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 08-202

Docket No. 52-010

May 5, 2008

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

Subject: **Response to Request for Additional Information Letter No. 104 Related to the ESBWR Design Certification – Safety Analyses – RAI Number 15.3-34**

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 July 18, 2007. GEH response to RAI Number 15.3-34 is addressed in Enclosure 1.

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

Sincerely,

James C. Kinsey

James C. Kinsey
Vice President, ESBWR Licensing

D068
NRO

Reference:

1. MFN 07-409, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, GEH, *Request For Additional Information Letter No. 104 Related To ESBWR Design Certification Application*, dated July 18, 2007.

Enclosure:

1. Response to Portion of NRC Request for Additional Information Letter No. 104 Related to ESBWR Design Certification Application – Safety Analyses – RAI Number 15.3-34

cc:	AE Cubbage	USNRC (with enclosure)
	GB Stramback	GEH/San Jose (with enclosure)
	RE Brown	GEH/Wilmington (with enclosure)
	eDRF	0000-0080-3975

Enclosure 1

MFN 08-202

Response to Portion of NRC Request for Additional Information Letter No. 104 Related to ESBWR Design Certification Application

Safety Analyses

RAI Number 15.3-34

NRC RAI 15.3-34:

Regarding the inadvertent shutdown cooling function operation event, DCD Tier 2, Rev. 3, Section 15.3.12 states that: "the increased subcooling caused by misoperation of the RWCU/SDC shutdown cooling mode could result in a slow power increase due to the reactivity insertion. During power operation the reactor settles in a new steady state. During startup or shutdown, this power rise is terminated by a flux scram before fuel thermal limits are approached. Therefore, only a qualitative description is provided here and this event does not have to be analyzed for a specific core configuration."

Please quantify the range of expected temperature limits and the resulting reactivity and reactivity-rate resulting from misoperation of the RWCU/SDC shutdown cooling mode to justify the statement that the thermal limits will not be violated.

GEH Response:

A TRACG simulation of inadvertent starting Reactor Water Cleanup (RWCU)/Shutdown Cooling (SDC) shutdown cooling during startup has been performed using conservative bounding values, yielding more than twice the rated heat removal capacity of 55.4 MWt (Table 5.4-3 in Reference 1). Figure 1 shows that starting the RWCU/SDC shutdown cooling results in a gradual power increase from a typical startup power of 85 MWt or 1.9% of rated thermal power (Section 4D.2.2.3 in Reference 2) to a new stable level of 150 MWt or 3.3% of rated thermal power over a period of 800 seconds. Figure 2 shows the core average fuel temperature increased by approximately 5.5 °C. Figure 3 shows the CPR of the hottest bundle, which decreases to 14 from the initial value of 20. Figure 4 show the inlet subcooling of the hottest bundle increased by about 6.5°C. Figure 5 shows the steam dome pressure increased to 3.3 MPa from 3.04 MPa.

The TRACG simulation results confirm that the increased subcooling caused by mis-operation of the RWCU/SDC shutdown cooling during startup results in a slow power increase due to the moderator reactivity insertion. The power increase is limited by the fuel-temperature reactivity feedback and stays well below the high flux scram setpoint of 675 MWt or 15% of rated thermal power for startup (Table 3.3.1.4-1 in Reference 3). The MCPR and fuel thermal limits are never challenged over the course of this transient.

