Docket Nos.: 50-361
and 50-362

NOV 21 1986

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Gentlemen:

SUBJECT: SAFETY EVALUATION OF PRESSURIZED THERMAL SHOCK FOR SAN ONOFRE 2 AND 3

By letter dated January 22, 1986, you submitted information on material properties and fast neutron fluence for the San Onofre 2 and 3 reactor pressure vessels. The January 22, 1986 submittal was in compliance with the requirements of 10 CFR 50.61, "Fracture Toughness Requirements for Protection Against Pressurized Thermal Shock Events". The NRC staff has reviewed your submittal and finds that the San Onofre 2 and 3 reactor pressure vessels meet the fracture toughness requirements of 10 CFR 50.61 for 32 years of effective full power operation.

In addition, we request that you submit periodic future re-evaluations of the pressurized thermal shock reference temperature (RT_{PTS}) and comparisons of these values with the values predicted in your submittal of January 22, 1986. Such future submittals could be made at the same time you submit the pressure-temperature operating limits required by Appendix G to 10 CFR 50.

If you have any questions regarding this issue, please contact me.

Sincerely,

/S/

Harry Rood, Senior Project Manager
PWR Project Directorate No. 7
Division of Licensing-B

Enclosure:
As stated

cc: See next page

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Enclosure 1

SAN ONOFRE UNITS 2 AND 3, FAST NEUTRON FLUENCE FOR FRACTURE TOUGHNESS REQUIREMENTS FOR PROTECTION AGAINST PRESSURIZED THERMAL SHOCK EVENTS (10 CFR 50.61)

By letter dated January 22, 1986, the Southern California Edison Company (SCE), licensee for San Onofre Units 2 and 3, submitted information on the material properties and the fast neutron fluence (E greater than or equal to 1.0 MeV) of the reactor pressure vessel in compliance with the requirements of 10 CFR 50.61. The NRC staff has reviewed the San Onofre 2 and 3 pressure vessel material properties, chemical compositions, estimated fluences after 32 effective full power years of operation, and the predicted valves of RT_{PTS}. The results of the staff's review are given below.

MATERIAL PROPERTIES AND CHEMICAL COMPOSITION

The controlling beltline material from the standpoint of PTS susceptibility was identified to be intermediate shell plate C-6404-2 for Unit 2 and intermediate shell plate C-6802-1 for Unit 3.

The material properties of the controlling material and the associated margin and chemistry factors were reported to be:

	Utility Submittal		Staff Evaluation	
	Unit 2	Unit 3	Unit 2	Unit 3
Cu (copper content, %)	0.10	0.06	0.10	0.06
Ni (nickel content, %)	0.58	0.58	0.58	0.58
I (Initial RT_{NDT}, °F)	16	40	16	40
M (Margin, °F)	48	48	48	48
CF (Chemistry Factor, °F)	----	---	57.3	30.4

The NRC staff concludes that the controlling material has been properly identified. The justifications given for the copper and nickel contents and the initial RT_{NDT} are acceptable. The margin has been derived from consideration of the bases for these values, following the PTS Rule, Section 50.61 of 10 CFR Part 50. Based on the reported values of fluence, Equation 1 of the PTS rule governs, and the chemistry factor is as shown above.

ESTIMATED FLUENCE AND RT_{PTS}

The following evaluation concerns the estimation of the fluence to the pressure vessel for 32 effective full power years of operation and the corresponding values of RT_{PTS}.

The intial San Onofre 2 and 3 fluence calculations were performed for the FSAR. Later calculations were submitted to the NRC in connection with the PTS issue in CEN-189, dated December, 1981. These calculations are bounding estimates and ignore future low leakage core loadings. However, even with these conservatisms the 32 effective full power years peak pressure vessel fast neutron fluence is 3.2% for Unit 2 and less than 0.5% for Unit 3 of the fluence required to reach the 10 CFR 50.61 specified limit of RT_{PTS} = 270°F. This is due to the very low amount of copper and nickel content in the shell plates and welds of the pressure vessels. Therefore, the fluence estimate is conservative and acceptable.

The equation specified in 10 CFR 50.61 as applicable for the San Onofre 2 pressure vessel is:

$$RT_{pts} = I+M+(-10+470xCu+350xCuxNi)xf^{0.27}$$

where:

I	= Initial RT_{NDT}	= 16°F
M	= Uncertainty Margin	= 48°F
Cu	= w/o Copper in shell plate C-6404-2	= 0.10
Ni	= w/o Nickel in shell plate C-6404-2	= 0.58
f	= Peak fluence on shell plate C-6404-2 in units of 10^{19} n/cm^2 for 32 effective full power years = 3.68	

Then:

$$RT_{PTS} = 64+(-10+470x0.10+350x0.10x0.58) \times 3.68^{0.27}$$

$$= 64+57.3x1.42 = 145.5°F$$

which is less than 270°F i.e. the applicable screening criterion and, thus, is acceptable.

The equation specified in 10 CFR 50.61, as applicable for the San Onofre 3, pressure vessel is:

$$RT_{PTS} = I+M+(-10+470xCu+350xCuxNi)xf^{0.27}$$

where:

I	= Initial RT_{NDT}	= 16°F
M	= Uncertainty Margin	= 48°F
Cu	= w/o Copper in shell plate C-6404-2	= 0.10
Ni	= w/o Nickel in shell plate C-6404-2	= 0.58
f	= Peak fluence on shell plate C-6404-2 in units of 10^{19} n/cm^2 for 32 effective full power years = 3.68	

Then:

$$RT_{PTS} = 84+(-10+470x0.06+350x0.06x0.58) \times 3.68_{0.27}$$

$$= 84+30.4x1.42 = 131.2°F$$

which is less than 270°F i.e. the applicable screening criterion and, thus, is acceptable.

REQUEST FOR PERIODIC RE-EVALUATION

The NRC staff requests that SCE provide a re-evaluation of the RT_{PTS} for San Onofre 2 and 3 and a comparison to the predicted valves in the January 22, 1986 submittal along with future pressure-temperature operating limits which are required by Appendix G to 10 CFR 50 (this request for information is covered under clearance No. 3150-0011). It should be noted that this re-evaluation is a requirement of 10 CFR 50.61 whenever core loadings, surveillance measurements, or other information indicate a significant change in projected values.

This request is being made in veiw of:

(a) the pressure-temperature updating requirements for the fracture toughness of the beltline material in 10 CFR 50 Appendix G, and

(b) the fact that the RT_{PTS} value is readily available from the calculation of the pressure temperature limits, and

(c) the staff desire to be informed on the current value of the RT_{PTS} for all PWRs.