HITACHI

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MFN 09-203

Docket No. 52-010

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

Subject: **Response to Portion of NRC Request for Additional Information Letter No. 291 Related to ESBWR Design Certification Application ESBWR RAI Numbers 19.2-104 S01, 19.2-112 S01, 19.2-124, 19.2-125, 22.5-28 and 22.5-29**

Enclosure 1 contains the GE Hitachi Nuclear Energy (GEH) response to the subject NRC RAIs transmitted via the Reference 1 letter.

RAIs and previous responses were transmitted in References 2 through 5.

Enclosure 1 is the proprietary version of the RAI responses and contains GEH proprietary information as defined by 10 CFR 2.390. GEH customarily maintains this information in confidence and withholds it from public disclosure.

Enclosure 2 is the non-proprietary version of the RAIs, which is suitable for public disclosure.

The affidavit contained in Enclosure 3 identifies that the information contained in Enclosure 1 has been handled and classified as proprietary to GEH. GEH hereby requests that the information of Enclosure 1 be withheld from public disclosure in accordance with the provisions of 10 CFR 2.390 and 9.17.

D068
NRO

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

Sincerely,

Richard E. Kingston

Richard E. Kingston
Vice President, ESBWR Licensing

Reference:

1. MFN 09-013, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, GEH, *Request For Additional Information Letter No. 291 Related To ESBWR Design Certification Application*, dated January 6, 2009.

2. MFN 08-649, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, GEH, *Request For Additional Information Letter No. 222 Related To ESBWR Design Certification Application*, dated August 20, 2008.

3. MFN 08-910 Response to Portion of NRC Request for Additional Information Letter No. 222 Related to ESBWR Design Certification Application ESBWR RAI Numbers 19.1-178, 19.2-120 and 19.2-121, dated November 18, 2008.

4. MFN 08-616, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, GEH, *Request For Additional Information Letter No. 230 Related To NEDE-33392, "BIMAC Test Report*, dated August 4, 2008.

5. MFN 08-801, *Response to Portion of NRC Request for Additional Information Letter No. 230 Related to ESBWR Design Certification Application ESBWR RAI Numbers 19.2-93 through 19.2-119 dated November 3, 2008*

Enclosures:

1. Response to Portion of NRC Request for Additional Information Letter No. 291 Related to ESBWR Design Certification Application Probabilistic Risk Assessment RAI Numbers 19.2-104S01, 19.2-112 S01, 19.2-124, 19.2-125, 22.5-28 and 22.5-29

2. Response to NRC Request for Additional Information Letter No. 291 Related to ESBWR Design Certification Application Probabilistic Risk Assessment RAI Numbers 19.2-104S01, 19.2-112 S01, 19.2-124, 19.2-125, 22.5-28 and 22.5-29 - Non-Proprietary Version

   Attachment 1 DCD Tier 2, Revision 6 Markup

3. Affidavit – MFN 09-203

cc:	AE Cubbage	USNRC (with enclosure)
	JG Head	GEH/Wilmington (with enclosure)
	DH Hinds	GEH/Wilmington (with enclosure)
	eDRFSection	0000-100-0941 RAIs 19.2-104 S01, 19.2-112 S01, 19.2-124 and 19.2-125 0000-0099-3586 RAIs 22.5-28 and 22.5-29

Enclosure 2

MFN 09-203

Response to NRC Request for

Additional Information Letter No. 291

Related to ESBWR Design Certification Application

ESBWR Probabilistic Risk Assessment

RAI Numbers 19.1-104 S01, 19.2-112 S01,
19.2-124, 19.2-125, 22.5-28 and 22.5-29

Non-Proprietary Version

NRC RAI 19.2-104 S01

Question Summary: Provide a complete scaling rationale within the context of two-phase instability phenomena.

