November 5, 2007

Mr. Keith J. Polson
Vice President Nine Mile Point
Nine Mile Point Nuclear Station, LLC
P.O. Box 63
Lycoming, NY 13093

SUBJECT: NINE MILE POINT NUCLEAR STATION, UNIT NO. 2 - AUTHORIZATION UNDER 10 CFR 50.55a(a)(3)(i) FOR PROPOSED ALTERNATIVE REACTOR PRESSURE VESSEL CIRCUMFERENTIAL SHELL WELD VOLUMETRIC EXAMINATIONS (TAC NO. MD3696)

Dear Mr. Polson:

By letter dated November 16, 2006, as supplemented by letter dated April 20, 2007, Nine Mile Point Nuclear Station, LLC requested permanent relief from certain American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section XI requirements related to examination of reactor pressure vessel circumferential shell welds at Nine Mile Point Nuclear Station, Unit No. 2 (NMP2) through the end of the facility's license renewal extended period of operation.

The results of the Nuclear Regulatory Commission (NRC) staff's review and evaluation of the afformentioned submittals is provided in the enclosed safety evaluation (SE). Based on the SE, the NRC staff concludes that the proposed alternative will provide an acceptable level of quality and safety. Therefore, the alternative proposed under the relief request is authorized pursuant to Section 50.55a(a)(3)(i) of Title 10 of the *Code of Federal Regulations* (10 CFR), through the end of the NMP2 license renewal extended period of operation. All other requirements of the ASME Code, Sections III and XI, for which relief has not been specifically requested remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

Sincerely,

/RA/

Mark G. Kowal, Chief
Plant Licensing Branch I-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-410

Enclosure:
Safety Evaluation

cc w/encl: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

PROPOSED ALTERNATIVE REACTOR PRESSURE VESSEL CIRCUMFERENTIAL SHELL

WELD VOLUMETRIC EXAMINATIONS

NINE MILE POINT NUCLEAR STATION, LLC

NINE MILE POINT NUCLEAR STATION, UNIT NO. 2

DOCKET NO. 50-410

1.0 INTRODUCTION

The Nuclear Regulatory Commission (NRC) staff has reviewed and evaluated the information submitted by Nine Mile Point Nuclear Station (NMPNS), LLC (the licensee) in its letter dated November 16, 2006 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML063320461), as supplemented by letter dated April 20, 2007 (ADAMS Accession No. ML071210245), which requested permanent relief from the inservice inspection (ISI) requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(g) for the volumetric examination of reactor pressure vessel (RPV) shell circumferential welds through the end of the Nine Mile Point Nuclear Station, Unit No. 2 (NMP2) license renewal extended period of operation. The letters provided technical justification for the request and proposed alternate provisions for the subject weld examinations.

2.0 REGULATORY REQUIREMENTS

ISI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) Class 1, 2, and 3 components is performed in accordance with ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," and applicable addenda as required by 10 CFR 50.55a(g), except where specific relief has been granted by the NRC pursuant to 10 CFR 50.55a(g)(6)(i). 10 CFR 50.55a(a)(3) states that alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if: (i) the proposed alternatives would provide an acceptable level of quality and safety or (ii) compliance with the specified requirements 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), ASME Code Class 1, 2, and 3 components (including supports) shall meet the requirements, except the design and access provisions and the pre-service examination requirements, set forth in the ASME Code, Section XI, 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 10-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated

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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 ASME Code, Section XI, for the NMP2 second 10-year interval ISI program is the 1989 Edition with no addenda.

10 CFR 50.55a(g)(6)(ii)(A)(2) requires that all licensees augment their RPV examination by implementing once, as part of the ISI interval in effect on September 8, 1992, the examination requirements for RPV shell welds specified in Item No. B1.10, Examination Category B-A, “Pressure Retaining Welds in Reactor Vessel,” of Table IWB-2500-1 to Section XI. Additionally, 10 CFR 50.55a(g)(6)(ii)(A)(2) requires that the examinations cover essentially 100 percent of the RPV shell welds.

10 CFR 50.55a(g)(6)(ii)(A)(2) defines "essentially 100%” as used in Table IWB-2500-1 to mean more than 90 percent of the examination volume of each weld. The schedule for implementation of the augmented inspection is dependent upon the number of months remaining in the 10-year ISI interval that was in effect on September 8, 1992.

