June 1, 2005

Mr. J. V. Parrish
Chief Executive Officer
Energy Northwest
P.O. Box 968 (Mail Drop 1023)
Richland, WA 99352-0968

SUBJECT: SAFETY EVALUATION FOR COLUMBIA GENERATING STATION - RELIEF REQUEST FOR ALTERNATIVES TO VOLUMETRIC EXAMINATION OF REACTOR PRESSURE VESSEL CIRCUMFERENTIAL SHELL WELDS IN ACCORDANCE WITH BWRVIP-05 (TAC NO. MC3916)

Dear Mr. Parrish:

By letter dated July 15, 2004 (ADAMS Accession No. ML042150393), Energy Northwest, the licensee for the Columbia Generating Station (CGS), submitted a request for relief from the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI requirements related to examination of reactor pressure vessel (RPV) circumferential shell welds at CGS. The licensee provided additional information by letter dated April 1, 2005 (ADAMS Accession No. ML051030283). The relief request proposed an alternative in accordance with BWRVIP-05 to the RPV circumferential shell welds examination requirements of ASME Code, Section XI, for the remaining period of the current operating license.

The Nuclear Regulatory Commission staff completed its review and evaluation of the information provided by the requesting relief from ASME Code, Section XI requirements at CGS to utilize an alternative for examination of reactor pressure vessel circumferential shell welds. Based on the enclosed evaluation, the staff found the relief request acceptable. This completes the technical review for TAC Number MC3916.

Sincerely,

/RA/
Robert Gramm, Chief, Section 2
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-397

Enclosure: As stated

cc w/encl: See next page

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ADAMS ACCESSION NO. ML051310091 ***SE input** **NRR-028**

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

ALTERNATIVES FOR VOLUMETRIC EXAMINATION OF REACTOR PRESSURE VESSEL

CIRCUMFERENTIAL SHELL WELDS IN ACCORDANCE WITH BWRVIP-05

ENERGY NORTHWEST

COLUMBIA GENERATING STATION

DOCKET NO. 50-397

1.0 INTRODUCTION

By letter dated July 15, 2004 (ADAMS Accession No. ML042150393), Energy Northwest, the licensee, submitted a request to the Nuclear Regulatory Commission (NRC) for relief from the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI requirements related to examination of reactor pressure vessel (RPV) circumferential shell welds at Columbia Generating Station (CGS). The licensee provided additional information by letter dated April 1, 2005 (ADAMS Accession No. ML050890032).

The relief request proposed an alternative in accordance with "BWR [boiling-water reactor] Vessel and Internals Project, BWR Reactor Pressure Vessel Shell Weld Inspection Recommendations (BWRVIP-05)" to the RPV circumferential shell welds examination requirements of ASME Code, Section XI, for the remaining period of the current operating license.

2.0 REGULATORY EVALUATION

2.1 Inservice Inspection Requirements

Inservice inspection (ISI) of the ASME Code Class 1, 2, and 3 components is performed in accordance with Section XI of the ASME Code and applicable Addenda as required by Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(g), except where specific relief has been granted by the Commission pursuant to 10 CFR50.55a(g)(6)(i). Section 50.55a(a)(3) of 10 CFR states that proposed alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if the licensee demonstrates that: (i) the proposed alternatives would provide an acceptable level of quality and safety, or (ii) compliance with the specified requirements of this section would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Pursuant to 10 CFR 50.55a(g)(4), components (including supports) which are classified as ASME Code Class 1, 2, and 3 shall meet the requirements, except the design and access provisions and the pre-service examination requirements, set forth in the ASME Code, Section XI, “Rules for Inservice Inspection of Nuclear Power Plant Components,” to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that inservice examination of components and system pressure tests conducted during the first 120-month interval and subsequent intervals comply with the requirements in the latest Edition and Addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b) twelve months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein.

The applicable ISI Code of records for CGS is the 1989 Edition with no Addenda of Section XI of the ASME Code.

