March 6, 2003

Mr. P. E. Katz, Vice President
Calvert Cliffs Nuclear Power Plant, Inc.
Calvert Cliffs Nuclear Power Plant
1650 Calvert Cliffs Parkway
Lusby, MD 20657-4702

SUBJECT: CALVERT CLIFFS NUCLEAR POWER PLANT, UNIT NOS. 1 AND 2 - ALTERNATIVE TO INSERVICE INSPECTION REQUIREMENT FOR REPLACEMENT STEAM GENERATOR GIRTH WELDS (TAC NOS. MB6560 AND MB6561)

Dear Mr. Katz:

By letter dated October 22, 2002, Calvert Cliffs Nuclear Power Plant, Inc. (CCNPP) submitted a request for relief pursuant to 10 CFR 50.55a(a)(3)(i). Specifically, CCNPP proposed an alternative to the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI requirement concerning the CCNPP Steam Generator Replacement Project. The proposed alternative involved the steam generator inservice inspection program plan for the third 10-year interval.

The Nuclear Regulatory Commission staff completed its review of the submittal and concludes that CCNPP has provided an acceptable alternative to the requirements of ASME Code, Section XI, Table IWC-2500-1. Requiring ISI examination of the new girth weld for the steam generators will provide little value in monitoring and maintaining the structural integrity of the steam generators because the susceptibility of the new closure girth weld to fatigue cracking is very low. Details of the review are delineated in the enclosed safety evaluation. Therefore, the proposed alternative is authorized pursuant to 10 CFR 50.55a(a)(3)(i) for the third 10-year interval of the Steam Generator Inservice Inspection Program.

If you have any questions, please do not hesitate to call Mr. Peter S. Tam at 301-415-1451.

Sincerely,

/RA/

Richard J. Laufer, Chief, Section 1
Project Directorate 1
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-317 and 50-318

Enclosure: Safety Evaluation

cc w/encl: See next page

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OFFICE	PDI-1/PM	PDI-1/LA	EMEB/SC	OGC**	PCI-1/SC
NAME	PTam	SLittle	TChan*	RHoefling	RLaufer
DATE	3/6/03	3/6/03	2/3/03	3/5/03	3/6/03

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*SE transmitted by memo of 2/3/03. **See previous concurrence.

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

AN ALTERNATIVE TO THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

BOILER AND PRESSURE VESSEL CODE

FOR STEAM GENERATOR REPLACEMENT GIRTH WELDS

CALVERT CLIFFS NUCLEAR POWER PLANT, UNIT NOS. 1 AND 2

DOCKET NOS. 50-317 AND 50-318

1.0 INTRODUCTION

By letter dated October 22, 2002, Calvert Cliffs Nuclear Power Plant, Inc. (CCNPP, the licensee) submitted a request for relief pursuant to 10 CFR 50.55a(a)(3)(i). Specifically, the licensee proposed an alternative to the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI requirement concerning the CCNPP Steam Generator Replacement Project. The proposed alternative involved the steam generator inservice inspection (ISI) program plan for the third 10-year interval.

2.0 REGULATORY EVALUATION

The provisions of 10 CFR 50.55a(g) specifies that ISI of nuclear power plant components shall be performed in accordance with the requirements of the ASME Code, Section XI, except where specific written relief has been granted by the Commission 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 Nuclear Regulatory Commission (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.

The CCNPP Steam Generator Replacement Project and the Third 10-Year ISI Program Plan for Calvert Cliffs Units 1 and 2 meet the requirements of ASME Code, Section XI, 1998 Edition (except for Subsections IWE and IWL), as approved by the NRC letter from M. Gamberoni to C. H. Cruse, dated April 5, 2000. ASME Code, Section XI, Table IWC-2500-1, Examination Category C-A requires ISI of welds when the welds are located at a gross structural discontinuity as defined by ASME Code, Section III, NB-3213.2. Examples are junctions between shells of different thicknesses, cylindrical shell-to-conical shell junctions, shell (or head)-to-flange welds, and head-to-shell welds. As an alternative to the generic criteria of gross structural discontinuity for categorizing ISI welds, CCNPP proposes to utilize the associated stress and fatigue analysis for the entire replacement steam generator to show that susceptibility of the closure girth weld to fatigue cracking is significantly less than the steam generator welds currently in the ISI program. Therefore, adding the closure girth weld to the ISI

program for the steam generators provides no added value in monitoring and maintaining the structural integrity of the vessel.

3.0 TECHNICAL EVALUATION

3.1 System/Component(s) for Which Relief is Requested

Replacement Steam Generator Closure Girth Weld, ASME Class 2.

3.2 Code Requirement

The 1998 Edition (no Addenda) of ASME, Section XI, Table IWC-2500-1, Examination Category C-A, requires in part that shell circumferential welds in pressure vessels be categorized as ISI welds when the welds are located at a gross structural discontinuity as defined by ASME Section III, NB-3213.2. Examples are junctions between shells of different thicknesses, cylindrical shell-to-conical shell junctions, shell (or head)-to-flange welds, and head-to-shell welds.

3.3 Supporting Information

CCNPP's ISI program for the secondary side of the steam generators currently includes the following circumferential welds (Attachment 1 of CCNPP's application):

- Head Circumferential Weld
- Upper Steam Drum-To-Transition Cone Weld
- Tubesheet-to-Shell Weld

The head circumferential weld and the upper steam drum-to-transition cone weld are welds on the original steam drum section, which will be re-installed. These two circumferential welds have been subjected to 2 10-year ISI inspection intervals. The tubesheet-to-shell weld is part of the replacement lower assembly, and, therefore a new weld in the ISI program.

