50-237 CE DRESDEN 2

RESPONSE TO RAI RE REACTOR PRESSURE VESSEL INTEGRITY

REC'D W/LTR DTD 07/30/98....9808050037

ATTACHMENT

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION REGARDING REACTOR PRESSURE VESSEL INTEGRITY AT DRESDEN NUCLEAR POWER STATION UNITS 2 AND 3, QUAD CITIES UNITS 1 AND 2, AND LASALLE COUNTY STATION UNITS 1 AND 2

References:

1) T. Carpenter letter to NRC dated December 23, 1997, transmitting "Update of Bounding Assessment of BWR/2-6 Reactor Pressure Vessel Integrity Issues (BWRVIP-46)," EPRI Report TR-109727, December 1997

2) M.S. Tuckman (Duke Power) letter to NRC dated July 3, 1997, transmitting CEOG Report "Best Estimate Copper and Nickel Values in CE Fabricated Reactor Vessel Welds," CE NPSD-1039, Revision 2, Final Report, June 1997

3) Howell letter to NRC dated May 28, 1998, transmitting B&WOG Report "Response to Request for Additional Information Regarding Reactor Pressure Vessel Integrity," BAW-2325, May 1998

4) D. Saccomando letter to NRC dated January 17, 1996, transmitting FTI Report "Evaluation of RT_{NDT}, USE, and Chemical Composition of Core Region Electroslag Welds r Dresden Units 2 and 3, "BAW-2258, January 1996

5) D. Saccomando letter to NRC dated January 17, 1996, transmitting FTI Report "Evaluation of RT_{NDT}, USE, and chemical Composition of Core Region Electroslag Welds for Quad Cities Units 1 and 2," BAW-2259, January 1996

6) "WCAP-10502, "Carolina Power & Light Company, Shearon Harris Unit No. 1, Reactor Vessel Radiation Surveillance Program," May 1984 (See Attachment)

7) L. Loflin (Shearon Harris Nuclear Power) letter to NRC dated September 8, 1989, transmitting BAW-2083, "Analysis of Capsule U, Carolina Power & Light Company, Shearon Harris Unit No. 1, Reactor Vessel Material Surveillance Program," August 1989

8) I. Johnson (ComEd) letter to J. Stang (NRC) dated September 30, 1997, transmitting "GE Report "Pressure-Temperature Curves for Dresden and Quad Cities Stations," GE-NE-B11-00707-01R2, April 1997

9) W. Morgan (ComEd) letter to T.E. Murley (NRC) dated October 20, 1989, transmitting "GE Report SASR 88-10, LaSalle County Station Units 1 and 2 Fracture Toughness Analysis Per 10CFR50 Appendix G," March 1988

10) "GE Report MDE-89-0786, "Flux Wire Dosimeter Evaluation for LaSalle Nuclear Power Station, Unit 1," DRF A00-02764, October 1987 (See Attachment)

11) "GE Report SASR 87-59, "Flux Wire Dosimeter Evaluation for LaSalle Nuclear Power Station, Unit 2," DRF A00-02764, October 1987 (See Attachment).

12) G. Benes (ComEd) letter to NRC dated March 23, 1995, transmitting, "GE Report GE-NE-523-A166-1294, Revision 1, "LaSalle Unit 1 RPV Surveillance Materials Testing and Analysis," June 1995

13) G. Benes (ComEd) letter to NRC dated February 29, 1996, transmitting "GE Report GE-NE-B1301786-01, Revision 0, "LaSalle Unit 2 RPV Surveillance Materials Testing and Analysis," February 1996

14) Techalloy Illinois, Inc. Certified Material Test Report for weld wire heat 5P6771, as supplied to CBI Nuclear Company, June 28, 1974 (See Attachment)

15) Weld Results from BWRVIP Letter 98-310 regarding "Transmittal of CBI Reactor Vessel Fabrication Data" dated July 6, 1998 (See Attachment)

Based on information received in Reference 1, in accordance with the provisions of Generic Letter 92-01, Supplement 1, the NRC requested the following:

Section 1.0: Assessment of Best-Estimate Chemistry

"1. An evaluation of the bounding assessment in the reference above [Reference 1] and its applicability to the determination of the best-estimate chemistry for all of the reactor pressure vessel (RPV) beltline welds. Based upon this reevaluation, supply the information necessary to completely fill out the data requested in Table 1 (attached) for each RPV beltline material. If the limiting material for the vessel's pressure-temperature limits is not a weld, include the information requested in Table 1 for the limiting material also."

Section 2.0: P-T Limit Evaluation

"2. If the limiting material for [Dresden, Quad Cities, or LaSalle] changes or if the adjusted reference temperature for the limiting material increases as a result of the above evaluations, provide the revised RT_{NDT} value for the limiting material. In addition, if the adjusted RT_{NDT} value increased, provide a schedule for revising the P-T limits. The schedule should ensure that compliance with 10 CFR Part 50, Appendix G, is maintained."

