July 20, 2005

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 NO. 2 - RELIEF REQUEST FOR USE WELD OVERLAY AND ASSOCIATED ALTERNATIVE INSPECTION TECHNIQUES (TAC NOS. MC6219 AND MC6220)

Dear Mr. Vanderheyden:

By letter dated March 5, 2005, as supplemented on March 8, 2005, Calvert Cliffs Nuclear Power Plant, Inc. (the licensee) submitted a relief request to use alternative repair and examination techniques for unacceptable indications in welded nozzles at Calvert Cliffs Nuclear Power Plant, Unit No. 2 (Calvert Cliffs Unit 2). Specifically, the licensee requested relief from the requirements of American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, for ASME Class 1 dissimilar metal welds, 2-DR-2007-1 and 2-LD-2004-1 (piping nozzle to safe-end welds for the drain on the No. 21 reactor coolant system (RCS) hot leg and for the letdown line on the No. 22A RCS cold leg). The licensee proposed to use a weld overlay to repair these welds and the Performance Demonstration Initiative (PDI) program for the inspection as alternatives to the ASME Code requirements pursuant to Section 50.55a(a)(3)(i) of Part 50 of Title 10 of the *Code of Federal Regulations* (10 CFR).

On March 10, 2005, the Nuclear Regulatory Commission (NRC) staff completed its review of the relief request, determined that the proposed alternatives would provide an acceptable level of quality and safety, and granted verbal authorization for the subject alternatives pursuant to 10 CFR 50.55a(a)(3)(i). The proposed alternatives are authorized for Calvert Cliffs Unit 2 for the remainder of the third 10-year inservice inspection interval.

All other requirements of the ASME Code, Section XI for which relief has not been specifically requested remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

A copy of the safety evaluation is enclosed. If you have any questions, please contact the project manager, Pat Milano, at (301)415-1457.

Sincerely,

/RA/

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

Docket No. 50-318

Enclosure: Safety Evaluation

cc w/encl: See next page

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OFFICE	PDI-1/PM	PDI-1/LA	EMCB/SC	OGC	PDI-1/SC
NAME	PMilano	SLittle	TChan	TSmith	RLaufer
DATE	07/14/05	07/14/05	06/28/05	07/18 /05	07/20/05

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Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2

cc:

President
Calvert County Board of
Commissioners
175 Main Street
Prince Frederick, MD 20678

Carey Fleming, Esquire
Sr. Counsel - Nuclear Generation
Constellation Generation Group, LLC
750 East Pratt Street, 17th floor
Baltimore, MD 21202

Lou Larragoite
Calvert Cliffs Nuclear Power Plant
1650 Calvert Cliffs Parkway
Lusby, MD 20657-4702

Resident Inspector
U.S. Nuclear Regulatory
Commission
P.O. Box 287
St. Leonard, MD 20685

Mr. R. I. McLean, Administrator
Radioecology Environ Impact Prog
Department of Natural Resources
Nuclear Evaluations
580 Taylor Avenue
Tawes State Office Building
Annapolis, MD 21401

Regional Administrator, Region I
U.S. Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406

Kristen A. Burger, Esquire
Maryland People's Counsel
6 St. Paul Centre
Suite 2102
Baltimore, MD 21202-1631

Patricia T. Birnie, Esquire
Co-Director
Maryland Safe Energy Coalition
P.O. Box 33111
Baltimore, MD 21218

Mr. Loren F. Donatell
NRC Technical Training Center
5700 Brainerd Road
Chattanooga, TN 37411-4017

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REGARDING ALTERNATIVE REPAIR AND EXAMINATION TECHNIQUES

FOR DISSIMILAR METAL PIPING NOZZLE TO SAFE-END WELDS

CALVERT CLIFFS NUCLEAR POWER PLANT, UNIT NO. 2

CALVERT CLIFFS NUCLEAR POWER PLANT, INC.

