Portland General Electric Company

James E. Cross Vice President, Nuclear

March 13, 1991

Trojan Nuclear Plant
Docket 50-344
License NPF-1

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington DC 20555

Dear Sirs:

Supplemental Response to Generic Letter 88-11

Generic Letter 88-11, "NRC Position on Radiation Embrittlement of Reactor Vessel Materials and Its Impact on Plant Operations", required licensees to reanalyze neutron radiation embrittlement of the reactor vessel beltline materials using the revised methodology of Revision 2 to Regulatory Guide 1.99, "Radiation Embrittlement of Reactor Vessel Materials". The generic letter required licensees to submit their analyses and schedules for corrective actions within 180 days of the effective date of Regulatory Guide 1.99, Revision 2. Portland General Electric Company's (PGE's) original submittal was dated November 30, 1988.

In the original submittal, PGE proposed a deviation from the Regulatory Guide with regard to use of Plant surveillance data. After discussions with the Nuclear Regulatory Commission (NRC) regarding this deviation, PGE is submitting revised calculations for adjusted reference temperature (ART) to incorporate suggestions made by the NRC.

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Re-calculation of the adjusted reference temperature and an estimated schedule for corrective action implementation is provided in Attachment A. This schedule is contingent on NRC acceptance of PGE's analysis.

Sincerely,

James E Cross

Attachment

c: Mr. John B. Martin
Regional Administrator, Region V
U.S. Nuclear Regulatory Commission

Mr. David Stewart-Smith
State of Oregon
Department of Energy

Mr. R. C. Barr
NRC Resident Inspector
Trojan Nuclear Plant

SUPPLEMENTAL RESPONSE TO U.S. NUCLEAR REGULATORY COMMISSION (NRC) GENERIC LETTER 88-11

Introduction

The NRC issued Generic Letter (GL) 88-11, "NRC Position on Radiation Embrittlement of Reactor Vessel Materials and Its Impact on Plant Operations", on July 17, 1988. The purpose of GL 88-11 was to call attention to Revision 2 to Regulatory Guide (RG) 1.99, "Radiation Embrittlement of Reactor Vessel Materials". The generic letter requires that licensees perform analyses of neutron embrittlement using the revised RG 1.99 methodology, to ensure continued compliance with Appendix G of Title 10 of the Code of Federal Regulations, Part 50 (10 CFR 50). The analyses and a schedule of resulting corrective actions, if any, were to be submitted to the NRC within 180 days of the effective date of the revised RG. Portland General Electric Company's (PGE's) initial response to GL 88-11 was dated November 30, 1988.

Analysis

Regulatory Guide 1.99, Revision 2, provides a revised methodology for determination of the effects of neutron embrittlement on reactor vessel beltline materials. The end product from implementation of RG 1.99 is an adjusted reference temperature (ART) for the limiting vessel beltline material. This ART is then used in determining the Plant heatup and cooldown pressure-temperature (P-T) limits. Two methods of calculating the ART are provided. The first method is for those plants for which no surveillance data (i.e., material capsule data) exists, and the second method is for plants which have available surveillance data.

PGE has a Radiation Surveillance Program for the Trojan Nuclear Plant reactor vessel. Table 4.4-5 of the Trojan Technical Specifications (TTS) provides a list of the six Trojan surveillance capsules, designated by letters "U" through "Z", and the removal schedule for each surveillance capsule. A description of the program and the results of the analyses for specimens from surveillance capsules "U" and "X" have previously been submitted as Westinghouse Reports WCAP-8426(1), WCAP-9469(2) and WCAP-10861(3).

Regulatory Guide 1.99 references Paragraph 5.1 of American Society for Testing and Materials (ASTM) E 185-82, "Standard Practice for Conducting Surveillance Tests For Light Water-Cooled Nuclear Power Reactor Vessels" as the governing code for selection of materials for incore surveillance capsules. Use of ASTM E 185-82 would result in Heat B9883-1 as the limiting material for the Trojan vessel. However, material for the Trojan surveillance capsules was chosen in accordance with the guidelines in ASTM E 185-73, which resulted in selection of Heat C5583-1 as the limiting material for the Trojan vessel.

The method used in PGE's November 30, 1988 submittal to calculate the adjusted reference temperature for the Trojan reactor vessel departed from the method of Revision 2 to Regulatory Guide 1.99 only in that linear extrapolation of credible surveillance capsule data was used to predict the properties of the limiting material, B9883-1. This adjustment of capsule data was accomplished by multiplying the chemistry factor of the surveillance material by the ratios of the average chemistry factors for each heat as provided in Table 2 of RG 1.99. This was justified for two reasons. First, the concentrations of all residual elements of interest, either in the past per ASTM E 185-73 (copper, phosphorous), or now per ASTM E 185-82 (copper, nickel), are well within the normal product analysis tolerances for this class of steel. Second, the difference in initial RT_{NDT} between B9883-1 and C5583-1 is only 10°F, which is less than the published standard deviation of 17°F for the calculational method.

