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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 19.1-126 S01 and 19.1-129 S01**

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 Reference 2 and 3. The GEH response to RAI Numbers 19.1-126 S01 and 19.1-129 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 07-104, Letter from U.S. Nuclear Regulatory Commission to David H. Hinds, *Request for Additional Information Letter No. 91 Related to ESBWR Design Certification Application*, February 5, 2007.

3. 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.

Enclosures:

1. Enclosure 1, MFN 07-423 Supplement 3 Response to Portion of NRC Request for Additional Information Letter No. 109 Related to ESBWR Design Certification Application ESBWR Probabilistic Risk Assessment RAI Numbers 19.1-126 S01 and 19.1-129 S01.

2. Enclosure 1, Attachment 1 MFN 07-423 Supplement 3 Markup of DCD Tier 2 Revision 5, Table 19.2-3 Risk Insights and Assumptions

cc: AE Cubbage USNRC (with enclosure)
GB Stramback GEH/San Jose (with enclosure)
RE Brown GEH/Wilmington (with enclosure)
eDRFSection 0000-0077-2504 RAI 19.1-126 S01
0000-0077-2506 RAI 19.1-129 S01

Enclosure 1

MFN 07-423, Supplement 3

Response to Portion of NRC Request for

Additional Information Letter No. 109

Related to ESBWR Design Certification Application

Probabilistic Risk Assessment

RAI Numbers 19.1-126 S01, 19.1-129 S01

NRC RAI 19.1-126 S01

The staff has reviewed RAI 19.1-126 and RAI 19.1-127, which requested the capability of the fire watch to justify the .0074 probability of barrier failure and the low fire CDF. GEH responded that shutdown risk related to fire barriers is evaluated and managed in accordance with the outage risk management

program of 10CFR50.65(a)(4). To evaluate the robustness of the shutdown fire core damage frequency estimate, the staff is still requiring the sensitivity cases of modeled fire barriers to be submitted on September 28, 2007. In addition, please explain in the PRA how the COL holder will choose between roving and continuous fire watches for the modeled fire barriers. GEH will address their response towards resolution of RAI 19.1-126 and 19.1-127.

GEH Response

The sensitivity cases of modeled fire barriers were submitted on September 28, 2007 in revision 2 of NEDO-33201 in subsection 11.3.7.6, Fire Barrier Failure Probability for Shutdown Fire Model. The sensitivity cases demonstrate that the potential risk impact of the fire barrier failure associated with a fire watch is significantly below the threshold values (1.E-4/yr for CDF and 1.E-6/yr for LRF).

DCD subsection 9.5.1.15, Fire Protection Program, discusses the organization and responsibilities in subsection 9.5.1.15.2. The site engineer in charge of the Fire Protection Program is responsible for assuring the availability and acceptability of:

> *"- Fire barriers including fire rated walls, floors and ceilings, fire rated doors, dampers, etc., fire stops and wraps, and fire retardant coatings. Procedures specifically address the administrative controls to be put in place, including fire watches, when a fire barrier is breached for maintenance."*

Therefore, it is up to the site Fire Protection Engineer (FPE) to decide whether a roving fire watch is adequate or a continuous fire watch is required. For the modeled fire barriers, their risk importance values based on the shutdown CDF cutsets have been documented in NEDO-33201 Table 11.3-49. It is assumed that the site FPE will use the risk importance values as an input to implement compensatory actions when a fire barrier is breached for maintenance, which include choosing between the roving and continuous fire watches.

Based on the assumptions 10 and 11 in NEDO-33201 Rev. 2 subsection 12.2.3 and the shutdown fire barrier sensitivity results in Tables 11.3-49 and 11.3-50, there are three cases of fire barriers modeled for shutdown fire PRA:

1. Only one fire barrier exists on the fire propagation path. In this case, there are two sub-cases:
    a. The fire barrier is a fire door: the fire scenario for fire propagation between fire areas housing the RWCU pumps (fire areas F1152 and F1162) falls in this sub-case.

b. The fire barriers are walls or sealed penetrations: the fire propagation scenarios for fire areas F4250 & F4260, F4350 & F4360, and F9150 & F9160 fall in this sub-case.

2. Multiple fire barriers in series exist on the fire propagation paths. In this case, the two target fire areas are well separated by a third fire area. Since the two fire areas contain components for the two redundant trains, it is assumed that simultaneous breaching of the multiple fire barriers in series is forbidden. The following are the shutdown fire scenarios included in this case:

   - Fire areas F3301 & F3302 are separated by a corridor (fire area F3100).
   - Fire areas F5550 & F5560 are separated by a corridor (fire area F5100).

For the modeled fire scenario in sub-case 1a, the breaching of the fire barrier without a continuous fire watch may result in an unacceptable risk increase. Therefore, as an insight from shutdown fire PRA, a procedure requirement will be added to DCD Chapter 19 in Table 19.2-3 to request a continuous fire watch for the breaching of the fire door between fire areas F1152 and F1162.

For sub-case 1b, a maintenance activity that requires breaching of the fire barriers (walls or sealed penetrations) is unlikely. Even if a breaching of fire barrier is assumed to be required, a roving fire watch should still be adequate for the modeled fire scenarios since the risk increase is not significant.

For case 2, if simultaneous breaching of the multiple fire barriers in series is not allowed and only one fire barrier is breached, the fire barrier failure probability for the most limiting fire propagation path should be the failure of one fire door, which is 7.40E-3. For fire scenario with fire areas F3301 and F3302, the risk increase without any fire watch is not significant. The same conclusion can be drawn for the fire scenario for fire areas F5550 and F5560.