ComEd has performed a re-evaluation of RPV weld chemistry values previously submitted as part of the current licensing basis for Dresden Units 2 and 3, Quad Cities Units 1 and 2, and LaSalle Units 1 and 2 and presented the results in the attached Tables 1 through 6 respectively. These tables include the latest known best-estimate chemistry information for all beltline materials in the six ComEd Boiling Water Reactor (BWR) RPVs. Additional input information has been provided in these tables to ease the comparison and understanding of the calculated adjusted reference temperatures (ARTs). The footnotes, provided with each table, identify the references and the evaluation methods used to determine the best-estimate chemistry values.

For most of the weld best-estimate chemistries, the mean-of-the-sources approach, utilized by both Combustion Engineering Owners Group (CEOG) and Babcock & Wilcox Owners Group (B&WOG), has been utilized in the evaluation of all chemistry data with multiple material sources. In applying this approach to a given weld wire heat, all available test results from separate and distinct test or production welds are averaged. The resulting average values for separate and distinct test or production welds are subsequently averaged to obtain the best estimate value. The mean-of-the-sources approach provides the most appropriate estimate of weld chemistry. This approach eliminates the inappropriate weighting effect which widely varying numbers of analyses performed on individual weld blocks can have.

For Dresden Units 2 and 3 and Quad Cities Units 1 and 2, Reference 3 has been utilized for the B&W-fabricated welds. It contains more recent chemistry information than the Framatome Technologies Incorporated (FTI) analyses of Linde 80 welds documented in NRC Inspection Report 99901300/97-01, dated January 28, 1998. (See cover letter References 1 and 2).

Consistently applying the mean of the sources approach to the available electroslag (ES) weld data presented in References 4 and 5, results in a higher value of generic best-estimate nickel and a 1° increase in the ART for ES welds. For all the other Dresden and Quad Cities RPV beltline welds, the changes in best-estimate chemistries resulted in lower or no change to the ARTs. The most limiting beltline material among the four Dresden and Quad Cities RPVs, i.e. Dresden Unit 3 girth weld made with weld wire heat 299L44, was used in the calculation of the current licensing basis P-T limits for all four Dresden and Quad Cities units. The ART for this weld is actually reduced by using the latest best-estimate chemistry values, and it still bounds the 1° increase in ART for the ES welds.

Consequently, the limiting material for Dresden Units 2 and 3 and Quad Cities Units 1 and 2 does not change and has a reduction in ART based on the revised best-estimate chemistry values. For this reason, the current licensing basis P-T limits for Dresden Units 2 and 3 and Quad Cities Units 1 and 2 are conservative. ComEd elects not to change the current licensing basis for Dresden Units 2 and 3 and Quad Cities Units 1 and 2 at this time.

For LaSalle Unit 1, all weld best-estimate chemistry values were obtained from Reference 2, which provides a detailed explanation of the approach used to determine the best-estimate chemistry values for each beltline weld. The vertical welds, 4-308 in the lower-intermediate shell coarse and 2-307 in the lower shell course, were fabricated using tandem weld wires from separate heats of material. For these welds, Table 5 presents the best-estimate chemistry values from Reference 2, for the individual weld wires as well as the tandem weld wires. The ART for the lower intermediate shell course vertical weld, 4-308, increased for the tandem weld wire and the single weld wire heat, 12008, but did not become the limiting material. The ARTs for the other beltline welds were reduced using the best-estimate chemistry values. The most limiting beltline material of LaSalle Unit 1 remains the middle shell weld, 3-308, made with weld wire heat 1P3571. The ART for this weld is actually reduced by using the latest CEOG best-estimate chemistry values from Reference 2.

For LaSalle Unit 2, additional information for CBI Nuclear Company (CBIN) weld 5P6771, obtained from Carolina Power & Light and shown in References 6, 7, and 14, has been utilized in addition to the CBIN data provided in Reference 1. Also, additional weld chemistry data and data source information was obtained from Reference 15 for welds 3P4000 and 3P4966. Although minor changes in best-estimate chemistry values resulted, the ARTs for the welds did not change based on the best-estimate chemistry values. The most limiting beltline material of LaSalle Unit 2 remains the lower-intermediate shell plate 22-2, heat C9404-2.

Consequently, the current licensing basis P-T limits for LaSalle Unit 1 are conservative and for LaSalle Unit 2 are unchanged. ComEd elects not to change the current licensing basis at this time.

In summary, the chemistry values for the beltline welds of the Dresden Units 2 and 3, Quad Cities Units 1 and 2, and LaSalle Units 1 and 2 reactor pressure vessels were evaluated using the information provided in References 1 – 7, 14 and 15. Based on this information, the best-estimate chemistry values were determined using the appropriate method for grouping multiple sets of chemistry data. The results of this evaluation are provided in Tables 1 through 6 for Dresden Units 2 and 3, Quad Cities Units 1 and 2, and LaSalle Units 1 and 2 reactor pressure vessels, respectively. As seen from these tables, the limiting material did not change and the ART for the limiting material was reduced or remained unchanged for all of the vessels.

