



**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

MFN 08-431

Docket No. 52-010

May 5, 2008

U.S. Nuclear Regulatory Commission  
Document Control Desk  
Washington, D.C. 20555-0001

Subject: **Response to Portion of NRC Request for Additional Information Letter No. 179 Related to ESBWR Design Certification Application - Auxiliary Systems - RAI Number 9.5-68 S01**

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 NRC letter dated April 8, 2008, Reference 1. GEH response to RAI Number 9.5-68 S01 is addressed in Enclosure 1. The original response was transmitted via Reference 2 in response to Reference 3.

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.

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

Sincerely,

James C. Kinsey  
Vice President, ESBWR Licensing

D068  
NRC

References:

1. MFN 08-364, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, GEH, *Request For Additional Information Letter No. 179 Related To ESBWR Design Certification Application*, dated April 8, 2008
2. MFN 08-251, Response to Portion of NRC Request for Additional Information Letter Nos. 129 and 140 Related to ESBWR Design Certification Application - Auxiliary Systems - RAI Numbers 9.5-65, 9.5-67, 9.5-68 (NRC Letter No. 129), and 9.5-70 (NRC Letter No. 140), dated April 2, 2008
3. MFN 07-701, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, General Manager, *Request for Additional Information Letter No. 129 Related to the ESBWR Design Certification Application*, dated December 19, 2007

Enclosure:

1. Response to Portion of NRC Request for Additional Information Letter No. 179 Related to ESBWR Design Certification Application - Auxiliary Systems - RAI Number 9.5-68 S01

cc: AE Cabbage      USNRC (with enclosure)  
GB Stramback      GEH/San Jose (with enclosure)  
RE Brown          GEH/Wilmington (with enclosure)  
DH Hinds          GEH/Wilmington (with enclosure)  
eDRF                0000-0081-6538, Revision 4

**Enclosure 1**

**MFN 08-431**

**Response to Portion of NRC Request for  
Additional Information Letter No. 179  
Related to ESBWR Design Certification Application  
Auxiliary Systems  
RAI Number 9.5-68 S01**

**\*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.**

**For historical purposes, the original text of RAI 9.5-68 and the GEH response is included. The original DCD mark-ups included with the response are not provided.**

**NRC RAI 9.5-68**

Question 1. DCD Tier 2, Revision 4, Section 9.5.1.11 states that smoke control in accordance with NFPA 92A guidelines is provided for unsprinklered areas where the FHA identifies a potential for heavy smoke or heat conditions. The 2006 Edition of NFPA 92A (the edition identified in DCD Tier 2, Table 1.9-22) applies to a specific method of smoke control that relies on maintaining a differential pressure across fire area boundaries to prevent the spread of smoke from the area on fire to adjacent areas, or in the case of stairwells, prevent smoke from entering the stairwell. Regarding Tables 9A.5-1 through 9A.5-7 of the FHA in Appendix 9A of DCD Tier 2, Revision 4, the staff is not able to find any unsprinklered areas where a potential for heavy smoke or heat conditions is identified by GEH and none of the fire area descriptions indicate that smoke control is provided in accordance with NFPA 92A. These tables would be the appropriate place to identify any provisions for smoke control for specific fire areas. The DCD should be revised to indicate in Tables 9A.5-1 through 9A.5-7 any areas that are provided with smoke control in accordance with NFPA 92A or should include a statement that no areas meeting the criteria for this type of smoke control have been identified and provide the criteria for "heavy smoke or heat conditions".

Question 2. DCD Tier 2, Revision 4, Section 9.5.1.12 quotes the regulatory guidance that it should be demonstrated that smoke, hot gases, or the fire suppressant does not migrate into other fire areas to the extent that safe shutdown capabilities, including operator actions, could be adversely affected and states that the ESBWR fire protection design satisfies this guidance with a combination of fire dampers and other barriers, smoke evacuation capabilities, and minimal required operator manual actions. Fire dampers that are not smoke dampers do not provide an effective means of preventing smoke from passing through a ventilation duct that penetrates a fire barrier. The smoke evacuation capabilities described in the DCD are generally for smoke clearing after the fire has been extinguished. If smoke control measures are required during a fire to prevent the migration of smoke from one fire area to another in order to achieve and maintain safe shutdown, the details of these smoke control capabilities should be described in the DCD.

Question 3. Also note that the ABWR certified design includes smoke control capabilities that use the methods described in NFPA 92A (differential pressure across the fire barrier) and the ABWR certified design includes ITAAC for the verification of that capability. Should the ESBWR credit similar NFPA 92A smoke control capabilities for post-fire safe shutdown, similar ITAAC would be required for the ESBWR.

