UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

February 24, 2011

Mr. George H. Gellrich, Vice President
Calvert Cliffs Nuclear Power Plant, LLC
Calvert Cliffs Nuclear Power Plant
1650 Calvert Cliffs Parkway
Lusby, MD 20657-4702

SUBJECT: CALVERT CLIFFS NUCLEAR POWER PLANT, UNIT NOS. 1 AND 2 - RELIEF FROM THE REQUIREMENTS OF THE ASME CODE (TAC NOS. ME3963 AND ME3964)

Dear Mr. Gellrich:

By letter dated May 18, 2010, as supplemented by letters dated December 9, 2010, and November 1, 2010, Constellation Energy (the licensee) submitted relief request (RR) ISI-04-05 for the U.S. Nuclear Regulatory Commission (NRC) review and approval. The licensee requested relief from the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, to repair the dissimilar metal (DM) welds. RR ISI-04-05 pertains to the use of full structural weld overlays (FSWOL) as an alternate repair technique for Alloy 82/182 DM welds in the reactor coolant pump inlet and outlet nozzles, pressurizer surge hot leg nozzles, safety injection cold leg nozzles, pressurizer spray cold leg nozzles, pressurizer relief nozzles, cold leg letdown drain nozzles, cold leg charging inlet nozzles, and cold leg loop drain nozzles at Calvert Cliffs Nuclear Power Plant (Calvert Cliffs), Units 1 and 2.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(a)(3)(i), the licensee requested to use the proposed alternative on the basis that the alternative provides an acceptable level of quality and safety, and pursuant to 10 CFR 50.55a(g)(4)(iv), the licensee requested to use later code editions and addenda for inservice inspection (ISI) items subject to the limitations and modifications listed in 10 CFR 50.55a(b).

The NRC staff has reviewed the subject request and finds that, as set forth in the enclosed safety evaluation, the licensee has adequately addressed:

(a) all of the regulatory requirements set forth in 10 CFR 50.55a(a)(3), 10 CFR) 50.55a(g)(4), 10 CFR 50.55a(b)(2)(xv), the requirements, except the design and access provisions, and

(b) the pre-service examination requirements, set forth in the ASME Code, Section XI, "Rules for In-service Inspection (ISI) of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components, and the proposed alternatives would provide an acceptable level of quality and safety.

On the basis of review and evaluation of the licensee's submittals, the NRC staff concludes that the proposed alternatives, except the proposed ISI requirements, would provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the NRC staff authorizes the use of RR ISI-04-05, except the proposed ISI requirements, for the repair of the subject DM welds at Calvert Cliffs, Units 1 and 2, by installing FSWOL if unacceptable flaw indications are identified. However, this authorization is limited to the condition that the maximum area of weld overlay on the ferritic material using ambient temperature temper bead welding must not exceed 700 square inches and that the proposed ISI requirements of RR ISI-04-05 must not be used.

Therefore, the NRC staff authorizes RR ISI-04-05 with the condition specified in the following paragraphs for the fourth 10-year ISI interval for each unit which started on October 10, 2009, and will end on June 30, 2019.

The NRC staff is currently revising 10 CFR 50.55a to incorporate by reference the 2007 Edition and 2005, 2006, and 2008 Addenda of the ASME Code, Section III, Section XI, and Operation and Maintenance Code. In this rulemaking effort, the NRC staff is also planning to incorporate into 10 CFR 50.55a alternative examination requirements and acceptance standards for Class 1 Pressurized-Water Reactor Piping and Vessel Nozzle Butt Welds Fabricated with UNS N06082 or UNS W86182 weld filler material with or without application of a list of mitigation activities. The ISI requirements for the FSWOL in the proposed revised rule for 10 CFR 50.55a might be different from that of RR ISI-04-05.

The NRC staff anticipates that the final rule for 10 CFR 50.55a will be issued in summer 2011. The NRC-approved RR ISI-04-05 with conditions specified above will still be effective for the installation of the FSWOL and preservice inspection on the subject piping for the duration of the fourth ISI interval. However, after the issuance of the final rule, the licensee must follow the ISI requirements in the revised 10 CFR 50.55a with conditions specified therein, if any.

All other ASME Code, Section XI, requirements for which relief was not specifically requested and authorized herein by the NRC staff remain applicable, including the third party review by the Authorized Nuclear Inservice Inspector.

Please contact me at 301-415-2942, or the Project Manager, Douglas V. Pickett at 301-415-1364, if you have any questions.

Sincerely,

Nancy L. Salgado

Nancy L. Salgado, Chief
Plant Licensing Branch I-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-317 and 50-318

Enclosure:
Safety Evaluation

cc w/encl: Distribution via Listserv

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO RELIEF REQUEST ISI-04-05 FOR APPROVAL OF ALTERNATIVE FOR

DISSIMILAR METAL WELD REPAIRS

CALVERT CLIFFS NUCLEAR POWER PLANT, LLC

CONSTELLATION ENERGY

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

DOCKET NOS. 50-317 AND 50-318

1.0 INTRODUCTION

By letter dated May 18, 2010 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML101410060), as supplemented by letters dated November 1, 2010, and December 9, 2010 (ADAMS Accession Nos. ML103070140 and ML103470279), Constellation Energy (the licensee) submitted relief request (RR) ISI-04-05 for the U.S. Nuclear Regulatory Commission (NRC) review and approval. The licensee requested relief from the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, to repair the dissimilar metal (DM) welds. RR ISI-04-05 pertains to the use of full structural weld overlay (FSWOL) as an alternate repair technique for Alloy 82/182 DM welds in the reactor coolant pump inlet and outlet nozzles, pressurizer surge hot leg nozzles, safety injection cold leg nozzles, pressurizer spray cold leg nozzles, pressurizer relief nozzles, cold leg letdown drain nozzles, cold leg charging inlet nozzles, and cold leg loop drain nozzles at Calvert Cliffs Nuclear Power Plant (Calvert Cliffs), Units 1 and 2.

RR ISI-04-05 was submitted as a contingency, in case unacceptable flaw indications are found during examinations of DM welds listed in RR ISI-04-05 in any refueling outages during the fourth 10-year inservice inspection (ISI) program interval of Calvert Cliffs, Units 1 and 2. The fourth 10-year ISI interval for each unit started on October 10, 2009, and will end on June 30, 2019.

2.0 REGULATORY REQUIREMENTS

Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(g)(4) specifies that ASME Code Class 1, 2, and 3 components (including supports) must 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 In-service 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

Enclosure

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), 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein.

10 CFR 50.55a(a)(3) states that alternatives to the requirements of paragraph (g) of 10 CFR 50.55a may be used, when authorized by the NRC, if the licensee demonstrates (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.

10 CFR 50.55a(b)(2)(xv), "Appendix VIII specimen set and qualification requirements," states in part, licensees who use later editions and addenda than the 2001 Edition of the ASME Code shall use the 2001 Edition of Appendix VIII. Licensees choosing to apply these provisions shall apply all of the provisions under this paragraph except for those in 10 CFR 50.55a(b)(2)(xv)(F) which are optional.

