GE Hitachi Nuclear Energy

Richard E. Kingston
Vice President, ESBWR Licensing

PO Box 780
Wilmington, NC 28402-0780, M/C A-65
USA

T 910 819-6192
F 910 362-6192
rick.kingston@ge.com

Proprietary Notice
This letter forwards proprietary information in accordance with 10CFR2.390. Upon the removal of Enclosure 2, the balance of this letter may be considered non-proprietary.

MFN 09-775

Docket No. 52-010

December 12, 2009

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

Subject: **Response to NRC Request for Additional Information Letter No. 387 Related to ESBWR Design Certification Application – RAI 7.1-141**

The purpose of this letter is to submit the GEH response to RAI 7.1-141 (Reference 1) and Licensing Topical Report (LTR) NEDE-33304P, "*GEH ESBWR Setpoint Methodology,*" Revision 2 for your review and use. This letter is to support NRC review of the GEH application for final design approval and standard design certification of the ESBWR standard plant design pursuant to 10 CFR Part 52.

Enclosure 2 contains proprietary information as defined in 10CFR2.390. The affidavit contained in Enclosure 4 identifies that the information contained in Enclosure 2 has been handled and classified as proprietary to GEH. A non-proprietary version is contained in Enclosure 3.

The affidavit contained in Enclosure 4 identifies that the information contained in Enclosure 2 has been handled and classified as proprietary to GEH. GEH hereby requests that the information of Enclosure 2 be withheld from public disclosure in accordance with the provisions of 10 CFR 2.390 and 9.17.

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NRO

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

Sincerely,

Peter M Yandow FOR

Richard E. Kingston
Vice President, ESBWR Licensing

Reference:

1. MFN 09-692, Letter from U.S. Nuclear Regulatory Commission to Jerald G. Head, "Request for Additional Information Letter No. 387 Related to ESBWR Design Certification Application dated October 30, 2009."

Enclosures:

1. MFN 09-775, Response to NRC Request for Additional Information Letter No. 387 Related to ESBWR Design Certification Application - RAI Number 7.1-141

2. MFN 09-775, Response to NRC Request for Additional Information Letter No. 387 Related to ESBWR Design Certification Application - NEDE-33304P, Revision 2 - GEH Proprietary Information

3. MFN 09-775, Response to NRC Request for Additional Information Letter No. 387 Related to ESBWR Design Certification Application - DCD Markups and NED0-33304, Revision 2 – Public Version

4. Affidavit – Larry J. Tucker

cc: AE Cubbage USNRC (with enclosures)
RE Brown GEH/Wilmington (with enclosures)
LJ Tucker GEH/Wilmington (with enclosures)
PM Yandow GEH/Wilmington (with enclosures)
EDRF Section 0000-0110-4894

Enclosure 1

MFN 09-775

Response to NRC Request for

Additional Information Letter No. 387

Related to ESBWR Design Certification Application

RAI Number 7.1-141

NRC RAI 7.1-141

Based on the review of NEDE-33304P and GEH's responses to RAIs 7.1-86 and 102, NRC staff finds that GEH has not demonstrated that the ESBWR setpoint methodology, as described in NEDE-33304P, conforms to the 95/95 tolerance limit as an acceptable criterion for uncertainties specified in NRC Regulatory Guide (RG) 1.105, Revision 3. Specifically, the use of single-sided distribution and the subsequent use of the 1.645/2 factor to calculate the setpoints are not justified to demonstrate conformance to the 95/95 criterion in RG 1.105, Revision 3. This staff finding was confirmed by the Department of Energy's Oak Ridge National Laboratory (ORNL), which was contracted by the staff for a detailed evaluation. Therefore, the NRC staff requests that GEH revise NEDE-33304P to remove the reduction factor of 1.645/2 and to make corresponding changes to the supporting information. This is considered to be the staff's preferred resolution option. The evaluation prepared by ORNL is included as an enclosure.

Alternatively, GEH may provide an alternative to the RG 1.105, Revision 3 acceptance criterion and explain in sufficient detail and bases to demonstrate compliance with the relevant regulatory requirements.

This RAI supersedes and closes RAIs 7.1-86 and 7.1-102.

GEH Response

GEH has committed to establish Limiting Safety System Setpoints that ensure with 95% probability the associated trip will occur before the parameters reach the associated analytical limit value in the plant safety analysis, at 95% confidence level. In its summary, the ORNL evaluation in the TER attached to the RAI expresses two concerns:

1) Combination of uncertainties through SRSS (Square Root Sum of Squares) may not be conservative if some of the uncertainties are not randomly distributed in a normal distribution.

