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MFN 06-119
Supplement 6

Docket No. 52-010

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

Subject: **Response to Portion of NRC Request for Additional Information Letter No. 16 Related to ESBWR Design Certification Application - Design of Structures, Components, Equipment, and Systems - RAI Number 3.12-24 S01**

Enclosure 1 contains GEH's revised response to the subject RAI transmitted via References 1 and 2.

Should you have any questions about the information provided here, please contact me.

Sincerely,

James C. Kinsey

James C. Kinsey
Vice President, ESBWR Licensing

D068
NRO

References:

1. MFN 06-254, Summary of May 26, 2006, Meeting With General Electric Regarding Audit Of ESBWR Piping Design And Analysis, dated July 19, 2006
2. MFN 06-103, Letter from U.S. Nuclear Regulatory Commission to David H. Hinds, ESBWR, General Electric Company, Request For Additional Information Letter No. 16 Related To ESBWR Design Certification Application, March 30, 2006

Enclosure:

1. Response to Portion of NRC Audit dated May 26, 2007, Related to *ESBWR Design Certification Application* - RAI Number 3.12-24 S01

cc:	AE Cubbage	USNRC (with enclosure)
	RE Brown	GEH/Wilmington (with enclosure)
	DH Hinds	GEH/Wilmington (with enclosure)
	GB Stramback	GEH/San Jose (with enclosure)
	eDRF	0000-0059-0246, Revision 3

Enclosure 1

MFN 06-119 Supplement 6

Response to Portion of NRC Audit

Dated May 26, 2007

Related to ESBWR Design Certification Application

RAI Number 3.12-24 S01

For historical purposes, the original text of RAI 3.12-24 and 3.12-24 S01 and the GEH response are included, except for any attachements or DCD mark-ups.

NRC RAI 3.12-24

NRC Bulletin 88-08 addresses unisolable sections of piping connected to the RCS (including the RPV) that may be subjected to temperature oscillations induced by leaking valves. Identify unisolable piping segments directly connected to the RCS and describe the analysis method to mitigate problems identified in Bulletin 88-08, including supplements 1, 2 and 3.

GE Response

(1) NRCB 88-08 and NRCB, Supplement 1:

Theoretically, the problem of thermal fatigue in unisolable sections of piping connected to the RCS caused by cold water leaks through a normally closed block valve, with the pressure upstream of the valve greater than the RCS and the temperature upstream of the valve significantly lower than the RCS temperature, could occur in the following cases:

1.1 Condensate Isolation Valves of the Isolation Condenser System (B32). In the ESBWR, the problem of thermal stratification has been reduced to a minimum by means of a loop seal by providing a reduction in the pipeline where the condensate block valves are installed of 0.5 m minimum below the RPV nozzle elevation. The piping downstream of the condensate block valves are not insulated except for the horizontal piping directly connected to the RPV nozzle. In addition, temperature elements strapped or magnetically attached to the top and bottom surface of the horizontal pipe are provided to detect temperature stratification in the piping.

1.2 Standby Liquid Control System (C41) Squib Valves. In this case the problem of leaks does not exist due to the design of the squib valves.

(2) NRC 88-08, Supplement 3

The problem of injection of cold water through the stem seal connection of a normally closed gate valve could theoretically occur in the following cases:

2.1 Nuclear Boiling System (B21) RPV head vent piping drain line isolation valves. In the ESBWR globe type valves with bellow seals are provided.

2.2 The Gravity-Driven Cooling System (E50) squib valves do not have a seal line either. Therefore it can be concluded that initially the condensate return piping of the Isolation Condensate Systems could be affected by the problem mentioned in NRC Bulletin 88.08 and that the design of the

system in the ESBWR has taken into account the necessary measures to reduce the risk of stratification and to detect it.

DCD Impact

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

NRC RAI 3.12-24 S01

STAFF EVALUATION

Unresolved

The *response to this RAI require drawings of the piping layout with respect to RPV connections. Also, the issue here is not thermal stratification, rather it is thermal oscillations induced by leaking valves in the unisolable section of the piping.*

During audit, GE should demonstrate those piping which are exposed to this temperature oscillation and explain how this phenomenon is considered in the ESBWR piping design.

CONCLUSION

GE discussed all cases included in its RAI response with P&I drawings to illustrate the potential thermal oscillations that might occur in an unisolable section of piping connected to the RCS (including the RPV) induced by leaking valves.

1.1 Condensate Isolation Valves of the Isolation Condenser System (B32). This section of the piping can be isolated by the containment isolation valves and hence not subject to any thermal oscillations.

1.2 Standby Liquid Control System (C41) Squib Valves. GE showed design drawings of several types of squib valves and based on their designs these valves will not leak since their operation is controlled by explosive which knocks out the valve disc from its completely sealed position.

2.1 Nuclear Boiling System (B21) RPV head vent piping drain line isolation valves. These valves address the stem leaking aspect of the Bulletin 88-08. GE showed a design of such a valve with bellows, which prevents any leaking through the valve stem. This section of the piping may also be subject to thermal oscillation depending on its actual routing. GE provided proposed text for this concern and the commitments delineated are acceptable.

2.2 The Gravity-Driven Cooling System (E50) squib valves do not have a seal line either. GE reviewed this system again to ensure that thermal oscillation would not occur in this section of the piping. GE will address this in its revised response to this RAI.

