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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO GENERIC LETTER 92-01

ARKANSAS NUCLEAR ONE, UNIT 1

ENTERGY OPERATIONS, INC.

DOCKET NO. 50-313

1.0 INTRODUCTION

By letters dated July 1, 1992, October 29, 1993, and June 3, 1994, Entergy Operations provided its response to Generic Letter (GL) 92-01, Revision 1. By letter dated June 23, 1994, the Babcock & Wilcox Owners Group (B&WOG) submitted for staff review plant specific information in BAW-2222 confirming the applicability of topical reports, BAW-2178PA and BAW-2192PA, which related to the equivalent margin analysis as required by Appendix G to 10 CFR 50. By letter dated July 8, 1994, Entergy Operations proposed changes to the NRC reactor vessel data base for ANO-1 and confirmed that BAW-2178PA and BAW-2192PA, as well as BAW-2222, are applicable to ANO-1.

GL 92-01 is a part of the staff's program to evaluate reactor vessel integrity, requesting reactor vessel material information from licensees. The staff evaluates licensees' responses to GL 92-01, including previously docketed information, to confirm that licensees satisfy the requirements in 10 CFR 50.61, Appendices G and H to 10 CFR Part 50.

A substantial amount of information was provided in response to GL 92-01, Revision 1. These data have been entered into a computerized NRC data base designated Reactor Vessel Integrity Database (RVID). The RVID contains the following tables: A pressurized thermal shock (PTS) table for PWRs, a pressure-temperature limit table for BWRs, and an upper-shelf energy (USE) table for PWRs and BWRs. The following attachments provide the Arkansas Nuclear One, Unit 1, (ANO-1) plant specific values. Attachment 1 provides the USE table, Attachment 2 provides the PTS table, and Attachment 3 provides a key for the nomenclature used in the tables. The tables include the data necessary to perform USE, pressure-temperature limit, and RT_{pts} evaluations. These data were taken from Entergy's responses to GL 92-01 and previously docketed information. References to the specific source of the data are provided in the tables.

2.0 EVALUATION

The staff reviewed the licensee's proposed changes to RVID data related to ANO-1 and the applicability of BAW-2178PA and BAW-2192PA to ANO-1. In the July 8, 1994 letter, the licensee proposed three changes to chemistry factors

ENCLOSURE

in the PTS table in RVID. In the first change, the licensee calculated the chemistry factor for lower shell plate, heat number C-5114-1, using surveillance data reported in BAW-2075, Revision 1. The licensee preformed separate calculations for longitudinal and transverse specimen test results and proposed the greater of the two chemistry factors in the PTS table. This methodology produced a more conservative chemistry factor than the method that combined longitudinal and transverse data in the calculation. In the second change, the licensee calculated the chemistry factor for upper shell plate, heat number C-5114-2, by Table 2 of Regulatory Guide 1.99, Revision 2. This calculation provided a higher and, thus, conservative chemistry factor for plate C-5114-2. In the third change, the licensee provided the chemistry factor for circumferential weld WF-112, heat number 406L44, using surveillance data from those plants that have the same weld heat number. The data came from Oconee 1, Point Beach 2, Davis-Besse, ANO-1, Rancho-Seco, and B&WOG's own data and were described in BAW-1803, Revision 1. The staff finds these changes are acceptable because they result in conservative chemistry factors for plates C-5114-1 and C-5114-2 and weld WF-112.

In the July 8, 1995 letter, the licensee also proposed several changes to the USE table. The licensee proposed revised values of neutron fluences at the 1/4T location (T = vessel thickness at beltline) and the unirradiated USE as described in BAW-2222. Based on these changes, the 1/4T USE at end of life (EOL) also was modified. The staff finds the proposed USE values acceptable with one noted exception. The exception is in the 1/4T USE at EOL for the bottom shell, heat number C-5114-1. The licensee calculated 76.2 ft-lbs by using Regulatory Guide 1.99, Revision 2, Figure 2. The staff calculated 74 ft-lbs by using ANO-1's surveillance data as directed by Regulatory Guide 1.99, Revision 2, Position 2.2. The conservative 74 ft-lbs value will be included in the RVID.

In BAW-2222, the licensee demonstrated that the plant specific values are within the bounding analysis of BAW-2178PA and BAW-2192PA. For service levels A and B loads, the licensee demonstrated a $J_{0.1}/J_{applied}$ ratio of 1.43 for the limiting material at ANO-1. In BAW-2192PA, the bounding analysis yielded a ratio of 1.0. The ANO-1 ratio is greater than the bounding analysis ratio (1.43 > 1.0); therefore, the generic analysis is valid for the ANO-1 reactor vessel, demonstrating compliance with 10 CFR 50, Appendix G, Paragraph IV.A.1. For service levels C and D loads, the licensee demonstrated the controlling J-R value for ANO-1 is 569 lb/in. The lower bound J-R value in BAW-2178PA is 534 lb/in. The ANO-1 value is greater than the bounding value (569 > 534); therefore, the ANO-1 reactor vessel is bounded by the generic analysis in BAW-2178PA. The staff concludes the ANO-1 reactor vessel meets the bounding criteria in topical reports, BAW-2192PA and BAW-2178PA; therefore, the conclusions of the reports are applicable to ANO-1.

3.0 CONCLUSIONS

Entergy Operations demonstrated that the plant specific values in BAW-2222 are within the bounding analysis of the topical reports BAW-2178PA and BAW-2192PA. Therefore, the conc usions of the topical reports are applicable to the Arkansas Nuclear One, Unit 1 reactor vessel.