Table 1. Information Requested on Dresden Unit 2 RPV Beltline Welds and/or Limiting Materials

Unless otherwise noted, all ART input data obtained from current licensing basis GE-NE-B11-00707-01R2, "Pressure-Temperature Curves for Dresden and Quad Cities Stations," April 1997. All beltline materials are included for comparison. Adjusted reference temperature (ART) calculated per Reg Guide 1.99 Rev. 2.

Vessel Manufacturer:	Babcock & Wilcox
Plate and Weld Thickness (without cladding):	6.13"
32 EFPY Peak ID Surface Fluence (without cladding):	3.60E+17 n/cm^2
32 EFPY Peak 1/4T Fluence **(A)** :	2.49E+17 n/cm^2

Component Description	Weld Type	# of Vertical Welds	Heat or Heat/Lot	Initial RT_{NDT} (°F)	%Cu	%Ni	CF per RG1.99 R2 Tables	EOL Fluence Factor @ 1/4T	EOL ΔRT_{NDT} (°F)	σ_I	σ_Δ	Margin (°F)	EOL ART (°F) (F)
Plates:													
Lower 6-198-2	N/A	N/A	A-9128-2	10	0.2	0.55	143	0.1967	28.13	0.0	14.07	28.13	66
Lower 6-198-3	N/A	N/A	B-3990-2	12	0.18	0.51	125	0.1967	24.59	0.0	12.30	24.59	61
Lower 6-198-1	N/A	N/A	A-9128-1	30	0.2	0.55	143	0.1967	28.13	0.0	14.07	28.13	86
Lower-Intmed 6-198-12	N/A	N/A	B4065-1	20	0.23	0.55	160	0.1967	31.47	0.0	15.74	31.47	83
Lower-Intmed 6-198-13	N/A	N/A	B5764-1	10	0.1	0.5	65	0.1967	12.79	0.0	6.40	12.79	36
Lower-Intmed 6-198-11	N/A	N/A	B-4030-1	6	0.2	0.59	148 **(B)**	0.1967	29.11	0.0	14.56	29.11	64
Lower-Intmed 6-198-9	N/A	N/A	B-4030-2	-2	0.2	0.58	147 **(B)**	0.1967	28.91	0.0	14.46	28.91	56
Vertical Welds:													
Lower Intmed. Shell	ES	2	Generic **(C)**	23.1	0.24	0.36	139	0.1967	27.34	13.0	13.67	37.73	88
			(E)		**0.24**	**0.37**	**141**		**27.73**		**13.87**	**38.02**	**89**
Lower Intmed. Shell	SAW	1	1P0661/8304 (SA-775)	-5	0.19	0.63	162	0.1967	31.87	20.0	15.94	51.15	78
			(D)		**0.17**	**0.64**	**158**		**31.08**		**15.54**	**50.66**	**77**
Lower Intmed. Shell	SAW	1	1P0815/8350 (SA-812)	-5	0.17	0.52	138	0.1967	27.14	20.0	13.57	48.34	70
			(D)		**0.17**	**0.52**	**138**		**27.14**		**13.57**	**48.34**	**70**
Lower Shell	ES	3	Generic **(C)**	23.1	0.24	0.36	139 **(B)**	0.1967	27.34	13.0	13.67	37.73	88
			(E)		**0.24**	**0.37**	**141**		**27.73**		**13.87**	**38.02**	**89**
Lower Shell	SAW	1	1P0815/8304 (SA-806)	-5	0.17	0.52	138	0.1967	27.14	20.0	13.57	48.34	70
			(D)		**0.17**	**0.52**			**27.14**		**13.57**	**48.34**	**70**
Girth Weld:													
Lower to Lower Intmed. Shell	SAW	N/A	71249/8504 (SA-1344)	10	0.26	0.61	182	0.1967	35.80	0.0	17.9	35.80	82
			(D)		**0.23**	**0.59**	**168**		**33.05**		**16.53**	**33.05**	**76**

Footnotes With Discussion of Analysis Method and Data Used for Each Weld Wire Heat:

(A) Peak 1/4T fluence applied conservatively to all beltline materials for P-T limit ART calculation.

(B) Corrected from GE-NE-B1100707-01R2 per Reg. Guide 1.99 Rev. 2 Tables

(C) Electroslag (ES) weld values from BAW-2258, January 1996. Best-estimate chemistry values for ES welds include one standard deviation per Reg Guide 1.99 Rev. 2 for generic values.

(D) For same heat/lot combination, mean-of-the-sources best-estimate chemistry based on BAW-2325, May 1998; other inputs held constant.

(E) Recalculated electroslag (ES) best-estimate weld chemistry values based on data from BAW-2258, January 1996, but applying current B&WOG mean-of-the-sources approach by grouping together data from individual surveillance welds from Dresden Unit 3, Quad Cities Units 1 and 2, and Peach Bottom Units 2 and 3; other inputs held constant. Best-estimate chemistry values for ES welds include one standard deviation per Reg Guide 1.99 Rev. 2 for generic values.

(F) Calculated ART values are rounded to the nearest °F in accordance with the rounding-off method of ASTM Practice E29.

