence," (IEEE Std. 603, Section 5.6) addresses the independence between redundant portions of a safety-related system, between safety-related systems and the effects of DBEs, and between safety-related systems and other systems. Where required, proper signal isolation devices are discussed.

For the instrumentation systems, DCD Tier 2, Table 7.1-1, "Regulatory Requirements Applicability Matrix," provides a mapping of the RG 1.75 requirement to the appropriate systems. Each individual system, in its safety evaluation section, references the RG 1.75 requirement to Subsections 8.3.1.3 and 8.3.1.4. These subsections address the physical identification of safety-related equipment and the physical independence of redundant systems.

(3) Discussion of ITAAC that are used to Validate the Requirements of IEEE Std. 603, Section 5.6 and RG 1.75.

Demonstration of conformance with IEEE Std. 603, Section 5.6 also demonstrates conformance with RG 1.75. The ITAAC are described below.

IEEE Std. 603, Section 5.6, "Independence," addresses the physical and electrical separation and isolation requirements for the redundant portions of safety-related systems and interfaces between safety-related systems and other systems. Detailed information on the applicability of IEEE Std. 603 to ESBWR design is presented in DCD Tier 2, Rev. 4, Subsection 7.1.6.6.1 and Table 7.1-2. IEEE Std. 603, Section 5.6 applies to all Q-DCIS systems and to the N-DCIS systems' interface with the RPS. Table 7.1-2 provides a section roadmap for evaluation of compliance to IEEE Std. 603 for each of the Chapter 7 sections.

For the instrumentation systems, DCD Tier 1, Rev. 4, Table 2.2.15-2, ITAAC 3 provides the ITAAC to verify conformance with IEEE Std. 603, Section 5.6, and Table 2.2.15-1 provides the list of applicable systems for the Table 2.2.15.2 ITAAC. For the systems not listed in Table 2.2.15-1 but identified as interfacing with the RPS in Section 1 of this response, the RPS Table 2.2.7-4, ITAAC 4 addresses the RPS interface with these systems.

For the electrical systems, DCD Tier 1, Rev. 4, Table 2.13.3-3, Items 1, 2, 4, and 5, "Direct Current (DC) Power Supply," and Table 2.13.5-2, Items 1, 2, 4, and 5,

"Uninterruptible AC Power Supply," provide the ITAAC to verify the physical identification and independence requirements of IEEE Std. 603, Section 5.6.

DCD Impact

No DCD changes will be made in response to this RAI.

NRC RAI 7.2-2 S02

The response to RAI 7.2-2 S01, MFN 07-285 S01 states; "For the systems not listed in Table 2.2.15-1 but identified as interfacing with the RPS in Section 1 of this response, the RPS Table 2.2.7-4, ITAAC 4 addresses the RPS interface with these systems."

ITAAC 4 does not add information but refers right back to 2.2.15 by merely saying; "Conformance with IEEE Std. 603 requirements by the safety-related control system structures, systems, and components is addressed in Subsection 2.2.15"; ITA "See Subsection 2.2.15"; and Acceptance Criteria "See Subsection 2.2.15"

Neither the RAI response nor the RPS ITAAC identify the systems that interface with the RPS but are not listed in Tier 1, Table 2.2.15-1. Please identify these additional systems and revise ITAAC 4 of Tier 1 RPS Table 2.2.7-4.

GEH Response

The referenced response is revised to state the following:

"For the systems not listed in Table 2.2.15-1 but identified as interfacing with the RPS in Section 1 of this response, the RPS Table 2.2.7-4 ITAAC 2 and 3 address the RPS interface with these systems."

These ITAAC reference Table 2.2.7-2, "RPS Automatic Functions, Initiators, and Associated Interfacing Systems," and Table 2.2.7-3, "RPS Controls, Interlocks (System Interfaces), and Bypasses," respectively. The tables provide the necessary information required for systems that interface with the RPS.

It is not necessary that the referenced tables provide information that exactly matches the list of systems from DCD Tier 2, Revision 4, Subsection 7.2.1.2.1. The RPS ITAAC addresses the subset of these interfacing systems necessary for the safety-related functions of the RPS.

GEH believes that the existing ITAAC for the RPS are adequate and that no changes to ITAAC 4 of Tier 1, RPS Table 2.2.7-4 are required.

DCD Impact

No DCD changes will be made in response to this RAI.