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Subject: Response to Portion of NRC Request for Additional Information Letter No. 216, Related to ESBWR Design Certification Application - Auxiliary Systems - RAI Number 9.4-30 S02

The purpose of this letter is to submit the GE Hitachi Nuclear Energy (GEH) response to the U.S. Nuclear Regulatory Commission Request for Additional Information (RAI) sent by NRC Letter 216, dated July 3, 2008 (Reference 1). The GEH response to RAI Number 9.4-30 S02 is addressed in Enclosure 1. The GEH response to RAI 9.4-30 S01 was submitted via Reference 2 in response to Reference 3. The original response was submitted via Reference 4 in response to Reference 5.

Should you have any questions or require additional information regarding the information provided here, please contact me.

Sincerely,

Richard E. Kingston

Richard E. Kingston
Vice President, ESBWR Licensing

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References:

1. MFN 08-575, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request for Additional Information Letter No. 216 Related to ESBWR Design Certification Application,* July 3, 2008.
2. MFN 08-348 - Response to Portion of NRC Request for Additional Information Letter No. 158 Related to ESBWR Design Certification Application - Auxiliary Systems - RAI Numbers 9.4-29 S01 and 9.4-30 S01, April 15, 2008.
3. MFN 08-209, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, GEH, *Request For Additional Information Letter No. 158 Related To ESBWR Design Certification Application,* dated February 29, 2008.
4. MFN 07-687, Response to Portion of NRC Request for Additional Information Letter No.1 03 Related to ESBWR Design Certification Application - Control Room Habitability Systems - RAI Numbers 6.4-11,6.4-12, 6.4-15,6.4-17,9.4-29,9.4-30,9.4-36,9.4-37,9.4-49, 14.3-152, and 14.3-153, dated December 21, 2007.
5. MFN 07-414, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, GEH, *Request For Additional Information Letter No. 103 Related To ESBWR Design Certification Application,* dated July 23, 2007.

Enclosure:

1. MFN 08-697, Response to Portion of NRC Request for Additional Information Letter No. 216 Related to ESBWR Design Certification Application - Auxiliary Systems - RAI Number 9.4-30 S02

cc:	AE Cubbage	USNRC (with enclosures)
	DH Hinds	GEH (with enclosures)
	RE Brown	GEH (with enclosures)
	eDRF	0000-0089-7053

Enclosure 1

MFN 08-697

Response to Portion of NRC Request for Additional Information Letter No. 216

Related to ESBWR Design Certification Application

Auxiliary Systems

RAI Number 9.4-30 S02

For historical purposes, the original text of RAI 9.4-30 and RAI 9.4-30 S01 with the corresponding GEH responses is included. The DCD mark-up is not included.

NRC RAI 9.4-30

In DCD, Tier 2, Revision 3, Section 9.4.1, Figure 9.4-1 the EFU discharges its flow into the plenum above the false ceiling in the control room. For the first two hours an air handling unit (AHU) operates off the non-safety battery power to facilitate removal of non-safety heat loads. The inference is that after two hours the recirculation AHU would be shut down. As such, there would be no recirculation from the plenum above the false ceiling to the plenum below the false floor for distribution through the control room. Breathable air, especially if it is warm air from the outside, may not dissipate to the operator breathable zone and the operator could experience reduced oxygen. Please discuss the features which provide assurance that the air in the operator breathable zone would be adequately refreshed in the first 72 hours.

GEH Response

During the post accident period up to 72 hours, breathing air is supplied into the plenum above the false ceiling with the Control Room Habitability Area (CRHA) envelope isolated at a minimum flow rate of 200 l/s (424 cfm). During that time period, no recirculation air handling unit (AHU) is in service to assist air circulation. In order to ensure this minimum flow rate, a controlled leak path from the CRHA envelope will be introduced. This leak path will maintain a 31Pa (1/8"wg) positive pressure and the minimum flow rate. Locating the leak path under the raised floor of the control room removed from the air supply location will provide a flow path for the incoming filtered fresh air to assure that the operator breathable zone is refreshed.