Full Text:

The GEH response to RAI 19.2-104 does not clearly address the scaling issues associated with the BiMAC test facility. Using ½ scale and the same heat flux may not produce well-scaled experimental conditions due to the fact that the rate of natural circulation is determined by the balance between the gravity induced driving head and the resistance from the frictional pressure drop and connective acceleration. It is not clear how these points are addressed. It is well known that for dynamic simulation of two-phase flow systems, the Zuber (phase change) number and the subcooling number should be preserved in addition to the friction number. However, for natural circulation, the velocity scale in the Zuber number is determined by the natural circulation rate. Because of this, unless a special scaling condition is imposed, most probably the Zuber number will be completely distorted.

Please provide a complete scaling rationale within the context of the two-phase instability phenomena in light of the above concerns.

NRC RAI 19.2-104 (original)

Question Summary: Scaling relations

Full Text:

The scaling base of the MAC multi-channel test is not clear. Please explain how the multi-channel test is scaled relative to the prototype and what the scaling relations are.

GEH Response (original)

Simple geometric scaling (½-scale) The principle consideration is that both pressure drop and steam quality in the channel scale with L/D, and this is the basis for our ½-scale design. For the same heat flux levels we would expect somewhat more conservative depiction of flow instability at ½-scale because the phase-coupling would be somewhat "tighter" at ½-scale.

The exact scaling relations (meaning ability to match one-to-one) for flow and pressure drop are not known, because this "exotic" geometry gives rise to non-equilibrium (both thermal and mechanical) that is beyond anyone's capability of prediction. This is why we insisted from the beginning to: (a) make conservative estimates of flow and quality build-up in the channel using analysis in NEDO-33201 Chapter 21 [1], and (b) carry out the main tests at full prototypic scale in all respects in NEDE-33392P [2]. These (single-tube) tests already demonstrated what is needed for assessing BiMAC performance—stable operation, much higher flow and sensible energy transfer than expected from the original conservative estimates, and self-adjusting flow behavior to power levels. As noted in [2] the multi-channel tests were done as a matter of original commitment.

Having said that, we point out that in the experiments we reached twice the base power relevant to BiMAC (100 kW/m^2 or 8.8 Btu/s.ft^2):

"There is a total of [[[1]]] m and [[ ]] m of running lengths in the inclined and riser portions of the pipe array, and a total equivalent (coverage) area of [[1.25{3}]] m^2. So at [[ ]]% power to the band heaters (and a similar heat flux by the copper blocks in pipe #20) we would have an average heat flux of [[ ]] kW/m^2. In the experiments we reached up to [[ ]]% of rated power and so up to ~ [[ ]] kW/m^2. The copper blocks are applied over a pipe length of [[ ]] m, the heated area is [[ ]] m^2, and so that the maximum available heat flux is [[ ]] MW/m^2. In the experiments we reached up to ~33% of rated power which corresponds to a peak heat flux of ~ [[ ]] kW/m^2."

GEH Response

[REFERENCE]

3. T. G. Theofanous, "The MAC Experiments Fine Tuning of the BiMAC Design", NEDE-33392P Rev. 0 (March 2008)

GEH questions the basic premise of this question; namely the statement: "*Using ½ scale and the same heat flux may not produce well-scaled experimental conditions*". GEH does not see the purpose of scaling the prototype at these ½-scale tests, and we do not use the same heat flux as the one relevant to the prototype! Most importantly, we do not try to match any subcooling or phase change "numbers", rather we work on a whole range of subcoolings reaching down to just a few degrees as compared to the 10 K (18°F) relevant to ESBWR. To explain:

The full scale tests demonstrated that, at prototypic conditions, the BiMAC is so far from being challenged by either burnout or flow instability phenomena that experimental data in this operating regime are utterly uninteresting. In these tests, in order to approach the boundaries at which "interesting" behaviors begin to happen, we had to double the thermal load (reaching an equivalent of over 200 kW/m^2 [[ ]]), <u>in addition</u> we had to allow operation at one-half of the relevant subcooling to the ESBWR (10 K (18°F)), <u>and</u> we had to nearly triple the locally peaked heat fluxes (at the edge of inclined channel) in relation to those relevant to ESBWR. Indeed it took all these 3 factors <u>together</u> to reach conditions of interest. Moreover, in no case did we see Ledineg type instabilities.

