April 2, 2002

U. S. Nuclear Regulatory Commission
Washington, DC 20555

ATTENTION: Document Control Desk

SUBJECT: Calvert Cliffs Nuclear Power Plant
Unit Nos. 1 & 2; Docket Nos. 50-317 & 50-318
15-Day Response to NRC Bulletin 2002-01, "Reactor Pressure Vessel Head Degradation and Reactor Coolant Pressure Boundary Integrity"

REFERENCE: (a) NRC Bulletin 2002-01: Reactor Pressure Vessel Head Degradation and Reactor Coolant Pressure Boundary Integrity, dated March 18, 2002

The purpose of this letter is to forward Calvert Cliffs Nuclear Power Plant, Inc.'s (CCNPP's) 15-day response to Nuclear Regulatory Commission (NRC) Bulletin 2002-01 (Reference a). The Bulletin was issued to require pressurized-water reactor (PWR) addressees to submit:

(1) information related to the integrity of the reactor coolant pressure boundary including the reactor pressure vessel head and the extent to which inspections have been undertaken to satisfy applicable regulatory requirements, and

(2) the basis for concluding that plants satisfy applicable regulatory requirements related to the structural integrity of the reactor coolant pressure boundary and future inspections will ensure continued compliance with applicable regulatory requirements, and

(3) a written response to the NRC in accordance with the provisions of Title 10, Section 50.54(f), of the *Code of Federal Regulations* (10 CFR 50.54(f)) if they are unable to provide the information or they can not meet the requested completion dates.

Attachment (1) to this letter provides the information required within 15 days of the date of Bulletin 2002-01.

Should you have questions regarding this matter, we will be pleased to discuss them with you.

Very truly yours,

STATE OF MARYLAND :
: TO WIT:
COUNTY OF CALVERT :

I, Charles H. Cruse, being duly sworn, state that I am Vice President - Nuclear Energy, Calvert Cliffs Nuclear Power Plant, Inc. (CCNPP), and that I am duly authorized to execute and file this response on behalf of CCNPP. To the best of my knowledge and belief, the statements contained in this document are true and correct. To the extent that these statements are not based on my personal knowledge, they are based upon information provided by other CCNPP employees and/or consultants. Such information has been reviewed in accordance with company practice and I believe it to be reliable.

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Subscribed and sworn before me, a Notary Public in and for the State of Maryland and County of ____________________, this _____ day of ______________, 2002.

WITNESS my Hand and Notarial Seal: ____________________________________
Notary Public

My Commission Expires: ____________________________________
Date

CHC/GT/bjd

Attachment: (1) 15-Day Response to NRC Bulletin 2002-01

cc: R. S. Fleishman, Esquire
J. E. Silberg, Esquire
Director, Project Directorate I-1, NRC
D. M. Skay, NRC
H. J. Miller, NRC
Resident Inspector, NRC
R. I. McLean, DNR

ATTACHMENT (1)

15-DAY RESPONSE TO NRC BULLETIN 2002-01

Requested Information A

a summary of the reactor pressure vessel head inspection and maintenance programs that have been implemented at your plant,

CCNPP Response

The reactor pressure vessel heads at Calvert Cliffs Nuclear Power Plant (CCNPP) are inspected for boric acid corrosion in accordance with Generic Letter 88-05. The inspections are controlled by plant procedure number MN-3-301, "Boric Acid Corrosion Inspection (BACI) Program." The program's objective is to prevent degradation of the primary pressure boundary by boric acid corrosion of ferritic steel components within the Class 1 pressure boundary. This degradation could be caused by Class 1 system leakage or by leakage from other systems containing borated water adjacent to Class 1 ferritic steel components. It is recognized that leakage smaller than the allowable Technical Specification limit has the potential to cause degradation.

The Boric Acid Corrosion Inspection Program procedure contains:

1. Examination locations where leakage may cause degradation of the primary pressure boundary by boric acid corrosion.
2. Examination requirements and frequency of examinations.
3. Responsibilities for initiating engineering evaluations and implementing subsequent proposed corrective actions, if leakage is discovered.

During each refueling outage the reactor vessel head penetrations are required to be examined. This examination is performed with the reactor head cooling shroud raised to permit direct observation of the control element drive mechanisms (CEDM) stacks. The shroud has been modified for Unit 2 to provide an access port for performing future inspections without raising the shroud. The examination is a VT-2, which does not require removal of insulation.

The procedure requires evidence of boric acid leakage to be documented via an "Issue Report" to enter the observation into the site corrective action program. If boric acid leakage is identified, the boric acid residue must be removed and the underlying steel must be evaluated for wastage. If corrosion is noted then the component must be evaluated for suitability for continued service.

