



HITACHI

GE Hitachi Nuclear Energy

James C. Kinsey
Vice President, 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. 138 - Related to ESBWR Design Certification Application – RAI Number 20.0-16**

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 the Reference 1 NRC letter. GEH response to RAI Number 20.0-16 is addressed in Enclosures 1 and 2.

Verified DCD changes associated with this RAI response 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 this RAI response. Other changes shown in the markups 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

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NLO

Reference:

1. MFN 08-035, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request for Additional Information Letter No. 138 Related to the ESBWR Design Certification Application*, dated January 14, 2008

Enclosures:

1. MFN 08-324 – Response to Portion of NRC Request for Additional Information Letter No. 138 - Related to ESBWR Design Certification Application – RAI Number 20.0-16
2. MFN 08-324 – Response to Portion of NRC Request for Additional Information Letter No. 138 - Related to ESBWR Design Certification Application – DCD Markups from the Response to RAI Number 20.0-16

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 0000-0082-8647

Enclosure 1

MFN 08-324

**Response to NRC Request for
Additional Information Letter No. 138
Related to ESBWR Design Certification Application**

RAI Number 20.0-16

NRC RAI 20.0-16

TMI Item III.D.1.1

The clarification section of NUREG-0737 states that "Applicant shall provide a summary of description, together with initial leak-test results, of their program to reduce leakage from systems outside of containment that would or could contain primary coolant or other highly radioactive fluids or gases during or following a serious transient or accident." Please describe and justify the screening process used to determine which systems should be leak tested and meet the criteria described in the clarification section NUREG-0737. Identify the systems which require the leak testing. Also, provide a description and justification for the leak testing proposed to be performed for systems included under this item.

GEH Response

The clarification section of NUREG-0737 for TMI Item III.D.1.1 also provides a detailed list of systems that should be leak tested. During preparation of the response to RAI 20.0-12, this detailed list of systems and functions from the clarification section of NUREG-0737 was reviewed and the corresponding ESBWR systems were identified to be the following:

- Isolation Condenser System (ICS)
- Fuel and Auxiliary Pools Cooling System (FAPCS)
- Containment Monitoring System (CMS)

A recent design change to improve post-LOCA reduction of the containment pressure (see response to RAI 6.2-140 Supplement 1 in MFN 08-322 for details) results in one system being added to this list:

- Reactor Water Cleanup/Shutdown Cooling (RWCU/SDC) System

GEH's screening process for developing this list of systems consisted of reviewing the list of systems that are mentioned in the clarification section of NUREG-0737 for TMI Item III.D.1.1 and identifying the comparable ESBWR systems used to perform those design functions. The attached table shows how the system list in TMI Item III.D.1.1 compares to the ESBWR design.

The same clarification section of NUREG-0737 also requests a list of systems containing radioactive materials that are excluded from the program and a justification for their exclusion. The ESBWR Nuclear Boiler System (main steam and feedwater) contains radioactive materials during normal operation, but is automatically isolated during severe transients and accidents. Thus, the Nuclear Boiler System does not belong on the list of systems requiring leak testing under TMI Action Item III.D.1.1. The Offgas System also contains radioactive materials during normal operation, but has historically been excluded from periodic leak testing for BWRs. The Offgas System has a high design pressure of around 2.4 MPa gage (350 psig), and is isolated from the reactor pressure vessel during serious transients and accidents after MSIV closure occurs. Activity levels in the Offgas System are continuously monitored and indicated in the Main Control Room (MCR), and high activity levels are alarmed in the MCR.

NUREG-0737 indicates the leak testing program to address TMI Action Item III.D.1.1 is to be implemented in the Technical Specifications. ESBWR Technical Specification (DCD Tier 2 Chapter 16) Subsection 5.5.2 implements the program for minimizing leakage from these systems. This Technical Specification subsection will be updated in the next DCD revision to list the systems identified above. The portion of ICS located outside containment is submerged during normal operation. Consequently, it is not accessible to plant personnel under post-accident conditions or for routine surveillance during normal plant operation.