From these tests, we also learned three important things. First, how effective sensible heat removal is in the presence of even a few degrees of subcooling. Second, how necessary it is to thermally overload the inclined portion before we are able to build water vapor (quality) in the channel. Third, how necessary it is to operate the inclined portion of the flow channel in the quality region before seeing any evidence of deficient cooling at the peak heat flux region (at the edge). The approach to the ½-scale SE tests was guided by these findings. In addition, since the whole purpose of the ½-scale tests was to study flow instability, we wanted to be sure that such conditions are achieved in these tests. And indeed, we did reach Ledineg type instabilities, including flow reversals, but even then it turned out to be nearly impossible to obtain deficient cooling conditions.

We found it necessary to far exceed the conditions relevant to ESBWR, in all three respects mentioned above for the full-scale tests, before something interesting could happen in the ½-scale SE tests; namely thermal overload <u>in combination with</u> essentially zero subcooling at the inlet. The overall behavior was consistent with the findings in the full-scale tests, with the understanding that at ½-scale the coupling between phases is somewhat stronger and thus the susceptibility to instability also somewhat greater. This somewhat conservative behavior from flow instability standpoint was actually what we aimed for at ½-scale - that is a magnification of the phenomenon of interest that was impossible to get at full scale.

Even within this artificial regime, we found that power distributions that are biased to the riser according to the expected 1:3 down-to-side split expected in BiMAC operation, tend to stabilize the flow. This is illustrated by Run [[ ]] (Appendix I to Reference 2). In this test, pipes 1-6 were with uniform power, pipes 8-19 were with the riser at 40% higher than the inclined portions, and pipe 20 was with the riser about 300% of that on the incline portion. Equivalent flux levels at time 990 minutes are shown in the table below (note that in pipe #20 the power ultimately reached[[ ]]):

[[

]]

Review of the flow data in Appendix I show that: (a) Pipe #20 is the most stable all the way out to the attainment of zero subcooling (~990 minutes); at that time, and as the power to the riser increased to near maximum tested, the channel became Ledineg unstable; (b) The same is true for #18, #16 and #12, except that the onset is somewhat delayed and the instabilities are subdued relative to #20; (c) Pipe #14 remains stable throughout; (d) Pipes #10, #8, and even #4 run at extremely low power, are subject to chugging-type instabilities (absent of flow reversals) that set in as subcooling was reduced to below 10 K (18°F); and (e) Pipe #6, subject to a uniform distribution of power over the inclined and riser portions, did produce flow reversals.

Finally, comparisons between the full scale (prototypic) and ½-scale tests show that everything is as expected (and as described in our previous response to the original RAI). That is areas and flows scale by L^2, so that at the same subcooling, and same exit quality (which is the principal object of similarity), the same scaled flow rate is obtained for the same scaled power. For example, pipe #20 in Run [[ ]] at 980 minutes (Appendix I), was loaded by [[ ]], and at subcooling of [[ ]] it produced a flow rate of [[ ]], while Run [[ ]] #19:30 (Appendix C to Reference 2), was loaded by [[]], and at subcooling of [[ ]] (the closest to the [[ ]] applied to this test) it produced a flow rate of [[ ]]. Adjusting for the [[ ]]; that is for the additional sensible heat of [[ ]] carried away in the SC test, we have [[ ]]. So now these [[ ]] corresponds to the scaled value of [[ ]], and the [[ ]] corresponds to the scaled value of [[ ]] .....very good agreement with the scaling law!

To further clarify the point, a heat flux-based scaling would suggest that (under the assumption that the two-phase multiplier and turning losses were not affected by the reduced scale - which is not necessarily completely true in the near horizontal geometry of the main portion of the channel), due to reduced gravity head at reduced scales, similarity would require that heat flux be reduced in proportion to the square root of the scale factor (lower flux by 30% at ½ scale); this is a condition which is certainly covered by the SE tests, and a condition which is further removed from both the coolability and stability envelopes. Conversely, as explained above, the "deficit" in gravity head can be made up by increasing power, which moves the operation closer to the stability and coolability envelopes - this was clearly a desired direction in the half-scale tests aiming to illustrate "interesting" behaviors.

