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Supplement 1

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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 34 – Auxiliary Systems, Standby Liquid Control System – RAI Numbers 9.3-5 S01, 9.3-9 S01, and 9.3-20 S01 – Supplement 1**

Enclosure 1 contains GE's response to the subject NRC RAI transmitted via Reference 1 which is a supplemental request to the RAI transmitted via Reference 2. The original RAI response was submitted to the NRC in Reference 3.

If you have any questions or require additional information regarding the information provided here, please contact me.

Sincerely,

Kathy Sedney for

James C. Kinsey
Project Manager, ESBWR Licensing

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Reference:

1. E-mail request from A. Cubbage (NRC) dated December 1, 2006. Subject: Request for supplemental RAI responses chapter 9.3 (MFN 06-216). (ACN: ML070670068)
2. MFN 06-198, Letter from U.S. Nuclear Regulatory Commission to David Hinds, *Request for Additional Information Letter No. 34 Related to the ESBWR Design Certification Application*, June 22, 2006.
3. MFN 06-216, Letter from David Hinds to the U.S. Nuclear Regulatory Commission, *Partial Response to NRC Request for Additional Information Letter No. 34 Related to ESBWR Design Certification Application – Auxiliary Systems - RAI Numbers 9.3-3 through 9.3-10 and 9.3-12 through 9.3-23, July 19, 2006.*

Enclosure:

1. MFN 06-216 Supplement 1– Response to Portion of NRC Request for Additional Information Letter No. 34 – RAI Numbers 9.3-5 S01, 9.3-9 S01, and 9.3-20 S01 Supplement 1

cc: AE Cubbage USNRC (with enclosure)
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GB Stramback GE/San Jose (with enclosure)
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Enclosure 1

MFN 06-216
Supplement 1

Response to Portion of NRC Request for Additional Information Letter No. 34 Related to ESBWR Design Certification

Auxiliary Systems – Standby Liquid Control System

RAI Numbers 9.3-5 S01, 9.3-9 S01, and 9.3-20 S01

NRC RAI 9.3-5 S01

The staff requested in RAI 9.3-5 that GE explain in detail how the standby liquid control system (SLCS) meets General Design criteria (GDC) 4. The staff understands that compliance with GDC 4 is implied by reference to compliance with the General Requirements as indicated in the DCD, page 9.3-12; however, the staff is concerned that equipment and piping located near the SLCS piping that extends from the SLCS rooms to the reactor vessel penetration may present the hazard of missiles from pipe whipping associated with proximity to other high energy pipe lines. The staff is also concerned about water hammer loads generated by the fast-opening squib valves and high pressure accumulator. Please update the DCD specifically to reference GDC 4 and to address these related concerns.

GE Response

DCD, Tier 2, Revision 3, Subsection 9.3.5.3 states: "Because the SLC system is located within its own compartment inside the Reactor Building, it is adequately protected from flooding, tornadoes, and internally/externally generated missiles. The SLC system equipment is protected from pipe break by providing adequate distance between the Seismic Category I and non-seismic SLC equipment, where such protection is necessary. In addition, appropriate distance is provided between the SLC system and other high energy piping systems." The path of the small bore (3") SLCS injection line has not been determined. During future detailed engineering, the pipe is routed and analyzed in order to prevent or mitigate the potential dynamic effects from high-energy piping systems in order to satisfy the requirements of GDC 4.

To prevent water hammer, the injection valves are arranged at the lowest point, and the injection line is continuously vented at the injection nozzle inside the vessel (4mm vent hole). This maintains the injection line full of water at all times and provides reasonable assurance that water hammer is prevented. There are no adverse affects on SLC operation from the vent hole because it is located inside the vessel.

DCD Impact

No DCD changes have been made in response to this RAI.

NRC RAI 9.3-9 S01

Please incorporate this RAI response in the DCD by adding design pressures and temperatures to Figure 9.3-1a referenced in 9.3-3, above. Update the DCD to discuss the capability of the ESBWR SLCS to detect, collect, and control system leakage. Also, update the DCD to discuss the capability to isolate portions of the system in case of excessive leakage or malfunctions.