2.1 Regulatory Background

2.1.1 BWRVIP-05 Report

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 Boiling Water Reactor (BWR) Owners Group, submitted the BWRVIP-05 report, "BWR Reactor Pressure Vessel Shell Weld Inspection Recommendations," for NRC staff review. This report evaluated the current inspection requirements for RPV shell welds in BWRs, formulated recommendations for alternative inspection requirements, and provided a technical basis for these recommended requirements. As modified, the BWRVIP-05 report 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 axial (i.e., longitudinal) welds and essentially zero percent of the circumferential RPV shell welds, except for the intersections of the axial and circumferential shell welds. In addition, the report included proposals to provide alternatives to the ASME Code, Section XI requirements for successive and additional examinations of circumferential shell welds, provided in paragraphs IWB-2420 and IWB-2430, respectively, of the ASME Code, Section XI.

On July 28, 1998, the NRC staff issued a Safety Evaluation Report (SER) on the BWRVIP-05 report[1]. 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 circumferential shell welds were acceptable. The evaluation indicated that examination of the circumferential shell welds shall be performed if axial shell weld examinations reveal an active degradation mechanism.

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[1] The NRC staff has identified that in some instances its SER is referenced as dated on July 28, 1998, but in other instances as July 30, 1998. For clarification purposes, the NRC staff notes that this SER is a letter addressed to Carl Terry, BWRVIP Chairman, dated July 28, 1998 and titled “Final SER of the BWR Vessel and Internals Project BWRVIP-05 Report (TAC No. M93925).”

In the BWRVIP-05 report, the BWRVIP committee concluded that the conditional probabilities of failure for BWR RPV circumferential shell welds are orders of magnitude lower than that of the 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 from RPV axial and circumferential shell welds during the original 40-year license period and at conditions approximating an 80-year RPV lifetime for a BWR nuclear plant, as indicated respectively in Tables 2.6-4[2] and 2.6-5[2] of the NRC staff's July 28, 1998, SER. The failure frequency for an RPV 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 axial and circumferential shell welds in BWR RPVs fabricated by Chicago Bridge and Iron Nuclear (CBIN), Combustion Engineering, and Babcock and Wilcox. 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 cold overpressure transient was 1.0×10^{-3} per reactor-year. For each of the RPV fabricators, Table 2.6-4 of the NRC staff's SER identifies the conditional failure probabilities for the plant-specific conditions with the highest projected reference temperature (for that fabricator) after the initial 40-year license period.

2.1.2 Generic Letter 98-05

On November 10, 1998, the NRC staff issued Generic Letter (GL) 98-05, "Boiling Water Reactor Licensees Use of the BWRVIP-05 Report to Request Relief from Augmented Examination Requirements on Reactor Pressure Vessel Circumferential Shell Welds," 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 circumferential RPV 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 circumferential shell welds will continue to satisfy the limiting conditional failure probability for circumferential shell welds in the NRC staff's July 28, 1998, SER, 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, SER.

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

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[2] Tables 2.6-4 and 2.6-5 are not included in this Safety Evaluation (SE) and can be found in the NRC staff's SER dated July 28, 1998.

2.1.3 BWRVIP-74 Report

The NRC staff reviewed BWRVIP-74, "BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines," dated September 21, 1999, to determine the applicability of this alternative for an extended period of operation (under license renewal). The NRC staff's evaluation of the BWRVIP-74 report was provided by SER dated October 18, 2001 (ADAMS Accession No. ML012920549), which concluded that Appendix E of the July 28, 1998, SER conservatively evaluated BWR RPVs to 64 effective full-power years (EFPY), which is 10 EFPY greater than what is realistically expected for the end of an additional 20-year license renewal period. Therefore, the NRC staff's analysis provides a technical basis for relief from the current ISI requirements of the ASME Code, Section XI for volumetric examination of the circumferential welds as they may apply for the license renewal period. The October 18, 2001, SER further states that to obtain relief, each licensee will have to demonstrate that:

(1) At the end of the renewal period, the circumferential welds will satisfy the limiting conditional failure probabilities for circumferential welds in Appendix E of the NRC staff's July 28, 1998, SER, and

(2) That they 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, SER.

The July 28, 1998, SER provides Table 2.6-5, which also includes the conditional failure probabilities identified in Appendix E for each vessel fabricator, along with the corresponding highest projected reference temperature. Therefore, this table provides the limiting case studies for plants requesting relief to the end of the extended period of operation. This relief does not apply to the axial welds; therefore, the licensees still need to perform the required ASME Code inspections of "essentially 100%" of all axial welds.

