March 19, 2004

Mr. George Vanderheyden, 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 - REQUEST FOR RELIEF RELATED TO THE THIRD 10-YEAR INSERVICE INSPECTION INTERVALS (ISI) (TAC NOS. MC0779 AND MC0780)

Dear Mr. Vanderheyden:

By letter dated September 9, 2003, Calvert Cliffs Nuclear Power Plant, Inc. submitted a relief request for the Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2 (CCNPP1&2). The submittal requested relief from selected requirements of the American Society of Mechanical Engineers Boiler Pressure and Vessel Code (ASME Code), Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," 1998 Edition with no Addenda, Appendix VIII, Supplement 10, "Qualification Requirements for Dissimilar Metal Piping Welds," for both the units third 10-year inservice inspection (ISI) intervals. The licensee proposed an alternative program to Supplement 10 requirements.

The Nuclear Regulatory Commission staff has reviewed the September 9, 2003, submittal as discussed in the enclosed safety evaluation. Based on its review, the staff has determined that the proposed alternative program will provide an acceptable level of quality and safety. Accordingly, the alternatives are authorized for use at CCNPP1&2, pursuant to 10 CFR 50.55a(a)(3)(i), for the remainder of the third 10-year ISI interval. All other ASME Code, Section XI requirements for which relief was not specifically requested and approved in this relief request remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

Sincerely,

/RA/

Richard J. Laufer, Chief, Section 1
Project Directorate I
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

March 19, 2004

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Docket Nos. 50-317 and 50-318

Enclosure: Safety Evaluation

cc w/encl: see next page

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ACCESSION NUMBER: **ML040490729** *Safety Evaluation provided - no changes made

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST FOR RELIEF

THIRD 10-YEAR INSERVICE INSPECTION INTERVAL

CALVERT CLIFFS NUCLEAR POWER PLANT, UNIT NOS. 1 AND 2 (CCNPP1&2)

CALVERT CLIFFS NUCLEAR POWER PLANT, INC.

DOCKET NOS. 50-317 AND 50-318

1.0 INTRODUCTION

The inservice inspection of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) Class 1, Class 2, and Class 3 components is to be performed in accordance with Section XI of the ASME Code and applicable edition and addenda as required by 10 CFR 50.55a(g), 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 in part that 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 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, "Rules for Inservice Inspection (ISI) 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 10-year 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 third 10-year ISI intervals for CCNPP1&2 both began on July 1, 1999, and end on July 1, 2009. The ISI Code of record for the third 10-year interval is the 1998 Edition with no Addenda. The components (including supports) may meet the requirements set forth in subsequent editions and addenda of the ASME Code incorporated by reference in 10 CFR 50.55a(b) subject to the limitations and modifications listed therein and subject to Commission approval.

Enclosure

By letter dated September 9, 2003, Calvert Cliffs Nuclear Power Plant, Inc., (CCNPPI or the licensee) submitted a relief request for the CCNPP1&2. The submittal requested relief from selected requirements of the ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," 1998 Edition with no Addenda, Appendix VIII, Supplement 10, "Qualification Requirements for Dissimilar Metal Piping Welds."

2.0 DISCUSSION

2.1 Components For Which Relief Is Requested

Dissimilar metal piping welds are subject to examination using procedures, personnel, and equipment qualified to the 1998 Edition with no Addenda of the ASME Code, Section XI, Appendix VIII, Supplement 10, "Qualification Requirements for Dissimilar Metal Piping Welds."

The licensee proposed alternatives to the following Supplement 10 requirements:

1. Paragraph 1.1(b) states, in part: "Pipe diameters within a range of 0.9 to 1.5 times a nominal diameter shall be considered equivalent."

2. Paragraph 1.1(d) states: "All flaws in the specimen set shall be cracks."

3. Paragraph 1.1(d)(1) states: "At least 50% of the cracks shall be in austenitic material. At least 50% of the cracks in austenitic material shall be contained wholly in weld or buttering material. At least 10% of the cracks shall be in ferritic material. The remainder of the cracks may be in either austenitic or ferritic material."

4. Paragraph 1.2(b) states, in part: "The number of unflawed grading units shall be at least twice the number of flawed grading units."