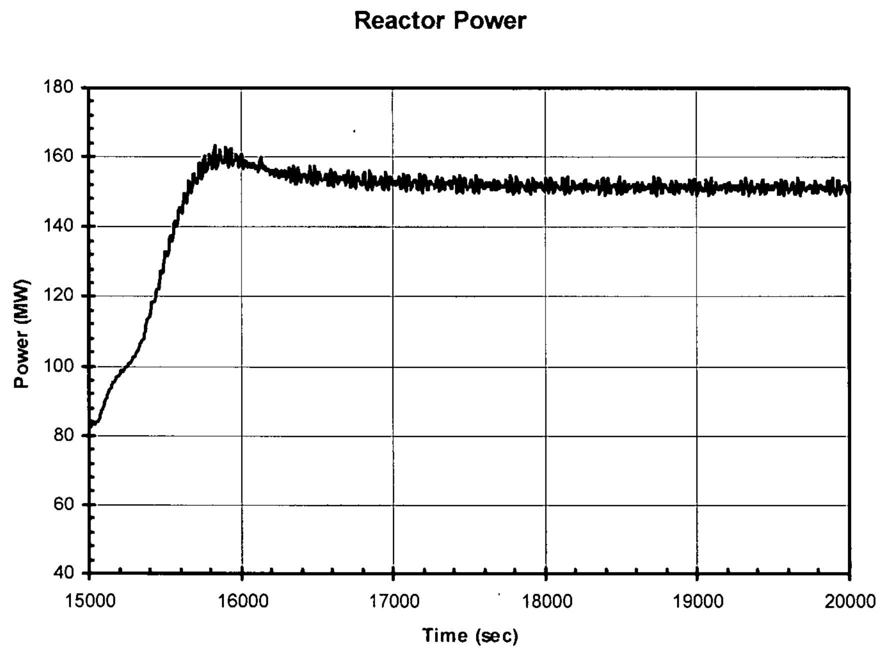

Figure 1. Reactor Power

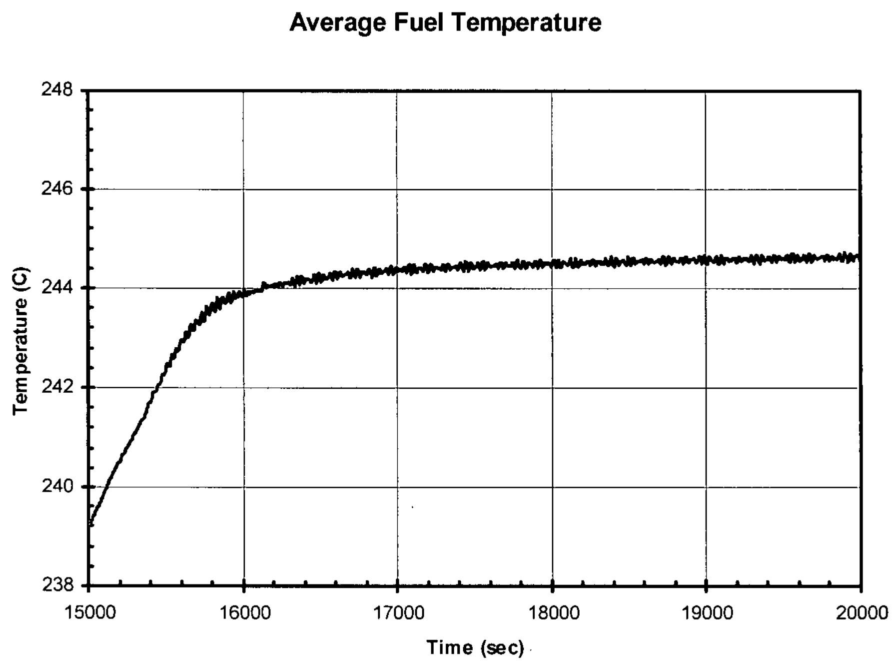

Figure 2. Average Fuel Temperature

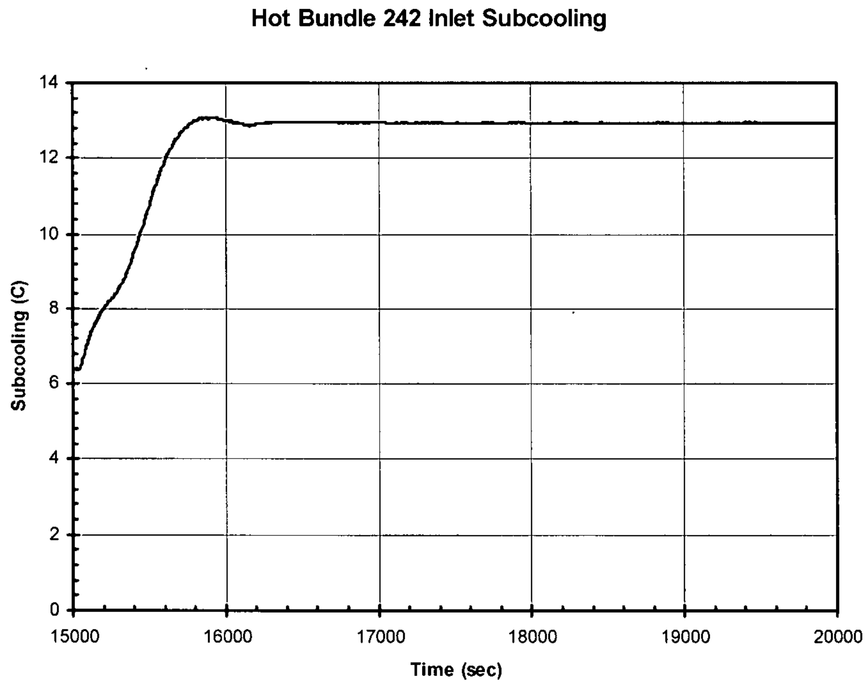

Figure 3. Hot Bundle Inlet Subcooling

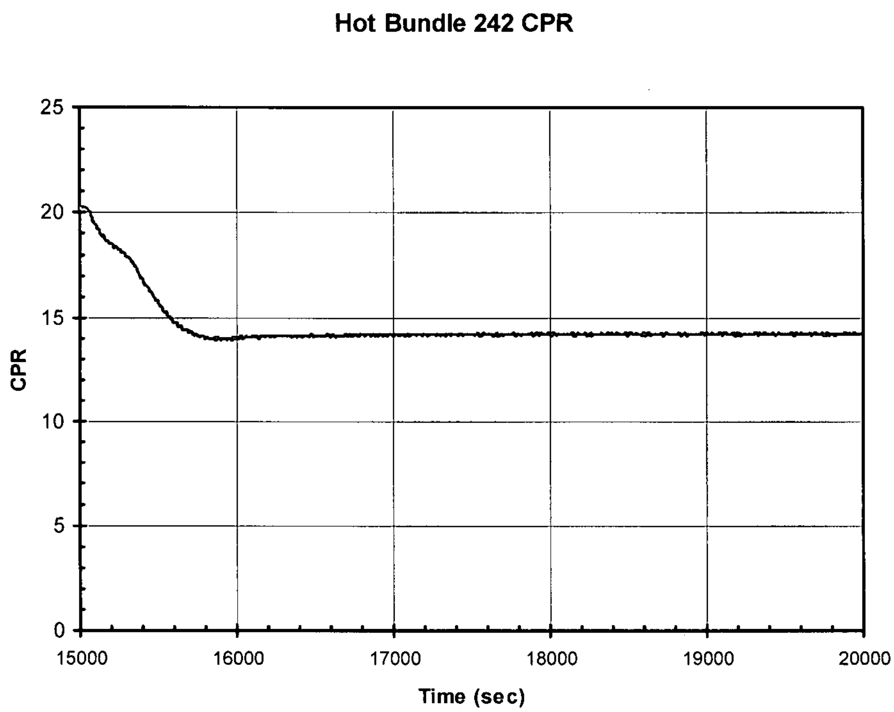

Figure 4. Hot Bundle CPR

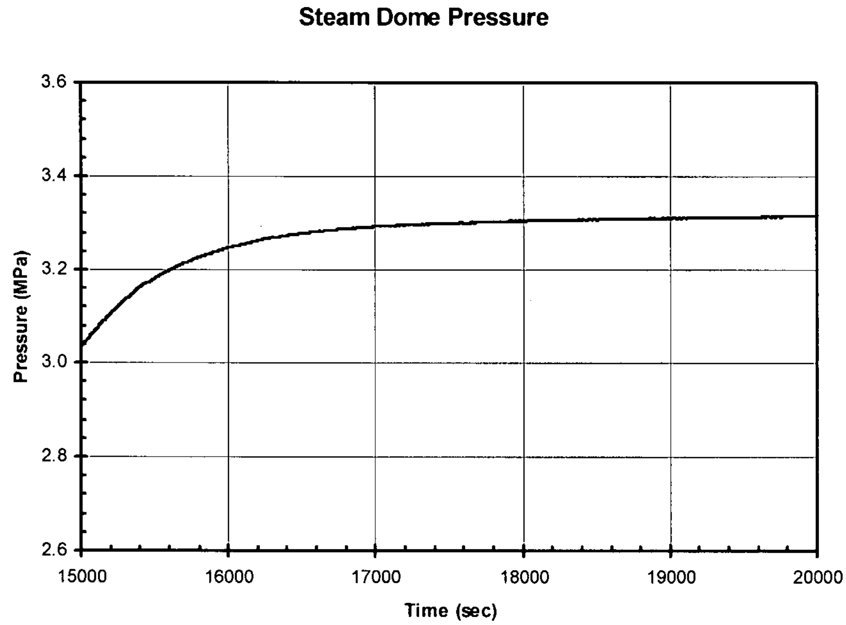

Figure 5. Steam Dome Pressure

References:

[1] ESBWR DCD Tier 2, Chapter 5, "Reactor Coolant System and Connected Systems," Rev. 4, 26A6642AR, September 2007.
[2] ESBWR DCD Tier 2, Chapter 5, "Reactor," Rev. 4, 26A6642AP, September 2007.
[3] ESBWR DCD Tier 2, Chapter 16, "Technical Specifications," Rev. 4, 26A6642BR, September 2007.

DCD Impact:

The first paragraph in DCD Tier 2, Subsection 15.3.12.2 will be modified as follows in Revision 5:

"A shutdown cooling malfunction leading to a moderator temperature decrease could result from mis-operation of the cooling water controls for RWCU/SDC system heat exchangers. The resulting temperature decrease causes a slow insertion of positive reactivity into the core. During startup, a reactor scram on high flux or short period may occur, or it may stabilize at a higher power. During full power operation or startup, no thermal limits are reached. The sequence of events for this event is a slow rise in reactor power. The operator can take action to limit the power rise; however, there is no operator action required to mitigate the event."