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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 135 Related to ESBWR Design Certification Application – RAI Numbers 7.1-71, 7.1-73, and 7.1-74**

The purpose of this letter is to submit the GE Hitachi Nuclear Energy (GEH) responses to the U.S. Nuclear Regulatory Commission (NRC) Requests for Additional Information (RAI) sent by NRC letter dated January 14, 2008.

Verified DCD changes associated with these RAI responses are identified in the enclosed DCD markups by enclosing the text within a black box. The marked-up pages may contain unverified changes in addition to the verified changes resulting from these RAI responses. Other changes shown in the markup(s) may not be fully developed and approved for inclusion in DCD Revision 5.

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

Sincerely,

James C. Kinsey
Vice President, ESBWR Licensing

D068
NRO

Reference:

1. MFN 08-038, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, GE, *Request For Additional Information Letter No. 135 Related To ESBWR Design Certification Application*, dated January 14, 2008

Enclosure:

1. Response to Portion of NRC Request for Additional Information Letter No. 135 Related to ESBWR Design Certification Application - RAI Numbers 7.1-71, 7.1-73, and 7.1-74
2. DCD Markups

cc:

AE Cubbage	USNRC (with enclosure)
GB Stramback	GEH/San Jose (with enclosure)
RE Brown	GEH/Wilmington (with enclosure)
eDRF Sections	
	0000- 0080-0590 (RAI 7.1-71)
	0000-0080-00652 (RAI 7.1-73)
	0000- 0080-0666 (RAI 7.1-74)

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Enclosure 1

Response to Portion of NRC Request for Additional Information Letter No. 135 Related to ESBWR Design Certification Application – RAI Numbers 7.1-71, 7.1-73, and 7.1-74

NRC RAI 7.1-71

In the section identifying conformance of the DCIS to the CFR, DCIS conformance to four (4) selected TMI action requirements was removed. Please explain why.

GEH Response

Three of the four selected TMI action requirements that were removed from Subsection 7.1.6.1 are not applicable to the ESBWR and are addressed as such in Table 7.1-1 and Table 1A-1. The three TMI action requirements are:

- 10 CFR 50.34(f)(2)(xii) [II.E.1.2]
- 10 CFR 50.34(f)(2)(xx) [II.G.1]
- 10 CFR 50.34(f)(2)(xxii) [II.K.2.9]

The fourth TMI action requirement, 10 CFR 50.34(f)(2)(xxiii) [II.K.2.10], is noted in Table 1A-1 as being applicable to the ESBWR. This requirement will be added back into Subsection 7.1.6.1 of the DCD Tier 2. Subsections 7.2.1.3.1, 7.3.5.3.1 and 7.4.4.3.1 and Table 7.1-1 will be revised to add this requirement and provide conformance information. Table 1A-1 will be revised to add Subsections 7.1.6 and 7.2.1 in the Associated Location(s) column.

DCD Impact

DCD Tier 2, Subsections 7.1.6.1, 7.2.1.3.1, 7.3.5.3.1, 7.4.4.3.1 and Tables 1A-1 & 7.1-1 will be revised as noted in the Enclosure 2 markups.

NRC RAI 7.1-73

We understand that the certification is for a single unit site. If the applicability of ESBWR is expanded to multiple unit sites in the future, per IEEE-603, the specific ability to simultaneously perform required safety functions in all units must be addressed. DCD Revision 4 states that the Q-DCIS of multiple units would not have shared components nor shared divisions. Please address the shared N-DCIS components and how their functional limits and failure would affect the Q-DCIS.

GEH Response

Even if the ESBWR applicability is expanded to multiple unit sites, operation or failure of shared N-DCIS components will not affect the performance of the Q-DCIS.

DCD Impact

DCD Tier 2, Section 7.1.6.6.1.14 will be revised as shown in the Enclosure 2 markup.

NRC RAI 7.1-74

In Section 1.7.4, COL Information, it is stated that upon completion of the final design configuration the licensee will make available to the NRC the final P&IDs used for construction. RG 1.206, Section C.I.7.2.1.2, identifies additional detailed information besides the P&IDs, which should be made available by the COL. This includes preliminary logic diagrams and location layout drawings of all reactor trip systems and supporting systems in the FSAR. BTP 7-16, Revision 4 provides a similar list and detailed content which should be listed here in the DCD.

GEH Response

The COL item included in DCD Tier 2 Section 1.7.4 was not added as a result of any requirement in RG 1.206. It was added to the DCD due to NRC requests (see RAI 3.2-7 and its supplements) related to supplying final P&IDs instead of simplified P&IDs that appear in the DCD.