DOCKET NUMBER 50-318

1.0 INTRODUCTION

By letter dated March 5, 2005 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML050690056), as supplemented by letter dated March 8, 2005 (ADAMS No. ML050800037), Calvert Cliffs Nuclear Power Plant, Inc. (the licensee) submitted a relief request pertaining to the repair and inspection of piping nozzle to safe-end weld nos. 2-DR-2007-1 and 2-LD-2004-1 at Calvert Cliffs Nuclear Power Plant, Unit No. 2 (Calvert Cliffs 2). These welds were repaired by the use of a weld overlay during the spring 2005 refueling outage. The licensee proposed the use of weld overlay for repair and the Performance Demonstration Initiative (PDI) program for inspection as an alternative to the requirements of American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI and Code Case N-504-2, "Alternative Rules for Repair of Class 1, 2, and 3 Austenitic Stainless Steel Piping."

During the spring 2005 refueling outage, unacceptable indications were detected by ultrasonic examination on weld Nos. 2-DR-2007-1 and 2-LD-2004-1 (piping nozzle to safe-end welds for the drain on the No. 21 reactor coolant system (RCS) hot leg and for the letdown line on the No. 22A RCS cold leg). The indications are believed to be primary water stress-corrosion cracking (PWSCC) based on the signal response received during the ultrasonic test examination. The welds are made of Alloy 82/182 materials, which are susceptible to PWSCC.

2.0 REGULATORY EVALUATION

In accordance with Section 50.55a(g)(4) of Part 50 of Title 10 of the *Code of Federal Regulations* (10 CFR), ASME Code Class 1, 2, and 3 components must meet the requirements set forth in ASME Code, Section XI, “Rules for Inservice Inspection of Nuclear Power Plants Components,” to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that all inservice examinations and system pressure tests conducted during the first 10-year inservice inspection (ISI) interval, and subsequent intervals, comply with the requirements in the latest edition and addenda of ASME Code, Section XI, incorporated by reference in 10 CFR 50.55a(b) on the date 12 months prior to the start of the 10-year interval. For Calvert Cliffs Units 1 and 2, the 1998 Edition with no

Addenda of ASME Code, Section XI (except Subsections IWE and IWL), is the applicable edition for the current third 10-year ISI interval.

In accordance with 10 CFR 50.55a(g)(6)(ii)(C), the implementation of Supplements 1 through 8, and 10 of Appendix VIII to Section XI, of the 1995 Edition with the 1996 Addenda of the ASME Code is required on a phased schedule ending on November 22, 2002. Supplement 11, "Qualification Requirements for Full Structural Overlaid Wrought Austenitic Piping welds," was required to be implemented by November 22, 2001.

Pursuant to 10 CFR 50.55a(a)(3), alternatives to these requirements may be authorized by the Nuclear Regulatory Commission (NRC) if the licensee demonstrates that: (i) the proposed alternatives 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 licensee submitted the subject relief request, pursuant to 10 CFR 50.55a(a)(3)(i), as proposed alternatives to the requirements of ASME Code, Section XI.

3.0 TECHNICAL EVALUATION

3.1 Code Requirements

The requirements for which the relief is requested are contained in ASME Code, Section XI, Article IWA-4000 and Appendix VIII, Supplement 11 (1995 Edition with 1996 Addenda), "Qualification Requirements for Full Structural Overlaid Wrought Austenitic Piping Welds," and Code Case N-504-2. The details of the relevant Code requirements are tabulated in Tables 1, 2, and 3.

3.1.1 System/Component(s) for which Relief is Requested

The proposed relief applies to the weld overlay repair and ultrasonic examination of two ASME Class 1 dissimilar metal welds, 2-DR-2007-1 (2 inches diameter drain nozzle on the No. 21 RCS hot leg) and 2-LD-2004-1 (2 inches diameter letdown line nozzle on the No. 22A RCS cold leg).