5. Paragraph 1.2(c)(1) and 1.3(c) state, in part: "At least 1/3 of the flaws, rounded to the next higher whole number, shall have depths between 10% and 30% of the nominal pipe wall thickness. Paragraph 1.4(b) distribution table requires 20% of the flaws to have depths between 10% and 30%."

6. Paragraph 2.0, first sentence states: "The specimen inside surface and identification shall be concealed from the candidate."

7. Paragraph 2.2(b) states, in part: "The regions containing a flaw to be sized shall be identified to the candidate."

8. Paragraph 2.2(c) states, in part: "For a separate length sizing test, the regions of each specimen containing a flaw to be sized shall be identified to the candidate."

9. Paragraph 2.3(a) states: "For the depth sizing test, 80% of the flaws shall be sized at a specific location on the surface of the specimen identified to the candidate."

10. Paragraph 2.3(b) states: "For the remaining flaws, the regions of each specimen containing a flaw to be sized shall be identified to the candidate. The candidate shall determine the maximum depth of the flaw in each region."

11. Table VIII-S2-1 provides the false call criteria when the number of unflawed grading units is at least twice the number of flawed grading units.

2.2 LICENSEE'S PROPOSED ALTERNATIVE AND BASIS

Pursuant to 10 CFR 50.55a(a)(3)(i), the licensee proposed the following for both the units third ISI intervals. The proposed alternative demonstration would be implemented through the Electric Power Research Institute (EPRI), Performance Initiative Program (PDI).

Paragraph 1.1(b) proposed alternative:

> The specimen set shall include the minimum and maximum pipe diameters and thicknesses for which the examination procedure is applicable. Pipe diameters within a range of ½ inch (13 mm) of the nominal diameter shall be considered equivalent. Pipe diameters larger than 24 inches (610 mm) shall be considered to be flat. When a range of thicknesses is to be examined, a thickness tolerance of ± 25% is acceptable.
>
> Technical Basis - The change in the minimum pipe diameter tolerance from 0.9 times the diameter to the nominal diameter minus 0.5 inch provides tolerances more in line with industry practice. Though the alternative is less stringent for small pipe diameters, they typically have a thinner wall thickness than larger diameter piping. A thinner wall thickness results in shorter sound path distances that reduce the detrimental effects of the curvature. This change maintains consistency between Supplement 10 and the recent revision to Supplement 2.

Paragraph 1.1 (d) proposed alternative:

> At least 60% of the flaws shall be cracks, the remainder shall be alternative flaws. Specimens with intergranular stress corrosion cracking (IGSCC) shall be used when available. Alternative flaws, if used, shall provide crack-like reflective characteristics and shall be limited to the case where implantation of cracks produces spurious reflectors that are uncharacteristic of service induced flaws. Alternative flaw mechanisms shall have a tip width of less than or equal to 0.002 inch (0.05 mm).
>
> Note: To avoid confusion the proposed alternative modifies instances of the term "cracks" or "cracking" to the term "flaws" because of the use of alternative flaw mechanisms.
>
> Technical Basis - [...] [I]mplanting a crack requires excavation of the base material on at least one side of the flaw. While this may be satisfactory for ferritic materials, it does not produce a useable axial flaw in austenitic materials because the sound beam, which normally passes only through base material, must now travel through weld material on at least one side, producing an unrealistic flaw response. In addition, it is important to preserve the dendritic structure present in field welds that would otherwise be destroyed by the implantation process. To resolve these issues, the proposed alternative allows the use of up to 40% fabricated flaws as an alternative flaw mechanism under controlled conditions. The fabricated flaws are isostatically compressed which produces ultrasonic reflective characteristics similar to tight cracks.

Paragraph 1.1(d)(1) alternative:

At least 80% of the flaws shall be contained wholly in weld or buttering material. Recent experience has indicated that flaws contained within the weld are the likely scenarios. At least one and a maximum of 10% of the flaws shall be in ferritic base material. At least one and a maximum of 10% of the flaws shall be in austenitic base material.

Technical Basis - Under the current Code, as few as 25% of the flaws are contained in austenitic weld or buttering material. Recent experience has indicated that flaws contained within the weld are the likely scenarios. The metallurgical structure of austenitic weldmaterial is ultrasonically more challenging than either ferritic or austenitic base material. The proposed alternative is therefore more challenging than the current Code.

Paragraph 1.2(b) alternative:

Detection sets shall be selected from Table VIII-S10-1. The number of unflawed grading units shall be at least one and a half times the number of flawed grading units.

