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Subject: Response to Portion of NRC Request for Additional Information Letter No. 208 - Related To NEDE-33338P, "ESBWR Feedwater Temperature Operating Domain For Transient And Accident Analysis" – RAI Number 4.3-29

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 the Reference 1 NRC letter. GEH response to RAI Number 4.3-29 is addressed in Enclosure 1.

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

Sincerely,

Richard E. Kingston

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Vice President, ESBWR Licensing

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NRO

Reference:

1. MFN 08-508, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request For Additional Information Letter No. 208 Related To NEDE-33338P, "ESBWR Feedwater Temperature Operating Domain For Transient And Accident Analysis"*, dated June 3, 2008.

Enclosure:

1. MFN 08-675 – Response to Portion of NRC Request for Additional Information Letter No. 208 - Related to NEDE-33338P, "ESBWR Feedwater Temperature Operating Domain For Transient And Accident Analysis" – RAI Number 4.3-29

cc: AE Cubbage USNRC (with enclosure)
RE Brown GEH/Wilmington (with enclosure)
DH Hinds GEH/Wilmington (with enclosure)
eDRF 0000-0090-6920

Enclosure 1

MFN 08-759

Response to Portion of NRC Request for Additional Information Letter No. 208 Related to NEDE-33338P, "ESBWR Feedwater Temperature Operating Domain For Transient And Accident Analysis"

RAI Number 4.3-29

NRC RAI 4.3-29

Justify which AOO event is bounding for the instability analysis.

In response to RAI 4.4-57 the regional decay ratio was calculated for a loss of feedwater heating (LOFWH) with selected control rod run-in/select rod insert (SCRRI/SRI) anticipated operational occurrences (AOO) and loss of feedwater (LOFW) AOO for the equilibrium core at the peak hot excess (PHE) exposure point. The results indicate that the LOFWH regional mode decay ratio is 0.66 while the LOFW regional mode decay ratio is 0.58. The staff notes that these values are somewhat similar (within 1 standard deviation). Considering variation in nuclear parameters from cycle to cycle and variation in core neutronic and stability characteristics with variation in inlet subcooling, please describe what analyses are performed on a cycle specific basis to determine the limiting anticipated operational occurrences (AOO) from a stability standpoint to determine the location of the SP1M point on the power/temperature operating map. If LOFWH with SCRRI/SRI is considered generically bounding, please provide additional quantitative and qualitative justification.

GEH Response

Based on the decay ratio results as reported in References 4.3-29-1 and 4.3-29-2, LOFWH with SCRRI/SRI (stability conservatively evaluated at the point where the drop in feedwater temperature is ~16.7°C (30°F) such that right before the initiation of SCRRI/SRI the power increases to a higher value than rated and levels off at that value) is the bounding AOO comparing with LOFW in terms of stability. Evaluation should be performed at LOFWH on a cycle specific basis to confirm the location of the SP1M point on the ESBWR power/temperature operating map.

Given the same initial plant conditions, the regional mode decay ratio at LOFWH with SCRRI/SRI is 0.66 while the LOFW regional decay ratio is 0.58 as documented in Appendix 4D of Reference 4.3-29-1. Although the difference is relatively small, the LOFWH decay ratio should always be limiting based on TRACG simulation methodology for AOO stability (Section 4D.1.5 of Reference 4.3-29-1). Qualitatively, the final steady state for decay ratio evaluation after LOFWH with SCRRI/SRI always has the following characteristics relative to LOFW final state starting from the same initial nominal steady state:

- Higher core power, about 6% higher but similar core flow (within ~3%); therefore, higher power/flow ratio,
- More core inlet subcooling because of feedwater temperature reduction (~30°F), which leads to more pronounced bottom peaking in axial power shape so more susceptible to regional mode oscillation.

All above differences are independent of the variation of nuclear parameters through different cycles as determined by the TRACG application methodology and starting from same initial plant condition for both transients. Furthermore, all these differences are unfavorable to LOFWH stability and result in higher regional decay ratio, which justifies that LOFWH with SCRRI/SRI is considered generically bounding.

References

4.3-29-1 ESBWR Design Control Document, Chapter 4, Reactor, Rev 5, May 2008.

4.3-29-2 GE Hitachi Nuclear Energy, "TRACG Application for ESBWR Stability Analysis," NEDE-33083P-A, Supplement 1, Revision 1, January 2008.

DCD Impact

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

No changes to the NEDO-33338 LTR will be made in response to this RAI.