2.2 Augmented Inservice Inspections Requirements for RPV Circumferential Shell Welds

Section 10 CFR 50.55a(g)(6)(ii)(A)(2) requires licensees to augment their RPV examinations by implementing, as part of the ISI interval, the examination requirements for RPV shell welds specified in Item B1.10 of Section XI to the ASME Code, Table IWB-2500-1, Examination Category B-A, "Pressure Retaining Welds in Reactor Vessel." Item B1.10 of Section XI to the ASME Code includes the volumetric examination requirements in Item B1.11 of Section XI for RPV circumferential shell welds, and in Item B1.12 of Section XI for RPV axial shell welds. Section 50.55a(g)(6)(ii)(A)(2) of 10 CFR defines "essentially 100% examination" as covering 90 percent or more of the examination volume of each weld.

2.3 Additional Regulatory Guidance

2.3.1 NRC Staff Evaluation of the BWRVIP-05 Report

By letter dated September 28, 1995 (ADAMS Accession No. 9510030130), as supplemented by letters dated June 24 (ADAMS Accession No. 9606270011), and October 29, 1996 (ADAMS Accession No. 9610310079), May 16 (ADAMS Accession No. 9808200035), June 4, June 13 (ADAMS Accession No. 9706180413), and December 18, 1997 (ADAMS Accession No. 9712240085), and January 13, 1998 (ADAMS Accession No. 9801150081), the Boiling Water Reactor Vessel and Internals Project (BWRVIP), a technical committee of the BWR Owners Group (BWROG), submitted the proprietary report. The BWRVIP-05 report evaluates the current inspection requirements for RPV shell welds in BWRs, formulates recommendations for alternative inspection requirements, and provides a technical basis for these recommended requirements. As modified, the BWRVIP-05 proposed to reduce the scope of inspection of BWR RPV welds from essentially 100 percent of all RPV shell welds to examination of 100 percent of the RPV axial shell welds and essentially zero percent of the RPV circumferential shell welds, except for the intersections of the RPV axial and circumferential shell welds. In addition, the report includes proposals to provide alternatives to ASME Code requirements for successive and additional examinations of RPV circumferential shell welds, provided in paragraph IWB-2420 and IWB-2430 respectively, of Section XI of the ASME Code.

The NRC staff issued a Safety Evaluation (SE) of BWRVIP-05 on July 28, 1998 (ADAMS Accession No. 9808040041). This evaluation concluded that the failure frequency of RPV circumferential shell welds in BWRs was sufficiently low to justify elimination of ISI of these welds. In addition, the evaluation concluded that the BWRVIP proposals on successive and additional examinations of RPV circumferential shell welds were acceptable. The evaluation indicated that examination of the RPV circumferential shell welds will be performed, if RPV axial shell weld examinations reveal an active degradation mechanism. The NRC staff supplemented the July 28, 1998, SE in an SE to the BWRVIP dated March 7, 2000 (ADAMS Accession No. ML003690281). In the March 7, 2000, SE, the NRC staff updated the interim probabilistic failure frequencies for RPV axial shell welds and revised Table 2.6-4 of the July 28, 1998, SE to correct a typographical error in the 32 effective full power years (EFPY) chemistry factor value cited for the limiting Chicago Bridge and Iron (CB&I) case study for RPV circumferential shell welds. The correction changed the 32 EFPY chemistry factor value for the CB&I case study from 109.5EF to 134.9EF.

The BWRVIP-05 report concluded that the conditional probabilities of failure for BWR RPV circumferential shell welds are orders of magnitude lower than that of the RPV axial shell welds. As a part of its review of the report, the NRC staff conducted an independent probabilistic fracture mechanics assessment of the results presented in the BWRVIP-05 report. The NRC staff's assessment conservatively calculated the conditional probability of failure values for RPV axial and circumferential welds during the current 40-year license period and at conditions approximating an 80-year vessel lifetime for a BWR nuclear plant. The failure frequency is calculated as the product of the frequency for the critical (limiting) transient event and the conditional probability of failure for the weld.

