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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST FOR AUTHORIZATION OF ALTERNATE EXAMINATION OF

REACTOR PRESSURE VESSEL CIRCUMFERENTIAL WELDS

PUBLIC SERVICE ELECTRIC & GAS COMPANY

HOPE CREEK GENERATING STATION

DOCKET NO. 50-354

1.0 INTRODUCTION

By letter dated July 9, 1999, Public Service Electric and Gas Company (PSE&G or the licensee) requested that the U.S. Nuclear Regulatory Commission (NRC) approve an alternative to the inservice inspection (ISI) requirements for performing volumetric examination of reactor pressure vessel (RPV) circumferential welds at the Hope Creek Generating Station (HCGS). These examinations are required by Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) and by the augmented examination requirements of Section 50.55a(g)(6)(ii)(A)(2) to Title 10 of the *Code of Federal Regulations* (10 CFR).

The alternative was proposed pursuant to the provisions of 10 CFR 50.55a(g)(6)(ii)(A)(5), and was based on the guidance provided in Generic Letter (GL) 98-05, "Boiling Water Reactor Licensees Use of BWRVIP-05 Report to Request Relief From Augmented Examination Requirements on Reactor Pressure Vessel Circumferential Shell Welds." The alternative was proposed as a permanent relief (i.e., for the remaining term of operation under the existing license for HCGS) from the ISI requirements of 10 CFR 50.55a(g) for the volumetric examination of the HCGS RPV circumferential welds.

2.0 BACKGROUND

By letter dated September 28, 1995, as supplemented by letters dated June 24, and October 29, 1996; May 16, June 4, June 13, and December 18, 1997, and January 13, 1998, the Boiling Water Reactor Vessel and Internals Project (BWRVIP), a technical committee of the BWR Owners Group (BWROG), submitted the proprietary report, "BWR Vessel and Internals Project, BWR Reactor Vessel Shell Weld Inspection Recommendations (BWRVIP-05)," for staff review and approval. In this report, the BWRVIP proposed to reduce the scope of inspection of RPV welds from essentially 100 percent of all RPV shell welds to the examination of essentially 100 percent of the axial welds and inspecting essentially none of the circumferential welds, except at the intersection of the axial and circumferential welds. Approximately 2 to 3 percent of the circumferential welds would be inspected under this proposal.

In the NRC's final safety evaluation (FSE) of the BWRVIP-05 report dated July 28, 1998, the staff accepted the reduction in inspection of RPV circumferential welds. The staff provided the Commission with its methods and acceptance criteria for considering both partial and permanent requests for relief of the augmented reactor vessel examinations required by 10 CFR 50.55a(g)(6)(ii)(A) in SECY-98-219.

On November 10, 1998, the NRC issued GL 98-05 which informed licensees for BWR plants that staff review of BWRVIP-05 was complete. GL 98-05 states that BWR licensees can request permanent (i.e., for the remaining term of operation under the existing, initial license) relief from complying with the augmented ISI requirements in 10 CFR 50.55a(g) for the volumetric examination of circumferential RPV welds if the following two criteria are met:

(1) at the expiration of the license, the circumferential welds will continue to satisfy the limiting conditional failure probability for circumferential welds in the staff's July 28, 1998, FSE, and

(2) the licensee has implemented operator training and has established procedures that limit the frequency of cold overpressure events to the amount specified in the staff's July 28, 1998, FSE.

GL 98-05 states that BWR licensees still need to perform their required inspections of "essentially 100 percent" of all axial (longitudinal) RPV welds.

3.0 EVALUATION

3.1 Request for Relief

The licensee has requested permanent relief from performing the ISI requirements of 10 CFR 50.55a(g) for the circumferential shell welds in the HCGS RPV.

3.2 Applicable Requirements

Pursuant to the requirements of 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components must meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," of the ASME Code to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that all inservice examinations and system pressure tests conducted during the first 10-year interval and subsequent intervals on ASME Code Class 1, 2, and 3 components must comply with the requirements in the latest edition and addenda of Section XI incorporated by reference in 10 CFR 50.55a(b) on the date 12 months prior to the start of the 10-year interval.