2) Use of 1.645 sigma to achieve 95% probability at 95% confidence when the 95% probability covers one side of a population and exposes 5% tails on one side of a population ("single sided").

Item 1) can be addressed by considering other conservatisms applied in the safety analysis, and the assumption in the setpoint calculation that each of the trip units has deviated in the adverse direction (versus deviating randomly in different directions) to demonstrate the trip will occur with 95/95 confidence level. If necessary, standard statistical tests referenced in the ORNL evaluation can be applied to test for uniform distributions. Advanced statistical techniques (e.g., Monte Carlo analysis) can be used to combine uncertainties if all are not uniformly distributed, and increased sample sizes can be applied when necessary to assure the type of distribution is known.

Item 2) is inconsistent with the most recent ISA RP67.04 application guide and previously approved setpoint methodologies. The NRC requirement for 95% probability/95% confidence level, which was first published in Branch Technical Position HICB-12 Draft Rev 4, focused on drift confidence level. Then in RG 1.105 Rev 3, it was applied at 95% confidence level not limited to drift. While RG 1.105 Rev 3 specifies acceptable 2-sided 95/95 tolerance limits for the instrument uncertainties, there is no statement in RG 1.105 Rev 3 indicating how these 2-sided uncertainties are to be used to determine the margin for setpoints approached from one direction. It is to be noted ISA RP67.04 Part 2 specifically states that a correction factor of 1.645/2 for 2-sigma uncertainties for setpoints approached from one direction is appropriate. Apparently, the TER authors are reading into RG 1.105 Rev 3 something that is not specifically stated or directly addressed.

In some instances, the staff's request does not provide a clear improvement in plant safety. Note that for the GEH methodology there is margin between the analytical limit (AL) and the allowable value (AV) based on applicable instrument errors during operation which provides 95% probability that the AV will not exceed the AL, and another margin between the allowable value and the nominal trip setpoint (NTSP) based on applicable instrument errors during calibration, which provides 90% probability that the NTSP will not exceed the AV. Effecting a change to the Limiting Safety System Setpoint value could have the unintended effect of increasing the probability of spurious trips, each of which could then become an initiating event. In some cases, GEH and other vendors will be able to counter this when procuring and testing the instruments. However, because the instruments are procured and tested in bulk (i.e., each model has multiple applications and is type tested rather than tested for a particular setpoint value), there will be cases where the NRC requested statistical factor moves the setpoint closer to the operating point with no mitigation possible. For these special cases, reactor/NSSS vendors or plant licensees/applicants, may request alternatives to the approved methodologies if spurious trips are of concern. All potential initiating events that could be caused by spurious trips are within the ESBWR design basis and are easily mitigated by its safety-related systems. Consequently, any change in the Spurious Trip Avoidance probability would not have a significant effect on the PRA results relative to the NRC's safety goals because the ESBWR has a large margin to the NRC safety goals.

Outside of the ESBWR certification, GEH has contacted its utility customers and other NSSS vendors through NEI to attempt to resolve these concerns through an alternative approach to that in the request, while still providing the desired 95/95 probability confidence level. However, because the staff indicated significant review will be required of any alternative to their preferred resolution option, GEH accepts the staff's preferred resolution option for the ESBWR design certification, and will replace the reduction factor of 1.645/2 as described in NEDE-33304P, Revision 2. GEH is following the staff's preferred resolution option to close this concern.

The equations and sample calculation in NEDE-33304P have been updated accordingly, and all DCD references to this licensing topical report (LTR) will be revised to update the title, revision status and issue date of the LTR.

This change and the revised NEDE-33304P are applicable only to ESBWR setpoint methodology.

DCD Impact

DCD Tier 2, Table 1.6-1 and References 7.1-9, 7.2-1, 7.3-2, 7.4-2, 7.5-2 and 7.8-4, will be revised in Revision 7 as noted in the attached markups to update the title, revision status and issue date of LTR NEDE-33304P. DCD Chapter 16 Generic Technical Specifications Section 5.5.11 will be revised as noted in the attached markup to update the title of LTR NEDE-33304P.

LTR NEDE-33304P, Revision 2, incorporates the changes to the methodology and the sample calculation, and revises the LTR so that it only applies to ESBWR. The revised LTR is an enclosure to the letter transmitting this RAI response.