Question 4. DCD Tier 2, Revision 4, Section 9.5.1.11 also states that safe egress and safe smoke refuge areas during a fire incident are provided in accordance with NFPA 92A guidelines for building occupants and the fire brigade. Section 9.4.4.2 states that

the turbine building main stairwells are pressurized to prevent infiltration of smoke from other turbine building areas in the event of a fire. Section 9.4 does not identify any other stairwells in the plant that are pressurized. Are the turbine building stairwells the only stairwells in the plant that are pressurized to prevent smoke infiltration? As above, provision should be identified in Tables 9A.5-1 through 9A.5-7 since it is relevant to the FHA.

### GEH Response

#### RAI question 1 regarding smoke control

DCD Tier 2, Revision 4, Section 9.5.1.11 does state that smoke control in accordance with NFPA 92A guidelines is provided for unsprinklered areas where the FHA identifies a potential for heavy smoke or heat conditions. However, areas identified in the FHA with a potential for heavy smoke or heat condition are provided with sprinkler systems for smoke control. The Fire Hazard Analysis (FHA) provides the criteria for automatic suppression as quantity and type of combustible materials present. Therefore, smoke control per NFPA 92A, Standard for Smoke-Control system Utilizing Barriers and Pressure Differences, is not required for maintaining smoke to the zone of fire origin. DCD 9.5.1.11 is revised to state areas identified in the FHA with a potential for heavy smoke or heat condition are provided with sprinkler systems for smoke control.

#### DCD Impact

DCD Tier 2, Subsection 9.5.1.11 is revised to state areas identified in the FHA with a potential for heavy smoke or heat condition are provided with sprinkler systems for smoke control as shown on attached DCD Revision 5 markup.

#### RAI question 2 regarding smoke migration affecting safe shutdown

The ESBWR fire protection design satisfies this guidance with a combination of fire dampers and other barriers with minimal required operator actions. The operator actions would be in the MCR to initiate shutdown prior to evacuation. Details are provided in the fire hazards analysis in Appendix 9A.

The following is the risk evaluation of potential smoke propagation.

- **N-DCIS room A (fire area F3301), Div I and IV Q-DCIS rooms (fire areas F3110 and F3140):** The risk increase due to the additional failures for the postulated smoke damage is not significant since the ESBWR plant has N-2 redundancy in the safety system design. With the additional failure probability of the smoke removal mode and the failure of fire dampers to isolate, the risk contribution due to smoke propagation is not significant.

- **N-DCIS room B (fire area F3302), Div II and Div III Q-DCIS rooms (fire areas F3120 and F3130):** Same as above. The risk increase due to smoke propagation is not significant.
- **Electric and electronic rooms in the electric building for each train of the electrical distribution system:** The risk increase due to the additional failures for the postulated smoke damage is not significant since only one train of the electric system is impacted. With the additional failure probability of the smoke removal mode and the failure of fire dampers to isolate, the risk contribution due to smoke propagation is not significant.
- **Different levels in the reactor building:** The ESBWR plant is designed with N-2 redundancy (four divisions) in safety related systems to enable safe shutdown of the facility with only one of the four divisions operational. Each division is separated by smoke barriers with smoke/fire damper combinations in the ductwork passing between fire areas. The risk increase due to smoke propagation from one fire area to adjacent areas is therefore not significant.

In summary, the risk associated with postulated smoke propagation is not significant.

#### **DCD Impact**

None

#### **RAI question 3 regarding credit for smoke control for post fire shutdown**

The ESBWR does not credit NFPA 92A smoke control capabilities for post-fire shutdown; therefore, no ITAAC is required.

#### **DCD Impact**

None

#### **RAI question 4 regarding pressurization of stairwells**

The Turbine, Electrical, Reactor, Fuel, Radwaste and Control Buildings are provided with pressurized stairwells, in accordance with International Building Code (IBC) 2003 edition, section 1019.1.8 which requires pressurized stairwells where stairwells serve floors 75 ft. or more above the lowest level of fire department vehicle access (grade level) or more than 30 ft. below the level of exit discharge. The design of the pressurized stairwells complies with NFPA 92A. Per the requirements of IBC 2003 section 1019.1.8, pressurized stairwells are not required for the Service Building.

**DCD Impact**

DCD Tier 2, Subsection 9.5.1.11 is revised to address the buildings requiring pressurized stairwells, in accordance with International Building Code (IBC) 2003 Edition, Section 1019.1.8 as shown on attached DCD Revision 5 markup.

