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MFN 06-436

Docket No. 52-010

November 13, 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. 79– Nuclear Boiler System – RAI Numbers 6.2-118, 6.2-120 and 6.2-133**

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 06-393, Letter from U.S. Nuclear Regulatory Commission to David Hinds, *Request for Additional Information Letter No. 79 Related to ESBWR Design Certification Application*, October 11, 2006

Enclosure:

1. MFN 06-436 – Response to Portion of NRC Request for Additional Information Letter No. 79 – Nuclear Boiler System – RAI Numbers 6.2-118, 6.2-120 and 6.2-133

cc: AE Cubbage USNRC (with enclosures)
GB Stramback GE/San Jose (with enclosures)
eDRF 0060-2993, Rev. 1

Enclosure 1

MFN 06-436

Response to Portion of NRC Request for

Additional Information Letter No. 79

Related to ESBWR Design Certification Application

Nuclear Boiler System

RAI Numbers 6.2-118, 6.2-120, 6.2-133

NRC RAI 6.2-118

DCD Tier 2, Revision 1, Section 6.2.4.3.1.1, "Influent Lines," under the heading "Feedwater Line," describes the design of a spring-check valve as follows:

The spring-check valve outside containment is provided with an air-opening, spring-closing operator, which, upon remote manual signal from the main control room, provides additional seating force on the valve disk to assist in long-term leakage protection. Should a break occur in the feedwater line, the check valves prevent significant loss of reactor coolant inventory and offer immediate isolation.

The details of the spring-check valve's operation are unclear. For example, if the valve uses air to open, and remote-manual action provides additional seating force (from the spring, presumably), does this mean that the valve is normally held open by air? If so, how can the valve close immediately during an accident?

Provide more description of the spring-check valve's operation, especially of its remote manual operation.

GE Response

The valve is a spring assisted positive acting swing check valve and is equipped with a solenoid valve and a pneumatic actuator. When the solenoid valve is energized by remote manual operation, air pressure is supplied to the under side of the piston of the actuator. The air pressure under the piston compresses a spring inside the actuator, which disengages the actuator shaft from the valve disc swing arm and allows the valve to operate as a swing check valve. During normal operation, the valve disc opens and is held open due to flow of fluid through the valve and a differential pressure across the disc in the normal direction of flow. When there is no flow in the feedwater line, the disc closes.

During an accident, the valve disc closes and is held closed upon loss of flow in the normal direction or a reverse flow condition. When the solenoid valve is deenergized by remote manual operation, air pressure is released from the under side of the piston of the actuator, which decompresses the spring in the actuator. Decompression of the spring allows the actuator shaft to engage with the valve disc swing arm, which assists the disc in closing and applies an additional seating force on the disc.

DCD Impact

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

NRC RAI 6.2-120

DCD Section 6.2.4.3.1.2, "Effluent Lines," under the heading "Main Steam and Drain Lines,"describes the power-operated main steam isolation valves (MSIVs) as closing under either spring force or gas pressure. It states, in part:

The separate and independent action of either gas pressure or spring force is capable of closing an isolation valve.

Considering that virtually every BWR MSIV in the U.S. needs both gas pressure and spring force to close under accident conditions, verify that the quoted sentence is correct.

GE Response

Under normal plant operating and most accident conditions, either gas pressure or spring force is capable of closing each inboard and outboard Main Steam Isolation Valve (MSIV). However, in the event of an accident inside containment, the containment pressure may be much higher than during normal plant operation. Under these conditions, both gas pressure and spring force are needed to close the inboard MSIV. However, the outboard MSIV is capable of closing with either gas pressure or spring force because the accident pressure inside containment has no appreciable effect on the environmental pressure of the outboard MSIV. Text will be added to Subsection 6.2.4.3.1.2 under the heading "Main Steam and Drain Lines" to provide clarification in DCD Tier 2, Revision 3.

DCD Impact

DCD Tier 2, Revision 3, Section 6.2 will be revised as noted in the attached markup.

Isolation Condenser Condensate and Venting Lines

The isolation condenser condensate lines penetrate the containment and connect directly to the reactor pressure vessel. The isolation condenser venting lines extend from the isolation condenser through the containment and connect together downstream of two normally closed control valves in series. The venting line terminates below the minimum drawdown level in the suppression pool. An isolation condenser purge line also penetrates the containment and it contains an excess flow check valve and a normally open shutoff valve. Each IC condensate line has two open isolation gate-valves (F003 and F004) located in the containment where they are protected from outside environmental conditions, which may be caused by a failure outside the containment. In case of the venting lines there are two normally closed control globe-valves in series in each branch of the vent line. The condensate lines are automatically isolated when leakage is detected.

The IC condensate line isolation valves and the pipes penetrating the containment are designed in accordance to ASME Code Section III, Class 1 Quality Group A, Seismic Category I. Penetration sleeves used at the locations where the condensate return pipes exit the pool at the containment pressure boundary are designed and constructed in accordance with the requirements specified within Subsection 3.6.2.1. In addition, the IC System outside the containment consists of a closed loop designed to ASME Code Section III, Class 2, Quality Group B, Seismic Category I, which is a "passive" substitute for an open "active" valve outside the containment. This closed-loop substitute for an open isolation valve outside the containment implicitly provides greater safety. The combination of an already isolated loop outside the containment plus the two series automatic isolation valves inside the containment comply with the intent of isolation functions of US NRC Code of Federal Regulations 10 CFR 50, Appendix A, Criteria 55 and 56.

