

Amendment 12, LRA Changes from RAI Responses

Enclosure 2 Summary Table

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Chapter 4
TIME-LIMITED AGING ANALYSES

Table 4.2-3 Predicted USE Values at 54 EFPY (EOLE) for Callaway

RPV Material	Cu (Wt. %)	1/4 T Fluence (n/cm ²) ⁽¹⁾	Initial USE (ft - lb)	USE Decrease (%)	USE (ft-lb)
Reactor Vessel Beltline Materials					
Intermediate Shell Plate R2707-1	0.05	1.752E19	78	22	61
Intermediate Shell Plate R2707-2	0.06	1.752E19	100	22	78
Intermediate Shell Plate R2707-3	0.06	1.752E19	99	22	77
Lower Shell Plate R2708-1	0.07	1.752E19	82	22	64
- Using Credible Surveillance Data	0.07	1.752E19	82	17	68
Lower Shell Plate R2708-2	0.06	1.752E19	105	22	82
Lower Shell Plate R2708-3	0.08	1.752E19	101	22	79
Intermediate Shell Longitudinal Weld Seams	0.04	1.752E19	143	22	112
- Using Credible Surveillance Data	0.04	1.752E19	143	17	119
Lower Shell Longitudinal Weld Seams	0.04	1.752E19	143	22	112
- Using Credible Surveillance Data	0.04	1.752E19	143	17	119
Intermediate to Lower Shell Circumferential Weld Seam	0.04	1.752E19	112	22	87
- Using Credible Surveillance Data	0.04	1.752E19	112	17	93
Reactor Vessel Extended Beltline Materials					
Nozzle Shell Plate R2706-1	0.045	4.326E17	102	9.2	93
Nozzle Shell Plate R2706-2	0.055	4.326E17	87	9.2	79
Nozzle Shell Plate R2706-3	0.075	4.326E17	101	9.2	92

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RPV Material	Cu (Wt. %)	1/4 T Fluence (n/cm ²) ⁽¹⁾	Initial USE (ft - lb)	USE Decrease (%)	USE (ft-lb)
Inlet Nozzle R2702-1	<u>0.1846</u> 0.16	4.326E17	135	14 ⁽²⁾	116
Inlet Nozzle R2702-2	<u>0.1846</u> 0.16	4.326E17	137	14 ⁽²⁾	118
Inlet Nozzle R2702-3	<u>0.1846</u> 0.16	4.326E17	137	14 ⁽²⁾	118
Inlet Nozzle R2702-4	<u>0.1846</u> 0.16	4.326E17	134	14 ⁽²⁾	115
Outlet Nozzle R2703-1	<u>0.1846</u> 0.16	4.326E17	90	14 ⁽²⁾	77
Outlet Nozzle R2703-2	<u>0.1846</u> 0.16	4.326E17	114	14 ⁽²⁾	98
Outlet Nozzle R2703-3	<u>0.1846</u> 0.16	4.326E17	113	14 ⁽²⁾	97
Outlet Nozzle R2703-4	<u>0.1846</u> 0.16	4.326E17	118	14 ⁽²⁾	101
Nozzle Shell to Intermediate Shell Weld Seam	0.04	4.326E17	145	9.2	132
Inlet Nozzle to Shell Weld Seams	0.163	4.326E17	101	17 ⁽³⁾	84
Outlet Nozzle to Shell Weld Seams	0.163	4.326E17	99	17 ⁽³⁾	82
Nozzle Shell Long Weld Seams	0.045	4.326E17	128	9.2	116

¹ Fluence values are based on the limiting beltline and extended beltline fluence.

² The projected USE decreases were calculated in accordance with Position 1.2 of Regulatory Guide 1.99, Revision 2, and were conservatively taken from the base metal 0.20 % copper line in Figure 2 of the Reg. Guide.

³ The projected USE decreases were calculated in accordance with Position 1.2 of Regulatory Guide 1.99, Revision 2, and were conservatively taken from the weld metal 0.20 % copper line in Figure 2 of the Reg. Guide.

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Table 4.2-4 Calculation of Callaway Unit 1 RT_{PTS} Values for 54 EFPY (EOLE) at the Clad/Base Metal Interface

RPV Material	Cu (Wt. %)	Ni (Wt. %)	CF (°F)	Fluence (n/cm ²) ⁽¹⁾	FF	$RT_{NDT(U)}$ (°F)	ΔRT_{NDT} (°F)	σ_U (°F)	σ_D (°F)	M (°F)	RT_{PTS} (°F)
Reactor Vessel Beltline Materials											
Intermediate Shell Plate R2707-1	0.05	0.58	31	2.94E19	1.2859	40	39.9	0	17	34	114
Intermediate Shell Plate R2707-2	0.06	0.61	37	2.94E19	1.2859	10	47.6	0	17	34	92
Intermediate Shell Plate R2707-3	0.06	0.62	37	2.94E19	1.2859	-10	47.6	0	17	34	72
Lower Shell Plate R2708-1	0.07	0.58	44	2.94E19	1.2859	50	56.6	0	17	34	141 ⁽²⁾
-Using Credible Surveillance Data	-	-	25.6	2.94E19	1.2859	50	32.9	0	8.5	17	100
Lower Shell Plate R2708-2	0.06	0.57	37	2.94E19	1.2859	10	47.6	0	17	34	92
Lower Shell Plate R2708-3	0.08	0.62	51	2.94E19	.2859	20	65.6	0	17	34	120 ⁽²⁾
Intermediate Shell Longitudinal Weld Seams (G2.03)	0.04	0.05	28.8	2.94E19	1.2859	-60	37.0	0	18.5	37	14
-Using Credible Surveillance Data	-	-	40.8	2.94E19	1.2859	-60	52.5	0	14	28	20
Lower Shell Longitudinal Weld Seams (G2.03)	0.04	0.05	28.8	2.94E19	1.2859	-60	37	0	18.5	37	14
-Using Credible Surveillance Data	-	-	40.8	2.94E19	1.2859	-60	52.5	0	14	28	20
Intermediate to Lower Shell Circumferential Weld Seam (E3.14)	0.04	0.05	28.8	2.94E19	1.2859	-60	37	0	18.5	37	14