The NRC staff determined the conditional probability of failure for RPV axial and circumferential shell welds in BWR vessels fabricated by CB&I, Combustion Engineering (CE), and Babcock and Wilcox (B&W). The analysis identified a cold overpressure event that occurred in a foreign reactor as the limiting event for BWR RPVs, with the pressure and temperature from this event used in the probabilistic fracture mechanics calculations. The NRC staff estimated that the probability for the occurrence of the limiting overpressurization transient was 1 x 10-3 per reactor year. For each of the vessel fabricators, Table 2.6-4 of the March 7, 2000, SE identifies the conditional failure probabilities for the plant-specific conditions with the highest projected reference temperature (for that fabricator) through the expiration of the initial 40-year license period.

2.3.2 Generic Letter 98-05

The NRC staff issued Generic Letter (GL) 98-05 on November 10, 1998, which states that BWR licensees may request permanent (i.e., for the remaining term of operation under the existing, initial license) relief from the ISI requirements of 10 CFR 50.55a(g) for the volumetric examination of RPV circumferential shell welds (ASME Code Section XI, Table IWB-2500-1, Examination Category B-A, Item No. B1.11, "Circumferential Shell Welds") by demonstrating that:

(1) At the expiration of the license, the RPV circumferential shell welds will continue to satisfy the limiting conditional failure probability for RPV circumferential shell welds in the NRC staff's July 28, 1998, SE, and

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

Licensees will still need to perform the required inspections of "essentially 100 percent" of all RPV axial shell welds.

3.0 TECHNICAL EVALUATION

3.1 Code Requirement for Which Relief is Requested

The licensee requested relief from the following requirements in the 1989 Edition with no Addenda of Section XI to the ASME Code:

- Subarticle IWB-2500, Table IWB 2500-1, Examination Category B-A, "Pressure Retaining Welds in Reactor Vessel," Item No. B1.11, "Circumferential Shell Welds."

This relief is requested for the following components:

ISI Class 1, Examination Category B-A, Code Item No. B1.11, "Circumferential Shell Welds" to include:

Weld No. AA, "Bottom Head to #1 Shell Course"
Weld No. AB, "#1 to #2 Shell Course"
Weld No. AC, "#2 to #3 Shell Course"
Weld No. AD, "#3 to #4 Shell Course"

3.2 Licensee's Proposed Alternative to the ASME Code

In accordance with 10 CFR 50.55a(a)(3)(i) and using the guidelines of BWRVIP-05, and the July 28, 1998, SE on BWRVIP-05, the licensee proposed to use a probabilistic fracture mechanics evaluation for the CGS RPV circumferential shell welds as the basis for eliminating the required volumetric examinations and augmented volumetric examinations for the welds through the expiration of the current operating license for CGS. The licensee proposed the following alternative in lieu of performing the required volumetric examinations of the RPV circumferential shell welds:

> Energy Northwest herein requests approval to implement this alternative examination methodology for Columbia as allowed by GL 98-05 and proposes to modify Columbia's ISI schedule to perform inspections of essentially 100 percent of the RPV axial shell welds and essentially zero percent of the RPV circumferential welds (item B1.11). Approximately two to three percent of circumferential welds will continue to be examined at their points of intersection with the axial welds. These inspections are being proposed as an alternative to the ISI requirements for circumferential welds in the ASME Code, Section XI, 1989 Edition (no Addenda).

3.3 Licensee's Bases for Alternative

BWRVIP-05 provides the technical basis to justify relief from the examination requirements of RPV circumferential shell welds. The results of the NRC staff's evaluation of BWRVIP-05 are documented in the July 28, 1998, SE. BWR licensees may request permanent relief from the ISI requirements of 10 CFR 50.55a(g) for the volumetric examination of RPV circumferential shell welds (ASME Code Section XI, Table IWB-2500-1, Examination Category B-A, Item No. B1.11, "Circumferential Shell Welds") by demonstrating that:

(1) At the expiration of the license, the RPV circumferential shell welds will continue to satisfy the limiting conditional failure probability for RPV circumferential shell welds in the NRC staff's July 28, 1998, SE, (Criterion 1) and

(2) Licensees have implemented operator training and established procedures that limit the frequency of cold over-pressure events to the amount specified in the NRC staff's July 28, 1998, SE (Criterion 2).

