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FACIL:50-261 H. B. Robinson Plant, Unit 2, Carolina Power and Ligh 05000261
AUTH.NAME AUTHOR AFFILIATION
MCDUFFIE,M.A. Carolina Power & Light Co.
RECIP.NAME RECIPIENT AFFILIATION
VARGA,S.A. Operating Reactors Branch 1

SUBJECT: Provides addl info re matl properties in reactor vessel & forwards Special Rept EPRI NP-3573-SR, "Robinson 2 Reactor Vessel:Pressurized Thermal Shock Analysis for Small Break LOCA," in response to NRC 840911 request.

"See Repts"

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CP&L
Carolina Power & Light Company

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OCT 30 1984

SERIAL: NLS-84-427

Director of Nuclear Reactor Regulation
Attention: Mr. Steven A. Varga, Chief
Operating Reactors Branch No. 1
Division of Licensing
United States Nuclear Regulatory Commission
Washington, DC 20555

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261/LICENSE NO. DPR-23
PRESSURIZED THERMAL SHOCK - REACTOR VESSEL MATERIALS

Dear Mr. Varga:

SUMMARY

Carolina Power & Light Company (CP&L) submitted a report to the NRC on June 29, 1984 which contained CP&L's findings with regard to material properties in the H. B. Robinson Steam Electric Plant, Unit No. 2 (HBR2) reactor vessel. The NRC staff has requested certain clarifying information by letter dated September 11, 1984. The purpose of this letter is to provide that information and additional clarifications.

DISCUSSION

The copper content of the Lower Girth Weld was accepted as approximately 0.2 percent in your letter of September 11, 1984. The Company intends to use 0.20 percent copper and 0.80 percent nickel to calculate RT_{NDT} for the Lower Girth Weld using the proposed rule on Pressurized Thermal Shock (PTS) published in the Federal Register on February 7, 1984. This was discussed and agreed upon with members of the NRC staff on October 15, 1984. Calculations for RT_{NDT} are enclosed. Your formal concurrence in using 0.20 percent copper and 0.80 percent nickel based on our June 29, 1984 submittal is requested.

The first area in which the staff requested clarification is the material properties of the reactor vessel plate material. Figure 2.1 entitled "Identification and Location of Beltline Region Material" was submitted with CP&L's 150-day PTS report on January 25, 1982. The figure has been revised to include the updated end of license fluence based on CP&L's flux reduction program. The revised figure is enclosed for your use and supersedes the figure submitted in our 150-day report. Calculations made in accordance with the proposed rule on PTS show that the plate material will not approach the

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proposed PTS Screening Criteria prior to the expiration of the HBR2 Operating License. Calculations to that effect are enclosed.

The other area in which the NRC staff requested clarification was with regard to the chemical composition of the Upper Girth Weld. The staff requested information concerning the correlation between the HBR2 surveillance weld and the Upper Girth Weld. Resolution of the question of the relationship between the welds is not necessary for closing the PTS issue for HBR2 since, if either the chemistry assumed by CP&L or the chemistry measured in the surveillance weld is assumed for the Upper Girth Weld, the PTS Screening Criteria will not be reached prior to the expiration of the HBR2 Operating License. (See enclosed calculations). The Company has the capability for further flux reduction in the area of the Upper Girth Weld through the Part-Length Shielded Assembly concept should minor variations in chemistry or fluence arise.

Finally, the NRC staff requested a copy of an EPRI report referenced by a Westinghouse report which was enclosed with our letter of June 29, 1984. The requested report is enclosed. The Company believes, however, that the materials data and conclusions contained within the report are not necessary to close the PTS issue for HBR2. The report is, therefore, provided for information only.

CONCLUSION

Carolina Power & Light Company requests your formal concurrence in utilizing 0.20 percent copper and 0.80 percent nickel to calculate RT_{NDT} for the Lower Girth Weld. Resolution of the Upper Girth Weld chemistry is not necessary for resolving the PTS issue at Robinson.

The Company firmly believes, as stated in our letters of September 30, 1983, November 7, 1983, and June 29, 1984, that the PTS issue has been resolved for H. B. Robinson and again requests that the NRC formally acknowledge that conclusion.

