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Subject: **Response to Portions of NRC Request for Additional Information Letter Nos. 106, 122, and 103 Related to ESBWR Design Certification Application - Control Building Ventilation - RAI Numbers 6.4-18, 6.4-19, and 9.4-32, Respectively**

Enclosure1 contains the GE Hitachi Nuclear Energy (GEH) responses to the subject NRC RAIs transmitted via the Reference 1, 2, and 3 letters, respectively.

Verified DCD changes associated with this RAI response are identified in Enclosure 2 in the 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 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

James C. Kinsey
Vice President, ESBWR Licensing

NRO

References:

1. MFN 07-497, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request for Additional Information Letter No. 106 Related to ESBWR Design Certification Application*, September 6, 2007
2. MFN 07-659, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request for Additional Information Letter No. 122 Related to ESBWR Design Certification Application*, December 6, 2007
3. MFN 07-414, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request for Additional Information Letter No. 103 Related to ESBWR Design Certification Application*, July 23, 2007

Enclosures:

1. MFN 08-216 - Response to Portions of NRC Request for Additional Information Letter Nos. 106, 122, and 103 Related to ESBWR Design Certification Application - Control Building Ventilation - RAI Numbers 6.4-18, 6.4-19, and 9.4-32, Respectively
2. MFN 08-216 - Response to Portions of NRC Request for Additional Information Letter Nos. 106 and 122 Related to ESBWR Design and, 6.4-19, Respectively – DCD Markups

cc:	AE Cubbage	USNRC (with enclosures)
	DH Hinds	GEH/Wilmington (with enclosures)
	GB Stramback	GEH/San Jose (with enclosures)
	RE Brown	GEH/Wilmington (with enclosures)
	eDRF	0000-0080-5157

Enclosure 1

MFN 08-216

Response to Portion of NRC Request for Additional Information Letter Nos. 106, 122, and 103 Related to ESBWR Design Certification Application

Control Building Ventilation

RAI Numbers 6.4-18, 6.4-19, and 9.4-32, Respectively

NRC RAI 6.4-18:

A. DCD, Tier 2, Revision 3, Table 1.9-9 states for SRP Section 9.4.5 "The engineered safety features described in Chapter 6 do not require a separate ventilation system. This section is not applicable to ESBWR." Please make the appropriate correction in the DCD to account for the addition of the EFU system in DCD revision 3.

B. DCD, Tier 2, Revision 3, Table 1.9-6 states that SRP Section 6.5.1 is not applicable to the ESBWR. Please make the appropriate correction in the DCD to account for the addition of the EFU system in DCD revision 3.

C. DCD, Tier 2, Revision 3, Table 1.9-20 states that SRP section 6.5.1 is not applicable to the EWBWR and comments that there is no standby gas treatment. Please make the appropriate correction in the DCD to account for the addition of the EFU system in DCD revision 3.

GEH Response:

A. The Emergency Filter Unit (EFU) supplies the engineered safety feature for radiological protection of the Control Room Habitability Area (CRHA) as described in DCD Tier 2, Section 6.4 and Subsection 9.4.1, and is the ventilation system credited to meet NUREG-0800, Standard Review Plan (SRP) Section 6.5.1 review requirements. The CRHA cooling function is performed by passive features during accident conditions and not by the EFU. SRP Section 9.4.5 is not applicable to ESBWR because there are no credited ventilation systems required to maintain a controlled environment in areas containing safety-related equipment. DCD Tier 2, Table 1.9-9 will be revised for reasons stated.

B. & C. The ESBWR utilizes a safety-related filter system to protect the main control room environment following a design basis accident as discussed in DCD Tier 2, Section 6.4. The system meets the acceptance criteria in SRP 6.5.1. DCD Tier 2, Tables 1.9-6, 1.9-9, and 1.9-20 will be revised as required.

DCD Impact:

DCD Tier 2, Table 1.9-6, Table 1.9-9, and Table 1.9-20 will be revised as shown in the attached markup.

NRC RAI 6.4-19:

In DCD, Tier 2, Revision 4, COL Information item, 6.4-2-A, Toxic Gas Analysis, states:

"The COL Applicant will identify potential site specific toxic or hazardous materials that may affect control room habitability in order to meet the requirements of TMI Action Plan III. D.3.4 and GDC 19."

