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MFN 08-781 S01

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Subject: **Response to Portion of NRC Request for Additional Information
Letter No. 302 Related to Design Control Document (DCD)
Revision 5 – RAI Number 6.2-189 S01**

The purpose of this letter is to submit the GE Hitachi Nuclear Energy (GEH) responses to the U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) sent by NRC letter No. 302 (Reference 1). GEH response to RAI Number 6.2-189 S01 is addressed in Enclosure 1. ESBWR DCD markups associated with this response are provided in Enclosure 2.

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

Sincerely,

Richard E. Kingston
Vice President, ESBWR Licensing

Reference:

1. MFN 09-150, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request for Additional Information Letter No. 302 Related to Design Control Document (DCD) Revision 5*, dated February 5, 2009.

Enclosures:

1. MFN 08-781 S01, Response to Portion of NRC Request for Additional Information Letter No. 302 Related to Design Control Document (DCD) Revision 5 – RAI Number 6.2-189 S01
2. MFN 08-781 S01, Response to Portion of NRC Request for Additional Information Letter No. 302 Related to Design Control Document (DCD) Revision 5 – RAI Number 6.2-189 S01 – DCD Markups

cc: AE Cubbage USNRC (with enclosures)
JG Head GEH/Wilmington (with enclosures)
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Enclosure 1

MFN 08-781 S01

Response to Portion of NRC Request for

Additional Information Letter No. 302

Related to Design Control Document (DCD) Revision 5

RAI Number 6.2-189 S01

NRC RAI 6.2-189 S01

Update the DCD to include Table 6.2-189-1 on Bounding Estimate of the ESBWR Containment Pressures to clarify how you determined the containment Pressure adjustment as noted in the proposed change to the footnote on Main Steam Line Break, with Containment Pressure adjustment of DCD Tier 2 Table 6.2-5.

GEH Response

Table 6.2-189-1 presented in the response to RAI 6.2-189 will be added to DCD Tier 2 as Table 6.2-5a. In addition, a new case will be added to this table to reflect the additional bounding main steam line break with offsite power scenario, which was included in the response to RAI 21.6-103, MFN 09-224. Also, DCD Tier 2 Table 6.2-5 will be further revised from the markup in MFN 09-224, deleting the last two rows and the associated footnote, to remove the duplicated information. Please note that only one deleted row is shown in the attached Table 6.2-5 markup because the other row was added after DCD Tier 2 Revision 5, in the response to RAI 6.2-189 (MFN 08-781 dated October 13, 2008).

DCD Impact

DCD Tier 2, Table 6.2-5 will be revised as noted in the attached markup.

DCD Tier 2, Table 6.2-5a will be added as noted in the attached markup.

Enclosure 2

MFN 08-781 S01

Response to Portion of NRC Request for

Additional Information Letter No. 302

Related to Design Control Document (DCD) Revision 5

RAI Number 6.2-189 S01

DCD Markups

**Table 6.2-5
Summary of Containment-LOCA Performance Analyses**

Break Location	Break Size ⁺⁽¹⁾ m ² (ft ²)	Single Failure	Maximum DW Pressure ^{*(6)} kPa (psia)	Maximum DW Pressure ^{(6)*} kPaG (psig)	Margin ^{***(7)} to Design Pressure of 310 kPaG (45 psig) (%)	Short-term Bulk DW Temperature °C (°F)	Long-term Bulk DW Temperature °C (°F)	Long-term WW Temperature °C (°F)	Long-term Suppression Pool Temperature °C (°F)
Based on standard TRACG evaluation model:									
Steam Line Inside Containment ^{+++ (3)}	0.09832 (1.058)	1 DPV	365.75 (53.05)	264.39 (38.35)	15%	182.91 (361.24)	140.47 (284.85)	122.73 (252.91)	75.56 (168.00)
Feedwater Line ⁽²⁾⁺⁺	0.07420 (0.7986)	1 DPV	338.87 (49.15)	237.52 (34.45)	23%	169.88 (337.78)	139.33 (282.80)	118.45 (245.21)	72.00 (161.60)
GDCS Injection Line	0.004561 (0.04910)	1 DPV	314.46 (45.61)	213.11 (30.91)	31%	164.16 (372.49)	137.39 (279.30)	114.55 (238.19)	63.98 (147.16)
Bottom Head Drain Line	0.004052 (0.04361)	1 DPV	324.95 (47.13)	223.60 (32.43)	28%	164.75 (328.55)	138.20 (280.76)	115.69 (240.26)	64.75 (148.57)
Based on bounding values:									
Steam Line Inside Containment ^{+++ (3)}	0.09832 (1.058)	1 DPV	396.25 (57.47)	294.90 (42.77)	5%	173.58 (344.44)	143.35 (290.03)	125.94 (258.69))	74.81 (166.66)
Feedwater Line ⁽²⁾⁺⁺	0.07420 (0.7986)	1 DPV	367.88 (53.36)	266.53 (38.66)	14%	169.47 (337.05)	142.13 (287.83)	121.95 (251.51)	71.08 (189.94)
Steam Line Inside Containment ⁽³⁾⁺⁺⁺	0.09832 (1.058) ⁺⁽¹⁾	1 SRV	397.45 (57.65)	296.10 (42.95)	5%	173.57 (344.43)	143.46 (290.22)	126.55 (259.79)	74.59 (166.26)
Feedwater Line ⁺⁺⁽²⁾	0.07420 (0.7986)	1 SRV	369.63 (53.61)	268.28 (38.91)	14%	167.94 (334.30)	142.24 (288.03)	123.16 (253.69)	69.61 (157.30)
Steam Line Inside Containment ^{OSP} ⁽⁴⁾	<u>0.09832 (1.058)⁽¹⁾</u>	<u>1 SRV</u>	<u>394.12 (57.16)</u>	<u>292.76 (42.46)</u>	<u>6%</u>	<u>174.97 (346.95)</u>	<u>143.17 (289.71)</u>	<u>128.39 (263.10)</u>	<u>74.33 (165.79)</u>
(Deleted) Steam Line With Noncondensable Gas Adjustment⁺⁺⁺⁺	0.09832 (1.058)	1 DPV	408.06 < 408.51 (59.2518)	< 307.166.82 (44.550)	≥ 1%	173.58 (344.44)	143.35 (290.03)	125.94 (258.69)	74.81 (166.66)