**NRC RAI 9.5-68 S01**

*In response to part 1 of the RAI, GEH proposes to add a statement to DCD Section 9.5.1.11 that areas identified in the FHA with a potential for heavy smoke or heat condition are provided with sprinkler systems for smoke control. The ESBWR criteria for providing sprinklers is the expected combustible loading in each area. While an area with a high combustible loading may experience high levels of smoke during a fire, the sprinkler systems are installed to extinguish or control the fire as their primary function. Sprinkler systems are activated by the heat generated by a fire, not by the smoke, and large quantities of smoke can be generated before the sprinkler system is activated. Consequently, the DCD should not state that the sprinkler systems are installed for smoke control.*

**GEH Response**

GEH concurs that the DCD should not state that sprinkler systems are installed for smoke control. Safe egress and safe smoke refuge areas during a fire incident are provided in accordance with NFPA 92A guidelines. GEH does not rely on positive pressure from building ventilation to comply with any other guidelines of NFPA 92A for smoke control. In addition, the original response proposed other changes in DCD Subsection 9.5.1.11, which are being rewritten for clarity.

**DCD Impact**

DCD Tier 2, Subsection 9.5.1.11, Revision 5, will be revised as noted in the attached markup to delete statement regarding sprinklers and smoke control. In addition, the standalone paragraph added per question 4 of the original response, is relocated to compile the discussion on conformance to NFPA 92A in one paragraph.

The COL applicant shall provide specific design and certification testing details for fire barriers and electrical raceway fire barrier systems in accordance with applicable sections of NFPA 251, ASTM E-119 and guidance in Regulatory Guide 1.189 (9.5.1-5-A).

#### **9.5.1.11 Building Ventilation**

Fire protection/smoke control provisions for ventilation for the various building areas are designed as follows:

~~Smoke control in accordance with NFPA 92A guidelines is provided for unsprinklered areas where the FHA identifies a potential for heavy smoke or heat conditions. Additionally, safe egress and safe smoke refuge areas during a fire incident are provided in accordance with NFPA 92A guidelines for building occupants and the fire brigade. The Turbine, Electrical, Reactor, Fuel, Radwaste and Control Buildings are provided with pressurized stairwells, in accordance with International Building Code (IBC) 2003 edition, section 1019.1.8 which requires pressurized stairwells where stairwells serve floors 75 ft. or more above the lowest level of fire department vehicle access (grade level) or more than 30 ft. below the level of exit discharge. Per these IBC requirements, pressurized stairwells are not required for the Service Building. NFPA 101 guidelines are utilized for the design and labeling of safe egress routes.~~

Smoke removal meets NFPA 804 with exception to NFPA 804 Sections 8.4.3 (3) and 8.4.3.2. Automatic sprinkler protection is provided for the high density cable tunnels, fuel oil tank rooms, diesel-generator rooms and a significant portion of the Turbine Building to limit heat and smoke generation. The COL Holder will establish provisions for manual smoke control by manual actions of the fire brigade for all plant areas in accordance with NFPA 804 guidelines (9.5.1-6-H).

#### **Control Building (CB) Smoke Removal**

The CB HVAC System (CBVS) provides smoke removal through two CBVS subsystems: Control Room Habitability Subsystem (CRHAVS) and Control Building General Area HVAC Subsystem (CBGAVS). Fire-rated penetration seals and smoke dampers are provided to prevent smoke and hot gases from migrating into other fire areas.

#### **Control Room Habitability HVAC Area Subsystem (CRHAVS)**

The MCR is separated from the rest of the Control Building by a 1-hour fire barrier and separated from other major plant areas by 3-hour fire barriers.

Manual fire fighting capability in the MCR consists of portable dry Class ABC chemical fire extinguishers. Additionally, hose stations with UL-approved fixed fog nozzles are installed outside both entrances to the MCR. No hose stations are located within the MCR.

The MCR is provided with smoke detectors that actuate audible and visible alarms on the MFAP in the MCR.

Smoke detection capability in the CRHAVS automatically detects and annunciates the presence of smoke. Upon receipt of the outside air intake smoke alarm, the MCR operator manual action is required to isolate the MCR from the outside air and place the CRHAVS in full recirculation mode~~CRHAVS automatically isolates and is placed in full recirculation mode to isolate the MCR from the outside air.~~ To purge smoke from the MCR when there is no smoke in the outside air intake, the CRHAVS is placed in the smoke removal mode, in which the MCR air recirculation