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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 26 - Isolation Condenser System - RAI Numbers 5.4-22 S01, 5.4-29 S01, 5.4-32 S01, 5.4-41 S01, 5.4-42 S01, and 5.4-52 S01**

Enclosure 1 contains GE's response to the subject NRC RAIs originally transmitted via the Reference 1 letter and supplemented by NRC requests 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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Reference:

1. MFN 06-141, Letter from U.S. Nuclear Regulatory Commission to David Hinds, *Request for Additional Information Letter No. 26 Related to ESBWR Design Certification Application*, May 3, 2006

Enclosure:

1. MFN 07-192 - Response to Portion of NRC Request for Additional Information Letter No. 26 - Related to ESBWR Design Certification Application - Isolation Condenser System - RAI Numbers 5.4-22 S01, 5.4-29 S01, 5.4-32 S01, 5.4-41 S01, 5.4-42 S01, and 5.4-52 S01

cc:	AE Cubbage	USNRC (with enclosures)
	BE Brown	GE/Wilmington (with enclosures)
	GB Stramback	GE/San Jose (with enclosures)
	eDRF	0000-0065-7298 for RAI 5.4-22 S01
		0000-0065-6463 for RAI 5.4-29 S01
		0000-0065-4743 for RAIs 5.4-32 S01 and 5.4-41 S01
		0000-0065-8590 for RAI 5.4-42 S01
		0000-0066-6683 for RAI 5.4-52 S01

Enclosure 1

MFN 07-192

Response to Portion of NRC Request for

Additional Information Letter No. 26

Related to ESBWR Design Certification Application

Isolation Condenser System

RAI Numbers 5.4-22 S01, 5.4-29 S01, 5.4-32 S01, 5.4-41 S01, 5.4-42 S01, and 5.4-52 S01

NRC RAI 5.4-22 S01:

The following are in reference to GE's response to RAI 5.4-22 (MFN 06-265).

(A) Please include the isolation condenser system (ICS) design parameters in the process diagram.

(B) In the standby mode, temperature in the condensate return line (node 3) appears to be high. Please explain this high temperature.

GE Response:

(A) The Isolation Condenser System (ICS) Process Flow Diagram design parameters provided in response to RAI 5.4-22 (MFN 06-265) will be included in DCD Tier 2, Figure 5.1-3c, in Revision 4.

(B) Node 3 has a condensate temperature of 99.7°C at the Isolation Condenser (IC) lower headers. To add margin in the IC/Passive Containment Cooling (PCC) pool water volume, the conservative assumption was made to set the IC/PCC pool water to its saturation temperature. Therefore, the IC/PCC pool temperature affects node 3.

DCD Impact:

(A) DCD Tier 2, Figure 5.4-4, will be relocated as Figure 5.1-3c and revised in DCD Tier 2, Revision 4, as shown in the attached markup (see response to RAI 5.4-29 S01 for further details).

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

NRC RAI 5.4-29 S01:

Provide the information in GE's response to 5.4-25 (MFN 06-249) in the DCD Tier 2. Also, include the schematic of the isolation condenser.

GE Response:

It should be noted that the detailed Isolation Condenser (IC) information that is the subject of this supplemental RAI was originally provided in the response to RAI 5.4-29 (MFN 06-249), and not in the response to RAI 5.4-25 as stated above. This detailed IC information will be included in DCD Tier 2, Section 5.4.6.2.2 and Table 5.4-1, in Revision 4.

A front view schematic of the IC was provided in response to RAI 5.4-29 (MFN 06-249) in Appendix A to that letter, and will be included as a new Figure 5.1-3b in DCD Tier 2, Revision 4. In addition, other related DCD Tier 2 Figures will be renumbered or relocated.

DCD Impact:

DCD Tier 2, Section 5.4.6.2.2 and Table 5.4-1, will be revised in DCD Tier 2, Revision 4, as shown in the attached markup.

DCD Tier 2, Figure 5.1-3, will be renumbered as Figure 5.1-3a in DCD Tier 2, Revision 4, as shown in the attached markup. DCD Tier 2, Figure 5.1-3b, will be incorporated in DCD Tier 2, Revision 4, to provide the front view schematic of the IC, as shown in the attached markup. DCD Tier 2, Figure 5.4-4, will be relocated as Figure 5.1-3c and revised in DCD Tier 2, Revision 4, as shown in the attached markup (see response to RAI 5.4-22 S01 for further details).

