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MFN 06-502

Docket No. 52-010

December 8, 2006

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555-0001

Subject: **Response to Portion of NRC Request for Additional Information Letter No. 72 – Isolation Condenser System – RAI Number 5.4-54**

Enclosure 1 contains GE's response to the subject NRC RAIs transmitted via the Reference 1 letter.

If you have any questions about the information provided here, please let me know.

Sincerely,

Kathy Sedney for

David H. Hinds
Manager, ESBWR

D068

Reference:

1. MFN 06-384, Letter from U.S. Nuclear Regulatory Commission to David Hinds, *Request for Additional Information Letter No. 72 Related to ESBWR Design Certification Application*, October 10, 2006

Enclosure:

1. MFN 06-502 – Response to Portion of NRC Request for Additional Information Letter No. 72– Isolation Condenser System – RAI Number 5.4-54

cc: AE Cubbage USNRC (with enclosures)
GB Stramback GE/San Jose (with enclosures)
eDRF 0061-7137

Enclosure 1

MFN 06-502

Response to Portion of NRC Request for

Additional Information Letter No. 77

Related to ESBWR Design Certification Application

Isolation Condenser System

RAI Number 5.4-54

NRC RAI 5.4-54:

Please discuss the forms of degradation that the IC tubes are considered susceptible to during their design life. Discuss PC/ICC pool water chemistry.

(A) Please discuss the forms of degradation that the IC tubes are considered susceptible to during their design life (given the range of operating and design conditions permitted by the requirements). In your response, include the types of indications that have historically been observed in IC tubes (for those plants that use an IC, refer to RAI 5.4-33, MFN 06-249) and the reason for plugging IC tubes in operating reactors.

(B) Discuss water chemistry assumed in PC/ICC pools, and provisions to monitor and maintain chemistry within assumed ranges.

GE Response:

(A) As part of the response to this RAI, please note that the ESBWR isolation condensers are a somewhat unique heat exchanger design wherein the tubes are external (as opposed to conventional tube and shell heat exchangers and steam generators), and immersed in an open pool of water at ambient temperature and pressure. The IC units are not used in normal operation and are only activated rarely for specific containment isolation events. Consequently, for the vast majority of the plant life the IC tubes are immersed in deionized water at ambient temperature. For relatively brief transients, the inside surface of the tubes will be affected by reactor steam at operating temperature. The only expected form of degradation is general corrosion, which, for Alloy 600 under the conditions that will exist in the ESBWR design, is minimal.

Previous BWR designs that included isolation condensers generally used stainless steel condenser tubes, or in at least one instance, brass. There have been some cases of tube cracking in these plants, most notably Millstone 1 in 1976. The Millstone transgranular stress corrosion cracking (TGSCC) of Type 304 tubes occurred as a result of chloride contamination. The Millstone isolation condenser repairs involved re-tubing with Alloy 600. Alloy 600 is noted for resistance to chloride induced cracking. Other instances of tube cracking have been reported at Oyster Creek, Nine Mile Point 1, and Tarapur. Again, the cracking was attributed to either TGSCC from chloride contamination, or in two cases, thermal fatigue from a suspect leaking valve. In most cases where repairs occurred, the repair consisted of tube replacement. GE is not aware of tube plugging being applied to IC units in BWR plants. See also GE's response to RAI 5.4-58 regarding the stress corrosion resistance of the niobium modified Alloy 600 used for the ESBWR IC tubes.

(B) The PC/ICC pool water is deionized water supplied from the Fuel and Auxiliary Pool Cooling System. This system provides both cooling and cleanup of the pool water. Water chemistry for these systems is maintained at the same purity level as reactor water during cold shutdown. The ESBWR water quality for these systems will be consistent with the current BWRVIP/EPRI Water Chemistry Guidelines (BWRVIP-130/EPRI TR-1008192, July 2004).

Conductivity will be monitored continuously with the balance of the chemistry parameters maintained by periodic sampling.

DCD Impact:

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