

GE-Hitachi Nuclear Energy Americas LLC

**James C. Kinsey**  
Project Manager, ESBWR Licensing

PO Box 780 M/C A-55  
Wilmington, NC 28402-0780  
USA

T 910 675 5057  
F 910 362 5057  
jim.kinsey@ge.com

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**Subject: Response to Portion of NRC Request for Additional Information  
Letter No. 96 Related to ESBWR Design Certification Application –  
RAI Number 7.1-47**

Enclosure 1 contains GEH's response to the subject NRC RAI transmitted via the referenced letter.

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

Sincerely,



James C. Kinsey  
Project Manager, ESBWR Licensing

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KRO

Reference:

1. MFN 07-231, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request for Additional Information Letter No. 96 Related to ESBWR Design Certification Application*, April 12, 2007

Enclosures:

1. MFN 07-430, Response to Portion of NRC Request for Additional Information Letter No. 96 Related to ESBWR Design Certification Application - RAI Number 7.1-47

cc: AE Cubbage      USNRC (with enclosures)  
RE Brown      GEH/Wilmington (with enclosures)  
GB Stramback      GEH/San Jose (with enclosures)  
eDRF      0000-0072-5767

**MFN 07-430**

**Enclosure 1**

**Response to Portion of NRC Request for Additional  
Information Letter No. 96 Related to ESBWR Design  
Certification Application**

**RAI Number 7.1-47**

### **NRC RAI 7.1-47**

*Update the DCD Section 7.1 to demonstrate that the ESBWR design has complied with RG 1.209. The NRC issued Regulatory Guide (RG) 1.209, "Guidelines for Environmental Qualification of Safety-Related Computer-based Instrumentation and Control systems in Nuclear Power Plants" in March 2007. Update DCD Section 7.1 to demonstrate that the ESBWR design has complied with RG 1.209.*

### **GE Response**

The ESBWR design will incorporate the guidance of Regulatory Guide (RG) 1.209, "Guidelines for Environmental Qualification of Safety-Related Computer-based Instrumentation and Control systems in Nuclear Power Plants," dated March 2007. GE will revise DCD Tier 2, Subsections 7.1 and 3.11, and Chapter 1 Table 1.9-21 to demonstrate ESBWR compliance with RG 1.209, as described below.

### **DCD Impact**

DCD Tier 2 will be revised as shown below.

#### **7.1.6.6.1.5 Equipment Qualification (IEEE Std. 603, Section 5.4)**

It is required that safety-related system equipment be designed to meet the safety-related functional performance requirements over the range of normal, abnormal, and Design Basis Accident environmental conditions for the area in which it is located. Equipment qualification typically includes EMI qualification, seismic qualification, and other environmental condition qualification such as temperature, humidity, radiation, and pressure. Q-DCIS systems are designed to meet the equipment qualification requirements set forth in 10 CFR 50.49, RG 1.209, RG 1.89, RG 1.100, IEEE Std. 603, and other associated equipment qualification requirements IEEE Std. 323, and IEEE Std. 344. The qualification ~~was~~ is established using qualification methods set forth in ~~GE's Environmental Qualification Program. (See Reference 7.1-2).~~ Q-DCIS components are designed to be qualified to operate in the normal, ~~and~~ abnormal, and DBA environments in which they are located.

For environmental qualification, the following areas are addressed:

Temperature and Humidity: Q-DCIS components are designed to be qualified using type testing; as the preferred method and, and analysis to demonstrate that the components will perform all specified functions correctly when operated within the specified temperature range and relative humidity range. ~~The components will be qualified in accordance with RG 1.89 (IEEE Std. 323—1974) and IEEE Std. 323—1983. All qualification will be based on type testing. The designers of the HVAC systems will be required to confirm that the maximum control room temperature plus mounting panel temperature rise, allowing for the heat load of the Q-DCIS equipment, does not exceed the temperature limit, and that control room humidity is maintained within limits.~~

Pressure: Q-DCIS components are designed to be qualified (by analysis) to perform safety-related functions ~~to specification~~ for any absolute pressure in the range specified. ~~The design of the HVAC systems surrounding the Q-DCIS components ensures that the maximum control room pressure does not exceed the specified limit.~~

Radiation: Q-DCIS components are designed to be qualified (by analysis) to perform safety-related functions ~~within specification limits~~ over their service life under the specified radiation conditions. The design ensures that the maximum radiation levels at the equipment locations do not exceed the allowed limits.

Seismic Qualification: Q-DCIS components are designed to be qualified (by type testing and analysis) to demonstrate that the components will perform all safety-related ~~specified~~ functions correctly when operated within the specified seismic limits, and when mounted in accordance with the specified mounting methods. Q-DCIS components are to be qualified in accordance with the requirements of RG 1.100 (IEEE Std. 344—1975). Qualification is based on type testing. The design ensures that the maximum seismic accelerations at the mounting locations of the equipment do not exceed the allowed limits.