3.0 TECHNICAL EVALUATION

In letters dated November 16, 2006, and April 20, 2007, the licensee provided the following technical information to justify its request for permanent relief and proposed alternative.

3.1 Affected NMP2 Pressure Retaining RPV Shell Circumferential Welds

Weld Number*	**Description**	**ASME Code Category**	**ASME Code Item Number**
2RPV-AA	Bottom Head Radial Plate to Shell 1	B-A	B1.11
2RPV-AB	Shell 1 to Shell 2	B-A	B1.11
2RPV-AC	Shell 2 to Shell 3	B-A	B1.11
2RPV-AD	Shell 3 to Shell 4	B-A	B1.11

* Note: The welds are shown on Figure 1 of the licensee's letters dated November 16, 2006, and April 20, 2007.

3.2 ASME Code Requirements

ASME Code, Section XI, Table IWB-2500-1, Examination Category B-A, Item No. B1.11 requires a volumetric examination of essentially 100 percent of the weld length of the RPV shell circumferential welds each inspection interval. The applicable ASME Code, Section XI, for the NMP2 second 10-year interval ISI program is the 1989 Edition with no addenda.

3.3 Licensee's Proposed Alternative Examination

The licensee stated that the failure frequency for ASME Code, Section XI, Table IWB-2500-1, Examination Category B-A, Item No. B1.11 is sufficiently low to justify their elimination from the ISI requirement of 10 CFR 50.55a(g) based on the NRC staff's July 28, 1998, SER for the BWRVIP-05 report.

The licensee proposed that the ISI examination requirements of ASME Code, Section XI, Table IWB-2500-1, Examination Category B-A, Item No. B1.12, "Reactor Pressure Vessel Shell Longitudinal Welds," shall be performed, to the extent possible, and shall include inspection of the RPV shell circumferential welds only at the intersection of these welds with the longitudinal welds, or approximately 2 to 3 percent of the RPV shell circumferential welds. The proposed alternative for volumetric examination of the RPV shell welds includes performing an examination, from the external outside diameter surface or where access is practical from the internal inside diameter surface of the RPV to the maximum extent possible. The examination of the remaining accessible portions of the RPV circumferential shell welds will be permanently deferred for the life of the license renewal extended period of operation.

The licensee stated that the procedures for these examinations shall be qualified such that flaws relevant to the RPV integrity can be reliably detected and sized, and the personnel implementing these procedures shall be qualified in the use of these procedures. Qualification and examination will be completed in accordance with the 1995 Edition through 1996 Addenda of the ASME Code, Section XI, Appendix VIII as modified by the Performance Demonstration Initiative and 10 CFR 50.55(a).

3.4 Licensee's Basis for Relief Request

The licensee stated that the technical basis for the permanent elimination of the examination requirement of the RPV shell circumference welds is contained in the BWRVIP-05 report and its supplements. The NRC staff conducted an independent risk-informed assessment of the analysis contained in the BWRVIP-05 report and documented its results in the associated NRC staff SER, dated July 28, 1998, and its supplement. This assessment concluded that the probability of failure of the BWR RPV circumferential welds is orders of magnitude lower than that of the axial shell welds and the added risk caused by not inspecting the circumferential welds is negligible. Additionally, the NRC staff assessment concluded that inspection of BWR RPV circumferential welds does not measurably affect the probability of failure.

The licensee also cited NRC GL 98-05, which permits BWR licensees to request permanent relief from the ISI requirements of 10 CFR 50.55a(g) for the volumetric examination of RPV shell circumferential welds. In GL 98-05, the NRC staff stated that BWR licensees may request permanent relief for the remaining current license period by demonstrating that:

(1) At the expiration of the license, the circumferential welds will continue to satisfy the limiting conditional failure probability for circumferential welds in the NRC staff's July 28, 1998, SER (Criterion 1), 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, SER (Criterion 2).

The licensee also stated that its request demonstrates that the safety criteria specified in the BWRVIP-74-A report and the NRC staff's October 18, 2001, SER will continue to be met for the extended period of operation.

