VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

October 15, 2002

United States Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

Serial No.: 02-601
LR/DWL R0
Docket Nos.: 50-280/281
50-338/339
License Nos.: DPR-32/37
NPF-4/7

Gentlemen:

VIRGINIA ELECTRIC AND POWER COMPANY (DOMINION)
SURRY AND NORTH ANNA POWER STATIONS UNITS 1 AND 2
RESPONSE TO REQUEST FOR SUPPLEMENTAL INFORMATION
LICENSE RENEWAL APPLICATIONS

Dominion and the NRC staff have engaged in a series of discussions regarding the Surry and North Anna reactor vessel integrity evaluations applicable to the license renewal period. During these discussions, the NRC staff requested various details of the Dominion evaluations for the Surry and North Anna reactor vessels to facilitate staff confirmatory evaluations. Preliminary responses were provided via e-mail and subsequent phone conversations. The formal response to the staff's request for North Anna Units 1 and 2 is presented in Attachment 1. The formal response to the staff's request for Surry Units 1 and 2 is presented in Attachment 2. The attached information provides reasonable assurance that the Surry and North Anna reactor vessels can comply with 10CFR50.61, 10CFR50 Appendix G, 10CFR50 Appendix H, and can safely operate during the period of the renewed license.

Should you have any questions regarding this submittal, please contact Mr. J. E. Wroniewicz at (804) 273-2186.

Very truly yours,

Leslie N. Hartz
Vice President – Nuclear Engineering

Attachment
Commitments made in this letter: None

A086

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COMMONWEALTH OF VIRGINIA)
)
COUNTY OF HENRICO)

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by Leslie N. Hartz, who is Vice President - Nuclear Engineering, of Virginia Electric and Power Company. She has affirmed before me that she is duly authorized to execute and file the foregoing document in behalf of that Company, and that the statements in the document are true to the best of her knowledge and belief.

Acknowledged before me this 15th day of October, 2002.

My Commission Expires: March 31, 2004.

Maggie McClure
Notary Public

(SEAL)

Attachment 1

License Renewal – Supplemental Information
Serial No. 02-601

North Anna Power Station, Units 1 and 2
License Renewal Applications

Virginia Electric and Power Company
(Dominion)

REACTOR VESSEL NEUTRON EMBRITTLEMENT – NORTH ANNA

The following information concerning Reactor Vessel Beltline Neutron Fluence, Pressurized Thermal Shock, Charpy Upper Shelf Energy, and Limits for Heatup and Cooldown was prepared in support of North Anna license renewal application. This information demonstrates an ability to comply with applicable regulations governing reactor vessel integrity including 10 CFR 50 Appendix G, 10 CFR 50 Appendix H, and 10 CFR 50.61 during a postulated 20-year license renewal period.

1. Calculated Beltline Fluence

The reactor vessel beltline neutron fluence values applicable to a postulated 20 year license renewal period were calculated using the Virginia Power Reactor Vessel Fluence Methodology Topical Report [Ref. 1]. The methodology described in that report was developed in accordance with Draft Regulatory Guide DG 1053 [Ref. 2]. The reactor vessel fluence calculational methodology was benchmarked using a combination of Virginia Power surveillance capsules, pressure vessel simulator measurements, and Surry Unit 1 ex-vessel cavity dosimetry measurements.

The underlying requirement of DG-1053 is that the fluence determination should be made on a plant-specific, best-estimate basis rather than on a generic conservative basis. The methodology used to determine the best-estimate fluence must be demonstrated to have an associated uncertainty of ±20 percent at the 1-sigma level. This level of uncertainty is consistent with the assumptions made in the development of the Pressurized Thermal Shock (PTS) screening criteria for vessel welds and plates.

The fluence analyses performed in accordance with the approved Topical Report VEP-NAF-3-A used ENDF/B-VI cross sections. Specifically, the discrete-ordinates calculations used the BUGLE-93 cross section library and the Monte Carlo calculations used the MCNPDAT6 cross section library. These cross sections do not introduce the biases in calculated fluences that have been seen when using earlier cross section libraries (libraries based on END/B-IV and early ENDF/B-V cross sections).

More generally, Dominion's methodology as documented in VEP-NAF-3-A was benchmarked against the PCA experimental results, measured in-vessel dosimetry results, and measured ex-vessel dosimetry results. These benchmark results, along with analytical uncertainty estimates, demonstrate that the methodology has an uncertainty of less than 20% (1 sigma).

Table 1-A presents calculated peak neutron fluence values for the North Anna Unit 1 and Unit 2 reactor pressure vessels at the beginning and end of the license renewal period (BOLRP and EOLRP). Tables 1-B and 1-C present calculated peak neutron

fluence values for individual reactor vessel beltline materials at EOLRP for Units 1 and 2, respectively.

Table 1-A
Calculated Peak Fluence Values

	1	2
North Anna Unit Number	1	2
EFPY at BOLRP	32.3	34.3
EFPY at EOLRP	50.3	52.3
Fluence* at Clad/Base Metal Interface		
BOLRP	3.920	3.960
EOLRP	5.900	5.910
Fluence* at ¼ of wall thickness		
BOLRP	2.446	2.471
EOLRP	3.681	3.687
Fluence* at ¾ of wall thickness		
BOLRP	0.952	0.962
EOLRP	1.433	1.435

*Note: All fluence values are in units of 10^{19}n/cm^2 (E > 1.0 Mev)

Table 1-B
North Anna Unit 1 EOLRP Fluence Values

RPV Weld Wire Heat or Material ID	Location	Inner Surface Fluence*	¼-T Fluence*	¾-T Fluence*
990286/295213	Nozzle Shell Forging	0.211	0.132	0.051
990311/298244	Intermediate Shell Forging	5.900	3.681	1.433
990400/292332	Lower Shell Forging	5.900	3.681	1.433
25295	Nozzle to Int. Shell Circ Weld (0D 94%)	0.211	0.132	0.051
4278	Nozzle to Int. Shell Circ Weld (ID 6%)	0.211	0.132	0.051
25531	Int. to Lower Shell Circ Weld	5.900	3.681	1.433

*Note: All fluence values are in units of 10^{19}n/cm^2 (E > 1.0 Mev)

Table 1-C
North Anna Unit 2 EOLRP Fluence Values

RPV Weld Wire Heat or Material ID	Location	Inner Surface Fluence*	¼-T Fluence*	¾-T Fluence*
990598/291396	Nozzle Shell Forging	0.225	0.140	0.055
990496/292424	Intermediate Shell Forging	5.910	3.687	1.435
990533/297355	Lower Shell Forging	5.910	3.687	1.435
4278	Nozzle to Int. Shell Circ Weld (0D 94%)	0.225	0.140	0.055
801	Nozzle to Int. Shell Circ Weld (ID 6%)	0.225	0.140	0.055
716126	Int. to Lower Shell Circ Weld	5.910	3.687	1.435

*Note: All fluence values are in units of 10^{19}n/cm^2 (E > 1.0 Mev)

2. Pressurized Thermal Shock

The following values were calculated in accordance with 10 CFR 50.61.

Table 2
North Anna Unit 1 Values of RT_{PTS} at 50.3 EFPY

Limiting Materials	Inter. Shell 990311/ 298244	Lower Shell 990400/ 292332	Circ. Weld 25531
Initial Ref. NDT Temp. (°F)	17	38	19
Copper Content (%)	0.12	0.16	0.11
Nickel Content (%)	0.82	0.83	0.13
Table* Chemistry Factor (°F)	86.0		
Table* Margin (°F)	34		
Table* Ref. PTS Temp. (°F)	174.3		
S/C** Chemistry Factor (°F)		88.9	93.1
S/C** Margin (°F)		17	28
S/C** Ref. PTS Temp. (°F)		182.5	180.4

Table 3
North Anna Unit 2 Values of RT_{PTS} at 52.3 EFPY

Limiting Materials	Inter. Shell 990496/ 292424	Lower Shell 990533/ 297355	Circ. Weld 716126
Initial Ref. NDT Temp. (°F)	75	56	-48
Copper Content (%)	0.10	0.13	0.07
Nickel Content (%)	0.85	0.83	0.05
Table* Chemistry Factor (°F)	67.0	96.0	
Table* Margin (°F)	34	34	
Table* Ref. PTS Temp. (°F)	205.1	227.7	
S/C** Chemistry Factor (°F)			10.4
S/C** Margin (°F)			14.9
S/C** Ref. PTS Temp. (°F)			-18.2

*Table refers to Tables 1 and 2 in Reg. Guide 1.99 Rev. 2 [Ref. 3]
**Note: Chemistry factor determined using credible surveillance capsule (S/C) data.

3. Upper Shelf Energy

The requirements on upper shelf energy are included in 10 CFR 50, Appendix G. 10 CFR 50, Appendix G requires utilities to submit an analysis at least 3 years prior to the time that the upper shelf energy of any of the RPV material is predicted to drop below 50 ft-lb, as measured by Charpy V-notch specimen testing.

There are two methods that can be used to estimate the change in upper shelf energy (USE) with irradiation, depending on the availability of credible surveillance capsule data as defined in Revision 2 of Regulatory Guide 1.99. For vessel beltline materials that are not in the surveillance program or not credible, the Charpy upper shelf energy is assumed to decrease as a function of fluence and copper content, as indicated in Regulatory Guide 1.99, Revision 2 [Ref. 3].

When two or more credible surveillance data sets become available from the reactor, they may be used to determine the Charpy USE of the surveillance material. The surveillance data are then used in conjunction with the Regulatory Guide data to predict the change in USE of the RPV due to irradiation.

Using the ¼ thickness fluence of Section 1, the values of upper shelf energy (USE) in Tables 4 and 5 were calculated for the North Anna Unit 1 and Unit 2 reactor pressure vessels at the end of the license renewal period being evaluated.

Table 4
North Anna Unit 1 USE Values at 50.3 EFPY

Limiting Materials	Inter. Shell 990311/ 298244	Lower Shell 990400/ 292332	Circ. Weld 25531
Initial USE Value (ft-lbs)*	92	85	102
Decrease (%)	28	34	34
USE Value (ft-lbs)	65.9	56.5	67.8

*Note: Initial values are measured.

Table 5
North Anna Unit 2 USE Values at 52.3 EFPY

Limiting Materials	Inter. Shell 990496/ 292424	Lower Shell 990533/ 297355	Circ. Weld 716126
Initial USE Value (ft-lbs)*	74	80	107
Decrease (%)	26	30	28
USE Value (ft-lbs)	54.8	56.3	76.6

*Note: Initial values are measured.

As shown by these results, the upper shelf energy (USE) values at the end of the license renewal period are greater than the NRC (10CFR50) Appendix G requirement of 50 foot-pounds for the limiting materials.

4. **Limits for Heatup and Cooldown**

Figure 1 presents the heatup curves, without margin for instrumentation errors, for a maximum rate of 60°F/hour for the limiting material in the North Anna Units 1 and 2 reactor pressure vessel beltline. Note on these curves, that moderator temperature is Reactor Coolant System water temperature. Likewise, Figure 2 presents the cooldown curves, without margin for instrumentation errors, for a maximum rate of 100°F/hour for the limiting material in the North Anna Units 1 and 2 reactor pressure vessel beltline. The heatup curves of Figure 1 and the cooldown curves of Figure 2 are based upon the limiting adjusted reference temperature (ART) values from Tables 6 and 7; and are valid for up to 50.3 EFPY in Unit 1 and for up to 52.3 EFPY in Unit 2. Since these curves provide sufficient margin on the operating window relative to the pump seal requirements, no additional actions are required for the license renewal periods of North Anna Unit 1 and Unit 2.

Maximum allowable low temperature over-pressure protection system (LTOPS) power operated relief valve (PORV) setpoints have been developed which bound both North Anna Units 1 and 2. They were developed based on end of license renewal heatup and cooldown curves using the current Westinghouse methodology [Ref. 5]. The setpoints conservatively account for instrument uncertainties and the pressure difference between the wide range pressure transmitter and the reactor vessel limiting beltline region.

The following PORV setpoints, which depend upon the reactor coolant system (RCS) temperature, will provide adequate margin to the North Anna Units 1 and 2 Appendix G limits throughout a 20 year license renewal period with no restrictions on the number of RCPs running:

RCS Temperature	PORV Setpoint
$T_{RCS} \leq 130°F$	395 psig
$130°F \leq T_{RCS} \leq 305°F$	450 psig

Table 6
North Anna Unit 1 ART Values at 50.3 EFPY

Beltline Materials	ART at ¼ T	ART at ¾ T
Intermed. Shell Forging 990311/298244		
Table* Chemistry Factor	166.1 °F	145.6 °F
Lower Shell Forging 990400/292332		
S/C** Chemistry Factor	174.0 °F	152.8 °F
Circumferential Weld 25531		
S/C** Chemistry Factor	171.5 °F	149.4 °F

*Table refers to Tables 1 and 2 in Reg. Guide 1.99 Rev. 2 [Ref. 3]
**Note: Chemistry factor determined using credible surveillance capsule (S/C) data.

Table 7
North Anna Unit 2 ART Values at 52.3 EFPY

Beltline Materials	ART at ¼ T	ART at ¾ T
Intermed. Shell Forging 990496/292424		
Table* Chemistry Factor	198.7 °F	182.7 °F
Lower Shell Forging 990533/297355		
S/C** Chemistry Factor	218.5 °F	195.6 °F
Circumferential Weld 716126		
S/C** Chemistry Factor	-19.2 °F	-21.7 °F

*Table refers to Tables 1 and 2 in Reg. Guide 1.99 Rev. 2 [Ref. 3]
**Note: Chemistry factor determined using credible surveillance capsule (S/C) data.

5. Reactor Vessel Surveillance Program

The revised North Anna Unit 1 and 2 surveillance capsule withdrawal schedules [Ref. 4], which include provisions for license renewal, in the form of footnotes, are provided in Tables 8 and 9, respectively. Dominion anticipates implementation of the recommendation of GALL report for the withdrawal of the final plant-specific surveillance capsules.

Conclusion:

The aforementioned information demonstrates an ability to comply with applicable regulations during a postulated 20-year license renewal period. Required analysis will be performed and implemented in accordance with the requirements of the applicable regulations, and in anticipation of the expiration of affected plant Technical Specifications.