T[redacted]2. Information Requested on Dresden Unit 3 RPV B[redacted]e Welds and/or Limiting Materials

Unle[redacted]herwise noted, all ART input data obtained from current licensing basis GE-NE-B1100707-01R2, [redacted]essure-Temperature Curves for Dresden and Quad Cities Stations," April 1997. All beltline materials are included for comparison. Adjusted reference temperature (ART) calculated per Reg Guide 1.99 Rev. 2.

Vessel Manufacturer:	Babcock & Wilcox
Plate and Weld Thickness (without cladding):	6.13"
32 EFPY Peak ID Surface Fluence (without cladding):	5.10E+17 n/cm^2
32 EFPY Peak 1/4T Fluence **(A)** :	3.53E+17 n/cm^2

Component Description	Weld Type	# of Vertical Welds	Heat or Heat/Lot	Initial RT_{NDT} (°F)	%Cu	%Ni	CF per RG1.99 R2 Tables	EOL Fluence Factor @ 1/4T	EOL ΔRT_{NDT} (°F)	σ_I	σ_Δ	Margin (°F)	EOL ART (°F) **(E)**
Plates:													
Lower 6-111-2	N/A	N/A	C1256-2	-10	0.11	0.5	73	0.2413	17.61	0.0	8.81	17.61	25
Lower 6-111-6	N/A	N/A	B5159-2	0.0	0.24	0.47	153	0.2413	36.92	0.0	17.00	34.00	71
Lower 6-111-7	N/A	N/A	C1182-2	10	0.22	0.5	148	0.2413	35.71	0.0	17.00	34.00	80
Lower-Intmed 6-111-3	N/A	N/A	A0237-1	10	0.23	0.49	151	0.2413	36.44	0.0	17.00	34.00	80
Lower-Intmed 6-111-10	N/A	N/A	B5118-1	10	0.22	0.49	146	0.2413	35.23	0.0	17.00	34.00	79
Lower-Intmed 6-111-11	N/A	N/A	C1290-2	10	0.15	0.49	104	0.2413	25.10	0.0	12.55	25.10	60
Vertical Welds:													
Lower Intmed. Shell	ES	3	Generic **(B)**	23.1	0.24	0.36	139	0.2413	33.54	13.0	16.77	42.44	99
			(D)		**0.24**	**0.37**	**141**		**34.02**		**17.01**	**42.82**	**100**
Lower Shell	ES	3	Generic **(B)**	23.1	0.24	0.36	139	0.2413	33.54	13.0	16.77	42.44	99
			(D)		**0.24**	**0.37**	**141**		**34.02**		**17.01**	**42.82**	**100**
Girth Weld:													
Lower to Lower Intmed. Shell	SAW	N/A	299L44/8650 (WF-19/WF-25)	-5	0.35	0.68	224	0.2413	54.05	20.0	27.03	67.25	116
			(C)		**0.34**	**0.68**	**221**		**53.33**		**26.67**	**66.67**	**115**

Footnotes With Discussion of Analysis Method and Data Used for Each Weld Wire Heat:

(A) Peak 1/4T fluence applied conservatively to all beltline materials for P-T limit ART calculation.

(B) Electroslag (ES) weld values from BAW-2258, January 1996. Best-estimate chemistry values for ES welds include one standard deviation per Reg Guide 1.99 Rev. 2 for generic values.

(C) For same heat/lot combination, mean of the sources best-estimate chemistry based on BAW-2325, May 1998.

(D) Recalculated electroslag (ES) best-estimate weld chemistry values based on data from BAW-2258, January 1996, but applying current B&WOG mean-of-the-sources approach by grouping together data from individual surveillance welds from Dresden Unit 3, Quad Cities Units 1 and 2, and Peach Bottom Units 2 and 3; other inputs held constant. Best-estimate chemistry values for ES welds include one standard deviation per Reg Guide 1.99 Rev. 2 for generic values.

(E) Calculated ART values are rounded to the nearest °F in accordance with the rounding-off method of ASTM Practice E29.

Table 3. Information Requested on Quad Cities Unit 1 RPV Beltline Welds and Limiting Materials

Unless otherwise noted, all ART input data obtained from current licensing basis GE-NE-B1100-707-01R2, "Pressure-Temperature Curves for Dresden and Quad Cities Stations," April 1997. All beltline materials are included for comparison. Adjusted reference temperature (ART) calculated per Reg Guide 1.99 Rev. 2.