We trust that this information meets the needs of the NRC staff and should close out this issue. Please contact Mr. S. R. Zimmerman of my staff at (919) 836-6242 if you have any questions.

Yours very truly,

M. A. McDuffie

M. A. McDuffie
Senior Vice President
Nuclear Generation

JJS/ONH/cfr (6490NH)

Enclosures

cc: Mr. J. P. O'Reilly (NRC-RII)
Mr. G. Requa (NRC)
NRC Resident Inspector (RNP)

RT_{NDT} CALCULATIONS FOR UPPER AND LOWER GIRTH WELDS

Upper Circumferential Weld (Assuming Bounding Chemistry) Cu = .35

$$RT_{NDT} = RT_{NDT}(0) + \Delta RT_{NDT}(RG) + 2\sigma_o$$

$$= -56 + 283(f/10^{19})^{.194} + 2(17)$$

$$= -56 + 283(1.75)^{.194} + 34$$

$$= -56 + 315.5 + 34$$

$$= 293.5°F \text{ EOL}$$

Note: CP&L's letter of 6/29/84 calculated an EOL RT_{NDT} of 153°F using best estimate chemistry. Both calculations satisfy the proposed PTS Rule (FR 2/7/84).

Lower Circumferential Weld Cu = .20 Ni = .80

$$RT_{NDT} = RT_{NDT}(0) + \Delta RT_{NDT}(\text{mean}) + (\sigma_o^2 + \sigma_\Delta^2)^{1/2}$$

$$\Delta RT_{NDT} = [-10 + 470(.20) + 350(.20 \times .80)]\ [f/10^{19}]^{.27}$$

$$= [140]\ [1.89]^{.27}$$

$$= 166$$

$$RT_{NDT} = -56 + 166 + 59 = 169°F \text{ EOL}$$

Consequently the upper circumferential weld is controlling.

(6490NH/cfr)

RD_{NDT} Calculations for Vessel Plate Material

Core Region Plate Chemistry

Plate	Melt	Nickel%	Copper%	Phosphorus%
W9807-3	B0605	.10	.12	.012
-5	A5891	.10	.15	.012
-9	P1444	.15	.14	.015
W10201-1	A6623	.11	.13	.010
-2	A6520	.25	.15	.009
-3	B1255	.08	.11	.006
-4	A6604	.09	.12	.007
-5	B1256	.12	.10	.010
-6	B1250	.09	.09	.010

Maximum Chemical Factor and Fluence/Shell Course

Shell	Plate	Chem. Factor	EOL Fluence
Upper	W10201-2	73.6	$1.75 \times 10^{19} n/cm^2 > 1$ Mev
Intermediate	W10201-4	50.2	$3.89 \times 10^{19} n/cm^2 > 1$ Mev
Lower	W9807-5	65.8	$1.89 \times 10^{19} n/cm^2 > 1$ Mev

End of License RT_{NDT} (3 highest plates)

Plate	Inital RT_{NDT}	ΔRT_{NDT}	Final RT_{NDT}
W10201-1	69°F	65°F	134°F
W10201-2	30°F	84°F	118°F
W9807-5	33°F	78.5°F	111°F

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Calculation of Max. I.D. Fluence in Core Region

Cycle 1-8 Flux = 6.62×10^{10} n/cm^2-sec*

Cycle 9 → EOL Flux = 3.82×10^{10} n/cm^2-sec*

$6.62 \times 10^{10} \times 7.23$ EFPY $\times 3.1536 \times 10^7$ sec/yr $= 1.51 \times 10^{19}$
3.82×10^{10} $(27 - 7.23) \times 3.1536 \times 10^7$ sec/yr $= 2.38 \times 10^{19}$

TOTAL $= 3.89 \times 10^{19}$

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* These fluxes were calucalted by Westinghouse. TEC calculations, submitted by CP&L's letter dated September 30, 1983, are slightly higher but within uncertainty range.

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IDENTIFICATION, L TION AND END OF LIC E FLUENCE OF BELTLINE REGION MATERIAL FOR THE H. B. ROBINSON UNIT NO. 2 REACTOR VESSEL