Table 8
SURVEILLANCE CAPSULE WITHDRAWAL SCHEDULE[1] FOR NORTH ANNA UNIT 1

Capsule Ident.	Capsule Location[2]	Lead Factor[3]	Capsule Status[4]	Estimated Withdrawal EFPY/Year	Insert EFPY/Year	Est. Capsule Fluence ($x10^{19}$)[5]
V	165°	1.6	Active	1.1/1979	NA	0.30
U	65°	1.0	Active	5.90/1987	NA	0.88
W	245°	1.03	Active	14.7/1998	NA	2.04
Z Z Z	305° 165° 165°	0.69 1.6 1.6	Active[6]	16.1/2000 NA EOL/2018	NA 16.1/2000 NA	1.48 1.48 4.64
T T T	55° 245° 245°	0.69 1.03 1.03	Standby[7]	16.1/2000 NA NA	NA 16.1/2000 NA	1.48 1.48 3.52 (EOL)
Y	295°	1.03	Standby[7]	NA	NA	4.24 (EOL)
S	45°	0.55	Standby[7]	NA	NA	2.27 (EOL)
X	285°	1.6	Standby[7]	EOL/2018	NA	6.59

[1] Withdrawal schedule meets requirements of ASTM E-185-82, "Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels," dated July 1, 1982.

[2] See North Anna UFSAR Figure 5.4-4 for original capsule installation locations.

[3] *Lead Factor* is defined in ASTM E-185-82 as *the ratio of the neutron flux density at the location of the specimens in a surveillance capsule to the neutron flux density at the reactor pressure vessel inside surface at the peak fluence location.*

[4] Capsules required to satisfy the requirements of ASTM E-185-82 during the current license period are designated *Active*. Capsules not required by ASTM E-185-82, but which are maintained for contingencies, are designated *Standby*.

[5] Surveillance capsule neutron fluence estimates based on fluence analysis presented in WCAP-11777, "Analysis of Capsule U from the Virginia Electric and Power Company North Anna Unit 1 Reactor Vessel Radiation Surveillance Program," dated February 1988.

[6] Capsule X may be withdrawn at EOL in lieu of Capsule Z to satisfy ASTM E-185-82 fourth capsule requirement for the current license period.

[7] Capsules T, Y, S, and X are available to satisfy potential fluence monitoring requirements during a postulated 20 year license renewal period.

Table 9
SURVEILLANCE CAPSULE WITHDRAWAL SCHEDULE[8] FOR NORTH ANNA UNIT 2

Capsule Ident.	Capsule Location[9]	Lead Factor[10]	Capsule Status[11]	Estimated Withdrawal EFPY/Year	Insert EFPY/Year	Est. Capsule Fluence ($x10^{19}$)[12]
V	165°	1.66	Active	1.0/1982	NA	0.25
U	65°	1.19	Active	6.3/1989	NA	1.07
W	245°	1.19	Active	15.3/1999	NA	2.58
Z Z Z	305° 165° 165°	0.81 1.66 1.66	Standby[13]	15.3/1999 NA NA	NA 15.3/1999 NA	1.76 1.76 5.82 (EOL)
T T T	55° 65° 65°	0.81 1.19 1.19	Standby[13]	15.3/1999 NA NA	NA 15.3/1999 NA	1.76 1.76 4.67 (EOL)
Y	295°	1.19	Standby[13]	NA	NA	5.50 (EOL)
S	45°	0.65	Standby[13]	NA	NA	3.00 (EOL)
X	285°	1.72	Active[14]	EOL/2020	NA	7.95

[8] Withdrawal schedule meets requirements of ASTM E-185-82, "Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels," dated July 1, 1982.

[9] See North Anna UFSAR Figure 5.4-4 for original capsule installation locations.

[10] *Lead Factor* is defined in ASTM E-185-82 as *the ratio of the neutron flux density at the location of the specimens in a surveillance capsule to the neutron flux density at the reactor pressure vessel inside surface at the peak fluence location.*

[11] Capsules required to satisfy the requirements of ASTM E-185-82 during the current license period are designated *Active*. Capsules not required by ASTM E-185-82, but which are maintained for contingencies, are designated *Standby*.

[12] Surveillance capsule neutron fluence estimates based on fluence analysis presented in WCAP-12497, "Analysis of Capsule U from the Virginia Electric and Power Company North Anna Unit 2 Reactor Vessel Radiation Surveillance Program," dated January 1990.

[13] Capsules Z, T, Y, and S are available to satisfy potential fluence monitoring requirements during a postulated 20 year license renewal period. Capsule Y may be withdrawn in lieu of capsule X to satisfy ASTM E-185-82 fourth capsule requirement for the current license period.

[14] Withdrawal of Capsule X at EOL satisfies ASTM E-185-82 requirement for EOL capsule, and provide material properties data at a fluence which exceeds that expected to be achieved at the end of a postulated 20 year license renewal period.

MATERIAL PROPERTY BASIS

LIMITING MATERIAL: Lower Shell Forging
LIMITING ART VALUES AT EOLR: 1/4T, 218.5°F
3/4T, 195.6°F

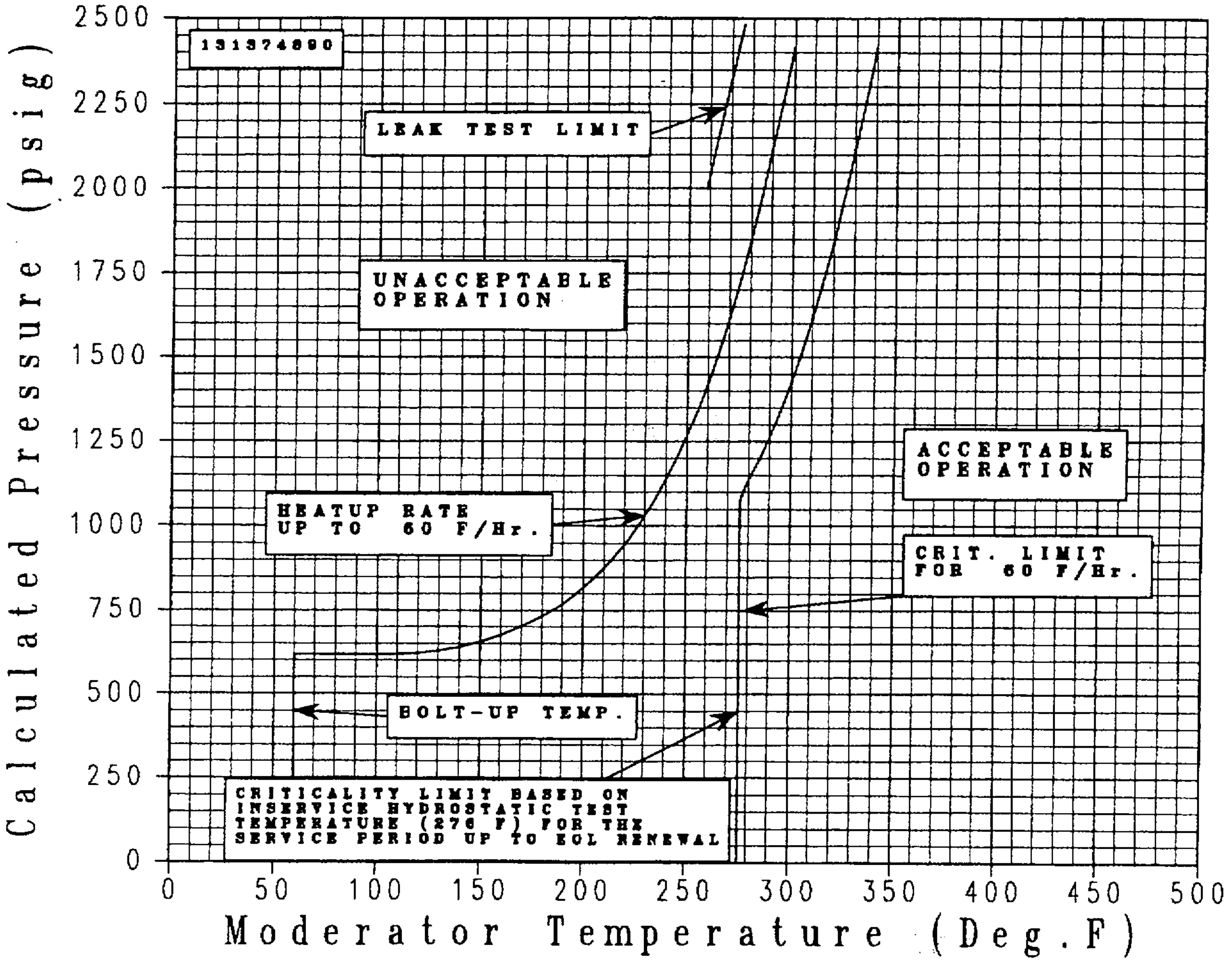

Figure - 1 North Anna Units 1 and 2 Reactor Coolant System Heatup Limitations (Heatup Rates up to 60°F/hour With Margins of 0 °F and 0 psi for Instrumentation Errors) Applicable to the End of License Renewal Period

MATERIAL PROPERTY BASIS

LIMITING MATERIAL: Lower Shell Forging
LIMITING ART VALUES AT EOLR: 1/4T, 218.5°F
3/4T, 195.6°F

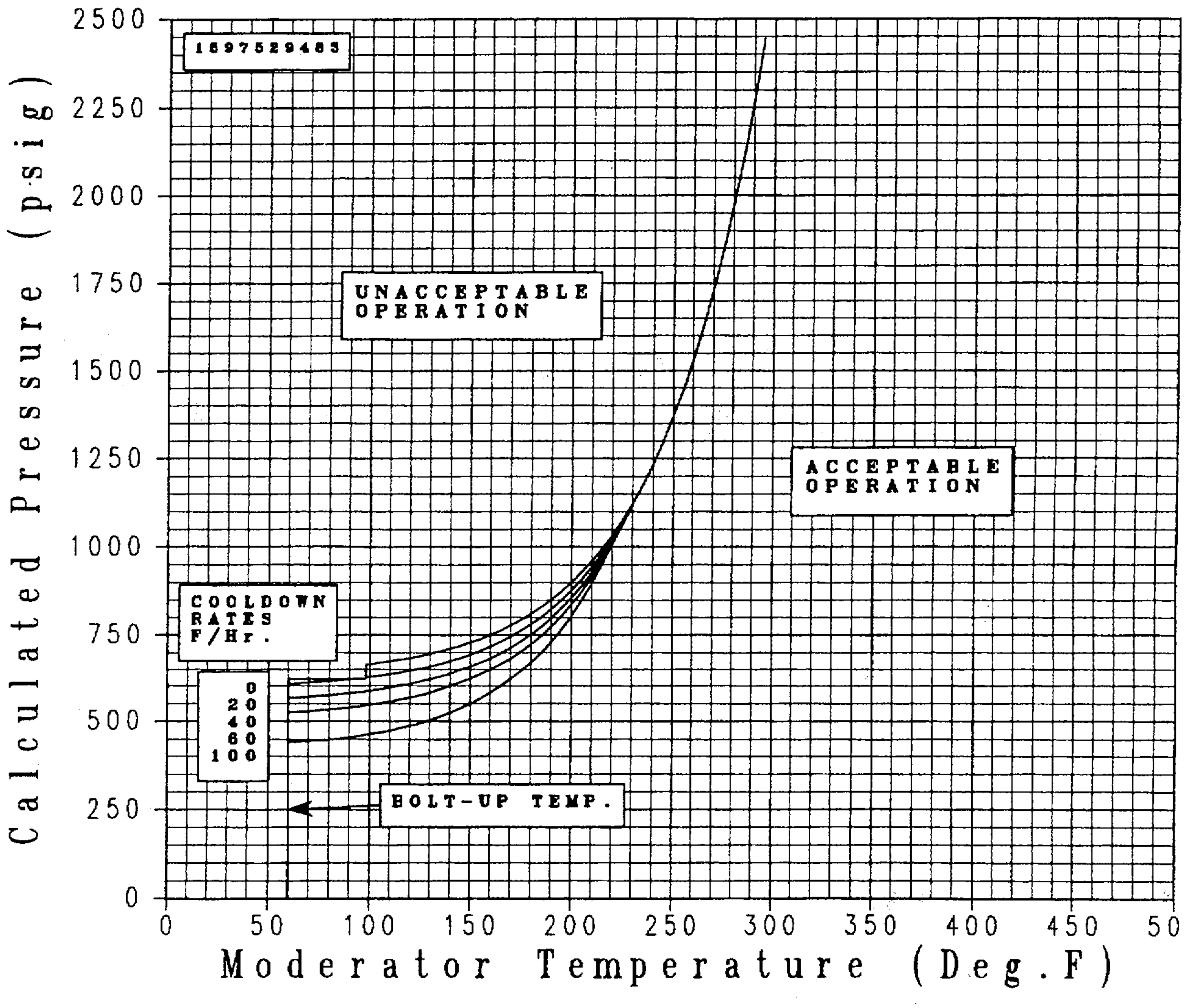

Figure - 2 North Anna Units 1 and 2 Reactor Coolant System Cooldown Limitations (Cooldown Rates up to 100°F/hour With Margins of 0 °F and 0 psi for Instrumentation Errors) Applicable to the End of License Renewal Period

References:

1. Virginia Power Topical Report VEP-NAF-3A, "Reactor Vessel Fluence Analysis Methodology," dated November, 1997.

2. Draft Regulatory Guide DG-1053, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence," June 1996 previous draft was DG-1025, September 1993.

3. NRC Reg. Guide 1.99 Revision 2, "Radiation Embrittlement of Reactor Vessel Materials," May, 1988.

4. Letter from J. P. O'Hanlon to USNRC, "Virginia Electric and Power Company, North Anna Power Station Units 1 and 2, Reactor Vessel Surveillance Capsule Withdrawal Schedules," Serial No. 98-646, dated December 17, 1998.

5. WCAP-14040-NP-A, Rev. 2, Methodology Used to Develop Cold Overpressure Mitigating System Setpoints and RCS Heatup and Cooldown Limit Curves, January 1996.

Attachment 2

License Renewal – Supplemental Information
Serial No. 02-601

Surry Power Station, Units 1 and 2
License Renewal Applications

Virginia Electric and Power Company
(Dominion)

REACTOR VESSEL NEUTRON EMBRITTLEMENT - SURRY

The following information concerning Reactor Vessel Beltline Neutron Fluence, Pressurized Thermal Shock, Charpy Upper Shelf Energy, and Limits for Heatup and Cooldown was prepared in support of Surry license renewal application. This information demonstrates an ability to comply with applicable regulations governing reactor vessel integrity including 10 CFR 50 Appendix G, 10 CFR 50 Appendix H, and 10 CFR 50.61 during a postulated 20-year license renewal period.

