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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 109 Related to ESBWR Design Certification Application, RAI Numbers 19.1-122S01 and 19.1-148S01**

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 October 12, 2007 (Reference 1). Previous RAIs and responses were transmitted in References 2 and 3. The GEH responses to RAI Number 19.1-122S01 and 19.1-148S01 are 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

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Reference:

1. MFN 07-555, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request for Additional Information Letter No. 109 Related to ESBWR Design Certification Application*, October 12, 2007.

2. MFN 07-423. *Response to Portion of NRC Request for Additional Information Letter No. 91 Related to ESBWR Design Certification Application ESBWR Probabilistic Risk Assessment RAI Numbers 19.1-117 through 19.1-133, 19.1-140, 19.1-142, 19.1-144, 19.1-148, 19.2-69 through 19.2-74 and 19.2-76 through 79.* August 13, 2007.

3. MFN 07-104, Letter from U.S. Nuclear Regulatory Commission to David . Hinds, *Request for Additional Information Letter No. 91 Related to ESBWR Design Certification Application.* January 31, 2007.

Enclosure:

1. Response to Portion of NRC Request for Additional Information Letter No. 109 Related to ESBWR Design Certification Application ESBWR Probabilistic Risk Assessment, Regulatory Treatment of Non-Safety Systems (RTNSS) RAI Numbers 19.1-122S01 and 19.1-148S01

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Enclosure 1
MFN 07-423, Supplement 2

Response to Portion of NRC Request for Additional Information Letter No. 109 Related to ESBWR Design Certification Application ESBWR Probabilistic Risk Assessment Regulatory Treatment of Non-Safety Systems (RTNSS) RAI Numbers 19.1-122S01 and 19.1-148S01

NRC RAI 19.1-122 (original)

Please provide a sensitivity study in the shutdown PRA that credits only the systems required to be operable according to Technical Specifications. This request is related to SECY 97-168, in which the staff concluded that the current level of shutdown safety was achieved by voluntary measures that are not required by current regulations, and that these measures could be withdrawn by licensees without NRC approval.

GEH Response

Three of the credited systems in the shutdown PRA model are required to be available by the Technical Specifications. Isolation Condenser System (ICS) and Gravity Driven Cooling System (GDCS) are the only systems explicitly covered by Tech Specs in shutdown modes. ADS function is also required by Tech Specs to support GDCS venting.

A sensitivity study has been performed with the following changes to the baseline shutdown model. All FAPCS, FPS, CRD and RWCU/SDC nodes were flagged to TRUE (failed). Recovery actions and system independent operator actions (closure of drywell hatch) are unchanged from the baseline shutdown case.

The results of the sensitivity are:

CDF with only systems required by Tech Specs: less than 5E-7

Baseline shutdown CDF: less than 1E-8

There is a fairly significant increase in the CDF, but the results are still relatively low. There are two primary reasons that the difference in the two cases is not all that great. One reason is that the top cutsets in the baseline case (making up 98% of the CDF) are unaffected by the sensitivity. These cases are below TAF LOCA events and the only mitigation is closing the lower drywell hatches. These sequences are not the top cutsets in the sensitivity case, but many are in the top 15 cutsets, and all are still in the top 50. The second reason is that all the systems removed from the model are entirely dependant on human action. The only three automated systems (ICS, GDCS, ADS) are still credited. The systems removed from the model had much higher failure values due to reliance on operators.

The numbers presented result from the requested sensitivity. However, regulations besides the Tech Specs will be in place for other systems. The fire protection system (FPS) will be required to have at least one or more pumps available because of the plant Fire Protection Program or other regulatory requirements. FAPCS availability is not covered in Tech Specs, but the system will be in continuous operation for spent fuel pool cooling. These two systems are not credited in the sensitivity, are not covered in Tech Specs for shutdown modes, but they are expected to be available.

Crediting only systems required operable by Tech Specs for shutdown, both the CDF and LERF results are well within the safety goals. Based on the values obtained in this analysis (no credit for systems that are certain to be available through other commitments), no additional regulatory oversight appears necessary with respect to the level of shutdown safety.

DCD/NEDO-033201 Impact

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

NEDO-33201 Rev 2 Chapter 11 contains the details of the sensitivity case above.

