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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 77 - Isolation Condenser System - RAI Number 5.4-53 S01**

Enclosure 1 contains GE's response to the subject NRC RAI originally transmitted via the Reference 1 letter and supplemented by an NRC request for clarification.

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

Sincerely,

Kathy Sedney for

James C. Kinsey
Project Manager, ESBWR Licensing

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NRO

Reference:

1. 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

Enclosure:

1. MFN 06-508 Supplement 1 - Response to Portion of NRC Request for Additional Information Letter No. 77 - Related to ESBWR Design Certification Application - Isolation Condenser System - RAI Number 5.4-53 S01

cc:	AE Cubbage	USNRC (with enclosures)
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Enclosure 1

MFN 06-508 Supplement 1

Response to Portion of NRC Request for

Additional Information Letter No. 77

Related to ESBWR Design Certification Application

Isolation Condenser System

RAI Number 5.4-53 S01

NRC RAI 5.4-53:

In DCD Tier 2, Revision 1, Section 5.4.6.2.2, it was indicated that a low-level leak (radiation level above background) results in an alarm to the operator. Please discuss how much above background these alarm setpoints will be (e.g., 2 times background). The staff notes that alarm setpoints slightly above background provide an early indication of a leak. In addition, please discuss operator actions to be taken in response to leakage (given that leakage would be an unanticipated occurrence). Please discuss whether the leak rate from a critical size flaw in an IC tube was determined and used in determining when the IC should be isolated. If not, why not? If so, discuss what you considered to be a critical size flaw.

GE Response:

As described in Subsection 5.4.6.2.2 of DCD Tier 2, Rev 2, four radiation monitors are provided for each Isolation Condenser (IC) train. Low-level radiation leak detection above background results in an alarm to the operator that is initiated on a 2-out-of-4 logic. Before high radiation levels exceed site boundary limits, isolation of the leaking IC occurs automatically by closure of steam supply and condensate return line isolation valves, which is initiated on a 2-out-of-4 logic.

ESBWR instrument setpoints are determined by plant-specific analyses using the NRC approved *GE Setpoint Methodology* (reference GE proprietary LTR NEDC-31336P-A) that addresses setpoints, margins, errors, and response times. The high radiation setpoint is selected so as not to exceed site boundary radiation dose limits in accordance with 10 CFR Part 20. The alarm setpoint is selected close enough to background so that an early warning of a leak is detected, but with adequate margin to prevent spurious actuation.

Since only three out of four IC's are needed to remove post reactor isolation decay heat after sustained reactor operation at 100% power, the operator can manually isolate an IC that has alarmed, without affecting the ability of the ICS to function as intended.

The leak rate resulting from an IC tube flaw is not required to be determined since flaw size is not the basis for establishing the setpoints as mentioned above.

NRC RAI 5.4-53 S01:

In response to RAI 5.4-53, GE indicated that the alarm setpoint for the IC radiation monitor is selected close enough to background so that an early warning of a leak is detected, but with adequate margin to prevent spurious actuation. However, the response did not fully address several aspects of the staff's original question. For example, it did not address the operator actions to be taken in response to leakage and it did not address why the leak rate for a critical size flaw was not determined and used in determining when the isolation condenser should be isolated. Address these questions. If these are more appropriately treated as COL Actions Items, please discuss your plans to add this as a COL Action Item.

GE Response:

The detection of gaseous effluents from radioactive releases is discussed under DCD Tier 2, Revision 3, Section 11.5, "Process Radiation Monitoring System (PRMS)." The Isolation Condenser (IC) Vent Exhaust Radiation Monitoring System (RMS) is specifically described in DCD Tier 2, Revision 3, Subsection 11.5.3.1.5. The COL information for PRMS is contained in DCD Tier 2, Revision 3, Subsection 11.5.7, which includes a COL Holder responsibility in Subsection 11.5.7.1 to perform the derivation of each RMS subsystem's lower limit of detection. This is noted here as additional information in regards to the previous discussion on detection setpoint relative to background. The additional topics of this supplemental request are discussed below.

