February 26, 2009

Mr. Robert E. Brown
Senior Vice President, Regulatory Affairs
GE Hitachi Nuclear Energy
3901 Castle Hayne Road MC A-50
Wilmington, NC 28401

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 312 RELATED TO ESBWR DESIGN CERTIFICATION APPLICATION

Dear Mr. Brown:

By letter dated August 24, 2005, GE-Hitachi Nuclear Energy (GEH) submitted an application for final design approval and standard design certification of the economic simplified boiling water reactor (ESBWR) standard plant design pursuant to 10 CFR Part 52. The U.S. Nuclear Regulatory Commission (NRC) staff is performing a detailed review of this application to enable the staff to reach a conclusion on the safety of the proposed design.

The NRC staff has identified that additional information is needed to continue portions of the review. The staff's request for additional information (RAI) is contained in the enclosure to this letter.

If you have any questions or comments concerning this matter, you may contact me at 301-415-6256 or Dennis.Galvin@nrc.gov or you may contact Amy Cubbage at 301-415-2875 or Amy.Cubbage@nrc.gov.

Sincerely,

/RA/

Dennis Galvin, Project Manager
ESBWR/ABWR Projects Branch 1
Division of New Reactor Licensing
Office of New Reactors

Docket No. 52-010

Enclosure:
Request for Additional Information

cc: See next page

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Request for Additional Information
cc: See next page
Distribution: See next page

ACCESSION NO.: ML090570319 NRO-002

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SUBJECT: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 312 RELATED TO ESBWR DESIGN CERTIFICATION APPLICATION DATED FEBRUARY 26, 2009

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Requests for Additional Information (RAIs):
ESBWR Design Control Document (DCD) Revision 5

RAI Number	Reviewer	Question Summary	Full Text
RAI 9.4-29 Supplement 3 (MFN 08-858, November 5, 2008)	Forrest E	Adequacy of EFU supply and circulation	The purpose of RAI 9.4-29 is to obtain information on how the EFU delivers air to the CRHA and promotes mixing to support the assumption in the passive cooling analysis that the temperature is uniform throughout the CRHA without thermal stratification and that the concentrations of CO2 being developed through normal breathing were well mixed so that the fresh air would be available to the operator in the breathing zone. The RAI asked that this information be included in the DCD so that the staff could use it as the basis of a finding on the acceptability of air mixing in the CRHA. A. The GEH response to RAI 9.4-29 S02 is based on the premise that there would be four flexible HVAC ducts distributing the EFU flow to the occupied parts of the main control room with sufficient velocity to promote mixing, prevent upward air flow and thermal stratification and that other areas of the main control room would not be occupied. The GEH response states that each duct would exhaust 100 cfm at a velocity of 80 fps. The 80 fps exhaust velocity is equivalent to a 55 mph wind. It would be noisy. It would require the equivalent of a 2 inch diameter opening. It would impact motor horse power requirements for the fan. Confirm the accuracy of 80 fps. The GEH response preferentially distributes flow to the occupied areas. Other areas such as bathrooms, kitchens, and shift supervisor office are excluded from EFU supply flow. There are no physical barriers in the CRHA that divide the CRHA into occupied and unoccupied zones. The volume for the CRHA in Table 15.4-5 has a free air volume of 78,000 cubic feet. The GEH response reduces this volume to a volume containing ventilation ducting of 42,000 cubic feet and further reduces it to 33,600 cubic feet to allow for furniture and equipment. The staff understands the concept of delivering flow preferentially to the areas that are most likely to be occupied.

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			However, with the flow comes the heat (or cold) of unconditioned air and radioactive contamination not removed through the filter system. The current passive cooling analysis for the first 72 hours indicates that the temperature would be 86 degrees F in 12 hours. On a hot 117 degree F day, would temperatures rise in the occupied areas to a level that would make work conditions unacceptable possibly exceeding the 93 degree F limitation? Could operators in the occupied area work effectively with cold unconditioned air at the winter design conditions blowing directly upon them? Would concrete walls and ceilings in the unoccupied areas still provide cooling or heating for the CRHA since temperatures are unlikely to be uniform through out the room? What would be the impact on safety-related equipment with hot unconditioned air blowing down on cabinets in the occupied area? Has the impact of preferential flow to occupied areas been considered in the passive cooling analysis? Has GEH considered the potential to lower the EFU supply duct to a location near the floor and raising the discharge point to a location near the ceiling in order to take credit for natural circulation to promote mixing? Does the dose analysis for CR operators need to be revised to reflect that the radiation is being preferentially delivered to the occupied areas (36,000 cubic feet) as opposed to the whole CRHA (78,000 cubic feet) during the first 72 hours? Wouldn't this reduction of volume to an occupied volume which receives fresh air in effect concentrate the dose? In the passive cooling analysis, GEH states that the false ceiling and the false floor do not provide a barrier for heat transfer since they are heavily ventilated for return air and supply air flow. How does the false ceiling prevent hot air from rising and stagnation from developing? Horizontal or even downward velocities have not been shown to be sufficient to overcome gravitational effects of temperature to prevent stagnation and stagnation