3.2 Licensee's Proposed Alternative and Bases

The licensee proposed a full structural weld overlay for the subject welds. The nozzle material is ferritic steel (ASME IX base material group designation P1). The pipe material is austenitic stainless steel (P8). The existing filler material is Alloy 82/182 (ASME IX weld filler metal group designation F43, equivalent to P43). The full structural overlay is designed in accordance with ASME Section XI, Code Case N-504-2. The full structural overlay satisfies all the structural design requirements of the pipe, as if the pipe were not there. The weld overlay completely covers (360E around the circumference) the existing Alloy 82/182 weld metal and extends on to the ferritic material and austenitic stainless steel material at each end. The temper bead technique will be implemented in accordance with ASME Section XI, Code Case N-638, "Similar and Dissimilar Metal Welding using Ambient Temperature Machine GTAW [Gas Tungsten Arc Welding]," for that portion of the overlay over the ferrite base material.

The licensee stated that the repair modification will be performed in compliance with IWA-4000 of the 1998 Edition with no Addenda of ASME Section XI, as modified and supplemented in Table 1 of the licensee's March 8 submittal. Certain requirements of IWA-4000 will be accomplished using the methodology of Code Case N-504-2, with modifications described in Table 2 of the March 8 submittal, and the methodology of Code Case N-638. Code Case N-504-2 was approved for generic use in Regulatory Guide (RG) 1.147, Revision 13, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," and was developed for austenitic stainless steel material. An alternate application for nickel based and ferritic materials is proposed due to the specific configuration of the subject weldments. The licensee intends to follow the methodology of Code Case N-504-2 for weld overlay repair except for the differences identified in Table 2 of the licensee's submittal. The licensee also intends to follow the methodology of Code Case N-638 for any welding on ferritic or ferritic/austenitic interfaces where the Construction Code required post-weld heat treatment. There is no proposed modification to the application of Code Case N-638.

The licensee stated that Appendix VIII of ASME Section XI is too restrictive and cannot be used for the structural weld overlay required non-destructive examination (NDE). Relief is requested to use the PDI program implementation of Appendix VIII. A detailed comparison of Appendix VIII and PDI requirements is summarized in Table 3 of the licensee's March 5 submittal. The italicized portions of the table provide an explanation of the proposed alternative. Relief is requested to allow closer spacing of flaws in the qualification specimen, provided they do not interfere with detection or discrimination. The specimens used to date for qualification to the Tri-party (NRC/Boiling-Water Reactor Owners Group/Electric Power Research Institute (EPRI)) agreement have a flaw population density greater than allowed by current Code requirements. These samples have been used successfully for all previous qualifications under the Tri-party agreement program. To facilitate their use and provide continuity from the Tri-party agreement program to Supplement 11, the PDI program has merged the Tri-party test specimens into its weld overlay program.

The bases for the proposed alternative are discussed in Tables 1, 2, and 3. Any applicable requirements not modified by Tables 1, 2, and 3 will be met as described in IWA-4000, Appendix VIII Supplement 11, and Code Cases N-504-2 and N-638.

3.3 Staff Evaluation

During the spring 2005 refueling outage at Calvert Cliffs Unit 2, unacceptable indications were found by ultrasonic examination in two dissimilar metal welds (2-DR-2007-1 and 2-LD-2004-1). The licensee believed that these flaws were the result of PWSCC. This was based on the consideration of the characteristics of the UT signal response and the locations of the flaws. The flaws were located in the Alloy 82/182 weld metal, which is known to be susceptible to PWSCC. In the relief request, the licensee proposed a weld overlay repair plan, which consists of the use of ASME Code Case N-504-2, with modification, and Code Case N-638, with use of contact pyrometers to monitor the process temperatures. The weld overlay repair plan was proposed as an alternative to the ASME Code requirements in IWA 4000. For the inspection of the weld overlay, the licensee proposed to use the PDI program as an alternative to the ASME Code requirements of Appendix VIII, Supplement 11, to ASME Section XI.