3.0 TECHNICAL EVALUATION

3.1 ASME Code Components Affected

ASME Code Class:	Class 1
Component:	Nickel Alloy 82 and Alloy 182 Dissimilar Metal Welds
System:	Reactor Coolant System

The Calvert Cliffs, Units 1 and 2, components for which a relief is requested are listed in the attached Table 1 and Table 2, respectively.

3.2 Applicable Code Edition and Addenda

The licensee stated that the code of record for the fourth 10-year ISI interval at Calvert Cliffs, Units 1 and 2, is the 2004 Edition with no Addenda of the ASME Code, Section XI.

3.3 Applicable Code Requirement

The licensee stated that the 2004 Edition with no Addenda of the ASME Code, Section XI, Article IWA-4410, "General Requirements," states, in part, that welding, brazing, defect removal, metal removal by thermal methods, and installation shall be performed in accordance with the requirements of this subarticle.

The licensee stated that the 2004 Edition with no Addenda of the ASME Code, Section XI, Article IWA-4611, "Defect Removal," provides requirements for defect removal.

The licensee stated that the 2001 Edition of the ASME Code, Section XI, 2001 Edition, Appendix VIII, Supplement 10, "Qualification Requirements for Dissimilar Metal Piping Welds," and Supplement 2, "Qualification Requirements for Wrought Austenitic Piping Welds," provides requirements for performance demonstration for ultrasonic examination.

3.4 Reason for Proposed Alternative

The licensee stated that Alloy 600 components and DM welds made with nickel Alloy 82/182 weld materials and exposed to elevated operating temperatures of the pressurized-water reactor (PWR) primary coolant are believed to pose a higher tendency to primary water stress-corrosion cracking (PWSCC). Due to concern to PWSCC, the licensee is proposing FSWOL for the DM welds listed in Attachment 1, Tables 1 and 2. The FSWOL is designed to provide a replacement structural boundary to the existing DM weld and will extend around the full circumference of the existing nozzle Alloy 82/182 weld, overlapping the neighboring sections of carbon steel piping and stainless steel safe-end. Due to proximity of the adjacent similar metal piping welds, the FSWOL will extend over the adjacent stainless steel safe-end to nozzle welds, as necessary to provide sufficient overlay length for inspectability and residual stress improvement.

The licensee stated that the FSWOL has been used for several years on piping of both boiling-water reactor (BWR) and PWR reactors to arrest the growth of existing flaws while establishing a new structural pressure boundary. Currently, there are no generically accepted criteria for a licensee to apply a FSWOL to DM welds constructed of Alloy 82/182 weld material. For repair or replacement activities, the current code of record at Calvert Cliffs, Units 1 and 2, (the 2004 Edition and no Addenda of the ASME Code, Section XI), does not include requirements for the application of FSWOL.

The licensee stated that nozzle-to-safe end weld overlays have been applied to other plants as repairs in accordance with requirements of ASME Code Case N-504-3, "Alternative Rules for Repair of Class 1, 2, and 3 Austenitic Stainless Steel Piping," and ASME Code Case N-638-1, "Similar and Dissimilar Metal Welding Using Ambient Temperature Machine gas tungsten-arc welding (GTAW) Temper Bead Technique." ASME Code Case N-504-3 was written specifically for stainless steel pipe-to-pipe welds and ASME Code Case N-638-1 contains some restrictions and requirements that are not applicable to weld overlays. ASME Code Cases N-638-1 and N-504-3 were conditionally approved by the NRC in Regulatory Guide (RG) 1.147, Revision 15. ASME Code Case N-740-2, "Full Structural Dissimilar Metal Weld Overlay for Repair or Mitigation of Class 1, 2, and 3 Items," that specifically addresses weld overlays on DM welds containing nickel alloy welds was approved by the ASME Code Committee but not approved by the NRC in RG 1.147, Revision 15.

In addition, the licensee stated that the required ultrasonic testing (UT) examinations of FSWOL are governed by the requirements contained in the 2001 Edition and no Addenda of the ASME Code, Section XI, Appendix VIII, Supplement 11, "Qualification Requirements for Full Structural Overlaid Wrought Austenitic Piping Welds." The Supplement 11 specifies requirements for performance demonstration of UT examination procedures, equipment, and personnel used to detect and size flaws in FSWOL of wrought austenitic piping welds. The licensee stated that it performs UT examinations of the subject DM welds mitigated with FSWOL in accordance with Appendix VIII, Supplement 11, of the 2001 Edition and no Addenda of the ASME Code, Section XI, except as modified by the Performance Demonstration Initiative (PDI) program. The PDI modifications to the ASME Code, Section XI, Appendix VIII, Supplement 11, are described in Enclosure 5 of RR ISI-04-05.

3.5 Licensee's Proposed Alternative

The licensee stated that as an alternative to the provisions of the ASME Code, Section XI, Articles IWA-4410 and IWA-4611, it installs FSWOL on the subject welds based on the ASME Code Case N-740-2 methodology, if unacceptable flaw indications are identified during ISI examinations. The Electric Power Research Institute (EPRI) Materials Reliability Program (MRP) Technical Reports, MRP-139, Rev. 1, "Primary System Piping Butt Weld Inspection and Evaluation Guideline," (Reference 1), and MRP-169, Rev. 1-A, "Technical Basis for Preemptive Weld Overlay for Alloy 82/182 Butt Welds in Pressurized Water Reactors (PWRs)," (Reference 2), provide additional support for the application of FSWOL and ASME Code Case N-740-2.

Enclosure 1 of RR ISI-04-05 specifies an alternative applicable to the design, fabrication, examination, pressure testing, and ISI of FSWOL DM welds, and Enclosure 2 of RR ISI-04-05 specifies an alternative to the post-weld heat treatment requirements of ASME Code, Section III, and the temper bead requirements of ASME Code, Section XI. The licensee stated that the comparison of the proposed alternative of Enclosure 1 of RR ISI-04-05 with ASME Code Case N-504-3 and Appendix Q of the ASME Code, Section XI, has been performed and is provided in Enclosure 3 of RR ISI-04-05. Enclosure 4 of RR ISI-04-05 documents the technical basis for the proposed alternatives to ASME Code Case N-638-1.

Enclosure 5 of RR ISI-04-05 describes the proposed alternative, which is the PDI modifications, to the requirements of Appendix VIII, Supplement 11, of the 2001 Edition and no Addenda of ASME Code, Section XI.

3.6 Licensee's Basis for Proposed Alternative

The licensee stated that its proposed alternative (i.e., FSWOL DM welds) provides an acceptable methodology for preventing potential failures due to PWSCC based on the use of filler metals (e.g., Alloy 52M) that are resistant to PWSCC. The FSWOL procedures create compressive residual stress profiles in the original weld and the post-overlay pre-service and ISI requirements ensure structural integrity of the subject welds for the life of the plant. The proposed FSWOL DM welds will also meet the applicable stress limits from the ASME Code, Section III. The crack growth evaluations for PWSCC and fatigue of any conservatively postulated flaws will demonstrate that structural integrity will be maintained.