1. Calculated Beltline Fluence

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The underlying requirement of DG-1053 is that the fluence determination should be made on a plant-specific, best-estimate basis rather than on a generic conservative basis. The methodology used to determine the best-estimate fluence must be demonstrated to have an associated uncertainty of ±20 percent at the 1-sigma level. This level of uncertainty is consistent with the assumptions made in the development of the Pressurized Thermal Shock (PTS) screening criteria for vessel welds and plates.

The fluence analyses performed in accordance with the approved Topical Report VEP-NAF-3-A used ENDF/B-VI cross sections. Specifically, the discrete-ordinates calculations used the BUGLE-93 cross section library and the Monte Carlo calculations used the MCNPDAT6 cross section library. These cross sections do not introduce the biases in calculated fluences that have been seen when using earlier cross section libraries (libraries based on END/B-IV and early ENDF/B-V cross sections).

More generally, Dominion's methodology as documented in VEP-NAF-3-A was benchmarked against the PCA experimental results, measured in-vessel dosimetry results, and measured ex-vessel dosimetry results. These benchmark results, along with analytical uncertainty estimates, demonstrate that the methodology has an uncertainty of less than 20% (1 sigma).

Table 1-A presents calculated peak neutron fluence values for the Surry Unit 1 and Unit 2 reactor pressure vessels at the beginning and end of the license renewal period (BOLRP and EOLRP). Tables 1-B and 1-C present calculated peak neutron fluence values for individual reactor vessel beltline materials at EOLRP for Units 1 and 2, respectively.

Table 1-A
Calculated Peak Fluence Values

Surry Unit Number	1	2
EFPY at BOLRP	29.6	30.1
EFPY at EOLRP	47.6	48.1
Fluence* at Clad/Base Metal Interface		
BOLRP	3.530	3.520
EOLRP	5.400	5.340
Fluence* at ¼ of wall thickness		
BOLRP	2.154	2.147
EOLRP	3.294	3.258
Fluence* at ¾ of wall thickness		
BOLRP	0.802	0.799
EOLRP	1.226	1.213

*Note: All fluence values are in units of 10^{19}n/cm^2 (E > 1.0 MeV)

Table 1-B
Surry Unit 1 EOLRP Fluence Values

RPV Weld Wire Heat or Material ID	Location	Inner Surface Fluence*	¼-T Fluence*	¾-T Fluence*
122V109VA1	Nozzle Shell Forging	0.496	0.303	0.113
C4326-1	Intermediate Shell	5.400	3.294	1.226
C4326-2	Intermediate Shell	5.400	3.294	1.226
4415-1	Lower Shell	5.400	3.294	1.226
4415-2	Lower Shell	5.400	3.294	1.226
J726/25017	Nozzle to Int Shell Circ Weld	0.496	0.303	0.113
SA-1585/72445	Int. to Low Sh. Circ (ID 40%)	4.700	2.867	1.067
SA-1650/72445	Int. to Low Sh. Circ (OD 60%)	4.700	2.867	1.067
SA-1494/8T1554	Int Shell Long. Welds L3 & L4	0.914	0.558	0.208
SA-1494/8T1554	Lower Shell Long. Weld L1	0.790	0.482	0.179
SA-1526/299L44	Lower Shell Long. Weld L2	0.790	0.482	0.179

*Note: All fluence values are in units of 10^{19}n/cm^2 (E > 1.0 Mev)

Note: Results reflect presence of part-length hafnium flux suppression inserts installed in Surry Unit 1 reload cores.

Table 1-C
Surry Unit 2 EOLRP Fluence Values

RPV Weld Wire Heat or Material ID	Location	Inner Surface Fluence*	¼-T Fluence*	¾-T Fluence*
123V303VA1	Nozzle Shell Forging	0.471	0.287	0.107
C4331-2	Intermediate Shell	5.340	3.258	1.213
C4339-2	Intermediate Shell	5.340	3.258	1.213
C4208-2	Lower Shell	5.340	3.258	1.213
C4339-1	Lower Shell	5.340	3.258	1.213
L737/4275	Nozzle to Int Shell Circ Weld	0.471	0.287	0.107
R3008/0227	Int. to Lower Shell Circ Weld	5.340	3.258	1.213
WF-4/8T1762	Int. Shell Long. L4 (ID 50%)	1.080	0.659	0.245
SA-1585/72445	Int. Sh. L3 (100%), L4 (OD 50%)	1.080	0.659	0.245
WF-4/8T1762	LS L2 (ID 63%), L1 (100%)	1.080	0.659	0.245
WF-8/8T1762	LS Long. Weld L2 (OD 37%)	1.080	0.659	0.245

*Note: All fluence values are in units of 10^{19}n/cm^2 (E > 1.0 MeV)

2. Pressurized Thermal Shock

The following values were calculated in accordance with 10 CFR 50.61.

Table 2
Surry Unit 1 Values of RT_{PTS} at 47.6 EFPY

Limiting Materials	Lower Shell 4415-1	Circ. Weld 72445	Long. Weld 299L44
Initial Ref. NDT Temp. (°F)	20	- 5	- 7
Copper Content (%)	0.11	0.22	0.34
Nickel Content (%)	0.50	0.54	0.68
Surface Fluence (10^{19}n/cm^2)	5.40	4.70	0.79
Table* Chemistry Factor (°F)			220.6
Table* Margin (°F)			69.5
Table* Ref. PTS Temp. (°F)			268.5
S/C** Chemistry Factor (°F)	85.0	138.0	
S/C** Margin (°F)	17.0	48.3	
S/C** Ref. PTS Temp. (°F)	157.4	235.2	

Table 3
Surry Unit 2 Values of RT_{PTS} at 48.1 EFPY

Limiting Materials	Lower Shell C4208-2	Circ. Weld 0227	Long. Weld 8T1762
Initial Ref. NDT Temp. (°F)	-30	0	- 5
Copper Content (%)	0.15	0.19	0.19
Nickel Content (%)	0.55	0.55	0.57
Surface Fluence (10^{19}n/cm^2)	5.34	5.34	1.08
Table* Chemistry Factor (°F)	107.3		152.4
Table* Margin (°F)	34.0		68.5
Table* Ref. PTS Temp. (°F)	155.8		219.1
S/C** Chemistry Factor (°F)		128.0	
S/C** Margin (°F)		48.8	
S/C** Ref. PTS Temp. (°F)		230.0	

*Table refers to Tables 1 and 2 in Reg. Guide 1.99 Rev. 2 [Ref. 3]
**Note: Chemistry factor determined using credible surveillance capsule (S/C) data [Ref. 4].

Because the value of the RT_{PTS} for weld material SA-1526 (i.e., 299L44) is only slightly lower than the PTS screening criterion of 270°F, NRC staff requested confirmation of the basis for selecting the RG 1.99 Revision 2 [Ref. 3] Position 1.1 chemistry factor in lieu of the chemistry factor determined in accordance with Position 2.1 based on available surveillance data. In addition, the NRC requested confirmation that the neutron fluence values for surveillance capsules containing weld material fabricated with the same weld wire heat as SA-1526 were developed with methods that meet the requirements of RG 1.190, "Calculational and Dosimetry Methods For Determining Pressure Vessel Neutron Fluence." An evaluation of the surveillance capsule neutron fluence values, and the basis for the selected Chemistry Factor are provided below.

Dominion contracted Framatome to confirm that the neutron fluence values associated with surveillance capsules containing weld material fabricated with weld wire heat number 299L44 were developed in a manner consistent with their approved topical methodology, BAW-2241P-A [Ref. 7], which complies with the requirements of RG 1.190. If such confirmation could not be provided, Framatome was requested to provide RG 1.190-compliant fluence values using the methodology of BAW-2241P-A [Ref. 7]. [Ref. 22] presents the results of the Framatome surveillance capsule fluence analyses and evaluations. The surveillance capsule neutron fluence values presented in [Ref. 22] were verified as compliant with the requirements of BAW-2241P-A and RG 1.190, and are used in the RG 1.99 Revision 2 Position 2.1 calculations presented in Appendices A through E. Table 10 presents a comparison between the previously submitted fluence values and the revised RG 1.190-compliant fluences.

In addition to the fluence calculations, Framatome performed a fabrication records search to confirm the nature and origin of both the Surry 1 longitudinal weld L2 and the Surry 1 surveillance weld material. The results of their records search are presented in [Ref. 23]. Their record search confirmed that the Surry Unit 1 reactor vessel lower shell longitudinal weld seam (designated "L2") was fabricated with weld wire heat 299L44 and flux lot 8596. Fabrication records for surveillance weld material indicate that the same weld wire heat and flux lot as the second longitudinal weld seam were used in the construction of the surveillance weld. It also appears that the surveillance weld seam was fabricated along with the shell longitudinal seam, as Weld Control Records show that the same welder did the welding process for both parts on the same days and at the same times, using the same machine. The surveillance material received the same heat treatment as the shell, and shipping records indicate that the surveillance material was sent to Rotterdam. This is evidence suggests that measured values of ΔRT_{NDT} obtained from Surry Unit 1 surveillance material are unbiased estimators of the irradiated behavior of the Surry Unit 1 reactor vessel beltline material fabricated from the same heat of weld wire, and that no adjustments for irradiation temperature or chemical composition variability are required for determination of surveillance material credibility or for application of the surveillance data to evaluate the beltline material. When evaluated in this manner, and with the revised RG-1.190-compliant surveillance capsule fluence values presented in [Ref. 22], the Surry Unit 1 surveillance data is determined to be credible (so the ΔRT_{NDT} margin term may be divided by 2), and a RG 1.99 Revision 2 Position 2.1 Chemistry Factor of 215.8°F is calculated. (See Appendix D.) The resulting RT_{PTS} value would be conservatively bounded by that presented in Table 2 for the SA-1526/299L44 beltline material. Because the surveillance weld is representative of the reactor vessel beltline weld, and the surveillance data is credible, a Chemistry Factor of 215.8°F is applicable to the Surry Unit 1 weld fabricated with weld wire heat number 299L44.

The NRC requested that Dominion perform several additional RG 1.99 Revision 2 Position 2.1 calculations using all available surveillance data applicable to weld wire heat number 299L44 in order to verify the conservatism of the Chemistry Factor used to evaluate the Surry Unit 1 beltline material fabricated with weld wire heat number 299L44. The results of the requested calculations are presented in Appendices A, B, and C. Calculations were performed under the following conditions:

A. The data credibility evaluation was performed with corrections for differences in irradiation temperature and chemical composition. The evaluation of the conservatism of using the Position 1.1 Chemistry Factor to evaluate the beltline weld material (i.e., verification that the difference between measured and predicted RT_{NDT} shift values is less than $2\sigma_{\Delta}$, or 56°F) was performed using a trend curve based on the RG 1.99 Revision 2 Position 1.1 Chemistry Factor for the mean surveillance material chemical composition.

B. Calculations were performed without corrections for differences in irradiation temperature and chemical composition. The evaluation of the conservatism of using the Position 1.1 Chemistry Factor to evaluate the beltline weld material was, again, performed using a trend curve based on the RG 1.99 Revision 2 Position 1.1 Chemistry Factor for the mean surveillance material chemical composition.

C. Calculations were performed without corrections for differences in irradiation temperature and chemical composition. The evaluation of the conservatism of using the Position 1.1 Chemistry Factor to evaluate the beltline weld material was performed using trend curves based on RG 1.99 Revision 2 Position 1.1 Chemistry Factors for individual surveillance capsule chemical compositions.

For each of these conditions, the surveillance data were determined to be non-credible (i.e., one or more measured values of RT_{NDT} shift was determined to differ from the best-estimate ΔRT_{NDT} trend curve for the surveillance data by more than $1\sigma_{\Delta}$, or 28°F).

In Case A, use of the RG 1.99 Rev. 2 Position 1.1 chemistry factor was determined to be conservative for all surveillance data points.

In Case B, use of the RG 1.99 Rev. 2 Position 1.1 chemistry factor was determined to be non-conservative for only one surveillance data point. Since there are nine surveillance data points in the population and only one falls outside of $2\sigma_{\Delta}$, it is concluded that use of the RG 1.99 Revision 2 Position 1.1 Chemistry Factor to assess the beltline material is conservative.

In Case C, use of the RG 1.99 Rev. 2 Position 1.1 chemistry factor was determined to be non-conservative for only one surveillance data point. Again, because there are nine surveillance data points in the population and only one falls outside of $2\sigma_{\Delta}$, it is concluded that use of the RG 1.99 Revision 2 Position 1.1 Chemistry Factor to assess the beltline material is conservative.

A conservative means of assessing the possible effects of chemical variability is to assume that all surveillance specimens fabricated from weld wire heat 299L44 are unbiased estimators of the irradiated behavior of the Surry Unit 1 reactor vessel beltline material fabricated from the same heat of weld wire. Therefore, in addition to the evaluations requested by the NRC (i.e., Appendices A, B, and C) and the evaluation of Surry Unit 1 surveillance data only (Appendix D), Dominion performed an additional evaluation (Appendix E) under this assumption. Consistent with NRC guidance, a correction for differences in irradiation temperature was applied in the RG 1.99 Revision 2 Position 2.1 data credibility determination since all surveillance specimens in the data set were not irradiated in the same reactor vessel. Further, a correction for differences in irradiation temperature was applied for the application of surveillance data to the beltline material since the surveillance specimens were not irradiated in Surry Unit 1. Standard NRC practice requires the reactor vessel beltline material chemistry to be assumed to be the "mean for the heat" chemical composition. The calculation of the "mean for the heat" chemical composition is based on available material chemistry data for materials fabricated from the same heat of weld wire as the reactor vessel beltline. It follows that, if Surry Unit 1 SA-1526 beltline material is represented by the "mean for the heat" chemical composition of weld materials fabricated from weld wire heat 299L44, measured values of ΔRT_{NDT} obtained from surveillance specimens fabricated from weld wire heat 299L44 are unbiased estimators of the mean ΔRT_{NDT} trend for the Surry Unit 1 SA-1526 beltline material. This relationship remains valid regardless of how the measured chemical composition of surveillance materials compares to the best-estimate chemical composition of the reactor vessel beltline material. NUREG/CR-6551 [Ref. 20] provides further confirmation that individual 299L44 surveillance data points should be considered unbiased estimators of the mean irradiated behavior of the Surry Unit 1 SA-1526 beltline material. The discussion on Page 89 and Figure D.12 of Ref. 20 demonstrates that, for Linde 80 materials, Cu concentrations above 0.26% do not affect ΔRT_{NDT}.