Enclosure 3

MFN 09-775

Response to NRC Request for

Additional Information Letter No. 387

Related to ESBWR Design Certification Application

DCD Markups and NED0-33304, Revision 2

Public Version

5.5 Programs and Manuals

5.5.10 Battery Monitoring and Maintenance Program

This Program provides for battery restoration and maintenance, which includes the following:

COL 16.0-1-A 5.5.10-1

a. With battery cell float voltage [< 2.13] V, actions to restore cell(s) to [≥ 2.13] V and perform SR 3.8.3.5,

b. Actions to equalize and test battery cells that had been discovered with electrolyte level below the minimum established design limit;

c. Limits on average electrolyte temperature, battery connection resistance, and battery terminal voltage; and

d. A requirement to obtain specific gravity readings of all cells at each discharge test, consistent with manufacturer recommendations.

5.5.11 Setpoint Control Program (SCP)

a. The Setpoint Control Program (SCP) implements the regulatory requirement of 10 CFR 50.36(c)(1)(ii)(A) that technical specifications will include items in the category of limiting safety system settings (LSSS), which are settings for automatic protective devices related to those variables having significant safety functions.

b. The Limiting Trip Setpoint (LTSP), Nominal Trip Setpoint ($NTSP_F$), Allowable Value (AV), As-Found Tolerance (AFT), and As-Left Tolerance (ALT) for each Technical Specification required automatic protection instrumentation function shall be calculated in conformance with the instrumentation setpoint methodology previously reviewed and approved by the NRC in NEDE- 33304P-A, "GEH ~~ABWR/~~ESBWR Setpoint Methodology," [Revision #, dated Month dd, yyyy, (MLxxxxxxxxx)], and the conditions stated in the associated NRC safety evaluation, [Letter to GEH from NRC, Title, dated Month, dd, yyyy, (MLxxxxxxxxx)].

COL 16.0- 1-A 5.5.11-1

c. For each Technical Specification required automatic protection instrumentation function, performance of a CHANNEL CALIBRATION surveillance shall include the following:

1. The as-found value of the instrument channel trip setting shall be compared with the previous as-left value or the specified $NTSP_F$.

7.1-9 GE-Hitachi Nuclear Energy, "GEH ~~ABWR/~~ESBWR Setpoint Methodology," NEDE-33304P, Class III (Proprietary), Revision ~~1~~2, ~~Nov~~December 200~~9~~8, and NEDO-33304, Class II (Non-proprietary), Revision ~~1~~2, ~~Nov~~December 200~~8~~9.

7.1-10 [*GE Hitachi Nuclear Energy, "ESBWR - Software Quality Assurance Program Manual," NEDE-33245P, Class III (Proprietary), Revision 4, July 2009, and NEDO-33245, Class I (Non-Proprietary), Revision 4, July 2009.*]*

7.1-11 GE Nuclear Energy, "General Electric Instrument Setpoint Methodology," NEDC-31336P-A, Class III (Proprietary), September 1996, and NEDO-31336-A, Class I (Non-proprietary), September 1996.

7.1-12 [*GE Hitachi Nuclear Energy, "ESBWR - Software Management Program Manual," NEDE-33226P, Class III (Proprietary), Revision 4, May 2009, and NEDO-33226, Class I (Non-proprietary), Revision 4, May 2009.*]*

7.1-13 (Deleted)

References that are bracketed and italicized with an asterisk following the brackets are designated as Tier 2. Prior NRC approval is required to change.

BTP HICB-19, Guidance for Evaluation of Defense-in-Depth and Diversity in Digital Computer-Based Instrumentation and Control Systems:

- Conformance: The SPTM function conforms to BTP HICB-19. The implementation of an additional diverse instrumentation and control system is described in Section 7.8.

BTP HICB-21, Guidance on Digital Computer Real-Time Performance:

- Conformance: The SPTM function conforms to BTP HICB-21.

7.2.3.3.6 TMI Action Plan Requirements

In accordance with the SRP for Section 7.2 and with Table 7.1-1, only I.D.3 applies to the SPTM function. This is addressed in Subsection 7.2.3.3.1 for 10 CFR 50.34(f)(2)(v)[I.D.3]. TMI action plan requirements are generically addressed in Table 1A-1 of Appendix 1A.

7.2.3.4 Testing and Inspection Requirements

Proper functioning of analog temperature sensors is verified by channel cross-comparison during the plant normal operation mode. The bulk pool temperatures are continuously compared between divisions and indicated by the PCF.