GE will further investigate this phenomenon for the ESBWR piping design and will revise its RAI response. Since actual routing of piping is important for examining this concern, GE may consider this as a COL action item. In the mean time NRC will check the MRP guidelines for the screening criteria to address the adequacy of GE's response to the thermal oscillation issue.

Unresolved, pending GE's revised response to this RAI and revised DCD.

DESCRIPTION OF ISSUE

NRC Bulletin 88-08 addresses unisolable sections of piping connected to the RCS (including the RPV) that may be subjected to temperature oscillations induced by leaking valves. Identify unisolable piping segments directly connected to the RCS and describe the analysis method to mitigate problems identified in Bulletin 88-08, including supplements 1, 2 and 3.

GE RESPONSE

(1) NRCB 88-08 and NRCB, Supplement 1:

Theoretically, the problem of thermal fatigue in unisolable sections of piping connected to the RCS caused by cold water leaks through a normally closed block valve, with the pressure upstream of the valve greater than the RCS and the temperature upstream of the valve significantly lower than the RCS temperature, could occur in the following cases:

1.1 Condensate Isolation Valves of the Isolation Condenser System (B32). In the ESBWR, the problem of thermal stratification has been reduced to a minimum by means of a loop seal by providing a reduction in the pipeline where the condensate block valves are installed of 0.5m minimum below the RPV nozzle elevation. The piping downstream of the condensate block valves are not insulated except for the horizontal piping directly connected to the RPV nozzle. In addition, temperature elements strapped or magnetically attached to the top and bottom surface of the horizontal pipe are provided to detect temperature stratification in the piping.

1.2 Standby Liquid Control System (C41) Squib Valves. In this case the problem of leaks does not exist due to the design of the squib valves.

(2) NRC 88-08, Supplement 3

The problem of injection of cold water through the stem seal connection of a normally closed gate valve could theoretically occur in the following cases:

2.1 Nuclear Boiling System (B21) RPV head vent piping drain line isolation valves. In the *ESBWR* globe type valves with bellow seals are provided.

2.2 The Gravity-Driven Cooling System (E50) squib valves do not have a seal line either. Therefore it can be concluded that initially the condensate return piping of the Isolation Condensate Systems could be affected by the problem mentioned in NRC Bulletin 88.08 and that the design of the system in the ESBWR has taken into account the necessary measures to reduce the risk of stratification and to detect it.

DCD Impact

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

STAFF EVALUATION

Unresolved

The response to this RAI require drawings of the piping layout with respect to RPV connections. Also, the issue here is not thermal stratification, rather it is thermal oscillations induced by leaking valves in the unisolable section of the piping. During audit, GE should demonstrate those piping which are exposed to this temperature oscillation and explain how this phenomenon is considered in the ESBWR piping design.

CONCLUSION

GE discussed all cases included in its RAI response with P&I drawings to illustrate the potential thermal oscillations that might occur in an unisolable section of piping connected to the RCS (including the RPV) induced by leaking valves.

1.1 *Condensate* Isolation Valves of the Isolation Condenser System (B32). This section of the piping can be isolated by the containment isolation valves and hence not subject to any thermal oscillations.

1.2 Standby Liquid Control System (C41) Squib Valves. GE showed design drawings of *several* types of squib valves and based on their designs these valves will not leak since their operation is controlled by explosive which knocks out the valve disc from its completely sealed position.

2.1 Nuclear Boiling System (B21) RPV head vent piping drain line isolation valves. These valves address the stem leaking aspect of the Bulletin 88-08. GE showed a *design* of such a valve with bellows, which prevents any leaking through the valve stem. This section of the piping may also be subject to thermal oscillation depending on its actual routing. GE provided proposed text for this concern and the commitments delineated are acceptable.

2.2 The Gravity-Driven Cooling System (E50) squib valves do not have a seal line either. GE reviewed this system again to ensure that thermal oscillation would not occur in this section of the piping. GE will address this in its revised response to this RAI.

GE will further investigate this phenomenon for the ESBWR piping design and will revise its RAI response. Since actual routing of piping is important for examining this concern, GE may consider this as a COL action item. In the mean time NRC will check the MRP guidelines for the screening criteria to address the adequacy of GE's response to the thermal oscillation issue.

Unresolved, pending GE's revised response to this RAI and revised DCD.

GEH REVISED RESPONSE

Theoretically, the problem of thermal fatigue in unisolable sections of piping connected to the RCS caused by cold water leaks through a normally closed block valve, with the pressure upstream of the valve greater than the RCS and the temperature upstream of the valve significantly lower than the RCS temperature, could occur in the following cases:

1.1 Standby Liquid Control System (C41) Squib Valves. In this case the problem of leaks does not exist due to the design of the squib valves.

1.2 The Gravity-Driven cooling system (E50) squib valves. In this case the problem of leaks does not exist due to the design of the squib valves.

1.3 Nuclear Boiler system (B21) RPV head vent piping drain isolation valve. If the physical location of the valve is close to the RPV, there is the potential for having a thermal oscillation problem. The design of the pipe routing will be completed to prevent this from occurring.

The problem of injection of cold water through the stem seal connection of a normally closed gate valve could theoretically occur in the following cases:

2.1 Nuclear Boiling System (B21) RPV head vent piping drain line isolation valves. In the ESBWR globe type valves with bellow seals are provided to prevent leaking from occurring.

DCD Impact

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