3.6.1 FSWOL Design and Verification

The licensee stated that the fundamental design basis for FSWOL DM welds is to maintain the original design margins with no credit taken for the underlying PWSCC susceptible weldments. The assumed design basis flaw for the purpose of structural sizing the weld overlay is a 360° circumferential flaw that is 100 percent through the original wall thickness of the DM weld. In page 7 of Attachment 1 of RR ISI-04-05, the licensee describes the specific analyses (i.e., nozzle-specific stress analysis for establishing residual stress profile, fracture mechanics analyses for predicting crack growth, analysis for demonstrating weld overlay impact on existing stress, shrinkage analysis, and added weight due to weld overlay) and verifications to be performed in the event FSWOL will need to be installed on the subject welds.

3.6.2 Suitability of Proposed Ambient Temperature Temper Bead Technique

The licensee stated that an ambient temperature temper bead welding technique will be used when welding on the ferritic base materials of the nozzles in lieu of the post-weld heat treatment requirements of ASME Code, Section III. Research conducted by EPRI and other organizations on the use of an ambient temperature temper bead process utilizing the machine GTAW is documented in EPRI Report GC-111050, "Ambient Temperature Preheat for Machine GTAW Temper Bead Application," (Reference 3). According to this report, repair welding performed with an ambient temperature temper bead procedure utilizing the machine GTAW welding process exhibit mechanical properties equivalent to or better than those of the surrounding base material. Laboratory testing, analysis, successful procedure qualifications, and successful repairs have all demonstrated the effectiveness of this process.

Enclosure 2 of RR ISI-04-05 addresses the effects of the ambient temperature temper bead welding process on mechanical properties of welds, hydrogen cracking, cold restraint cracking, and extent of overlay coverage of ferritic base metal.

3.7 Duration of Relief

The licensee requested the provisions of its proposed alternatives documented in RR ISI-04-05, for Calvert Cliffs, Units 1 and 2, for any refueling outages during the fourth 10-year ISI program interval which commenced on October 10, 2009, and will end on June 30, 2019.

4.0 STAFF EVALUATION

The NRC staff has evaluated the information provided in RR ISI-04-05 dated May 18, 2010, as revised by letter dated December 9, 2010, and as supplemented by letter of response to the NRC staff request for additional information (RAI) dated November 1, 2010, in support of repair of DM welds by installing FSWOL as an alternative to the ASME Code, Section XI, requirements. If unacceptable flaw indications are identified in the DM welds (Alloy 82/182) listed in Tables 1 and 2 during ISI examinations, the licensee will install FSWOL in accordance with RR ISI-04-05. RR ISI-04-05 uses the provisions of ASME Code Case N-740-2. ASME Code Case N-740-2, "Full Structural Dissimilar Metal Weld Overlay for Repair or Mitigation of Class 1, 2, and 3 Items," specifically addresses requirements for FSWOL for repair or mitigation of DM welds containing nickel alloy weld materials, was approved by the ASME Code Committee but has not yet been approved by the NRC in RG 1.147, Revision 16.

The NRC, by letter dated February 28, 2010, (Reference 4), approved topical report (TR) MRP-169, "Material Reliability Program, Technical Basis For Preemptive Weld Overlays for Alloy 82/182 Butt Welds in PWRS (MRP-169), "Rev. 1-A, EPRI Report 1021014, (Reference 2). This TP provides adequate technical basis for the design, analyses, and inspections of the FSWOL in PWR to demonstrate that piping components overlaid with FSWOL will provide reasonable assurance for structural integrity. The NRC staff will use MRP-169, Rev. 1-A, as a guide to review RR ISI-04-05.

ASME Code Case N-504-4, "Alternative Rules for Repair of Class 1, 2, and 3 Austenitic Stainless Steel Piping," establishes requirements for repair of ASME Code Class 1, 2, and 3 austenitic stainless steel piping by depositing weld reinforcement (weld overlay) on the outside

surface of the pipe as an alternative to the provisions of either the Construction Code or the ASME Code, Section XI. ASME Code Case N-504-4 has been conditionally approved for use by the NRC in RG 1.147, Revision 16, with condition, "The provisions of Section XI, Nonmandatory Appendix Q, "Weld Overlay Repair of Class 1, 2, and 3 Austenitic Stainless Steel Piping Weldments," must also be met. In addition, the following conditions shall be met: (a) the total laminar flaw area shall not exceed 10 percent of the weld surface area, and no linear dimension of the laminar flaw area shall exceed the greater of 3 inches or 10 percent of the pipe circumference; (b) the finished overlay surface shall be 250 micro-inches (6.3 micrometers) root mean square or smoother; (c) the surface flatness shall be adequate for ultrasonic examination; and (d) radiography shall not be used to detect planar flaws under or masked by laminar flaws."

ASME Code Case N-638-4, "Similar and Dissimilar Metal Welding Using Ambient Temperature Machine GTAW Temper Bead Technique," establishes requirements for performing ambient temperature temper bead welding as an alternative to preheat and post-weld heat treatment requirements of the Construction Code. ASME Code Case N-638-4 has been conditionally approved for use by the NRC in RG 1.147, Revision 16, with condition "(1) Demonstration for ultrasonic examination of the repaired volume is required using representative samples which contain construction type flaws; (2) The provisions of 3(e)(2) or 3(e)(3) may only be used when it is impractical to use the interpass temperature measurement methods described in 3(e)(1), such as in situations where the weldment area is inaccessible (e.g., internal bore welding) or when there are extenuating radiological conditions."

The regulation in 10 CFR 50.55a(b)(2)(xv), "Appendix VIII specimen set and qualification requirements," states in part, licensees who use later editions and addenda than the 2001 Edition of the ASME Code shall use Appendix VIII of the 2001 Edition.

The NRC staff used the requirements of ASME Code Cases N-504-4 and N-638-4 and Appendix Q to ASME Code, Section XI, and MRP-169, Rev. 1-A, (References. 2 and 4) to evaluate RR ISI-04-05. The NRC staff notes that for the weld overlay design, the licensee followed ASME Code Cases N-504-3 and N-638-1. The NRC staff finds that there are no significant differences between two versions of each of the code cases.

4.1 General Requirements

FSWOL is a deposition of weld reinforcement on the outside diameter (OD) surface of the DM weld or piping. FSWOL of DM welds is an acceptable methodology for preventing potential failures due to PWSCC based on the use of filler metals (e.g., Alloy 52M) that are less susceptible to PWSCC. The licensee stated that compressive residual stress profiles in the original weld created by FSWOL and the post-overlay, pre-service, and ISI examination requirements ensure structural integrity of the subject welds for the life of the plant. The proposed FSWOL DM welds will meet the applicable stress limits from ASME Code, Section III. The crack growth evaluations for PWSCC and fatigue of any conservatively postulated flaws will demonstrate that structural integrity will be maintained.

General requirements for the FSWOL design documented in Section 1.0 of Enclosure 3 of RR ISI-04-05 include material specification and the applicable base metal (i.e., carbon steel, stainless steel, and Alloy 82/182) and weld overlay filler metal (i.e., Alloy 52M), and the chromium content of the weld overlay deposits. The NRC staff finds that the proposed

alternatives are consistent with the general requirements of ASME Code Case N-504-4 and Appendix Q of ASME Code, Section XI. Therefore, the NRC staff finds that Section 1.0 of Enclosure 3 of RR ISI-04-05 is acceptable.