DCD Impact

DCD Tier 2, Figure 6.4-1, Figure 9.4-1, Figure 9.4-2 and DCD Tier 1, Figure 2.16.2-4 will be revised as shown in attached markup to reflect the controlled leakage path. DCD Tier 2 subsection 9.4.1.2 will also be revised as shown in attached markup to include this controlled leakage path design feature.

NRC RAI 9.4-30 S01

"In the response to RAI 9.4-30, the addition of a discharge path from the CRHA partially addresses the concern but needs to be fully described in the DCD. Please state how the leakage will be controlled (such as by a differential pressure monitor, relief damper, control damper, etc.). In addition, the recirculation of air in the CRHA has not been fully addressed. Please provide information on how the fresh air from the EFU is prevented from short circuiting the major areas of the CRHA and passing directly out through the discharge path without refreshing the CRHA as a whole. Please coordinate the response with the response to RAI 9.4-29S1."

GEH Response

The CRHA EFU airflow will be optimized during detailed design using ASHRE guidance with several methods available to ensure adequate mixing and fresh air delivery throughout the space. Air from the EFU is directed and discharged directly into the occupied areas in the control room where the operators are most likely to be located (control room control panels and monitors). To reduce short-circuiting of the EFU supply past the operator's zone, these supply air outlets will be located distant from the exhaust locations. There are three primary exhaust (leakage) locations; two airlocks, and the third (with adjustable air flow capability), located under the raised floor. The underfloor release path would also be located as far as possible from the diffusers. Leakage at this third location will be controlled manually, at the relief device (orifice & needle valve) located under the raised floor. The control would be via an extension rod extending up into the CR and terminating at a spot where the operators can both view gauges (indicating the CRHA dP and EFU fan flow) and adjust the relief device as needed.

DCD Impact

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

NRC RAI 9.4-30 S02

"In response to RAI 9.4-30 S01 (MFN 08-348), GEH stated that the EFU will be "optimized during detailed design." The EFU airflow is a safety-related function and needs to be defined before certification. This includes flow paths, mixing, and potential stratification concerns. EFU airflow impacts operator fresh air supply and passive cooling assumptions. The staff needs information on the adequacy of the airflow to support a finding in the safety evaluation report. The staff noted in the response to RAI 6.4-9, that air leakage through access paths could total 172 cfm. This would leave approximately 252 cfm to be controlled at the relief device, which was stated to be a manual needle valve with a handle that protruded through the CRHA floor and appropriate gauges."

A. Since the time of concern is the 30 days post accident, will appropriate instructions be placed in the emergency operating procedures to require monitoring and adjustment of the relief device to maintain the 1/8-inch positive pressure? How frequent would this monitoring be done and how much of a burden would it place on operators at a critical time in accident recovery.

B. Do changes in outside air temperature which could cycle as much as 27 degrees in a day change the volumetric addition of air to the control room such that the manual relief valve would have to be adjusted to keep the pressure constant. How frequently would these changes have to be made?

C. Do changes in outside air temperature impact the electrical load requirements for the EFU fans such as current and voltage on the safety-related battery supply and on the ancillary diesels? Is there sufficient load capacity to operate in the coldest, most dense air conditions? Is adequacy of fresh air supply assured under all temperature conditions?

D. Will an SR be established in the technical specification to verify that the control device can maintain the 1/8 inch w.g. positive pressure in connection with periodic EFU testing?

E. Will the manual control device be used in normal operation? Will the operator be required to adjust it immediately upon accident initiation?

GEH Response

A. Quality Assurance Program Requirements (Operation) require development of emergency procedures for response to emergencies and other significant events. This requirement is addressed under DCD Tier 2, Section 13.5 COL Applicant Item 13.5-3-A, Emergency Procedure Development, to ensure applicable emergency procedures are developed prior to fuel load (ref: DCD Tier 2 Subsection 14.2.2.1). These emergency operating procedures will include provisions to monitor CRHA airflow and positive pressure relative to adjacent areas. While adjustment is not anticipated, the variable leakage device is provided to maintain required airflow and CRHA positive pressure relative to adjacent areas.