BWRVIP-74-A provides generic guidelines intended to present the appropriate inspection and flaw evaluation recommendations to assure safety function integrity of the RPV components through the period of extended operation. In its October 18, 2001, SER, the NRC staff concluded that Appendix E of the July 28, 1998, SER for the BWRVIP-05 report conservatively evaluated BWR RPVs to 64 EFPY, which is 10 EFPY greater than what is realistically expected at the end of an additional 20-year license renewal period. Therefore, the NRC staff's analysis provided a technical basis for relief from the current ISI requirements of the ASME Code, Section XI, for volumetric examination of the circumferential welds as they may apply for the license renewal period. The October 18, 2001, SER further stated that to obtain relief, each licensee will have to demonstrate that:

(1) At the end of the renewal period, the circumferential welds will satisfy the limiting conditional failure probabilities for circumferential welds in Appendix E of the NRC staff's July 28, 1998, SER for the BWRVIP-05 report (Criterion 1), and

(2) They 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, SER, for the BWRVIP-05 report (Criterion 2).

Following is a summary of the information provided by the licensee to demonstrate how Criterion 1 and Criterion 2 are met.

<u>Criterion 1 - Conditional Failure Probability</u>

Demonstrate that at the expiration of the license, the RPV shell circumferential welds will continue to satisfy the limiting conditional failure probability for RPV shell circumferential welds that is established in the July 28,1998, SER.

<u>Response</u>

For plants with RPVs fabricated by CBIN, the peak end-of-license neutron fluence for circumferential welds used in the NRC probabilistic fracture mechanics analysis was

5.1×10^{18} neutrons per square centimeter (n/cm^2). At NMP2, the highest fluence anticipated at the end of the license renewal extended period of operation (54 EFPY) is 8.6×10^{17} n/cm^2 (see Reference 7[3] in the licensee's letters).

The table[4] below illustrates that NMP2 has additional conservatism in comparison to the NRC staff's limiting case analysis. The chemistry factor and mean adjusted reference temperature (ART) are calculated consistent with the guidelines of Regulatory Guide (RG) 1.99, "Radiation Embrittlement of Reactor Vessel Materials," Revision 2. The data used for the evaluation based on the BWRVIP-05 methodology are also shown in the table.

Comparison of Input Parameters for BWRVIP Methodology and NRC Staff Assessment

Parameter Description	**NMP2 Circumferential Weld**	**NRC Staff Assessment for 32 EFPY (Circumferential Welds)**
	Using BWRVIP Methodology	BWRVIP-05 SER Data (for CBIN Vessels)
	54 EFPY	32 EFPY
Fluence (n/cm$^{2)}$	8.6×10^{17}	5.1×10^{18}
Initial RT_{NDT} (°F)	-50	-65
Chemistry Factor	54	134.9
Cu%	0.04*	0.10
Ni%	0.82*	0.99
ΔRT_{NDT} (°F)	Monte Carlo Predicted	109.5
Mean ART (°F)	9.7	44.5

* Note: Cu and Ni values are maximums from different heat/lot numbers for the beltline welds and are used together to create a bounding result.

The licensee stated that the methodology used for the RPV neutron fluence calculation is in accordance with the recommendations of RG 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence," and has been approved by the NRC staff in letters to NMPNS, LLC dated October 27, 2003, and January 27, 2004. As shown in the above table, the impact of irradiation results in a mean ART of 9.7 °F for the NMP2 limiting

[3] Reference 7 is not included in this SE and can be found referenced in the licensee's letters dated November 16, 2006, and April 20, 2007.

[4] The licensee's **Table 1: Comparison of Input Parameters for NRC Staff Assessment and BWRVIP Methodology** is excerpted in this SE from the licensee's letter dated April 20, 2007.

circumferential weld, which is lower than the maximum allowable mean ART of 44.5 °F from the NRC staff's July 28, 1998, SER.

The licensee provided the results of an NMP2 plant-specific probabilistic fracture mechanics evaluation. The evaluation was performed with the VIPER code, which was developed as part of the BWRVIP-05 effort. The evaluation used data shown in the table above under the column "Using BWRVIP Methodology," and neutron fluence based on 54 EFPY of operation (i.e., at the end of the renewed license term). The evaluation demonstrated that the conditional probability of failure of the NMP2 circumferential welds at the end of the license renewal period was less than 1×10^{-7}. The licensee concluded that the NMP2 circumferential welds satisfy, at the end of the license renewal extended period of operation, the limiting conditional failure probability for circumferential welds in the NRC staff's July 28, 1998, SER.