In response to the NRC staff's RAI dated November 1, 2010, regarding filler material minimum requirement for delta ferrite content, the licensee stated that weld filler material used as a buffer layer must meet Article NB-2400 requirements of ASME Code, Section III. As specified in Subarticle NB-2433.2, of the ASME Code, Section III, "The minimum acceptable delta ferrite shall be 5 FN." The licensee added that a stainless steel barrier layer will only be applied if adverse chemistry conditions exist in the underlying stainless steel; however, no credit is taken for this barrier layer towards the required overlay design thickness. The NRC staff finds the licensee will meet the minimum requirement for delta ferrite content.

4.2 Design and Analysis Requirements

Section 2.0 of Enclosure 3 of RR ISI-04-05 provides the requirements for the FSWOL design and the crack growth calculation.

The NRC staff notes that for design basis flaw for the purpose of structural sizing the weld overlay, the licensee assumed a 360° circumferential flaw that is 100 percent through the original wall thickness of the DM weld. The licensee stated that the following is a list of the specific analyses and verifications to be performed in the event FSWOL will need to be installed on the subject welds.

- Nozzle-specific stress analyses will be performed to establish a residual stress profile in each nozzle. Severe internal diameter weld repairs will be assumed in these analyses that effectively bound any actual weld repairs that may have occurred in the nozzles. The analyses will then simulate application of the weld overlays to determine the final residual stress profiles. Post-weld overlay residual stresses at normal operating conditions will be shown to result in beneficial compressive stresses on the inner portion of the components, providing a condition that results in retarding or arresting crack growth and minimizing new crack initiation due to PWSCC.

- Fracture mechanics analyses will also be performed to predict crack growth for postulated flaws. Crack growth due to PWSCC and fatigue will be analyzed for the original DM weld. The crack growth analyses will consider all design loads and transients, plus the post-weld overlay and through-wall residual stress distributions. It will demonstrate that the postulated cracks will not grow beyond the design basis for the weld overlays.

- The stress analyses will demonstrate that applying the weld overlays does not impact the conclusions of the existing nozzle stress reports. The ASME Code, Section III, stress and fatigue criteria will be met for regions of the overlays remote from assumed cracks.

- Shrinkage will be measured during the overlay application. Shrinkage stresses at other locations in the piping systems arising from the weld overlays will be demonstrated not to have an adverse effect on the systems. Clearances of affected supports and restraints

will be checked after the overlay repair, and will be adjusted within the design ranges as required.

- The total added weight on the piping systems due to the overlays will be evaluated for potential impact on piping system stresses and dynamic characteristics.

- The as-built dimensions of the weld overlays will be measured and evaluated to demonstrate that they meet or exceed the minimum design dimensions of the overlays.

The NRC staff finds that these analyses are consistent with the NRC approved TR MRP-169, "Material Reliability Program, Technical Basis for Preemptive Weld Overlays for Alloy 82/182 Butt Welds in PWRS (MRP-169), "Rev. 1-A, EPRI Report 1016602, and therefore, are acceptable.

By letter dated November 1, 2010, the NRC staff issued RAI requesting the licensee commit to submit for the NRC review the final nondestructive examination (NDE) report within 14 calendar days of completion of the UT examinations of the subject welds. Further, the NRC staff requested the licensee commitment to submit the design analysis of FSWOL demonstrating that the application of the FSWOL satisfies the ASME Code, Section III, Article NB-3000, requirements and the crack growth evaluation of flaws demonstrating the life of the overlay before returning to Mode 4. The licensee responded that before Calvert Cliffs, Units 1 and 2, return to Mode 4, information identifying the affected DM weld, flaw characteristics detected during the weld examination, weld overlay material and size dimension information, and the weld overlay sizing analysis that justifies installation of the FSWOL will be submitted. Additional analyses including a nozzle specific residual stress analysis, fracture mechanics analyses, an ASME Code, Section III analysis, a weld overlay shrinkage analysis, and a weld overlay weight analysis will be completed within a reasonable time period following the units return to power.

By letter dated November 1, 2010, the NRC staff issued an RAI requesting the licensee to clarify the axial length of the weld overlay, $0.75\sqrt{Rt}$, (R is the outer pipe radius and t is the nominal pipe thickness), to be applied to both sides of the weld overlay (i.e., the nozzle side and the safe-end side). The licensee responded that the weld length $0.75\sqrt{Rt}$ applies to both sides of the susceptible weld, because the axial length and end slope of the weld overlay shall cover the weld and heat affected zones on each side of the weld, as well as any stress-corrosion cracking (SCC) susceptible base material adjacent to the weld, and provide for load redistribution from the item into the weld overlay and back into the item without violating applicable stress limits of Article NB-3200 of the ASME Code requirements. The NRC staff finds that the licensee will apply the weld overlay to both sides as required by Subarticle Q-3000(b)(1) of Appendix Q of ASME Code, Section XI. Therefore, the requirement of Subarticle Q-3000(b)(1) of Appendix Q of the ASME Code, Section XI, is satisfied.

4.3 Examination Requirements

Section 3.0 of Enclosure 3 of RR ISI-04-05 provides requirements for acceptance, pre-service, and inservice examinations of the overlaid DM welds. The NRC staff finds that the proposed requirements are either consistent with or exceed the requirements of ASME Code Case N-504-4 and Appendix Q of the ASME Code, Section XI. The specific issues are discussed in the following paragraphs.

The licensee stated that the NDE examination will be conducted in accordance with the ASME Code, Section XI, Article IWA-2200, requirements, except as specified herein. NDE personnel shall be qualified in accordance with the requirements of Article IWA-2300 of ASME Code, Section XI. The UT examination procedures and personnel shall be qualified in accordance with Appendix VIII, Supplement 11, requirements. The examination coverage requirements for axial and circumferential flaws shall be met.

4.3.1 Acceptance Examination

The licensee stated that the weld overlay and the adjacent base material for at least ½ inch from each side of the overlay shall be examined using the liquid penetrant examination method. The weld overlay shall satisfy the surface examination acceptance criteria for welds of the Construction Code or Article NB-5300 of the ASME Code. The adjacent base material shall satisfy the surface examination acceptance criteria for base material of the Construction Code or NB-2500 of the ASME Code. If ambient temperature temper bead welding is performed, the liquid penetrant examination of the completed weld overlay shall be conducted no sooner than 48 hours following completion of the three tempering layers over the ferritic steel.

The licensee stated that the examination volume A-B-C-D in Figure 1(a) of Enclosure 1 of RR ISI-04-05 shall be ultrasonically examined to assure adequate fusion or bond with the base material and to detect welding flaws. Planar flaws detected in the weld overlay acceptance examination shall meet the pre-service examination standards of IWB-3514 of the ASME Code. The NRC staff finds the proposed acceptance examination acceptable because they are consistent with the Appendix Q to the ASME Code, Section XI, requirements.

4.3.2 Pre-service Examination

The licensee stated that the examination volume in Figure 2 of Enclosure 1 of RR ISI-04-05 shall be ultrasonically examined. The angle beam shall be directed perpendicular and parallel to the piping axis, with scanning performed in four directions, to locate and size any planar flaw that have propagated into the outer 25 percent of the base metal thickness or into the weld overlay. For weld overlays on cast austenitic stainless steel base materials, if a 100 percent through-wall flaw is used for crack growth, only planar flaws that have propagated into the weld overlay, or are in the overlay, are required to be located and sized.