The licensee's stress and fatigue analysis performed for the replacement steam generators evaluated the entire vessel for a design life of 40 years taking into account the operating history of the steam drum section prior to replacement. A summary of the stress analysis is tabulated below:

Junction	Range of Stress Intensity (ksi) (P_L + P_b + Q)	Allowable Stress Intensity (ksi)		Fatigue Usage Factor	Fatigue Usage Factor Limit
		$3S_m$	$1.5S_m$		
Head Circumferential Weld	20.3	80.1	40.1	0.04	1.0
Tubesheet-to-Shell Weld	71.6	90.0	45.0	0.03	1.0
Upper Steam Drum-to-Transition Cone Weld	36.0	80.1	40.1	0.02	1.0
Replacement Steam Generator Closure Girth Weld	26.0	80.1	40.1	0.002	1.0

The data tabulated above shows that the susceptibility of the closure girth weld to fatigue cracking is very low in comparison to the other three circumferential welds listed that are currently in the ISI program. Of particular note is the comparison between the upper steam drum-to-transition cone weld and the closure girth weld. Per ASME Section XI, Table IWC-2500-1, the upper steam drum-to-transition cone weld is also an ISI weld solely due to the weld being classified as a gross structural discontinuity since this weld is a cylindrical shell-to-conical shell junction. The upper steam drum-to-transition cone weld has both a higher stress intensity range and fatigue usage factor than the closure girth weld. The upper steam drum-to-transition cone weld is part of the original steam drum and has undergone 2 10-year ISI inspections with no flaws detected. This weld will remain an ISI weld. Based on the stress analysis performed for the replacement steam generator, the probability of the upper steam drum-to-transition cone weld developing a fatigue crack is significantly higher than the closure girth weld. Therefore, subjecting the closure girth to future volumetric inspections will not provide any added value in monitoring the structural integrity of the steam generators.

3.4 Licensee's Proposed Alternative

The CCNPP Steam Generator Replacement Project involves replacing the steam generator lower assembly section containing the steam generator tubes and completely refurbishing the original steam drum in accordance with ASME Section III, 1989 Edition (no Addenda) and ASME Section XI, 1998 Edition (no Addenda). Both sections will then be joined by the closure girth weld. The secondary side of the steam generator (both the original Combustion Engineering parts, and replacement parts from Babcock & Wilcox Canada) is classified as ASME Class 2 for the purposes of ISI but was constructed in accordance with ASME Class 1 requirements. As such, a stress and fatigue analysis of the secondary side has been performed which determined the predicted maximum stress intensity ranges and cumulative usage factors at specific junctions throughout the vessel shell. The junctions evaluated included the closure girth weld and other shell circumferential welds currently categorized as ISI welds. In lieu of categorizing the closure girth weld as an ISI weld solely due to the weld being classified by definition as a gross structural discontinuity (since the weld will become a junction between shells of different thicknesses), CCNPP proposes to utilize the stress analysis to show that susceptibility of this weld to fatigue cracking is significantly less than the steam generator welds currently in the ISI program. Therefore, adding the closure girth weld to the ISI program for the replacement steam generators provides no added value in monitoring and maintaining the structural integrity of the vessel.

3.5 NRC Staff Evaluation

The licensee's proposed alternative involves the steam generator ISI Program for the third 10-year interval. As previously stated, the CCNPP Steam Generator Replacement Project and the third 10-year ISI Program Plan meet the requirements of ASME Code, Section XI, 1998 Edition (except for Subsections IWE and IWL). ASME Code Section XI, Table IWC-2500-1, Examination Category C-A requires ISI of welds when the welds are located at a gross structural discontinuity as defined by ASME Code, Section III, NB-3213.2. Examples are junctions between shells of different thicknesses, cylindrical shell-to-conical shell junctions, shell (or head)-to-flange welds, and head-to-shell welds. As an alternative to the generic criteria of gross structural discontinuity for categorizing ISI welds, the licensee proposed to utilize the associated stress and fatigue analysis for the entire replacement steam generator to

show that susceptibility of the closure girth weld to fatigue cracking is significantly less than the steam generator welds currently in the ISI program. As shown in the summary of stress analysis (table above), the fatigue usage factor is listed as 0.002. This value is very low in comparison with the values of other steam generator circumferential welds. Therefore, requiring ISI examination of the girth weld for the steam generators will provide little value in monitoring the structural integrity of the steam generators because the susceptibility of the closure girth weld to fatigue cracking is very low. Furthermore, the secondary side of the steam generator (both the original Combustion Engineering parts, and replacement parts from Babcock & Wilcox Canada) is classified as ASME Class 2 for the purposes of ISI, but was constructed in accordance with ASME Class 1 requirements. The construction Code for Class 1 components requires that the girth weld be examined using radiographic and surface examination methods. Those examinations will reveal any structural defects if present in the completed girth weld. In addition, the upper steam drum-to-transition cone weld, which has significantly higher fatigue usage, has undergone 2 10-year ISI inspections with no flaws detected. Based on the higher fatigue usage experienced by the immediate adjacent welds as well as the configuration of the new closure girth weld, the NRC staff finds that service-induced degradation would most likely exhibit itself first at these adjacent welds rather than the new closure weld. Therefore, the NRC staff concludes that the new steam generator closure welds need not be categorized as a weld requiring ISI.

4.0 CONCLUSION

The NRC staff concludes that the licensee has provided an acceptable alternative to the requirements of ASME Code, Section XI, Table IWC-2500-1. Requiring ISI examination of the new girth weld for the steam generators will provide little value in monitoring and maintaining the structural integrity of the steam generators because the susceptibility of the new closure girth weld to fatigue cracking is very low. Therefore, the proposed alternative is authorized pursuant to 10 CFR 50.55a(a)(3)(i) for the third 10-year interval of the Steam Generator Inservice Inspection Program.

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Date: March 6, 2003

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