The NRC staff has evaluated the licensee's bases for the proposed alternatives as provided in the March 5 and 8 submittals. The staff notes that both Code Cases are approved for use by the NRC in RG 1.147 without limitations or modifications. Both Code Cases provide acceptable alternatives to the Code requirements. The bases of the licensee proposed alternatives were provided in Tables 1, 2, and 3 of its March 5 and 8 submittals. The staff's evaluation of the licensee's proposed alternatives relating to the relief/modifications to ASME Code, Section XI of IWA-4000, Code Case N-504-2 and Appendix VIII, Supplement 11 are provided below:

Relief Requests Related to IWA-4000

In IWA-4610(a), thermocouples (TC) and recording instruments are required to be used to monitor the process temperatures for welding. In lieu of the weld-attached thermocouples and recording instruments, the licensee proposed to use contact pyrometers and manual recording of the process temperatures. The licensee stated that the contact pyrometers will be calibrated in accordance with its control and calibration of measuring and test equipment program. The NRC staff concludes that the licensee's use of contact pyrometers in lieu of TC is acceptable because the contact pyrometer used in this repair has the capability of monitoring the process temperatures (50 EF, minimum preheat temperature and 350 EF, maximum interpass temperature) and will be properly calibrated.

Modifications to Code Case N-504-2

ASME Code Case N-504-2 allows the use of weld overlay repair by deposition of weld reinforcement on the outside surface of the pipe in lieu of mechanically reducing the defect to an acceptable flaw size. However, the subject Code Case is written for repairing austenitic stainless steel piping. Therefore, the material requirements of the carbon content limitation (0.035% maximum) and the delta ferrite content of at least 7.5 FN, as delineated in Code Case N-504-2 paragraphs (b) and (e), respectively, applies only to austenitic stainless steel materials to ensure its resistance to intergrannular stress-corrosion cracking (IGSCC). These requirements are not applicable to Alloy 52M, a nickel-based material which the licensee will use for weld overlay repair. For material compatibility in welding, the NRC staff considers Alloy 52M to be a better choice of filler material than austenitic stainless steel material for this weld joint configuration.

Alloy 52M contains 28-31.5% chromium which provides excellent resistance to IGSCC in the reactor coolant environment. Alloy 52M is identical to Alloy 52 in chemistry with the exception that Alloy 52M has a higher content of Niobium (0.5 - 1.0%) for the purpose of improving its weldability. This filler metal (ERNiCrFe-7A with classification UNS N06054) is identified as F-No. 43 (F43) Grouping per Code Case 2142-2. Therefore, the licensee's proposed use of Alloy 52M for the weld overlay repair as an alternative to the requirements of Code Case N-504-2 paragraphs (b) and (e) is acceptable because it will provide an acceptable level of quality and safety.

Modifications to Appendix VIII, Supplement 11

The U.S. nuclear industry created the PDI to implement performance demonstration requirements contained in Appendix VIII of Section XI of the ASME Code. To this end, PDI has developed a program for qualifying equipment, procedures, and personnel for examinations of weld overlays in accordance with the UT criteria of Appendix VIII, Supplement 11. Prior to the

Supplement 11 program, the EPRI maintained a performance demonstration program for weld overlay qualification under the Tri-party Agreement.[1]

Instead of having two programs with similar objectives, the NRC staff recognized the PDI program for weld overlay qualifications as an acceptable alternative to the Tri-party Agreement.[2]

The PDI program does not fully comport with the existing requirements of Supplement 11. PDI presented the differences at public meetings in which the NRC participated.[3, 4] The differences are in flaw location within test specimens and fabricated flaw tolerances. The changes in flaw location permitted using test specimens from the Tri-party Agreement, and the changes in fabricated flaw tolerances provide UT acoustic responses similar to the responses associated with IGSCC.

