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Subject: Response to Portion of NRC Request for Additional Information Letter No. 101 Related to ESBWR Design Certification Application, RAI Numbers 19.1-150, 19.1-151, 22.5-12 through 22.5-14, 22.5-17 and 22.5-18.

The purpose of this letter is to submit the GE-Hitachi Nuclear Energy Americas LLC (GEH) response to the U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) sent by NRC letter dated June 21, 2007 (Reference 1). The GEH response to RAI Numbers 19.1-150, 19.1-151, 22.5-12 through 22.5-14, 22.5-17 and 22.5-18 is in Enclosure 1.

Should you have any questions about the information provided here, please contact me.

Sincerely,

Kathy Sedney for

James C. Kinsey
Project Manager, ESBWR Licensing

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NRO

Reference:

1. MFN 07-357, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request for Additional Information Letter No. 101 Related to ESBWR Design Certification Application,* June 21, 2007.

Enclosure:

1. Response to Portion of NRC Request for Additional Information Letter No. 101 Related to ESBWR Design Certification Application ESBWR Probabilistic Risk Assessment RAI Numbers 19.1-150, 19.1-151, and Regulatory Treatment of Non-Safety Systems (RTNSS) RAI Numbers 22.5-12 through 22.5-14, 22.5-17 and 22.5-18

cc:	AE Cubbage	USNRC (with enclosure)
	GB Stramback	GEH/San Jose (with enclosure)
	RE Brown	GEH/Wilmington (with enclosure)

EDRF Section	0000-0072-8617	NRC RAI 19.1-150 and 151
	0000-0073-2336	NRC RAI 22.5-12,13,14,17,18

Enclosure 1

MFN 07-455

Response to Portion of NRC Request for
Additional Information Letter No. 101 Related to
ESBWR Design Certification Application
ESBWR Probabilistic Risk Assessment
RAI Numbers 19.1-150, 19.1-151,
and
Regulatory Treatment of Non-Safety Systems (RTNSS)
RAI Numbers 22.5-12 through 22.5-14, 22.5-17 and 22.5-18

NRC RAI 19.1-150

Section 19.2.3.2.1 describes the bounding approach used for probabilistic fire analysis and states the analysis assumes the worst effects of fire on all the equipment and systems located in each group of fire areas, that is, any fire in any fire area will cause the worst damage. Please confirm that worst effects/damage includes any potential fire-induced multiple spurious actuations that could adversely affect the capability to achieve and maintain safe shutdown. For example, the worst damage to a pump or valve in the area affected by the fire might be assumed to be loss of the equipment function. However, operation of the pump or valve due to a spurious actuation may have an adverse affect on safe shutdown that exceeds the consequences of loss of component function due to fire damage. Regulatory Guide 1.189, Rev. 1, provides guidance for considering spurious actuations in the post-fire safe-shutdown analysis.

GEH Response

The ESBWR is designed to prevent spurious actuations that could adversely affect the capability to achieve and maintain safe shutdown. Therefore, the fire PRA assumes that any fire in any fire area will cause the worst damage, which is the failure of the affected components.

The ESBWR design features described in DCD Tier 2 Section 7.1.3 help minimize the adverse effect on safe shutdown caused by fire-induced spurious actuations. First of all, the ESBWR instrumentation and control system is digital. A spurious signal cannot be induced by fire damage in a fiber optic cable. The hard wires are minimized to limit the consequences of a postulated fire. Typically the main control room (MCR) communicates with the safety-related and nonsafety-related DCIS rooms with fiber optics. From the DCIS rooms to the components, fiber optics will also be used up to the Remote Multiplexing Units (RMUs) in the plant. Hard wires then are used to control the subject components. Typically two load drivers are actuated simultaneously in order to actuate the component. To eliminate spurious actuations, these two load drivers are located in different fire areas. Therefore, a fire in a single fire area cannot cause spurious actuation.

The ESBWR plant has a passive design. The safety systems do not have active components such as the high-pressure injection pumps in the traditional plant designs. For the high/low pressure interfaces, multiple check valves are included which prevent the opening of the path even if a spurious actuation should occur after a fire. DCD Tier 2 section 7.6.1 describes the HP/LP system interlock function.