Standby Liquid Control System Line

The Standby Liquid Control (SLC) system line penetrates the containment to inject directly into the reactor pressure vessel. In addition to a simple check valve inside the containment, a check valve, together with two parallel squib-valves are located outside the DW. Because the SLC line is normally closed, rupture of this non-flowing line is extremely improbable. However, should a break occur subsequent to the opening of the squib-valves, the check valves ensure isolation.

All mechanical components required for boron injection are at least Quality Group B. Those portions which are part of the reactor coolant pressure boundary are classified Quality Group A.

6.2.4.3.1.2 Effluent Lines

GDC 55 states that each effluent line, which form part of the reactor coolant pressure boundary and penetrate the containment, be equipped with two isolation valves; one inside the containment and one outside, located as close to the containment wall as practicable.

Table 6.2-14 lists those effluent lines that comprise the reactor coolant pressure boundary and which penetrate the containment.

Main Steam and Drain Lines

The main steam lines, which extend from the reactor pressure vessel to the main turbine and condenser system, penetrate the containment. The main steam drain lines connect the low points of the steam lines, penetrate the containment and are routed to the condenser hotwell. For these lines, isolation is provided by automatically actuated globe-valves, one inside and one just outside the containment.

The main steamline isolation valves (MSIVs) are spring loaded, pneumatically-operated globe valves designed to close on loss of gas pressure or loss of power to the solenoid-operated pilot valves. Each valve has two pilot valves supplied from independent power sources, both of which must be de-energized to close the MSIV. Two MSIVs are used in series to assure isolation when needed. Each MSIV uses gas pressure for closure upon interruption of electrical power to the pilot valves. A spring closes the valve when there is no gas pressure. Under normal plant operating and most accident conditions, the separate and independent action of either gas pressure or spring force is capable of closing each MSIV. However, if there is a main steamline break between the inboard MSIV and the containment wall, both gas pressure and spring force are needed to close the inboard MSIV. Either gas pressure or spring force is needed to close the outboard MSIV under all accident conditions. Refer to Subsection 5.4.5 for Main Steamline Isolation System description.

Isolation Condenser Steam Supply Lines

The isolation condenser steam supply lines penetrate the containment and connect directly to the reactor pressure vessel. Two isolation gate-valves are located in the containment where they are protected from outside environmental conditions, which may be caused by a failure outside the containment. The isolation valves in each IC loop are signaled to close automatically on excessive flow. The flow is sensed by four differential flow transmitters in either the steam supply line or the condensate drain line. The isolation valves are also automatically closed on high radiation in the steam leaving an IC-pool compartment. The isolation functions are based on any 2-out-of-4 channel trips.

NRC RAI 6.2-133

In DCD Tier 2, Revision 1, Tables 6.2-21 and -22, CIVs for Feedwater Lines A and B, the entries for "Leakage Past Seat" are "N/A" for the inboard CIVs but "(b3)" (main condenser) for the outboard CIVs. Would not seat leakage from both inboard and outboard CIVs go to the main condenser?

GE Response

Seat leakage from both the inboard and outboard CIVs in the Feedwater lines flows to the main condenser. Therefore, the "Leakage Past Seat" in Tables 6.2-21 and 6.2-22 will be changed to "(b3)" for valves F103A and F103B.

DCD Impact

DCD Tier 2, Section 6.2 will be revised as noted in the attached markup.

Table 6.2-21

Containment Isolation Valve Information for the Nuclear Boiler System

Feedwater Line A

Penetration Identification	**B21-MPEN-006**	
Valve No.	F103A	F102A
Applicable Basis	GDC 55	GDC 55
Tier 2 Figure	5.1-2	5.1-2
ESF	No	No
Fluid	Water	Water
Line Size	550 mm	550 mm
Type C Leakage Test	See Table 3.9-8	See Table 3.9-8
Pipe Length from Cont. to Outboard Isolation Valve	COL applicant to provide	COL applicant to provide
Leakage Through Packing[(a)]	N/A	(a_2)
Leakage Past Seat[(b)]	(b_3)	(b_3)
Location	Inboard	Outboard
Valve Type	Check	Stop Check
Operator[(c)]	N/A	AO
Normal Position	Open	Open
Shutdown Position	N/A	Open
Post-Acc Position	N/A	Closed
Power Fail Position	N/A	N/A
Cont. Iso. Signal[(d)]	Q	Q
Primary Actuation	Self	Air to open
Secondary Actuation	N/A	Remote manual
Closure Time (sec)	N/A	N/A
Power Source	N/A	Spring

Note: For explanation of codes, see legend on Table 6.2-15.

Table 6.2-22

Containment Isolation Valve Information for the Nuclear Boiler System

Feedwater Line B

Penetration Identification	**B21-MPEN-007**	
Valve No.	F103B	F102B
Applicable Basis	GDC 55	GDC 55
Tier 2 Figure	5.1-2	5.1-2
ESF	No	No
Fluid	Water	Water
Line Size	550 mm	550 mm
Type C Leakage Test	See Table 3.9-8	See Table 3.9-8
Pipe Length from Cont. to Outboard Isolation Valve	COL applicant to provide	COL applicant to provide
Leakage Through Packing[(a)]	N/A	(a_2)
Leakage Past Seat[(b)]	(b_3)	(b_3)
Location	Inboard	Outboard
Valve Type	Check	Stop Check
Operator[(c)]	N/A	AO
Normal Position	Open	Open
Shutdown Position	N/A	Open
Post-Acc Position	N/A	Closed
Power Fail Position	N/A	N/A
Cont. Iso. Signal[(d)]	Q	Q
Primary Actuation	Self	Air to open
Secondary Actuation	N/A	Remote manual
Closure Time (sec)	N/A	N/A
Power Source	N/A	Spring

Note: For explanation of codes, see legend on Table 6.2-15.