The licensee stated that the pre-service examination acceptance standards of IWB-3514 of the ASME Code, Section XI, shall be met for the weld overlay. In applying the acceptance standards to planar indications, the thickness, t_1 or t_2, defined in Figure 1(b) of Enclosure 1 of RR ISI-04-05, shall be used as the nominal wall thickness in IWB-3514, provided the base material beneath the flaw (i.e., safe end, nozzle, or piping material) is not susceptible to SCC. For susceptible material (i.e., Alloy 82/182 DM weld), t_1 shall be used. The NRC staff notes that for less susceptible material (i.e., stainless steel pipe), t_2 will be used. In addition, the NRC staff notes that the licensee will use the nominal wall thickness t_1 for flaw in E-F-G-H, and t_2 for flaws in A-E-H-D or F-B-C-G, shown in Figure 1(b) of Enclosure 1 of RR ISI-04-05. For flaws that span two examination volumes (such as illustrated at F-G in Figure 1(b) of Enclosure 1 of RR ISI-04-05), the t_1 thickness shall be used.

The NRC staff finds the proposed pre-service examinations are consistent with (or exceed) the ASME Code, Section XI, Appendix Q requirements, and therefore are acceptable.

4.3.3 ISI Examination

The licensee stated that the weld overlay examination shall be added to the inspection plan. The weld overlay inspection interval shall not be greater than the life of the overlay. The weld overlay examination volume in Figure 2 of Enclosure 1 of RR ISI-04-05 shall be ultrasonically examined during the first or second refueling outage following application. If ISI examinations reveal planar flaw growth, or new planar flaws, meeting the acceptance standards of IWB-3514 and IWB-3600, IWC-3600, or IWD-3600 of the ASME Code, Section XI, the weld overlay examination volume shall be re-examined during the first or second refueling outage following discovery of the growth or new flaws. The NRC staff finds the proposed ISI examinations are consistent with (or exceed) the Appendix Q to the ASME Code, Section XI, requirements, and therefore, are acceptable.

By letter dated November 1, 2010, the NRC staff issued RAI requesting the licensee discuss whether the cast austenitic stainless steel (CASS) pipe (safe ends or pump casings) joining the DM weld prevents 100 percent examination coverage of the DM weld. The licensee responded that the assumed design basis flaw for the purpose of structural sizing the weld overlays is a 360° circumferential flaw that is 100 percent through the original wall thickness of the Alloy 82/182 DM weld. Therefore, no credit for the structural integrity of the underlying Alloy 82/182 weld is taken. There are currently no ASME Code, Section XI, Appendix VIII, qualified techniques to examine CASS material or through CASS material. However, the examination techniques utilized for examining the weld overlay and the underlying Alloy 82/182 DM weld are fully qualified. The NRC staff finds the licensee response acceptable because the licensee did not take credit for the structural integrity of the underlying Alloy 82/182 weld, instead the licensee assumed a conservative design basis flaw.

By letter dated November 1, 2010, the NRC staff issued RAI requesting the licensee clarify or correct the inconsistency between the proposed Footnote (a) of Figure 1 and Footnote (1) of Figure 2 of Enclosure 1 of RR ISI-04-05. The licensee responded that Figure 1 provides definitions of the acceptance examination volume and thickness for the weld overlay itself while Figure 2 defines the pre-service and in-service examination volume. As such, the figures are not related. Dimension "b" of Figure 1 does not define the examination extent. Dimension "b" is equivalent to the nominal thickness of the nozzle or pipe being overlaid which varies accordingly with the component and defines whether the t_1 or t_2 thickness is utilized when applying the acceptance standards. As stated in Section 3.0(a)(3) of Enclosure 1 of RR ISI-04-05, the entire volume A-B-C-D shall be ultrasonically examined to assure adequate fusion (i.e., adequate bond) with the base material and to detect welding flaws, such as interbead lack of fusion, inclusions, or cracks. The NRC staff finds that the licensee's response acceptable because the licensee will ensure that the area (A-B-C-D) UT examined shall not be less than ½ inch from the toe of the original weld.

The licensee stated that the acceptance standards for laminar flaws in the weld overlay are identical to that of paragraph Q-4100(c)(1) of Appendix Q of the ASME Code, Section XI, except that paragraph 3.0(a)(4)(a) of Enclosure 1 of RR ISI-04-05 includes additional limitation. The limitation is that the total laminar flaw shall not exceed 10 percent of the weld surface area and

that no linear dimension of the laminar flaw area exceeds 3.0 inches. The licensee's basis for this additional limitation is to provide additional conservatism to the weld overlay examination and to reduce the size of the uninspectable volume beneath a laminar flaw. In addition, paragraph 3.0(a)(1) of Enclosure 1 of RR ISI-04-05 stated that the weld overlay shall have a surface finish of 250 micro-inches root mean square or better and contour that permits UT examination in accordance with procedures qualified in accordance with Appendix VIII, Section XI, of the ASME Code. The NRC staff finds the licensee's proposed acceptance standards for laminar flaws provide additional conservatism and satisfy the conditions set forth by the NRC in RG 1.147, Revision 16 for ASME Code Case N-504-4.

4.3.4 Additional Examinations for Inspection Expansion

The licensee incorporated additional requirements for inspection expansion in Section 3.0(d) of Enclosure 1 of RR ISI-04-05. The licensee stated that if the ISI examinations reveal a defect, planar flaw growth into the weld overlay design thickness, or axial flaw growth beyond the specified examination volume, additional weld overlay examination volumes, equal to the number scheduled for the current inspection period, shall be examined prior to return to service. If additional defects are found in the second sample, 50 percent of the total population of weld overlay examination volumes shall be examined prior to return to service. If additional defects are found, the entire remaining population of weld overlay examination volumes shall be examined prior to return to service. The NRC staff finds the requirements for the additional examinations are acceptable because the population of the overlaid DM welds examinations will be expanded when the ISI examinations reveal a defect (i.e., planar flaw growth into the weld overlay design thickness or axial flaw growth beyond the specified examination volume). The NRC staff finds that the licensee's proposed additional examinations are consistent with the requirements of Q-4310 of Appendix Q to the ASME Code, Section XI.

4.4 Ambient Temperature Temper Bead Welding

The use of an ambient temperature temper bead process utilizing the machine GTAW is documented in EPRI Report GC-111050, "Ambient Temperature Preheat for Machine GTAW Temper Bead Application," (Reference 3). According to this report, repair welding performed with an ambient temperature temper bead procedure utilizing the machine GTAW welding process exhibit mechanical properties equivalent to or better than those of the surrounding base material. The effectiveness of this process has been demonstrated by laboratory testing, analysis, successful procedure qualifications, and successful repairs.

The NRC staff reviewed Enclosure 2 of RR ISI-04-05 that addresses the effects of the ambient temperature temper bead welding process on mechanical properties of welds, hydrogen cracking, cold restraint cracking, and extent of overlay coverage of ferritic base metal.

