Docket File

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

May 12, 1994

Docket Nos. 50-295
and 50-304

Mr. D. L. Farrar
Manager, Nuclear Regulatory Services
Commonwealth Edison Company
Executive Towers West III, Suite 500
1400 OPUS Place
Downers Grove, Illinois 60515

Dear Mr. Farrar:

SUBJECT: GENERIC LETTER (GL) 92-01, REVISION 1, "REACTOR VESSEL STRUCTURAL INTEGRITY," ZION NUCLEAR POWER STATION, UNITS 1 AND 2, (TAC NOS. M83744 AND M83745)

By letters dated July 2, 1992 and November 19, 1993, Commonwealth Edison Company (CECo or the licensee) provided its responses to GL 92-01, Revision 1 for Zion Nuclear Power Station, Units 1 and 2. The staff has completed its review of your responses and based on its review, the staff has determined that CECo has provided the information requested in GL 92-01.

The GL is part of the staff's program to evaluate reactor vessel integrity for Pressurized Water Reactors (PWRs) and Boiling Water Reactors (BWRs). The information provided in response to GL 92-01, including previously docketed information is being used to confirm that licensees satisfy the requirements and commitments necessary to ensure reactor vessel integrity for their facilities.

A substantial amount of information was provided in response to GL 92-01, Revision 1. These data have been entered into a computerized database designated the Reactor Vessel Integrity Database (RVID). The RVID contains the following tables: A pressurized thermal shock (PTS) table for PWRs, a pressure-temperature limits table for BWRs and an upper-shelf energy (USE) table for PWRs and BWRs. Enclosure 1 provides the PTS table(s), Enclosure 2 provides the USE table(s) for your facilities, and Enclosure 3 provides a key for the nomenclature used in the tables. The tables include the data necessary to perform USE and RT_{PTS} evaluations. These data were taken from your responses to GL 92-01 and previously docketed information. References to the specific source of the data are provided in the tables.

For Zion, Unit 1, which intends to use Topical Reports BAW-2178P and BAW-2148P as its licensing basis, we request that, within 30 days, you provide confirmation of plant specific applicability of topical report BAW-2178P to Zion, Unit 1, and submit a request for approval of this topical report as part of the basis for demonstrating compliance with 10 CFR Part 50, Appendix G, Paragraph IV.A.1. To demonstrate that the topical report is applicable to Zion, Unit 1, you must compare the limiting material properties for the Zion, Unit 1, vessel to the values reported in the topical report. Your submittal will be reviewed as a plant specific licensing action. We further request that you verify that the information you have provided for Zion, Unit 1, has been accurately entered in the RVID. If no comments are made in your response to the last request, the staff will use the information in the tables for future NRC assessments of its reactor pressure vessel. Once your confirmation of the applicability of the topical report and request for approval are received, the staff will consider your actions related to GL 92-01, Revision 1, to be complete.

For Zion, Unit 2, which intends to use Topical Reports BAW-2178P and BAW-2148P as its licensing basis, we request that, within 30 days, you provide confirmation of plant specific applicability of topical report BAW-2178P to Zion, Unit 2, and submit a request for approval of this topical report as part of the basis for compliance with 10 CFR Part 50, Appendix G, Paragraph IV.A.1. To demonstrate that the topical report is applicable to Zion, Unit 2, you must compare the limiting material properties for the Zion Unit 2, vessel to the values reported in the topical report. Your submittal will be reviewed as a plant specific licensing action.

In addition, for Zion, Unit 2, the staff has determined that additional data are required to confirm that the USE at EOL for forging ZV3855 is greater than 50 ft-lb because you have provided a generic mean value for the unirradiated USE from four similar forgings. This value does not consider material variability among the forgings. When the unirradiated USE for a particular forging has not been determined, you can set the USE equal to the lower tolerance limit calculated for the group of similar forgings. The unirradiated USE should be determined such that there exists 95% confidence that at least 95% of the population is greater than the lower tolerance limit. If the lower tolerance limit results in a projected USE at EOL of less than 50 ft-lb, then you must demonstrate, in accordance with Appendix G, 10 CFR Part 50, that lower values of USE will provide margins of safety against fracture equivalent to those required by Appendix G of Section III of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code). We request that you submit, within 30 days, a schedule for performing these analyses.