There are differences between the PDI program and Supplement 11. The differences are identified in the following Supplement 11 paragraphs: 1.1(b), 1.1(d)(1), 1.1(e)(1), 1.1(e)(2), 1.1(e)(2)(a)(1), 1.1(e)(2)(a)(2), 1.1(e)(2)(a)(3), 1.1(e)(2)(b)(1), 1.1(e)(2)(b)(2), 1.1(e)(2)(b)(3), 1.1(f)(1), 1.1(f)(3), 1.1(f)(4), 2.0, 2.1, 2.2(d), 2.3, 3.1, 3.2(a), 3.2(b) and 3.2(c), and are evaluated below:

Paragraph 1.1(b) of Supplement 11 states the limitations to the maximum thickness for which a procedure may be qualified. The ASME Code states that, "The specimen set must include at least one specimen with overlay thickness within minus 0.10-inch to plus 0.25-inch of the maximum nominal overlay thickness for which the procedure is applicable." The ASME Code requirement addresses the specimen thickness tolerance for a single specimen set, but is confusing when multiple specimen sets are used. The PDI proposed alternative states that "the specimen set shall include specimens with overlay not thicker than 0.10-inch more than the minimum thickness, nor thinner than 0.25-inch of the maximum nominal overlay thickness for which the examination procedure is applicable." The proposed alternative provides clarification on the application of the tolerance. The tolerance is unchanged for a single specimen set; however, the proposed alternative clarifies the tolerance for multiple specimen sets by providing tolerances for both the minimum and maximum thicknesses. The proposed wording eliminates confusion while maintaining the intent of the overlay thickness tolerance. Therefore, the NRC staff finds this PDI Program alternative maintains the intent of the Supplement 11 requirements and is acceptable.

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1 The Tri-party Agreement is between NRC, EPRI, and the Boiling Water Reactor Owners Group (BWROG), "Coordination Plan for NRC/EPRI/BWROG Training and Qualification Activities of NDE (Nondestructive Examination) Personnel," July 3, 1984.

2 US NRC Letter from William H. Bateman to Michael Bratton, "Weld Overlay Performance Demonstration Administered by PDI as an Alternative for Generic Letter 88-01 Recommendations," January 15, 2002. ML020160532

3 US NRC Memorandum from Donald G. Naujock to Terence Chan, "Summary of Public Meeting Held January 31 - February 2, 2002, with PDI Representatives," March 22, 2002. ML010940402

4 US NRC Memorandum from Donald G. Naujock to Terence Chan, "Summary of Public Meeting Held June 12 through June 14, 2001, with PDI Representatives," November 29, 2001. ML013330156

Paragraph 1.1(d)(1) requires that all base metal flaws be cracks. PDI determined that certain Supplement 11 requirements pertaining to location and size of cracks would be extremely difficult to achieve. For example, flaw implantation requires excavating a volume of base material to allow a pre-cracked coupon to be welded into this area. This process would add weld material to an area of the specimens that typically consists of only base material, and could potentially make ultrasonic examination more difficult and not representative of actual field conditions. In an effort to satisfy the requirements, PDI developed a process for fabricating flaws that exhibit crack-like reflective characteristics. Instead of all flaws being cracks, as required by Paragraph 1.1(d)(1), the PDI weld overlay performance demonstrations contain at least 70% cracks with the remainder being fabricated flaws exhibiting crack-like reflective characteristics. The fabricated flaws are semi-elliptical with tip widths of less than 0.002-inches. The licensee provided further information describing a revision to the PDI Program alternative to clarify when real cracks, as opposed to fabricated flaws, will be used: "Flaws shall be limited to the cases where implantation of cracks produces spurious reflectors that are uncharacteristic of actual flaws." The NRC staff has reviewed the flaw fabrication process, compared the reflective characteristics between actual cracks and PDI-fabricated flaws, and found the fabricated flaws for this application provide assurance that the PDI program meets the intent of the Supplement 11 requirements. Therefore, the NRC staff finds the proposed alternative to the Supplement 11 requirements acceptable.

