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MFN 06-241 Supplement 4

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Subject: Response to Portion of NRC Request for Additional Information Letter No. 34 Related to ESBWR Design Certification Application - Emergency Core Cooling Systems - RAI Numbers 6.3-18 S02 and 6.3-24 S02

Enclosure 1 contains the GE Hitachi Nuclear Energy (GEH) response to the subject NRC RAIs originally transmitted via the Reference 1 letter and supplemented by NRC requests for clarification in Reference 2.

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

Sincerely,

James C. Kinsey
Vice President, ESBWR Licensing

DOUG
NRO

References:

1. MFN 06-198, Letter from U.S. Nuclear Regulatory Commission to David Hinds, *Request for Additional Information Letter No. 34 Related to ESBWR Design Certification Application*, June 22, 2006
2. MFN 07-497, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request for Additional Information Letter No. 106 Related to ESBWR Design Certification Application*, September 6, 2007

Enclosure:

1. MFN 06-241 Supplement 4 - Response to Portion of NRC Request for Additional Information Letter No. 34 - Emergency Core Cooling Systems - RAI Numbers 6.3-18 S02 and 6.3-24 S02

cc: AE Cabbage USNRC (with enclosures)
GB Stramback GEH/San Jose (with enclosures)
RE Brown GEH/Wilmington (with enclosures)
eDRF RAI 6.3-18S02: 0000-0076-3794
RAI 6.3-24S02: 0000-0076-2482

Enclosure 1

MFN 06-241 Supplement 4

Response to Portion of NRC Request for

Additional Information Letter No. 34

Related to ESBWR Design Certification Application

Emergency Core Cooling Systems

RAI Numbers 6.3-18 S02 and 6.3-24 S02

NRC RAI 6.3-18:

The following important parameters given in DCD Tier 2, Table 6.3-2 should be incorporated into the ITAAC in DCD Tier 1, Table 2.4.2-1:

- (a) Minimum total drainable inventory (for 3 GDCS pools): 1760 cubic meters*
- (b) Minimum long term core cooling flow delivered by the GDCS equalizing lines for a delta P of 1.32 psid across the equalizing lines: 100 gpm*
- (c) Minimum flow through the deluge lines required to flood the lower drywell region: 70 kg/sec*
- (d) Minimum available suppression pool water inventory: 1 meter above top of active fuel (TAF), 334 cubic meters*
- (e) Minimum GDCS equalizing line driving head: 3.3 feet*

GEH Response:

The level of detail requested is beyond the intent of what is needed to assure the system will perform as required. There are ongoing discussions with the industry and the NRC as to the content that is required in Tier 1. When such requirements are settled upon, each system in Tier 1 may go through a thorough review to satisfy the agreed upon requirements.

NRC RAI 6.3-18 S01:

Your response to several ITAAC related RAIs stated that "There are ongoing discussions with the industry and the NRC as to the content that is required in Tier 1. When such requirements are settled upon, each system in Tier 1 may go through a thorough review to satisfy the agreed upon requirements."

Please provide revised responses to these RAIs to address the original questions. There may be additional RAIs with similar responses. Those responses should also be supplemented.

GEH Response:

DCD Tier 1, Table 2.4.2-1, "ITAAC for the Gravity-Driven Cooling System," was revised in Revision 3 to add the information requested in RAI 6.3-18, items (a), (d), and (e), as follows:

- (a) Item 15 and 16 were added to Table 2.4.2-1 to specify Inspections, Tests, Analyses and Acceptance Criteria (ITAAC) for the combined minimum drainable volume for the 3 Gravity-Driven Cooling System (GDCS) pools.*
- (d) Item 18 was added to Table 2.4.2-1 to specify ITAAC for the minimum volume that is drainable from the suppression pool to the reactor pressure vessel (RPV) via the GDCS equalizing lines.*

(e) Item 19 was added to Table 2.4.2-1 to specify ITAAC for the suppression pool level needed to maintain the minimum GDCS equalizing line driving head.

Note: The above ITAAC items will be further modified in the DCD as described in RAI 6.3-23 S01.

RAI 6.3-18, item (b), was not incorporated in DCD Tier 1, Table 2.4.2-1. This item requested that the ITAAC be revised to include a statement from DCD Tier 2, Table 6.3-2, that the GDCS equalizing line delivers a minimum long term cooling flow of 22.7 m³/hr (100 gpm) at a minimum ΔP of 9.12 kPa (1.32 psid). This information does not meet the criteria in DCD Tier 2, Subsection 14.3.7, for inclusion as ITAAC because this detail is more appropriately addressed by the verification that each GDCS line has a flow loss coefficient less than that assumed in the TRACG code models. Verification that the as-built flow loss coefficient for each GDCS line is less than that assumed in the TRACG code models provides the required assurance that GDCS system flow, which varies depending on relative levels and pressures, will be sufficient to maintain RPV water level one meter above the top of active fuel (TAF) following a design basis accident (DBA). GE will revise DCD Tier 1, Table 2.4.2-1, Item 2, in Revision 4, to clarify that this ITAAC requires verification that the as built flow loss coefficient for each GDCS injection line and GDCS equalizing line is less than that assumed in the TRACG code models.