Operator Actions

Because the effluent radiation monitoring logic initiates an automatic isolation of the affected IC division, there are no immediate operator actions. Because the first indication received by the control room operators is a radiation detector alarm, operator follow-up actions are directed by response procedure for the alarm. The operators will also respond by carrying out actions in accordance with Technical Specifications based procedures. In the event of an isolated IC train, the procedures will guide and/or direct operator actions in response to condition statements under Limiting Condition for Operation (LCO) 3.5.4 (DCD Tier 2, Revision 3, Chapter 16). As per current operating plant experience, such procedures will address issues such as initial confirmation of the IC train isolation, investigation and determination of the cause for the isolation, development of a response plan, examination and repair of an IC heat exchanger (if required) or required actions for other equipment (for example, detector setpoint adjustment), and restoration of the train to OPERABLE status in accordance with Technical Specifications. The operating plant procedures are addressed under DCD Tier 2, Revision 3, Section 13.5, "Plant Procedures," and the procedures are a COL Holder responsibility per Subsection 13.5.3. The scope of the procedures development plan described under Subsection 13.5.3 covers those procedures that would be used in response to an IC isolation event.

Determining When An IC Train Should Be Isolated

Flaw size up to and including a critical flaw does not provide a direct means of determining when an IC train is to be isolated. Depending on the effluent monitor setpoint, and the activity level of the Nuclear Boiler System steam, and whether some additional initiating event is involved, there could be many variables in play. The large volume and hydraulic interconnection of the IC/Passive Containment Cooling (PCC) heat exchanger pools and expansion pools makes detection of a leak difficult and time consuming. The release is also submerged, and therefore quenched, making determination of the source of leakage difficult. Comparatively, the sensitivity of an effluent detector to a change in airborne radioactivity in the effluent from any individual train compartment due to the release of Nuclear Boiler System steam containing radiolytic nitrogen (N16) and other possible entrained radioactive noncondensibles (such as argon, krypton and xenon) will result in an early detectable indication of a tube leak (again, based on operating plant procedures that routinely check effluent release status). As an example, a 1 gpm liquid leak rate equates to 2.27x10e-01 m^3/hr; the combined pools volume is approximately 4470.2 m^3. The steam volumetric leak rate at (1040 psia) is approximately 6.0 m^3/hr. DCD Tier 2, Revision 3, Tables 11.1-2b, 11.1-4b, 11.1-5b and 11.1-6 provide values

for the normal operating Nuclear Boiler System water and steam radiolytic components. Detection capabilities are described in DCD Tier 2, Revision 3, Tables 11.5-1 and 11.5-2.

The ESBWR design includes keeping the IC/PCC heat exchanger pools as clean and uncontaminated as possible. A dedicated cooling and filtering pool recirculation system is provided for the maintenance of pool chemistry conditions. This will limit tube fouling and also will act to collect radioactive contamination from the water. Although design details have not been fully completed for the IC/PCC pools cooling and filtering system, routine process sampling and monitoring for contamination buildup in the filter vessel are additional means the operators have to monitor for a very low rate IC tube leak.

Thus, critical flaw size is not a key parameter for determining the radiation monitor setpoint in order to maintain the health of any IC train or limit a release from the plant. The automatic IC train isolation at the RMS alarm setpoint provides a limit for the rate of release such that the site boundary radiation dose limits are not exceeded.

Addition of a COL Item

As noted in DCD Tier 2, Revision 3, Section 11.5 and in the footnote to DCD Tier 2, Revision 3, Table 11.5-2, derivation of the lower limit of detection is a COL Holder responsibility. As noted in DCD Tier 2, Revision 3, Section 13.5, procedure development for the operating unit is also a COL Holder responsibility. These responsibilities cover the routine monitoring of system health, the evaluation of component indications of degraded performance and decision to remove a Technical Specifications component from operable service, the alarm and abnormal occurrence response procedures, and the conduct of maintenance and restoration activities. Therefore, these responsibilities envelope the actions and response procedures involved in addressing IC heat exchanger tube leaks. No additional COL item is required.

DCD Impact:

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