DCD Tier 2 subsection 6.4.5 states that periodic monitoring of the CRHA air intake flows and positive CRHA differential pressure is performed during operation of the CRHA Recirculation AHU (normal operation) or EFU (emergency operation). Surveillance testing verifying CRHA airflow and positive differential pressure is performed under Technical Specification TS 5.5.12, Control Room Habitability Area (CRHA) Boundary Program. TS 5.5.12, paragraph d requires measurement at designated locations, of the CRHA pressure relative to all external areas adjacent to the CRHA boundary during the pressurization mode of operation by one train of the CRHAVS, operating at the flow rate required by the Ventilation Filter Testing Program (VFTP). This surveillance test is performed at a Frequency of 24 months on a STAGGERED TEST BASIS. The results shall be trended and used as part of the 24 month assessment of the CRHA boundary. This testing verifies proper airflow and positive pressure are established upon initiation of the EFU. As described in DCD Tier 2, Section 6.4.8, alarms are provided to alert operators of low airflow, high filter pressure drop and / or low CRHA differential pressure. CRHA system design ensures frequent adjustment of the variable leakage device will not be required and operator burden will be minimized. ESBWR utilizes digital controls for the CRHA system. This will allow monitoring of individual computer points with a warning or alarm signal programmed to display on the control screen when the reading data exceeds the preset value. Therefore, this would allow continuous monitoring of CRHA airflow and positive pressure relative to adjacent areas.

B. During summertime, the maximum Control Building (CB) design temperature is assumed at 47.2C (117 °F) with a 15 °C (27 °F) profile (ref DCD Tier 2 Table 3H-14). The change in air specific volume can be estimated using the psychometric chart with this change proportional to the change in volumetric flow:

Air specific volume at 117 °F db & 80 °F wb (40% humidity)
= 14.55 ft^3 / lb-air
Air specific volume at 90 °F db & 71 °F wb (40% humidity)
= 14.15 ft^3 / lb-air

ΔAir specific volume= [14.55 ft^3 /lb-air - 14.15 ft^3 /lb-air] / 14.55 ft^3/ lb-air
= 0.0275 =2.75%

With a change of less than 3% of the specific volume, the variation in airflow and the change in EFU static pressure would be minimal. No change in the CRHA variable leakage device adjustment position would be expected for this condition.

C. Considering the minimum ambient temperature (0% exceedance design minimum temperature) of –40°C (°F), the kW input required for this temperature condition approximately 26% greater than required at the reference ambient temperature of 21°C (70°F):

$$KW_2 = KW_1 \times (460 + 70) / (460 + (-40) = 1.26\ KW_1$$

The electrical requirements for the EFU including input power, line voltage and current draw have been determined using the extreme minimum ambient design temperature in initial EFU sizing calculation. Applying the most stringent design requirements for EFU fan motor sizing will ensure adequacy of fresh air is supplied under all temperature conditions.

D. Surveillance testing verifying CRHA airflow and positive differential pressure is performed under Technical Specification TS 5.5.12, Control Room Habitability Area (CRHA) Boundary Program. TS 5.5.12, paragraph d requires measurement at designated locations, of the CRHA pressure relative to all external areas adjacent to the CRHA boundary during the pressurization mode of operation by one train of the CRHAVS, operating at the flow rate required by the VFTP. Each EFU train consists of an air intake, two 100% capacity fans, filtration housing, ductwork and dampers. This surveillance test is performed at a Frequency of 24 months on a STAGGERED TEST BASIS. The results shall be trended and used as part of the 24-month assessment of the CRHA boundary.

E. As described in DCD Tier 2, Table 19.2-1, Comparison of ESBWR Features with Existing BWRs, no operator actions are required for safety function success in the ESBWR for the first 72 hours of an event. The CRHA system design meets this requirement. The CRHA variable leakage device is provided in the system design to compensate for long-term changes in CRHA leakage paths and pressure drops throughout the system boundaries. Frequent adjustment of this device is not anticipated. Adjustments due to a slow increase in EFU filter DP or slow pressure integrity degradation of CRHA airlocks would be compensated by the CRHA variable leakage device. Adjustment of the CRHA variable leakage device upon accident initiation is not anticipated.

DCD Impact

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