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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 166 Related to ESBWR Design Certification Application - Design of Structures, Components, Equipment, and Systems - RAI Number 3.9-168 S02**

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 NRC letter dated March 28, 2008. GEH response to RAI Number 3.9-168 S02 is addressed in Enclosure 1. The DCD Markup related to this response is provided in Enclosure 2.

The GEH response to RAI 3.9-168 was submitted via Reference 2 in partial response to NRC Letter 67 (Reference 3). The GEH response to RAI 3.9-168 S01 was submitted via Reference 4 in response to a request received via email (Chandu Patel) dated May 7, 2007 (Reference 5).

Verified DCD changes associated with this RAI response are identified in the enclosed DCD markups by enclosing the text within a black box. The marked-up pages may contain unverified changes in addition to the verified changes resulting from this RAI response. Other changes shown in the markup(s) may not be fully developed and approved for inclusion in DCD Revision 5.

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

Sincerely,

James C. Kinsey

James C. Kinsey
Vice President, ESBWR Licensing

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References:

1. MFN 08-316, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request for Additional Information Letter No. 166 Related to the ESBWR Design Certification Application,* dated March 28, 2008
2. MFN 07-021, *Response to Portion of NRC Request for Additional Information Letter No. 67 Related to ESBWR Design Certification Application – DCD Section 3.9 – RAI Numbers 3.9-168 and 3.9-172,* dated March 27, 2007
3. MFN 06-378, Letter from U.S. Nuclear Regulatory Commission to David H. Hinds, Manager, ESBWR, General Electric Company, *Request For Additional Information Letter No. 67 Related To ESBWR Design Certification Application*, dated October 10, 2006
4. MFN 08-109, *Response to Portion of NRC Request for Additional Information Letter No. 67 Related to ESBWR Design Certification Application -Inservice Testing of Pumps and Valves - RAI Numbers 3.9-159 S01 and 3.9-168 S01*, dated February 11, 2008
5. E-Mail from Chandu Patel (NRC), Supplement 1 to RAI 3.9-168, dated May 7, 2007

Enclosure:

1. Response to Portion of NRC Request for Additional Information Letter No. 166 Related to ESBWR Design Certification Application – Design of Structures, Components, Equipment, and Systems - RAI Number 3.9-168 S02

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	0000-0084-9532, Revision 1

Enclosure 1

MFN 08-458

Response to Portion of NRC Request for

Additional Information Letter No. 166

Related to ESBWR Design Certification Application

Design of Structures, Components, Equipment, and Systems

RAI Number 3.9-168 S02

Verified DCD changes associated with this RAI response are identified in the enclosed DCD markups by enclosing the text within a black box. The marked-up pages may contain unverified changes in addition to the verified changes resulting from this RAI response. Other changes shown in the markup(s) may not be fully developed and approved for inclusion in DCD Revision 5.

NRC RAI 3.9-168

Verify that all relief devices which perform a function of providing pressure relief to ensure the integrity of safety-related structures, systems, or components are designed, qualified, and capacity certified to meet all applicable requirements of ASME Section III and are included in the IST program. Specifically, in addition to any other systems which provide a safety-related function, provide this information for the following systems: the reactor coolant system, the main steam system, the facility and auxiliary pool cooling system, the shutdown cooling/standby liquid control system, the control rod drive system, the plant service water system, and the reactor building component cooling water systems.

GEH Response

The relief devices, which provide a pressure relief function to ensure the integrity of all safety-related structures, systems and components, are classified in accordance with classifications of structures, systems and components in DCD Table 3.2-1. Based upon the Quality Group classification in Table 3.2-1, the ASME Section III Code Class and design and fabrication requirements are identified in Table 3.2-3. Therefore, these relief devices are designed, manufactured and qualified, including capacity certification, in accordance with all applicable requirements of the ASME Code Section III. For the specific systems identified in this RAI, the principal components, which include relief devices, are classified in accordance with DCD Table 3.2-1. Of these systems, the applicable relief devices that provide a pressure relief function to ensure the integrity of safety-related structures, systems and components are the Nuclear Boiler System Safety Relief Valves (F006 and F003), the Standby Liquid Control System Accumulator Tank Relief Valve (F030A/B) and the Containment Drywell Wetwell Vacuum Breaker Valve (F002). These relief devices are included in the IST program in accordance with DCD Table 3.9-8.