Title 10 of the *Code of Federal Regulations*, Section 50.55a(g)(6)(ii)(A)(2) requires all licensees to "augment their reactor vessel examination by implementing once, as part of the inservice inspection interval in effect on September 8, 1992, the examination requirements for reactor vessel shell welds specified in Item B1.10 of Examination Category B-A, "Pressure Retaining Welds in Reactor Vessel," in Table IWB-2500-1 of subsection IWB . . ." This section requires licensees to implement augmented examinations of essentially 100 percent of the RPV shell

welds. ASME Code category B1.10 covers requirements for examinations of RPV circumferential shell welds (Examination Item B1.11) and longitudinal shell welds (Examination Item B1.12). Title 10 of the *Code of Federal Regulations*, Section CFR 50.55a(g)(6)(ii)(A)(2) defines "essentially 100 percent" examination as covering 90 percent or more of the examination volume of each weld.

3.3 Basis for Relief

Title 10 of the *Code of Federal Regulations*, Section 50.55a(g)(6)(ii)(A)(5) allows licensees who are unable to completely satisfy the augmented RPV shell weld examination requirements to submit information to the Commission to support such a determination and to propose alternatives to the examination requirements that would provide an acceptable level of quality and safety in lieu of complying with the requirements.

Title 10 of the *Code of Federal Regulations*, Section 50.55a(a)(3)(i) indicates that alternatives to the requirement in 10 CFR 50.55a(g) are justified when the proposed alternative provides an acceptable level of quality and safety in lieu of complying with the requirements.

3.4 Proposed Alternatives

Pursuant to 10 CFR 50.55a(a)(3)(i) and 10 CFR 50.55a(g)(6)(ii)(A)(5), the licensee proposed the following alternative program to the augmented examination requirements of 10 CFR 50.55a(g)(6)(ii)(A)(2), and the ISI requirements of Section XI:

(1) Elimination of the ISI and augmented examination requirements of 10 CFR 50.55a(g) for RPV circumferential welds based on results from the NRC and BWRVIP-05 probabilistic failure analyses.

(2) Use of the alternative requirements regarding successive and additional examination of RPV circumferential flaws in accordance with those of BWRVIP-05.

3.5 Evaluation

3.5.1 Licensee's Evaluation

The licensee demonstrated that the HCGS satisfies the first condition (see Section 2.0 above) of GL 98-05 for relief consideration through a plant-specific evaluation. The licensee used an end-of-license (EOL) inner-diameter (ID) fluence of 0.075×10^{19} n/cm^2, an initial reference temperature (RT_{NDT}) of -30 °F, a nickel content of 0.59 percent, and a copper content of 0.08 percent to calculate the mean RT_{NDT} for its limiting circumferential weld. The mean RT_{NDT} was defined in the FSE as the EOL RT_{NDT} without the margin term. The licensee then compared its calculated mean RT_{NDT} of 1.4 °F with the staff's value of 44.5 °F for the circumferential weld of a Chicago Bridge & Iron (CB&I) RPV that was reported in the FSE for a limiting plant-specific probabilistic fracture mechanics (PFM) analysis (Table 2.6-4 of the FSE), and concluded that the HCGS RPV is bounded by the staff's PFM analysis. Hence, the HCGS RPV circumferential welds satisfy the limiting conditional failure probability reported in the FSE.

To satisfy the second condition of GL 98-05 for relief consideration, the licensee reviewed the procedures for pressure testing and normal cold shutdown of the RPV. The licensee also reviewed its operator training and the operation of high pressure coolant injection (HPCI), reactor core isolation cooling (RCIC), standby liquid control (SLC), control rod drive (CRD), and reactor water cleanup (RWCU) systems which, under certain conditions, add water to the RPV. The licensee concluded that during the pressure testing and normal cold shutdown, the HCGS practice would minimize the likelihood of exceeding the pressure-temperature limits. Further, HPCI and RCIC do not function in cold shutdown and the low injection rates (< 60 gpm) for SLC, CRD, and RWCU allow the operator sufficient time to react to unanticipated events.