Branch Technical Position HICB-16 (included in Appendix 7A of SRP 7.0, Revision 4) is considered to be applicable to the ESBWR DCD per DCD Tier 2 Table 1.9-20. Sections B.3.3 and B.3.5 of HICB-16 indicate that DAC/ITAAC may be used at the design certification stage to provide the type of information requested in this RAI. The requested preliminary logic diagrams have already been supplied to the NRC in MFN 07-001, dated January 19, 2007. The location layout drawings of all reactor trip systems and supporting systems are not within the scope of HICB-16.
As noted in DCD Tier 2 Table 1.9-21, RG 1.206 is not applicable to the ESBWR DCD. RG 1.206 was written after the ESBWR DCD was prepared and contains many recommendations like the one cited that a COL applicant is expected to address in a COLA FSAR submittal. There is no need for the ESBWR DCD to contain a COL information item for each recommendation in RG 1.206 that is not addressed in the DCD. The recommendations of RG 1.206 are subject to consideration by the COL applicant at the time of the submittal of their license application.

Section C.III.1 (Information Needed for a Combined License Application Referencing a Certified Design) of RG 1.206, in the Section 7.2 write-up under Chapter 7, states:

> Identify any reactor trip system instrumentation, control, and supporting systems that are not addressed in the DCD of the referenced certified design or other parts of the COL application. Section C.I.7.2 of this guide presents the information needed to address these systems.

That is, RG 1.206 Section C.1.7.2 only applies to reactor trip system instrumentation, control and supporting systems "not addressed in the DCD." It is not anticipated that a COL Applicant would modify the reactor trip system. However, if there were changes, then the COL Applicant would address conformance to this section.

GEH considers the COL Applicant's evaluation of conformance to RG 1.206 to be sufficient to ensure the material requested in this RAI will be provided by a COL applicant at the appropriate time in the review process. Thus, there is no need to add a new COL item to DCD Tier 2.

DCD Impact

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

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Enclosure 2

DCD Markups

Verified DCD changes associated with these RAI responses are identified in the enclosed DCD markups by enclosing the text within a black box. The marked-up pages may contain unverified changes in addition to the verified changes resulting from these RAI responses. Other changes shown in the markup(s) may not be fully developed and approved for inclusion in DCD Revision 5.

DCD Markup for RAI 7.1-71

Table 1A-1

TMI Action Plan Items

Regulation	TMI Item	Description	ESBWR Resolution	Associated Location(s)
10 CFR 50. 34(f)(2)(xxiii)	II.K.2.10	Provide, as part of the reactor protection system, an anticipatory reactor trip that would be actuated on the loss of main feedwater and on turbine trip. (Applicable to B&W-designed plants only).	The ESBWR Anticipated Operational Occurrences (transients) are generally much slower than even previous BWR designs. However, due to limited high pressure make-up, a reactor trip and initiation of the Isolation Condenser Systems (ICS) will occur in response to a Loss of All Feedwater event. These are anticipatory trips actuated directly on loss of power to two of the four main feedwater pumps. The ESBWR includes as part of the standard plant ~~reference~~ design 110% bypass capacity for the main turbine. Scram only occurs on a turbine trip if an insufficient number of bypass valves open within a prescribed time period.	7.1.6, 7.2.1, 7.3, 7.4.4, 10.4.4.1, and 15.2.5.3.
10 CFR 50. 34(f)(2)(xxiv)	II.K.3.23	Provide the capability to record reactor vessel water level in one location on recorders that meet normal post-accident recording requirements. (Applicable to BWRs only).	Recording of water level is included in the Main Control Room (MCR). Water level measurements are from the wide and fuel range water level instruments. See the discussion of 10 CFR 50.34(f)(2)(xviii) for more detail.	7.5.1
10 CFR 50. 34(f)(2)(xxv)	III.A.1.2	Provide an onsite Technical Support Center, an onsite Operational Support Center, and, for construction permit applications only, a near-site	Space for the Technical Support Center is included in the Standard Design on the ground floor of the Electrical Building. The space provided is in conformance with	Figure 1.2-26, and 13.3

7.1.6.1 Code of Federal Regulations

10 CFR 50.55a(a)(1), Quality Standards for Systems Important to Safety.10 CFR 50.55a(h) Protection and Safety Systems, compliance with IEEE Std. 603:

- Conformance: The Q-DCIS complies with the above requirements.