DCD Impact

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

NRC RAI 3.9-168 S01

RAI 3.9-168 S01 Comment on response to RAI 3.9-168 from MFN 07-021:

RAI 3.9-168 S01 Discuss the exclusions and alternatives from the ASME OM Code noted in Item (f) of Table 3.9-8 on Page 3.9-85 of the DCD Tier 2, Revision 3, and the bases for those exclusions and alternatives.

GEH Response

As discussed in the response to RAI 3.9-159 S01, Table 3.9-8 will be revised to provide more detailed justifications for deferring quarterly IST testing to refueling outages or cold shutdown. The reasons used to exclude a valve from quarterly stroke testing will be consistent with guidance in NUREG 1482, Revision 1.

DCD Impact

DCD Tier 2, Table 3.9-8 will be revised in Revision 5 as shown in the response to RAI 3.9-159 S01.

NRC RAI 3.9-168 S02

Question summary: Table 3.9-8 IST Test Intervals

Full Text:

GEH is requested to justify the testing frequencies that have been extended in the revised table beyond refueling outage intervals, such as safety-relief valve (SRV) F006, safety valve F003, SRV discharge line inboard vacuum breaker F007, SRV discharge line outboard vacuum breaker F008, rupture disk F028, and drywell wetwell vacuum breaker valve F002. This information is needed to confirm that the proposed testing frequencies satisfy the NRC regulations that incorporate by reference the ASME Code inservice testing (IST) provisions.

In response to RAI 3.9-159, Supplement 1, in MFN 08-109 (dated February 11, 2008), GEH states that Table 3.9-8, "In-Service Testing," in ESBWR DCD Tier 2 was revised to provide more detailed justifications for deferring quarterly IST testing. A justification for extending the testing frequencies identified above was not provided.

GEH Response

The six valves mentioned in the RAI are discussed below.

Safety-relief valve (SRV) F006 and Safety valve F003: Paragraph ISTC–1200 of the OM Code states that safety and relief valves are not subject to Paragraph ISTC-3500 exercise testing; therefore, type "SO" tests are not required for these valves. The "SO" test every refueling outage for F006 was therefore deleted from the table. The frequency for the "R" testing is set at 5 years based on paragraph I-1320 of the OM Code. Per this paragraph, at least 20% of these valves will be tested during each 24-month interval. Note e) of Table 3.9-8 will be revised to clarify that the "R" test consists of visual examination, set pressure determination and seat tightness verification in accordance with Appendix I of the OM Code. Note also that the leakage test for these valves every 2 years will be deleted from the table, consistent with note g1 under the table.

In conjunction with this change, Chapters 16 and 16B, LCO 3.5.1, "Automatic Depressurization System (ADS) - Operating," will be revised to delete Surveillance Requirement 3.5.1.5 to periodically verify that each SRV opens when actuated using a manually initiated signal.

SRV discharge line inboard vacuum breaker F007 and SRV discharge line outboard vacuum breaker F008: The "SO" and "SC" tests for these valves are exercise tests in accordance with Paragraph ISTC-5220, consistent with Paragraph ISTC-5230, which requires vacuum breakers to meet testing requirements for check valves, as well as for safety and relief valves. The

frequency for the "R" test will be changed to 2 years, consistent with Paragraph I-1380 of the OM Code.

Rupture disk F028: Consistent with paragraph I-1360 of Appendix I of the OM Code, rupture disks are required to be replaced every five years. GEH's response to Supplement 1 of this RAI did not change the frequency of this test. The change in the "Test Freq." column was editorial ("YR" changed to "yrs").