GL 98-05 also states that licensees will still need to perform the required inspections of "essentially 100 percent" of all RPV axial shell welds. The relief request also stated that the licensee has demonstrated that the safety criteria specified in GL 98-05 and the July 28, 1998, SE have been met for the current operating license.

3.3.1 Licensee's Basis for Conforming with Criterion 1 - Criterion for Conditional Probabilities of Failure

The licensee provided in a letter dated April 1, 2005, a comparison of the limiting RPV circumferential shell weld parameters for the CGS RPV to those found in Table 2.6-4 of the July 28, 1998, SE for a CB&I vessel. These parameters included the 33.1 EFPY Mean reference temperature nil ductility (RT_{NDT}) calculations for the limiting RPV circumferential shell welds in the CGS RPV in order to support its basis for meeting Criterion 1 by demonstrating that the 33.1 EFPY Mean RT_{NDT} values for CGS are bounded by the Mean 32 EFPY RT_{NDT} value for the limiting CB&I vessel plant specific analysis.

3.3.2 Licensee's Basis for Conforming with Criterion 2 - Criterion on Mitigating the Probability of Cold Overpressurization Events

The licensee provided the following technical basis for meeting Criterion 2:

> In GL 98-05, the NRC stated that beyond design-basis events occurring during plant shutdown could lead to LTOP [low temperature overpressurization] events that could challenge RPV integrity. The BWRVIP assessment indicated that the major contribution to LTOP event frequency results from unmitigated injections from condensate or control rod drive systems and a failure to properly realign the reactor water cleanup system following a reactor trip at low temperatures could potentially cause an LTOP event. For a BWR to experience such an event would require several operator errors. Although no LTOP events have occurred at a domestic BWR, the NRC identified several events that could be considered precursors to such an event and cited one actual LTOP event that occurred at a foreign BWR. This event involved a series of operational errors that allowed a Control Rod Drive (CRD) pump to run until the vessel went water-solid with no

outflow from the reactor resulting in a maximum RPV pressure of 1150 psi within a temperature range of 79F to 88F. The probability that the operator fails to take action to mitigate coolant injection is a key variable in assessing the frequency of LTOP events.

Procedural Controls to Prevent LTOP Events

Operating procedures and Operator training programs at Columbia are barriers that make an LTOP event unlikely during low temperature evolutions such as RPV pressure testing at the conclusion of a refueling outage. These procedures require continuous monitoring and control of reactor water level, pressure, and temperature during cold shutdown and refueling operations.

The Operations procedure governing control room activities requires that operators continuously monitor indications and alarms, to detect abnormalities as early as possible, and immediately notify the control room supervisor of any changes or abnormalities in indications. This procedure requires that changes, which could affect reactor water level, pressure, or temperature, be performed only under the auspices of a Senior Reactor Operator (SRO). This ensures any deviations in reactor water level or temperature from specified parameters will be promptly identified and corrected. Additionally, at each shift turnover, operators discuss the status of plant conditions, any on-going activities that could affect critical plant parameters, and contingency planning. This ensures that on-coming operators are aware of any activities that could adversely affect reactor water level, pressure, or temperature. These procedures minimize the likelihood of an LTOP event from occurring and are reinforced through periodic operator training.

Work Management Control

A review of industry operating experience indicates that inadequate work management is a potential contributor to a cold over-pressure event. At Columbia, an outage management group schedules work performed during outages. All work activities are reviewed against a shutdown safety plan and coordinated through an outage control center, which provides operations oversight. In the control room, the SRO is required to maintain continuous attention to any work activity that could potentially affect reactor level or decay heat removal during refueling outages. Pre-job briefings are conducted for work activities that have the potential of affecting critical reactor parameters. The individuals involved in the work activity attend these briefings and discuss expected plant responses and contingency actions to address unexpected events or conditions that may be encountered.