The NRC staff reviewed Section 2 of Attachment 3, and Enclosure 4, of RR ISI-04-05 that provide requirements for the ambient temperature temper bead welding which follow the requirements of ASME Code Case N-638-4 with a few modifications. The modifications are discussed in the paragraphs following.

The licensee stated that ASME Code Case N-638-1, paragraph 1.0(a), limits the maximum area of an individual weld to 100 square inches. ASME Code Case N-740-2, Appendix I, limits the

area to 500 square inches. The proposed alternative expands the surface area to 700 square inches or greater as justified by residual stress analysis of the DM weld and of the ferritic material for the actual component to be repaired, in accordance with the requirements of EPRI Technical Report 1011898, "RRAC Code Justification for the Removal of the 100 Square Inch Temper bead Weld Limitation," (Reference 5). The NRC staff notes that EPRI Technical Report 1011898 concluded that there is no direct correlation of residual stresses with surface area of the repair for overlay repairs done using temper bead welding. The residual stresses associated with weld overlay repairs remain compressive in the weld region for larger area repairs as well as for smaller area repairs. The NRC staff also notes that ASME Code Case N-638-4, paragraph 1.0(b), limits the maximum area of an individual weld to 500 square inches. However, for Davis-Besse Nuclear Power Station, Unit 1, the NRC staff has previously approved the area of an individual weld up to 700 square inches but not greater than 700 square inches (NRC letter dated January 21, 2010, "Davis-Besse Nuclear Power Station, Unit 1 - Relief Request RR-A33 for the Application of Full Structural Weld Overlays on Dissimilar Metal Welds of Reactor Coolant Piping" (TAC No. ME0478), ADAMS Accession No. ML100080573). The NRC staff has determined that the analysis performed by Davis-Basse demonstrated favorable residual stress distribution on the inside surface of the pipe with minimal radial shrinkage and distortion, and reveals that increasing the weld overlay coverage areas improves the residual stress on the inside surface of the pipe. The licensee has not yet performed the stress analysis for DM welds at Calvert Cliffs, Units 1 and 2. Therefore, based on the NRC previous approval for Davis-Besse, the NRC staff approves the weld overlay on the ferritic material up to 700 square inches only but not greater than 700 square inches.

By letter dated November 1, 2010, the NRC staff issued an RAI requesting the licensee identify the impracticality in taking direct temperature measurements during welding for the proposed weld overlays. Enclosure 2, page 3, Section 3.0(e)(1) of RR ISI-04-05 states, in part, "Direct temperature measurement (e.g., pyrometers, temperature-indicting crayons, and thermocouples) during welding or if direct measurement is impractical, one of the following methods shall be used to determine the interpass temperature." The licensee stated that it is anticipated that there will be few, if any situations, where direct temperature measurement cannot reasonably be performed. Since RR ISI-04-05 involves a large number of welds that will be inspected for flaws during the fourth 10-year ISI interval, and as low as is reasonably achievable (ALARA) conditions might exist for some weld locations, it is impractical to predict where inaccessibility or inadequacy may exist. As a result, if the licensee encounters a situation where direct measurement is impractical due to either inaccessibility or will result in excessive radioactive dose exposure, the licensee will request specific relief, on a case-by-case basis, to use one of the alternatives listed in ASME Code Case N-740-2. The NRC staff finds the licensee's response acceptable because the licensee will follow ASME Code Case N-638-4.

4.5 Performance Demonstration Initiative Program

The U.S. nuclear utilities created the PDI program to implement performance demonstration requirements contained in Appendix VIII of Section XI of the ASME Code. To this end, the PDI program has developed a program for qualifying equipment, procedures, and personnel in accordance with the UT criteria of Appendix VIII, Supplement 11. Prior to the Supplement 11 program, EPRI was maintaining a performance demonstration program (the precursor to the PDI program) for weld overlay qualification under the Tri-party Agreement with the NRC, BWR Owner's Group, and EPRI, in the NRC letter dated July 3, 1984 (ADAMS Accession

No. ML8407090122). Later, the NRC staff recognized the EPRI PDI program for weld overlay qualifications as an acceptable alternative to the Tri-party Agreement in its letter dated January 15, 2002, to the PDI Chairman (ADAMS Accession No. ML020160532).

The PDI program is routinely assessed by the NRC staff for consistency with the current ASME Code and proposed changes. The PDI program does not fully comport with the existing requirements of Appendix VIII, Supplement 11. PDI presented the differences at public meetings in which the NRC participated (Memorandum from Donald G. Naujock to Terence L. Chan, "Summary of Public Meeting Held January 31 – February 2, 2002, with PDI Representatives," March 22, 2002 ADAMS Accession No. ML010940402, and Memorandum from Donald G. Naujock to Terence L. Chan, "Summary of Public Meeting Held June 12 through June 14, 2001, with PDI Representatives," November 29, 2001, ADAMS Accession No. ML013330156). Based on the discussions at these public meetings, the NRC staff determined that the PDI program provides an acceptable level of quality and safety.

The licensee identified and evaluated the differences between the PDI program and Appendix VIII, Supplement 11, of the ASME Code, Section XI, in Enclosure 5 of RR ISI-04-05. The NRC staff reviewed the differences and associated justifications the licensee provided in Enclosure 5 of RR ISI-04-05 and find them acceptable because the PDI program satisfies the intent of the Supplement 11 requirements.

Finally, the NRC staff finds that the requirements of RR ISI-04-05 related to design of FSWOL and preservice examinations are either consistent with or exceed the intent of the provisions of ASME Code Cases N-504-4 and N-638-4 and Appendix Q of the ASME Code, Section XI. Therefore, the licensee's proposed alternative related to design of FSWOL and preservice examinations is acceptable.

However, the staff finds that the proposed ISI requirements described in RR ISI-04-05 might be different from the ISI requirements in the final rule for 10 CFR 50.55a. Therefore, the NRC staff does not approve the proposed ISI requirements specified in RR ISI-04-05. The NRC staff anticipates that the final rule for 10 CFR 50.55a will be published in summer 2011. After the issuance of the final rule, the licensee must follow the ISI requirements in the revised 10 CFR 50.55a with conditions specified therein, if any.

5.0 CONCLUSION

On the basis of review and evaluation of the licensee's submittals, the NRC staff concludes that the proposed alternatives, except the proposed ISI requirements, would provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the NRC staff authorizes the use of RR ISI-04-05, except the proposed ISI requirements, for the repair of the subject DM welds at Calvert Cliffs, Units 1 and 2, by installing FSWOL if unacceptable flaw indications are identified. However, this authorization is limited to the condition that the maximum area of weld overlay on the ferritic material using ambient temperature temper bead welding must not exceed 700 square inches and that the proposed ISI requirements of RR ISI-04-05 must not be used.

Therefore, the NRC staff authorizes RR ISI-04-05 with the condition specified in the following paragraphs for the fourth 10-year ISI interval for each unit which started on October 10, 2009, and will end on June 30, 2019.

The NRC staff is currently revising 10 CFR 50.55a to incorporate by reference the 2007 Edition and 2008 Addenda of the ASME Code, Sections III, and Section XI. In this rulemaking effort, the NRC staff is also planning to incorporate into 10 CFR 50.55a alternative examination requirements and acceptance standards for Class 1 PWR Piping and Vessel Nozzle Butt Welds Fabricated with UNS N06082 or UNS W86182 weld filler material with or without application of a list of mitigation activities. The ISI requirements for the FSWOL in the proposed revised rule for 10 CFR 50.55a might be different from that of RR ISI-04-05.