Criterion 2 - Limiting the Frequency of Cold Overpressure Events

Demonstrate 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, SER.

Response

The NRC staff indicated that the potential for, and consequences of, non-design basis events not addressed in the BWRVIP-05 report should be considered. In particular, the NRC staff stated that non-design basis, cold overpressure transients should be considered. It is highly unlikely that a BWR would experience a cold overpressure transient. The NRC staff described several types of events that could be precursors to BWR RPV cold overpressure transients. These were identified as precursors because no cold overpressure event has occurred at a U.S. BWR. Also, the NRC staff identified one actual cold overpressure event that occurred during shutdown at a non-U.S. BWR. This event apparently included several operational errors that resulted in a maximum RPV pressure of 1150 pounds per square inch (psi) with a temperature of 88 °F. The BWRVIP responded with the conclusion that condensate and control rod drive (CRD) pumps could cause conditions that could lead to cold overpressure events. This is summarized in the NRC staff's July 28, 1998, SER.

High-pressure core spray injection (HPCSI) has been used after the reactor has been shutdown during RPV cooldown with RPV temperature well above that required for leakage testing during the last two refueling outages at NMP2 to provide As Low As Reasonable Achievable flushing of the injection piping. This procedure has multiple escalating contingencies, built in, to stop injection and includes procedures to prevent instrumentation problems from causing over-injection. Operator errors would need to occur before the vessel experiences high pressure. Thus, operator training would make this an unlikely source for overpressurization.

The reactor core isolation cooling (RCIC) system is steam turbine driven. During reactor cold shutdown conditions, no steam is available for operation of the system. Therefore, it is not plausible for the system to contribute to an overpressurization event while the unit is in cold shutdown.

During reactor cold shutdown conditions, the feedwater (FW) pumps are shutdown. It would require direct operator action to start a FW pump and inject into the vessel.

During normal cold shutdown conditions, RPV level and pressure are controlled with the CRD and reactor water cleanup (RWCU) systems using a “feed and bleed" process. The RPV is not taken solid during these times, and plant procedures require opening of the head vent valves after the reactor has been cooled to less than 212 °F. If either of these systems were to fail, the operator would adjust the other system to control level. Under these conditions, the CRD system typically injects water into the reactor at rate of approximately 63 gallons per minute (gpm). This slow injection rate allows the operator sufficient time to react to unanticipated level changes and, thus, significantly reduces the possibility of an event that would result in a violation of the pressure/temperature limits.

The standby liquid control (SLC) system is another high-pressure water source to the RPV. However, there are no automatic starts associated with the system that can occur with the reactor shutdown. SLC injection requires an operator to manually start the system from the control room or from the local test station. Additionally, the injection rate of the SLC pump is approximately 42 gpm, which would give the operator ample time to control reactor pressure in the case of an inadvertent injection.

In addition, operating procedural restrictions, operator training, and work control processes at NMP2 provide appropriate controls to minimize the potential for RPV cold overpressure events.

4.0 NRC Staff’s Evaluation

ASME Code, Section XI, Table IWB-2500-1, Examination Category B-A, Item No. B1.11 requires a volumetric examination of essentially 100 percent of the weld length of the RPV shell circumferential welds each inspection interval. The licensee requested permanent relief from the requirements of the ASME Code through the end of the license renewal extended period of operation for NMP2.

As described previously, GL 98-05 provides two criteria that BWR licensees requesting relief from the ISI requirements of 10 CFR 50.55a(g) for the volumetric examination of circumferential RPV welds (ASME Code, Section XI, Table IWB-2500-1, Examination Category B-A, Item No. B1.11, Circumferential Shell Welds) must satisfy. These criteria are intended to demonstrate that the conditions at the applicant’s plant are bounded by those in the NRC staff’s July 28, 1998, SER for the BWRVIP-05 report. In addition, as discussed in Section 2.1.3 of this SE, the October 18, 2001, SER for The BWRVIP-74 report provides two criteria that BWR licensees requesting relief through the end of the operating license (including an operating license extension of 20 years) from the 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 applicant's plant are bounded by those in the NRC staff’s July 28, 1998, SER. The licensee will still need to perform the required inspections of "essentially 100%" of all axial welds through the end of the period of operation.

4.1 Circumferential Shell Weld Conditional Failure Probability

The NRC staff provides guidance for calculating neutron fluence in an acceptable manner in RG 1.190. Therefore, the NRC staff evaluated the licensee's conformance with Criterion 1 of GL 98-05 using the guidance provided in RG 1.190.