The staff understands that the ESBWR has no provision for detecting and responding to a toxic gas event. Thus, the COL Applicant would not only have to identify potential site specific toxic or hazardous materials, but it would also have to include site specific design features such as monitoring equipment and other changes as necessary to respond to a toxic gas event including isolation capability and respirators if needed. These site-specific features would need to be considered for inclusion in site-specific ITAAC and technical specifications.

Please revise the COL Information Item to include the full scope of activities for which the applicant would be responsible.

GEH Response:

The standard ESBWR Control Room Habitability Area design does not consider a toxic gas hazard in the site vicinity as reflected in DCD Tier 2, Table 2.0 -1, Envelope of ESBWR Standard Plant Site Design Parameters. If the Toxic Gas Analysis performed by the COL Applicant determines that a site toxic gas or hazardous material release will impact control room habitability, protective measures will be required to be implemented by the COL Applicant.

The scope of DCD Tier 2, COL Applicant Item 6.4-2A will be revised to reflect the full scope of activities for which the applicant will be responsible.

DCD Impact:

DCD Tier 2, Subsections 6.4.5 and 6.4.9, will be revised as shown in the attached markup.

NRC RAI 9.4-32:

DCD, Tier 2, Revision 3, Section 9.4.1 states that the CRHAVS maintains a habitable control room under accident conditions by providing adequate radiation protection and breathing air. When power is available, the Air Handling Units (AHU) maintains the space temperature. Upon loss of power the remaining non safety-related heat loads are dissipated for 2 hours using battery power, and the remaining safety related heat loads are passively dissipated by the walls, floor ceiling, and interior walls.

A. *Please provide additional information justifying the use of a non-safety power source to provide cooling to non-safety heat loads in the first two hours of accident mitigation. Please include in the information the source and magnitude of these heat loads and the impact on control room temperatures and accident mitigation if cooling is not available and/or these non-safety heat loads are isolated.*

B. *Please identify any operator actions that may be required to isolate these heat loads during the first two hours of an accident.*

GEH Response:

A. As stated in DCD Tier 2, Subsection 9.4.1.2, the nonsafety-related heat loads are automatically de-energized when the CRHA Recirculation Air Handling Units (AHU) are not available during the first two hours. Therefore, no credit is taken for this nonsafety-related subsystem.

B. Nonsafety-related heat loads are automatically de-energized if the CRHA Recirculation AHU is not available, so no operator action is required for isolating the nonsafety-related heat loads.

DCD Impact:

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

Enclosure 2

MFN 08-216

* Response to Portion of NRC Request for Additional Information Letter Nos. 106, 122, and 103 Related to ESBWR Design Certification Application

Control Building Ventilation

RAI Numbers 6.4-18 and 6.4-19, Respectively

DCD Markups

* 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 markup(s) may not be fully developed and approved for inclusion in DCD Revision 5.

Table 1.9-6

Summary of Differences from SRP Section 6

SRP Section	Specific SRP Acceptance Criteria	Summary Description of Difference	Subsection Where Discussed
6.2.6		None	
6.2.7		None	
6.3	The requirements of Task Action Plan Item II.K.3.15 of NUREG-0737 and NUREG-0718, which involves isolation of HPCI and RCIC for BWR plants, must also be satisfied.	Not applicable to the ESBWR. There are no RCIC or HPCI systems in the ESBWR design.	
6.4	II.3	For differential pressure testing of the control room, the periodic verification interval of every 18 months in criteria II.3.a through II.3.c is increased to every 24 months to accommodate the ESBWR's 2-year operating cycle.	6.4.7, Chapter 16 Section 5.5.12.d
6.5.1		None~~Not applicable to the ESBWR~~	
6.5.2		Not applicable to the ESBWR	
6.5.3		None	
6.5.4		Not applicable to the ESBWR	
6.5.5		Not applicable to the ESBWR. Guidance provided is specific to Mark I, II and III containments and cannot be applied to the ESBWR containment design.	
6.6		None	
6.7		Not applicable to the ESBWR	

Table 1.9-9

Summary of Differences from SRP Section 9

SRP Section	Specific SRP Acceptance Criteria	Summary Description of Difference	Subsection Where Discussed
9.4.3		None	
9.4.4		None	
9.4.5		None~~The engineered safety features described in Chapter 6 do not require a separate ventilation system. This section is not applicable to ESBWR.~~	
9.5.1	Section C.8.1.2.c of BTP SPLB 9.5-1 recommends that automatic suppression capability should be provided in the Control Room Complex as described in Regulatory Guide 1.189. Section 6.1.2 of Regulatory Guide 1.189 states in part: "Peripheral rooms in the control room complex should have automatic water suppression …"	ESBWR design does not include a sprinkler system in the Control Building offices around the Main Control Room.	9.5.1.12.1.2