Succinctly, the CCNPP BACI program requires action each refueling outage to discover boric acid leakage and if leakage is found requires repair of the leak, removal of accumulated boric acid, and assessment of corrosion of the underlying steel.

In accordance with our commitment in response to Nuclear Regulatory Commission (NRC) Bulletin 2001-01, we have recently completed a 100% visual inspection of the Unit 1 reactor vessel head under the insulation. Unit 1 has close fitting reflective Transco encapsulated mineral wool insulation. The outer ring of insulation can be removed to provide access to the incore instrumentation (ICI) flange penetrations and the outer CEDM penetrations. The remaining insulation was raised to permit access with a fiber optic camera. There was no evidence of recent boric acid leakage onto the head. A small amount of loose and chunk boric acid from a previous leakage event was present adjacent to and nearby two ICI nozzles. The boric acid was removed and the underlying steel was determined to be in acceptable condition with minimal surface corrosion present.

The most recent 100% bare metal visual examination performed on the Unit 2 reactor vessel head was performed during the 1989 refueling outage, when the Transco Encapsulated Mineral Wool insulation was removed and replaced with PCI Nukon Fiberglass Blanket type insulation. There were no boric acid leaks or accumulations noted at that time.

Per our commitment in response to Bulletin 2001-01, we will be performing 100% bare metal visual examination of the top of the Unit 2 head during the spring 2003 refueling outage.

Requested Information B

an evaluation of the ability of your inspection and maintenance programs to identify degradation of the reactor pressure vessel head including, thinning, pitting, or other forms of degradation such as the degradation of the reactor pressure vessel head observed at Davis-Besse,

CCNPP Response

The recently completed inspection performed on Unit 1 would have identified any corrosion on the top of the reactor vessel head. Figures 1 through 4 show sample pictures taken during the inspection. These pictures are a very good representation of what was found during the inspection.

There was no evidence of corrosion or significant accumulations of boric acid. As discussed in our response to Requested Information C below, we have had leakage of reactor coolant onto the head in the past. The generally excellent condition of the head, as shown in the photographs in Figures 1 through 4, demonstrate the effectiveness of our BACI program that identifies the extent of any boric acid leakage onto the head and cleans any boric acid off of the low alloy steel head surface. We conclude the maintenance and inspection program was successful in discovering and rectifying leakage. We believe the program continues to ensure a clean head for both Unit 1 and Unit 2.

Requested Information C

a description of any conditions identified (chemical deposits, head degradation) through the inspection and maintenance programs described in 1.A that could have led to degradation and the corrective actions taken to address such conditions,

CCNPP Response

There have been three instances in the past 12 years in which boric acid leakage was found on the reactor vessel heads. Two of the events were discovered on Unit 2 during the spring 1993 refueling outage. One involved leaking ICI flange connections that permitted leakage of primary coolant onto the periphery of the vessel head. The second event that year involved leakage from a seal weld at the top of the reactor vessel level monitoring system. This leakage was closer to the center of the head. The third event was discovered on Unit 1 during the spring 1994 refueling outage and was identical to the ICI leakage event discovered on Unit 2 in 1993. In all three events leakage occurred above the insulation and could have permeated the insulation, or flowed through gaps in the insulation such that deposits could have accumulated on the reactor pressure vessel head.

The Unit 2 leakage from the ICI penetrations discovered in 1993 was corrected, and has not recurred. This was verified during the spring 2001 refueling outage when the insulation around the ICI flanges was removed and the steel was evaluated for evidence of boric acid corrosion. No corrosion or boric acid residue was observed. The 1993 leakage from a seal weld at the top of the reactor vessel level monitoring system occurred through a fabrication defect in a seal weld. The seal weld was repaired. According to maintenance records, all insulation pads that had been contaminated by borated water or boric acid crystals were removed, all boric acid was removed, and the underlying head in the vicinity of the degraded pads was inspected for boric acid corrosion. New insulation pads were installed. Personnel that installed the new insulation did not report any corrosion of the head or left over boric acid residue.

The Unit 1 leakage discovered in 1994 caused boric acid corrosion of alloy steel bolting on the ICI flange. Eventually similar damage was discovered on the discarded bolting that had been removed from Unit 2 in 1993. A formal root cause evaluation was performed to address the potential lessons to be learned from the leakage events. Weaknesses were identified in the CCNPP BACI program. One of the recommendations of the Root Cause Analysis was to change the program into a formal CCNPP procedure. Additional enhancements made to the BACI program following the 1994 outage included:

1. A list of components and surfaces that require inspection was added.
2. Any boric acid residue was required to be removed.
3. The underlying steel was required to be cleaned and evaluated for evidence of corrosion.
4. Inspections that had not been initiated under the BACI program, but that had identified borated water leakage onto carbon or low alloy steel surfaces were required to be resolved through the BACI program, i.e., the acid would need to be cleaned and the steel evaluated.