⁽¹⁾ The break area is from the RPV side of the break.
⁽²⁾⁺⁺ For the feedwater line break, the total break area from the TB side is limited at the two parallel venturi sections, with flow area of 0.04997 m² (0.53787 ft²) each. The break area from the RPV side of the break is limited by the feedwater sparger piping, which has a flow area of 0.07420 m² (0.79862 ft²). The analysis assumes feedwater lines are completely isolated in 52 seconds after the LOCA initiation (isolation valves start to close at 42 s with closure time of 10s).
⁽³⁾⁺⁺⁺ Main Steam Line Break, at Level 34, 2 GDCS vent paths. The break area from the RPV side of the break is limited by the MSL nozzle, which has a flow area of 0.09832 m² (1.05831 ft²).
⁽⁴⁾ Main Steam Line Break with offsite power, see Table 6.2-6 for initial conditions. Other bounding cases are based on the initial DW pressure and WW pressure of 110.3 kPa (16.0 psia).
~~++++ Main Steam Line Break, with Containment Pressure adjustment, and noncondensable gas from SLCS, and safety/non-safety related pneumatic containment valves during MSLB event~~
^{(5)*} Maximum DW pressure calculated during the 72 hours following a LOCA.
^{(6)**} Minimum pressure margin calculated during the 72 hours following a LOCA.

Table 6.2-5a

Bounding Estimate of the ESBWR Containment Pressure¹

(1) TRACG Calculated Pressure and Margin

<u>Case #</u>	<u>Break Location</u>	<u>Single Failure</u>	<u>Peak DW Pressure (kPa)</u>	<u>GDCS NC Gas Mass at 72 hrs (kg)</u>	<u>DW Head NC Gas Mass at 72 hrs (kg)</u>	<u>DW NC Gas Mass at 72 hrs (kg)</u>	<u>WW NC Gas Mass at 72 hrs (kg)</u>	<u>DW Pressure (psig)</u>	<u>TRACG Calculated DW Pressure Margin at 72 hr [based on design limit of 310 kPaG (45 psig)], %</u>
<u>1</u>	<u>Steam Line Inside Containment</u>	<u>1 DPV</u>	<u>396.25</u>	<u>27.01</u>	<u>121.05</u>	<u>3.85</u>	<u>14875.00</u>	<u>42.77</u>	<u>5</u>
<u>2</u>	<u>Feedwater Line</u>	<u>1 DPV</u>	<u>367.88</u>	<u>712.66</u>	<u>50.20</u>	<u>22.13</u>	<u>14247.76</u>	<u>38.66</u>	<u>14</u>
<u>3</u>	<u>Steam Line Inside Containment</u>	<u>1 SRV</u>	<u>397.45</u>	<u>13.61</u>	<u>124.21</u>	<u>3.22</u>	<u>14884.95</u>	<u>42.95</u>	<u>5</u>
<u>4</u>	<u>Feedwater Line</u>	<u>1 SRV</u>	<u>369.63</u>	<u>702.43</u>	<u>13.88</u>	<u>3.29</u>	<u>14313.51</u>	<u>38.91</u>	<u>14</u>
<u>5</u>	<u>Steam Line Inside Containment, OSP²</u>	<u>1 SRV</u>	<u>394.12</u>	<u>10.98</u>	<u>145.40</u>	<u>3.21</u>	<u>14417.78</u>	<u>42.46</u>	<u>6</u>

(2) Pressure Margin (Purge all residual noncondensable gas from DW to WW)