DCD Impact

DCD Tier 2 Appendix 1A Table 1A-1 will be revised as noted in the attached markup. Cross-references to DCD Subsections 5.2.5, 6.2.6.3 and 7.3.3 have been replaced with a reference to Subsection 5.4.7, which is the only DCD location other than Table 1A-1 and the Tech Specs that discusses the TMI Action Item III.D.1.1 leakage control program. The RWCU/SDC system has been added to the list of systems in the ESBWR Resolution column of Table 1A-1.

DCD Tier 2, Chapter 16 Section 5.5.2 will be revised as noted in the attached markup to add the list of systems.

A change that had been proposed in response to RAI 7.2-4 Supplement 1 in MFN 06-146 Supplement 1 to add a reference to TMI Action Item III.D.1.1 in DCD Tier 2 Subsection 7.3.3.3.6 for the Leak Detection and Isolation System (LD&IS) is no longer valid. LD&IS was removed from the list of systems on the TMI Action Plan III.D.1.1 program at NRC request in response to RAI 20.0-12. Removal of LD&IS from the list of systems is further supported by the above response to RAI 20.0-16. Thus, the change to Subsection 7.3.3.3.6 described in MFN 06-146 Supplement 1 will not be included in DCD Revision 5.

Table – TMI Action Item III.D.1.1 Systems List Assessment

NUREG-0737 Identified Systems	Corresponding ESBWR System	Comment
Residual Heat Removal (RHR)	Fuel and Auxiliary Pools Cooling System (FAPCS)	FAPCS suppression pool cooling mode
	Reactor Water Cleanup / Shutdown Cooling System	RWCU/SDC has cross-tie lines to FAPCS for suction and discharge
Containment Spray Recirculation	Fuel and Auxiliary Pools Cooling System (FAPCS)	FAPCS containment spray mode
	Reactor Water Cleanup / Shutdown Cooling System	RWCU/SDC has cross-tie lines to FAPCS for suction and discharge
High Pressure Injection Recirculation	N/A	No corresponding system in ESBWR design
Containment and Primary Coolant Sampling	Containment Monitoring System (CMS)	
Reactor Core Isolation Cooling	Isolation Condenser System (ICS)	ICS performs similar function for ESBWR to RCIC function in earlier BWR designs.
Makeup and Letdown (PWRs only)	N/A	PWR only
Waste gas	N/A	Offgas system performs this function via connection to main condenser during normal operation. Excluded from leak testing program for reasons discussed in text of RAI response.

Enclosure 2

MFN 08-324

**Response to NRC Request for
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DCD Markups from the Response to
RAI Number 20.0-16**

Verified DCD changes associated with this RAI response 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 this RAI response. Other changes shown in the markups may not be fully developed and approved for inclusion in DCD Revision 5.

Table 1A-1
TMI Action Plan Items

Regulation	TMI Item	Description	ESBWR Resolution	Associated Location(s)
10 CFR 50.34(f)(2)(xxvi)	III.D.1.1	Provide for leakage control and detection in the design of systems outside containment that contain (or might contain) accident source term radioactive materials following an accident. Applicants shall submit a leakage control program, including an initial test program, a schedule for retesting these systems, and the actions to be taken for minimizing leakage from such systems. The goal is to minimize potential exposures to workers and public, and to provide reasonable assurance that excessive leakage will not prevent the use of systems needed in an emergency.	<p>Leakage is reduced to as low-as-practical levels for all required post-accident systems outside the containment that could contain highly radioactive fluid using a program that consists of:</p> <ul style="list-style-type: none"> Monitoring drain sumps to ascertain gross leakage occurring from systems included in this program. Inspecting miscellaneous components (e.g., vents, drains, valve packing, valve packing leakoffs, pump packing, pump gland seal leakoffs, etc.) for leakage during initial system startup as part of the system preoperational test, and reducing any detected leakage to as-low-as-practical levels. After fuel load these components are monitored as part of a surveillance test program. Performing indirect inspections or a suitable substitute in situations where it is not possible, practical or permissible (e.g., due to high radiation) to make direct inspections. Examples of indirect inspection techniques include inspecting floor areas for wetting and monitoring the associated equipment or floor drain 	<p>5.4.7, 5.2.5, 6.2.6.3, 7.3.3 and Chapter 16 Section 5.5.2</p>