As mentioned in response to Requested Information A above, a small amount of boric acid from a previous leakage event was identified during the recently completed bare metal inspection of the Unit 1 head (Figure 4). It was determined that the source of this accumulation of boric acid was the 1994 ICI leak (which occurred prior to the changes in the BACI program). The relatively small amount of boric acid residue adjacent to and nearby two ICI penetrations was removed. The underlying steel around the penetrations was examined for evidence of corrosion. No evidence of structurally significant corrosion, pitting or wall thinning was identified.

During the spring 2001 Unit 2 outage, CCNPP installed a modification to the ICI flanges that consisted of cutting off the old ICI flanges and welding new “Quickloc” flanges in their place. The welding proved to be difficult, which caused CCNPP and contractor personnel to spend considerably more time in the vicinity of the head and the head penetrations than had been originally planned. The periphery of the head was decontaminated to the extent practicable in order to minimize the potential for personnel contamination incidents during the work. Prior to the decontamination exercise, the surface of the vessel in the vicinity of the ICI flanges was visually inspected and was found to be clean. At the conclusion of the welding activities CCNPP had qualified examiners perform inspections of the available head surfaces near the ICI penetrations. No corrosion or evidence of wastage was noted. During the modification, the insulation pads nearer to the center of the head were peeled back to provide access to the ICI penetrations. The outer ring of CEDM penetrations was revealed when the insulation was peeled back. No evidence of boric acid leakage was noted. Contamination surveys were taken on the head in preparation for the modification. The contamination levels were not excessive, as they would be if there had been leakage onto the head insulation.

The improved BACI program as well as evidence collected during the ICI flange modification process provides assurance that Unit 2 does not currently have any accumulation of boric acid in contact with the reactor vessel head. There have been no other known instances of leakage onto either vessel head.

Requested Information D

your schedule, plans, and basis for future inspections of the reactor pressure vessel head and penetration nozzles. This should include the inspection method(s), scope, frequency, qualification requirements, and acceptance criteria,

CCNPP Response

We currently plan to perform 100% bare metal visual inspection of the reactor vessel heads on each unit with particular emphasis on detailed examination of the location where the CEDM and other penetrations intersect with the top surface of the head. We plan to perform these inspections during every refueling outage. The visual examinations are "qualified" in the sense that finite element calculations have been performed that prove that a throughwall crack in a penetration would result in visual evidence of leakage. The NDE examiner and procedure qualification requirements and acceptance criteria are the same as that we provided in our response to Bulletin 2001-01.

As time passes the probability of experiencing primary water stress corrosion cracking (PWSCC) of the alloy 600 penetration or weld material increases. If inspections of penetrations at other plants provide information that indicate an increase in the probability of PWSCC we will consider modifying our plan to perform volumetric (or equivalent wetted surface) examinations.

Requested Information E

your conclusion regarding whether there is reasonable assurance that regulatory requirements are currently being met (see the Applicable Regulatory Requirements, above). This discussion should also explain your basis for concluding that the inspections discussed in response to Item 1.D will provide reasonable assurance that these regulatory requirements will continue to be met. Include the following specific information in this discussion:

(1) If your evaluation does not support the conclusion that there is reasonable assurance that regulatory requirements are being met, discuss your plans for plant shutdown and inspection.

(2) If your evaluation supports the conclusion that there is reasonable assurance that regulatory requirements are being met, provide your basis for concluding that all regulatory requirements discussed in the Applicable Regulatory Requirements section will continue to be met until the inspections are performed.

CCNPP Response

Calvert Cliffs is in compliance with the applicable regulatory requirements described in the Applicable Regulatory Requirements section and will continue to remain in compliance through the remainder of the term of our operating licenses. Calvert Cliffs is in compliance with General Design Criteria (GDC) 14 in that the reactor coolant pressure boundary has an extremely low probability of abnormal leakage, of rapidly propagating failure, and of gross rupture. The phenomena that have been recently observed regarding reactor vessel head leakage are thought to be caused by PWSCC of the Alloy 82/182/600 penetrations, or by boric acid corrosion of low alloy steel due to leakage of coolant through a PWSCC crack in Alloy 82/182/600 penetrations. The former has been shown to not represent a near-term risk of violating GDC 14 for moderate susceptibility plants such as Calvert Cliffs. The potential for boric acid corrosion is mitigated by the absence of boric acid deposits on the top of our reactor vessel heads. General Design Criteria 31, which specifies that the probability of rapidly propagating fracture of the reactor coolant pressure boundary (RCPB) be minimized, is similarly satisfied. Finally, GDC 32, which specifies that components which are part of the RCPB have the capability of being periodically inspected to assess their structural and leaktight integrity, is satisfied because Calvert Cliffs has the capability to inspect for boric acid corrosion of the head by performing visual examination (and has just completed such an exam on Unit 1) and also has the capability to perform volumetric (or equivalent wetted surface) examinations of the Alloy 82/182/600 components that are susceptible to PWSCC degradation.