Drywell wetwell vacuum breaker valve F002: The "SO" and "SC" tests for these valves are exercise tests in accordance with Paragraph ISTC-5220, consistent with Paragraph ISTC-5230, which requires vacuum breakers to meet testing requirements for check valves, as well as for safety and relief valves. The frequency for these exercise tests will be changed to once per refueling outage because sufficient differential pressure/flow between the wetwell and the drywell cannot be created to perform an exercise test at power. The frequency for the "R" test will be changed to every refueling outage ("RO"), consistent with paragraph I-1370 of the OM Code.

DCD Impact

DCD Tier 2, Table 3.9-8 and Chapters 16 and 16B technical specification surveillance requirements will be revised in Revision 5 as noted in the attached markup.

Table 3.9-8

Inservice Testing

No.	Qty	Description (g)	Valve Type (i)	Act (b)	Code Class (a)	Code Cat. (c)	Valve Func. (d)	Norm Pos	Safety Pos.	Fail Safe Pos	C I V	Test Para (e)	Test Freq. (f)
(Deleted) ~~F103~~	~~2~~	~~FW discharge line downstream maintenance valve~~	~~CK~~	~~SA~~	~~1~~	~~A/C~~	~~A~~	~~O~~	~~C~~	~~N/A~~	~~Y~~	~~SC~~ ~~L~~	~~RO~~ ~~App J~~
F001A/B/C/D	4	Inboard ~~main steam isolation valve~~ (MSIV) (g10)	~~GB~~ GT ~~AF~~ ~~QT~~	NO PM	1	A	A	O	C	C	Y	L P SC FC	App J 2~~YR~~ yrs CS CS
F002A/B/C/D	4	Outboard ~~main steam isolation valve~~ (MSIV) (g10)	~~GB~~ GT ~~AF~~ ~~QT~~	AO PM	1	A	A	O	C	C	Y	L P SC FC	App J 2 yrs~~YR~~ CS CS
F006	10	Safety -relief valve (SRV) (g1) ~~(g2)~~	RV	SA NOA ~~O~~	1	A, C	A	C	O/C	N/A	--	R ~~SO~~	5 yrs~~YR~~ ~~RO~~
F003	8	Safety Valve ~~(SV)~~ (g1)	RV	SA	1	A, C	A	C	O/C	N/A	--	R	5 yrs~~YR~~
F004	~~48~~	~~Depressurization valve~~ (DPV) on the stub tube connected to the RPV	SQ	EX	1	D	A	C	O	N/A	--	X P	E2 2 yrs

Table 3.9-8

Inservice Testing

No.	Qty	Description (g)	Valve Type (i)	Act (b)	Code Class (a)	Code Cat. (c)	Valve Func. (d)	Norm Pos.	Safety Pos.	Fail Safe Pos	C I V	Test Para (e)	Test Freq. (f)
F713	4	Excess flow check valve – MSL flow restrictor instrument line (g6~~3~~), (g~~4~~)	~~QBL~~ GBCK	SA	2	A, C	A	O	O/C	N/A	Y	L, ~~S~~ SO SC	App J RO RO
F026	1	RPV top head vent inboard shutoff valve (g2~~1~~)	QBL, GT	~~MN~~O	1	B	A	C	C	~~N/A~~as-is	--	P SC ~~OMN1S~~ ~~C~~	2 yrs~~YR~~ CS~~RO~~ ~~OMN1~~
F027	1	RPV top head vent outboard shutoff valve (g2~~1~~)	QBL, GT	~~NOM~~ ~~O~~	1	B	A	C	C	~~N/A~~as-is	--	P SC ~~OMN1S~~ ~~C~~	2 yrs~~YR~~ ~~RO~~CS ~~OMN1~~
F007	~~12~~10	SRV discharge line inboard vacuum breaker (g11)	VB	SA	3	C	A	C	O/C	N/A	--	R SC SO	~~RO~~2 yrs RO RO
F008	~~12~~10	SRV discharge line outboard vacuum breaker (g11)	VB	SA	3	C	A	C	O/C	N/A	--	R SC SO	~~RO~~2 yrs RO RO
F035	10	SRV pneumatic supply line check valve (g12)	CK	SA	3	C	A	C	C	N/A	--	SC SO	RO RO