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RPV Material	Cu (Wt. %)	Ni (Wt. %)	CF (°F)	Fluence (n/cm ²) ⁽¹⁾	FF	$RT_{NDT(U)}$ (°F)	ΔRT_{NDT} (°F)	σ_U (°F)	σ_D (°F)	M (°F)	RT_{PTS} (°F)
-Using Credible Surveillance Data	-	-	40.8	2.94E19	1.2859	-60	52.5	0	14	28	20
Reactor Vessel Extended Beltline Materials											
Nozzle Shell Plate R2706-1	0.045	0.615	28.5	7.26E17	0.3559	20	10.1	0	5.1	10.1	40
Nozzle Shell Plate R2706-2	0.055	0.665	34	7.26E17	0.3559	30	12.1	0	6.1	12.1	54
Nozzle Shell Plate R2706-3	0.075	0.6	47.5	7.26E17	0.3559	30	16.9	0	8.5	16.9	64
Inlet Nozzle R2702-1	<u>0.1846</u> 0.16	0.885	<u>146.6</u> <u>123.9</u>	7.26E17	0.3559	10	<u>52.2</u> <u>44.1</u>	0	17	34	<u>96.2</u> <u>88</u>
Inlet Nozzle R2702-2	<u>0.1846</u> 0.16	0.875	<u>146.4</u> <u>123.8</u>	7.26E17	0.3559	10	<u>52.1</u> <u>44.1</u>	0	17	34	<u>96.1</u> <u>88</u>
Inlet Nozzle R2702-3	<u>0.1846</u> 0.16	0.79	<u>144.8</u> <u>122.8</u>	7.26E17	0.3559	-10	<u>51.5</u> <u>43.7</u>	0	17	34	<u>75.5</u> <u>68</u>
Inlet Nozzle R2702-4	<u>0.1846</u> 0.16	0.795	<u>145.0</u> <u>122.9</u>	7.26E17	0.3559	-10	<u>51.6</u> <u>43.7</u>	0	17	34	<u>75.6</u> <u>68</u>
Outlet Nozzle R2703-1	<u>0.1846</u> 0.16	0.64	<u>139.2</u> <u>119</u>	7.26E17	0.3559	-10	<u>49.5</u> <u>42.4</u>	0	17	34	<u>73.5</u> <u>66</u>
Outlet Nozzle R2703-2	<u>0.1846</u> 0.16	0.67	<u>140.3</u> <u>119.8</u>	7.26E17	0.3559	10	<u>49.9</u> <u>42.6</u>	0	17	34	<u>93.9</u> <u>87</u>
Outlet Nozzle R2703-3	<u>0.1846</u> 0.16	0.675	<u>140.5</u> <u>119.9</u>	7.26E17	0.3559	10	<u>50.0</u> <u>42.7</u>	0	17	34	<u>94.0</u> <u>87</u>
Outlet Nozzle R2703-4	<u>0.1846</u> 0.16	0.66	<u>139.9</u> <u>119.5</u>	7.26E17	0.3559	0	<u>49.8</u> <u>42.5</u>	0	17	34	<u>83.8</u> <u>77</u>

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RPV Material	Cu (Wt. %)	Ni (Wt. %)	CF (°F)	Fluence (n/cm ²) ⁽¹⁾	FF	$RT_{NDT(U)}$ (°F)	ΔRT_{NDT} (°F)	σ_U (°F)	σ_D (°F)	M (°F)	RT_{PTS} (°F)
Nozzle Shell to Intermediate Shell Weld Seam	0.04	1.005	54	7.26E17	0.3559	-60	19.2	0	9.6	19.2	-22
Inlet Nozzle to Shell Weld Seams	0.163	0.035	74.6	7.26E17	0.3559	-40	26.5	0	13.3	26.5	13
Outlet Nozzle to Shell Weld Seams	0.163	0.035	74.6	7.26E17	0.3559	-40	26.5	0	13.3	26.5	13
Nozzle Shell Long Weld Seams	0.035	1.005	47.5	7.26E17	0.3559	-40	16.9	0	8.5	16.9	-6

¹ Fluence values are based on the limiting beltline and extended beltline fluence.

² The limiting RT_{PTS} value for the axially oriented welds and plates is 120°F, which corresponds to the Lower Shell Plate R2708-3. Note that the Lower Shell Plate R2708-1 resulted in a higher RT_{PTS} value of 141°F when the surveillance data was not used; however, the Lower Shell Plate R2708-1 RT_{PTS} value is 100°F when the credible surveillance data was used. Thus, taking credit for the Lower Shell Plate R2708-1 credible surveillance data, the limiting material of the axially oriented welds and plates is the Lower Shell Plate R2708-3.