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MFN 07-402 S01

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Subject: **Response to a Portion of NRC Request for Additional Information Letter No. 105, Related to ESBWR Design Certification Application, Equipment Qualification in Tier 1, RAIs 7.1-12 S01 and 7.1-13 S01**

The purpose of this letter is to submit the GE Hitachi Nuclear Energy (GEH) responses to the Reference 1 supplements to U.S. Nuclear Regulatory Commission (NRC) Requests for Additional Information (RAIs) sent by NRC letter dated October 11, 2006. GEH responses to RAI Numbers 7.1-12 S01 and 7.1-13 S01 are addressed in Enclosure 1.

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

Sincerely,

Kathy Sedney for

James C. Kinsey
Vice President, ESBWR Licensing

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NRO

Reference:

1. MFN 07-460, Letter from U.S. Nuclear Regulatory Commission to David Hinds, *Request for Additional Information Letter No. 105 Related to ESBWR Design Certification Application,* August 16, 2007.

Enclosure:

1. MFN 07-402 S01, Response to a Portion of NRC Request for Additional Information Letter No. 105, Related to ESBWR Design Certification Application, Equipment Qualification in Tier 1 and IEEE-603 DAC ITAAC, RAI Numbers 7.1-12 S01 and 7.1-13 S01.

cc:	AE Cubbage	USNRC (with enclosure)
	GB Stramback	GEH/San Jose (with enclosure)
	RE Brown	GEH/Wilmington (with enclosure)
	eDRF sections	0000-0074-0520 R1 and 0000-0074-2431

Enclosure 1

MFN 07-402 S01

Response to a Portion of NRC Request for

Additional Information Letter No. 105

Related to ESBWR Design Certification Application,

Equipment Qualification In Tier 1 and IEEE-603 DAC ITAAC,

RAI Numbers 7.1-12 S01 and 7.1-13 S01

For historical purposes, the original texts of RAIs 7.1-12 and 7.1-13 and their GEH responses are included.

NRC RAI 7.1-12

How is the ESBWR design in conformance with IEEE-603 Safety System Criterion 5.4, Equipment Qualification?

IEEE-603-1991, Safety System Criterion 5.4, Equipment Qualification:

The application document (DCD, Tier 2) should confirm that the safety system equipment is designed to meet the functional performance requirements over the range of normal and worst case (e.g., any transient, accident or anticipated operational occurrence) environmental conditions where the equipment is expected to operate. The DCD, Tier 2, should address mild environment qualification and electromagnetic interference (EMI) qualification of safety system I&C equipment. The DCD should confirm that there is independence between environmental control systems and sensing systems that would indicate the failure or malfunctioning of environmental control systems. The application also should include confirmation that the environmental protection for instrument sensing lines conforms with the guidance of RG 1.151-07/1983, "Instrument Sensing Lines" and EMI qualification conforms with the guidance of RG 1.180, Rev.1,"Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation Control Systems." If some of the activities will be performed beyond the design certification stage, then the DCD should identify the COL action requirements. Appropriate ITAAC acceptance criteria should be proposed to verify this commitment.

Response

DCD Tier 2, Revision 3, Subsection 7.1.6.4, states that instrument sensing lines are designed to satisfy the requirements of RG 1.151 and EMI qualification conforming with RG 1.180. DCD Tier 2, Revision 3, Subsection 7.1.6.6.1.5, states that the safety-related Q-DCIS components are designed to be qualified to operate in the normal and abnormal (including temperature, humidity, pressure, radiation, seismic, and EMI) environments in which they are located.

No COL action requirements are proposed because environmental qualification (EQ) of safety-related equipment will be performed as part of the basic configuration ITAAC and commitment to the design requirements stated in Tier 2 that exists for each applicable safety-related system. A separate ITAAC to demonstrate conformance with Criterion 5.4, Equipment Qualification, is not required because of the basic configuration ITAAC and commitment to the design requirements stated in Tier 2, as stated above.

DCD Impact:

No change to the DCD will be made as a result of the response to NRC RAI 7.1-12.

NRC RAI 7.1-12 S01

The response states that no COL action requirements are proposed because environmental qualification (EQ) of safety-related equipment will be performed as part of the basic configuration ITAAC. However, in Tier 1 Section 1.2.2.1, Verification for Basic Configuration for Systems, states that equipment located in a mild environment during or following a DBA need not be tested or analyzed. The DCD has not addressed mild environment qualification and electromagnetic interference (EMI) qualification of safety system I&C equipment. The digital I&C equipment EQ issue should be addressed either by DAC process or by the COL action requirement.

GEH Response

The statement that equipment located in a mild environment during or following a DBA need not be tested or analyzed is incorrect in DCD Tier #1, Section 1.2.2.1, Revision 3 and the statement and Section 1.2.2.1 were deleted in DCD Tier #1, Revision 4.

DCD Tier #1, Revision 4 Section 1.1.1 contains a new definition "Environmental Qualification," that includes the following statement concerning safety-related equipment located in mild environment, "Safety-related equipment located in a mild environment will be qualified for their environmental requirements through specifications and certifications to the environments; however, for a mild environment, only safety-related digital instrumentation and control equipment will be addressed by ITAAC in Tier 1, consistent with NRC guidance in NUREG-0800, Section 14.3. Additionally, EMI susceptibility and emissions qualification is performed by type testing for the safety-related digital instrumentation and control equipment and is not specifically addressed in an ITAAC."