DCD Impact

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

No changes to NEDO-33201 or NEDE-33392P will be made in response to this RAI.

NRC RAI 19.2-112 S01

Question Summary: Source terms for severe accidents during shutdown

Full Text:

The GEH response to RAI 19.2-112 addresses the point on margin to CHF only qualitatively and not quantitatively. The point that was made in the RAI is that the margin to CHF was large in the central channel geometry and therefore relatively higher heat flux peaking at the edge channel does not matter. However, this cannot be justified without proper quantification.

Please quantify the safety margin for the edge channels using the differences in the boundary conditions for the central channels and the edge channels.

NRC RAI 19.2-112 (original)

Question Summary: Results for near-edge tubes

Full Text:

The failure modes evaluated in the tests were the potential for burnout and dryout of the tubes as a result of any deficient natural convection cooling at the applied heat loads. Although the vertical piping may have a higher heat flux peaking, it is important to demonstrate that the near edge piping sections also have sufficient margin for coolability. For the MAC tests to be conclusive in establishing robustness with respect to these failure modes, it appears that a single tube test of the near-edge tubes is needed. Please indicate which tests in the existing test matrix address near-edge effects, and what the pertinent results are. Otherwise, please carry out such a test or justify why it is not necessary.

GEH Response (original)

Such a test is clearly not necessary because the MAC data show that the potential for burnout arises only in extreme and unrealistic conditions where inlet subcooling is reduced to zero and total power to the channel is increased significantly, so as to produce (steam) quality in the channel. Accordingly these "bounds" were explored with the longest (mid-section) channels and power levels reached under these conditions (both locally and in total) cover those of interest in near-edge channels (much shorter, much less total power, much less steam quality). This can also be seen by the flow performance of each channel (long vs. short) in the SE series of tests.

In addition, it should be kept in mind that: "Finally a more nearly horizontal "dish" bottom would reduce the intensity of organized natural convection currents, such as those that gave rise to local peaking on the edge channels shown in Figure 3.2—see also Figure 3.7." [MAC test report].

GEH Response

GEH would like to emphasize the key point in our previous response. Our point was focused on the mechanism of burnout in such geometry. A new point that was not emphasized previously and can be added now is stated in the response to RAI 19.2-104 S01: "*... we found that power distributions that are biased to the riser according to the expected 1:3 down-to-side split expected in BiMAC operation, tend to stabilize the flow.".* Clearly, this "biasing" gets stronger and stronger as we move towards the "edge" channels. So the picture is that in near edge channels we have lower and lower quality and more and more stable flow conditions driven by the riser, all in comparison to central channels. Thus our stated fragility of [[ ]] found for the central channels gets more and more conservative as we approach the edge channels. An additional margin is found by the reduction of the 10-degree inclination to the near-horizontal, [[ ]] inclination which reduces the peaking at the interface between incline and vertical. When margins are so great, they normally cannot be quantified, and this is the case here. For example, one reason we cannot determine a realistic margin here is because this would require running at the applicable subcooling [[ ]], which in turn would not allow an approach to CHF within the capacity of our facility.

DCD Impact

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

No changes to NEDO-33201 or NEDE-33392P will be made in response to this RAI.

NRC RAI 19.2-124

Question Summary: Perform a review of melt spreading experiments and an analysis of asymmetric melt pour into the ESBWR lower drywell.

Full Text:

Section 21.5 of the ESBWR PRA, Revision 3, on containment and BiMAC performance against basemat penetration by molten core debris, does not provide any review of past molten core-concrete interaction (MCCI) experiments for transient core melt pouring and melt spreading behavior in order to bound this initial transient heat load and its effects on the BiMAC device. Please perform such a review and explain how the experiments apply to the BiMAC design in the ESBWR lower drywell. In addition, please provide an analysis of an initial asymmetric pour that would inhibit melt spreading and possibly cause an excessive heat flux damaging the BiMAC device near its corners.