Table 3.9-8

Inservice Testing

No.	Qty	Description (g)	Valve Type (i)	Act (b)	Code Class (a)	Code Cat. (c)	Valve Func. (d)	Norm Pos	Safety Pos.	Fail Safe Pos	C I V	Test Para (c)	Test Freq. (f)
F010	1	N2 supply line inboard isolation check valve to ADS, SRV and ICIV accumulator (g5h)	CK	SA	2	A, C	A	O/C	C	N/A	Y	L SC SO	App J RO RO
T10 Containment													
F001	3	Drywell wetwell vacuum breaker isolation valve	~~QT~~QBF QBL	NO~~,~~ SO	2	~~B~~A	A	O	O/C~~C/O~~	as-is	--	P L SO SC	2 yrs 2 yrs 3 mo 3 mo
F002	3	Drywell wetwell vacuum breaker valve (g3)	~~CK~~VB	SA~~V B~~	2	A, C	A	C	O/C	N/A	--	SO SC L P R	RO RO 2 yrs 2 yrs ~~E3~~RO
T15 Passive Containment Cooling System Valves													
F001	6	Vent fan ball check valves	CK	SA	2	A, C	A	C	O/C	N/A	--	L SO SC	2 yrs RO RO

SA Self-actuated

SO Solenoid operated

EH Electro-hydraulic operated

~~SQ Squib. This valve is a one-time use valve designed as a single machined forging with a breakaway outlet cap. The valve is open by a pyrotechnic actuator that drives a shear plunger against the edge of the cap.~~

~~VB Vacuum Breaker. Valves that provide pressure relief when a set pressure value is exceeded or when a set differential pressure is exceeded across the valve.~~

c) A, B, C or D – Valve category per ASME OM Code –Subsection ISTC-1300.

d) Valve Function:

A or P – Active or passive per ASME OM Code – Paragraph ISTC-1300.

e) Valve test parameters per ASME OM Code – Subsection ISTC and Appendix I:

L Seat leakage rate (Paragraph ISTC-3600 and ~~DCD Tier 2~~ Subsection 6.2.6.3

~~OMN1SC Full cycle exercise and stroke closed design basis verification tests in accordance with ASME Code Case OMN-1~~

~~OMN1SO Closure exercise and design basis verification tests in accordance with ASME Code Case OMN-1~~

P Valve position verification (Paragraph ISTC-3700)

R Safety and relief test including visual examination, set pressure determination and seat tightness testing in accordance with ~~Paragraph ISTC-3000, 5230, 5240, Table ISTC-3500-1, Note (2), and~~ Appendix I of the OM Code~~)~~. Category A and B requirements for safety and relief valves of ISTC-3500 and ISTC-3700 are excluded per ISTC-1200.

SO Open stroke tests for Category A and B valves (Paragraph ISTC-3521) and Category C valves (Paragraph ISTC-3522)

SC Closure stroke tests for Category A and B valves (Paragraph ISTC-3521) and Category C valves (Paragraph ISTC-3522)

FO Fail open tests for Category A and B valves (Paragraph ISTC-3560)

FC Fail closed tests for Category A and B valves (Paragraph ISTC-3560)

X Explosively actuated valve tests (Paragraph ISTC-5260)

~~Visual Visual examination~~ RDR 5-year replacement of rupture disk (Paragraph I-3340 and I-3360)

f) Valve test frequency for the specified test parameter including summary of exclusions and alternatives per ASME OM Code – Subsection ISTC and Appendix I:

CS Cold shutdown

RO Refueling outages. For position verification: refueling outages, but in no case greater than two years.