DCD Tier #1, Revision 4, Section 3.8 has been added to the DCD and it addresses mild environment qualification for safety-related digital I&C. It identifies that safety-related digital I&C equipment located in a mild environment is designed to perform its safety-related function under normal and AOO environmental conditions. Also, DCD Tier #1, Revision 4 includes Table 3.8-1 "ITAAC for Environmental Qualification of Mechanical and Electrical Equipment," which states, in part, safety-related digital I&C equipment located in a mild environment is identified and, analysis will be performed to identify the environmental design bases, type tests, analyses, or a combination of type tests and analyses will be performed, and inspection will be performed to verify the as-installed safety-related digital I&C equipment located in a mild environment.

The digital I&C equipment EQ issue will be addressed with the DAC process.

DCD Tier #2, Section 7.1.3.2, Revision 4 states that Q-DCIS components are subjected to tests for EMI, RFI, and surge conditions that conform with guidelines in RG 1.180.

DCD Impact

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

NRC RAI 7.1-13

How is the ESBWR design in conformance with IEEE-603 Safety System Criterion 5.5, System Integrity?

IEEE-603-1991, Safety System Criterion 5.5, System Integrity:

The application document (DCD, Tier 2) should confirm that tests have been conducted on safety system equipment components and the system racks and panels to demonstrate that the safety system performance is adequate to ensure completion of protective actions over the range of transient and steady-state conditions of both the energy supply and the environment. Where tests have not been conducted, the applicant should confirm that the safety system components are conservatively designed to operate over the range of service conditions. For digital computer-based systems, the confirmation of system real-time performance is adequate to ensure completion of protective action within the critical points of time identified as required. The application should confirm that the design provides for protection systems to fail into a safe state, or into a state demonstrated to be acceptable on some other defined basis, if conditions such as disconnection of the system, loss of energy, or adverse environments are experienced. The application document should include a failure modes and effects analysis. The analysis should justify the acceptability of each failure effect. Failure of computer system hardware or software should not inhibit manual initiation of protective functions or the operator performance of preplanned emergency or recovery actions. Lightning protection should be addressed as part of the electromagnetic compatibility. Lightning protection features should conform with the guidance of RG 1.204, 11/2005, "Guidelines for Lightning Protection of Nuclear Power Plants." If some of the activities will be performed beyond the design certification stage, then the DCD, Tier 2, should identify the COL action requirements. Appropriate ITAAC acceptance criteria should be proposed to verify this commitment.

Response

DCD Tier 2, Revision 3, Subsection 7.1.6.6.1.6, states that the Q-DCIS systems are required to accomplish their safety-related functions under the full range of applicable conditions enumerated in the design basis. Other areas addressed as requirements include adequate system real-time performance for digital computer-based systems to ensure completion of protective action, evaluation of hardware integrity and software integrity (software safety-related analysis, as part of BTP HICB-14 requirements), failure to a safe state upon loss of energy or adverse environmental conditions, and the requirements for manual reset.

Summaries of the equipment qualification test reports and failure modes and effects analyses (FMEAs) will be included in future revisions (as presented in MFN 07-004, dated January 20, 2007 and MFN 07-265, dated June 1, 2007) of the platform specific safety-related system Licensing Topical Reports (LTRs):

- NEDO-33288, "Application of Nuclear Measurement Analysis and Control (NUMAC) for the ESBWR Reactor Trip System," Revision 0, MFN 07-160, March 21, 2007.
- Triconex Topical Report 7286-545-1-A, "Qualification Summary Report, Nuclear Qualification of Tricon Triple Modular Redundant PLC System," Revision 1-A, MFN 07-101, March 2, 2007.

NEDO-33288 addresses the ESBWR reactor trip system architecture and Triconex Topical Report 7286-545-1-A addresses the ESBWR SSLC/ESF system architecture.

DCD Tier 2, Revision 3, Subsection 7.1.6.4, addresses lightning protection in conformance with RG 1.204.

No COL action requirements are proposed because system integrity is demonstrated by the EQ process that is performed as part of the basic configuration ITAAC and commitment to the design requirements stated in Tier 2 for each applicable safety-related system. A separate ITAAC to demonstrate conformance with Criterion 5.5, System Integrity, is not required because of the basic configuration ITAAC and commitment to the design requirements stated in Tier 2, as stated above.

DCD Impact:

No change in the DCD will be made as a result of the response to NRC RAI 7.1-13.

NRC RAI 7.1-13 S01

The response states that summaries of the equipment qualification test reports and failure modes and effects analyses (FMEAs) will be included in future revisions of the platform specific safety-related system licensing topical report (LTRs). However, because these LTRs will not be submitted before the final SER for design certification, this issue should be in the DAC process.

GEH Response

DCD Tier #1, Revision 4, added Section 3.8 "Environmental Qualification of Mechanical and Electrical Equipment," and added Table 3.8-1 "ITAAC for Environmental Qualification of Mechanical and Electrical Equipment." FMEA is included in Table 2.2.15-2 "ITAAC For IEEE Std. 603 Compliance Confirmation". Therefore, equipment qualification and FMEA have been effectively included in the DAC process.

DCD Impact:

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