Vessel Manufacturer:	Babcock & Wilcox
Plate and Weld Thickness (without cladding):	6.13"
32 EFPY Peak ID Surface Fluence (without cladding):	3.50E+17 n/cm^2
32 EFPY Peak 1/4T Fluence **(A)** :	2.42E+17 n/cm^2

Component Description	Weld Type	# of Vertical Welds	Heat or Heat/Lot	Initial RT_{NDT} (°F)	%Cu	%Ni	CF per RG1.99 R2 Tables	EOL Fluence Factor @ 1/4T	EOL ΔRT_{NDT} (°F)	σ_I	σ_Δ	Margin (°F)	EOL ART (°F) **(E)**
Plates:													
Lower 6-122-1	N/A	N/A	B5524-1	0	0.27	0.57	180	0.1933	34.79	0.0	17.00	34.00	69
Lower 6-122-2	N/A	N/A	A0610-1	-20	0.21	0.51	143	0.1933	27.64	0.0	13.82	27.64	35
Lower 6-122-11	N/A	N/A	C1485-2	-10	0.23	0.5	153	0.1933	29.57	0.0	14.79	29.57	49
Lower-Intmed 6-122-4	N/A	N/A	C1505-2	-6	0.18	0.52	126	0.1933	24.36	0.0	12.18	24.36	43
Lower-Intmed 6-122-6	N/A	N/A	C1498-2	-20	0.17	0.5	119	0.1933	23.00	0.0	11.50	23.00	26
Lower-Intmed 6-122-13	N/A	N/A	A0931-1	-20	0.14	0.51	96	0.1933	18.56	0.0	9.28	18.56	17
Vertical Welds:													
Lower Intmed. Shell	ES	4	Generic **(B)**	23.1	0.24	0.36	139	0.1933	26.87	13	13.43	37.38	87
			(D)		**0.24**	**0.37**	**141**		**27.26**		**13.63**	**37.67**	**88**
Lower Shell	ES	4	Generic **(B)**	23.1	0.24	0.36	139	0.1933	26.87	13	13.43	37.38	87
			(D)		**0.24**	**0.37**	**141**		**27.26**		**13.63**	**37.67**	**88**
Girth Weld:													
Lower to Lower Intmed. Shell	SAW	N/A	72445/8688 (WF-101)	-5	0.21	0.59	162	0.1933	31.31	20	15.66	50.80	77
			(C)		**0.22**	**0.54**	**158**		**30.54**		**15.27**	**50.33**	**76**
Lower to Lower Intmed. Shell	SAW	N/A	406L44/8688 (WF-112)	-5	0.31	0.59	197	0.1933	38.08	20	19.14	55.37	88
			(C)		**0.27**	**0.59**	**183**		**35.37**		**17.69**	**53.40**	**84**

Footnotes With Discussion of Analysis Method and Data Used for Each Weld Wire Heat:

(A) Peak 1/4T fluence applied conservatively to all beltline materials for P-T limit ART calculation.

(B) Electroslag (ES) weld values from BAW-2259, January 1996. Best-estimate chemistry values for ES welds include one standard deviation per Reg Guide 1.99 Rev. 2 for generic values.

(C) For same heat/lot combination, mean-of-the-sources best-estimate chemistry based on BAW-2325, May 1998.

(D) Recalculated electroslag (ES) best-estimate weld chemistry values based on data from BAW-2259, January 1996, but applying current B&WOG mean-of-the-sources approach by grouping together data from individual surveillance welds from Dresden Unit 3, Quad Cities Units 1 and 2, and Peach Bottom Units 2 and 3; other inputs held constant. Best-estimate chemistry values for ES welds include one standard deviation per Reg Guide 1.99 Rev. 2 for generic values.

(E) Calculated ART values are rounded to the nearest °F in accordance with the rounding-off method of ASTM Practice E29.

T[redacted]4. Information Requested on Quad Cities Unit 2 RP[redacted]ltline Welds and/or Limiting Materials

Unle[redacted]herwise noted, all ART input data obtained from current licensing basis GE-NE-B1100-707-01R[redacted]essure-Temperature Curves for Dresden and Quad Cities Stations," April 1997. All beltline materials are included for comparison. Adjusted reference temperature (ART) calculated per Reg Guide 1.99 Rev. 2.

Vessel Manufacturer:	Babcock & Wilcox/RDM/CB&I
Plate and Weld Thickness (without cladding):	6.13"
32 EFPY Peak ID Surface Fluence (without cladding):	4.90E+17 n/cm^2
32 EFPY Peak 1/4T Fluence (A) :	3.39E+17 n/cm^2

Component Description	Weld Type	# of Vertical Welds	Heat or Heat/Lot	Initial RT_{NDT} (°F)	%Cu	%Ni	CF per RG1.99 R2 Tables	EOL Fluence Factor @ 1/4T	EOL ΔRT_{NDT} (°F)	σ_I	σ_Δ	Margin (°F)	EOL ART (°F) (E)
Plates:													
Lower 6-122-8	N/A	N/A	C1516-2	6	0.16	0.46	108	0.2357	25.46	0.0	12.73	25.46	57
Lower 6-122-10	N/A	N/A	C1501-2	-10	0.18	0.49	124	0.2357	29.23	0.0	14.61	29.23	48
Lower 6-122-14	N/A	N/A	C1722-2	10	0.14	0.54	97	0.2357	22.86	0.0	11.43	22.86	56
Lower-Intmed 6-139-16	N/A	N/A	C2753-2	10	0.08	0.5	51	0.2357	12.02	0.0	6.01	12.02	34
Lower-Intmed 6-139-22	N/A	N/A	C2868-1	10	0.08	0.48	51	0.2357	12.02	0.0	6.01	12.02	34
Lower-Intmed 6-139-25	N/A	N/A	C3307-2	10	0.12	0.55	82	0.2357	19.33	0.0	9.66	19.33	49
Vertical Welds:													
Lower Intmed. Shell	ES	3	Generic (B)	23.1	0.24	0.36	139	0.2357	32.76	13	16.38	41.82	98
			(D)		**0.24**	**0.37**	**141**		**33.23**		**16.62**	**42.20**	**99**
Lower Shell	ES	3	Generic (B)	23.1	0.24	0.36	139	0.2357	32.76	13	16.38	41.82	98
			(D)		**0.24**	**0.37**	**141**		**33.23**		**16.62**	**42.20**	**99**
Girth Weld:													
Lower to Lower Intmed. Shell	SAW	N/A	S3986/3870 (Linde 124, by CB&I)	-32	0.05	0.96	68	0.2357	16.03	0.0	8.01	16.03	0
			(C)		**0.05**	**0.96**	**68**		**16.03**		**8.01**	**16.03**	**0**