Further, we request that you verify that the information you have provided for Zion, Unit 2, facility has been accurately entered in the RVID. If no comments are made in your response to this request, the staff will use the information in the tables for future NRC assessments of its reactor pressure vessel. Once your response is received and its schedule is determined to be satisfactory, the staff will consider your actions related to GL 92-01, Revision 1, to be complete. When your analyses are submitted, they will be reviewed as a plant-specific licensing action.

The information requested by this letter is within the scope of the overall burden estimated in GL 92-01, Revision 1, "Reactor Vessel Structural Integrity, 10 CFR 50.54(f)." The estimated average number of burden hours is 200 person hours for each addressee's response. This estimate pertains only to the identified response related matters and does not include the time required to implement actions required by the regulations. This action is covered by the Office of Management and Budget Clearance Number 3150-0011, which expires June 30, 1994.

Sincerely,

Original signed by:

Clyde Y. Shiraki, Senior Project Manager
Project Directorate III-2
Division of Reactor Projects III/IV
Office of Nuclear Reactor Regulation

Enclosures:
1. Pressurized Thermal Shock Tables
2. Upper-shelf Energy Tables
3. Nomenclature Key

cc w/enclosures:
See next page

Distribution:
Docket File
NRC & Local PDRs
PDIII-2 r/f
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OFC	LA:PDIII-2	PM:PDIII-2	D;PDIII-2			
NAME	CHAWES CMH	CSHIRAKI CS	JDYER JM			
DATE	5/11/94	5/12/94	5/12/94	/ /94	/ /94	/ /94
COPY	YES/NO	YES/NO	YES/NO	YES/NO	YES/NO	YES/NO

Z183744.LTR

Mr. D. L. Farrar
Commonwealth Edison Company

Zion Nuclear Power Station
Unit Nos. 1 and 2

cc:

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Summary File for Pressurized Thermal Shock

Plant Name	Beltline Ident.	Heat No. Ident.	ID Neut. Fluence at EOL/EFPY	IRT_{NDT}	Method of Determin. IRT_{NDT}	Chemistry Factor	Method of Determin. CF	%Cu	%Ni
Zion 1	Forging	ANA 102	8.65E18	20°F	Plant Specific	82	Table	0.06	0.83
EOL: 4/6/2013	Int. Shell	C3795-2	1.73E19	-10°F	Plant Specific	80.8	Table	0.12	0.49
	Int. Shell	B7835-1	1.73E19	-20°F	Plant Specific	79	Calculated	0.12	0.49
	Lower Shell	B7823-1	1.73E19	-20°F	Plant Specific	87.4	Table	0.13	0.48
	Lower Shell	C3799-2	1.73E19	-20°F	Plant Specific	103.4	Table	0.15	0.50
	WF-154 Upper Circ. Weld	406L44	8.65E18	-5°F	Generic	183.09	Calculated	0.31	0.59
	WF-70 Middle Circ. Weld	72105	1.73E19	-26°F	NRC Generic	199.88	Calculated	0.35	0.59
	Int. Axial Welds WF-8	8T1762	6.29E18	-5°F	Generic	152.25	Table	0.20	0.55
	Int. Axial Welds WF-4	8T1762	6.29E18	-5°F	Generic	152.25	Table	0.20	0.55
	Lower Axial Welds WF-8	8T1762	6.29E18	-5°F	Generic	152.25	Table	0.20	0.55

References

Chemical composition and IRT_{NDT}, except for the Middle Circ. Weld data are from July 2, 1992, letter from M. A. Jackson (CECo) to T. E. Murley (USNRC), subject: Braidwood Station, Units 1 and 2; Byron Station, Units 1 and 2; Zion Station, Units 1 and 2

Fluences are from BAW-2166

The amount of nickel for ANA 102 was reported in the November 19, 1993 letter from T.W. Simpkin (CECo) to T.E. Murley (USNRC).