NRC RAI 5.4-32 S01:

GE's response to 5.4-32 (MFN 06-249) states the purpose and actuation logic but it does not describe how the nitrogen rotary motor operated valve (NMOV) and the pneumatic piston-operated valve (NO) valves operate. Since these valves are not the standard valves, provide a detailed description of the valve operation. 5.4-41 and 6.3-18 through 6.3-25 (MFN 06-249, MFN 06-241) Your response to several ITAAC related RAIs stated that there are ongoing discussions with the industry and the NRC as to the content that is required in Tier 1. When such requirements are settled upon, each system in Tier 1 may go through a thorough review to satisfy the agreed upon requirements. Please provide revised responses to these RAIs to address the original questions. There may be additional RAIs with similar responses. Those responses should also be supplemented.

GE Response:

Valve operation for Isolation Condenser System (ICS) nitrogen rotary motor operated valves (NMOVs) and pneumatic piston operated valves (NOs) are described in detail in DCD Tier 2, Revision 3, Tables 6.2-23 through 6.2-30. These tables identify the valve type, actuation signal, valve position, and other design information, for each IC train valve.

ITAAC related RAI for the ICS have been revised and updated in Revision 3 of the DCD Tier 1 Table 2.4.1-1. Specifically, RAI 5.4-41 was addressed specifically in DCD Tier 1 Table 2.4.1-1 Items 18 and 19.

Resolution of RAI 6.3-18 though 6.3-25 is addressed in the response to RAI 6.3-18 S01 (MFN 06-241 Supplement 2).

DCD Impact:

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

NRC RAI 5.4-41 S01:

Your response to several ITAAC related RAIs stated that "There are ongoing discussions with the industry and the NRC as to the content that is required in Tier 1. When such requirements are settled upon, each system in Tier 1 may go through a thorough review to satisfy the agreed upon requirements." Please provide revised responses to these RAIs to address the original questions. There may be additional RAIs with similar responses. Those responses should also be supplemented.

GE Response:

Please refer to the response to RAI 5.4-32 S01.

DCD Impact:

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

NRC RAI 5.4-42 S01:

GE's response to 5.4-42 (MFN 06-249) states that time delay for level 2 automatic start-up of the ICS (30 secs) is included in Chapter 15. This is an important operational parameter for ICS. Please add this detail to Section 5.4.6. Also, DCD, Tier 2, Section 7.4.4.3 discusses the time delay, however the duration of the delay is not specified. Please add this detail to Section 7.4.4.3.

GE Response:

In the interest of maintaining consistency, setpoints and time delays are stated in the analysis section in which they are applied, and typically are not repeated in other sections of the DCD. However, DCD Tier 2, Revision 3, Table 5.4-1, does include the 30-second time delay that is referenced in DCD Tier 2, Subsection 5.4.6.2.3.

DCD Impact:

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

NRC RAI 5.4-52 Original Question:

Describe in detail the periodic heat removal capability testing of the IC in the DCD Tier 2.

GE Original Response:

The DCD Tier 2 Subsection 5.4.6.4 "Testing and Inspection Requirements" describes in detail the periodic heat removal capacity. However, the following will be added to the DCD in the next revision.

5.4.6.4 Testing and Inspection Requirements

Testing

> "Periodic heat removal capability testing of the ICs is required during plant operation at five-year intervals. This test is accomplished using data derived from the temperature sensor located downstream of the condensate return isolation valve (F004), together with the LD&IS differential pressure signal from one of the dPTs, on the condensate return line.
>
> During normal plant operation, a periodic surveillance test of normally-closed condensate return and condensate return bypass valves on condensate line to RPV, being moved into an open condition, are performed."

NRC RAI 5.4-52 S01:

General Electric's response to RAI 5.4-52 (GE Letter MFN 06-249, dated August 1, 2006) described changes to DCD Tier 2, Subsection 5.4.6.4, Testing and Inspection Requirements, for the Isolation Condenser System (ICS). These changes included a requirement that heat removal capability testing of each isolation condenser (IC) be conducted "at five year intervals."

GE Supplemental Response:

GE has decided to revise DCD Tier 2, Subsection 5.4.6.4, to require that the heat capacity testing of the four isolation condensers (ICs) be performed every 24 months on a staggered test basis frequency. This frequency will ensure more timely identification of any degradation in ICS performance by testing one IC train every 24 months, while reducing the required testing of each IC train to once every eight years.

DCD Impact:

DCD Tier 2, Subsection 5.4.6.4, will be revised in DCD Tier 2, Revision 4, as shown in the attached markup.