10 CFR 50.34(f), Conformance ~~with~~ to Three Mile Island (TMI) Action Plan Requirements:

- Response to TMI related matters is generically ~~generally~~ addressed in ~~Chapter 1,~~ Appendix 1A. TMI action plan requirements are identified for the systems in Table 7.1-1. The applicable systems are ~~generally~~ designed to conform. However, because of the design features, several of these requirements are not applicable. These are identified as follows:
  - II.K.3.13 – HPCI and RCIC Initiation Levels,
  - II.K.3.15 - Isolation of HPCI and RCIC (Turbine Driven),
  - II.K.3.21 - Automatic Restart of LPCS and LPCI, and
  - II.K.3.22 - RCIC Automatic Switchover of Suction Supply.

The TMI action items applicable to the I&C systems are:

- 10 CFR 50.34(f)(2)(iv) [I.D.2], Safety parameter display system,
- 10 CFR 50.34(f)(2)(v) [I.D.3], Bypass and Inoperable Status Indication,
- 10 CFR 50.34(f)(2)(xvii) [II.F.1], Accident Monitoring Instrumentation,
- 10 CFR 50.34(f)(2)(xviii) [II.F.2], Inadequate Core Cooling Instrumentation,
- 10 CFR 50.34(f)(2)(xiv) [II.E.4.2], Containment Isolation Systems,
- 10 CFR 50.34(f)(2)(xix) [II.F.3], Instruments for Monitoring Plant Conditions Following Core Damage,
- 10 CFR 50.34(f)(2)(xxiii) [II.K.2.10], Anticipatory Reactor Trip,
- 10 CFR 50.34(f)(2)(xxiv) [II.K.3.23], Central Reactor Vessel Water Level Recording,

10 CFR 50.62, Requirements for Reduction of Risk from Anticipated Transients Without Scram (ATWS) Events for Light-Water-Cooled Nuclear Power Plants:

- Conformance: The design has ATWS mitigation functions, as described in Section 7.8.

10 CFR 52.47(a)(1)(iv), Resolution of Unresolved and Generic Safety Issues:

- Conformance: Resolution of unresolved and generic safety issues is discussed in Section 1.11.

10 CFR 52.47(a)(1)(vi), ITAAC in Design Certification Applications:

Table 7.1-1

Regulatory Requirements Applicability Matrix

		System																											
Applicable Criteria Guidelines: SRP NUREG-0800, Section 7.1	Reference Standard	RPS (Q)	NMS (Q)	SPTM Function (Q)	ADS (Q)	GDCS (Q)	LD&IS (Q)	CRHS (Q)	SSLC /ESF (Q)	SLC (Q)	RSS (Q & N)	RWCU /SDC (N)	ICS (Q)	PAM (Q & N)	CMS (Q &N)	PRMS (Q &N)	ARMS (N)	Interlock Systems (Q & N)	NBS (Q)	RC&IS (N)	FWCS (N)	PAS (N)	SB&PC (N)	NMS (N)	CIS(N)	DPS(N) ATWS/SLC (Q)	Q-DCIS (Q)	N-DCIS (N)
10 CFR																													
50.55a(a)(1)		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X							X	X	
50.55a(h)	IEEE Std. 603	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X							X	X	
50.34(f)(2)(v)(I.D.3)		X	X	X	X	X	X	X	X	X			X	X	X	X		X	X								X	
50.34(f)(2)(xvii)(II.F.1)														X	X	X	X											
50.34(f)(2)(xviii)(II.F.2)														X														
50.34(f)(2)(xiv)(II.E.4.2)					X	X	X	X	X																			
50.34(f)(2)(xix)(II.F.3)														X	X	X	X											
50.34(f)(2)(xxiv)(II.K.3.23)														X														
50.44(c)(4)															X													
50.62										X										X	X					X#	X	
52.47(a)(1)(iv)		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
52.47(a)(1)(vi)		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
52.47(a)(1)(vii)		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
52.47(a)(2)		X	X	X	X	X	X	X	X	X	X		X	X	X	X		X	X							X	X	
52.47(b)(2)(i)		X	X	X	X	X	X	X	X	X	X		X	X	X	X		X	X								X	
50.34(f)(2) xii [II.E.1.2]		N/A																										
50.34(f)(2) xx [II.G.1]		N/A																										
50.34(f)(2) xxii [II.K.2.9]		N/A																										
50.34(f)(2) xxiii [II.K.2.10]		X							X				X		~~N/A~~													
52.79(c)		N/A																										

- Conformance: The RPS design of bypass and inoperable status indication conforms ~~with~~to these requirements and is consistent with the conformance of the RPS design ~~with~~ to RG 1.47. It also conforms ~~with~~to the requirements ~~of~~for control and protection system interaction, as described in IEEE Std. 603, Sections 5.8 and 6.3.