The staff requests that Entergy Operations verify the data in the attached tables. No response is necessary unless an inconsistency is identified. If no comments are received within 60 days from the receipt of this safety evaluation, the staff will consider Arkansas Nuclear One, Unit 1's actions related to GL 92-01, Revision 1, to be complete. Due to the impending issuance of the RVID to the public, the changes shown in the table may not agree with the issued database. However, the changes will be incorporated in the next revision of RVID.

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Date: August 25, 1995

Attachment 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
Arkansas 1 EOL: 5/20/2014	Nozzle Belt Forging	AYN 131	A 508-2	97.6	4.83E18	109	Generic
	Upper Shell	C-5114-2	A 533B-1	84.7	5.48E18	107	Direct
	Upper Shell	C-5120-2	A 533B-1	66.6	5.48E18	86	65%
	Bottom Shell	C-5114-1	A 533B-1	74	5.26E18	96	Direct
	Bottom Shell	C-5120-1	A 533B-1	62.1	5.26E18	80	65%
	Nozzle Belt/Upper Shell Circ. Weld WF-182-1	821T44	Linde 80, SAW	EMA	4.83E18	EMA	Sister Plant
	Upper/ Lower Shell Circ. Weld WF-112	406L44	Linde 80, SAW	EMA	5.26E18	EMA	Generic
	Upper Shell Axial Welds WF-18	8T1762	Linde 80, SAW	EMA	3.95E18	EMA	Generic
	Lower Shell Axial Welds WF-18	8T1762	Linde 80, SAW	EMA	3.89E18	EMA	Generic

References

Chemical composition data are from July 1, 1992, letter from J. J. Fisicaro (EO) to USNRC Document Control Desk, subject: Response to Generic Letter 92-01, Revision 1, "Reactor Vessel Structural Integrity."

Fluence data reported in BAW-2222.

UUSE for plates C5120-2, C5114-2, C5120-1, and C5114-1 was reported in BAW-2222. References are provided in this report.

UUSE for forging AYN 131 was 95/95 tolerance limit that was reported in BAW-2222.

1/4 USE at EOL for C-5114-1 based on Surveillance Reports

Attachment 2

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
Arkansas 1	Nozzle Belt Forging	AYN 131	8.62E18	3°F	Generic	20	Table	0.03	0.70
EOL: 5/20/2014	Upper Shell	C-5114-2	9.79E18	-10°F	Plant Specific	105.6	Table	0.15	0.52
	Upper Shell	C-5120-2	9.79E18	-10°F	Plant Specific	122.75	Table	0.17	0.55
	Lower Shell	C-5114-1	9.4E18	0°F	Plant Specific	54.9	Calculated	0.15	0.52
	Lower Shell	C-5120-1	9.4E18	-10°F	Plant Specific	122.75	Table	0.17	0.55
	Nozzle Belt/Upper Shell Circ. Weld WF-182-1	821T44	8.62E18	-5°F	Generic	162.09	Calculated	0.24	0.63
	Upper/ Lower Shell Circ. Weld WF-112	406L44	9.4E18	-5°F	Generic	174.96	Calculated	0.31	0.59
	Upper Shell Axial Welds WF-18	BT1762	7.05E18	-5°F	Generic	152.25	Table	0.20	0.55
	Lower Shell Axial Welds WF-18	BT1762	6.95E18	-5°F	Generic	152.25	Table	0.20	0.55

Reference

Chemistry Factor for WF-182-1 weld was calculated from Davis-Besse surveillance data that was reported in BAW-2125. The Davis-Besse surveillance weld was fabricated with the same heat number as WF-182-1.

Chemistry Factor for WF-112 weld was calculated from Oconee 1, Point Beach 2, B&WOG, Davis-Besse, ANO-1, and Rancho Seco surveillance data that was reported in BAW-1803, Rev. 1. These surveillance welds were fabricated with the same heat number as WF-112.

Chemistry Factor for plate C5114-1 was calculated using ANO1 surveillance data reported in BAW-2075, Revision 1.

IRT_{NDT} for Nozzle Belt Forging is a mean value from 24 forgings similar to AYN 131. The data is reported in BAW-10046P and has a standard deviation of 31°F.

Fluence, IRT_{NDT}, and chemical composition data are from July 1, 1992, letter from J. J. Fisicaro (EO) to USNRC Document Control Desk, subject: Response to Generic Letter 92-01, Revision 1, "Reactor Vessel Structural Integrity"

Θ_1 = 19.7 for welds WF-182-1, WF-112, and WF-18
Θ_1 = 31 for forging AYN 131

RT_{PTS} (WF-112) = -5 + 2√[(19.7)^2+(14)^2] + 174.96(0.9827) ≈ -5 + 48 + 172 = 215
RT_{PTS} (WF-18) = -5 + 2√[(19.7)^2+(28)^2] + 152.25(0.9020) = -5 + 68 + 137 = 200

Attachment 3

Nomenclature and Tables

Pressurized Thermal Shock

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 form 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 form 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.

Column10: Nickel content; cited directly from licensee value except when more than one value was reported. (Staff used the average value in the latter case.)

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, A302B 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 copper 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 Babcock & Wilcox Owners Group approved topical reports, BAW 2178PA and BAW 2192PA.

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 Babcock & Wilcox Owners Group approved topical reports, BAW 2178PA and BAW 2192PA.

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 data.

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
This indicates that there is insufficient data to determine the unirradiated USE.