The calculations summarized in Appendix E demonstrate that the surveillance data were determined to be non-credible and, again, only one of nine data points was determined to be non-conservative with respect to RG 1.99 Revision 2 Position 1.1 predictions. The chemistry factor based on the surveillance data (although non-credible) was determined to be 229.3 °F. This Chemistry Factor is not significantly different from either the RG 1.99 Revision 2 Position 2.1 Chemistry Factor based only on Surry Unit 1 surveillance data (i.e., 215.8°F), or the RG 1.99 Revision 2 Position 1.1 Chemistry Factor based on the "mean for the heat" chemical composition for welds fabricated with weld wire heat 299L44 (i.e., 220.6°F). Thus, the Appendix E evaluation provides further confirmation of the conservatism of RG 1.99 Revision 2 Position 1.1 calculations for this material, and of the assertion that measured values of ΔRT_{NDT} obtained from weld materials fabricated weld wire heat 299L44 may be considered unbiased estimators of the irradiated behavior of reactor vessel beltline material fabricated from the same heat of weld wire.

The RG 1.99 Revision 2 Position 2.1 ratio procedure requires the Chemistry Factor determined based on surveillance data to be increased by the ratio of the RG 1.99 Revision 2 Position 1.1 Chemistry Factor (based on the "mean for the heat" chemical composition) and the Position 1.1 Chemistry Factor for the surveillance material (based on the surveillance material mean chemical composition). The foregoing data and evaluations confirm that application of the RG 1.99 Revision 2 Position 2.1 ratio procedure to 299L44 surveillance data for its application to the Surry Unit 1 SA-1526 beltline material would be excessively conservative and unnecessary. Use of multiple (i.e., 9) surveillance data points in the Appendix E evaluation ensures that the possible effects of chemical composition variability have been addressed.

Framatome Topical Report BAW-2308 [Ref. 21] represents an additional source of analytical margin for the Surry 1 weld material fabricated with weld wire heat 299L44. This report provides a technical basis for reducing the Initial RT_{NDT} value for 299L44 materials from -7°F with a standard deviation of 20.6°F to –81.8°F with a standard deviation of 11.6°F. The RT_{PTS} margin provided by this topical, once approved, will support acceptable RT_{PTS} screening calculations well beyond the end of the proposed license renewal period.

The foregoing evaluations provide reasonable assurance that the Surry 1 reactor vessel can comply with 10CFR50.61 and can safely operate during the period of the renewed license.

3. Upper Shelf Energy

The requirements on upper shelf energy are included in 10 CFR 50, Appendix G. 10 CFR 50, Appendix G requires utilities to submit an analysis at least 3 years prior to the time that the upper shelf energy of any of the reactor pressure vessel (RPV) material is predicted to drop below 50 ft-lb, as measured by Charpy V-notch specimen testing.

There are two methods that can be used to estimate the change in upper shelf energy (USE) with irradiation, depending on the availability of credible surveillance capsule data as defined in Revision 2 of Regulatory Guide 1.99. For vessel beltline materials that are not in the surveillance program or not credible, the Charpy upper shelf energy is assumed to decrease as a function of fluence and copper content, as indicated in Regulatory Guide 1.99, Revision 2.

When two or more credible surveillance data sets become available from the reactor, they may be used to determine the Charpy USE of the surveillance material. The surveillance data are then used in conjunction with the Regulatory Guide data to predict the change in USE of the RPV due to irradiation.

Using the ¼ thickness (1/4 T) fluence values per Section 1, the values of upper shelf energy (USE) in Tables 4 and 5 were calculated for the Surry Unit 1 and Unit 2 reactor pressure vessels at the end of the license renewal period being evaluated.

Table 4
Surry Unit 1 USE Values at 47.6 EFPY

Limiting Materials	Lower Shell 4415-2	Circ. Weld 72445	Long. Weld 299L44
Initial USE Value (ft-lbs)*	83	77	70
¼ T Fluence (10^{19}n/cm^2)	3.29	2.87	0.482
Decrease (%)	26	45	38
USE Value (ft-lbs)	61.6	42.1	43.6

Table 5
Surry Unit 2 USE Values at 48.1 EFPY

Limiting Materials	Intermed. Shell C4331-2	Circ. Weld 0227	Long. Weld 8T1762
Initial USE Value (ft-lbs)*	84	90	70
¼ T Fluence (10^{19}n/cm^2)	3.26	3.26	0.659
Decrease (%)	27	43	30
USE Value (ft-lbs)	60.9	51.2	49.2

*Note: Initial values are measured.

As shown by these results, the upper shelf energy (USE) values at the end of the license renewal period are greater than the NRC (10CFR50) Appendix G requirement of 50 foot-pounds for some of the limiting materials. For the other limiting materials (welds), an equivalent margins analysis (EMA) was used to justify the acceptability of values below the 50 foot-pound requirement. This EMA [Ref. 17] uses the methodology of the approved USE Reports [Refs. 18 and 19]. Four service levels - A, B, C and D - are evaluated for an equivalent margins analysis. There are two conditions for each loading case to be met. They are:

1. The applied J-integral shall be less than J-integral of the material at a ductile flaw extension of 0.10 inches.
2. Flow extensions shall be ductile and stable.

In addition to these two conditions, one more requirement has to be met for service level D, which is as follows:

3. The extent of stable flaw extension shall be less than or equal to 75% of the vessel wall thickness, and the remaining ligament shall not be subject to tensile instability.

In addition, the NRC has requested further information regarding the history of the USE submittals and NRC approvals. In Generic Letter 92-01, Rev. 1, "Reactor Vessel Structural Integrity, 10CFR50.54(f)," dated March 6, 1992 [Ref. 8], the NRC requested information regarding the USE values for beltline materials used in the Surry reactor pressure vessels. Dominion transmitted a B&W report (BAW-2166, [Ref. 10] dated June 1992) via June 29, 1992 letter [Ref. 9] entitled, "Virginia Electric and Power Company, Surry Power Station Units 1 and 2, Response to Generic Letter 92-01, Reactor Vessel Structural Integrity."

The NRC responded on July 21, 1993 with a letter [Ref. 11], "Surry Power Station, Units 1 and 2 - Request for Additional Information Regarding Generic Letter 92-01, Revision 3," requesting specific information on the confirmation of topicals that would be used for licensing basis for USE values. Dominion responded to the RAIs via September 23, 1993 letter [Ref. 12], "Virginia Electric and Power Company, Surry Power Station Units 1 and 2, Response to Request for Additional Information Regarding Response to Generic Letter 92-01, Rev. 1."

The NRC then requested verification of the USE data for the then newly-developed Reactor Vessel Integrity Database (RVID) in a letter [Ref. 13] dated May 24, 1994, "Generic Letter 92-01, Revision 1, Reactor Vessel Structural Integrity, Surry Power Station, Units 1 and 2, (TAC NOS. M83739 and M83740)." The requested verification from Dominion was provided via the transmittal of B&W report BAW-2222 [Ref. 15], dated June 1994. Dominion's letter [Ref. 14] transmitting BAW-2222 was "Virginia Electric and Power Company, Surry Power Station Units 1 and 2, Generic Letter 92-01, Revision 1, Reactor Vessel Structural Integrity Request for Additional Information," dated June 30, 1994.

Following the June 30, 1994 Dominion letter, the NRC issued "GL 92-01, Rev. 1 Reactor Vessel Structural Integrity, Supplement 1," on May 19, 1995 [Ref. 16]. In this letter, the NRC stated that all plants were able to demonstrate compliance with the requirements of Appendix G with regards to the issue of USE.

4. Limits for Heatup and Cooldown

Figure 1 presents the heatup curves, without margin for instrumentation errors, for a maximum rate of 60°F/hour for the limiting material in the Surry Units 1 and 2 reactor pressure vessel beltline. Note on these curves, that moderator temperature is the Reactor Coolant System water temperature. Likewise, Figure 2 presents the cooldown curves, without margin for instrumentation errors, for a maximum rate of 100°F/hour for the limiting material in the Surry Units 1 and 2 reactor pressure vessel beltline. The heatup curves of Figure 1 and the cooldown curves of Figure - 2 are based upon the limiting adjusted reference temperature (ART) values from Tables 6 and 7, and are valid for up to 47.6 EFPY in Unit 1 and for up to 48.1 EFPY in Unit 2. Since these curves provide sufficient margin on the operating window relative to the pump seal requirements, no additional actions are required for the license renewal periods of Surry Unit 1 and Unit 2.

Maximum allowable low temperature over-pressure protection system (LTOPS) power operated relief valve (PORV) setpoints have been developed which bound both Surry Units 1 and 2. They were developed based on end of license renewal heatup and cooldown curves using the current Westinghouse methodology (Ref. 5). The setpoints conservatively account for instrument uncertainties and the pressure difference between the wide range pressure transmitter and the reactor vessel limiting beltline region.

The following PORV setpoints will provide adequate margin to the Surry Units 1 and 2 Appendix G limits throughout a 20 year license renewal period with no restrictions on the number of RCPs running:

RCS Temperature	PORV Setpoint
$T_{RCS} \leq 325°F$	399 psig

Table 6
Surry Unit 1 ART Values at 47.6 EFPY

Beltline Materials	ART at ¼ T	ART at ¾ T
Lower Shell 4415-1		
S/C** Chemistry Factor	148.6 °F	126.8 °F
Circumferential Weld 72445		
S/C** Chemistry Factor	220.0 °F	183.9 °F
Longitudinal Weld 299L44		
Table* Chemistry Factor	238.2 °F	182.5 °F

*Table refers to Tables 1 and 2 in Reg. Guide 1.99 Rev. 1 [Ref. 3]
**Note: Chemistry factor determined using credible surveillance capsule (S/C) data [Ref. 4].

Table 7
Surry Unit 2 ART Values at 48.1 EFPY

Beltline Materials	ART at ¼ T	ART at ¾ T
Lower Shell C4208-2		
Table* Chemistry Factor	144.5 °F	117.0 °F
Circumferential Weld 0227		
S/C** Chemistry Factor	216.5 °F	183.7 °F
Longitudinal Weld 8T1762		
Table* Chemistry Factor	198.0 °F	157.8 °F

*Table refers to Tables 1 and 2 in Reg. Guide 1.99 Rev. 1 [Ref. 3]
**Note: Chemistry factor determined using credible surveillance capsule (S/C) data [Ref. 4].

5. Reactor Vessel Surveillance Program

The Surry Unit 1 and 2 surveillance capsule withdrawal schedules [Ref. 6], which include provisions for license renewal are provided in Tables 8 and 9, respectively. Specifically, Dominion has already acquired surveillance capsule data for Surry Units 1 and 2 that bounds, in terms of accumulated fluence, the predicted end-of-license-renewal inner surface fluence at the limiting beltline weld material (i.e. 0.79×10^{19} n/cm^2 for the Surry Unit 1 lower shell longitudinal weld, SA-1526); surveillance data from the Surry Unit 1 surveillance program has been collected at fluences as high as 1.992×10^{19} n/cm^2 [Ref. 22]. Additional Surry Units 1 and 2 standby surveillance capsules are available to provide additional material properties data and fluence monitoring during the license renewal period. Dominion anticipates implementation of the recommendation of Generic Aging Lessons Learned Report (GALL) [Ref. 24] report for the withdrawal of the final plant-specific surveillance capsules.

Conclusion:

The aforementioned information demonstrates an ability to comply with applicable regulations during a postulated 20-year license renewal period. Required analysis will be performed and implemented in accordance with the requirements of the applicable regulations, and in anticipation of the expiration of affected plant Technical Specifications.

Table 8
SURVEILLANCE CAPSULE WITHDRAWAL SCHEDULE
SURRY UNIT 1

Withdrawal Schedule[a]

Capsule Identification	Capsule Loc. (Deg.)	Withdraw EFPY (Year)	Insert EFPY (Year)	Est. Caps. Fluence[b] ($\times 10^{19}$)	
T	285	1.5/1974	NA	0.289	
W	55	3.0/1978	NA	0.431	
V	165	6.0/1986	NA	1.94	
X	65	13.3/1994	NA	1.88	
X	165	NA	13.3/1994	NA	
X	165	15.8/1997	NA	2.42	
Z	245	13.3/1994	NA	1.88	
Z	285	NA	13.3/1994	NA	
Z	285	28.8/EOL	NA	5.18	
Y	305	15.8/1997	NA	1.48	
Y	165	NA	15.8/1997	NA	
Y	165	NA	NA	4.24	(EOL)
U	45	13.3/1994	NA	0.99	
U	65	NA	13.3/1994	NA	
U	65	NA	NA	3.04	(EOL)
S[c]	295	21.0/2002	NA	2.90	

NOTES: (1) The capsule fluence estimates may be compared to the Surry 1 calculated end-of-license (EOL) 0° vessel inner surface fluence of 3.96×10^{19} n/cm^2.

(2) All Surry 1 surveillance capsules need only be evaluated for dosimetry to obtain data for use in fluence analysis. Irradiated materials properties need not be determined for any Surry 1 capsules unless the data is desired for use in the development of revised heatup and cooldown curves.

a. Surry Unit 1 is a participant in B&WOG Master Integrated Reactor Vessel Materials Surveillance Program (B&W Report BAW-1543)

b. Fluence estimates based on WCAP-11015, Revision 1 (*Surry Units 1 and 2 Reactor Vessel Fluence and RTPTS Evaluations*, dated April, 1987) extrapolations beyond Surry 1 Cycle 7, with 80% capacity factor assumed, and core thermal power uprating to 2,546 MWt assumed at beginning of Cycle 11.

c. Capsule S to be withdrawn and evaluated for dosimetry if no data from reactor cavity dosimetry is available.

Table 9
SURVEILLANCE CAPSULE WITHDRAWAL SCHEDULE
SURRY UNIT 2

Withdrawal Schedule[a]

Capsule Identification	Capsule Loc. (Deg.)	Withdraw EFPY (Year)	Insert EFPY (Year)	Est. Caps. Fluence[b] ($\times 10^{19}$)	
X	285	1.2/1975	NA	0.301	
W	245	3.8/1979	NA	0.654	
V	165	8.5/1986	NA	2.02	
Y	295	13.7/1994	NA	1.97	
Y	165	NA	13.7/1994	NA	
Y	165	19.7/2002	NA	3.14	
U	65	25.6/2008	NA	3.54	
T	55	19.7/2002	NA	1.93	
T	165	NA	19.7/2002	NA	
T	165	NA	NA	3.83	(EOL)
Z	305	13.7/1994	NA	1.38	
Z	245	NA	13.7/1994	NA	
Z	245	NA	NA	3.45	(EOL)
S[c]	45	15.0/1996	NA	2.31	(EOL)
W1	285	NA	10.9/1991	NA	
W1[d]	285	16.4/1997	NA	1.53	

NOTES: (1) The capsule fluence estimates may be compared to the Surry 2 calculated end-of-license (EOL) 0° vessel inner surface fluence of 3.43×10^{19} n/cm^2.