Table 1.9-20

NRC Standard Review Plans and Branch Technical Positions Applicability to ESBWR

SRP No.	SRP Title or BTP	Appl. Rev.	Issued Date	ESBWR Appli-cable?	Comments
9.3.4	Chemical and Volume Control System (PWR) (Including Boron Recovery System)	3	Draft 04/1996	No	PWR only.
9.3.5	Standby Liquid Control System (BWR)	3	Draft 04/1996	Yes	
9.4.1	Control Room Area Ventilation System	2	07/1981	Yes	
9.4.2	Spent Fuel Pool Area Ventilation System	2	07/1981	Yes	
9.4.3	Auxiliary and Radwaste Area Ventilation System	2	07/1981	Yes	
9.4.4	Turbine Area Ventilation System	2	07/1981	Yes	
9.4.5	Engineered Safety Feature Ventilation System	2	07/1981	Yes~~No~~	~~ESF ventilation not required in ESBWR design~~The EFU portion of the CRHAVS supplies the engineered safety feature for CRHA radiological protection as described in Section 6.4 and Subsection 9.4.1.
9.5.1	Fire Protection Program	4	10/2003	Yes	
	BTP SPLB 9.5-1	4	10/2003	Yes	
	Appendix A to BTP SPLB 9.5-1	4	10/2003	No	
	Appendix B to BTP SPLB 9.5-1	4	10/2003	Yes	
	Appendix C to BTP SPLB 9.5-1	4	10/2003	No	
	Appendix D to BTP SPLB 9.5-1	4	10/2003	No	
	Appendix E to BTP SPLB 9.5-1	4	10/2003	No	

6.4.5 Design Evaluations

System Safety Evaluation

Doses to main control room personnel are calculated for the accident scenario where the EFU provides filtered air to pressurize the CRHA. Doses are calculated for the following accident:

Loss Of Coolant Accident Table 15.4-9

The dose analyses are performed in accordance with the requirements of Regulatory Guides 1.194 and 1.196. For all events, the dose is within the dose acceptance limit of 5.0 rem TEDE. The details of the analytical assumptions for modeling the doses to the main control room personnel are delineated in Chapter 15. No radioactive material storage areas are located adjacent to the main control room pressure boundary. As discussed and evaluated in Subsection 9.5.1, the use of noncombustible construction and heat and flame resistant materials throughout the plant reduces the likelihood of fire and consequential impact on the main control room atmosphere. Operation of the CRHAVS in the event of a fire is discussed in Subsection 9.4.1. The exhaust stacks of the onsite standby power diesel generators are located in excess of 48 m (157 ft) away from the fresh air intakes of the main control room. The onsite standby power system fuel oil storage tanks are located in excess of 55 m (180 ft) feet from the main control room fresh air intakes. These separation distances reduce the possibility that combustion fumes or smoke from an oil fire would be drawn into the main control room.

Typical sources of onsite chemicals are listed in Table 6.4-2, and their locations are shown on Figure 1.1-1. Analysis of these sources are in accordance with Regulatory Guide 1.78 and the methodology in NUREG-0570, "Toxic Vapor Concentrations in the Control Room Following a Postulated Accidental Release" is to be performed on a site specific basis (See Subsection 6.4.9).

During emergency operation, the CRHA emergency habitability system passive heat sink is designed to limit the temperature rise inside the CRHA to 8.3°C (15°F). This maintains the CRHA within the limits for reliable human performance (References 6.4-1 and 6.4-2) over 72 hours. The walls and ceiling that act as the passive heat sink contain sufficient thermal mass to accommodate the heat sources from equipment, personnel, and lighting for 72 hours. The EFU portion of the CRHAVS nominally provides 200 l/s (424 scfm) of ventilation air to the main control room and is sufficient to pressurize the control room to at least a positive 31 Pa (1/8-inch water gauge) differential pressure with respect to the adjacent areas. This flowrate also supplies the recommended fresh air supply of 9.5 l/s (20 cfm) per person for a maximum occupancy of 21 persons (Reference ~~ASHRAE Standard 62~~6.4-3). Automatic isolation of the normal air intake and transfer of outside air supply to the EFU is initiated by either the following conditions:

- High radioactivity in CRHA normal air supply duct, and
- Extended Loss of AC power.