5.4.6.2 System Description

5.4.6.2.2 Detailed System Description

The IC is configured as follows:

- The steam supply line (properly insulated and enclosed in a guard pipe which penetrates the containment roof slab) is vertical and feeds two horizontal headers through four branch pipes. Each pipe is provided with a built-in flow limiter, sized to allow natural circulation operation of the IC at its maximum heat transfer capacity while addressing the concern of IC breaks downstream of the steam supply pipe. Steam is condensed inside 135 Inconel 600 vertical tubes and condensate is collected in two lower headers. Two pipes, one from each lower header, take the condensate to the common drain line which vertically penetrates the containment roof slab.

Table 5.4-1

Component and Subsystem Design Controls

Component/Subsystem	Control(s)
Number of IC Trains:	Four (4)
ICS station blackout (i.e., unavailability of all AC power) capability:	≥ 72 hours
IC sizing:	Sized to remove post-reactor isolation decay heat with three out of four ICs operating and to reduce reactor pressure and temperature to safe shutdown conditions, in 36 hours, with occasional venting of radiolytically generated noncondensable gases to the suppression pool.
ICS Performance Requirements:	Heat removal capacity of the ICS (with 3 of 4 IC trains in service) is at least 101.25 MWt when reactor is above rated operating pressure.
Condensate return valve stroke-open time:	≤30 seconds with a logic delay time not to exceed 1 second after the opening setpoint is reached.
IC design ~~capacity~~parameters:	33.75 MWt each IC unit and is made of two identical modules. The IC has a design pressure of 10.34 MPag (1500 psig) and a design temperature of 314.5°C (598°F). The design heat transfer coefficient is 8650 $W/m^{2}{}^{o}C$.
Nominal Diameter of the Steam Supply Line: Condensate Return Line:	 350 mm (14 inches) 200 mm (8 inches)
Outer Diameter of the Condenser Tubes:	50.8 mm (2 inches)