Operator Training to Prevent RPV LTOP Events

Procedural controls for reactor temperature, level, and pressure are an integral part of operator training. Specifically, operators are trained in methods of controlling water level within specified limits, as well as responding to abnormal water level conditions outside the established limits.

Licensed operator training further reduces the possibility of an LTOP. The initial licensed operator training curriculum covers brittle fracture and vessel thermal stress;

operational transient procedures, including the operational transient on reactor high water level; technical specifications limiting conditions for operation; and, simulator training of plant heat up and cool down including performance of surveillance tests which ensure pressure/temperature curve adherence. In addition, periodic operator training reinforces management's expectations for strict procedural compliance and conservative decision-making.

Industry Events Review

Energy Northwest continuously reviews operating experience to ensure Columbia's procedures and training are revised to benefit from lessons learned from industry events, including LTOP events. This is done with the objective of precluding similar events from occurring at Columbia.

Considering the operational and administrative barriers discussed above, the probability that the operator fails to take action to mitigate coolant injection is low enough to assure the frequency of an LTOP event at Columbia is bounded by the amount specified in the NRC's safety evaluation (reference 4) [Final Safety Evaluation of the BWR Vessel Internals Project BWRVIP-05 Report dated July 28, 1998]. Thus, Criterion 2 of GL 98-05 is met.

Conclusion

The BWRVIP-05 report provides the technical basis for eliminating inspection of BWR RPV circumferential shell welds. The BWRVIP-05 report concludes that the probability of failure of the BWR RPV circumferential shell welds is orders of magnitude lower than that of the axial shell welds. Based on an assessment of the materials in the limiting circumferential weld in the beltline of Columbia's RPV, the conditional probability of RPV failure is less than or equal to that estimated in the NRC's analysis through the end of the current operating license. Based on established operator training, practices and procedural controls, the frequency of an LTOP event at Columbia is less than or equal to the frequency assumed in the NRC's July 28, 1998, safety evaluation.

4.0 STAFF EVALUATION

As discussed in Section 2.3.1 of this SE, the July 28, 1998, SE for BWRVIP-05 provides two criteria that BWR licensees requesting relief from ISI requirements of 10 CFR 50.55a(g) for the volumetric examination of RPV circumferential shell welds must satisfy. These criteria are intended to demonstrate that the conditions at the licensee's plants are bounded by those in the SE. The licensee will still need to perform the required inspections of “essentially 100 percent” of all RPV axial shell welds.

4.1 Neutron Fluence Calculation

For any given RPV circumferential or axial shell weld material, the conditional probability of failure increases with the material's neutron fluence value and mean RT_{NDT} value, as projected to the expiration of the operating license for the facility. At the expiration of the operating license, the mean RT_{NDT} estimates for RPV circumferential shell welds should satisfy the limiting conditional failure probability for the weld materials, as stated in the July 28, 1998, SE. The neutron fluence values for the RPV circumferential shell welds at the inside surface of the RPV are critical inputs to the mean RT_{NDT} estimate calculations.

The end of the current license peak vessel fluence is reported in NEDO-33144, for 33.1 EFPYs of operation, which corresponds to the end of the 40 calendar year license, and accounts for the power uprate implemented with the 11^{th} cycle. The 33.1 EFPY fluence was calculated using the methodology of NEDC-32983P, "General Electric Methodology for Reactor Pressure Vessel Fast Neutron Flux Evaluation", which was approved by letter dated September 14, 2001. Acceptability was based on the fact that the methodology followed the guidance in Regulatory Guide (RG) 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence," dated March 2001.