The NRC staff anticipates that the final rule for 10 CFR 50.55a will be issued in summer 2011. The NRC-approved RR ISI-04-05 with conditions specified above will still be effective for the installation of the FSWOL and preservice inspection on the subject piping for the duration of the fourth ISI interval. However, after the issuance of the final rule, the licensee must follow the ISI requirements in the revised 10 CFR 50.55a with conditions specified therein, if any.

All other ASME Code, Section XI, requirements for which relief was not specifically requested and authorized herein by the NRC staff remain applicable, including the third party review by the Authorized Nuclear Inservice Inspector.

6.0 REFERENCES

1. EPRI MRP Technical Report 1015009, (MRP-139, Rev. 1), "Primary System Piping Butt Weld Inspection and Evaluation Guideline," December 2008, Agencywide Documents Access and Management System (ADAMS) Accession No. ML100970671.

2. EPRI MRP Technical Report 1021014, (MRP-169, Rev. 1-A), "Technical Basis for Preemptive Weld Overlay for Alloy 82/182 Butt Welds in Pressurized Water Reactors (PWRs)," October 2010.

3. EPRI Technical Report GC-111050, "Ambient Temperature Preheat for Machine GTAW Temper Bead Application," November 1998.

4. NRC Letter to Nuclear Energy Institute, dated August 9, 2010, "Final Safety Evaluation for nuclear Energy Institute Topical Report Materials Reliability Program (MRP): Technical Basis for Preemptive Weld Overlays for Alloy 82/182 Butt Welds in Pressurized Water Reactors (MRP-169) (TAC No. MD8005)," ADAMS Accession Nos. ML101620010 (Cover Letter) and ML101660468 (Enclosure).

5. EPRI Technical Report 1011898, "RRAC Code Justification for the Removal of the 100 Square Inch Temper bead Weld Limitation," November 2005.

6. EPRI Technical Report 1013558, "Repair and Replacement Applications Center: Temper Bead Welding Applications, 48-Hour Hold Requirements for Ambient Temperature Temper Bead Welding," December 2006.

Principal Contributor: A. Rezai, NRR/CPNB

Date: February 24, 2011

Table 1. Calvert Cliffs, Unit 1, DM Welds

Dissimilar Weld (DM) Designator ID	Code Category	Item No.	DM Weld Material	Base Material	Location	Stainless Steel Weld ID	Nozzle Size (inch)
102300/30-RC-11A-W7	R-A	R1.20	82/182	A516-70/A351-CF8M Elbow to Safe End	11A RCP Inlet	30-RC-11A-W8	30
102450/30-RC-11A-W10	R-A	R1.20	82/182	A516-70/A351-CF8M Pipe to Safe End	11A RCP Outlet	30-RC-11A-W9	30
104550/30-RC-11B-W7	R-A	R1.20	82/182	A516-70/A351-CF8M Elbow to Safe End	11B RCP Inlet	30-RC-11B-W8	30
104700/30-RC-11B-W10	R-A	R1.20	82/182	A516-70/A351-CF8M Pipe to Safe End	11 B RCP Outlet	30-RC-11B-W9	30
107450/30-RC-12A-W7	R-A	R1.20	82/182	A516-70/A351-CF8M Elbow to Safe End	12A RCP Inlet	30-RC-12A-W8	30
107600/30-RC-12A-W10	R-A	R1.20	82/182	A516-70/A351-CF8M Pipe to Safe End	12A RCP Outlet	30-RC-12A-W9	30
109600/30-RC-12B-W7	R-A	R1.20	82/182	A516-70/A351-CF8M Elbow to Safe End	12B RCP Inlet	30-RC-12B-W8	30
109750/30-RC-12B-W10	R-A	R1.20	82/182	A516-70/A351-CF8M Pipe to Safe End	12B RCP Outlet	30-RC-12B-W9	30
110450/12-PSL-W1	R-A	R1.11 and R1.15	82/182	A105-Gr II/A351-CF8M Nozzle to Safe End	PZR Surge at Pressurizer	12-PSL-W2	12
111100/12-PSL-W13	R-A	R1.11 and R1.15	82/182	A105-Gr II/A351-CF8M Nozzle to Safe End	PZR Surge at RCS Hot Leg	12-PSL-W12	12

Continued (Table 1. Calvert Cliffs, Unit 1, DM Welds)

Dissimilar Weld (DM) Designator ID	Code Category	Item No.	DM Weld Material	Base Material	Location	Stainless Steel Weld ID	Nozzle Size (inch)
113150/12-SC-1004-W1	R-A	R1.20	82/182	A105-Gr II/A351-CF8M Nozzle to Safe End	Shut Down Cooling Outlet Nozzle from 12 Hot Leg	12-SC-1004-W2	12
114350/12-SI-10009-W16	R-A	R1.20	82/182	A182-F-1/A351-CF8M Nozzle to Safe End	Safety Injection to 11A Cold Leg	12-SI-1009-W15	12
115200/12-SI-1010-W14	R-A	R1.20	82/182	A182-F-1/A351-CF8M Nozzle to Safe End	Safety Injection to 11B Cold Leg	12-SI-1010-W13	12
116000/12-SI-1011-W13	R-A	R1.20	82/182	A182-F-1/A351-CF8M Nozzle to Safe End	Safety Injection to 12A Cold Leg	12-SI-1011-W12	12
116750/12-SI-1012-W13	R-A	R1.20	82/182	A182-F-1/A351-CF8M Nozzle to Safe End	Safety Injection to 12B Cold Leg	12-SI-1012-W12	12
118500/4-PS-1003-W6	R-A	R1.11 and R1.15	82/182	SA508-C12/SA-182-F316 Nozzle to Safe End	PZR Spray Nozzle @ Pressurizer	4-PS-1003-W5	4
118550/3-PS-1001-W1	R-A	R1.20	82/182	A105-GrII/A-182TP316 Nozzle to Safe End	PZR Spray from 11A Cold Leg	3-PS-1001-W2	3

Continued (Table 1. Calvert Cliffs, Unit 1, DM Welds)