RAI Number	Reviewer	Question Summary	Full Text
			would have a detrimental impact on passive cooling. Provide details on how stagnation is prevented in the DCD so that the staff can use it in support of a finding of acceptability. B. The information provided on temperatures inside cabinets and equipment qualification will be evaluated with RAI 3.11-18 and/or RAI 6.4-21. However, the preferential distribution of EFU supply air to occupied areas may affect the equipment qualification temperatures in the preferential distribution area. Provide assurance that the bulk temperatures upon which cabinet cooling is based are not affected by the preferential distribution of EFU air. C. Fresh air requirements as presented in ASHRAE Standard 62-1989 are based on the room being fully mixed. In response to RAI 9.4-29 S02, GEH stated that the mixing would be achieved by 80 fps velocity of four flexible hose supplies of essentially 100 cfm each to the occupied areas of the CRHA. The staff requested in part "A" that this velocity be reviewed for accuracy. Does preferential supply of fresh air to occupied areas leave other unoccupied areas depleted in fresh air? Is there any thing that would prevent an operator from going to an unoccupied area (such as the shift supervisor's office or bathroom which do not have a fresh air supply) and experiencing effects of lack of fresh air? In response to RAI 9.4-29 S02, GEH stated that CO_2 is heavier than air, thus it would settle to the bottom and be preferentially removed by the discharge path. Is the CO_2 removal based on the air in the CRHA being well mixed (the 80 fps mixing velocity argument) or is it based on CO_2 having a higher density in a stagnant air environment? It should be noted that a portion of the air leaving the CRHA exits through door seals and would have no benefit of gravitational density differences between CO_2 and air.

RAI Number	Reviewer	Question Summary	Full Text
			In response to RAI 9.4-29 S02, GEH stated that a CO_2 concentration of 5,000 ppm is the lower limit enforced by OSHA, and recommended by NIOSH and ACGIH. State the specific OSHA enforcement regulation or provide a copy for staff review and discuss its applicability to the CRHA which is in essence a confined entry space operating with out air recirculation. The staff's concern is that the lower limit that GEH has sited was developed for industry applications where recirculation mechanisms and clean up mechanisms were available and people could be evacuated. CO2 alarms would also be available. The CRHA with essentially zero leakage is a confined entry space. CO2 levels build up in time based on the supply of fresh air and the removal of CRHA air containing some CO2 build up. The staff does not anticipate that CO2 levels by themselves will reach a level of toxicity to be life threatening. ASHRAE 62-1989 suggests a limit of 1000 ppm of CO2 as a point at which operators may start experiencing some degradation of performance. The reason is that in addition to CO2, other objectionable gasses build up from the process of breathing and human activities. The staff's concern is that at some point, operator performance would be degraded by a combination of CO2 and these additional gasses. Demonstrate in the DCD that mixing of the air in the CRHA would be adequate to prevent localized build up of CO2 and other irritants. CO2 is a readily measurable commodity that can provide an alarm when action is needed. Describe how the CRHA environment degradation is monitored during the 72-hour non-recirculation period and what actions can be taken to assure that air remains sufficiently fresh to prevent unacceptable operator performance degradation. References to confined entry vessel regulations that show the CRHA for its size and configuration has sufficient air flow and mixing for extended occupancy would be useful.

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			In order to produce a finding of acceptability, the staff needs to have included in the DCD sufficient information to substantiate that the environment will remain reasonably fresh and not impair operator performance. The staff is specifically interested in the degree of mixing, control of temperature, control of dose, and control of air freshness to insure an adequate environment. Include the appropriate information in the DCD.

cc:

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