10 CFR 50.34(f)(2)(xxiii)[II.K.2.10], Anticipatory Reactor Trip:

- Conformance: The reactor will trip in response to a Loss of All Feedwater Event. This is an anticipatory trip actuated on loss of power to two of the four main feedwater pumps. The reactor will also trip on a turbine trip only if an insufficient number of bypass valves open within a prescribed time period.

10 CFR 52.47(a)(1)(iv), Resolution of Unresolved and Generic Safety Issues:

- Conformance: Resolution of unresolved and generic safety issues is discussed in Section 1.11.

10 CFR 52.47(a)(1)(vi), ITAAC in Design Certification Applications:

- Conformance: ITAAC are provided for Instrumentation and Control (I&C) systems and equipment in Tier 1, Section 2.2.

10 CFR 52.47(a)(1)(vii), Interface Requirements:

- Conformance: There are no interface requirements for this section.

10 CFR 52.47(a)(2), Level of Detail:

- Conformance: The level of detail provided for the RPS within the DCD documents conforms ~~with~~to this requirement.

10 CFR 52.47(b)(2)(i), Innovative Means of Accomplishing Safety Functions:

- Conformance: The I&C design does not use innovative means for accomplishing safety functions.

7.2.1.3.2 General Design Criteria

GDC 1, 2, 4, 13, 19, 20, 21, 22, 23, 24, 25, and 29:

- Conformance: The RPS ~~is in conformance with~~design conforms to these GDC ~~identified above~~.

7.2.1.3.3 Staff Requirements Memorandum

Item II.Q of SECY-93-087, Defense Against Common-Mode Failures in Digital Instrument and Control Systems:

- Conformance: The Reactor Trip (Protection) System design conforms ~~with~~to Item II.Q of SECY-93-087 NRC Branch Technical Position (BTP HICB-19) by the implementation of an additional Diverse Instrumentation and Control System ~~as~~ described in Section 7.8.

Table 7.1-1 identifies the SSLC/ESF and the associated codes and standards applied, in accordance with the SRP. This subsection addresses conformance ~~with~~ to regulatory requirements, guidelines, and industry standards.

7.3.5.3.1 Code of Federal Regulations

10 CFR 50.55a(1), Quality Standards for Systems Important to Safety:

- Conformance: The SSLC/ESF conforms ~~with~~to these standards.

10 CFR 50.55a(h), Protection and Safety Systems Compliance with IEEE Std. 603:

- Conformance: Safety-related systems are designed ~~in~~ to conform~~ance with~~ to RG 1.153 and IEEE Std. 603 as discussed in Subsections 7.1.6.4 and 7.2.1.3.4.

10 CFR 50.34 (f)(2)(v) [I.D.3], Bypass and Inoperable Status Indication:

- Conformance: The SSLC/ESF ~~demonstrates compliance~~complies by providing automatic indication of bypassed and inoperable status (IEEE Std. 603, Sections 5.8, 6.2, and 7.2).

10 CFR 50.34 (f)(2)(xiv) [II.E.4.2], Containment Isolation Systems:

- Conformance: The SSLC/ESF logic controlling containment isolation functions conforms ~~with~~ to these criteria.

10 CFR 50.34 (f)(2)(xxiii) [II.K.2.10], Anticipatory Reactor Trip:

- Conformance: The SSLC/ESF will initiate ICS in response to a Loss of All Feedwater Event. This is an anticipatory trip actuated on loss of power to two of the four main feedwater pumps.

10 CFR 52.47(a)(1)(iv), Resolution of Unresolved and Generic Safety Issues:

- Conformance: Resolution of unresolved and generic safety issues is discussed in Section 1.11.

10 CFR 52.47(a)(1)(vi), ITAAC in Design Certification Applications:

- Conformance: ITAAC are provided for the I&C systems and equipment in Tier 1, Section 2.2.

10 CFR 52.47(a)(1)(vii), Interface Requirements:

- Conformance: There are no interface requirements for this ~~Section~~section.

10 CFR 52.47(a)(2), Level of Detail:

- Conformance: The level of detail provided for the SSLC/ESF within the DCD conforms ~~with~~to this requirement.

10 CFR 52.47(b)(2)(i), Innovative Means of Accomplishing Safety Functions:

with the system operation. Electrical separation is maintained between the redundant divisions.