120350/3-PS-1002-W1	R-A	R1.20	82/182	A105-Gr II/A-182 TP316 Nozzle to Safe End	PZR Spray from 11B Cold Leg	3-PS-1002-W2	3
123100/4-SR-1005-W1	R-A	R1.20	82/182	SA508-C12/SA-182-F316 Nozzle to Safe End	PZR Relief	4-SR-1005-W2	4
123450/4-SR-1006-W1	R-A	R1.20	82/182	SA508-C12/SA-182-F316 Nozzle to Safe End	PZR Relief	4-SR-1006-W2	4
125050/2-LD-1004-W1	R-A	R1.20	82/182	A105-Gr II/A-182-TP316 Nozzle to Safe End	12A Cold Leg Letdown/Drain	2-LD-1004-W2	2
128900/2-CV-1004-W19	R-A	R1.11	82/182	A105-Gr II/A-182-TP316 Nozzle to Safe End	12B Cold Leg Charging Inlet	2-CV-1004-W18	2
130450/2-CV-1005-W29	R-A	R1.11	82/182	A105-Gr II/A-182-TP316 Nozzle to Safe End	11A Cold Leg Charging Inlet	2-CV-1005-W28	2
131200/2-DR-1003-W1	R-A	R1.20	82/182	A105-Gr II/A-182-TP316 Nozzle to Safe End	11A Cold Leg Loop Drain	2-DR-1003-W1A	2
131500/2-DR-1004-W1	R-A	R1.20	82/182	A105-Gr II/A-182-TP316 Nozzle to Safe End	11B Cold Leg Loop Drain	2-DR-1004-W1A	2
132150/2-DR-1006-W1	R-A	R1.20	82/182	A105-Gr II/A-182-TP316 Nozzle to Safe End	12B Cold Leg Loop Drain	2-DR-1006-W1A	2
132450/2-DR-1007-W1	R-A	R1.20	82/182	A105-Gr II/A-182-TP316 Nozzle to Safe End	11 Hot Leg Loop Drain	2-DR-1007-W1A	2

Table 2. Calvert Cliffs, Unit 2, DM Welds

Dissimilar Weld (DM) Designator ID	Code Category	Item No.	DM Weld Material	Base Material	Location	Stainless Steel Weld ID	Nozzle Size (inch)
109280/30-RC-21A-W7	R-A	R1.20	82/182	A516-70/A351-CF8M Elbow to Safe End	21A RCP Inlet	30-RC-21A-W8	30
109310/30-RC-21A-W10	R-A	R1.20	82/182	A516-70/A351-CF8M Pipe to Safe End	21A RCP Outlet	30-RC-21A-W9	30
110280/30-RC-21B-W7	R-A	R1.20	82/182	A516-70/A351-CF8M Elbow to Safe End	21B RCP Inlet	30-RC-21B-W8	30
110310/30-RC-21B-W10	R-A	R1.20	82/182	A516-70/A351-CF8M Pipe to Safe End	21B RCP Outlet	30-RC-21B-W9	30
111280/30-RC-22A-W7	R-A	R1.20	82/182	A516-70/A351-CF8M Elbow to Safe End	22A RCP Inlet	30-RC-22A-W8	30
111310/30-RC-22A-W10	R-A	R1.20	82/182	A516-70/A351-CF8M Pipe to Safe End	22A RCP Outlet	30-RC-22A-W9	30
112280/30-RC-22B-W7	R-A	R1.20	82/182	A516-70/A351-CF8M Elbow to Safe End	22B RCP Inlet	30-RC-22B-W8	30
112310/30-RC-22B-W10	R-A	R1.20	82/182	A516-70/A351-CF8M Pipe to Safe End	22B RCP Outlet	30-RC-22B-W9	30
113010/12-PSL-W1	R-A	R1.11 and R1.15	82/182	A105-Gr II/A351-CF8M Nozzle to Safe End	PZR Surge @ Pressurizer	12-PSL-W2	12
113130/12-PSL-W13	R-A	R1.11 and R1.15	82/182	A105-Gr II/A351-CF8M Nozzle to Safe End	PZR Surge @ RCS Hot Leg	12-PSL-W12	12
114900/12-SC-2004-W1	R-A	R1.20	82/182	A105-Gr II/A351-CF8M Nozzle to Safe End	Shut Down Cooling Outlet Nozzle from 12 Hot Leg	12-SC-2004-W2	12

Continued (Table 2. Calvert Cliffs, Unit 2, DM Welds)

Dissimilar Weld (DM) Designator ID	Code Category	Item No.	DM Weld Material	Base Material	Location	Stainless Steel Weld ID	Nozzle Size (inch)
115140/12-SI-2009-W15	R-A	R1.20	82/182	A182-F-1/A351-CF8M Nozzle to Safe End	Safety Injection to 21A Cold Leg	12-SI-2009-W14	12
116190/12-SI-2010-W13	R-A	R1.20	82/182	A182-F-1/A351-CF8M Nozzle to Safe End	Safety Injection to 21B Cold Leg	12-SI-2010-W12	12
117120/12-SI-2011-W13	R-A	R1.20	82/182	A182-F-1/A351-CF8M Nozzle to Safe End	Safety Injection to 22A Cold Leg	12-SI-2011-W12	12
118120/12-SI-2012-W13	R-A	R1.20	82/182	A182-F-1/A351-CF8M Nozzle to Safe End	Safety Injection to 22B Cold Leg	12-SI-2012-W12	12
1360/4-PS-2003-W8	R-A	R1.11 and R1.15	82/182	SA508-C12/SA-182-F316 Nozzle to Safe End	PZR Spray Nozzle @ Pressurizer	4-PS-2003-W7	4
137010/3-PS-2001-W1	R-A	R1.20	82/182	A105-Gr II/A-182-TP316 Nozzle to Safe End	PZR Spray from 21A Cold Leg	3-PS-2001-W2	3
138010/3-PS-2002-W1	R-A	R1.20	82/182	A105-Gr II/A-182-TP316 Nozzle to Safe End	PZR Spray from 21B Cold Leg	3-PS-2002-W2	3
141000/4-SR-2005-W1	R-A	R1.20	82/182	SA508-C12/SA-182-F316 Nozzle to Safe End	PZR Relief	4-SR-2005-W2	4

Continued (Table 2. Calvert Cliffs, Unit 2, DM Welds)

Dissimilar Weld (DM) Designator ID	Code Category	Item No.	DM Weld Material	Base Material	Location	Stainless Steel Weld ID	Nozzle Size (inch)
142000/4-SR-2006-W1	R-A	R1.20	82/182	SA508-C12/SA-182-F316 Nozzle to Safe End	PZR Relief	4-SR-2006-W2	4
156530/2-CV-2021-W34	R-A	R1.11	82/182	A105-Gr II/A-182-TP316 Nozzle to Safe End	22B Cold Leg Charging Inlet	2-CV-2021-W33	2
152440/2-CV-2005-W30	R-A	R1.11	82/182	A105-Gr II/A-182-TP316 Nozzle to Safe End	21A Cold Leg Charging Inlet	2-CV-2005-W29	2
157010/2-DR-2003-W1	R-A	R1.20	82/182	A105-Gr II/A-182-TP316 Nozzle to Safe End	21A Cold Leg Loop Drain	2-DR-2003-W2	2
158010/2-DR-2004-W1	R-A	R1.20	82/182	A105-Gr II/A-182-TP316 Nozzle to Safe End	21B Cold Leg Loop Drain	2-DR-2004-W2	2
160010/2-DR-2006-W1	R-A	R1.20	82/182	A105-Gr II/A-182-TP316 Nozzle to Safe End	22B Cold Leg Loop Drain	2-DR-2006-W2	2

All other ASME Code, Section XI, requirements for which relief was not specifically requested and authorized herein by the NRC staff remain applicable, including the third party review by the Authorized Nuclear Inservice Inspector.

Please contact me at 301-415-2942, or the Project Manager, Douglas V. Pickett at 301-415-1364, if you have any questions.

Sincerely,

/ra/

Nancy L. Salgado, Chief
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Office of Nuclear Reactor Regulation

Docket Nos. 50-317 and 50-318

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