During discussions with the NRC (Messrs. Bevan, Randall, and Tsao) and an NRC consultant (Mr. Nagata of the Idaho National Engineering Laboratory), PGE was informed that the NRC was reluctant to accept surveillance data from other than the limiting plate as the basis for calculating the adjusted reference temperature (ART). This was true even in a case where the two materials were chemically equivalent where copper and nickel contents were concerned. It was suggested that the trending of the surveillance capsule material (C5583-1) well below the Regulatory Guide 1.99, Revision 2 generic predictions [i.e., actual Chemistry Factor (CF) of 75.84 vs predicted CF of 110] was sufficient justification to reduce the margin discussed in Subsection 2.1 of the Regulatory Guide to 0°F. The ART for equivalent full-power years (EFPY) is compared with the current total RT_{NDT} calculated in accordance with Regulatory Guide 1.99, Revision 1 in Table I.

The increase in the 3/4T ARTs for 15 EFPY requires that the heatup and cooldown pressure-temperature operating limits be re-evaluated. The Capsule V (removed during the 1990 Refueling Outage) data is currently under evaluation and will result in calculation of revised heatup-cooldown curves valid to 15 EFPY. Schedules for implementation of corrective actions are dependent on NRC approval of this resubmittal and a License Change Application (LCA) to revise the Technical Specifications. PGE will submit an LCA within 4 months following approval of this resubmittal by the NRC. It is anticipated the revised heatup-cooldown curves and procedure or setpoint changes will be implemented by the end of the 1992 Refueling Outage pending approval of the LCA by the NRC.

References

1. Davidson, J. A.; Phillips, J. H.; and Yanichko, S. E., "Portland General Electric Company, Trojan Unit No. 1 Reactor Vessel Radiation Surveillance Program", WCAP-8426, January 1975.

2. Davidson, J. A; Anderson, S. L.; and Kaiser, W. T.; "Analysis of Capsule U from Portland General Electric Trojan Reactor Vessel Radiation Surveillance Program", WCAP-9469, May 1979.

3. Yanichko, S. E.; Anderson, S. L.; and Kaiser, W. T.; "Analysis of Capsule X from Portland General Electric Company Trojan Reactor Vessel Radiation Surveillance Program", WCAP-10[illegible], June 1985.

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TABLE I

CALCULATION OF ADJUSTED REFERENCE
TEMPERATURE (ART) FOR PLATES C5587-1, B9983-1, AND C5583-1

Reactor age: 10 equivalent full-power years (EFPY)

Fractional Thickness	Fluence at 10 EFPY	Fluence Factor Exponent	Fluence Factor (ff)
Inner Diameter (ID)	0.915	0.283	0.975
1/4 Thickness (1/4T)	0.549	0.305	0.832
3/4 Thickness (3/4T)	0.198	0.350	0.567

Chemistry Factors (CF)

C5587-1: 107.8 (from Table 1, Regulatory Guide 1.99, Revision 2)
B9883-1: 118.5 (from Table 1, Regulatory Guide 1.99, Revision 2)
C5583-1: 75.84 (from surveillance capsule data and Section 2.1 of Regulatory Guide 1.99, Revision 2)

Initial Reference Temperature Nil Ductility Transition (RT_{NDT}) (IRT) Values:

C5587-1: 10°F
B9883-1: 10°F
C5583-1: 0°F

ART Calculations:

ART = IRT + CF*ff + Margin

C5587-1:

1/4T: ART = 10 + 107.8*0.832 + 0 = 99.7°F
3/4T: ART = 10 + 107.8*0.567 + 0 = 71.1°F

B9883-1

1/4T: ART = 10 + 118.5*0.832 + 0 = 108.7°F
3/4T: ART = 10 + 118.5*0.567 + 0 = 77.2°F

C5583-1

1/4T: ART = 0 + 75.84*0.832 + 17 = 80.1°F
3/4T: ART = 0 + 75.84*0.567 + 17 = 60.0°F

TABLE I
(continued)

	10 EFPY	
	1/4T	3/4T
Total RT_{NDT}[(a)] RG 1.99, Revision 1	111°F	55°F
ART RG 1.99, Revision 2	108.7°F	77.2°F

(a) The current heatup and cooldown pressure/temperature limits are based upon the total RT_{NDT} values.

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