(2) With the exception of Capsule Y and W1, all Surry 2 surveillance capsules need only be evaluated for dosimetry to obtain data for use in fluence analysis. Irradiated materials properties need not be determined for any Surry 2 capsules (except Y and W1) unless the data is desired for use in the development of revised heatup and cooldown curves.

a. Surry Unit 2 is a participant in B&WOG Master Integrated Reactor Vessel Materials Surveillance Program (B&W Report BAW-1543)

b. Fluence estimates based on WCAP-11015, Revision 1 (*Surry Units 1 and 2 Reactor Vessel Fluence and RTPTS Evaluations,* dated April, 1987) extrapolations beyond Surry 2 Cycle 7, with 80% capacity factor assumed, and core thermal power uprating to 2546 MWt assumed at beginning of Cycle 11.

c. Capsule S to be withdrawn and evaluated for dosimetry if no data from reactor cavity dosimetry is available.

d. Master Integrated Reactor Vessel Materials Surveillance Program capsule.

Table 10: Fluence Value Comparison Based on [Ref. 22]

Surveillance Capsule ID	Previously Recorded Fluence (x 10^{19})	RG 1.190-Compliant Fluence (x 10^{19})	RG 1.190-Compliant Fluence Reference
Capsule TMI2-LG1 (BWOG CR-3 Irrad.)	0.83	0.83	[7]
Capsule CR3-LG1 (BWOG CR-3 Irrad.)	0.779	0.755	[7]
Capsule TMI2-LG1 (BWOG CR-3 Irrad.)	0.968	0.968	[7]
Three Mile Island Unit 1 Capsule C	0.866	0.882	[22]
Three Mile Island Unit 1 Capsule E	0.107	0.097	[7]
Capsule W-1 (CR-3 NBD)	0.669	0.669	[25]
Surry Unit 1 Capsule T	0.281	0.292	[22]
Surry Unit 1 Capsule V	1.940	1.992	[22]
Surry Unit 1 Capsule X	1.599	1.599	[26]

MATERIAL PROPERTY BASIS

LIMITING MATERIAL: LOWER SHELL LONGITUDINAL WELD (1/4T)
INTERMEDIATE TO LOWER SHELL CIRC. WELDS (3/4T)
LIMITING ART VALUES AT EOL: 1/4T, 238.2°F
3/4T, 183.9°F

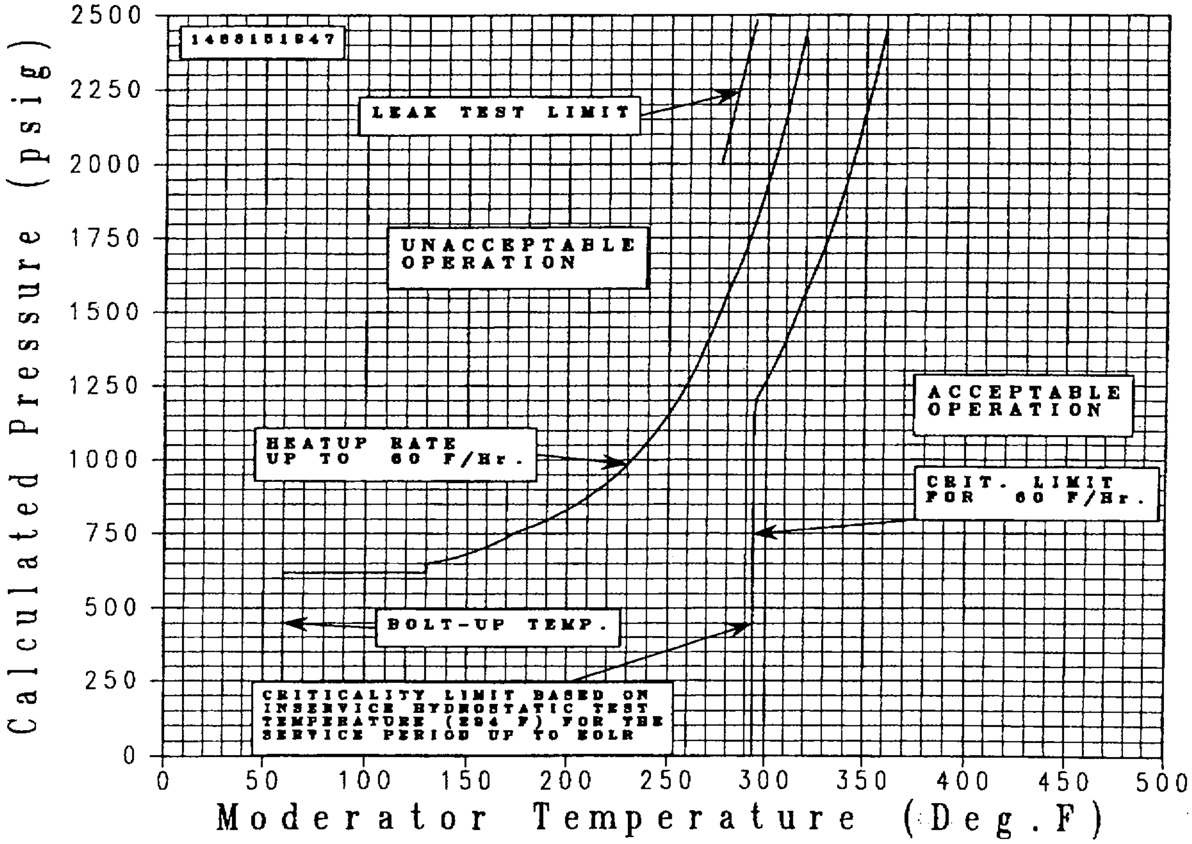

Figure – 1 Surry Units 1 and 2 Reactor Coolant System Heatup Limitations (Heatup Rates up to 60°F/hr) Applicable to End of License Renewal (With Margins of 0°F and 0 psi for Instrumentation Errors)

MATERIAL PROPERTY BASIS

LIMITING MATERIAL: LOWER SHELL LONGITUDINAL WELD (1/4T)
INTERMEDIATE TO LOWER SHELL CIRC. WELDS (3/4T)

LIMITING ART VALUES AT EOLR: 1/4T, 238.2°F
3/4T, 183.9°F

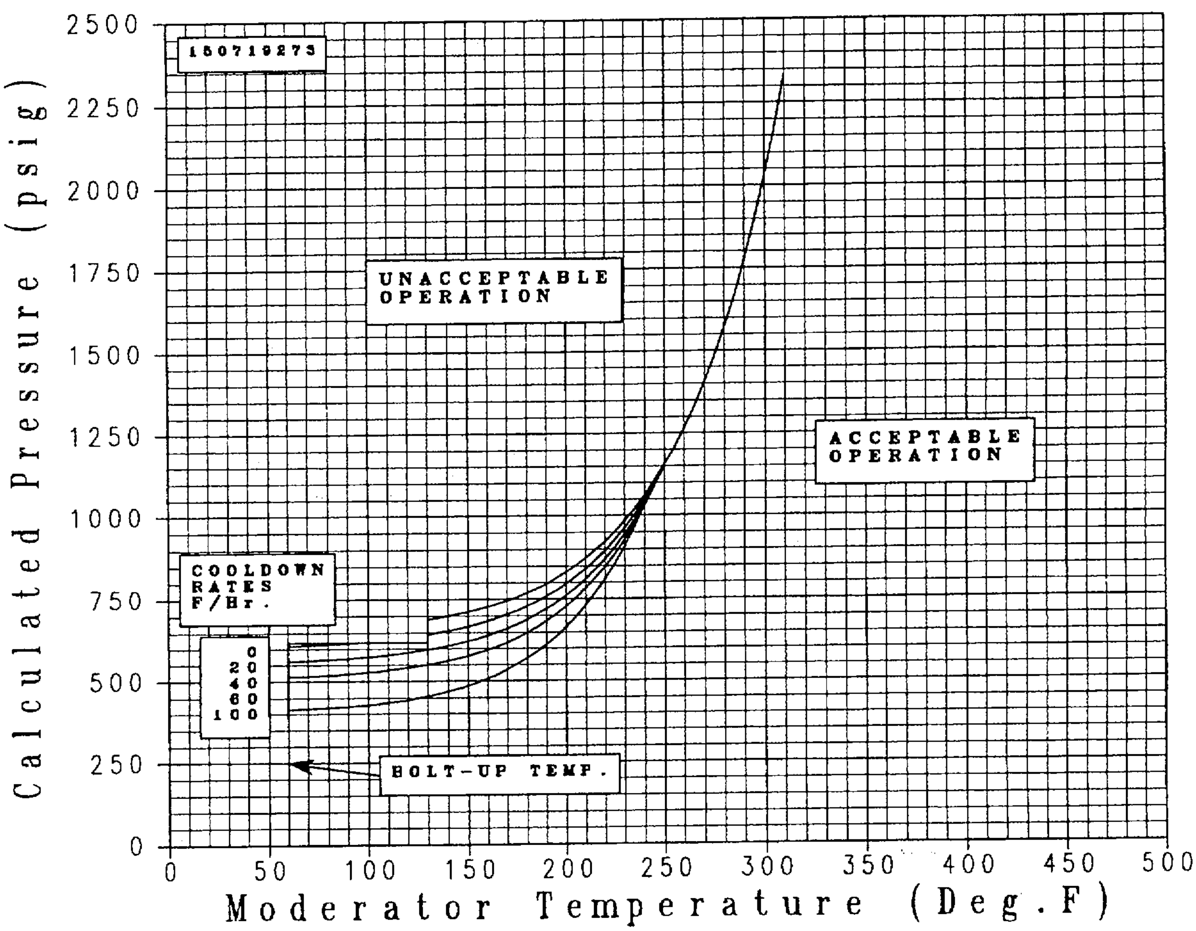

Figure - 2 Surry Units 1 and 2 Reactor Coolant System Cooldown Limitations (Cooldown Rates of 0,20,40, 60 and 100°F/hr) Applicable to End of License Renewal (With Margins of 0°F and 0 psi for Instrumentation Errors)

References:

1. Virginia Power Topical Report VEP-NAF-3A, "Reactor Vessel Fluence Analysis Methodology," dated November, 1997.

2. Draft Regulatory Guide DG-1053, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence," June 1996 previous draft was DG-1025, September 1993.

3. NRC Reg. Guide 1.99 Revision 2, "Radiation Embrittlement of Reactor Vessel Materials," May, 1988

4. Letter from J. P. O'Hanlon to USNRC, "Virginia Electric and Power Company, Surry and North Anna Power Stations Units 1 and 2, Surry 1 Reactor Vessel Surveillance Capsule X Analysis Report, GL 92-01, Revision 1, Supplement 1, Response to Request for Additional Information and Topical Report on Reactor Vessel Fluence Analysis Methodology," Serial No. 98-252, dated June 18, 1998.

5. WCAP-14040-NP-A, Rev. 2, "Methodology Used to Develop Cold Overpressure Mitigating System Setpoints and RCS Heatup and Cooldown Limit Curves", January 1996.

6. Tables 4.1-12 and 4.1-13, Surry Units 1 and 2 UFSAR

7. Framatome Topical Report BAW-2241P-A, "Fluence and Uncertainty Methodologies," Rev. 01, December 1999.

8. NRC Generic Letter 92-01, Rev. 1, "Reactor Vessel Structural Integrity, 10CFR50.54(f)," dated March 6, 1992.

9. Dominion Letter, "Virginia Electric and Power Company, Surry Power Station Units 1 and 2, Response to Generic Letter 92-01, Reactor Vessel Structural Integrity," dated June 29, 1992.

10. B&W Report BAW-2166, "B&W Owners Group Response to Generic Letter 92-01," dated June 1992

11. NRC Letter, "Surry Power Station, Units 1 and 2 - Request for Additional Information Regarding Generic Letter 92-01, Revision 3," dated July 21, 1993.

12. Dominion Letter, "Virginia Electric and Power Company, Surry Power Station Units 1 and 2, Response to Request for Additional Information Regarding Response to Generic Letter 92-01, Rev. 1," dated September 23, 1993.

13. NRC Letter, "Generic Letter 92-01, Revision 1, Reactor Vessel Structural Integrity, Surry Power Station, Units 1 and 2, (TAC NOS. M83739 and M83740)," dated May 24, 1994.

14. Dominion Letter, "Virginia Electric and Power Company, Surry Power Station Units 1 and 2, Generic Letter 92-01, Revision 1, Reactor Vessel Structural Integrity Request for Additional Information," dated June 30, 1994.

15. B&W Report BAW-2222, "Response to Closure Letters to Generic Letter 92-01, Revision 1," dated June 1994.

16. NRC Letter, "NRC GL 92-01, Rev. 1 Reactor Vessel Structural Integrity, Supplement 1," dated May 19, 1995.

17. Framatome Report BAW-2323, "Low Upper-Shelf Toughness Fracture Mechanics Analysis of Reactor Vessels of Surry Units 1 and 2 For Extended Life Through 48 Effective Full Power Years," June 1998.

18. Framatome Report BAW-2178P-A, "Low Upper-Shelf Toughness Fracture Mechanics Analyses of Reactor Vessels of B&W Owners Reactor Vessel Working Group for Level C & D Service Loads," July 1994.

19. Framatome Report BAW-2192P-A, "Low Upper-Shelf Toughness Fracture Analysis of Reactor Vessels B&W Owners Reactor Vessel Working Group for Level A & B Conditions," July 1994.

20. NUREG/CR-6551, "Improved Embrittlement Correlations for Reactor Vessel Steels," prepared by Eason, E. D., Wright, J. E., and Odette, G. R., November 1998.

21. Framatome Report BAW-2308, "Initial RT_{NDT} of Linde 80 Weld Materials," July 2002.

22. Framatome Report 51-5021094-00, "Consistent and Benchmarked Neutron Fluence Values for Reactor Vessel Materials Surveillance Capsules Containing Weld Material Fabricated with Weld Wire Heat Number "299L44" Applicable to Surry Unit 1 Weld Material SA-1525 (Designated Weld "L2"), October 2002.

23. Framatome Report 51-5021199-00, "Surry 1 Lower Shell Longitudinal welds and RVSP Material,", October 7, 2002.

24. NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," dated July 2001.

25. Framatome Report BAW-2350P, "Test Results of W1 Capsule, Master Integrated Reactor Vessel Surveillance Program," April 1999.