GE Response

SLCS readiness, which is discussed in DCD, Tier 2, Revision 3, Subsection 9.3.5.3, is maintained by monitoring accumulator pressure and level from the Main Control Room (MCR). System leakage would be detected by low accumulator pressure and/or level. Existence of either of these conditions would be investigated and corrected by the operator. In the event of accumulator leakage, the Equipment and Floor Drain System (EFDS) collects the leakage into a separate 200-liter stainless steel drum for special disposal.

The entire system is capable of isolation up to and including the outboard isolation check valve. In order to ensure the capability of SLC injection, the portion of the system from the outboard isolation check valve into the reactor vessel is not capable of isolation.

Figure 9.3-1a was revised in DCD Tier 2, Revision 3, to incorporate design temperatures and pressures in response to RAI 9.3-3 S01.

DCD Impact

No DCD changes have been made in response to this RAI.

NRC RAI 9.3-20 S01

The staff has determined that the basis for the three minute delay that is the subject of this RAI is required for the staff to reach its technical conclusions. Update the DCD to include this response.

GE Response

DCD Tier 2, Revision 3, Subsection 9.3.5.2 was revised to include the basis for the three-minute time delay for initiation of the SLC system.

DCD Impact

DCD Tier 2, Revision 3, Subsection 9.3.5.2 was revised as noted in the attached markup.

accumulator vent could quickly reduce accumulator pressure and limit the amount of nitrogen injected into the reactor vessel. Any nitrogen injected into the reactor vessel would eventually be purged from the reactor by operation of safety/relief valves or the high pressure Isolation Condenser vent system for purging the noncondensable gases, depending on equipment status and operator response actions. The initial amount of nitrogen injected into the reactor vessel in the event of failure to close the shut-off valve would be minimal in the event that reactor pressure is controlled by operation of the high-pressure Isolation Condensers. As the reactor absolute pressure decreases to about 6.9 MPa (1000 psia), the injected nitrogen would be transported to the Isolation Condensers where it would be vented to the suppression pool.

Failure of the Isolation Condenser vent or limitations in its capacity would only inhibit the rate of heat removal in the Isolation Condenser so that the rate of reactor depressurization would become limited by the rate of decrease in the decay heat. Such limits would provide ample time for operation of the accumulator vent.

For ATWS events, the failure of control rods to insert in response to a valid trip demand is assumed. The SLCS automatically initiates by the Average Power Range Monitor (APRM) not downscale (≥ 6%) and one of the following conditions persisting for at least 3 minutes:

- High reactor dome gauge pressure of ≥ 7.76 MPa (≥ 1125 psig)
- Low reactor vessel water level (≤ Level 2)

The three-minute delay provides time for completion of the FMCRD motor-driven run-function before initiation of the SLCS, thereby preventing the unnecessary injection of the boron solution into the reactor.

Sodium Pentaborate Solution injection ensures a timely accomplishment of hot shutdown. Subsequent injections as the reactor depressurizes ensure that cold shutdown can be achieved with no further occurrence of critical conditions. Refer to Section 15.5 for SLCS performance in the evaluation of ATWS events.

9.3.5.3 Safety Evaluation

The SLCS is mainly a reactivity control system that is maintained in an operable status whenever the reactor is critical. A large number of independent control rods are available to shutdown the reactor including redundant and diverse methods to insert the control rods, at any time during the core life.

Availability of the SLCS is ensured by redundancy in the injection valves. Adequate functioning of the system is ensured if one of the two injection valves open in each train. No other function is required for proper system operation. Addition of nitrogen to recover gas pressure after initial injection is not necessary for adequate functioning of the system. Protection against inadvertent premature operation of the shut-off valve is ensured by use of redundancy in the initiation signal for this function.

The system is designed to bring the reactor from rated power to a cold shutdown condition at any time in core life. The reactivity compensation provided reduces reactor power from rated to zero and allows cooling of the nuclear system to less than the cold shutdown temperature with the control rods remaining withdrawn in the rated power pattern. These conditions (hot shutdown and cold shutdown) include, where applicable, the reactivity gains that result from complete