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 06-431 Supplement 11

Docket No. 52-010

May 21, 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. 63 Related to ESBWR Design Certification Application - Technical Specifications - RAI Number 16.2-40 S01**

Enclosure 1 contains the subject supplemental Request for Additional Information (RAI) response resulting from a March 27, 2007, e-mail from the NRC. The GE Hitachi Nuclear Energy (GEH) response to the original RAI was provided in the Reference 1 letter.

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

Sincerely,

James C. Kinsey

James C. Kinsey
Vice President, ESBWR Licensing

DO68
NRO

Reference:

1. MFN 06-431, Letter from David Hinds to U.S. Nuclear Regulatory Commission, *Response to Portion of NRC Request for Additional Information Letter No. 63 Related to ESBWR Design Certification Application – Technical Specifications – RAI Numbers 16.0-2 through 16.0-7, 16.2-10, 16.2-12 through 16.2-22, 16.2-25, 16.2-31 through* ***16.2-40****, 16.2-43, 16.2-44, 16.2-46 through 16.2-49, 16.2-51, 16.2-53, 16.2-55 through 16.2-72, and 16.2-78 through 16.2-80,* November 13, 2006

Enclosure:

1. MFN 06-431 Supplement 11 - Response to Portion of NRC Request for Additional Information Letter No. 63 Related to ESBWR Design Certification Application - Technical Specifications - RAI Number 16.2-40 S01

cc:

AE Cubbage	USNRC (with enclosure)
DH Hinds	GEH (with enclosure)
RE Brown	GEH (with enclosure)
eDRF	77-3296/1

Enclosure 1

MFN 06-431 Supplement 11

Response to Portion of NRC Request for

Additional Information Letter No. 63

Related to ESBWR Design Certification Application

- Technical Specifications -

RAI Number 16.2-40 S01

NRC RAI 16.2-40

Justify not having temperature limits for TS 3.5.3 GDCS pools or incorporate into Pool Operability LCO if needed.

GE Response

As described in the response to NRC RAI 6.2-68, the ESBWR accident analyses for peak containment pressure assume that the initial GDCS water and gas space temperatures are in equilibrium with the drywell air temperature. These analyses were performed assuming an initial temperature of 115°F for both the drywell gases and the GDCS pool water.

When in Modes 1, 2, 3 or 4, LCO 3.6.1.5, "Drywell Air Temperature," ensures that drywell air temperature is maintained $\leq$ 46.1°C (115°F). The limit for drywell air temperature limits GDCS pool temperature because there is no mechanism during that could cause GDCS pool temperature to rise above drywell air temperature. Therefore, LCO 3.5.2, "Gravity-Driven Cooling System (GDCS) – Operating," does not include an explicit limit for GDCS pool water temperature when in Modes 1, 2, 3 or 4.

When in Modes 5 or 6, Technical Specifications do not provide a limit for either drywell air temperature or GDCS pool temperature. This is acceptable because the reactor is shutdown and reactor coolant system temperature is < 200°F, which significantly reduces the probability and consequences of an accident. LCO 3.5.3, "Gravity-Driven Cooling System (GDCS) – Shutdown," does not include an explicit limit for GDCS pool water temperature because the limit for GDCS pool temperature is intended to limit peak containment pressure and the containment is not required to be Operable in Modes 5 and 6.

The General Electric response to RAI 6.2-68 was submitted in Letter MFN 06-215, "Response to Portion of NRC Request for Additional Information Letter No. 33 Related to ESBWR Design Control Application – Engineered Safety Features – RAI Numbers 6.2-48 through 6.2-51, 6.2-53 through 6.2-57, and 6.2-64 through 6.2-74," dated July 12, 2006.

DCD Impact

No Design Control Document (DCD) changes will be made in response to this RAI.

NRC RAI 16.2-40, Supplement 1 (Received by e-mail from Larry Rossbach - 03/27/07)

4. Comment on response to RAI 16.2-40 from MFN 06-431:

Summary of Question:

RAI 16.2-40 requested justification for why Technical Specification (TS) 3.5.3 Gravity-Driven Cooling System (GDCS) does not state GDCS pool temperature limits. Accident analysis assumes that GDCS pool temperature is less than or equal to 115°F.

Summary of Response:

GEs response to this RAI stated that the ESBWR accident analysis for peak containment pressure assumes that the initial GDCS water and gas space temperatures are in equilibrium with the drywell air temperature. The analysis assumes an initial temperature of 115°F for both the drywell gases and the GDCS pool water, and that TS 3.6.1.5 ensures that drywell air temperature is maintained less than or equal to this limit. The limit for drywell air temperature limits GDCS pool temperature because there is no mechanism that could cause GDCS pool temperature to rise above drywell air temperature.

Comment on Response:

DCD Tier 2, Revision 3, Chapter 16B, Bases for TS 3.6.1.5 states that the analysis assumes an initial average drywell air temperature of {46.1°C (115°F)}. This limitation ensures that the safety analysis remains valid by maintaining the expected initial conditions and ensures that the peak Loss-of-Coolant Accident (LOCA) drywell temperature does not exceed the maximum allowable of 171°C (340°F). The GE response also states that "there is no mechanism that could cause GDCS pool temperature to rise above drywell air temperature."