GEH Response

1. During the first pour from the reactor vessel the BiMAC is protected by ½ m [1.6 feet] of concrete. Therefore, there are no thermal loads on the BiMAC until much, much later, if at all.
2. Starting with the melt spread analysis performed during the Mark-I Liner attack study, and as it was confirmed by several experiments later, any significant quantity of melt pouring from a reactor vessel will "seek" and spread over all available area (in our case the whole of the LDW floor). There are many reviews in the literature, including all available experiments (for example "Core Melt Spreading on a Reactor Containment Floor, Progress in Nuclear Energy, Vol 36, No 4, 408-468, 2000) that support this conclusion.
3. The claim that "an initial asymmetric pour that would inhibit melt spreading and possibly cause an excessive heat flux damaging the BiMAC device near its corners" is not understood. There is no way that a massive melt pour from the reactor vessel, symmetric OR asymmetric will be prevented from spreading over the whole floor area as we point out in 2 above.
4. The corners of the BiMAC will also be buried under ~½ m (1.6 feet) of concrete.

DCD Impact

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

No changes to NEDO-33201 or NEDE-33392P will be made in response to this RAI.

NRC RAI 19.2-125

Question Summary: Explain how downcomer pipes in the lower drywell would be protected against steam explosions.

Full Text:

Section 21.4 of the ESBWR PRA, Revision 3, does not consider ex-vessel steam explosions as a mechanism to damage the BiMAC downcomer feed pipes along the vertical walls. Asymmetric melt pours into the water pool, after initial melt deposition and deluge valve actuation, could result in ex-vessel steam explosions that could 'crimp' the BiMAC downcomer tubes and thus affect long-term coolability. Please explain how these downcomer pipes will be protected against damage from steam explosions, and perform an analysis that shows the impact of steam explosions on the downcomer pipes.

GEH Response

[REFERENCE]

1. GE Hitachi ESBWR NEDO-33201 Rev. 3, Chapter 21, General Electric-Hitachi (GEH) (May 2008)

Energetic ex-vessel steam explosions "after initial melt deposition and deluge valve actuation" are not considered credible threats to the BiMAC because:

(a) The deluge valves are to be actuated after lower head failure and the first major melt pour from the reactor vessel that would follow such failure. Because of a variety of mechanisms involving heat losses, this cannot occur until a significant fraction of the core debris has been molten inside the lower head, and this implies that once a pathway has been created all available melt at the time will pour, thusly opening further the pathway. From this point on, melt relocation would occur by "dripping", the rate of which is controlled by decay heat and thermal losses. This dripping would be so slow as to not engender any significant premixtures, and as a consequence any energetic steam explosions. This is generally acknowledged—for example the Splinter Scenario II in the Mark-I liner attack study (NUREG/CR- 5423, August 1991)—it was discussed in the SAT report [1], and it is the reason for the partition mechanism of the debris into a quenched portion that does not participate thermally with the amount (of the first pour) that potentially remained in a molten state, again as discussed in the SAT.

(b) Moreover, again as explained in the SAT, the first pour will be mostly metallic and in superheated state, which would be the real concern for energetic steam explosions in case the pour met a deep subcooled water pool in the LDW. The subsequent dripping noted above would be mostly oxidic, so, besides the low rates of pouring (absence of significant premixtures), there is an additional margin in that oxidic melts at the liquidus are of low energetics if not basically non-explosive.

NRC RAI 22.5-28

The title of Subsection 19A.8.1 in the ESBWR DCD Tier 2 has been modified in Revision 5 to focus only on availability controls for structures, systems, and components (SSCs) within the scope of the Regulatory Treatment for Non-Safety Systems (RTNSS) program. Subsection 19A.8.1 includes information beyond availability controls, such as the categories of RTNSS SSCs. GEH is requested to address the general regulatory oversight provisions for RTNSS SSCs in Subsection 19A.8.1 and to insert an additional subsection to address availability controls.