The peak end of the license value was calculated to be $3.09x10^{17}n/cm^2$. The NRC staff's plant specific limiting analysis for 32 EFPY fluence value resulted in $5.10x10^{18}n/cm^2$. Comparison of the accepted values for 32 EFPYs and the limiting value for 33.1 EFPYs indicates that the plant fluence value is significantly lower than the limiting value, and therefore, is acceptable.

4.2 RPV Circumferential Shell Weld Conditional Failure Probability

In the July 28, 1998, SE, the NRC staff evaluated the conditional failure probabilities for RPV axial and circumferential shell welds in the limiting BWR RPV designs manufactured by CE, CB&I, and B&W. The SE also reported the Mean RT_{NDT} calculations and values that were derived from the conditional failure probabilities for the limiting case studies. The evaluation criteria for the limiting conditional failure probabilities and Mean RT_{NDT} values are those listed for the limiting case studies specified in Table 2.6-4 of the July 28, 1998, SE.

The NRC staff performed an independent calculation of the Mean RT_{NDT} values for the limiting CGS RPV circumferential shell welds through 33.1 EFPY. Table 1 of this SE provides a summary and a comparison of the corresponding Mean RT_{NDT} values calculated by the licensee, the NRC staff and the BWRVIP-05 Mean RT_{NDT} value criterion for the limiting CB&I case study at 32 EFPY.

During the NRC staff's independent calculation of the Mean RT_{NDT} value for the limiting RPV circumferential shell weld, the NRC staff requested additional information on the calculation of the chemistry factor (CF) for weld wire heat 5P6756 and information on any applicable surveillance capsule data. In a letter dated April 1, 2005, the licensee provided additional information on the calculation of the CF for weld wire heat 5P6756. The licensee used a fitted CF of 119.72 (least square fit) that was provided by the BWRVIP using three integrated surveillance program (ISP) capsule data sets for a surveillance weld that was fabricated using weld wire heat 5P6756. This surveillance weld is representative of the RPV circumferential weld since it was made from the same heat of weld wire as the limiting RPV circumferential shell weld. The three capsule data sets were fabricated from one weld. The fitted CF for the ISP surveillance data was calculated using all available surveillance data from this one weld which meets the intent of RG 1.99, Revision 2. The licensee normalized the fitted CF to develop an adjusted CF for their vessel weld to account for the difference in chemical composition between the RPV circumferential shell weld and the surveillance weld. This was done by multiplying the fitted CF by the ratio of the CF for the RPV beltline weld, as established by the best estimate chemistry for weld wire heat 5P6756, to the CF for the surveillance weld, as established by the chemistry of the surveillance weld. This is equivalent to the methodology in Section 2.1 of RG 1.99, Revision 2. In addition, the licensee's letter dated April 1, 2005, provided a recalculated mean RT_{NDT} of -14.8EF using the mean peak fluence value as required by the July 28, 1998, SE, instead of the 1/4T fluence value. The NRC staff calculations using the guidelines of RG 1.99, Revision 2 and the above information provided by the licensee, confirmed the CF value of 157.68 and a mean RT_{NDT} of -14.8EF. In addition, this adjusted CF value of 157.68 is more conservative than the CF calculated from Table 1 of RG 1.99, Revision 2, using the best estimate chemistry for weld wire heat 5P6456.

The results in Table 1 of this SE demonstrate that the mean RT_{NDT} values calculated by the NRC staff for the CGS RPV circumferential shell welds are less than that for the limiting CB&I case study. Based on this analysis, the NRC staff concludes that the licensee has provided a valid basis for concluding that the conditional probability of failure values for the CGS RPV circumferential shell welds are sufficiently low to justify elimination of the volumetric examinations that are required for these welds through 33.1 EFPY.