Paragraph 1.1(e)(1) requires that at least 20% but less than 40% of the flaws shall be oriented within ±20 degrees of the axial direction (of the piping test specimen). Flaws contained in the original base metal heat-affected zone satisfy this requirement; however, PDI excludes axial fabrication flaws in the weld overlay material. PDI has concluded that axial flaws in the overlay material are improbable because the overlay filler material is applied in the circumferential direction (parallel to the girth weld); therefore, fabrication anomalies would also be expected to have major dimensions in the circumferential direction. The NRC staff finds, based upon engineering judgment, that this approach to implantation of fabrication flaws is reasonable for meeting the intent of the Supplement 11 requirements. Therefore, the staff concludes that the PDI's application of flaws oriented in the axial direction is acceptable.

Paragraph 1.1(e)(1) also requires that the rules of IWA-3300 shall be used to determine whether closely spaced flaws should be treated as single or multiple flaws. PDI treats each flaw as an individual flaw and not as part of a system of closely spaced flaws. PDI controls the flaws going into a test specimen set such that the flaws are free of interfering reflections from adjacent flaws. In some cases, this permits flaws to be spaced closer than what is allowed for classification as a multiple set of flaws by IWA-3300, thus potentially making the performance demonstration more challenging than the existing requirements. Hence, the NRC staff concludes that PDI's control for closely spaced flaws is acceptable.

Paragraph 1.1(e)(2) requires that specimens be divided into base metal and overlay grading units. The PDI program adds clarification with the addition of the word "fabrication" and ensures flaw identification by ensuring all flaws will not be masked by other flaws with the addition of, "Flaws shall not interfere with ultrasonic detection or characterization of other flaws." PDI's alternative provides clarification and assurance that the flaws are identified. Therefore, the NRC staff finds the PDI alternative to the Supplement 11 requirements is acceptable.

Paragraph 1.1(e)(2)(a)(1) requires that a base grading unit shall include at least 3 inches of the length of the overlaid weld, and the base grading unit includes the outer 25% of the overlaid weld and base metal on both sides. The PDI program reduced the criteria to 1 inch of the length of the overlaid weld and eliminated from the grading unit the need to include both sides of the weld. The proposed change permits the PDI program to continue using test specimens from the existing weld overlay program which have flaws on both sides of the welds. These test specimens have been used successfully for testing the proficiency of personnel for over 16 years. The weld overlay qualification is designed to be a near-side (relative to the weld) examination, and it is improbable that a candidate would detect a flaw on the opposite side of the weld due to the sound attenuation and re-direction caused by the weld microstructure. However, the presence of flaws on both sides of the original weld (outside the PDI grading unit) may actually provide a more challenging examination, as candidates must determine the relevancy of these flaws, if detected. The NRC staff determined, based on engineering judgment, that PDI's use of the 1-inch length of the overlaid weld base grading unit and the elimination from the grading unit of the need to include both sides of the weld, as described in the PDI Program alternative, is an acceptable alternative to the Supplement 11 requirements. Therefore, the staff finds the proposed alternative acceptable.

Paragraph 1.1(e)(2)(a)(2) requires, when base metal cracking penetrates into the overlay material, that a portion of the base grading unit shall not be used as part of the overlay grading unit. The NRC staff finds that the PDI program adjusts for the changes in Paragraph 1.1(e)(2)(a)(2) and conservatively states that when base metal flaws penetrate into the overlay material, no portion of it shall be used as part of the overlay fabrication grading unit. The staff finds that the PDI program also provided clarification by the addition of the term "flaws" for "cracks" and the addition of "fabrication" to "overlay grading unit." The staff concludes that the PDI program alternative provides clarification and conservatism and, therefore, is acceptable.

