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MFN 06-313 Supplement 6

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U.S. Nuclear Regulatory Commission
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Subject: Response to Portion of NRC Request for Additional Information Letter No. 40 Related to ESBWR Design Certification Application, RAI Numbers 19.1-08(b)S02 and 19.2-19S01.

The purpose of this letter is to supplement 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 July 5, 2006 (Reference 1) and responded to in References 2 and 3 on August 18, 2006 and September 12, 2006 respectively. The GEH response to RAI Numbers 19.1.8(b)S02 and 19.2-19S01 is addressed in the Enclosure.

Sincerely,

Kathy Sedney for

James C. Kinsey
Project Manager, ESBWR Licensing

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NRO

Reference:

1. MFN 06-222, Letter from U.S. Nuclear Regulatory Commission to David Hinds, Request for Additional Information Letter No. 40 Related to ESBWR Design Certification Application, July 5, 2006.

2. MFN 06-257 – Response to Portion of NRC Request for Additional Information Letter No. 40 Related to ESBWR Design Certification Application – ESBWR Probabilistic Risk Assessment – RAI Numbers 19.1-8, 19.1-17, 19.2-6, 19.2-10, 19.2-13 and 19.2-18. August 18, 2006.

3. MFN 06-313. Response to Portion of NRC Request for Additional Information Letter No. 40 Related to ESBWR Design Certification Application – ESBWR Probabilistic Risk Assessment – RAI Numbers 19.1-8 (b) (Revised Response), 19.1-9, 19.1-10, 19.1-16, 19.1-18, 19.2-4. 19.2-5, 19.2-15, 19.2-16, 19.2-19, 19.2-20, 19.2-21, 19.2-23, 19.2-34, 19.2-58 through 19.2-62, and 19.2-64. September 12, 2006

Enclosure:

1. MFN 06-313 Supplement 6 Response to Portion of NRC Request for Additional Information Letter No. 40 Related to ESBWR Design Certification Application ESBWR Probabilistic Risk Assessment RAI Numbers 19.1-8 S02 and 19.2-19S02.

cc:	AE Cubbage	USNRC (with enclosure)
	GB Stramback	GEh/San Jose (with enclosure)
	RE Brown	GEh/Wilmington (with enclosure)
	eDRF Section	0000-0072-5574

Enclosure 1 to MFN 06-313 Supplement 6

Response to Portion of NRC Request for Additional Information Letter No. 40 Related to ESBWR Design Certification Application ESBWR Probabilistic Risk Assessment RAI Numbers 19.1-8S02 and 19.2-19S01

NRC RAI # 19.1-8 S02

In sequences with dry CCI, the aerosol loading would be much higher than for wet CCI sequences considered in the RAI response. Address how aerosols would impact PCCS performance and the time to containment venting in dry CCI sequences.

NRC RAI 19.1-8(b) (Original Response)

Full RAI provided for completeness.
Discuss how the operating efficiency of the Passive Containment Cooling System (PCCS) (including thermo-physical properties, heat transfer coefficients, steam condensation efficiency, fission product removal, and axial and radial velocity distribution within the condenser tubes) is impacted by each of the following:

(a) large quantities of non-condensible gases such as CO_2 and H_2,

(b) corium-concrete interaction (CCI) – generated aerosols including plugging effects, and

(c) increases in Isolation Condenser (IC) pool temperatures as the event progresses. Support the responses with an appropriate analysis for each case.

GE Response (original)

This revised response addresses the part (b) of this RAI.

(b) During severe accident conditions during which PCCS is required to operate, no CCI is possible because of BiMAC; this is why the BiMAC was put in the design. Even under hypothetically assumed CCI scenarios, the lower drywell is flooded with a water height of 10 meters or higher. With such water height, the concentration of CCI generated aerosol above the surface of the water is significantly small (reference NUREG/CR-5901) and does not impact PCCS performance.

Note: GE provided a revised response to Part (b) of this RAI in MFN 06-313, dated 9/12/06. The response to RAI 19.1-8(S01) did not include a revised response to RAI 19.1-8(b).

GEH Response to RAI 19.1-8(b) Supplement 1

Sequences with dry CCI are analyzed in NEDO-33201 Section 9, Revision 2. In these sequences, since there is no steam produced in containment without the actuation of the deluge system, PCCS heat removal is minimal. Therefore, the impact of aerosols on PCCS performance and the time to containment venting in dry CCI sequences would be minor.

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.

19.2-19 S01

Received by e-mail from T. Kevern.

The RAI requested a description of how the deluge downcomers/headers are protected from being disabled by corium splatter, corium jets from an off-center head failure, or a missile consequent to RPV head failure. The response implies that there is no protection for these lines, and makes several statements about accident progression that warrant a supporting analysis. Please provide that analysis.

NRC RAI 19.2-19 (Original)

The deluge downcomers are presumably headered together at some point to feed into the basemat internal melt arrest and coolability system (BiMAC). Describe how the downcomers/headers are protected from being disabled by "corium splatter", corium jets from an off-center head failure, or a missile consequent to RPV head failure. Describe how such a disabling event would affect subsequent accident progression.

GE Response (Original)

In a postulated "high/side" failure locations such as that discussed in RAI 19.1-9, both the quantity of melt and the driving force (low pressure scenario) would be of small magnitude, and thus insufficient to produce damage, even if it happened that such failure would azimuthally coincide with the position of one of the downcomers. All other failures, and by far the most likely ones, would involve one or more of the lower head penetrations, and thusly they would be directed straight down, with a margin of more than 2 meters from the closest pedestal wall (and BiMAC downcomer attached to it). Such a distance is deemed adequate to exclude any direct interaction between relocating melt and BiMAC downcomers.

GEH Response Supplement 1

The question was interpreted to refer to the potential for melt-through caused by corium splatter, AND sufficient amounts of continuous melt flow to ENTER AND PLUG some significant fraction of the BiMAC system of cooling pipes. Merely severing the deluge header/downcomer boundaries would not interfere with the BiMAC function. Random small quantities of splatter are not a significant impediment to BiMAC functioning. As stated in our previous response, the expected lower head penetration failures cannot provide anything but random small quantities of splatter on the deluge header/downcomer.

Further perspectives on likely modes of lower head failure and implications on quantities of debris involved and direction of melt flow may be found in the RR comments and responses as well as in the various Addenda (p. III.35 in particular) of the RR version of Section 21.

Finally, the detailed design provides protection of the open ends of the recirculation downcomers so that only LDW-pool water can enter.

DCD/NEDO33201 Impact

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

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