3.5.2 Staff's Evaluation

The staff compared the material information for the limiting RPV circumferential weld reported by the licensee with the information in the NRC reactor vessel integrity database (RVID) and found two discrepancies. In the RVID, the fluence is 0.17×10^{19} n/cm^2 and the nickel content is 0.63 percent for the limiting circumferential weld as opposed to 0.075×10^{19} n/cm^2 and 0.59 percent as shown in the licensee's submittal dated July 9, 1999. The values shown in the licensee's submittal are consistent with the information shown in General Electric Report GE-NE-523-A64-129, "Hope Creek 1 Generating Station RPV Surveillance Materials Testing and Fracture Toughness Analysis," which was submitted to the NRC via a letter from PSE&G dated June 9, 1995. The values shown in the licensee's submittal are also consistent with Revision 1 of the same report which was submitted to the NRC via a letter from PSE&G dated September 1, 1999. However, these reports have not been reviewed by the staff. In order to evaluate the weld data, given the above described discrepancies, the staff used the more conservative RVID values and found the corresponding mean RT_{NDT} is 26.4 °F. This value is significantly greater than the licensee's value of 1.4 °F, however, it is still less than the mean RT_{NDT} of 44.5 °F from the staff's limiting plant-specific analyses for the CB&I RPV. It should be noted that the HCGS RPV was the only one fabricated by Hitachi. However, it was determined in the FSE that the Hitachi-fabricated vessel is comparable to the CB&I vessels.

Since the RT_{NDT} values for the HCGS circumferential welds are bounded by the corresponding mean RT_{NDT} values for the limiting CB&I RPV, the staff concludes that the licensee has provided sufficient assurance that the projected embrittlement of the circumferential welds in the HCGS RPV is also bounded by that assessed for the CB&I RPV. The staff, therefore, concludes that the probability of failure for the circumferential welds in the HCGS RPV should be less than that calculated by the staff (2.0×10^{-10} per reactor year) for the limiting CB&I RPV, and the assessment of the circumferential welds in the HCGS RPV is consistent with the staff's analysis in SECY-98-219.

As to the second condition for the relief consideration, the staff agrees with the licensee that it has implemented operator training and has established procedures that limit the frequency of cold overpressure events to the amount specified in the FSE.

4.0 CONCLUSIONS

Based on the above evaluation, the NRC staff has determined that the licensee has proposed an acceptable alternative to the requirements of 10 CFR 50.55a(g)(6)(ii)(A)(2) for performing the augmented examinations of the RPV circumferential welds at HCGS. This determination is based on the following considerations:

(1) the circumferential welds in the HCGS RPV will continue to satisfy the limiting conditional failure probability estimated in the staff's FSE at the expiration of the plant license.

(2) the licensee has implemented operator training and has established plant-specific procedures that limit the frequency of cold overpressure events to the amount specified in the FSE.

The staff concludes that the proposed alternative provides an acceptable level of quality and safety relative to ensuring the structural integrity of the circumferential welds. Therefore, the proposed alternative is authorized pursuant to 10 CFR 50.55a(a)(3)(i). The augmented examinations of the HCGS RPV circumferential welds may be permanently deferred for the remaining term of operation under the existing, initial operating license (i.e, through April 11, 2026).

Principal Contributor: S. Sheng

Date: November 1, 1999

under the existing, initial operating license (i.e, through April 11, 2026). The staff's safety evaluation is enclosed.

If you have any questions regarding this matter, please contact the Hope Creek Project Manager, Richard B. Ennis, at (301) 415-1420.

Sincerely,

Original signed by:
James W. Clifford, Chief, Section 2
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-354

Enclosure: Safety Evaluation

cc w/encl: See next page

DISTRIBUTION

Docket File	JClifford	OGC	SSheng
PUBLIC	REnnis	ACRS	RScholl (E-Mail SE)
PDI-2 Reading	TClark	MTschiltz	GMeyer, RGN-I
EAdensam (EGA1)	GHill (2)	KWichman	

OFFICE	PDI-2/PM	PDI-2/LA	EMCB/SC	OGC	PDI-2/SC
NAME	REnnis:lcc	TClark	KWichman	RBachmann	JClifford
DATE	10/6/99	10/6/99	10/7/99	10/14/99	10/31/99

OFFICIAL RECORD COPY
DOCUMENT NAME: G:\PDI-2\Hope Creek\Sea6037.wpd