Footnotes With Discussion of Analysis Method and Data Used for Each Weld Wire Heat:

(A) Peak 1/4T fluence applied conservatively to all beltline materials for P-T limit ART calculation.

(B) Electroslag (ES) weld values from BAW-2259, January 1996. Best-estimate chemistry values for ES welds include one standard deviation per Reg Guide 1.99 Rev. 2 for generic values.

(C) Recalculated best-estimate weld chemistry values based on data from Reference 1, Table B-3, applying mean-of-the-sources approach by separately grouping data from the Brunswick 1 and Trojan surveillance weld blocks, and treating all other data as from separate sources; other inputs held constant.

(D) Recalculated electroslag (ES) best-estimate weld chemistry values based on data from BAW-2259, January 1996, but applying current B&WOG mean-of-the-sources approach by grouping together data from individual surveillance welds from Dresden Unit 3, Quad Cities Units 1 and 2, and Peach Bottom Units 2 and 3; other inputs held constant. Best-estimate chemistry values for ES welds include one standard deviation per Reg Guide 1.99 Rev. 2 for generic values.

(E) Calculated ART values are rounded to the nearest °F in accordance with the rounding-off method of ASTM Practice E29.

Table [redacted]. Information Requested on LaSalle Unit 1 RPV Be[redacted] Welds and/or Limiting Materials

Unless otherwise noted, all ART input data obtained from current licensing basis GE Report SASR 88-10, "LaSalle County Station Units 1 and 2 Fracture Toughness Analysis Per 10 CFR 50 Appendix G," March 1988 All beltline materials are included for comparison. Adjusted reference temperature (ART) calculated per Reg Guide 1.99 Rev. 2.

Vessel Manufacturer:	Combustion Engineering
Plate and Weld Thickness (without cladding):	6.13" **(A)**
32 EFPY Peak ID Surface Fluence (without cladding):	6.1E+17 n/cm^2 **(B)**
32 EFPY Peak 1/4T Fluence:	3.9E+17 n/cm^2 **(B) (C)**

Component Description	Weld Type	# of Vertical Welds	Heat or Heat/Lot	Initial RT_{NDT} (°F)	%Cu	%Ni	CF per RG1.99R2 Tables	EOL Fluence Factor @ 1/4T	EOL ΔRT_{NDT} (°F)	σ_I	σ_Δ	Margin (°F)	EOL ART (°F) **(G)**
Plates:													
Middle G-5605-1	N/A	N/A	A5333-1	-10	0.12	0.54	82	0.2553	20.93	0.0	10.47	20.93	32
Middle G-5605-2	N/A	N/A	B0078-1	-10	0.15	0.50	105	0.2553	26.81	0.0	13.40	26.81	44
Middle G-5605-3	N/A	N/A	C6123-2	-10	0.13	0.68	93	0.2553	23.74	0.0	11.87	23.74	37
Lower-Intmed. G-5604-1	N/A	N/A	C6345-1	-20	0.15	0.49	104 **(D)**	0.2553	26.55	0.0	13.28	26.55	33
Lower-Intmed. G-5604-2	N/A	N/A	C6318-1	-20	0.12	0.51	81	0.2553	20.68	0.0	10.34	20.68	21
Lower-Intmed. G-5604-3	N/A	N/A	C6345-2	-20	0.15	0.51	105	0.2553	26.81	0.0	13.40	26.81	34
Lower G-5603-1	N/A	N/A	C5978-1	14	0.11	0.58	74	0.2553	18.89	0.0	9.45	18.89	52
Lower G-5603-2	N/A	N/A	C5978-2	23	0.11	0.59	74	0.2553	18.89	0.0	9.45	18.89	61
Lower G-5603-3	N/A	N/A	C5979-1	10	0.12	0.66	84	0.2553	21.45	0.0	10.72	21.45	53
Vertical Welds:													
Middle Shell 3-308	SAW	3	305424	-50	0.30	0.64	200	0.2553	51.06	0.0	25.53	51.06	52
			(E)		**0.273**	**0.629**	**189**		**48.25**		**24.13**	**48.25**	**46**
			1P3571	-30	0.37	0.75	241	0.2553	61.53	0.0	28.00	56.00	88
			(E)		**0.283**	**0.755**	**212**		**54.12**		**27.06**	**54.12**	**78**
Lower Intmed. Shell 4-308	SAW	3	305414	-50	0.33	0.59	204	0.2553	52.08	0.0	26.04	52.08	54
			(E)		**0.337**	**0.609**	**210**		**53.61**		**26.81**	**53.61**	**57**
			12008	-50	0.28	0.74	209	0.2553	53.36	0.0	26.68	53.36	57
			(E)		**0.235**	**0.975**	**236**		**60.25**		**28.00**	**56.00**	**66**
			305414/12008 Tandem (E)		**0.286**	**0.792**	**220**		**56.17**		**28.00**	**56.00**	**62**
Lower Shell 2-307	SAW	3	21935	-50	0.21	0.68	177	0.2553	45.19	0.0	22.59	45.19	40
			(E)		**0.183**	**0.704**	**171**		**43.66**		**21.83**	**43.66**	**37**
			12008	-50	0.27	1.0	249	0.2553	63.57	0.0	28.00	56.00	70
			(E)		**0.235**	**0.975**	**236**		**60.25**		**28.00**	**56.00**	**66**
			21935/12008 Tandem (E)		**0.213**	**0.867**	**208**		**53.10**		**26.55**	**53.10**	**56**
Girth Weld:													
Middle-to-Lower-Intmed 6-308	SAW	N/A	6329637	-50	0.24	1.0	239	0.2553	61.02	0.0	28.00	56.00	67
			(E)		**0.205**	**0.105**	**101**	**0.2553**	**25.79**	**0.0**	**12.89**	**25.79**	**2**
Lower to Lower Intmed. Shell 1-313	SAW	N/A	AP6519 **(F)**	-60	0.18	0.06	84	0.2553	21.45	0.0	10.72	21.45	-17
			(E)		**0.131**	**0.060**	**63**	**0.2553**	**16.08**	**0.0**	**8.04**	**16.08**	**-28**