DCD Tier 2, Revision 3, Table 6.2-2, "Containment Conditions During Normal Operation," indicates that upper and lower drywell average temperatures during normal operation are 57.2°C (135°F).

DCD Tier 2, Revision 3, Table 9.4-13, "Drywell Cooling System Fan Cooling Units," indicates performance of the upper and lower drywell FCUs with an air inlet temperature of 57.2°C (135°F).

The average drywell temperature is an average of temperature elements located at various elevations and azimuths throughout the drywell.

DCD Tier 2, Revision 3, Chapter 6.2.1.1.2, describes the drywell as consisting of an upper and lower volume, and that the GDCS pools are located in the upper volume of the drywell.

It appears that GDCS bulk water temperature may not be accurately reflected by using drywell average temperature, in that temperatures in the upper levels of the drywell (i.e., in the space surrounding the GDCS pool walls and air space) may be potentially and consistently greater than 115°F - although drywell average temperature is below this value.

It also appears that accident analyses assume an initial drywell temperature of 115°F; however, Tables 6.2-2 and 9.4-13 provide information assuming an upper and lower drywell temperature that could potentially exceed this during normal operation.

Requested Response:

A) Please explain in further detail how GDCS pool temperature is to be adequately determined to be less than or equal to 115°F by referencing an equilibrium with average drywell air temperature. Recommend either directly reading GDCS bulk pool temperature or utilizing drywell air temperature indications adjacent to the GDCS pools (upper drywell volume). Provide this information into the Bases for TS 3.5.3, if required.

B) Please provide an anticipated equilibrium temperature gradient in the drywell - from top to bottom - at full power operation with normal ventilation under design outside air temperature and service water/chill water temperatures. Limiting Condition for Operation (LCO) 3.6.1.5 for average drywell temperature states that the limit is to be {less than or equal to 115°F}. Discuss if this temperature limit is consistent with the anticipated equilibrium temperature gradient at full power operation.

C) Please provide a discussion on how drywell average air temperature is to be determined, including the number of detectors per elevation/azimuth. Based on this, discuss how a detector(s) loss of function would affect drywell average temperature indication and potential operability of both containment and the GDCS.

GEH Response

Discussion

It is not necessary in the ESBWR design for the Gravity Driven Cooling System (GDCS) pools to be specifically maintained within a certain temperature band as an initial condition for any design basis accident (DBA). Therefore, this response will not specifically address the supplemental questions above, but will instead provide further explanation of why direct measurement of GDCS pool water temperatures and corresponding Technical Specification limits are not necessary for ensuring that the initial conditions of a design basis accident or transient analysis that either assumes the failure of or presents a challenge to the integrity of a fission product barrier are maintained.

Although the nominal and bounding containment performance analyses are performed considering an initial condition of 115°F for the GDCS pool water temperature (DCD Tier 2, Table 6.2 6), additional analyses using TRACG have been performed that demonstrate initial GDCS pool water temperatures as high as 150°F still result in acceptable peak containment pressures and temperatures following a DBA. Also, additional Emergency Core Cooling Systems (ECCS) performance analyses using TRACG have been performed that demonstrate GDCS pool water temperatures as high as 150°F have very minimal impact on reactor pressure vessel long term water level following a DBA. These analyses demonstrate the relative insensitivity of the calculated peak containment pressure and temperature and reactor pressure vessel long term water level after a DBA for both increased GDCS pool water and drywell (DW) air initial temperatures. The response to RAI 6.2-64 (MFN 06-215) provides an explanation of the effects of initial drywell temperature and non-condensable gases on peak containment pressure and temperature. The additional analyses, which have been performed in response to this RAI, expand on that response to also address the impact of increased initial GDCS pool water temperature.

In addition, GDCS pool water temperature is relatively stable during normal operations due to the heat sink capacities of the concrete reinforced walls and floors of the GDCS pools. Because

of the large heat sinks which comprise the GDCS pool walls and floors, average GDCS pool water temperatures are expected to gradually react to decreases and increases in drywell average air temperature, which is required to be monitored in accordance with DCD Tier 2, Chapter 16, Technical Specification Limiting Condition for Operation 3.6.1.5. Since the drywell average air temperatures are being monitored, it is not necessary to also monitor GDCS pool water temperatures.

In regards to possible stratification of drywell temperatures, it is important to note that the upper drywell and GDCS pool air spaces communicate with one another. These temperatures are expected to trend together in the same direction as the drywell average air temperature as well as the associated heat sink temperatures. Additionally, the normal operating containment ventilation design utilizes upper and lower drywell air handling units, which minimizes thermal stratification and the general uncertainties associated with severe temperature gradients. Therefore, it is not necessary to measure separately the GDCS pool water or air temperatures, to ensure the critical initial conditions of the containment and ECCS performance analyses are being maintained.

Conclusion

In conclusion, initial GDCS pool water temperature does not have a significant impact on the containment and ECCS performance analyses. Therefore, there is no required GDCS pool water temperature band necessary to ensure that the acceptance criteria of the containment and ECCS performance analyses are met. As such, 10 CFR 50.36(d)(2)(ii)(B), Criterion 2, is not applicable to this variable, and there is no requirement for a Technical Specification to monitor GDCS pool water temperature.

DCD Impact

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