The operator actions are minimized to improve the safety of ESBWR plants. Since the main control room communicates with the DCIS rooms via fibers, no spurious actuation will be originated from a MCR fire.

DCD/NEDO-33201 Impact

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

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

NRC RAI 19.1-151

Section 19A.4.2.1 states A fire in the control room does not affect the automatic actuations of the safety systems. However, this section also states that the remote shutdown panel allows the detection of failed automatic actuations and the performance of compensatory manual actuations. Please describe the reliance on and the nature of the compensatory manual actuations. Does the fire PRA credit any compensatory manual actions for safe shutdown and, if so, are the actions performed at the remote shutdown panel or at other locations in the plant? Regulatory Guide 1.189, Rev. 1, provides guidance for operator manual actions that are credited for post-fire safe shutdown.

GEH Response

As noted in the responses to RAI 19.1-150, the operator actions are minimized to improve the safety of ESBWR plants. The remote shutdown panel allows the operators to perform exactly the same functions as in the main control room. However, these actions are for defense-in-depth. The performance of the compensatory manual actions for safe shutdown is not credited in the ESBWR fire PRA model for a postulated fire in the main control room.

DCD/NEDO-33201 Impact

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

No changes to NEDO033201 will be made in response to this RAI.

NRC RAI 22.5-12

Section 19A.3.1.3, Control Room Habitability, implies that the control room ventilation will be maintained. However, habitability of the control room following a major incident or severe weather such as a hurricane, requires electrical power for lighting and other habitability needs. Please discuss control room lighting in relation to RTNSS analysis?

GEH Response

There are two separate functions considered for control room habitability.

First, control room ventilation must be functional to ensure that adequate radiation protection exists to permit access and occupancy of the control room under accident conditions without personnel receiving radiation exposures in excess of 5 rem whole body, or its equivalent to any part of the body, for the duration of the accident. The Control Room Habitability Area HVAC Subsystem addresses this function.

Second, control room lighting and other habitability needs are required to support long-term, (i.e. beyond 72) hour, post accident monitoring, which is discussed in DCD Section 19A.3.1.4. Power for these loads is provided from the two Plant Investment Protection (PIP) 6.9 kV buses.

DCD/NEDO-33201 Impact

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

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

NRC RAI 22.5-13

Section 19A.4.4.3 states that, ... due to the conservative treatment of the condensate and feedwater systems in PRA, their risk significance does not warrant additional regulatory oversight. Section 19A.2.1 does place the feedwater run back logic as RTNSS equipment and table 19A-2 indicates regulatory treatment as LRO. However, the more complex logic design of the controllers involve some aspect of software design and the potential for a common cause failure of the controllers. How was the potential for common cause failure of the controllers addressed in the RTNSS analysis?

GEH Response

There are two issues related to the feedwater control function: the effects of a total loss of feedwater flow as an initiating event, and the ability to provide a runback of the feedwater pumps in response to ATWS conditions.

The reference to condensate and feedwater in Section 19A.4.4.3 is with respect to the first issue, i.e., their contribution to the loss of feedwater initiating event frequency. The criterion for RTNSS, in this case, is whether the failure of a structure, system or component (SSC) could contribute significantly to an initiating event that has a significant impact on core damage frequency (CDF) or large release frequency (LRF). The conclusion stated in section 19A.4.4.3 is that, due to the high reliability in the feedwater control system design features, failures of condensate or feedwater are not a significant contributor to CDF or LRF with respect to RTNSS.

The loss of feedwater initiating event frequency is a point estimate of 0.117 per year, based on industry operating experience. The ESBWR feedwater control system is implemented on a triplicate, fault tolerant digital controller, which is more reliable than the feedwater control systems originally installed in the current generation of reactors. The common cause failure of feedwater controllers was evaluated. However, no specific failure modes or actual events were identified. Therefore common cause failure of the controllers was judged to have no significant effect on the initiating event frequency.

Section 19A.2.1 discusses the Feedwater Runback function relative to RTNSS Criterion A, which addresses SSC functions that are relied upon to meet beyond design basis deterministic NRC performance requirements such as 10 CFR 50.62 for ATWS mitigation. Nonsafety-related SSCs that are relied upon to satisfy Criterion A, such as the feedwater runback logic, are designated as RTNSS based on the deterministic criteria of the ATWS rule (10 CFR 50.62.)