<u>Case #</u>	<u>Break Location</u>	<u>Single Failure</u>	<u>Total NC Gas Mass remaining in DW regions at 72 hrs (kg)</u>	<u>Total NC Gas Mass in WW (with All NC Gas purged into WW at 72 hrs) (kg)</u>	<u>Adjusted WW NC Gas Mass Ratio</u>	<u>Adjusted DW Pressure at 72 hr (kPa)</u>	<u>Adjusted DW Pressure at 72 hr (psia)</u>	<u>Adjusted DW Pressure at 72 hr (psig)</u>	<u>Adjusted DW Pressure Margin at 72 hr [based on design limit of 310 kPaG (45 psig)], %</u>
<u>1</u>	<u>Steam Line Inside Containment</u>	<u>1 DPV</u>	<u>151.92</u>	<u>15026.92</u>	<u>1.010</u>	<u>400.30</u>	<u>58.06</u>	<u>43.36</u>	<u>4</u>
<u>2</u>	<u>Feedwater Line</u>	<u>1 DPV</u>	<u>784.99</u>	<u>15032.75</u>	<u>1.055</u>	<u>388.15</u>	<u>56.30</u>	<u>41.60</u>	<u>8</u>
<u>3</u>	<u>Steam Line Inside Containment</u>	<u>1 SRV</u>	<u>141.04</u>	<u>15025.99</u>	<u>1.009</u>	<u>401.22</u>	<u>58.19</u>	<u>43.49</u>	<u>3</u>
<u>4</u>	<u>Feedwater Line</u>	<u>1 SRV</u>	<u>719.60</u>	<u>15033.11</u>	<u>1.050</u>	<u>388.22</u>	<u>56.31</u>	<u>41.61</u>	<u>8</u>
<u>5</u>	<u>Steam Line Inside Containment, OSP²</u>	<u>1 SRV</u>	<u>159.59</u>	<u>14577.37</u>	<u>1.011</u>	<u>398.48</u>	<u>57.79</u>	<u>43.09</u>	<u>4</u>

Table 6.2-5a

Bounding Estimate of the ESBWR Containment Pressure¹

(3) Pressure Margin with additional noncondensable gas from pneumatic valves and nitrogen dissolved in the SLC system liquid

<u>Case #</u>	<u>Break Location</u>	<u>Single Failure</u>	<u>Additional NC Gas Mass from Containment Valve Systems and SLCS Liquid³ (kg)</u>	<u>Total NC Gas Mass in WW (with All NC Gas purged into WW at 72 hrs) (kg)</u>	<u>New WW NC Gas Mass Ratio</u>	<u>Adjusted DW Pressure at 72 hr (kPa)</u>	<u>Adjusted DW Pressure at 72 hr (psia)</u>	<u>Adjusted DW Pressure at 72 hr (psig)</u>	<u>Adjusted DW Pressure Margin at 72 hr [based on design limit of 310 kPaG (45 psig)], %</u>
<u>1</u>	<u>Steam Line Inside Containment</u>	<u>1 DPV</u>	<u>184.50</u>	<u>15211.42</u>	<u>1.023</u>	<u>405.22</u>	<u>58.77</u>	<u>44.07</u>	<u>2</u>
<u>2</u>	<u>Feedwater Line</u>	<u>1 DPV</u>	<u>184.50</u>	<u>15217.25</u>	<u>1.068</u>	<u>392.91</u>	<u>56.99</u>	<u>42.29</u>	<u>6</u>
<u>3</u>	<u>Steam Line Inside Containment</u>	<u>1 SRV</u>	<u>184.50</u>	<u>15210.49</u>	<u>1.022</u>	<u>406.14</u>	<u>58.91</u>	<u>44.21</u>	<u>2</u>
<u>4</u>	<u>Feedwater Line</u>	<u>1 SRV</u>	<u>184.50</u>	<u>15217.61</u>	<u>1.063</u>	<u>392.98</u>	<u>57.00</u>	<u>42.30</u>	<u>6</u>
<u>5</u>	<u>Steam Line Inside Containment, OSP²</u>	<u>1 SRV</u>	<u>184.50</u>	<u>14761.87</u>	<u>1.024</u>	<u>403.53</u>	<u>58.53</u>	<u>43.83</u>	<u>3</u>

(4) Targeted Pressure Margin at 1%

					<u>DW Pressure (kPa)</u>	<u>DW Pressure (kPaG)</u>	<u>DW Pressure (psia)</u>	<u>DW Pressure (psig)</u>	<u>DW Pressure Margin [based on design limit of 310 kPaG (45 psig)], %</u>
					<u>408.51</u>	<u>307.16</u>	<u>59.25</u>	<u>44.55</u>	<u>1</u>
	<u>Pressures at 1% Margin</u>								

¹ Containment pressure adjustment assuming all noncondensable (NC) gases are purged into WW at 72 hrs, including NC gases remaining in DW regions, NC gases dissolved in the SLC system liquid, and NC gases from safety/non-safety related pneumatic containment valves during the event.

² Main Steam Line Break with offsite power, see Table 6.2-6 for initial conditions. Other bounding cases are based on the initial DW pressure and WW pressure of 110.3 kPa (16.0 psia).

³ Additional noncondensable gases from pneumatic valves (142.9 kg) and nitrogen dissolved in the SLC system liquid (41.6 kg), total 184.5 kg.