10 CFR 50.34(f)(2)(v)[I.D.3], Bypass and Inoperable Status Indication:

- Conformance: The ICS design conforms ~~with~~ to this requirement~~, since~~ because it is an ~~Emergency Core Cooling System (~~ECCS~~)~~.

10 CFR 50.34(f)(2)(xxiii)[II.K.2.10], Anticipatory Reactor Trip:

- Conformance: The ICS will initiate in response to a Loss of All Feedwater Event. This is an anticipatory trip actuated on loss of power to two of the four main feedwater pumps.

10 CFR 52.47(a)(1)(iv), Resolution of Unresolved and Generic Safety Issues:

- Conformance: Resolution of unresolved and generic safety issues is discussed in Section 1.11.

10 CFR 52.47(a)(1)(vi), ITAAC in Design Certification Applications:

- Conformance: ITAAC are provided for the I&C systems and equipment in Tier 1, Section 2.2.

10 CFR 52.47(a)(1)(vii), Interface Requirements:

- There are no interface requirements for ICS.

10 CFR 52.47(a)(2), Level of Detail:

- Conformance: The level of detail provided for the ICS within the DCD conforms ~~with~~to this BTP.

10 CFR 52.47(b)(2)(i), Innovative Means of Accomplishing Safety Functions:

- Conformance: The I&C design does not use innovative means for accomplishing safety functions.~~:~~

7.4.4.3.2 General Design Criteria

In accordance with the SRP for Section 7.4 and Table 7.1-1, the following GDC are addressed for the ICS:

GDC 1, 2, 4, 13, 19 and 24:

- Conformance: The ICS design conforms ~~with~~to these GDC.

7.4.4.3.3 Regulatory Guides

RG 1.22—, Periodic Testing of Protection System Actuation Functions:

- Conformance: The ICS system design conforms ~~with~~to RG 1.22.

DCD Markup for RAI 7.1-73

of the nonsafety-related I&C equipment for two hours. However, during a loss of power active HVAC is not available to the safety-related CB or RB equipment, except in the MCR habitability area as noted below. The Q-DCIS and its safety-related battery operated support equipment remain powered and the heat generated is removed passively (except possibly by small chassis mounted fans); the Q-DCIS and support equipment is qualified for the expected temperature rise. Battery-backed N-DCIS equipment is only powered for two hours if offsite and diesel generator power is lost; during that interval the ~~same~~ batteries supplying the N-DCIS also power nonsafety-related HVAC in the MCRA. If the nonsafety-related redundant HVAC is not available, safety-related temperature sensors with two-out-of-four logic trip the control room power that feeds the nonsafety-related I&C. The safety-related I&C that remains operable is qualified for the resulting temperature rise with~~using~~ passive heat removal. This scheme protects the equipment and maximizes operator comfort. Additional description of the HVAC design is included in Chapter 9.

~~Other auxiliary features that support the Q-DCIS functions prevent the safety-related system from degrading below an acceptable level.~~

7.1.6.6.1.14 Multi-Unit Stations (IEEE Std. 603, Section 5.13)

The ~~M~~multi-~~U~~unit ~~S~~station criteria do not apply to the standard single unit plant design. ~~The standard design~~ submitted for NRC ~~certification is for a single unit plant however for~~certification. For multiple unit designs only the N-DCIS would have common network components as necessary to control and monitor common hardware and systems. The Q-DCIS of multiple units would ~~not~~ have neither shared components nor shared divisions. The operation or failure of shared N-DCIS components does not affect the performance of the Q-DCIS.

7.1.6.6.1.15 Human Factors Considerations (IEEE Std. 603, Section 5.14)

The I&C system design includes a HFE design process that is consistent with the requirements outlined in NUREG-0711, "Human Factors Engineering Program Review Model." ~~The overall design and implementation process is described in Chapter 18.~~ The HFE process defines a comprehensive, iterative design approach for the development of a human-centered control and information infrastructure and is described in Chapter 18.

7.1.6.6.1.16 Reliability (IEEE Std. 603, Section 5.15)

The degree of redundancy, diversity, testability, and quality of the safety-related I&C design achieves the necessary functional reliability. Safety-related equipment is provided under GEH's 10 CFR 50 Appendix B quality program. The BTP-14 guidance followed for software development processes achieves reliable software design and implementation. To achieve defense against common mode failure, the design includes ~~many~~ defense-in-depth and diversity measures including the incorporation of the DPS described in Section 7.8. Reference 7.1-4, provides specific information on the redundancy and diversity used in safety-related I&C systems. The Q-DCIS is included in the consideration of the ~~P~~probabilistic ~~R~~risk ~~A~~assessment (PRA). (Refer to Chapter 19.)