DCD/NEDO-33201 Impact

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

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

NRC RAI 22.5-14

For each of the passive safety systems and the associated (active safety) system interfaces that are discussed in Section 19A.6, identify those components of the active systems (i.e., vessels, pumps, weldment and/or piping systems) that, if they were to fail, their failure could cause a loss of safety function of a passive safety-related system. Additionally, for those components for which failure could lead to a loss of safety function of a passive safety-related system, evaluate whether regulatory oversight is needed and determine the appropriate level of regulatory oversight commensurate with their risk importance.

GEH Response

See GEH Response to NRC RAI 22.5-17.

DCD/NEDO-33201 Impact

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

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

NRC RAI 22.5-17

Section 19A.6.1, Systematic Approach, addresses Criterion E and the systematic evaluation of adverse interactions between active and passive systems. Please provide additional detail to explain and clarify the systematic approach used to evaluate adverse system interactions including the manner in which potential adverse system interactions are evaluated for non-safety-related components.

GEH Response

The systematic approach that is used in DCD Tier 2 Section 19A.6.1 to evaluate potential adverse system interactions involves the following steps. Passive safety functions are evaluated to identify target areas or components that could be affected by an adverse condition. Then the systems that interface with each passive safety function are identified to determine if there are nonsafety-related SSCs that could potentially cause a failure of a passive safety function. Each interface between a nonsafety-related SSC and a passive safety function is then evaluated for potential adverse effects. Potential adverse system interactions for nonsafety-related components could either be due to functional interactions (e.g., valve failure in a supporting system), or to spatial interactions (e.g., flooding or spray damage due to a nearby pipe rupture). Spatial interactions are further addressed in the development of the Fire and Flooding portions of the PRA model. The result of the systematic evaluation is the identification of nonsafety-related SSCs that could cause adverse system interactions, and these SSCs would be considered for additional regulatory oversight.

The actual result of the evaluation of the ESBWR did not identify any SSCs that should be considered for RTNSS. This result is reasonable since there are several significant design standards relative to safety-related (passive) systems. Singing these standards during the design phase of the ESBWR precludes adverse interactions. For example, protection of safety-related systems against the dynamic effects of pipe breaks and flooding are design requirements. Nonsafety-related SSCs whose failure during a seismic event could cause an adverse interaction to a Seismic Category I SSC must be classified as Seismic Category II. In addition, the spatially-related effects of fires and flooding are evaluated in the PRA.

DCD/NEDO-33201 Impact

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

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

NRC RAI 22.5-18

Section 19A.8.4.10, Component Cooling - HVAC, Cooling Water, Chilled Water, and Plant Service Water, states that no explicit availability controls are supplied for these support systems. Discuss the basis for this determination.

GEH Response

In accordance with DCD Tier 2 Section 19A.8.1, 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 either by the focused PRA, or by deterministic criteria. The extent of oversight is commensurate with the safety significance of the RTNSS function, and is categorized as High Regulatory Oversight (HRO), Low Regulatory Oversight (LRO), or Support. 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 and a Technical Specification Limiting Condition for Operation is established for the system/component, in accordance with 10 CFR 50.36. If a RTNSS system is not significant, as described above, then the proposed level of regulatory oversight is Low Regulatory Oversight (LRO), which is addressed in regulatory availability specifications, which are described in the Availability Control Manual. In addition, systems designated as "support" have low risk significance and they provide support (generally component and room cooling) for RTNSS systems that provide active mitigation functions. Treatment of support systems relative to the systems they support is described in the Availability Control Manual (ACM.)

Guidance in the ACM states that when supported system availability controls are not met solely because a support system's availability controls are not being met, then the conditions and required actions associated with this supported system do have to be entered. Only the support system's actions are required to be entered.

If a support system becomes degraded, but does not affect the availability of a supported system, then this condition is considered to be less significant. In either case, in accordance with 10 CFR 50.65(a)(4), a risk evaluation is performed in accordance with the Maintenance Rule Program. If the risk is determined to be unacceptable, then appropriate actions must be taken to manage that risk.

DCD/NEDO-33201 Impact

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

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