~~E1 Valves used only for operating convenience, i.e., passive vent, drain, instrument, test, maintenance and system control valves. These valves are not required for primary containment isolation. Tests are not required per Paragraph ISTC-1200 (i.e., the valves are exempt per the criteria given in ISTC-1200).~~

E2 Fired and replaced per Paragraph ISTC-5260.

~~E3 Test scheduled per Appendix I, Paragraph I-3000.~~

~~OMN1 Exercise and performance based test frequencies in accordance with ASME Code Case OMN-1~~

App J Per Appendix J requirements

g) ~~Summary justification~~Justifications for code defined testing exceptions or alternatives as allowed by Paragraphs ISTC-3510 for exercising tests and ISTC-3630 for seat leakage rate tests are as follows.

g1) Paragraph ISTC-3600 (leak testing requirements) is not applicable to these valves since they function in the course of plant operation in a manner that demonstrates functionally adequate seat leak-tightness.

g2) Although these valves could be tested one at a time at power, there is a risk of depressurizing the reactor.

g3) These valves cannot be tested at power because sufficient differential pressure/flow between the wetwell and the drywell cannot be created.

g4) These valves cannot be tested at power because a reverse flow cannot be established.

g5) These valves are installed in nitrogen supply lines to nitrogen-operated valves. If the main valve is tested quarterly, the opening function of the check valve will be tested as part of that test. Otherwise the check valve cannot be tested without potentially stroking the main valve. The closing function cannot be tested at power because a reverse flow cannot be established.

g6) These valves are installed in sensing lines. Valve opening is verified by the continued operation of the sensor. High flow cannot be established through these valves at power to verify valve closure.

g7) These valves cannot be tested for opening at power because of the potential for moving the control rods and cannot be tested for closing at power because a reverse flow cannot be established.

SR 3.5.1.3	---------- - NOTE - Valve actuation may be excluded. ---------- Verify the function of each SRV actuates on an actual or simulated automatic initiation signal.	24 months
SR 3.5.1.4	---------- - NOTE - Squib actuation may be excluded. ---------- Verify each DPV actuates on an actual or simulated automatic initiation signal.	24 months
SURVEILLANCE		FREQUENCY
~~SR 3.5.1.5~~ COL 16.0-2-H 3.5.1-1	~~- NOTE -~~ ~~Not required to be performed until 12 hours after reactor steam dome pressure is ≥ {6.2} MPaG ({900} psig) and steam flow is adequate to perform the test.~~ ~~Verify each SRV opens when manually actuated.~~	~~24 months on a STAGGERED TEST BASIS for each valve solenoid~~

and Uninterruptible AC Electrical Power Distribution Divisions required by LCO 3.8.6. ~~of each of the required circuits that initiate the explosive charge for squib actuated valves in the ADS.~~

The 31 day Frequency is acceptable because either of the two safety-related actuators in each valve is capable of actuating the associated ADS valve. Additionally, an alarm will provide prompt notification of loss of circuit continuity for the required actuators in each ADS valve.

This SR is modified by a Note that continuity is not required to be met for one required ~~squib firing~~ actuator ~~circuit~~ intermittently ~~bypassed~~disabled under administrative controls. This ~~is acceptable because the keylock switch that disables the firing circuit~~ allows the continuity monitor to be tested and allows surveillance and maintenance with the assurance that the valve will not be opened inadvertently. The operation of the ~~keylock~~ disable switch in either division does not disable the ADS valve~~DPV~~ because the valve will still be opened by the ~~squib initiator~~actuator in the other division ~~and a single failure will not cause inadvertent actuation~~.

SR 3.5.1.3

This SR requires periodic verification that the ADS function of each SRV actuates on an actual or simulated automatic initiation signal. The ADS function of each SRV is required to actuate automatically to perform its design function. ~~This test overlaps Surveillance Testing required in the instrumentation section of the Technical Specifications and is intended~~The LOGIC SYSTEM FUNCTIONAL TEST in LCO 3.3.5.2 overlaps this SR to provide complete testing of the assumed safety function.