EMI Qualification: Q-DCIS components in conformance with RG 1.180, when mounted in accordance with the specified mounting methods, are designed to be qualified by type testing and analysis to demonstrate that the components will perform safety-related ~~all specified~~ functions correctly when operated within the specified EMI limits. Q-DCIS equipment is designed to be not susceptible to electromagnetic disturbances from neighboring modules and does not cause electromagnetic disturbances to neighboring modules. The EMI qualification design follows the requirements specified in Mil Std. 461E and IEC 61000-4, depending on the specific requirement conditions. Q-DCIS equipment is qualified to perform within its specifications continuously while exposed to EMI environmental limits at the hardware mounting location. ~~Reference 7.1-3 is used for the envelope limits.~~ The EMI susceptibility and emissions testing is performed by type testing. In addition to the equipment design considerations, plant-specific actions are required to establish practices to control emission sources, maintain good grounding practices, and maintain equipment and cable separation.

### **3.11 ENVIRONMENTAL QUALIFICATION OF MECHANICAL AND ELECTRICAL EQUIPMENT**

- (4) U.S. Nuclear Regulatory Commission (NRC) Regulatory Guides:
- a. Regulatory Guide 1.63-1987 "Electric Penetration Assemblies in Containment Structures for Nuclear Power Plants."
  - b. Regulatory Guide 1.73-1974 "Qualification Tests of Electric Valve Operators Installed Inside the Containment of Nuclear Power Plants."
  - c. Regulatory Guide 1.89-1984 "Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants."
  - d. Regulatory Guide 1.131-1977 "Qualification Tests of Electric Cables, Field Splices and Connections for Light-Water-Cooled Nuclear Power Plants."
  - e. Regulatory Guide 1.153-1996 "Criteria for Safety Systems."
  - f. Regulatory Guide 1.183-2000 "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactor."
  - g. Regulatory Guide 1.209-2007 "Guidelines for Environmental Qualification of Safety-Related Computer-based Instrumentation and Control systems in Nuclear Power Plants."

#### ***3.11.2.2 Qualification Program, Methods and Documentation***

10 CFR 50.49(b) electrical equipment that is located in a harsh environment is qualified by test or other methods as described in IEEE 323 and permitted by 10 CFR 50.49(f) (Reference 3.11 2). Equipment type test is the preferred method of qualification.

Safety-related mechanical equipment that is located in a harsh environment is qualified by analysis of materials data, which are generally based on test and operating experience.

The mechanical and electrical equipment shall have a design life of 60 years. The design life shall be verified using methods and procedures of qualification and documentation as stated in IEEE-323 and as addressed herein.

The qualification program and methodology are described in detail in the NRC approved licensing Topical Report on GE's environmental qualification program (Reference 3.11-3). This report also addresses compliance with the applicable portions of the General Design Criteria of 10 CFR 50, Appendix A, and the Quality Assurance Criteria of 10 CFR 50, Appendix B. Additionally, the report describes conformance to Regulatory Guides and IEEE Standards referenced in SRP 3.11.

Safety-related equipment located in a mild environment, as defined by 10 CFR 50.49 paragraph (c), are qualified per IEEE Std. 323. Q-DCIS equipment located in areas characterized as mild environments, will also meet RG 1.209, and type testing is the preferred method. Q-DCIS will meet RG 1.180 for EMI/RFI and the documentation will be consistent with the applicable elements of IEEE Std. 323, Section 7.1, subject to the loads specified, and margins as defined in

~~IEEE Standard 323 are not applicable. A mild environment is one where a postulated event, such as a Loss of Coolant Accident (LOCA) or High Energy Line Break (HELB) does not cause any significant change in the environment of the particular location. For example, the Control Room is in a mild environment. If there is any change in conditions resulting from a postulated event, the requirements of IEEE Standard 323 shall apply.~~

~~The vendors of equipment located in a mild environment are required to submit a certificate of compliance certifying that the equipment has been qualified to assure its required safety-related function in its applicable environment. This equipment is qualified for dynamic loads as addressed in Sections 3.9 and 3.10. Further, a surveillance and maintenance program shall be developed to ensure the operability during its design life.~~

~~The vendor shall specify qualified life, shelf life and activities of maintenance surveillance, periodic testing and any parts replacement required to maintain qualification of equipment provided in accordance with this document.~~

~~The procedures and results of qualification by tests, analyses or other methods for the safety-related equipment shall be documented, maintained, and reported as mentioned in Subsection 3.11.5. The requirements for this documentation are presented in GE's environmental qualification program (Reference 3.11-3).~~

| <b>Table 1.9-21</b><br><b>NRC Regulatory Guides Applicability to ESBWR</b> |                                                                                                                                                                |                       |                        |                                    |                 |
|----------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------------------------|------------------------------------|-----------------|
| <b>RG<br/>No.</b>                                                          | <b>Regulatory Guide Title</b>                                                                                                                                  | <b>Appl.<br/>Rev.</b> | <b>Issued<br/>Date</b> | <b>ESBWR<br/>Appli-<br/>cable?</b> | <b>Comments</b> |
| <u>1.209</u>                                                               | <u>Guidelines for Environmental<br/>Qualification of Safety-Related<br/>Computer Based Instrumentation<br/>and Control Systems in Nuclear<br/>Power Plants</u> | <u>0</u>              | <u>03/2007</u>         | <u>Yes</u>                         |                 |