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Appendix A

RG 1.99 Revision 2 Position 2.1 Calculations
All Available Surveillance Data for Weld Wire Heat 299L44
Including Corrections for Irradiation Temperature and Chemistry Variation Effects

calc98h (SM-1008 Rev. 0 Add. G).xls

Table 2: **Surry Unit 1 Weld Material SA-1526 (All Data, Irrad. Temp and Chemistry Corrections)**

Capsule ID (Including Source)	Copper (wt%)	Nickel (wt%)	Irradiation Temperature (F)	Fluence (x1E19)	Measured Delta-RT(NDT) (F)	Data Used In Assessing Vessel? (Yes or No)
Capsule TMI2-LG1 (BWOG CR-3 Irrad.)	0.370	0.700	556.0	0.830	216	Yes
Capsule CR3-LG1 (BWOG CR-3 Irrad.)	0.360	0.700	556.0	0.755	202	Yes
Capsule TMI2-LG1 (BWOG CR-3 Irrad.)	0.330	0.670	556.0	0.968	226	Yes
Three Mile Island Unit 1 Capsule C	0.330	0.670	556.0	0.882	166	Yes
Three Mile Island Unit 1 Capsule E	0.330	0.670	556.0	0.097	74	Yes
Capsule W-1 (CR-3 NBD)	0.360	0.700	546.3	0.669	262	Yes
Surry Unit 1 Capsule T	0.230	0.640	533.9	0.292	171	Yes
Surry Unit 1 Capsule V	0.230	0.640	538.8	1.992	250	Yes
Surry Unit 1 Capsule X	0.230	0.640	542.0	1.599	234	Yes
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-

Table 3: **Surry Unit 1 Weld Material SA-1526 (All Data, Irrad. Temp and Chemistry Corrections)**

Capsule ID (Including Source)	Copper (wt%)	Nickel (wt%)	Irradiation Temperature (F)	Fluence Factor	Measured Delta-RT(NDT) (F)	Adjusted Delta-RT(NDT) (F) *	Predicted Delta-RT(NDT) (F) **	Adjusted - Predicted Delta-RT(NDT) (F)	Surveillance Data Credible or Non-Credible?
Capsule TMI2-LG1 (BWOG CR-3 Irrad.)	0.370	0.700	556.0	0.9477	216	198	214	-16	Credible
Capsule CR3-LG1 (BWOG CR-3 Irrad.)	0.360	0.700	556.0	0.9212	202	188	208	-19	Credible
Capsule TMI2-LG1 (BWOG CR-3 Irrad.)	0.330	0.670	556.0	0.9909	226	225	223	1	Credible
Three Mile Island Unit 1 Capsule C	0.330	0.670	556.0	0.9648	166	167	218	-51	Non-Credible
Three Mile Island Unit 1 Capsule E	0.330	0.670	556.0	0.4108	74	78	93	-14	Credible
Capsule W-1 (CR-3 NBD)	0.360	0.700	546.3	0.8873	262	234	200	34	Non-Credible
Surry Unit 1 Capsule T	0.230	0.640	533.9	0.6633	171	184	150	35	Non-Credible
Surry Unit 1 Capsule V	0.230	0.640	538.8	1.1881	250	283	268	15	Credible
Surry Unit 1 Capsule X	0.230	0.640	542.0	1.1296	234	268	255	13	Credible
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-

* *For credibility check, measured shift values are adjusted to average surveillance material chemistry and irradiation temperature as required. See Table 4.*
** *Predicted Delta-RT(NDT) is based upon the RG 1.99 Revision 2 Position 2.1 Chemistry Factor determined with the Adjusted Delta-RT(NDT) values. (225.5 degrees F)*

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Table 4: **Surry Unit 1 Weld Material SA-1526 (All Data, Irrad. Temp and Chemistry Corrections)**

Beltline Material CF Determination

Beltline Material ID	Beltline Material Copper (wt%)	Beltline Material Nickel (wt%)	Irradiation Temperature (F)	Position 1.1 Chemistry Factor	Position 2.1 Chemistry Factor	Surveillance Data Credible or Non-Credible?	If Surv. Data Non-Credible, Verify Conservatism of Position 1.1 CF *	Chemistry Factor Applied to Beltline Material **
SA-1526/299L44	0.340	0.680	542.0	220.6	249.0	Non-Credible	Conservative	220.6

** Measured shift values are adjusted to the average surveillance material chemistry and irradiation temperature, and are verified to be within 2 sigma of the trend curve based on RG 1.99 Rev. 2 Position 1.1.*
For a large population of surveillance data (e.g., 9 data points for SA-1526), one or two slightly non-conservative data points do not invalidate the conclusion that use of RG 1.99 Rev. 2 Postion 1.1 is conservative.
*** If surveillance data are non-credible but the Pos. 1.1 CF is shown to be conservative, the lower of the Pos. 1.1 and Pos. 2.1 chemistry factors is applied to the beltline material with a full margin term.*
If surveillance data are non-credible and the Pos. 1.1 CF is shown to be non-conservative, the greater of the Pos. 1.1 and Pos. 2.1 chemistry factors is applied to the beltline material with a full margin term.

Credibility and Conservatism Assessment Summary

Capsule ID (Including Source)	(1) Temperature Correction Applied for Credibility?	(2) Chemistry Correction Applied for Credibility?	Surveillance Data Credible or Non-Credible?	(3) Temperature Correction Applied to Surv. Data for Application to Beltline Material?	(4) Chemistry Correction Applied to Surv. Data for Application to Beltline Material?	Conservatism Check for Pos. 1.1 CF when Surv. Data Non-Credible: Adjusted Delta-RT(NDT) (F) *	Predicted Delta-RT(NDT) (F) ***	Adjusted - Predicted Delta-RT(NDT) (F) *	Are adjusted surveillance data within 2 sigma of the applied CF trend curve? *
Capsule TMI2-LG1 (BWOG CR-3 Irrad.)	Yes	Yes	Credible	Yes	Yes	198	197	1	Conservative
Capsule CR3-LG1 (BWOG CR-3 Irrad.)	Yes	Yes	Credible	Yes	Yes	188	191	-3	Conservative
Capsule TMI2-LG1 (BWOG CR-3 Irrad.)	Yes	Yes	Credible	Yes	Yes	225	206	19	Conservative
Three Mile Island Unit 1 Capsule C	Yes	Yes	Non-Credible	Yes	Yes	167	200	-33	Conservative
Three Mile Island Unit 1 Capsule E	Yes	Yes	Credible	Yes	Yes	78	85	-7	Conservative
Capsule W-1 (CR-3 NBD)	Yes	Yes	Non-Credible	Yes	Yes	234	184	49	Conservative
Surry Unit 1 Capsule T	Yes	Yes	Non-Credible	Yes	Yes	184	138	46	Conservative
Surry Unit 1 Capsule V	Yes	Yes	Credible	Yes	Yes	283	247	37	Conservative
Surry Unit 1 Capsule X	Yes	Yes	Credible	Yes	Yes	268	235	34	Conservative
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-

(1) For the credibility determination, a temperature correction is not applied to measured values of transition temperature shift if applicable surveillance data were irradiated in a single reactor (i.e., were irradiated at a similar temperature).
(2) For the credibility determination, a chemistry correction is not applied to measured values of transition temperature shift if applicable surveillance data were obtained from a single source (i.e., were machined from the same block of material).
(3) For determination of the beltline material chemistry factor, a temperature correction is not applied to measured values of transition temperature shift if applicable surveillance data were irradiated in the reactor vessel which is being evaluated (i.e., were irradiated at a similar temperature). A temperature correction is applied only in the conservative direction.
(4) For determination of the beltline material chemistry factor, a chemistry correction (i.e., ratio procedure) is not applied to measured values of transition temperature shift if the chemical composition of applicable surveillance data is essentially identical to the best-estimate chemical composition of the beltline material being evaluated.

**** Predicted Delta-RT(NDT) is based upon the RG 1.99 Revision 2 Position 1.1 Chemistry Factor for the average chemical composition of the surveillance materials. (207.7 degrees F)*

Appendix B

RG 1.99 Revision 2 Position 2.1 Calculations
All Available Surveillance Data for Weld Wire Heat 299L44
<u>Without</u> Corrections for Irradiation Temperature and Chemistry Variation Effects

calc98h (SM-1008 Rev. 0 Add. G).xls

Table 2: **Surry Unit 1 Weld Material SA-1526 (All Data, No Corrections for Irrad. Temp and Chemistry)**

Capsule ID (Including Source)	Copper (wt%)	Nickel (wt%)	Irradiation Temperature (F)	Fluence (x1E19)	Measured Delta-RT(NDT) (F)	Data Used In Assessing Vessel? (Yes or No)
Capsule TMI2-LG1 (BWOG CR-3 Irrad.)	0.370	0.700	556.0	0.830	216	Yes
Capsule CR3-LG1 (BWOG CR-3 Irrad.)	0.360	0.700	556.0	0.755	202	Yes
Capsule TMI2-LG1 (BWOG CR-3 Irrad.)	0.330	0.670	556.0	0.968	226	Yes
Three Mile Island Unit 1 Capsule C	0.330	0.670	556.0	0.882	166	Yes
Three Mile Island Unit 1 Capsule E	0.330	0.670	556.0	0.097	74	Yes
Capsule W-1 (CR-3 NBD)	0.360	0.700	546.3	0.669	262	Yes
Surry Unit 1 Capsule T	0.230	0.640	533.9	0.292	171	Yes
Surry Unit 1 Capsule V	0.230	0.640	538.8	1.992	250	Yes
Surry Unit 1 Capsule X	0.230	0.640	542.0	1.599	234	Yes
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-

Table 3: **Surry Unit 1 Weld Material SA-1526 (All Data, No Corrections for Irrad. Temp and Chemistry)**

Capsule ID (Including Source)	Copper (wt%)	Nickel (wt%)	Irradiation Temperature (F)	Fluence Factor	Measured Delta-RT(NDT) (F)	Adjusted Delta-RT(NDT) (F) *	Predicted Delta-RT(NDT) (F) **	Adjusted - Predicted Delta-RT(NDT) (F)	Surveillance Data Credible or Non-Credible?
Capsule TMI2-LG1 (BWOG CR-3 Irrad.)	0.370	0.700	556.0	0.9477	216	216	210	6	Credible
Capsule CR3-LG1 (BWOG CR-3 Irrad.)	0.360	0.700	556.0	0.9212	202	202	204	-2	Credible
Capsule TMI2-LG1 (BWOG CR-3 Irrad.)	0.330	0.670	556.0	0.9909	226	226	219	7	Credible
Three Mile Island Unit 1 Capsule C	0.330	0.670	556.0	0.9648	166	166	213	-47	Non-Credible
Three Mile Island Unit 1 Capsule E	0.330	0.670	556.0	0.4108	74	74	91	-17	Credible
Capsule W-1 (CR-3 NBD)	0.360	0.700	546.3	0.8873	262	262	196	66	Non-Credible
Surry Unit 1 Capsule T	0.230	0.640	533.9	0.6633	171	171	147	24	Credible
Surry Unit 1 Capsule V	0.230	0.640	538.8	1.1881	250	250	263	-13	Credible
Surry Unit 1 Capsule X	0.230	0.640	542.0	1.1296	234	234	250	-16	Credible
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-

** For credibility check, measured shift values are adjusted to average surveillance material chemistry and irradiation temperature as required. See Table 4.* **This sensitivity case includes no corrections for irrad. temp. or chemistry.**

*** Predicted Delta-RT(NDT) is based upon the RG 1.99 Revision 2 Position 2.1 Chemistry Factor determined with the Adjusted Delta-RT(NDT) values. (221.2 degrees F)*

calc98h (SM-1008 Rev. 0 Add. G).xls

Table 4: **Surry Unit 1 Weld Material SA-1526 (All Data, No Corrections for Irrad. Temp and Chemistry)**

Beltline Material CF Determination

Beltline Material ID	Beltline Material Copper (wt%)	Beltline Material Nickel (wt%)	Irradiation Temperature (F)	Position 1.1 Chemistry Factor	Position 2.1 Chemistry Factor	Surveillance Data Credible or Non-Credible?	If Surv. Data Non-Credible, Verify Conservatism of Position 1.1 CF *	Chemistry Factor Applied to Beltline Material **
SA-1526/299L44	0.340	0.680	542.0	220.6	221.2	Non-Credible	Conservative	220.6

** Measured shift values are adjusted to the average surveillance material chemistry and irradiation temperature, and are verified to be within 2 sigma of the trend curve based on RG 1.99 Rev. 2 Position 1.1.*
For a large population of surveillance data (e.g., 9 data points for SA-1526), one or two slightly non-conservative data points do not invalidate the conclusion that use of RG 1.99 Rev. 2 Postion 1.1 is conservative.
*** If surveillance data are non-credible but the Pos. 1.1 CF is shown to be conservative, the lower of the Pos. 1.1 and Pos. 2.1 chemistry factors is applied to the beltline material with a full margin term.*
If surveillance data are non-credible and the Pos. 1.1 CF is shown to be non-conservative, the greater of the Pos. 1.1 and Pos. 2.1 chemistry factors is applied to the beltline material with a full margin term.