The airborne fission product source term in the reactor containment following the postulated LOCA is assumed to leak from the containment. The concentration of radioactivity is evaluated as a function of the fission product decay constants, the containment leak rate, and the meteorological conditions assumed. The assessment of the amount of radioactivity within the CRHA takes into consideration the radiological decay of fission products and the infiltration/exfiltration rates to and from the CRHA pressure boundary. Specific radiological

protection assumptions used in the generation of post-LOCA radiation source terms are described fully in Chapter 15.

Smoke protection is discussed in Subsection 9.4.1 and evaluated in Subsection 9.5.1. The use of noncombustible construction and heat and flame-resistant materials wherever possible throughout the plant minimizes the likelihood of fire and consequential fouling of the control room atmosphere with smoke or noxious vapor introduced into the control room air. In the smoke removal mode, a dedicated fan, intake, and exhaust path are utilized to purge the control room with a high volume of outside airflow.

A high radiation condition causes automatic changeover to the operating modes described in Subsection 6.4.4 and in Subsection 9.4.1.2. The EFU automatically starts to provide CRHA breathing air and pressurization during an SBO concurrent with a radiological event. Local, audible alarms warn the operators to shut the self-closing doors, if for some reason they are open.

Redundant EFU components are provided to ensure CRHA pressurization upon a radiological event concurrent with SBO.

The EFUs are designed in accordance with Seismic Category I requirements. The failure of components (and supporting structures) of any system, equipment or structure, which is not Seismic Category I, does not result in loss of a required function of the EFUs.

Potential site-specific toxic or hazardous materials that may affect control room habitability will be identified by the COL Applicant. The COL Applicant will identify potential site specific toxic or hazardous materials that may affect control room habitability in order to meet the requirements of TMI Action Plan III.D.3.4 and GDC 19. The COL Applicant will determine the protective measures to be instituted to ensure adequate protection for control room operators as recommended under Reg. Guide 1.78. These protective measures include features to (1) provide capability to detect releases of toxic or hazardous materials, (2) isolate the control room if there is a release, (3) make the control room sufficiently leak tight, and (4) provide equipment and procedures for ensuring the use of breathing apparatus by the control room operators (COL 6.4-2-A).

6.4.6 Life Support

In addition to the supply of vital air, food, water and sanitary facilities are provided.

6.4.7 Testing and Inspection

A program of preoperational and post operational testing requirements is implemented to confirm initial and continued system capability. The CRHAVS is tested and inspected at appropriate intervals consistent with plant technical specifications. Emphasis is placed on tests and inspections of the safety-related portions of the habitability systems.

Preoperational Inspection and Testing

Preoperational testing of the CRHAVS is performed to verify that the minimum air flow rate of 200 l/s (424 cfm) is sufficient to maintain pressurization of the main control room envelope of at least 31 Pa (1/8" wg) with respect to the adjacent areas. The positive pressure within the main control room is confirmed via the differential pressure transmitters within the control room. The installed flow meters are utilized to verify the system flow rates. The pressurization of the

- CRHA airlock doors are open during an SBO;
- Area high radiation in the CRHA; and
- High radiation in the Outside Air Intake duct.

6.4.9 COL Information

6.4-1-A CRHA Procedures and Training

The COL Applicant will verify procedures and training for control room habitability address the applicable aspects of NRC Generic Letter 2003-01 and are consistent with the intent of Generic Issue 83 (Subsection 6.4.4).

6.4-2-A Toxic Gas Analysis

The COL Applicant will identify potential site specific toxic or hazardous materials that may affect control room habitability in order to meet the requirements of TMI Action Plan III. D.3.4 and GDC 19. The COL Applicant will determine the protective measures to be instituted to ensure adequate protection for control room operators as recommended under Reg. Guide 1.78. These protective measures include features to (1) provide capability to detect releases of toxic or hazardous materials, (2) isolate the control room if there is a release, (3) make the control room sufficiently leak tight, and (4) provide equipment and procedures for ensuring the use of breathing apparatus by the control room operators (Subsection 6.4.5).

6.4.10 References

6.4-1 MIL-HDBK-759C, Human Engineering Design Guidelines.

6.4-2 MIL-STD-1472E, Human Engineering.

6.4-3 A Prioritization of Generic Safety Issues, NUREG-0933, October 2006.

6.4-4 ASHRAE Standard 62/2007 Ventilation for Acceptable Indoor Air Quality.