GEH Response

GEH will change DCD Tier# 2 Subsection 19A.8.1 title to "Regulatory Oversight - Availability Treatment" in order to more clearly illustrate that this subsection is meant to define the methods by which regulatory oversight is applied to RTNSS functions (i.e., Technical Specifications, Availability Controls, Maintenance Rule).

This clarification negates the need to insert an additional subsection that addresses the application of availability controls.

DCD Impact

DCD Tier #2, Revision 6, Section 19A.8 will be revised as noted in the attached markup.

NRC RAI 22.5-29

Revision 5 to the ESBWR DCD has deleted Subsections 19A.8.4.16, "Standby Liquid Control System Actuation for ATWS," and 19A.8.4.17, "Feedwater Runback Logic," from the discussion of RTNSS SSCs. Revision 5 to the ESBWR DCD also deleted the discussion of Control Room Habitability – Long Term Ventilation from the end of Subsection 19A.8.4. GEH is requested to discuss the basis for these changes.

GEH Response

GEH will provide references to the subsections where the treatment of Standby Liquid Control System Actuation for ATWS, Feedwater Runback Logic and Control Room Habitability – Long Term Ventilation, are discussed. This information was moved in an effort to consolidate multiple discussions of the same functions.

The Standby Liquid Control System Actuation for the Feedwater Runback Logic function is discussed in DCD subsection 19A.8.4.1. The function is subject to the Availability Controls Manual. A reference to subsection 19A.8.4.1 will be provided at the end of section 19A.8.4 in DCD R6.

The discussion of Control Room Habitability – Long-Term Ventilation function, at the end of subsection 19A.8.4, was deleted because it referred to the portable AC generator, which is no longer part of the design. The discussion of the regulatory treatment of the control room habitability function, including ancillary AC power that provides backup power to the control room air-handling units, was moved to subsection 19A.8.4.8. The function is addressed in the Availability Controls Manual. A reference to subsection 19A.8.4.8 will be provided at the end of section 19A.8.4 in DCD R6.

DCD Impact

DCD Tier #2, Revision 6, Section 19A.8.4 will be revised as noted in the attached markup.

Attachment 1

DCD Tier 2, Revision 6 Markup

Section 19A.8.1 Proposed Regulatory Oversight - Availability Treatment

Section 19A.8.4.13 Standby Liquid Control System Actuation/Feedwater Runback Logic

Section 19A.8.4.14 Control Room Habitability – Long-Term Cooling

19A.6.2.4 Conclusion

Based on the assessment of potential adverse systems interaction for the ESBWR, together with the continuing design and procedure controls, there is reasonable assurance that the more risk significant interactions are recognized and appropriate action has been taken to address them through design, procedures or regulatory oversight.

With two exceptions, potential adverse system interactions are addressed by design or operating program requirements. For those two instances, the interactions are important enough to be designated RTNSS under Criterion E, and be subjected to increased regulatory oversight.

The CONAVS (Reactor Building HVAC Purge Exhaust) filters and the lower drywell hatches discussed under Subsections 19A.6.2.2 and 19A.6.2.3, respectively, require increased regulatory oversight. The specific oversight mechanisms are indicated in Table 19A-2.

19A.7 SELECTION OF IMPORTANT NONSAFETY-RELATED SYSTEMS

As described above, the selection of RTNSS systems considers nonsafety-related SSCs that are necessary to meet NRC regulations, safety goal guidelines, and containment performance goal objectives. RTNSS systems needed to meet the NRC regulations specified in Criteria A, B and E are based on deterministic analyses. RTNSS systems needed to meet Criteria C and D are based on probabilistic insights.

Regulatory oversight is recommended for all RTNSS systems, commensurate with their risk significance. Important RTNSS systems have a relative high risk significance, and a more robust regulatory treatment, as discussed in Section 19A.8. RTNSS systems are evaluated in the focused PRA sensitivity studies to ensure that the combination of safety-related and nonsafety-related systems meets the safety goal guidelines. If the focused PRA analysis determines that a RTNSS system is necessary to meet the NRC safety goal guidelines, then it is considered as High Regulatory Oversight, otherwise, it is considered as Low Regulatory Oversight. The risk significance of each RTNSS system is discussed in Subsection 19A.8.4. Results of the regulatory treatment assessment are summarized in Table 19A-2.