Paragraph 1.1(e)(2)(a)(3) requires that for unflawed base grading units, at least one inch of unflawed overlaid weld and base metal shall exist on either side of the base grading unit. This is to minimize the number of false identifications of extraneous reflectors. The PDI program stipulates that unflawed overlaid weld and base metal exists on all sides of the grading unit and flawed grading units must be free of interfering reflections from adjacent flaws which addresses the same concerns as the ASME Code. Hence, the staff concludes that the PDI's application of the variable flaw-free area adjacent to the grading unit meets the intent of the Supplement 11 requirements and is, therefore, acceptable.

Paragraph 1.1(e)(2)(b)(1) requires that an overlay grading unit shall include the overlay material and the base metal-to-overlay interface of at least 6 square inches. The overlay grading unit shall be rectangular, with minimum dimensions of 2 inches. The PDI program reduces the base metal-to-overlay interface to at least 1 inch (in lieu of a minimum of 2 inches) and eliminates the minimum rectangular dimension. This criterion is necessary to allow use of existing examination specimens that were fabricated in order to meet NRC Generic Letter 88-01 (Tri-party Agreement, July 1984). This criterion may be more challenging to meet than that of the ASME Code because of the variability associated with the shape of the grading unit. Based on engineering judgment, the NRC staff concludes that PDI's application of the grading unit is an acceptable alternative to the Supplement 11 requirements and is acceptable.

Paragraph 1.1(e)(2)(b)(2) requires that unflawed overlay grading units shall be surrounded by unflawed overlay material and unflawed base metal-to-overlay interface for at least 1 inch around its entire perimeter. The PDI program redefines the area by noting unflawed overlay fabrication grading units shall be separated by at least 1 inch of unflawed material at both ends and sufficient area on both sides to preclude interfering reflections from adjacent flaws. The staff determined that the relaxation in the required area on the sides of the specimens, while still ensuring no interfering reflections, may provide a more challenging demonstration than required by ASME Code because of the possibility for having a parallel flaw on the opposite side of the weld. Therefore, based on engineering judgment, the staff concludes that the PDI's application is an acceptable alternative to the Supplement 11 requirements.

Paragraph 1.1(e)(2)(b)(3) requirements are retained in the PDI program. The PDI program allows procedure qualification to be performed separately from personnel and equipment qualification. Historical data indicate that, if ultrasonic detection or sizing procedures are thoroughly tested, personnel and equipment using those procedures have a higher probability of successfully passing a qualification test. In an effort to increase this passing rate, PDI has elected to perform procedure qualifications separately. In addition, the PDI program requires that initial procedure qualification contain three times the number of flaws required for a personal qualification. To qualify new values of essential variables, the equivalent of at least one personal qualification set is required. The NRC staff concludes that PDI's additions enhance the ASME Code requirements and are, therefore, acceptable because it provides for a more stringent qualification criteria.

Paragraph 1.1(f)(1) requirements are retained in the PDI program, with the clarification change of the term "flaws" for "cracks." In addition, the PDI program includes the requirements that sizing sets shall contain a distribution of flaw dimensions to verify sizing capabilities. The PDI program also requires that initial procedure qualification contain three times the number of flaws required for a personal qualification. To qualify new values of essential variables, the equivalent of at least one personal qualification set is required. The NRC staff concludes that PDI's additions enhance the ASME Code requirements and are, therefore, acceptable because it provides a more stringent qualification criteria.

Paragraphs 1.1(f)(3) and 1.1(f)(4) requirements are clarified by the PDI program by replacing the term "cracking" with "flaws" because of the use of alternative flaw mechanisms. The NRC staff concludes that this clarification in the PDI program meets the intent of the ASME Code requirements and is acceptable.