Each of four SPTM safety-related divisions is testable during plant normal operation to determine the operational availability of the system. Each safety-related SPTM division has the capability for testing, adjustment, and inspection during a plant outage.

7.2.3.5 Instrumentation and Controls Requirements

The I&C requirements related to SPTM are addressed in Subsections 7.2.3.1 and 7.2.3.2.

7.2.4 COL Information

None.

7.2.5 References

7.2-1 GE-Hitachi Nuclear Energy, "GEH ~~ABWR/~~ESBWR Setpoint Methodology," NEDE-33304P, Class III (Proprietary), Revision ~~1~~2, ~~Nov~~December 200~~8~~9, and NEDO-33304, Class II (Non-proprietary), Revision ~~1~~2, ~~Nov~~December 200~~8~~9.

7.2-2 (Deleted)

7.2-3 [*GE Hitachi Nuclear Energy, "ESBWR - Software Management Program Manual," NEDE-33226P, Class III (Proprietary), Revision 4, May 2009, and NEDO-33226, Class I (Non-proprietary), Revision 4, May 2009.*]*

7.2-4 [*GE Hitachi Nuclear Energy, "ESBWR - Software Quality Assurance Program Manual)," NEDE-33245P, Class III (Proprietary), Revision 4, July 2009, and NEDO-33245, Class I (Non-proprietary), Revision 4, July 2009.*]*

References that are bracketed and italicized with an asterisk following the brackets are designated as Tier 2. Prior NRC approval is required to change.

7.3-2 GE-Hitachi Nuclear Energy, "GEH ~~ABWR/~~ESBWR Setpoint Methodology," NEDE-33304P, Class III (Proprietary), Revision ~~1~~2, ~~Nov~~December 200~~9~~8, and NEDO-33304, Class II (Non-proprietary), Revision ~~1~~2, ~~Nov~~December 200~~8~~9.

7.3-3 [*GE Hitachi Nuclear Energy, "ESBWR - Software Management Program Manual," NEDE-33226P, Class III (Proprietary), Revision 4, May 2009, and NEDO-33226, Class I (Non-proprietary), Revision 4, May 2009.*]*

7.3-4 [*GE Hitachi Nuclear Energy, "ESBWR - Software Quality Assurance Program Manual," NEDE-33245P, Class III (Proprietary), Revision 4, July 2009, and NEDO-33245, Class I (Non-proprietary), Revision 4, July 2009.*]*

7.3-5 (Deleted)

References that are bracketed and italicized with an asterisk following the brackets are designated as Tier 2. Prior NRC approval is required to change.

7.4.5.5 Instrumentation and Control Requirements

The performance and effectiveness of the HP CRD isolation bypass valve function in a postulated accident is verified by observing the following MCR indications:

- Status indication of HP CRD isolation bypass valve position;
- GDCS pool level indication;
- RPV water level indication; and
- Drywell and RPV pressure indication.

The HP CRD isolation bypass function instrumentation located in the drywell is designed to operate in the harsh drywell environment that results from a LOCA. Instrumentation, located outside the drywell, is qualified for the environment in which they must perform their function.

7.4.6 COL Information

None.

7.4.7 References

7.4-1 (Deleted)

7.4-2 GE-Hitachi Nuclear Energy, "GEH ~~ABWR/~~ESBWR Setpoint Methodology," NEDE-33304P, Class III (Proprietary), Revision ~~1~~2, ~~Nov~~December 200~~8~~9, and NEDO-33304, Class II (Non-proprietary), Revision ~~1~~2, ~~Nov~~December 200~~8~~9.

RG 1.153, Criteria for Safety Systems:

- Conformance: The Pool Monitoring instrumentation is designed to satisfy the requirements of IEEE Std. 603, as endorsed by RG 1.153.

RG 1.180, Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems:

- Conformance: The Pool Monitoring instrumentation design conforms to RG 1.180. See Table 3.11-1 (Electrical and Mechanical Equipment for Environmental Qualification).

RG 1.209, Guidelines for Environmental Qualification of Safety-Related Computer-Based Instrumentation and Control Systems in Nuclear Power Plants:

- Conformance: See Table 3.11-1 (Electrical and Mechanical Equipment for Environmental Qualification).

7.5.5.3.4 Branch Technical Positions

BTP HICB-10, Guidance on Application of Regulatory Guide 1.97:

- Conformance: The Pool Monitoring instrumentation design conforms to RG 1.97 Revision 4, IEEE Standard 497-2002 (with clarifications and exceptions stated in RG 1.97 Revision 4), and RG 1.100.