The methodology used by the licensee to determine the RPV neutron fluence is in accordance with the recommendations of RG 1.190 and has been approved by the NRC in letters to NMPNS, LLC dated October 27, 2003, (ADAMS Accession No. ML032760696), and January 27, 2004, (ADAMS Accession No. ML040220584), respectively.

The licensee estimated that the neutron fluence at the end of the license renewal extended period of operation (54 EFPY) is 0.86 x 10^{18} n/cm^2. The NRC staff's independent plant-specific analysis for NMP2 resulted in a fluence value for 54 EFPY of 1.45x10^{18} n/cm^2. Because the licensee's value is significantly lower than the NRC staff's value and because the licensee's calculations adhere to the guidance in RG 1.190, the licensee's fluence value is acceptable.

In calculating the projected neutron fluence values for 54 EFPY, the NRC staff identified a possible discrepancy between the licensee's request for relief and the licensee's License Renewal Application (LRA) dated May 26, 2004 (Adams Accession No. ML041490223). In a teleconference on July 25, 2007, the licensee clarified that the projected neutron fluence values used in the LRA were based on conservative assumptions, whereas the values used in the request for relief were based on actual values and conditions in the RPV.

The NRC staff verified the licensee's calculated mean ART value for the limiting beltline weld metal. In this evaluation, the chemistry factor, ΔRT_{NDT}, and mean ART were calculated consistent with the guidelines of RG 1.99, Revision 2. The NRC staff finds the licensee's analysis to be acceptable because it meets the requirements specified in NRC staff's July 28, 1998, SER for the BWRVIP-05 report. By comparing the information in the NRC staff's Reactor Vessel Integrity Database with information in the licensee's request for relief, the NRC staff confirmed that the mean ART of the limiting circumferential shell weld at NMP2 is projected to be 9.7 °F at the end of the license renewal extended period of operation.

The NRC staff's SER for the BWRVIP-05 report provides a limiting conditional failure probability of 2.0 x 10^{-7} for a limiting plant-specific mean ART of 44.5 °F for CBIN-fabricated RPVs. The conditional failure probability is the probability of failure if the event were to occur. The cold overpressure event frequency is the frequency of the event occurring, determined as 10^{-3} per reactor-year in the evaluation of the BWRVIP-05 report. The vessel failure frequency is the product of conditional failure probability and cold overpressure event frequency. Since the calculated value of mean ART for the limiting circumferential shell weld at NMP2 is lower than that for the limiting plant-specific case for CBIN-fabricated RPVs, the RPV failure frequencies of the NMP2 circumferential shell welds is less than 2.0 x 10^{-10} per reactor-year. Therefore, the conditional failure probability of the NMPN2 RPV circumferential shell welds is bounded by the results obtained in the NRC assessment. A comparison of the data used in the NMP2 calculation and the NRC staff assessment is provided in the table in Section 3.4 of this SE.

4.2 Minimizing the Possibility of Cold Overpressure Events

Criterion 2 of GL 98-05 requires that the licensee implement sufficient procedures and/or operator training to ensure that the probability of a cold overpressure event is minimized. To satisfy this criterion, the licensee provided its analysis of the potential high-pressure injection sources, administrative controls, and operator training, all of which are currently in place, that help to minimize the risk of cold overpressure events.

The licensee examined a number of conditions that may be precursors to cold overpressurization. Although, no cold overpressure events have occurred in this country, the NRC staff has identified cold overpressure events in other countries. Those events resulted from operator errors and lack of, or faulty, procedures. The conditions examined by the licensee are all the circumstances that could be reasonably construed as overpressurization precursors.

- HPCSI System HPCSI is used to flush injection piping after the reactor has been shutdown during RPV cooldown. The procedure for this evolution has multiple contingencies to prevent overpressurization and multiple operator errors would have to occur before overpressurization could occur. Operator training would make the event extremely unlikely.

- RCIC System The RCIC system is steam turbine driven. Under shutdown conditions, no steam is available to operate RCIC; therefore, overpressurization due to RCIC initiation is not plausible.

- FW System During shutdown, the FW pumps are not in operation. To activate the FW pumps, direct operator action is required. However, operator training on operating procedures makes the possibility of cold overpressure due to FW pump initiation highly unlikely.