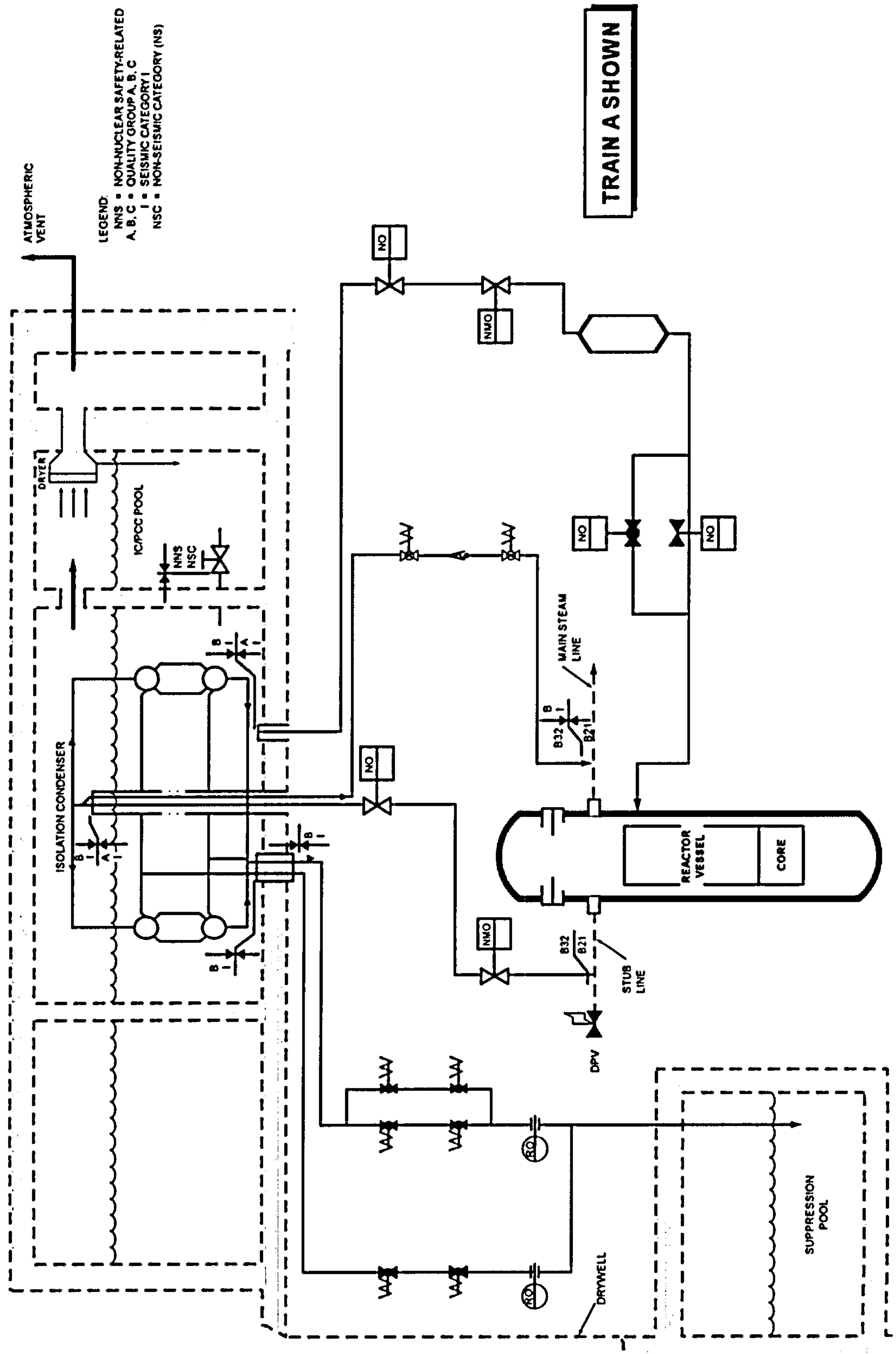


Figure 5.1-3a. Isolation Condenser System Schematic

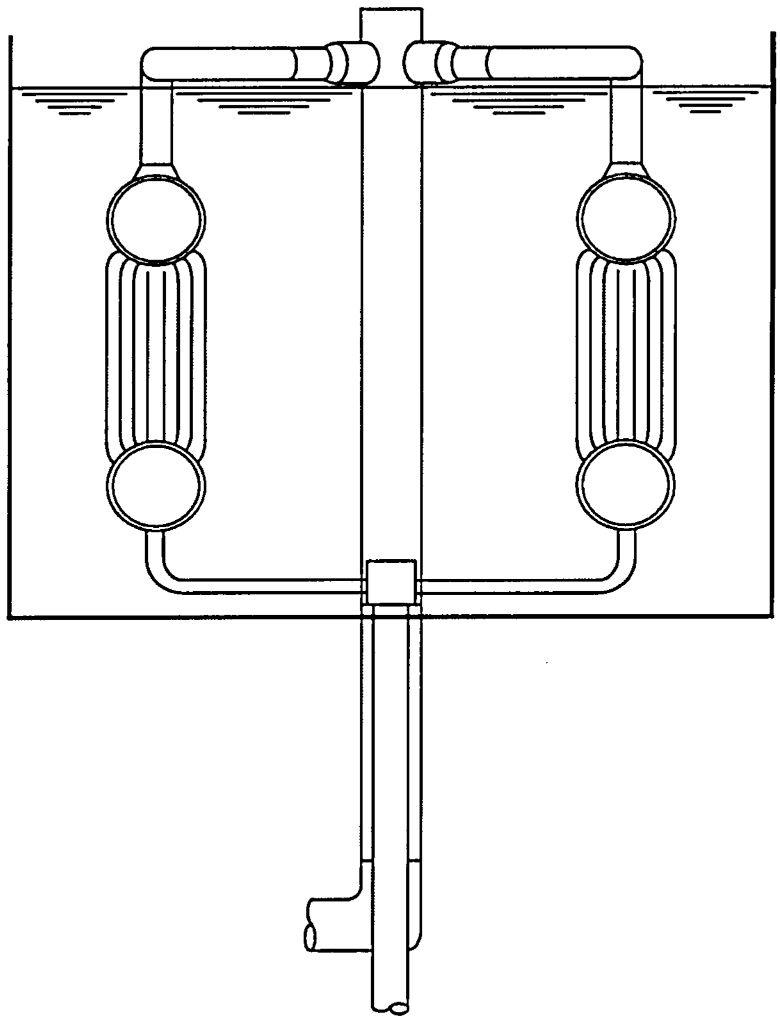
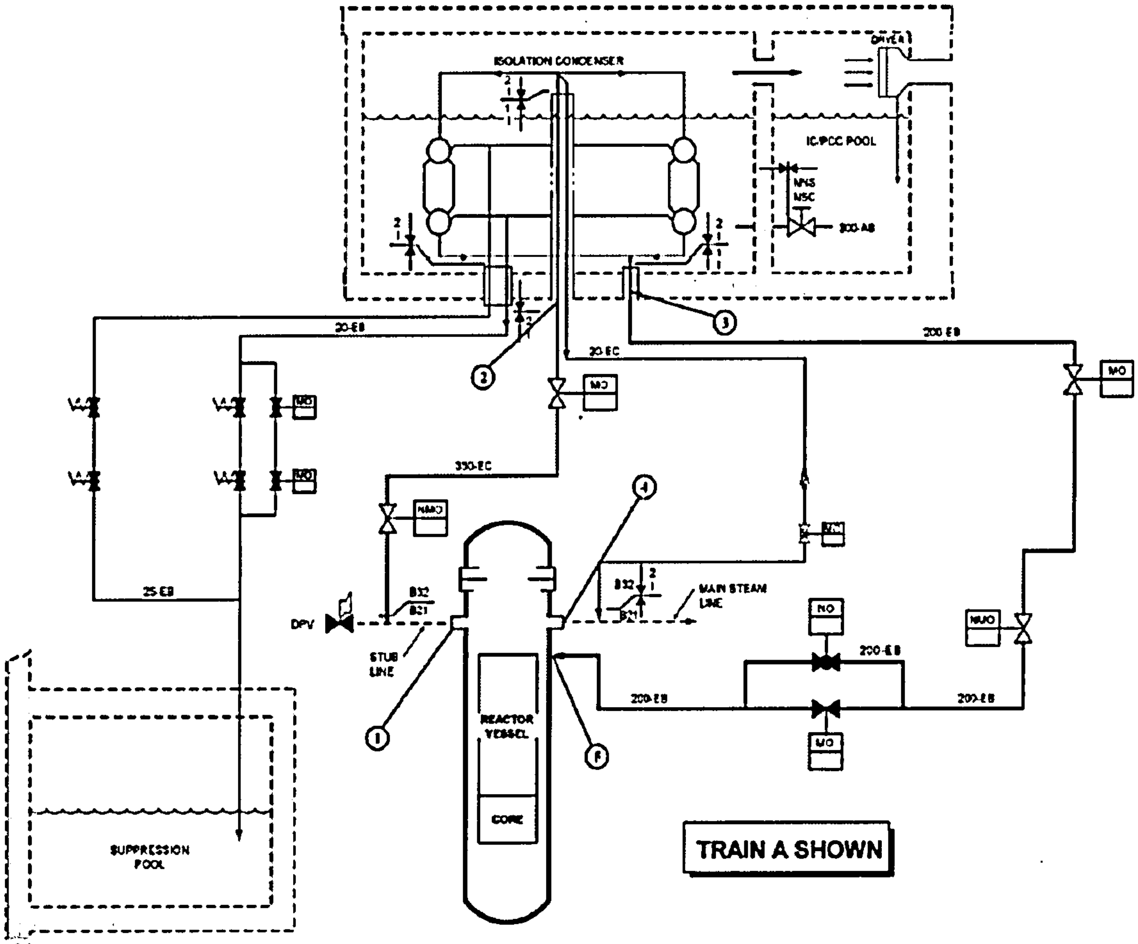