Paragraph 2.0 requirements are retained in the PDI program alternative. In addition, the PDI program provides clarification that the overlay fabrication flaw test and the base metal flaw test may be performed separately. The NRC staff concludes that this clarification in the PDI program meets the intent of the ASME Code requirements and is acceptable.

Paragraphs 2.1 and 2.2(d) requirements are clarified by the PDI program by the addition of the terms "metal" and "fabrication." The NRC staff determined that the clarifications provide acceptable classification of the terms they are enhancing. Therefore, the staff concludes that the PDI program meets the intent of the ASME Code requirements and is acceptable.

Paragraph 2.3 requires that, for depth sizing tests, 80% of the flaws shall be sized at a specific location on the surface of the specimen identified to the candidate. This requires detection and sizing tests to be performed separately. The PDI revised the weld overlay program to allow sizing to be conducted either in conjunction with, or separately from, the flaw detection test. If performed in conjunction with detection and the detected flaws do not meet the Supplement 11 range criteria, additional specimens will be presented to the candidate with the regions containing flaws identified. Each candidate will be required to determine the maximum depth of flaw in each region. For separate sizing tests, the regions of interest will also be identified and the maximum depth and length of each flaw in the region will similarly be determined. In addition, PDI stated that grading units are not applicable to sizing tests, and that each sizing region will be large enough to contain the target flaw, but small enough such that candidates will not attempt to size a different flaw. The NRC staff determined that the above clarification provides a basis for implementing sizing tests in a systematic, consistent manner that meets the intent of Supplement 11. Based on engineering judgment, the staff concludes that the PDI's method is acceptable.

Paragraph 3.1 requires that examination procedures, equipment and personnel (as a complete ultrasonic system) are qualified for detection or sizing of flaws, as applicable, when certain criteria are met. For a procedure to be qualified, the PDI program requires all the flaws within the scope of the procedure be detected which is a more stringent criteria than the detection in Table VIII S2-1; therefore, the PDI program criteria exceeds the ASME Code requirements for procedures and equipment qualification and the personnel meets the existing Code requirements. Therefore, the NRC staff concludes that the PDI program criteria is acceptable.

Paragraph 3.2(a) requirements are clarified by the PDI program by replacing the term "cracking" with "flaws" because of the use of alternative flaw mechanisms. The NRC staff concludes that this clarification in the PDI program maintains the intent of the ASME Code requirement and is acceptable.

Paragraph 3.2(b) requires that all extensions of base metal cracking into the overlay material by at least 0.10-inch are reported as being intrusions into the overlay material. The PDI program omits this criterion because of the difficulty in actually fabricating a flaw with a 0.10-inch minimum extension into the overlay, while still knowing the true state of the flaw dimensions. However, the PDI program requires that cracks be depth-sized to the tolerance specified in the ASME Code which is 0.125-inches. Since the ASME Code tolerance is close to the 0.10-inch value of Paragraph 3.2(b), any crack extending beyond 0.10-inch into the overlay material would be identified as such from the characterized dimensions. The NRC staff determined that reporting of an extension in the overlay material is redundant for performance demonstration testing because of the flaw sizing tolerance. Therefore, the staff concludes that PDI's omission of highlighting a crack extending beyond 0.10-inch into the overlay material is acceptable.

Paragraph 3.2(c) is renumbered to Paragraph 3.2(b) in the PDI program. The staff concludes that this PDI program change is administrative in nature and is, therefore, acceptable.

Based on the above evaluation, the NRC staff has determined that the licensee's proposed alternative to use the PDI qualification program for the ultrasonic examination of overlay repaired piping welds is acceptable, because it will provide an acceptable level of quality and safety.

4.0 CONCLUSION

The NRC staff has reviewed the licensee's relief request and determined that the proposed alternatives will provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the staff authorizes the proposed alternatives for the weld overlay repair and inspection of the subject degraded welds performed during the spring 2005 refueling outage at Calvert Cliffs Unit 2 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.

Principal Contributor: W. Koo

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