Table 1A-1
TMI Action Plan Items

Regulation	TMI Item	Description	ESBWR Resolution	Associated Location(s)
			<p>sumps for excessive flow or fill rates.</p> <p>The following ESBWR systems perform the design functions mentioned in the clarification section of NUREG-0737, Item III.D.1.1, and could contain radioactive material outside the primary containment boundary:</p> <ol style="list-style-type: none"> 1) Isolation Condenser System 2) Fuel and Auxiliary Pools Cooling System 3) Containment Monitoring System 4) <u>Reactor Water Cleanup/Shutdown Cooling System</u> <p>The portion of ICS outside containment is submerged during normal operation. Consequently, it is not accessible to plant personnel under post-accident conditions or for routine surveillance during normal plant operation.</p>	

5.5 Programs and Manuals

5.5.2 Primary Coolant Sources Outside Containment

This program provides controls to minimize leakage from those portions of systems outside containment that could contain highly radioactive fluids during a serious transient or accident to levels as low as practicable. The systems include the {Isolation Condenser System, Fuel and Auxiliary Pools Cooling System, Containment Monitoring System, and Reactor Water Cleanup/Shutdown Cooling System}. The program shall include the following:

- a. Preventive maintenance and periodic visual inspection requirements; and
- b. Integrated leak test requirements for each system at least once per 24 months.

The provisions of SR 3.0.2 are applicable.

5.5.3 Radioactive Effluent Controls Program

This program conforms to 10 CFR 50.36a for the control of radioactive effluents and for maintaining the doses to members of the public from radioactive effluents as low as reasonably achievable. The program shall be contained in the ODCM, shall be implemented by procedures, and shall include remedial actions to be taken whenever the program limits are exceeded. The program shall include the following elements:

- a. Limitations on the functional capability of radioactive liquid and gaseous monitoring instrumentation including surveillance tests and setpoint determination in accordance with the methodology in the ODCM;
- b. Limitations on the concentrations of radioactive material released in liquid effluents to unrestricted areas, conforming to ten times the concentration values in Appendix B, Table 2, Column 2 to 10 CFR 20.1001-20.2402;
- c. Monitoring, sampling, and analysis of radioactive liquid and gaseous effluents in accordance with 10 CFR 20.1302 and with the methodology and parameters in the ODCM;
- d. Limitations on the annual and quarterly doses or dose commitment to a member of the public from radioactive materials in liquid effluents released from each unit to unrestricted areas, conforming to 10 CFR 50, Appendix I;

7.1.6.1 Conformance with the 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

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 relative to the systems in Table 7.1-1. The applicable systems are ~~generally~~ designed to conform. However, because of the design features of the ESBWR, 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
 - II.K.3.22 - RCIC Automatic Switchover of Suction Supply

For the others, the degree of conformance, along with any clarifications or exceptions, is discussed in the safety evaluation subsections of Sections 7.2 through 7.8. The TMI action items applicable to the I&C systems are:

- 50.34(f)(2)(iv) [I.D.2] Safety parameter display system
- 50.34(f)(2)(v) [I.D.3] Bypass and Inoperable Status Indication
- 50.34(f)(2)(xii) [II.E.1.2] Auxiliary Feedwater System Automatic Initiation and Flow Indication
- 50.34(f)(2)(xvii) [II.F.1] Accident Monitoring Instrumentation
- 50.34(f)(2)(xviii) [II.F.2] Inadequate Core Cooling Instrumentation

7.3.3.3.6 TMI Action Plan Requirements:

In accordance with the SRP for 7.3 and with Table 7.1-1, 10 CFR 50.34(f)(2)(v) (I.D.3), ~~and 10 CFR 50.34(f)(2)(xiv) (II.E.4.2) and 10 CFR 50.34(f)(2)(xxvi)(III.D.1.1)- apply to~~ the LD&IS_Leak Detection and Isolation System. The LD&IS complies with the requirements as indicated above. However, TMI action plan requirements are generically addressed in Appendix 1A.

As a result of changes to TMI Action Plan item III.D.1.1 from the responses to RAIs 20.0-12 and 20.0-16, the changes shown here to DCD Subsection 7.3.3.3.6 from the response to RAI 7.2-4 Supplement 1 are no longer valid and will be removed.