IRT_{NDT} for Middle Circ. Weld, WF-70, was determined from an approved method in a February 22, 1994 letter from C.Y. Shiraki (USNRC) to D.L Farrar (CEC).

Chemistry Factor for Middle Circ Weld, WF-70, was calculated from Zion 1 and 2 surveillance data that was reported in BAW 1803, Rev. 1.

Chemistry Factor for Upper Circ. Weld, WF-154 was calculated from Point Beach 2 surveillance data that was reported in BAW 1803, Rev. 1. The Point Beach 2 weld surveillance material was fabricating the same heat of wire as used to fabricate WF-154.

Summary File for Pressurized Thermal Shock

Plant Name	Beltline Ident.	Heat No. Ident.	ID Neut. Fluence at EOL/EFPY	IRT_{ndt}	Method of Determin. IRT_{ndt}	Chemistry Factor	Method of Determin. CF	%Cu	%Ni
Zion 2	Lower Nozzle Belt Forging	ZV 3855	8.45E18	10°F	Plant Specific	58	Table	0.09	0.66
EOL: 11/14/ 2013	Lower Shell	B8029-1	1.69E19	-10°F	Plant Specific	81.2	Table	0.12	0.51
	Lower Shell	C4007-1	1.69E19	10°F	Plant Specific	87.67	Calculated	0.12	0.53
	Int. Shell	B8006-1	1.69E19	10°F	Plant Specific	81.8	Table	0.12	0.54
	Int. Shell	B8040-1	1.69E19	-10°F	Plant Specific	96.4	Table	0.14	0.52
	WF-200 Nozzle Belt to Int. Shell Circ. Weld	821T44	8.45E18	-5°F	Generic	177.95	Table	0.24	0.63
	SA-1769 Int. to Lower Shell Circ. Weld	71249	1.69E19	-5°F	Generic	182	Table	0.26	0.61
	WF-29 Lower Int. Shell Axial Weld	72102	6.04E18	-5°F	Generic	174.1	Table	0.23	0.63
	WF-70 Int. Shell Axial Welds	72105	6.04E18	-26°F	NRC Generic	199.88	Calculated	0.35	0.59

References

Chemical composition and IRT_{ndt} data are from July 2, 1992, letter from M. A. Jackson (CECo) to T. E. Murley (USNRC), subject: Braidwood Station, Units 1 and 2; Byron Station, Units 1 and 2; Zion Station, Units 1 and 2

Fluence data are from BAW-2166

IRT_{ndt} for Int. Shell Axial Welds, WF-70, was determined from an approved method in a February 22, 1994 letter from C.Y. Shiraki (USNRC) to D.L. Farrar (CEC).

Chemistry Factor for Int. Shell Axial Welds, WF-70 was calculated from Zion 1 and 2 surveillance data that was reported BAW 1803, Rev. 1.

Summary File for Upper Shelf Energy

Plant Name	Beltline Ident.	Heat No.	Material Type	1/4T USE at EOL	1/4T Neutron Fluence at EOL	Unirrad. USE	Method of Determin. Unirrad. USE
Zion 1 EOL: 4/6/2013	Forging	ANA 102	A 508-2	113	5.19E18	134	Direct
	Int. Shell	C3795-2	A 533B-1	52	1.04E19	66	Generic
	Int. Shell	B7835-1	A 533B-1	90	1.04E19	117	Direct
	Lower Shell	B7823-1	A 533B-1	51	1.04E19	66	Generic
	Lower Shell	C3799-2	A 533B-1	50	1.04E19	66	Generic
	WF-154 Upper Circ. Weld	406L44	Linde 80, SAW	EMA[2]	5.19E18	EMA[2]	
	WF-70 Middle Circ. Weld	72105	Linde 80, SAW	EMA[2]	1.04E19	EMA[2]	
	Int. Axial Welds WF-8	8T1762	Linde 80, SAW	EMA[2]	3.78E18	EMA[2]	
	Int. Axial Welds WF-4	8T1762	Linde 80, SAW	EMA[2]	3.78E18	EMA[2]	
	Lower Axial Welds WF-8	8T1762	Linde 80, SAW	EMA[2]	3.78E18	EMA[2]	