- CRD and RWCU Systems During normal shutdown conditions reactor vessel level and pressure are controlled using the CRD system and the RWCU system. The reactor is not taken solid during such operations, and operating procedures require that the venting valves be open when the coolant temperature is less than 212 ° F. Under these conditions, the CRD system injects at a rate of about 63 gpm. At this low rate, the operator has sufficient time to respond to any level and pressure changes. Therefore, cold overpressure due to inadvertent CRD system operation is highly unlikely.

- SLC System The SLC system is another high pressure injection source to the RPV. However, the SLC system is normally shutdown, and there are no automatic starts. SLC system initiation requires control room or local manual action. In addition, the maximum injection rate is only 42 gpm thus affording the operator adequate time to identify and stop any change in vessel water level caused by inadvertent initiation of the SLC system. Therefore, cold overpressure due to SLC system initiation is highly unlikely.

- RPV Pressure Testing RPV pressure testing is an infrequent evolution, and it is performed under strict management supervision so as not to violate facility pressure/temperature limits. Procedural controls require that the pressure increase be limited to 50 psi per minute and coolant pumps be shut down under solid water conditions. These practices, along with operator training, minimize the possibility of vessel cold overpressure due to RPV pressure testing.

The licensee's evaluation of potential injection sources that would cause a cold overpressure event is largely consistent with the industry response to the NRC staff's evaluation of the BWRVIP-05 report. Most high pressure injection sources that could cause cold overpressure events are prevented by interlocks, plant conditions, and/or administrative controls. In its final SER for the BWRVIP-05 report, the NRC staff noted that the CRD system could cause conditions that could lead to cold overpressure events. However, as noted above, the injection rate of the CRD system is low, and it will allow the operator sufficient time to react to unanticipated level changes, which reduce the possibility of an event that would result in a violation of the pressure/temperature limits.

4.3 Operator Training and Operating Procedures

The licensee summarized the steps taken to establish procedural controls and personnel training to minimize the probability of a cold overpressure event at NMP2. The following is a summary of the procedures and training.

- During normal cold shutdown conditions, vessel water level, pressure, and temperature are maintained within predetermined bands in accordance with operating procedures. One such procedure requires that operators frequently monitor the parameters to detect abnormalities as early as possible and the shift manager be notified should such an abnormality appear. In addition, changes that may affect water level, temperature, or pressure can only be performed under the supervision of the shift manager. Finally, activities that may affect critical parameters are discussed at shift turnovers.

- Operators are trained in methods of controlling water level, pressure, and temperature if they are found outside specified limits. Also operators are trained in brittle fracture and in maintaining the plant within the pressure temperature technical specification limits.

- During plant outages, the work control processes ensure that the outage schedule and its changes are reviewed to ensure that defense-in-depth is maintained. The outage schedule is under senior reactor operator supervision to avoid conditions that could adversely effect water level, temperature, and pressure.

- During plant outages, work is coordinated through the work control center that provides an additional level of operational oversight. Pre-job briefings are conducted for complex work activities such as vessel pressurization that have the potential of affecting vessel parameters. Such briefings are attended by all those involved in the evolutions. In addition, expected plant responses and contingency plans are addressed in the briefing discussions.

- Operator training covers, among other things, basic theory and application of brittle fracture, vessel thermal stresses, operational transient procedures, including high water level, and technical specification limitations (pressure/temperature limit curves) for heatup and cooldown. These scenarios are reinforced in simulator exercises to ensure that the required operational skills are developed. Such training also reenforces management's expectations for procedural compliance by the operators.

5.0 CONCLUSION

The NRC staff has reviewed the licensee's letter dated November 16, 2006, as supplemented by letter dated April 20, 2007, and has concluded that the licensee has demonstrated conformance with the applicable criteria in NRC GL 98-05 and in the NRC staff's evaluation of the BWRVIP-05 and BWRVIP-74 reports. The NRC staff has also concluded that the licensee has acceptably demonstrated that the conditional probability of failure values for the NMP2 circumferential 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 through the end of the facility's license renewal extended period of operation. Therefore, the licensee's proposed alternative is authorized pursuant to 10 CFR 50.55a(a)(3)(i) through the remainder of the facility's license renewal extended period of operation.

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. Furthermore, based on the considerations discussed above, the NRC staff concludes that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation of NMP2 in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of this alternative will not be inimical to the common defense and security or the health and safety of the public.

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