Figure 5.1-3b. Schematic of the Isolation Condenser



Standby Mode

Position ○	1	2	3	4	5
Flow [Kg/s]	0.00	0.00	0.00	2434.55	0.00
Temperature [°C]	287.4	287.9	99.7	287.2	287.4
Pressure [KPa(g)]	7069	7068	7101	7124	7072

Peak Drain Flow Operation

Position ○	1	2	3[1]	4	5[1]
Flow [Kg/s]	25.26	30.17	553.63	0.00	554.86
Temperature [°C]	295.0	292.8	98.1	297.1	287.9
Pressure [KPa(g)]	7649	7648	7579	7655	7649

[1] Peak Flow for condensate return line during initial IC operation

Steady State Heat Removal

Position ○	1	2	3	4	5
Flow [Kg/s]	77.75	77.79	77.96	0.00	77.85
Temperature [°C]	290.7	290.8	290.6	293.7	293.7
Pressure [KPa(g)]	7440	7439	7420	7450	7443

Figure 5.4-41-3c. Isolation Condenser System Simplified Process Diagram

5.4.6.4 Testing and Inspection Requirements

Testing

~~Periodic heat removal capability testing of the ICs is required during plant operation at five-year intervals.~~Periodic heat removal capability testing of the ICs is performed every 24 months on a staggered test basis to ensure at least one ICS train is tested every 24 months and that each IC train is tested at least every eight years. This test is accomplished using data derived from the temperature sensor located downstream of the condensate return isolation valve (F004), together with the LD&IS differential pressure signal from one of the dPTs, on the condensate return line.

During normal plant operation, a periodic surveillance test of normally-closed condensate return and condensate return bypass valves on condensate line to RPV, being moved into an open condition, are performed.