



GE Energy

James C. Kinsey  
Project Manager, ESBWR Licensing

PO Box 780 M/C J-70  
Wilmington, NC 28402-0780  
USA

T 910 675 5057  
F 910 362 5057  
jim.kinsey@ge.com

MFN 07-071

Docket No. 52-010

February 12, 2007

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. 69 – Safety Analyses - RAI Number 15.0-16**

Enclosure 1 contains GE's response to the subject NRC RAI transmitted via the Reference 1 letter.

If you have any questions about the information provided here, please let me know.

Sincerely,

*1 Kathy Sedney for*

James C. Kinsey  
Project Manager, ESBWR Licensing

*Das*

MFN 07-071

Page 2 of 2

Reference:

1. MFN 06-381, Letter from U.S. Nuclear Regulatory Commission to David Hinds, *Request for Additional Information Letter No. 69 Related to ESBWR Design Certification Application*, October 11, 2006

Enclosure:

1. MFN 07-071 – Response to Portion of NRC Request for Additional Information Letter No. 69 – Related to ESBWR Design Certification Application – Safety Analyses – RAI Number 15.0-16

cc: AE Cubbage USNRC (with enclosures)  
GB StrambackGE/San Jose (with enclosures)  
eDRF 0060-5228

**Enclosure 1**

**MFN 07-071**

**Response to Portion of NRC Request for  
Additional Information Letter No. 69  
Related to ESBWR Design Certification Application**

**Safety Analyses**

**RAI Number 15.0-16**

**NRC RAI 15.0-16:**

*The safety limit for minimum critical power (SLMCPR) is a safety limit which is required to be specified in technical specifications (TS) according to 10 CFR 50.36(c)(1)(i)(A). The SLMCPR is the primary parameter for specified acceptable fuel design limits (SAFDL). Generic Letter (GL) 88-16 guidance specifies that core operating limits shall be established and documented in the core operating limits report before each reload or any remaining part of a reload cycle. It only applies to the core operating limits, not the safety limits. The operating limit minimum critical power ratio (OLMCPR) value is established based on the cornerstone of SLMCPR.*

*The ESBWR DCD Tier 2, Chapter 15, Rev. 1, does not specify the SLMCPR value. The proposed TS section 2.1.1.2 does not specify the SLMCPR value either. Instead, TS 2.1.1.2 states, "Greater than 99.9 percent of the fuel rods in the core would be expected to avoid boiling transition."*

*The proposed TS 2.1.1.2, uses a criterion instead of a specified SLMCPR value, and is not acceptable, as currently drafted. Please include the SLMCPR value in the DCD Tier 2, Chapter 15 for the equilibrium core assumed in the transient and accident analyses. Also, revise the proposed TS 2.1.1.2 to specify a SLMCPR value (e.g. 1.12 or other conservative value based on the preliminary analysis).*

**GE Response:**

The conventional BWR methodology calculates the Number of Rods Subject to Boiling Transition (NRSBT) without the transient delta Critical Power Ratio (CPR) uncertainty to establish a SLMCPR value. Then, a calculated transient delta CPR is added to this SLMCPR in order to determine the Operating Limit Minimum CPR (OLMCPR).

However for the ESBWR TRACG methodology as described in Section 4.6.3 of NEDC-33083P-A ("TRACG Application for ESBWR"), the transient delta CPR uncertainty is inherently combined with the uncertainties included in the evaluation of the conventional BWR SLMCPR. This process allows for the direct calculation of the NRSBT for a transient occurring from an initial operating condition corresponding to the OLMCPR. Therefore, the NRSBT parameter becomes the cornerstone of the ESBWR TRACG methodology instead of the SLMCPR, which does not inherently exist for the ESBWR methodology. Note that 10 CFR 50.36(c)(1)(i)(A) does not require an SLMCPR. Rather it requires safety limits, "upon important process variables that are found to be necessary to reasonably protect the integrity of certain of the physical barriers that guard against the uncontrolled release of radioactivity." Specification of the safety limits is left to applicant. The development of a different Safety Limit for methodologies that do not include an SLMCPR in the specified acceptable fuel design limits (SAFDL) evaluation is appropriate. For the ESBWR, the Fuel Cladding Integrity Safety Limit (FCISL) expressed in terms of the NRSBT parameter is the ESBWR SAFDL corresponding to the conventional BWR SLMCPR SAFDL.

The ESBWR FCISL is documented in TS 2.1.1.2 as "Greater than 99.9% of the fuel rods in the core would be expected to avoid boiling transition." The ESBWR OLMCPR is documented in the Core Operating Limits Report (COLR).

The CPR will be continuously monitored above 25% power in the ESBWR. If a transient event occurs, the CPR is compared to those analyzed for FCISL to confirm the event is bounded. If the event is not bounded by those analyzed, an off line evaluation is performed to determine if the event is bounded. Monitoring the CPR process variable assures the FCISL is not violated.

RAI 16.2-14 additionally requested that GE "Explain the discrepancy between the Bases, which refer to MCPR, and TS SL 2.1.1.2." As described above, the replacement of the conventional BWR SLMCPR with the ESBWR Fuel Cladding Integrity Safety Limit (FCISL) in the TS 2.1.1.2 section is technically justifiable. However, the TS Bases were not consistent with this technical justification, and were revised in DCD Tier 2, Revision 2, as detailed below to be consistent with the FCISL and thus eliminate the discrepancies noted in RAI 16.2-14.