Technical Basis - [New] Table VIII-S10-1 provides a statistically based ratio between the number of unflawed grading units and the number of flawed grading units. The proposed alternative reduces the ratio to 1.5 times to reduce the number of test samples to a more reasonable number from the human factors perspective. However, the statistical basis used for screening personnel and procedures is still maintained at the same level with competent personnel being successful and less skilled personnel being unsuccessful. The acceptance criteria for the statistical basis are in Table VIII-S10-1.

Paragraph 1.2(c)(1) and 1.3(c) alternative:

The proposed alternative to the flaw distribution requirements of Paragraphs 1.2(c)(1) (detection) and 1.3(c) (length) is to use the Paragraph 1.4(b) (depth) distribution table (see below) for all qualifications.

Flaw Depth (% Wall Thickness)	**Minimum Number of Flaws**
10-30%	20%
31-60%	20%
61-100%	20%

In addition, the proposed alternative includes the following: "At least 75% of the flaws shall be in the range of 10 to 60% of wall thickness."

Technical Basis - The proposed alternative uses the depth sizing distribution for both detection and depth sizing for it provides for a better distribution of flaw sizes within the test set. This distribution allows candidates to perform detection, length, and depth sizing demonstrations simultaneously utilizing the same test set. The requirement that

at least 75% of the flaws shall be in the range of 10 to 60% of wall thickness provides an overall distribution tolerance yet the distribution uncertainty decreases the possibilities for testmanship [sic] that would be inherent to a uniform distribution. It must be noted that it is possible to achieve the same distribution utilizing the present requirements, but it is preferable to make the criteria consistent.

Paragraph 2.0, first sentence alternative:

For qualifications from the outside surface, the specimen inside surface and identification shall be concealed from the candidate. When qualifications are performed from the inside surface, the flaw location and specimen identification shall be obscured to maintain a ‘blind test’.

Technical Basis - The current Code requires that the inside surface be concealed from the candidate. This makes qualifications conducted from the inside of the pipe [e.g., pressurized water reactor (PWR) nozzle to safe end welds] impractical. The proposed alternative differentiates between inside diameter (ID) and outside diameter (OD) scanning surfaces, requires that they be conducted separately, and requires that flaws be concealed from the candidate. This is consistent with the recent revision to Supplement 2.

Paragraphs 2.2(b) and 2.2(c) proposed alternative:

... containing a flaw to be sized may be identified to the candidate.

Technical Basis - The current Code requires that the regions of each specimen containing a flaw to be length-sized shall be identified to the candidate. The candidate shall determine the length of the flaw in each region (Note, that length and depth sizing use the term "regions" while detection uses the term "grading units" - the two terms define different concepts and are not intended to be equal or interchangeable). To ensure security of the samples, the proposed alternative modifies the first "shall" to a "may" to allow the test administrator the option of not identifying specifically where a flaw is located. This is consistent with the recent revision to Supplement 2.

Paragraphs 2.3(a) and 2.3(b) alternative:

... regions of each specimen containing a flaw to be sized may be identified to the candidate.

Technical Basis - The current Code requires that a large number of flaws be sized at a specific location. The proposed alternative changes the "shall" to a "may" which modifies this from a specific area to a more generalized region to ensure security of samples. This is consistent with the recent revision to Supplement 2. It also incorporates terminology from length sizing for additional clarity.

Paragraph 3.1 alternative:

The proposed alternative modifies the acceptance criteria at Table VIII-S2-1 and replaces Table VIII-S10-1.

TABLE VIII-S10-1
PERFORMANCE DEMONSTRATION DETECTION TEST
ACCEPTANCE CRITERIA

Detection Test Acceptance Criteria		False Call Test Acceptance Criteria	
No. of Unflawed Grading Units	Minimum Detection Criteria	No. of Unflawed Grading Units	Maximum Number of False Calls
~~5~~	~~5~~	~~10~~	~~0~~
~~6~~	~~6~~	~~12~~	~~1~~
~~7~~	~~6~~	~~14~~	~~1~~
~~8~~	~~7~~	~~16~~	~~2~~
~~9~~	~~7~~	~~18~~	~~2~~
10	8	~~20~~ 15	~~3~~ 2
11	9	~~22~~ 17	~~3~~ 3
12	9	~~24~~ 18	~~3~~ 3
13	10	~~26~~ 20	~~4~~ 3
14	10	~~28~~ 21	~~5~~ 3
15	11	~~30~~ 23	~~5~~ 3
16	12	~~32~~ 24	~~6~~ 4
17	12	~~34~~ 26	~~6~~ 4
18	13	~~36~~ 27	~~7~~ 4
19	13	~~38~~ 29	~~7~~ 4
20	14	~~40~~ 30	~~8~~ 5