Credibility and Conservatism Assessment Summary

						Conservatism Check for Pos. 1.1 CF when Surv. Data Non-Credible			
Capsule ID (Including Source)	(1) Temperature Correction Applied for Credibility?	(2) Chemistry Correction Applied for Credibility?	Surveillance Data Credible or Non-Credible?	(3) Temperature Correction Applied to Surv. Data for Application to Beltline Material?	(4) Chemistry Correction Applied to Surv. Data for Application to Beltline Material?	Adjusted Delta-RT(NDT) (F) *	Predicted Delta-RT(NDT) (F) ***	Adjusted - Predicted Delta-RT(NDT) (F) *	Are adjusted surveillance data within 2 sigma of the applied CF trend curve? *
Capsule TMI2-LG1 (BWOG CR-3 Irrad.)	No	No	Credible	No	No	216	197	19	Conservative
Capsule CR3-LG1 (BWOG CR-3 Irrad.)	No	No	Credible	No	No	202	191	11	Conservative
Capsule TMI2-LG1 (BWOG CR-3 Irrad.)	No	No	Credible	No	No	226	206	20	Conservative
Three Mile Island Unit 1 Capsule C	No	No	Non-Credible	No	No	166	200	-34	Conservative
Three Mile Island Unit 1 Capsule E	No	No	Credible	No	No	74	85	-11	Conservative
Capsule W-1 (CR-3 NBD)	No	No	Non-Credible	No	No	262	184	78	Non-Conservative
Surry Unit 1 Capsule T	No	No	Credible	No	No	171	138	33	Conservative
Surry Unit 1 Capsule V	No	No	Credible	No	No	250	247	3	Conservative
Surry Unit 1 Capsule X	No	No	Credible	No	No	234	235	-1	Conservative
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-

(1) For the credibility determination, a temperature correction is not applied to measured values of transition temperature shift if applicable surveillance data were irradiated in a single reactor (i.e., were irradiated at a similar temperature). **This sensitivity case assumes that all surveillance data were irradiated at similar conditions.**

(2) For the credibility determination, a chemistry correction is not applied to measured values of transition temperature shift if applicable surveillance data were obtained from a single source (i.e., were machined from the same block of material). **This sensitivity case assumes that all surveillance data were obtained from a single source.**

(3) For determination of the beltline material chemistry factor, a temperature correction is not applied to measured values of transition temperature shift if applicable surveillance data were irradiated in the reactor vessel which is being evaluated (i.e., were irradiated at a similar temperature). A temperature correction is applied only in the conservative direction. **This sensitivity case assumes that all surveillance data were irradiated at conditions similar to those of the beltline material being evaluated.**

(4) For determination of the beltline material chemistry factor, a chemistry correction (i.e., ratio procedure) is not applied to measured values of transition temperature shift if the chemical composition of applicable surveillance data is essentially identical to the best-estimate chemical composition of the beltline material being evaluated. **This sensitivity case assumes that the chemical composition of surveillance data is essentially identical to that of the beltline material being evaluated.**

**** Predicted Delta-RT(NDT) is based upon the RG 1.99 Revision 2 Position 1.1 Chemistry Factor for the average chemical composition of the surveillance materials. (207.7 degrees F)*

Appendix C

RG 1.99 Revision 2 Position 2.1 Calculations
All Available Surveillance Data for Weld Wire Heat 299L44
Without Corrections for Irradiation Temperature and Chemistry Variation Effects
and Using RG 1.99 Revision 2 Position 1.1 Chemistry Factors
Based on Individual Surveillance Capsule Chemistries

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Table 2: **Surry Unit 1 Weld Material SA-1526 (All Data, No Corrections, Conservatism Check Based on Individual Capsule CF's)**

Capsule ID (Including Source)	Copper (wt%)	Nickel (wt%)	Irradiation Temperature (F)	Fluence (x1E19)	Measured Delta-RT(NDT) (F)	Data Used In Assessing Vessel? (Yes or No)
Capsule TMI2-LG1 (BWOG CR-3 Irrad.)	0.370	0.700	556.0	0.830	216	Yes
Capsule CR3-LG1 (BWOG CR-3 Irrad.)	0.360	0.700	556.0	0.755	202	Yes
Capsule TMI2-LG1 (BWOG CR-3 Irrad.)	0.330	0.670	556.0	0.968	226	Yes
Three Mile Island Unit 1 Capsule C	0.330	0.670	556.0	0.882	166	Yes
Three Mile Island Unit 1 Capsule E	0.330	0.670	556.0	0.097	74	Yes
Capsule W-1 (CR-3 NBD)	0.360	0.700	546.3	0.669	262	Yes
Surry Unit 1 Capsule T	0.230	0.640	533.9	0.292	171	Yes
Surry Unit 1 Capsule V	0.230	0.640	538.8	1.992	250	Yes
Surry Unit 1 Capsule X	0.230	0.640	542.0	1.599	234	Yes
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-

Table 3: **Surry Unit 1 Weld Material SA-1526 (All Data, No Corrections, Conservatism Check Based on Individual Capsule CF's)**

Capsule ID (Including Source)	Copper (wt%)	Nickel (wt%)	Irradiation Temperature (F)	Fluence Factor	Measured Delta-RT(NDT) (F)	Adjusted Delta-RT(NDT) (F) *	Predicted Delta-RT(NDT) (F) **	Adjusted - Predicted Delta-RT(NDT) (F)	Surveillance Data Credible or Non-Credible?
Capsule TMI2-LG1 (BWOG CR-3 Irrad.)	0.370	0.700	556.0	0.9477	216	216	210	6	Credible
Capsule CR3-LG1 (BWOG CR-3 Irrad.)	0.360	0.700	556.0	0.9212	202	202	204	-2	Credible
Capsule TMI2-LG1 (BWOG CR-3 Irrad.)	0.330	0.670	556.0	0.9909	226	226	219	7	Credible
Three Mile Island Unit 1 Capsule C	0.330	0.670	556.0	0.9648	166	166	213	-47	Non-Credible
Three Mile Island Unit 1 Capsule E	0.330	0.670	556.0	0.4108	74	74	91	-17	Credible
Capsule W-1 (CR-3 NBD)	0.360	0.700	546.3	0.8873	262	262	196	66	Non-Credible
Surry Unit 1 Capsule T	0.230	0.640	533.9	0.6633	171	171	147	24	Credible
Surry Unit 1 Capsule V	0.230	0.640	538.8	1.1881	250	250	263	-13	Credible
Surry Unit 1 Capsule X	0.230	0.640	542.0	1.1296	234	234	250	-16	Credible
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-

** For credibility check, measured shift values are adjusted to average surveillance material chemistry and irradiation temperature as required. See Table 4.* **This sensitivity case includes no corrections for irrad. temp. or chemistry.**

*** Predicted Delta-RT(NDT) is based upon the RG 1.99 Revision 2 Position 2.1 Chemistry Factor determined with the Adjusted Delta-RT(NDT) values. (221.2 degrees F)*

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Table 4: **Surry Unit 1 Weld Material SA-1526 (All Data, No Corrections, Conservatism Check Based on Individual Capsule CF's)**

Beltline Material CF Determination

Beltline Material ID	Beltline Material Copper (wt%)	Beltline Material Nickel (wt%)	Irradiation Temperature (F)	Position 1.1 Chemistry Factor	Position 2.1 Chemistry Factor	Surveillance Data Credible or Non-Credible?	If Surv. Data Non-Credible, Verify Conservatism of Position 1.1 CF *	Chemistry Factor Applied to Beltline Material **
SA-1526/299L44	0.340	0.680	542.0	220.6	221.2	Non-Credible	Conservative	220.6

** Measured shift values are adjusted to the average surveillance material chemistry and irradiation temperature, and are verified to be within 2 sigma of the trend curve based on RG 1.99 Rev. 2 Position 1.1.*
For a large population of surveillance data (e.g., 9 data points for SA-1526), one or two slightly non-conservative data points do not invalidate the conclusion that use of RG 1.99 Rev. 2 Postion 1.1 is conservative.
*** If surveillance data are non-credible but the Pos. 1.1 CF is shown to be conservative, the lower of the Pos. 1.1 and Pos. 2.1 chemistry factors is applied to the beltline material with a full margin term.*
If surveillance data are non-credible and the Pos. 1.1 CF is shown to be non-conservative, the greater of the Pos. 1.1 and Pos. 2.1 chemistry factors is applied to the beltline material with a full margin term.

Credibility and Conservatism Assessment Summary

						Conservatism Check for Pos. 1.1 CF when Surv. Data Non-Credible			
Capsule ID (Including Source)	(1) Temperature Correction Applied for Credibility?	(2) Chemistry Correction Applied for Credibility?	Surveillance Data Credible or Non-Credible?	(3) Temperature Correction Applied to Surv. Data for Application to Beltline Material?	(4) Chemistry Correction Applied to Surv. Data for Application to Beltline Material?	Adjusted Delta-RT(NDT) (F) *	Predicted Delta-RT(NDT) (F)	Adjusted - Predicted Delta-RT(NDT) (F) *	Are adjusted surveillance data within 2 sigma of the applied CF trend curve? *
Capsule TMI2-LG1 (BWOG CR-3 Irrad.)	No	No	Credible	No	No	216	222	-6	Conservative
Capsule CR3-LG1 (BWOG CR-3 Irrad.)	No	No	Credible	No	No	202	212	-10	Conservative
Capsule TMI2-LG1 (BWOG CR-3 Irrad.)	No	No	Credible	No	No	226	213	13	Conservative
Three Mile Island Unit 1 Capsule C	No	No	Non-Credible	No	No	166	208	-42	Conservative
Three Mile Island Unit 1 Capsule E	No	No	Credible	No	No	74	88	-14	Conservative
Capsule W-1 (CR-3 NBD)	No	No	Non-Credible	No	No	262	205	57	Non-Conservative
Surry Unit 1 Capsule T	No	No	Credible	No	No	171	117	54	Conservative
Surry Unit 1 Capsule V	No	No	Credible	No	No	250	209	41	Conservative
Surry Unit 1 Capsule X	No	No	Credible	No	No	234	199	35	Conservative
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-

(1) For the credibility determination, a temperature correction is not applied to measured values of transition temperature shift if applicable surveillance data were irradiated in a single reactor (i.e., were irradiated at a similar temperature). **This sensitivity case assumes that all surveillance data were irradiated at similar conditions.**
(2) For the credibility determination, a chemistry correction is not applied to measured values of transition temperature shift if applicable surveillance data were obtained from a single source (i.e., were machined from the same block of material). **This sensitivity case assumes that all surveillance data were obtained from a single source.**
(3) For determination of the beltline material chemistry factor, a temperature correction is not applied to measured values of transition temperature shift if applicable surveillance data were irradiated in the reactor vessel which is being evaluated (i.e., were irradiated at a similar temperature). A temperature correction is applied only in the conservative direction. **This sensitivity case assumes that all surveillance data were irradiated at conditions similar to those of the beltline material being evaluated.**
(4) For determination of the beltline material chemistry factor, a chemistry correction (i.e., ratio procedure) is not applied to measured values of transition temperature shift if the chemical composition of applicable surveillance data is essentially identical to the best-estimate chemical composition of the beltline material being evaluated. **This sensitivity case assumes that the chemical composition of surveillance data is essentially identical to that of the beltline material being evaluated.**

Appendix D

RG 1.99 Revision 2 Position 2.1 Calculations
Surry Unit 1 Surveillance Data for Weld Wire Heat 299L44
(No Temperature Correction, No Chemistry Correction)

calc98h (SM-1008 Rev. 0 Add. G).xls

Table 2: **Surry Unit 1 Weld Material SA-1526 (Surry 1 Data Only, No Temp Correction, No Chem Correction)**

Capsule ID (Including Source)	Copper (wt%)	Nickel (wt%)	Irradiation Temperature (F)	Fluence (x1E19)	Measured Delta-RT(NDT) (F)	Data Used In Assessing Vessel? (Yes or No)
Capsule TMI2-LG1 (BWOG CR-3 Irrad.)	0.370	0.700	556.0	0.830	216	No
Capsule CR3-LG1 (BWOG CR-3 Irrad.)	0.360	0.700	556.0	0.755	202	No
Capsule TMI2-LG1 (BWOG CR-3 Irrad.)	0.330	0.670	556.0	0.968	226	No
Three Mile Island Unit 1 Capsule C	0.330	0.670	556.0	0.882	166	No
Three Mile Island Unit 1 Capsule E	0.330	0.670	556.0	0.097	74	No
Capsule W-1 (CR-3 NBD)	0.360	0.700	546.3	0.669	262	No
Surry Unit 1 Capsule T	0.230	0.640	533.9	0.292	171	Yes
Surry Unit 1 Capsule V	0.230	0.640	538.8	1.992	250	Yes
Surry Unit 1 Capsule X	0.230	0.640	542.0	1.599	234	Yes
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-

Table 3: **Surry Unit 1 Weld Material SA-1526 (Surry 1 Data Only, No Temp Correction, No Chem Correction)**

Capsule ID (Including Source)	Copper (wt%)	Nickel (wt%)	Irradiation Temperature (F)	Fluence Factor	Measured Delta-RT(NDT) (F)	Adjusted Delta-RT(NDT) (F) *	Predicted Delta-RT(NDT) (F) **	Adjusted - Predicted Delta-RT(NDT) (F)	Surveillance Data Credible or Non-Credible?
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
Surry Unit 1 Capsule T	0.230	0.640	533.9	0.6633	171	171	143	28	Credible
Surry Unit 1 Capsule V	0.230	0.640	538.8	1.1881	250	250	256	-6	Credible
Surry Unit 1 Capsule X	0.230	0.640	542.0	1.1296	234	234	244	-10	Credible
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-

* *For credibility check, measured shift values are adjusted to average surveillance material chemistry and irradiation temperature as required. See Table 4.* **This sensitivity case includes no corrections for irrad. temp. or chemistry.**

** *Predicted Delta-RT(NDT) is based upon the RG 1.99 Revision 2 Position 2.1 Chemistry Factor determined with the Adjusted Delta-RT(NDT) values. (215.8 degrees F)*

calc98h (SM-1008 Rev. 0 Add. G).xls

Table 4: **Surry Unit 1 Weld Material SA-1526 (Surry 1 Data Only, No Temp Correction, No Chem Correction)**

Beltline Material CF Determination

Beltline Material ID	Beltline Material Copper (wt%)	Beltline Material Nickel (wt%)	Irradiation Temperature (F)	Position 1.1 Chemistry Factor	Position 2.1 Chemistry Factor	Surveillance Data Credible or Non-Credible?	If Surv. Data Non-Credible, Verify Conservatism of Position 1.1 CF *	Chemistry Factor Applied to Beltline Material **
SA-1526/299L44	0.340	0.680	542.0	220.6	215.8	Credible	-	215.8

** Measured shift values are adjusted to the average surveillance material chemistry and irradiation temperature, and are verified to be within 2 sigma of the trend curve based on RG 1.99 Rev. 2 Position 1.1.*
For a large population of surveillance data (e.g., 9 data points for SA-1526), one or two slightly non-conservative data points do not invalidate the conclusion that use of RG 1.99 Rev. 2 Postion 1.1 is conservative.
*** If surveillance data are non-credible but the Pos. 1.1 CF is shown to be conservative, the lower of the Pos. 1.1 and Pos. 2.1 chemistry factors is applied to the beltline material with a full margin term.*
If surveillance data are non-credible and the Pos. 1.1 CF is shown to be non-conservative, the greater of the Pos. 1.1 and Pos. 2.1 chemistry factors is applied to the beltline material with a full margin term.