19A.8 PROPOSED REGULATORY OVERSIGHT

19A.8.1 Regulatory Oversight – Availability ~~Controls~~Treatment

Regulatory oversight is applied to each system designated as RTNSS to ensure that it has sufficient reliability and availability to perform its RTNSS function, as defined by the focused PRA, or deterministic criteria. Oversight is applied in the form of availability controls, including Maintenance Rule performance monitoring for all RTNSS functions, and either Availability Controls Manual or Technical Specifications. The extent of oversight is commensurate with the safety significance of the RTNSS function, and is categorized as either High Regulatory Oversight (HRO), Low Regulatory Oversight (LRO), or Support.

HRO - If the focused PRA analysis determines that a RTNSS system is significant to public health and safety (that is, necessary to meet the NRC safety goals) then it is classified as HRO. Technical Specification Limiting Condition for Operation is established for the system/component, in accordance with 10 CFR 50.36.

are supplied for these support systems. In addition, performance monitoring of RTNSS components is required by the Maintenance Rule.

19A.8.4.10 Long-Term Containment Integrity

Long-term containment pressure control is accomplished by a combination of passive autocatalytic recombiners (PARs) in the containment airspaces and PCCS Vent Fans, which are operated to redistribute the non-condensable gases from the wetwell to the drywell so that overall containment pressure is reduced.

PARs are independently mounted components which are capable of recombining a stochiometric mix of hydrogen and oxygen into water vapor. This recombination is facilitated through the use of a selective metal catalyst, and requires no external power or controls. A Passive Containment Cooling vent fan is teed off of each PCCS vent line and exhausts to the GDCS pool. The fan aids in the long-term removal of non-condensable gas from the PCCS for continued condenser efficiency. The fans are operated by operator action and are powered by a reliable power source which has a diesel generator backed up by an ancillary diesel if necessary without the need to enter the primary containment.

These functions maintain containment pressure below the design pressure by counteracting a slight increase in noncondensable gases over time. They are not risk-significant and the proposed regulatory oversight is in the Availability Controls Manual.

19A.8.4.11 Reactor Building HVAC Purge Exhaust Filters

The reactor building contaminated area ventilation system filters must maintain the required filtering efficiency to ensure that theoretical control room doses are not exceeded for certain beyond design basis LOCAs. Failure to provide adequate filtration is considered to be an adverse system interaction. They have regulatory oversight in the Availability Controls Manual to provide assurance that they are capable of performing their function.

19A.8.4.12 Lower Drywell Hatches

An equipment hatch for removal of equipment during maintenance and an air lock for entry of personnel are provided in the lower drywell. These access openings are sealed under normal plant operation but may be opened when the plant is shut down. Closure of both hatches is required for the shutdown Loss-of-Coolant Accident (LOCA) below top of active fuel (TAF) initiators during MODES 5 and 6. Due to the low frequency of occurrence, this function is not risk-significant and the proposed regulatory oversight is in the Availability Controls Manual.

19A.8.4.13 Standby Liquid Control System Actuation/Feedwater Runback Logic

The regulatory treatment of the ATWS actuation logic and Feedwater Runback Logic functions is provided in subsection 19A.8.4.1, and the treatment of the SLC actuation for LOCA is provided in subsection 19A.8.4.3. These functions are included in the Availability Controls Manual.

19A.8.4.14 Control Room Habitability – Long-Term Cooling

The regulatory treatment of the control room habitability function is provided in subsection 19A.8.4.8, along with the treatment of the ancillary AC power that supplies backup power to the control room air handling units. The function is included in the Availability Controls Manual.

19A.8.5 COL Information

None.

19A.8.6 References

None.

MFN 09-203

Enclosure 3

Affidavit

GE-Hitachi Nuclear Energy Americas LLC

AFFIDAVIT

I, Larry J. Tucker, state as follows:

(1) I am the Manager, ESBWR Engineering, GE Hitachi Nuclear Energy ("GEH"), have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.