In addition to the DCD Tier 1 changes discussed above, DCD Tier 2, Table 6.3-1, Section B.2, will be revised in Revision 4, to clarify that the requirement for the "GDCS drain line loss coefficient (k/A^2)" applies to the "short-term cooling" injection lines and is "per injection line." Additionally, the Table 6.3-1, Section B.2, requirement for "Minimum long-term core cooling flow delivered by the GDCS equalizing lines..." will be replaced in Revision 4 with the requirement, "GDCS drain line loss coefficient (k/A^2) per equalizing lines (long-term cooling)," so that the requirement is consistent with the TRACG code models.

RAI 6.3-18, item (c), was not incorporated in DCD Tier 1, Table 2.4.2-1. This item requested that the ITAAC be revised to include a statement from DCD Tier 2, Table 6.3-2, that the GDCS deluge subsystem delivers a minimum flow to the lower drywell of 70 kg/sec (154 lb/sec). As indicated in the associated footnote to DCD Tier 2, Table 6.3-2, the GDCS deluge subsystem flow requirements apply to a beyond DBA core melt scenario and are not applicable to any Emergency Core Cooling System (ECCS) performance evaluation. Therefore, GDCS deluge subsystem parameters do not meet the criteria in DCD Tier 2, Subsection 14.3.7 for inclusion as ITAAC.

DCD Impact:

DCD Tier 1, Table 2.4.2-1, Items 2, 15, 16, 18, and 19 will be revised in DCD Tier 1, Revision 4, as shown in the attached markup. In addition, DCD Tier 2, Table 6.3-1 and Table 6.3-2 will be revised in DCD Tier 2, Revision 4, as shown in the attached markup.

NRC RAI 6.3-18 S02:

GEH's response did include the proposed ITAAC (items 2 a, b) the as-built flow loss coefficient (K/A²) for the GDCS injection and the equalizing line. However, the proposed ITAAC does not include the flow loss coefficient values assumed in the TRACG analyses.

Include the flow loss coefficient values assumed in the TRACG analyses in the Acceptance Criteria.

GEH Response:

DCD Tier 1, Revision 4, Table 2.4.2-3, provides ITAAC Items 8a and 8b for testing the Gravity-Driven Cooling System (GDCS) injection and equalizing lines to demonstrate the observed flow rate is sufficient to maintain water coverage as determined in the TRACG analysis. This fulfills the intent of the proposed ITAAC to ensure adequate flow is available.

DCD Impact:

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

NRC RAI 6.3-24:

DCD Tier 1, Section 2.4.2 ECCS - GDCS, Design Description

(a) Specify the location of the system

(b) Add equipment to be qualified for harsh environment

GEH Response:

See response to RAI 6.3-18.

NRC RAI 6.3-24 S01:

Your response to several ITAAC related RAIs stated that "There are ongoing discussions with the industry and the NRC as to the content that is required in Tier 1. When such requirements are settled upon, each system in Tier 1 may go through a thorough review to satisfy the agreed upon requirements."

Please provide revised responses to these RAIs to address the original questions. There may be additional RAIs with similar responses. Those responses should also be supplemented.

GEH Response:

DCD Tier 1, Subsection 2.4.2, includes a statement in Revision 3 of the location of the GDCS system in the first sentence. DCD Tier 1, Subsection 2.4.2, Revision 3, also includes a statement that "All GDCS safety-related components are qualified to withstand the harsh environments postulated for design basis accidents."

DCD Impact:

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

NRC RAI 6.3-24 S02:

GEH's response stated that the DCD, Tier 1, Subsection 2.4.2, Design Description, includes a statement that "All GDCS safety-related components are qualified to withstand the harsh environments postulated for design basis accidents." This requirement is not included in the ITAAC Table 2.4.2-1. Include the requirement in the ITAAC Table 2.4.2-1 for verification.

GEH Response:

DCD Tier 1, Revision 4, Table 2.4.2-3, Item 7, provides the ITAAC for environmental qualification of Gravity-Driven Cooling System (GDCS) safety-related equipment.

DCD Tier 2, Revision 4, Table 3.11-1, provides the list of GDCS safety-related equipment requiring environmental qualification.

DCD Impact:

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