This SR is modified by a Note that excludes SRV valve actuation as a requirement for this SR to be met. This is acceptable because SRVs are tested in accordance with the Inservice Test Program ~~the valve actuation is verified by SR 3.5.1.5~~.

The 24 month Frequency for performing this SR is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the SR were

SURVEILLANCE REQUIREMENTS (continued)

performed with the reactor at power. From past operating experience, it is believed that these components will pass the SR when performed once per the 24 month refueling interval.

SR 3.5.1.4

This SR requires periodic verification that that the ADS function of each DPV actuates on an actual or simulated automatic initiation signal. The ADS function of each DPV is required to actuate automatically to perform their design functions. The LOGIC SYSTEM FUNCTIONAL TEST in LCO 3.3.5.2 overlaps this SR~~This test overlaps Surveillance Testing required in the instrumentation section of the Technical Specifications and is intended~~ to provide complete testing of the assumed safety function.

This SR is modified by a Note that excludes squib valve actuation as a requirement for this SR to be met. This is acceptable because the design of the squib-actuated valve was selected for this application because of its very high reliability. The OPERABILITY of squib-actuated valves is verified by continuity tests in SR 3.5.1.2 and the Inservice Test Program for squib-actuated valves.

The 24 month Frequency for performing this SR is based on the need to perform this SR under the conditions that apply during a plant outage and the potential for an unplanned transient if the SR were performed with the reactor at power. ~~From past o~~Operating experience has shown ~~, it is believed~~ that these components ~~will~~ usually pass the SR when performed once per the 24 month refueling interval.

~~SR 3.5.1.5~~

~~This SR requires periodic verification that each SRV opens when actuated using a manually initiated signal. The SRV actuation is performed to verify that the valve and solenoids are functioning properly and that no blockage exists in the SRV discharge lines. SRV actuation is demonstrated by the response of the turbine control or bypass valves, by a change in the measured steam flow, or by any other method suitable to verify steam flow.~~

COL 16.0-2-H
3.5.1-1

~~The SRV manufacturer recommends that SRVs not be actuated unless steam pressure is ≥ {6.2} MPaG ({900} psig). Also, adequate steam flow must be passing through the main turbine control or turbine bypass valves to continue to control reactor pressure when the ADS valves divert steam flow upon opening. Meeting these recommendations requires that the reactor be placed in a MODE where the SR is applicable before the conditions for performing the SR are established. Therefore, this SR is modified by a Note stating that the SR is required to be performed within 12 hours after reactor dome pressure is ≥ {6.2} MPaG ({900} psig) and steam flow is adequate to perform the test. This Note allows entry into MODES where the SR is applicable without the SR being completed, however, the SR must be completed for each SRV within 12 hours after~~

BASES

~~minimum conditions for performing the SR are achieved. Operation in the applicable MODES for a short period of time without this SR completed is acceptable because of the following: there is a low likelihood of a LOCA requiring ADS actuation during this period; the SRVs are highly reliable and typically pass the SR when it is performed; the redundancy and diversity provided by 10 SRVs and 8 DPVs minimizes the consequences of an individual SRV failure; and, the decay heat load is significantly reduced following shutdown where SRV testing is required. Additionally, SRV OPERABILITY and the setpoints for overpressure protection are verified prior to valve installation.~~

~~The 24 month Frequency for performing this SR is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the SR were performed with the reactor at power. Operating experience has shown that these components usually pass the SR when performed at the 24 month Frequency.~~

~~This SR verifies SRV actuation. Actuation can be initiated by any of four solenoid operated pilot valves. Three of the solenoids are actuated by the SSLC logic and the fourth is actuated by the DPS. This SR Frequency requires that the SR be performed 24 months on a STAGGERED TEST BASIS for each valve solenoid logic so that each of the four solenoids is used to initiate valve actuation every fourth cycle.~~

REFERENCES

1. Chapter 6.
2. Chapters 15.
3. 10 CFR 50.46.
4. ~~{Supporting Analysis}~~