Calvert Cliffs is in compliance with 10 CFR 50.55a because we do not have existing pressure boundary leaks or degradation. Furthermore, we have an effective BACI program for identification and repair of leaks, and removal of boric acid residue and assessment of the underlying steel for continued service.

Calvert Cliffs is in compliance with Criterion V (Instructions, Procedures, and Drawings) of Appendix B to 10 CFR Part 50 in that we have procedures, instructions, and drawings that control our inspections. We document inspection results in accordance with this criterion.

Calvert Cliffs is in compliance with Criterion IX (Control of Special Processes) of Appendix B to 10 CFR Part 50 in that special processes, including nondestructive testing, are controlled and accomplished by qualified personnel using qualified procedures in accordance with applicable codes, standards, specifications, criteria, and other special requirements. We have recently completed a bare metal visual inspection of the Unit 1 reactor vessel head. The inspection was qualified, both in the sense of Criterion IX, and in the sense defined by NRC Bulletin 2001-01, in that a plant specific analysis has been performed that proves that a throughwall crack in a penetration would result in visual evidence of leakage.

Calvert Cliffs is in compliance with Criterion XVI (Corrective Action) of Appendix B to 10 CFR Part 50 in that we are performing proactive inspections of the RCPB to discover evidence on RCPB deterioration due to either PWSCC or boric acid corrosion. Furthermore, as discussed in response to Requested Information C, we have improved our BACI program through previous compliance with Criterion XVI following degradation of low alloy steel bolting in 1993 and 1994.

Calvert Cliffs remains in compliance with plant Technical Specifications in that we are not operating, nor do we plan to operate, with RCPB leakage.

Calvert Cliffs has implemented a program in accordance with Generic Letter 88-05, "Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants," that is very effective in identifying and addressing the corrosive effects of RCPB leakage. This program enables us to remain in compliance with GDC 14, 30, and 31.

We will remain in compliance with these regulatory requirements as long as our inspection program identifies any RCPB leakage prior to the occurrence of any significant boric acid corrosion on the reactor pressure vessel head. The design of the plant equipment located above the surface of the reactor vessel head in Combustion Engineering nuclear power plants has historically been reliable with respect to leakage of borated water onto the head. Each of the leakage events in CCNPP has resulted from modifications to the original Combustion Engineering design. For this reason we believe that the probability of additional leakage events onto the head is small. Additionally, our BACI program would promptly identify any leakage, should it occur, and would cause the leak to be repaired, the boric acid to be removed, and the underlying steel to be evaluated for evidence of boric acid corrosion.

We will remain in compliance with these regulatory requirements with respect to PWSCC of the Alloy 82/182/600 pressure boundary components until such time as a crack propagates through the Alloy 82/182/600 component and results in RCPB leakage. Our reactor vessel was fabricated by Combustion Engineering, and our experience indicates that Combustion Engineering fabricated vessels are somewhat less likely than vessels fabricated by others to experience throughwall leakage due to PWSCC. Nevertheless, the Electric Power Research Institute (EPRI) Materials Reliability Program (MRP) susceptibility ranking ranks us as moderate susceptibility. Our long-term goal is to prevent RCPB leakage. Our basis for concluding that throughwall cracks do not exist at this time is the EPRI MRP plant susceptibility ranking for Unit 2 and the recently concluded inspection for Unit 1.

Our basis for concluding the regulatory requirements discussed in the Applicable Regulatory Requirements section will continue to be met until the next inspection is also the EPRI MRP plant susceptibility ranking.

Figure 1

Pictures Taken During Calvert Cliffs Unit 1 Reactor Pressure Vessel Head Inspection

Figure 2

Pictures Taken During Calvert Cliffs Unit 1 Reactor Pressure Vessel Head Inspection

Figure 3

Pictures Taken During Calvert Cliffs Unit 1 Reactor Pressure Vessel Head Inspection

Figure 4

Pictures Taken During Calvert Cliffs Unit 1 Reactor Pressure Vessel Head Inspection