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MFN 06-501
Supplement 2

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U.S. Nuclear Regulatory Commission
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Subject: **Response to Portion of NRC Request for Additional Information E-mail Dated June 12, 2007 from S. Williams Related to ESBWR Design Certification Application – Isolation Condenser System, RAI Number 5.4-56 S01**

The purpose of this letter is to submit the GE Hitachi Nuclear Energy (GEH) response to the U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) sent by E-mail dated June 12, 2007 from Shawn Williams. RAI Number 5.4-56 S01 is addressed in Enclosure 1.

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

Sincerely,

Joseph Savage

for James C. Kinsey
Vice President, ESBWR Licensing

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NRO

References:

1. E-Mail Dated June 12, 2007, from U.S. Nuclear Regulatory Commission (Shawn Williams) to GEH, *Request For Additional Information Related to ESBWR Design Certification Application (RAI 5.4-56 S01)*

2. MFN 06-391, Letter from U.S. Nuclear Regulatory Commission to David Hinds Request for Additional Information Letter No. 77 Related to ESBWR Design Certification Application, October 11, 2006

3. MFN 06-501, Letter from David Hinds to the U.S. Nuclear Regulatory Commission, "Response to Portion of NRC Request for Additional Information Letter No. 72 – Isolation Condenser System – RAI Numbers 5.4-55 and 5.4-56," dated December 11, 2006 (*Note: Original RAI response letter referenced NRC Letter No. 72 but should have referenced Letter No. 77*)

Enclosure:

1. Response to Portion of NRC Request for Additional Information E-mail Related to ESBWR Design Certification Application, Isolation Condenser System, RAI Number 5.4-56 S01

cc: AE Cubbage USNRC (with enclosure)
DH Hinds GEH/Wilmington (with enclosure)
GB Stramback GEH/San Jose (with enclosure)
RE Brown GEH/Wilmington (with enclosure)
eDRF 0000-0077-1089

Enclosure 1

MFN 06-501 Supplement 2

Response to Portion of NRC Request for

Additional Information E-Mail

Related to ESBWR Design Certification Application

Isolation Condenser System

RAI Number 5.4-56 S01

For historical purposes, the original text of RAI 5.4-56 and the GE response are included. The attachments (if any) are not included from the original response to avoid confusion.

NRC RAI 5.4-56:

Please confirm that the method/technique for inspecting the IC tubes is capable of detecting general wall thinning, pit-like defects, and stress corrosion cracking along the entire length of the tube (and through the entire tube wall thickness). Please discuss the method/techniques that can be used for inspecting the tubes and the qualification requirements for these methods. Please provide the qualification data supporting the inspection technique (to demonstrate that the tubes are inspectible).

GE Response:

Due their size (NPS 2), the IC tubes are exempt from volumetric and surface inservice examinations by ASME Section XI, IWC-1220 (exempts size NPS 4 and smaller). Requirements for Class 2 inservice inspection (ISI) are addressed in Subsection IWC of ASME Section XI, which is referenced by DCD Section 6.6 for ISI. The eddy current inspection of IC tubing mentioned in Section 5.4.6.4 refers to the Construction Code, ASME Section III, NC-2550, which addresses examination of the tubing material. The isolation condensers are subject to leakage (VT-2) examination under ASME Section XI, IWC-2500, Category C-H, and the system is monitored for radiation leakage as described in Section 5.4.6.2.2.

DCD Impact:

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

NRC RAI 5.4-56 S01

E-mail from Shawn Williams:

Alloy 600, the material used for the IC tubes, is susceptible to degradation under certain conditions. Visual examination, as proposed by the applicant, will only indicate whether the degradation has penetrated through-wall, which is normally detected through radiation monitoring techniques. The applicant has neither provided long term corrosion tests that address the wide variation that could exist in material properties and water chemistry (given the existing regulatory requirements pertaining to fabrication and water chemistry) nor have they provided any supporting information such as from inspections of current materials that support that the material will not degrade.

The applicant has not adequately demonstrated that the IC tubes are not susceptible to degradation taking into account:

(1) the range of material and environmental conditions that could exist in the water chemistry and fabrication requirements,

(2) the lack of long-term service experience (with inspection results), and

(3) the limitations of accelerated corrosion testing to fully simulate the range of variables that may exist in the field (and pertinent to corrosion).

Thus,

A. Demonstrate that the IC tubes are not susceptible to degradation given the requirements pertaining to water chemistry and fabrication for the IC tubes or demonstrate the IC tubes have sufficient margin to failure (given the potential for degradation to occur).

B. Develop an inspection program that will periodically verify the integrity of the IC tubes or provide adequate justification for why no inspection requirements are needed.

GEH Response

A. Under normal operating conditions, the tubes of the isolation condenser (IC) heat exchanger are submerged in the IC pool. Given that there is minimal flow in the system under normal operating conditions, there are only two likely degradation mechanisms: (1) stress corrosion cracking (SCC) and (2) general corrosion.

1. SCC of the IC tubes is not considered a plausible mechanism for the following reasons:
    (a) The normal operating temperature for the IC pool is less than 65°C (DCD Tier 2; Table 6.2-6, "Plant Initial Conditions Considered in the Containment DBA Cases" lists IC/PCC pool temperature as 43.3 °C)
    (b) The water in the IC pool is demineralized water. The water chemistry of this pool is controlled, as described in DCD Tier 2, Subsection 5.2.3.2.2, and the impurity limits are shown in DCD Tier 2, Table 5.2-5;
    (c) The IC tubing is a modified Alloy 600 material specification that is niobium stabilized (DCD Tier 2, Subsection 5.2.3.2.3) and has been shown to be resistant to SCC than normal grades of Alloy 600 material; and,
    (d) There are no crevices in the IC heat exchanger assembly (DCD Tier 2, Figure 5.4-4a, "Schematic of the Isolation Condenser").

2. For Ni-Cr-Fe alloys under the IC pool conditions, general corrosion is minimal. A corrosion allowance will be included in the design to address the effects of general corrosion.

B. Since the most likely degradation mechanism is general corrosion, and its effects are accounted for in the design, no augmented inspections are planned for the IC heat exchanger tubing. Routine tubing leakage (VT-2) examination under ASME Section XI, IWC-2500, Category C-H is incorporated into the ISI program according to the programs implementation outlined by the COL Applicant (refer to DCD T2 Section 13.4).

DCD Impact

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