Technical Basis - The proposed alternative is identified as a new Table VIII-S10-1. It was modified to reflect the reduced number of unflawed grading units and allowable false calls. As a part of ongoing Code activities, Pacific Northwest National Laboratory has reviewed the statistical significance of these revisions and offered the revised Table VIII-S10-1.

2.3 Evaluation

Since 2001, EPRI PDI has been developing a program to implement Supplement 10 to Appendix VIII of Section XI of the ASME Code. During the development process, certain aspects of Supplement 10 were identified as difficult or impossible to implement. To overcome the implementation difficulties, PDI researched, tested, and demonstrated the effectiveness of an alternative to selected paragraphs of the Code. PDI representatives presented the alternative before the appropriate ASME committees which formalize the alternative in Code Case N-695 which was approved on May 21, 2003. The NRC staff representatives on these committees participated in the consensus process and joined with the industry in approving Code Case N-695. The differences between the Code and the PDI program are discussed below.

Paragraph 1.1(b)

The Code requirement of "0.9 to 1.5 times the nominal diameter are equivalent" was established for a single nominal diameter. When applying the Code-required tolerance to a range of diameters, the tolerance rapidly expands on the high side. Under the current Code requirements, a 5-inch OD pipe would be equivalent to a range of 4.5-inch to 7.5-inch diameter pipe. Under the proposed PDI guidelines, the equivalent range would be reduced to 4.5-inch to 5.5-inch diameter pipe. With current Code requirements, a 16-inch nominal diameter pipe would be equivalent to a range of 14.4-inch to 24-inch diameter pipe. The proposed alternative would significantly reduce the equivalent range to between 15.5-inch and 16.5-inch diameter pipe. The difference between Code and the proposed PDI program for diameters less than 5 inches is not significant because of shorter metal path and beam spread associated with smaller diameter piping. The staff considers the proposed alternative to be more conservative overall than current Code requirements. The staff finds that the proposed alternative will provide an acceptable level of quality and safety and, therefore, is acceptable.

Paragraph 1.1 (d)

The Code requires all flaws to be cracks. Manufacturing test specimens containing cracks free of spurious reflections and telltale indicators is extremely difficult in austenitic material. To overcome these difficulties, PDI developed a process for fabricating flaws that produce ultrasonic testing (UT) acoustic responses similar to the responses associated with real cracks. PDI presented its process for discussion at public meetings held June 12 through 14, 2001, and January 31 through February 2, 2002, at the EPRI NDE Center, Charlotte, NC. The staff attended these meetings and determined that the process parameters used for manufacturing fabricated flaws resulted in acceptable acoustic responses. PDI is selectively installing these fabricated flaws in specimen locations that are unsuitable for real cracks. The NRC staff finds that the proposed alternative will provide an acceptable level of quality and safety and, therefore, is acceptable.

Paragraph 1.1(d)(1)

The Code requires that at least 50% of the flaws be contained in austenitic material and 50% of the flaws in the austenitic material shall be contained fully in weld or buttering material. This means that at least 25% of the total flaws must be located in the weld or buttering material. Field experience shows that flaws identified during ISI of dissimilar metal welds are more likely to be located in the weld or buttering material. The grain structure of austenitic weld and buttering material represents a much more stringent ultrasonic scenario than that of a ferritic or austenitic base material. Flaws made in austenitic base material are difficult to create free of spurious reflectors and telltale indicators. The proposed alternative of 80% of the flaws in the weld metal or buttering material provides a challenging testing scenario reflective of field experience and minimizes testmanship associated with telltale reflectors common to placing flaws in austenitic base material. The staff considers the proposed alternative to be more conservative overall than current Code requirements. The staff finds that the proposed alternative will provide an acceptable level of quality and safety and, therefore, is acceptable.