(2) The information sought to be withheld is contained in Enclosure 1 of GEH letter MFN 08-801, Mr. Richard E. Kingston to U.S. Nuclear Regulatory Commission, *Response to Portion of NRC Request for Additional Information Letter No. 291 Related to ESBWR Design Certification Application ESBWR RAI Numbers* 19.2-104 S01, 19.2-112 S01, 19.2-124, 19.2-125, 22.5-28 and 22.5-29, dated April 3, 2009. The GEH proprietary information in Enclosure 1, *Response to Portion of NRC Request for Additional Information Letter No. 291 Related to ESBWR Design Certification Application Probabilistic Risk Assessment RAI Numbers* 19.2-104S01, 19.2-112 S01, 19.2-124, 19.2-125, 22.5-28 and 22.5-29 - *GEH Proprietary Information,* is delineated by a [[dotted underline inside double square brackets.{3}]]. Figures and large equation objects are identified with double square brackets before and after the object. In each case, the superscript notation {3} refers to Paragraph (3) of this affidavit, which provides the basis for the proprietary determination. A non-proprietary version of this information is provided in Enclosure 2, *Response to Portion of NRC Request for Additional Information Letter No. 330 Related to ESBWR Design Certification Application Probabilistic Risk Assessment RAI Numbers* 19.2-104S01, 19.2-112 S01, 19.2-124, 19.2-125, 22.5-28 and 22.5-29 - *Non-Proprietary Version.*

(3) In making this application for withholding of proprietary information of which it is the owner, GEH relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC Sec. 552(b)(4), and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10 CFR 9.17(a)(4), and 2.390(a)(4) for "trade secrets" (Exemption 4). The material for which exemption from disclosure is here sought also qualify under the narrower definition of "trade secret," within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975F2d871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704F2d1280 (DC Cir. 1983).

(4) Some examples of categories of information which fit into the definition of proprietary information are:

a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by GEH competitors without license from GEH constitutes a competitive economic advantage over other companies;

b. Information which, if used by a competitor, would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;

c. Information which reveals aspects of past, present, or future GEH customer-funded development plans and programs, resulting in potential products to GEH;

d. Information which discloses patentable subject matter for which it may be desirable to obtain patent protection.

The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs (4)a., and (4)b, above.

(5) To address 10 CFR 2.390(b)(4), the information sought to be withheld is being submitted to NRC in confidence. The information is of a sort customarily held in confidence by GEH, and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GEH, no public disclosure has been made, and it is not available in public sources. All disclosures to third parties including any required transmittals to NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence. Its initial designation as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in paragraphs (6) and (7) following.

(6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge, or subject to the terms under which it was licensed to GEH. Access to such documents within GEH is limited on a "need to know" basis.

(7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist or other equivalent authority, by the manager of the cognizant marketing function (or his delegate), and by the Legal Operation, for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GEH are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary agreements.

(8) The information identified in paragraph (2), above, is classified as proprietary because it identifies detailed GE ESBWR design information for the BiMAC. GE utilized prior design information and experience from its fleet with significant resource allocation in developing the system over several years at a substantial cost.

The development of the evaluation process along with the interpretation and application of the analytical results is derived from the extensive experience database that constitutes a major GEH asset.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GEH's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of GEH's comprehensive BWR safety and technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology and includes development of the expertise to determine and apply the appropriate evaluation process. In addition, the technology base includes the value derived from providing analyses done with NRC-approved methods.

The research, development, engineering, analytical and NRC review costs comprise a substantial investment of time and money by GEH.

The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial.

GEH's competitive advantage will be lost if its competitors are able to use the results of the GEH experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to GEH would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GEH of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing these very valuable analytical tools.

I declare under penalty of perjury that the foregoing affidavit and the matters stated therein are true and correct to the best of my knowledge, information, and belief.

Executed on this 3rd day of April 2009.

Larry J. Tucker
GE-Hitachi Nuclear Energy Americas LLC