References

UUSEs for plate B7835-1 reported in BAW-2082

Fluences are from BAW-2166

UUSE data for ANA 102 forging reported in a November 19, 1993 letter from T.W. Simpkin (CECo) to T.E. Murley (USNRC).

UUSE values for Plates C3795-2, B7835-1 and C3799-2 were determined from data from similar plates reported in BAW-10046P. The value is a tolerance limit with 95% confidence that at least 95% of the population is greater than the tolerance limit:

$$(TL = \overline{X} - K\sigma \text{ where: } \overline{X} = 91 ft\text{-}lb,\ K = 3.187,\ \sigma = 7.87)$$

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[2]BAW-2148P provides a plant specific equivalent margins analysis for Levels A and B. Licensee must confirm applicability of Topical Report BAW-2178P for Levels C and D.

Summary File for Upper Shelf Energy

Plant Name	Beltline Ident.	Heat No.	Material Type	1/4T USE at EOL	1/4T Neutron Fluence at EOL	Unirrad. USE	Method of Determin. Unirrad. USE
Zion 2	Lower Nozzle Belt Forging	ZV 3855	A 508-2	104	5.07E18	124[7]	Generic
EOL: 11/14/ 2013	Lower Shell	B8029-1	A 533B-1	64	1.01E19	81	65%
	Lower Shell	C4007-1	A 533B-1	76	1.01E19	94	Direct
	Int. Shell	B8006-1	A 533B-1	70	1.01E19	89	65%
	Int. Shell	B8040-1	A 533B-1	71	1.01E19	92	65%
	WF-200 Nozzle Belt to Int. Shell Circ. Weld	821T44	Linde 80, SAW	EMA[2]	5.07E18	EMA[2]	
	SA-1769 Int. to Lower Shell Circ. Weld	71249	Linde 80, SAW	EMA[2]	1.01E19	EMA[2]	
	WF-29 Lower Shell Axial Weld	72102	Linde 80, SAW	EMA[2]	3.63E18	EMA[2]	
	WF-70 Int. Shell Axial Welds	72105	Linde 80, SAW	EMA[2]	3.63E18	EMA[2]	

References

UUSE data for plate B8040-1 is from WCAP-12396

Fluence data are from BAW-2166

UUSE for forging ZV 3855 not available. Value reported in the mean value from four similar forgings that are documented in BAW-10046P

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[7] Additional information required to confirm value

[2] BAW-2148P provides a plant specific equivalent margins analysis for Levels A and B. Licensee must confirm applicability of Topical Report BAW-2178P for Levels C and D.

Enclosure 3

Nomenclature and Tables

PRESSURIZED THERMAL SHOCK AND USE TABLES FOR ALL PWR PLANTS

NOMENCLATURE

Pressurized Thermal Shock Table

Column 1: Plant name and date of expiration of license.
Column 2: Beltline material location identification.
Column 3: Beltline material heat number; for some welds that a single-wire or tandem-wire process has been reported, (S) indicates single wire was used in the SAW process, (T) indicates tandem wire was used in the SAW process.
Column 4: End-of-life (EOL) neutron fluence at vessel inner wall; cited directly from inner diameter (ID) value or calculated by using Regulatory Guide (RG) 1.99, Revision 2, neutron fluence attenuation methodology from the quarter thickness (T/4) value reported in the latest submittal (GL 92-01, PTS, or P/T limits submittals).
Column 5: Unirradiated reference temperature.
Column 6: Method of determining unirradiated reference temperature (IRT).