In an unlikely situation that simultaneous breaching of the multiple fire barriers in series on the fire propagation path has to be requested for fire scenarios in case 2, risk increase associated with a roving fire watch is still not significant for the fire scenario with fire areas F5550 and F5560. However, the fire risk increase associated with a roving fire watch for fire scenario with fire areas F3301 and F3302 could become significant. Therefore, a continuous fire watch should be required for this fire scenario.

In summary, the choice of a fire watch will depend on the specific characteristics of a fire scenario and the COL holder's administrative control of the breached fire barriers for maintenance activities. The following risk insight will be added into DCD Rev. 5 in Table 19.2-3, which will require continuous fire watch for the breached fire barriers:

During shutdown conditions, a continuous fire watch is required for the following scenarios with breached fire barriers for maintenance activities:

- *The breaching of the fire door between fire areas F1152 and F1162 (the reactor building fire areas that house RWCU pumps).*

- *The simultaneous breaching of the multiple fire barriers that can open fire areas F3301 and F3302 (the N-DCIS room fire areas) to fire area F3100 (the corridor fire area) at the same time.*

DCD/NEDO-33201 Impact

DCD Tier 2, Section 19 Table 19.2-3, Risk Insights and Assumptions, will be revised as described above and as noted in the attached mark-up.

NEDO-33201 Revision 3 Section 12 will be updated in response to this RAI.

NRC RAI 19.1-129 S01

The staff has reviewed GEH's response to RAI 19.1-129. Based on the phone call with GEH on Thursday, August 23, 2007, the staff learned that the ESBWR Main Control Room (MCR) controls are connected to back panel rooms via fiber optic cable, which are unaffected by a postulated MCR fire. The loss of the cables or Visual Display Units will not cause inadvertent actuations or affect the automatic actions associated with safety and non-safety related equipment. The staff also learned that there are 2 remote shutdown panels. To address MCR fire risk, please perform a sensitivity study that credits only automated equipment, or provide information in the PRA regarding the operator's capability to monitor the RWCU/SDC system status, RCS level, and RCS pressure from the back panel rooms. Please provide: (1) an Availability Control to prevent having both remote shutdown panels out of service at the same time, or (2) describe any administrative controls in the PRA that currently exist which would prevent both shutdown panels from being out of service at the same time.

GEH Response

For all modeled shutdown fire scenarios that are outside of the main control room (MCR), the MCR should still be available. Therefore, the remote shutdown panels are not modeled under the shutdown conditions in NEDO-33201 revision 2 Section 12. Instead, the MCR fire scenario is modeled with conservative assumptions (i.e., credit only automated equipment by assuming all operator actions failed except the manual scram) under the full-power conditions. This fire scenario bounds the MCR fire scenarios under all other modes except modes 5 and 6. Cold shutdown and refueling are considered in the shutdown PRA models. No credit has been taken for the remote shutdown panels in this fire scenario. Per DCD Revision 4 subsection 7.4.2.2.3, normally the turbine bypass valves automatically control reactor pressure, and the reactor feedwater system automatically maintains vessel water level. With these functions available, reactor cooldown is achieved through the normal heat sinks. Per DCD Revision 4 subsection 5.4.8.2.2, the entire cooldown using RWCU/SDC is controlled automatically and provides the capability to bring the reactor from high-pressure conditions to cold shutdown.

For the shutdown PRA models, a fire in main control room (MCR) will not result in an initiating event. Under the modeled shutdown conditions (modes 5 and 6), the reactor has been successfully cooled down with the Reactor Water Cleanup/Shutdown Cooling (RWCU/SDC) system running automatically.

Tech Spec section 3.3.3.1 provides the operability control for the remote shutdown system.

DCD/NEDO-33201 Impact

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

NEDO-33201 Revision 3 Section 12 will be updated in response to this RAI to clarify the PRA shutdown fire model for Modes 5 and 6 by incorporating the discussion above.

Enclosure 1, Attachment 1

MFN 07-423 Supplement 3

Markup of DCD Tier 2 Revision 5,

Table 19.2-3

Risk Insights and Assumptions

Table 19.2-3
Risk Insights and Assumptions

Insight or Assumption	Disposition
The dominant risk contributor with respect to shutdown modes is "Mode 6 Unflooded." This is consistent with the baseline shutdown CDF results since the isolation condenser system is not credited in the Mode 6 Unflooded event trees. Therefore, it is necessary to ensure the operability of the systems critical to decay heat removal function during this mode.	Operational Program
It is assumed that the watertight doors are normally closed at power. Opening of the doors would generate an alarm in the Control Room, and procedures direct their immediate closure upon receipt of an alarm.	Operational Program
It is assumed that, during shutdown, manual and automatic depressurization (ADS) of the vessel are available while the vessel head is in place.	Operational Program
It is assumed that the actuation of the GDCS due to an RPV Level 1 water level signal is available during the entire shutdown period.	Operational Program
During shutdown conditions, a continuous fire watch is required for the following scenarios with breached fire barriers for maintenance activities: • The breaching of the fire door between fire areas F1152 and F1162 (the reactor building fire areas that house RWCU pumps). • The simultaneously breaching of the multiple fire barriers that can open fire areas F3301 and F3302 (the N-DCIS room fire areas) to fire area F3100 (the corridor fire area) at the same time.	Operational Program