(SEE FOOTNOTES ON FOLLOWING PAGE)

T[redacted]. Information Requested on LaSalle Unit 1 RPV Be[redacted] Welds and/or Limiting Materials

Footnotes With Discussion of Analysis Method and Data Used for Each Weld Wire Heat:

(A) Source: Reference 12.

(B) Source: Reference 10.

(C) Peak 1/4T fluence applied conservatively to all beltline materials for P-T limit ART calculation, using more conservative lead factor of Reference 10 instead of Reg Guide 1.99 Rev. 2 Equation 3.

(D) Corrected from Reference 9.

(E) See Reference 2, Section 6 for explanation of analysis method and data used for each heat.

(F) Typo, believed to be heat 4P6519.

(G) Calculated ART values are rounded to the nearest °F in accordance with the rounding-off method of ASTM Practice E29.

T[redacted]6. Information Requested on LaSalle 2 RPV Beltline [redacted]ds and/or Limiting Materials

Unle[redacted]herwise noted, all ART input data obtained from current licensing basis GE Report SASR 88-10, [redacted]lle County Station Units 1 and 2 Fracture Toughness Analysis Per 10 CFR 50 Appendix G, [redacted]ch 1988. All beltline materials are included for comparison. Adjusted reference temperature (ART) calculated per Reg Guide 1.99 Rev. 2.

Vessel Manufacturer:	CBIN
Plate and Weld Thickness (without cladding):	6.19" **(A)**
32 EFPY Peak ID Surface Fluence (without cladding):	6.4E+17 n/cm^2 **(B)**
32 EFPY Peak 1/4T Fluence:	4.2E+17 n/cm^2 **(B) (C)**

Component Description	Weld Type	# of Vertical Welds	Heat or Heat/Lot	Initial RT_{NDT} (°F)	%Cu	%Ni	CF per RG1.99R 2 Tables	EOL Fluence Factor @ 1/4T	EOL ΔRT_{NDT} (°F)	σ_I	σ_Δ	Margin (°F)	EOL ART (°F) **(F)**
Plates:													
Lower 21-1	N/A	N/A	C9425-2	30	0.12	0.51	81	0.2661	21.55	0.0	10.78	21.55	73
Lower 21-2	N/A	N/A	C9425-1	32	0.12	0.51	81	0.2661	21.55	0.0	10.78	21.55	75
Lower 21-3	N/A	N/A	C9434-2	10	0.09	0.51	58	0.2661	15.43	0.0	7.72	15.43	41
Lower-Intmed. 22-1	N/A	N/A	C9481-1	10	0.11	0.50	73	0.2661	19.43	0.0	9.71	19.43	49
Lower-Intmed. 22-2	N/A	N/A	C9404-2	52	0.07	0.49	44	0.2661	11.71	0.0	5.85	11.71	75
Lower-Intmed. 22-3	N/A	N/A	C9601-2	10	0.12	0.50	81	0.2661	21.55	0.0	10.78	21.55	53
Vertical Welds:													
Lower Intmed. Shell	SAW	3	3P400 **(G)**	-50	0.02	0.89	27	0.2661	7.18	0.0	3.59	7.18	-36
			(H)		**0.02**	**0.93**	**27**		**7.18**		**3.59**	**7.18**	**-36**
Lower Shell	SAW	3	3P4966	-6	0.03	0.90	41	0.2661	10.91	0.0	5.46	10.91	16
	SAW		**(D)**		**0.026**	**0.92**	**41**		**10.91**		**5.46**	**10.91**	**16**
Girth Weld:													
Lower to Lower Intmed. Shell	SAW	N/A	5P6771	-34	0.04	0.95	54	0.2661	14.37	0.0	7.18	14.37	-5
			(E)		**0.04**	**0.94**	**54**		**14.37**		**7.18**	**14.37**	**-5**