Plant-Specific
This indicates that the IRT was determined from tests on material removed from the same heat of the beltline material.

MTEB 5-2
This indicates that the unirradiated reference temperature was determined from following MTEB 5-2 guidelines for cases where the IRT was not determined using American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section III, NB-2331, methodology.

Generic
This indicates that the unirradiated reference temperature was determined from the mean value of tests on material of similar types.

Column 7: Chemistry factor for irradiated reference temperature evaluation.
Column 8: Method of determining chemistry factor.

Table
This indicates that the chemistry factor was determined from the chemistry factor tables in RG 1.99, Revision 2.

Calculated
This indicates that the chemistry factor was determined from surveillance data via procedures described in RG 1.99, Revision 2.

Column 9: Copper content; cited directly from licensee value except when more than one value was reported. (Staff used the average value in the latter case.)

No Data
This indicates that no copper data has been reported and the default value in RG 1.99, Revision 2, will be used by the staff.

Column 10: Nickel content; cited directly from licensee value except when more than one value was reported. (Staff used the average value in the latter case.)

No Data

This indicates that no nickel data has been reported and the default value in RG 1.99, Revision 2, will be used by the staff.

Upper Shelf Energy Table

Column 1: Plant name and date of expiration of license.
Column 2: Beltline material location identification.
Column 3: Beltline material heat number; for some welds that a single-wire or tandem-wire process has been reported, (S) indicates single wire was used in the SAW process. (T) indicates tandem wire was used in the SAW process.
Column 4: Material type; plate types include A 533B-1, A 302B, A 302B Mod., and forging A 508-2; weld types include SAW welds using Linde 80, 0091, 124, 1092, ARCOS-B5 flux, Rotterdam welds using Graw Lo, SMIT 89, LW 320, and SAF 89 flux, and SMAW welds using no flux.
Column 5: EOL upper-shelf energy (USE) at T/4; calculated by using the EOL fluence and either the cooper value or the surveillance data. (Both methods are described in RG 1.99, Revision 2.)

EMA
This indicates that the USE issue may be covered by the approved equivalent margins analysis in the B&W Owners Group Topical Reports: BAW-2178P and BAW-2192-P.

Column 6: EOL neutron fluence at T/4 from vessel inner wall; cited directly from T/4 value or calculated by using RG 1.99, Revision 2, neutron fluence attenuation methodology from the ID value reported in the latest submittal (GL 92-01, PTS, or P/T limits submittals).

Column 7: Unirradiated USE.

EMA
This indicates that the USE issue may be covered by the approved equivalent margins analysis in the B&W Owners Group Topical Reports: BAW-2178P and BAW-2192P.

Column 8: Method of determining unirradiated USE.

Direct
For plates, this indicates that the unirradiated USE was from a transverse specimen. For welds, this indicates that the unirradiated USE was from test date.

65%
This indicates that the unirradiated USE was 65% of the USE from a longitudinal specimen.

Generic
This indicates that the unirradiated USE was reported by the licensee from other plants with similar materials to the beltline material.

NRC generic
This indicates that the unirradiated USE was derived by the staff from other plants with similar materials to the beltline material.

10, 30, 40, or 50 °F
This indicates that the unirradiated USE was derived from Charpy test conducted at 10, 30, 40, or 50 °F.

Surv. Weld
This indicates that the unirradiated USE was from the surveillance weld having the same weld wire heat number.

Equiv. to Surv. Weld
This indicates that the unirradiated USE was from the surveillance weld having different weld wire heat number.

Sister Plant
This indicates that the unirradiated USE was derived by using the reported value from other plants with the same weld wire heat number.

Blank
Indicates that there is insufficient data to determine the unirradiated USE.