NRC RAI 19.1-122 S01

The staff has reviewed GEH's response to RAI 19.1-122. The staff requested that GEH provide a sensitivity study in the shutdown PRA that credits only the systems required to be operable according to TS. The staff reviewed the results of this evaluation and found that the SRVs were assumed to be available. The SRVs are not required to be operable according to TS in Modes 5 and 6. This error impacts the availability of RCS overpressure protection following IC failure, the available of low pressure injection, and GDCS venting. Please revise this sensitivity study to remove the SRVs in providing overpressure protection, low pressure injection, and GDCS venting.

GEH Response

As stated in responses to RAI 19.1-94 S01(MFN 07-422, Supplement 2):

The SRV setpoint is a mechanical spring setpoint rather than one controlled by the I&C. The only way to disable this function is by gagging the valve. Operability of the power operation of these valves does not affect the mechanical relief function.

As stated in responses to RAI 19.1-93 S01(MFN 07-422, Supplement 2:

ESBWR Tech Specs are being updated to specifically address ADS availability during shutdown. The update will require ADS (both the valves and actuation signals) remain fully operable to support GDCS venting. This will ensure pressure relief capability during shutdown up until the vessel head is removed.

The results for the requested sensitivity case are provided in the original RAI response.

DCD/NEDO-33201 Impact

DCD Chapter 16 is being updated to address ADS availability during shutdown.

NEDO-33201 Rev 2 Chapter 11 contains the details of the sensitivity case discussed.

NRC RAI 19.1-148 (original)

Evaluate in shutdown PRA the consequences of a drained suppression pool during Modes 5 and 6. The shutdown PRA credits SRV actuation with relief to the suppression pool during Modes 5 and 6 following an extended loss of RWCU/SDC and, additionally, it appears that suppression pool level is necessary for GDCS operation at shutdown for long term cooling. However, suppression pool level is not required by Technical Specifications in Modes 5 and 6. Please evaluate in the PRA: (1) consequences of relieving steam to an empty suppression pool (e.g. suppression pool over-pressurization) and (2) consequences of an empty suppression pool on GDCS operation.

GEH Response

The probability of having an empty suppression pool combined with another initiating event (loss of RWCU/SDC) is assumed to be negligible.

The volume of the suppression pool (at Low Water Level) is 11.5 million gallons (DCD/Tier 2, Table 6.2-3).

Additionally, draining the suppression pool is not a normal event during BWR outages. A planned significant reduction in SP level would be treated as a special configuration.

DCD/NEDO-33201 Impact

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

No NEDO-33201 Rev 2 changes will be made in response to this RAI.

NRC RAI 19.1-148 S01

The staff reviewed GEH's response to RAI 19.1-148 which requested information in the PRA on: (1) consequences of relieving steam to an empty suppression pool (e.g., suppression pool over pressurization) and (2) consequences of an empty suppression pool on GDCS operation. GEH responded that the probability of having an empty suppression pool combined with another initiating event is negligible. Relative to a reported shutdown CDF of 9E-9, the likelihood of this event is not negligible given that operating BWR licensees drain the suppression approximately once per 10 years for maintenance. Also, the initiating event frequency for loss of RWCU/SDC is estimated by GEH to be 3E-3 per reactor year. Thus, as stated in RAI 19.1.148, please evaluate: (1) the consequences of relieving steam to an empty suppression pool (e.g., suppression pool over pressurization), and (2) the consequences of an empty suppression pool on GDCS operation.

GEH Response

1) Relieving steam to an empty SP would not cause SP failure. The vacuum breakers would lift to equalize pressure with the upper drywell (DW). During shutdown, it is likely the DW hatch would be open relieving the pressure to the fuel building. If the DW were closed in such a scenario, the DW would eventually overpressurize. The current shutdown PRA assumes all core damage sequences result in release, so an intact containment is not credited in any sequences.
2) Consequence on GDCS operation would be lack of long-term cooling by equalizing lines. However, initial injection with the GDCS pools would still be available and other systems, such as power-independent FPS, could be lined up for cooling as well.

All current shutdown sequences are below 3.00E-9, and all sequences above 1.00E-13 are either lower drywell LOCA sequences, or Mode 6 sequences (vessel head removed). All sequences that involve pressure relief are Mode 5 sequences with the vessel head still on, and the highest Mode 5 sequences have a CDF of less than 1E-13. Given that draining the suppression pool is a rare event, all sequences associated with relieving steam to a drained suppression pool would certainly be much lower than 1E-13. As such, the risk associated with an empty suppression pool is assumed to be negligible.

DCD/NEDO-033201 Impact

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

No NEDO-33201 changes will be made in response to this RAI.