Table 1
Columbia Generating Station
Bounding Reactor Pressure Vessel Circumferential Shell Weld Information

Parameter Description	Energy Northwest Mean RT_{NDT} Calculation Parameters for CGS RPV Circumferential Weld at 33.1 EFPY (Weld Wire Heat 5P6756)	NRC staff's Independent Mean RT_{NDT} Calculation Parameters for CGS RPV Circumferential Weld at 33.1 EFPY (Weld Wire Heat 5P6756)	NRC staff's Limiting Plant-Specific Analysis for CB&I Circumferential Welds at 32 EFPY
End of Life Inside Diameter Fluence, (10^{19} n/cm2)	0.0309	0.0309	0.51
Chemistry Factor, EF	157.68	157.68	134.9
Cu%	0.08	0.08	0.1
Ni%	0.936	0.936	0.99
Initial RT_{NDT}, EF	-50	-50	-65
ΔRT_{NDT}, EF	35.2	35.0	109.5
Mean RT_{NDT}, EF ($RT_{NDT}(u) + \Delta RT_{NDT}$)	-14.8	-14.9	44.5

4.3 Minimizing the Possibility of Low Temperature Overpressurization

To satisfy the second condition of GL 98-05 regarding a cold overpressure event, the licensee provided its analysis of the potential high-pressure injection sources, administrative controls, and operator training. The licensee noted that for a cold overpressurization event to occur a series of operator errors are required. Therefore, the licensee proposes to use operating procedures and operator training programs as barriers to cold overpressurization.

- Procedural Controls to Prevent Low Temperature Overpressure Events

The operations procedure which governs control room activities requires that operators monitor and notify the control room supervisor of any indications of abnormalities. These include reactor water level, vessel pressure and temperature. This ensures that any deviations in reactor coolant system water level, temperature or pressure will be promptly identified and corrected. Additionally, at each shift turnover, operators discuss the status of the plant conditions, any ongoing activities that could affect critical plant parameters and contingency planning. These procedures minimize the likelihood of a cold overpressure event from occurring and are reinforced through periodic operator training.

- Work Management Control

At CGS all work activities are reviewed against a shutdown safety plan and coordinated through an outage control center, which provides operational oversight. The senior reactor operator, in the control room is required to provide continuous attention to any work activity that could potentially affect reactor level or decay heat removal during refueling outages. The individuals involved in this work activity attend briefings and discuss expected plant response and contingency actions for possible unexpected events.

- Operator Training to Prevent Reactor Vessel Low Temperature Overpressure Events

Operators are trained in methods of controlling water level within specified limits, as well as responding to abnormal water level conditions outside established limits. The licensed operator training covers vessel brittle fracture and vessel thermal stresses, operational transient procedures, technical specification limiting conditions of operation and simulator training for plant heatup and cooldown including surveillance to ensure pressure temperature limit curve adherence.

- Industry Event Review

CGS personnel continuously review operating experience to assure that procedures and training are revised to benefit from lessons learned from industry events.

In summary the administrative and operational barriers discussed above, the probability that an operator fails to take action to prevent or mitigate a cold overpressure event is bounded by the safety evaluation in BWRVIP-05. This satisfies the second requirement in GL 98-05.

5.0 CONCLUSION

The NRC staff has reviewed the licensee's submittal and has determined that the licensee has acceptably demonstrated conformance to the applicable safety evaluation criteria in NRC GL 98-05 and in the NRC staff's evaluation of the BWRVIP-05 report. The NRC staff has also determined that the licensee has acceptably demonstrated that the conditional probability of failure values for the CGS RPV circumferential shell welds are sufficiently low enough to justify elimination of the augmented volumetric examinations that are required by 10 CFR 50.55a(g)(6)(ii)(A)(2) and the volumetric examinations that are required by the ASME Code, Section XI, Table IWB-2500-1, Examination Category B-A, Item No. B1.11.

Based on this analysis, the NRC staff concludes that the licensee's alternative will provide an acceptable level of quality and safety in lieu of performing the required volumetric examinations for the remaining period of the current operating license. Therefore, the licensee's alternative is authorized pursuant to 10 CFR 50.55a(a)(3)(i).

Additional requirements of the ASME Code, Section XI for which relief has not been specifically requested and approved by the NRC staff remain applicable, including third party reviews by the Authorized Nuclear Inservice Inspector.

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