BTP HICB-16, Guidance on the Level of Detail Required for Design Certification Applications Under 10 CFR Part 52:

- Conformance: The level of detail provided for the Pool Monitoring instrumentation design conforms to BTP HICB-16.

7.5.5.4 Testing and Inspection Requirements

See Subsection 9.1.3.4.

7.5.5.5 Instrumentation and Control Requirements

See Subsection 9.1.3.5.

7.5.6 (Deleted)

7.5.7 COL Information

None.

7.5.8 References

7.5-1 GE Nuclear Energy, "GE Nuclear Energy Quality Assurance Program Description," NEDO-11209-04A, Class I (Non-proprietary), Revision 8, March 1989.

7.5-2 GE-Hitachi Nuclear Energy, "GEH ~~ABWR~~/ESBWR Setpoint Methodology," NEDE-33304P, Class III (Proprietary), Revision ~~1~~2, ~~Nov~~December 200~~8~~9, and NEDO-33304, Class II (Non-proprietary), Revision ~~1~~2, ~~Nov~~December 200~~8~~9.

7.8.6 COL Information

None.

7.8.7 References

7.8-1 GE Hitachi Nuclear Energy, "ESBWR I&C Diversity and Defense-In-Depth Report," NEDO-33251, Class I (Non-proprietary), Revision 2, May 2009.

7.8-2 NUREG/CR-6303, "Method for Performing Diversity and Defense-in-Depth Analyses of Reactor Protection Systems, December 1994

7.8-3 [*GE Hitachi Nuclear Energy, "ESBWR - Software Quality Assurance Program Manual," Class III (Proprietary), Revision 4, July 2009, and NEDO-33245, Class I (Non-proprietary), Revision 4, July 2009*]*

7.8-4 GE Hitachi Nuclear Energy, "GEH ~~ABWR/~~ESBWR Setpoint Methodology," NEDE-33304P, Class III (Proprietary), Revision ~~1~~2, ~~Nov~~December 200~~9~~8, and NEDO-33304, Class II (Non-proprietary), Revision ~~1~~2, ~~Nov~~December 200~~9~~8.

References that are bracketed and italicized with an asterisk following the brackets are designated as Tier 2. Prior NRC approval is required to change.

Table 1.6-1

Referenced GE / GEH Reports

Report No.	Title	Section No.
(Deleted)		
NEDO-33289	GE Hitachi Nuclear Energy, "ESBWR Reliability Assurance Program," NEDO-33289, Class I (Non-proprietary), Revision 2, September 2008.	17.4
NEDE-33295P NEDO-33295	*GE Hitachi Nuclear Energy, "ESBWR Cyber Security Program Plan," NEDE-33295P, Class III (Proprietary), Revision 1, July 2009, and NEDO-33295, Class I (Non-proprietary), Revision 1, July 2009.]**	7.1, 7B
NEDE-33304P NEDO-33304	GE-Hitachi Nuclear Energy, "GEH ~~ABWR~~/ESBWR Setpoint Methodology," NEDE-33304P, Class III (Proprietary), and NEDO-33304, Class I (Non-proprietary), Revision ~~1~~2, ~~Nov~~December 200~~8~~9.	7.1, 7.2, 7.3, 7.4, 7.5, 7.8 Chapter 16 Sect. 5.5.11
NEDO-33306	GE Hitachi Nuclear Energy, "ESBWR Severe Accident Mitigation Design Alternatives," NEDO-33306, Class I (Non-proprietary), Revision 1, August 2007.	19.2
NEDE-33312P NEDO-33312	GE Hitachi Nuclear Energy, "ESBWR Steam Dryer Acoustic Load Definition," NEDE-33312P, Class III (Proprietary), Revision 1, July 2009, and NEDO-33312, Class I (Non-Proprietary), Revision 1, July 2009.	3L
NEDE-33313P NEDO-33313	GE Hitachi Nuclear Energy, "ESBWR Steam Dryer Structural Evaluation," NEDE-33313P, Class III (Proprietary), Revision 1, July 2009, and NEDO-33313, Class I (Non-Proprietary), Revision 1, July 2009.	3.9, 3L
NEDC-33326P NEDO-33326	*[Global Nuclear Fuel, "GE14E for ESBWR Initial Core Nuclear Design Report," NEDC-33326P, Class III (Proprietary), and NEDO-33326, Class I (Non-proprietary), Revision 1, March 2009.]**	4.3, 4.4, 4A, 4D, 15.0, 15.2, 15.3, 15.5