- 1) Revision to TS Bases 2.1.1 "APPLICABLE SAFETY ANALYSES" section:
  - a) The second sentence of the first paragraph was replaced with "To ensure damage does not occur, the Fuel Cladding Integrity Safety Limit (FCISL) is established as greater than 99.9% of the fuel rods in the core would be expected to avoid boiling transition".
  - b) The last sentence of the first paragraph phrase "MCPR limit" was replaced with "FCISL".
  - c) The 2.1.1.2 header "MCPR" was replaced with "FCISL".
  - d) In the 2.1.1.2 section, the first sentence of the first paragraph phrase "The fuel cladding integrity SL" was replaced with "The FCISL".
  - e) In the 2.1.1.2 section, the last sentence of the first paragraph the word "SL" was replaced with "FCISL".
  - f) In the 2.1.1.2 section, the second sentence of the second paragraph phrase "the fuel cladding integrity SL" was replaced with "the FCISL".
- 2) Revision to TS Bases 3.1.3 "APPLICABLE SAFETY ANALYSES" section:
  - a) The second sentence of the third paragraph phrase "MCPR Safety Limit" was replaced with "fuel cladding integrity Safety Limit".
- 3) Revision to TS Bases 3.1.4 "APPLICABLE SAFETY ANALYSES" section:
  - a) The first sentence of the second paragraph phrase "MCPR Safety Limit" was replaced with "fuel cladding integrity Safety Limit".
  - b) The second sentence of the second paragraph phrase "actual MCPR from becoming less than the MCPR SL" was replaced with "fuel cladding integrity Safety Limit being exceeded".
- 4) Revision to TS Bases 3.1.5 "APPLICABLE SAFETY ANALYSES" section:
  - a) The first sentence of the second paragraph phrase "MCPR Safety Limit" was replaced with "fuel cladding integrity Safety Limit".
- 5) Revision to TS Bases 3.2.1 "APPLICABLE SAFETY ANALYSES" section:
  - a) The last sentence of the second paragraph phrase "MCPR Safety Limit" was replaced with "fuel cladding integrity Safety Limit".
- 6) Revision to TS Bases 3.2.2 "BACKGROUND" section:
  - a) The second sentence of the first paragraph was replaced with "The Fuel Cladding Integrity Safety Limit (FCISL) is established as greater than 99.9% of the fuel rods in

the core would be expected to avoid boiling transition (refer to the Bases for SL 2.1.1.2)".

- 7) Revision to TS Bases 3.2.2 "APPLICABLE SAFETY ANALYSES" section:
  - a) The second sentence of the first paragraph was replaced with "To ensure that the FCISL is not exceeded during any transient event that occurs with moderate frequency, limiting transients have been analyzed to determine the CPR transient uncertainty".
  - b) The last two sentences of the first paragraph was replaced with "The steady-state and CPR transient uncertainties and the uncertainties in monitoring and simulating the core operating state are incorporated by the statistical model (Ref. 2) to determine the required operating limit MCPR".
- 8) Revision to TS Bases 3.2.2 "APPLICABILITY" section:
  - a) The last sentence of the first paragraph phrase "MCPR SL" was replaced with "FCISL".
- 9) Revision to TS Bases 3.3.1.1 "APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY" section:
  - a) In section 10, the last sentence of the first paragraph phrase "MCPR SL" was replaced with "fuel cladding integrity Safety Limit".
  - b) In section 11, the last sentence of the first paragraph phrase "MCPR SL" was replaced with "fuel cladding integrity Safety Limit".
  - c) In section 12, the first sentence of the first paragraph phrase "MCPR SL" was replaced with "fuel cladding integrity Safety Limit".
  - d) In section 12, the third sentence of the first paragraph phrase "MCPR SL" was replaced with "fuel cladding integrity Safety Limit".
- 10) Revision to TS Bases 3.3.1.4 "APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY" section:
  - a) In section 2.b, the first sentence of the last paragraph phrase "(MCPR Safety Limit)" was replaced with "(fuel cladding integrity Safety Limit)".
- 11) Revision to TS Bases 3.3.2.1 "BACKGROUND" section:
  - a) The second sentence of the second paragraph phrase "operating and Safety Limit MCPR and LHGR" was replaced with "operating limit MCPR, fuel cladding integrity Safety Limit and LHGR".
- 12) Revision to TS Bases 3.3.2.1 "APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY" section:
  - a) In section 1.a, the first sentence of the first paragraph phrase "operating and safety limit MCPR" was replaced with "operating limit MCPR, fuel cladding integrity Safety Limit".
  - b) In section 1.a, the last sentence of the last paragraph phrase "safety limit MCPR" was replaced with "fuel cladding integrity Safety Limit".
- 13) Revision to TS Bases 3.7.3 "LCO" section:
  - a) The first sentence of the first paragraph phrase "Safety Limit MCPR" was replaced with "fuel cladding integrity Safety Limit".

**14) Revision to TS Bases 3.7.3 "APPLICABILITY" section:**

- a) The first sentence of the first paragraph phrase "MCPR safety limit" was replaced with "fuel cladding integrity Safety Limit".

**DCD Impact:**

DCD Tier 2, Chapter 16B, was revised as described above in Revision 2.