Paragraph 1.2(b), Paragraph 3.1 (Table VIII-S10-1)

The Code requires that detection sets meet the requirements of Table VIII-S2-1 which specifies the minimum number of flaws in a test set to be 5 with 100% detection. The current Code also

requires the number of unflawed grading units to be two times the number of flawed grading units. The proposed alternative, as shown in the licensee's submittal as Table VIII-S10-1, would follow the detection criteria of the table beginning with a minimum number of flaws in a test set starting at 10, and reducing the number of unflawed grading units to one and a half times the number of flawed grading units, while maintaining the same statistical design basis as the Code. The proposed alternative paragraphs satisfy the pass/fail objective established for the Appendix VIII performance demonstration acceptance criteria. The staff finds that the proposed alternative will provide an acceptable level of quality and safety and, therefore, is acceptable.

Paragraph 1.2(c)(1), Paragraph 1.3(c)

For detection and length sizing, the Code requires at least one third of the flaws be located between 10 and 30% through the wall thickness and one third located greater than 30% through the wall thickness. The remaining flaws would be located randomly throughout the wall thickness. The proposed alternative sets the distribution criteria for detection and length sizing to be the same as the depth sizing distribution, which stipulates that at least 20% of the flaws be located in each of the increments of 10-30%, 31-60% and 61-100%. At least 75% of the flaws shall be in the range of 10 to 60% of the wall thickness with the remaining flaws located randomly throughout the pipe thickness. With the exception of the 10-30% increment, the proposed alternative is a subset of the current Code requirements. The 10-30% increment would be in the subset if it contained at least 30% of the flaws. The change simplifies assembling test sets for detection and sizing qualifications and is more indicative of conditions in the field. The staff finds that the proposed alternative will provide an acceptable level of quality and safety and, therefore, is acceptable.

Paragraph 2.0

The Code requires the specimen inside surface be concealed from the candidate. This requirement is applicable for test specimens used for qualification performed from the outside surface. With the expansion of Supplement 10 to include qualifications performed from the inside surface, the inside surface must be accessible while maintaining the specimen integrity. The proposed alternative requires that flaws and specimen identifications be obscured from candidates, thus maintaining blind test conditions. The staff considers this to be consistent with the intent of ASME Code requirements. The staff finds that the proposed alternative will provide an acceptable level of quality and safety and, therefore, is acceptable.

Paragraph 2.2(b) and 2.2(c)

The Code requires that the location of flaws added to the test set for length sizing shall be identified to the candidate. The proposed alternative is to make identifying the location of additional flaws an option. This option provides an additional element of difficulty to the testing process because the candidate would be expected to demonstrate the skill of detecting and sizing flaws over an area larger than a specific location. The staff considers the proposed alternative to be more conservative than current Code requirements. The staff finds that the proposed alternative will provide an acceptable level of quality and safety and, therefore, is acceptable.

Paragraph 2.3(a) and 2.3(b)

In Paragraph 2.3(a), the Code requires that 80% of the flaws be sized in a specific location that is identified to the candidate. The proposed alternative allows identification of the specific location to be an option. This permits detection and depth sizing to be conducted separately or concurrently. In order to maintain a blind test, the location of flaws cannot be shared with the candidate. For depth sizing that is conducted separately, allowing the test administrator the option of not identifying flaw locations makes the testing process more challenging. The staff considers the proposed alternative to be more conservative than current Code requirements. The staff finds that the proposed alternative will provide an acceptable level of quality and safety and, therefore, is acceptable.

In Paragraph 2.3(b), the Code also requires that the location of flaws added to the test set for depth sizing shall be identified to the candidate. The proposed alternative is to make identifying the location of additional flaws an option. This option provides an additional element of difficulty to the testing process because the candidate would be expected to demonstrate the skill of finding and sizing flaws in an area larger than a specific location. The staff considers the proposed alternative to be more conservative than current Code requirements. The staff finds that the proposed alternative will provide an acceptable level of quality and safety and, therefore, is acceptable.

3.0 CONCLUSION

The NRC staff has reviewed the licensee's submittal and determined that, in accordance with 10 CFR 50.55a(a)(3)(i), the proposed alternative program will provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the staff authorizes the proposed alternative described in the licensee's letter dated September 9, 2003, for CCNPP1&2 for their third 10-year ISI intervals. All other ASME Code, Section XI requirements for which relief was not specifically requested and approved in this relief request remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: J. Collins

Date: March 19, 2004