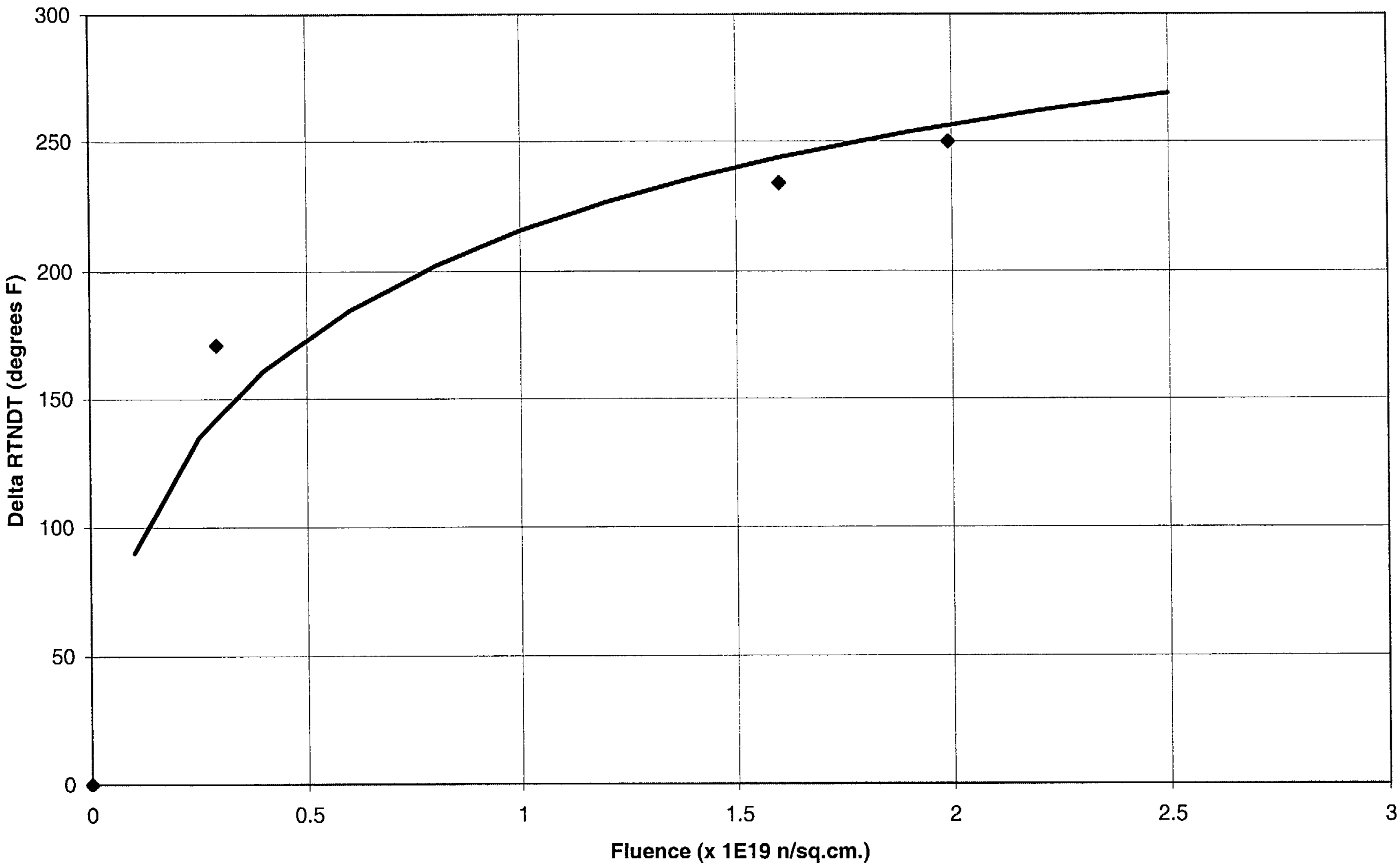
Credibility and Conservatism Assessment Summary

						Conservatism Check for Pos. 1.1 CF when Surv. Data Non-Credible			
Capsule ID (Including Source)	(1) Temperature Correction Applied for Credibility?	(2) Chemistry Correction Applied for Credibility?	Surveillance Data Credible or Non-Credible?	(3) Temperature Correction Applied to Surv. Data for Application to Beltline Material?	(4) Chemistry Correction Applied to Surv. Data for Application to Beltline Material?	Adjusted Delta-RT(NDT) (F) *	Predicted Delta-RT(NDT) (F) ***	Adjusted - Predicted Delta-RT(NDT) (F) *	Are adjusted surveillance data within 2 sigma of the applied CF trend curve? *
Capsule TMI2-LG1 (BWOG CR-3 Irrad.)	-	-	-	-	-	-	-	-	-
Capsule CR3-LG1 (BWOG CR-3 Irrad.)	-	-	-	-	-	-	-	-	-
Capsule TMI2-LG1 (BWOG CR-3 Irrad.)	-	-	-	-	-	-	-	-	-
Three Mile Island Unit 1 Capsule C	-	-	-	-	-	-	-	-	-
Three Mile Island Unit 1 Capsule E	-	-	-	-	-	-	-	-	-
Capsule W-1 (CR-3 NBD)	-	-	-	-	-	-	-	-	-
Surry Unit 1 Capsule T	No	No	Credible	No	No	-	-	-	-
Surry Unit 1 Capsule V	No	No	Credible	No	No	-	-	-	-
Surry Unit 1 Capsule X	No	No	Credible	No	No	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-

(1) For the credibility determination, a temperature correction is not applied to measured values of transition temperature shift if applicable surveillance data were irradiated in a single reactor (i.e., were irradiated at a similar temperature). **This sensitivity case assumes that all surveillance data were irradiated at similar conditions.**
(2) For the credibility determination, a chemistry correction is not applied to measured values of transition temperature shift if applicable surveillance data were obtained from a single source (i.e., were machined from the same block of material). **This sensitivity case assumes that all surveillance data were obtained from a single source.**
(3) For determination of the beltline material chemistry factor, a temperature correction is not applied to measured values of transition temperature shift if applicable surveillance data were irradiated in the reactor vessel which is being evaluated (i.e., were irradiated at a similar temperature). A temperature correction is applied only in the conservative direction. **This sensitivity case assumes that all surveillance data were irradiated at conditions similar to those of the beltline material being evaluated.**
(4) For determination of the beltline material chemistry factor, a chemistry correction (i.e., ratio procedure) is not applied to measured values of transition temperature shift if the chemical composition of applicable surveillance data is essentially identical to the best-estimate chemical composition of the beltline material being evaluated. **This sensitivity case assumes that the chemical composition of surveillance data is essentially identical to that of the beltline material being evaluated.**

**** Predicted Delta-RT(NDT) is based upon the RG 1.99 Revision 2 Position 1.1 Chemistry Factor for the average chemical composition of the surveillance materials. (175.8 degrees F)*

SA-1526 (Case D)



Appendix E

RG 1.99 Revision 2 Position 2.1 Calculations
All Surveillance Data for Weld Wire Heat 299L44
(Temperature Correction, No Chemistry Correction)

calc98h (SM-1008 Rev. 0 Add. G).xls

Table 2: **Surry Unit 1 Weld Material SA-1526 (All Data, Temp Correction, No Chem Correction)**

Capsule ID (Including Source)	Copper (wt%)	Nickel (wt%)	Irradiation Temperature (F)	Fluence (x1E19)	Measured Delta-RT(NDT) (F)	Data Used In Assessing Vessel? (Yes or No)
Capsule TMI2-LG1 (BWOG CR-3 Irrad.)	0.370	0.700	556.0	0.830	216	Yes
Capsule CR3-LG1 (BWOG CR-3 Irrad.)	0.360	0.700	556.0	0.755	202	Yes
Capsule TMI2-LG1 (BWOG CR-3 Irrad.)	0.330	0.670	556.0	0.968	226	Yes
Three Mile Island Unit 1 Capsule C	0.330	0.670	556.0	0.882	166	Yes
Three Mile Island Unit 1 Capsule E	0.330	0.670	556.0	0.097	74	Yes
Capsule W-1 (CR-3 NBD)	0.360	0.700	546.3	0.669	262	Yes
Surry Unit 1 Capsule T	0.230	0.640	533.9	0.292	171	Yes
Surry Unit 1 Capsule V	0.230	0.640	538.8	1.992	250	Yes
Surry Unit 1 Capsule X	0.230	0.640	542.0	1.599	234	Yes
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-

Table 3: **Surry Unit 1 Weld Material SA-1526 (All Data, Temp Correction, No Chem Correction)**

Capsule ID (Including Source)	Copper (wt%)	Nickel (wt%)	Irradiation Temperature (F)	Fluence Factor	Measured Delta-RT(NDT) (F)	Adjusted Delta-RT(NDT) (F) *	Predicted Delta-RT(NDT) (F) **	Adjusted - Predicted Delta-RT(NDT) (F)	Surveillance Data Credible or Non-Credible?
Capsule TMI2-LG1 (BWOG CR-3 Irrad.)	0.370	0.700	556.0	0.9477	216	223	209	14	Credible
Capsule CR3-LG1 (BWOG CR-3 Irrad.)	0.360	0.700	556.0	0.9212	202	209	203	6	Credible
Capsule TMI2-LG1 (BWOG CR-3 Irrad.)	0.330	0.670	556.0	0.9909	226	233	219	14	Credible
Three Mile Island Unit 1 Capsule C	0.330	0.670	556.0	0.9648	166	173	213	-40	Non-Credible
Three Mile Island Unit 1 Capsule E	0.330	0.670	556.0	0.4108	74	81	91	-10	Credible
Capsule W-1 (CR-3 NBD)	0.360	0.700	546.3	0.8873	262	259	196	63	Non-Credible
Surry Unit 1 Capsule T	0.230	0.640	533.9	0.6633	171	156	146	9	Credible
Surry Unit 1 Capsule V	0.230	0.640	538.8	1.1881	250	240	262	-23	Credible
Surry Unit 1 Capsule X	0.230	0.640	542.0	1.1296	234	227	249	-22	Credible
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-

* *For credibility check, measured shift values are adjusted to average surveillance material chemistry and irradiation temperature as required. See Table 4.* **This sensitivity case includes no corrections for chemistry.**

** *Predicted Delta-RT(NDT) is based upon the RG 1.99 Revision 2 Position 2.1 Chemistry Factor determined with the Adjusted Delta-RT(NDT) values. (220.8 degrees F)*

calc98h (SM-1008 Rev. 0 Add. G).xls

Table 4: **Surry Unit 1 Weld Material SA-1526 (All Data, Temp Correction, No Chem Correction)**

Beltline Material CF Determination

Beltline Material ID	Beltline Material Copper (wt%)	Beltline Material Nickel (wt%)	Irradiation Temperature (F)	Position 1.1 Chemistry Factor	Position 2.1 Chemistry Factor	Surveillance Data Credible or Non-Credible?	If Surv. Data Non-Credible, Verify Conservatism of Position 1.1 CF *	Chemistry Factor Applied to Beltline Material **
SA-1526/299L44	0.340	0.680	542.0	220.6	229.3	Non-Credible	Conservative	220.6

** Measured shift values are adjusted to the average surveillance material chemistry and irradiation temperature, and are verified to be within 2 sigma of the trend curve based on RG 1.99 Rev. 2 Position 1.1.*
For a large population of surveillance data (e.g., 9 data points for SA-1526), one or two slightly non-conservative data points do not invalidate the conclusion that use of RG 1.99 Rev. 2 Postion 1.1 is conservative.
*** If surveillance data are non-credible but the Pos. 1.1 CF is shown to be conservative, the lower of the Pos. 1.1 and Pos. 2.1 chemistry factors is applied to the beltline material with a full margin term.*
If surveillance data are non-credible and the Pos. 1.1 CF is shown to be non-conservative, the greater of the Pos. 1.1 and Pos. 2.1 chemistry factors is applied to the beltline material with a full margin term.

Credibility and Conservatism Assessment Summary

Capsule ID (Including Source)	(1) Temperature Correction Applied for Credibility?	(2) Chemistry Correction Applied for Credibility?	Surveillance Data Credible or Non-Credible?	(3) Temperature Correction Applied to Surv. Data for Application to Beltline Material?	(4) Chemistry Correction Applied to Surv. Data for Application to Beltline Material?	Conservatism Check for Pos. 1.1 CF when Surv. Data Non-Credible: Adjusted Delta-RT(NDT) (F) *	Predicted Delta-RT(NDT) (F) ***	Adjusted - Predicted Delta-RT(NDT) (F) *	Are adjusted surveillance data within 2 sigma of the applied CF trend curve? *
Capsule TMI2-LG1 (BWOG CR-3 Irrad.)	Yes	No	Credible	Yes	No	223	197	26	Conservative
Capsule CR3-LG1 (BWOG CR-3 Irrad.)	Yes	No	Credible	Yes	No	209	191	18	Conservative
Capsule TMI2-LG1 (BWOG CR-3 Irrad.)	Yes	No	Credible	Yes	No	233	206	27	Conservative
Three Mile Island Unit 1 Capsule C	Yes	No	Non-Credible	Yes	No	173	200	-27	Conservative
Three Mile Island Unit 1 Capsule E	Yes	No	Credible	Yes	No	81	85	-4	Conservative
Capsule W-1 (CR-3 NBD)	Yes	No	Non-Credible	Yes	No	259	184	75	Non-Conservative
Surry Unit 1 Capsule T	Yes	No	Credible	Yes	No	156	138	18	Conservative
Surry Unit 1 Capsule V	Yes	No	Credible	Yes	No	240	247	-7	Conservative
Surry Unit 1 Capsule X	Yes	No	Credible	Yes	No	227	235	-8	Conservative
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-

(1) For the credibility determination, a temperature correction is not applied to measured values of transition temperature shift if applicable surveillance data were irradiated in a single reactor (i.e., were irradiated at a similar temperature).
(2) For the credibility determination, a chemistry correction is not applied to measured values of transition temperature shift if applicable surveillance data were obtained from a single source (i.e., were machined from the same block of material). **This sensitivity case assumes that all surveillance data were obtained from a single source.**
(3) For determination of the beltline material chemistry factor, a temperature correction is not applied to measured values of transition temperature shift if applicable surveillance data were irradiated in the reactor vessel which is being evaluated (i.e., were irradiated at a similar temperature). A temperature correction is applied only in the conservative direction.
(4) For determination of the beltline material chemistry factor, a chemistry correction (i.e., ratio procedure) is not applied to measured values of transition temperature shift if the chemical composition of applicable surveillance data is essentially identical to the best-estimate chemical composition of the beltline material being evaluated.
This sensitivity case assumes that the chemical composition of surveillance data is essentially identical to that of the beltline material being evaluated.

**** Predicted Delta-RT(NDT) is based upon the RG 1.99 Revision 2 Position 1.1 Chemistry Factor for the average chemical composition of the surveillance materials. (207.7 degrees F)*

SA-1526 (Case E)