Footnotes With Discussion of Analysis Method and Data Used for Each Weld Wire Heat:

(A) Source: Reference 13.

(B) Source: Reference 11.

(C) Peak 1/4T fluence applied conservatively to all beltline materials for P-T limit ART calculation, using more conservative lead factor of Reference 11 instead of Reg Guide 1.99 Rev. 2 Equation 3.

(D) Source: Reference 1, Table B-5. Data sources were identified from Reference 15. Best-estimate chemistry values calculated using a simple average of all data in Table B-5 by treating single wire weld qualification data, tandem wire weld qualification data, weld wire CMTR data, and separate flux lot data as separate sources, was calculated.

(E) Source: References 6, 7, and 14. Best-estimate chemistry values calculated using mean-of-sources approach by grouping WCAP-10502 and BAW-2083 surveillance weld data, and treating single wire weld qualification data, tandem wire weld qualification data, and weld wire CMTR data as separate sources; other inputs held constant.

(F) Calculated ART values are rounded to the nearest °F in accordance with the rounding-off method of ASTM Practice E29.

(G) Typo, believed to be 3P4000.

(H) No new information for this heat provided in Reference 1, however additional data was provided in Reference 15. Best-estimate chemistry values calculated using a simple average of all data from Reference 15 by treating single wire weld qualification data, tandem wire weld qualification data, weld wire CMTR data, and separate flux lot data as separate sources.

REFERENCE 6

"WCAP-10502, "Carolina Power & Light Company, Shearon Harris Unit No. 1, Reactor Vessel Radiation Surveillance Program," May 1984

WCAP-10502

S.O. C&C-106

CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS UNIT NO. 1
REACTOR VESSEL RADIATION
SURVEILLANCE PROGRAM

L. R. Singer

May 1984

APPROVED: T. R. Mager

T. R. Mager, Manager
Metallurgical and NDE Analysis

Work Performed Under COL-106

WESTINGHOUSE ELECTRIC CORPORATION
Nuclear Energy Systems
P. O. Box 355
Pittsburgh, Pennsylvania 15230

TABLE A-3

CHEMICAL ANALYSIS OF THE WELD METAL USED USED IN THE CORE REGION LONGITUDINAL AND GIRTH WELD SEAMS OF THE SHEARON HARRIS UNIT NO. 1 REACTOR PRESSURE VESSEL

Element	Chemical Composition (weight %) Weld Metal				
	Intermediate and Lower Shell Longitudinal Weld Seams [a] (Weld Wire Heat No. 4P4784, Linde 124 Flux, Lot No. 3930)		Closing Girth Weld Seam [a] Joining the Intermediate to Lower Shell (Weld Wire Heat No. 5P6771, Linde 124 Flux, Lot No. 0342)		Westinghouse Surveillance Program Test Weldment[b] Weld Wire Heat No: 5P6771 Linde 124 Flux, Lot No. 0342 (Identical to the Closing Girth Seam Weld)
	Single Wire	Tandem Wire	Single Wire	Tandem Wire	
C	.10	.09	.06	.06	.04
Mn	1.37	1.32	1.22	1.30	1.23
P	.012	.013	.11	.013	.006
S	.013	.012	.012	.011	.006
Si	.43	.48	.46	.45	.41
Ni	.87	.91	.88	.95	.87
Mo	.49	.49	.50	.57	.48
Cr	.10	.14	.10	.08	.068
Cu	.06	.05	.03	.04	.023
Al	.009	.007	.010	.016	.018
Co	.016	.016	—	—	.009
Pb	.021	.021	—	—	< .005
W	.01	< .01	—	—	.02
Ti	.001	.001	—	—	< .001
Zr	< .001	< .001	—	—	< .001
V	.005	.005	.007	.005	< .008
Sn	.005	.005	—	—	.09
As	.006	.006	—	—	< .005
Cb	.002	.002	—	—	< .005
N_2	.002	.002	—	—	.005
B	< .001	< .001	—	—	.011

a Analysis by Chicago Bridge & Iron Company

b Analysis by Westinghouse of the last weldment supplied by Chicago Bridge & Iron Company for the Surveillance Program

REFERENCE 10

"GE Report MDE-89-0786, "Flux Wire Dosimeter Evaluation for LaSalle Nuclear Power Station, Unit 1," DRF A00-02764 July, 1986