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MFN 06-442, Supplement 5

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U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Document Control Desk
Rockville, MD 20852

Subject: **Revised Response to Portion of NRC Request for Additional Information Letter No. 342 Related to ESBWR Design Certification Application - RAI 19.1-144 S04**

Enclosure 1 contains revisions to the GE Hitachi Nuclear Energy (GEH) response to Request for Additional Information (RAI) Number 19.1-144 S04 from the U.S. Nuclear Regulatory Commission (NRC) sent by NRC letter dated May 14, 2009, including a corresponding markup to NEDO-33201 (Revision 5).

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

Sincerely,

Richard E. Kingston

Richard E. Kingston
Vice President, ESBWR Licensing

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NRO

Reference:

1. MFN 09-332, Letter from U.S. Nuclear Regulatory Commission to Jerald G. Head, GEH, *Request for Additional Information Letter No. 342 Related to ESBWR Design Certification Application*, dated May 14, 2009.

Enclosure:

1. Revised Response to Portion of NRC Request for Additional Information Letter No. 342 Related to ESBWR Design Certification Application, Probabilistic Risk Assesement, RAI 19.1-144 S04, and NEDO-33201 (Rev 5) Markup.

cc:

| | |
|---|---|
| AE Cubbage | USNRC (with enclosure) |
| JG Head | GEH/Wilmington (with enclosure) |
| DH Hinds | GEH/Wilmington (with enclosure) |
| eDRF Section: | 0000-0105-4831 |

# MFN 06-442, Supplement 5

# Enclosure 1

# Revised Response to Portion of NRC Request for Additional Information Letter No. 342 Related to ESBWR Design Certification Application

## RAI Number 19.1-144 S04

## Probabilistic Risk Assessment

## And

## NEDO-33201 (Rev 5) Markup

RAI 19.1-144 S04

The staff has reviewed GEH's response to RAI 19.1-144 S03 and requests the following additional supporting information to resolve the ICS functionality and operability issues during Mode 5 conditions:

a. Provide additional information in the description of ICS in the DCD regarding the ability of the IC stub tube and IC steam line to clear itself as the water level lowers in the vessel.

b. Provide additional information in the PRA concerning the reactor head vent, including the size of the head vent, status of head vent (opened or closed), the discharge path of the head vent, and the duration of time that the head vent can be opened and not impact ICS operation.

c. Provide clarification in Technical Specifications regarding (1) operability of the ICS during reactor vessel high water level (flooded stub tube), and (2) the impact of the Action Statements that allow ICS inoperability for an indefinite period of time.

GEH Response

a. DCD Tier 2 Subsection 5.4.9 is being revised to provide additional information in the description of ICS regarding the ability of the IC stub tube and IC steam line to clear itself as the water level lowers in the vessel.

b. NEDO-33201 Section 16 is being revised to provide additional information concerning the reactor head vent, including the size of the head vent, status of head vent (opened or closed), the discharge path of the head vent, and the duration of time that the head vent can be opened and not impact ICS operation. Thermal-hydraulic analyses using MAAP have shown there is over 64 hours to isolate the head vent if ICS starts automatically and the minimum CRD purge/cooling flow is credited, 32 hours if ICS is started manually without credit for CRD and 14.5 hours if ICS starts automatically without credit for CRD flow.

c. The GEH response to RAI 16.2-188 addresses the revision to the ESBWR GTS 3.5.5, Isolation Condenser System (ICS) – Shutdown, and GTS 3.5.5 Bases to provide clarification regarding (1) operability of the ICS during reactor vessel high water level (flooded stub tube), and (2) the impact of the Action Statements that allow ICS inoperability for an indefinite period of time.

DCD Impact

DCD Tier 2 Subsection 5.4.9 is revised as shown in the attached mark-up.

NEDO-33201 Section 16 is revised as shown in the attached mark-up.
NEDO-33201 Section 16 will be revised to reflect updated RAI response as shown in the attached mark-up.

The IC function is able to prevent RPV Level 1 from being reached if:

- The initial RPV water inventory is above Level 3
- There is little or no leakage from the RPV.

The maximum RCPB leak rate within the Technical Specification during full power operation is assumed to be insufficient to decrease the RPV level to the point where an ADS signal occurs, even if high pressure RPV makeup is not established during the sequence mission time. Therefore, failure of the IC function due to leaks is considered a low probability.

The success criterion of this function is the operation of both operable (2/2) ICs during the sequence mission time. The Tech Specs for Mode 5 only require 2 out of the 4 ICs be available.

In Tech Spec Mode 5, the RPV water level is normally maintained below the ICS stub tubes. Per DCD Tier 2, Subsection 5.4.9.2, the four steam stub lines consist of low alloy steel piping originating at the reactor vessel nozzles and running to the respective ICS train steam supply line interface connection, and include pairs of DPVs mounted at the terminal ends. The steam stub lines are mounted to the RPV as nominally horizontal piping, sloped back to the reactor vessel to assure moisture drainage away from the ICS steam line or the DPV inlets. Therefore, even under a postulated scenario that the ICS stub tubes are flooded originally, the loss of DHR events would eventually result in the boiling of the coolant, the RPV water level would drop below the ICS stub tubes' elevation and ICS can perform its DHR function, which then is self-correcting.

Per DCD Tier2, Subsection 5.4.12, the ESBWR has an RPV head vent system that handles any noncondensable gas buildup, that could inhibit natural circulation core cooling, at the high point inside the RPV head by sweeping the gasses through a main steamline and then ultimately to the condenser. The piping is 50.8 mm (two inches) in diameter. The vent piping directs air and non-condensable gases from the RPV to either the Equipment and Floor Drain Sump or one of the main steamlines. Per DCD Tier 2, Subsection 5.4.12.2, the RPV head vent remains open to the MSLs during normal power operation and following any postulated transient or accident. The motor-operated shutoff valve is designed to remain open, and is not required to perform an active safety function. The alternate path vent line to the equipment and floor drain sump system is normally closed to protect the RCPB and the nitrogen-operated isolation valves for this line are designed to remain shut following a postulated transient or accident. During reactor shutdown and after the plant reaches cold shutdown conditions, the two valves in the vent piping leading to the Equipment and Floor Drain Sump are opened and the valve in the piping connected to the main steamline is closed.

The duration of time the head vent can be open in Mode 5 is inconsequential because the average coolant temperature is below or equal to 93.3°C (200°F). In a postulated unplanned re-entry into Mode 4 from Mode 5 due to loss of DHR, the head vent should not impact the ICS operability because the isolation of this line should be considered to be very likely. Thermal-hydraulic analyses have been performed and show there is over 64 hours to isolate the head vent if ICS starts automatically and the minimum CRD purge/cooling flow is credited, 32 hours if ICS is started manually without credit for CRD and 14.5 hours if ICS starts automatically without credit for CRD flow. Moreover, if such opening is assumed to be a shutdown LOCA event, it has already been bounded by the existing event trees for LOCA other than feedwater or GDCS, which have negligible risk contributions.