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January 30, 2004

U. S. Nuclear Regulatory Commission
Washington, DC 20555

ATTENTION: Document Control Desk

SUBJECT: Calvert Cliffs Nuclear Power Plant
Unit No. 1; Docket Nos. 50-317
Request for Relaxation from NRC Order EA-03-009, "Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors

REFERENCE: (a) Letter from S. J. Collins (NRC) to Holders of Licenses for Operating Pressurized Water Reactors, dated February 11, 2003, "Issuance of Order Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors"(EA-03-009)

Calvert Cliffs Nuclear Power Plant hereby submits Attachment (1), a request for relaxation from certain inspection requirements of Reference (a), Section IV.C(1)(b)(i).

Calvert Cliffs Nuclear Power Plant will begin a refueling outage for Unit 1 in early April 2004. Inspection of the reactor vessel head penetration nozzles, as required by Reference (a), is scheduled to begin shortly after the start of the refueling outage. To ensure adequate contingency planning, we request approval of the relaxation on or before March 31, 2004.

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

Very truly yours,

for
George Vanderheyden
Vice President – Calvert Cliffs Nuclear Power Plant

GV/JKK//bjd

Attachment

A101

cc: J. Petro, Esquire
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Resident Inspector, NRC
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S. D. Bloom, NRC

ATTACHMENT (1)

REQUEST FOR RELAXATION OF ORDER REQUIREMENT IV.C(1)(b)(i) FOR CALVERT CLIFFS NUCLEAR POWER PLANT UNIT 1

Calvert Cliffs Nuclear Power Plant, Inc.
January 30, 2004

ATTACHMENT (1)

REQUEST FOR RELAXATION OF ORDER REQUIREMENT IV.C(1)(b)(i) FOR CALVERT CLIFFS NUCLEAR POWER PLANT UNIT 1

RELAXATION REQUEST:

Pursuant to the procedure specified in Section IV.F (2) of Nuclear Regulatory Commission (NRC) Order EA-03-009, "Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors" (Reference 1), Calvert Cliffs Nuclear Power Plant, Inc. (CCNPP) hereby submits a request for relaxation from certain inspection requirements of the Order, specifically, the relaxation request involves two requirements in Section IV.C(1)(b)(i) of the Order as described below.

RELAXATION REQUEST 1:

A. Order Requirement from Which Relaxation is Requested:

Requirement in Section IV.C(1)(b)(i) of the Order for ultrasonic testing of each Reactor Pressure Vessel (RPV) head penetration nozzle (i.e., nozzle base material) from two inches above the J-groove.

B. Specific Penetration Nozzles for Which Relaxation is Requested:

In accordance with the requirements of the Reference (1), our plan calls for ultrasonic test (UT) examinations of 100% of the Calvert Cliffs Unit 1 head penetrations in the area above the J-groove welds. However, physical restrictions exist for some portion of the UT examinations. The Unit 1 head penetrations are similar to the Unit 2 head penetrations for which we received relaxation from the same requirements in Reference (2). Specifically, the control element drive mechanism (CEDM) penetrations have guide/thermal sleeves with a funneled-end installed inside the CEDM penetration to position the CEDM shaft. There is also a counterbore step above the J-groove weld. This results in an annular gap of approximately 0.175 inches that reduces to 0.123 inches. The thin "gap scanning" (blade) UT probe does not fit into the region where gap width decreases.

C. Justification for Relaxation Request:

Compliance with the requirements specified in this order would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Experience with the inspection of our Unit 2 RPV head, similar to the RPV head on Unit 1, confirms the inability to examine a full two inches above the J-groove weld for all scans of the CEDM nozzles using a blade probe.

The primary impediment to effectively examine to the full extent (two inches above the J-groove weld root) is the counterbore step on the inside diameter (ID) of the nozzle. At the counterbore, the annular gap between the guide sleeve and the penetration nozzle narrows, from approximately 0.175 to 0.123 inches. It is possible to permanently remove the guide/thermal sleeves, allowing the insertion of a rotating ultrasonic probe, instead of a blade probe, and attach a new guide funnel to the CEDM nozzle, to improve the scan of the nozzle. However, the additional work associated with this modification would result in an estimated accumulation of dose between 80 and 120 man-rem, extend the outage two to three weeks, and cost roughly $10,000,000, without providing enough relevant inspection information to constitute a commensurate increase in quality and safety.

The in-core instrument nozzles and the RPV head vent nozzle will be ultrasonically tested two inches above the J-groove weld. The number of other affected nozzles that cannot be fully inspected cannot be determined prior to the completion of the inspection, as experienced during the Unit 2 inspection. Where limitations exist that preclude the full examination coverage, the limitations will be noted and reported as requested by Section IV.E of Reference (1). Each nozzle exam consists of about 120 scans, and we anticipate that we can accomplish the UT inspection for the full distance of two inches above the weld on

most scans on every penetration. Access limitations are expected due to gap clearance limitations. The least coverage expected above the J-groove weld will be approximately 0.75 inches. The proposed inspection of all of the CEDM nozzles will provide an acceptable level of quality and safety. Inspection 0.75 inches above the top of the J-groove weld is sufficient to interrogate the nozzle base material for evidence of cracking. Primary water stress corrosion cracking is driven by the residual stresses from weld shrinkage. The stresses that drive primary water stress corrosion cracking decay rapidly above the weld as illustrated in Figure (1). In the region where most limitations to obtaining a full two-inch scan above the J-groove weld are expected, (the region for which CCNPP is seeking relaxation of the requirements provided in the Order), the nozzle material is constrained by the shrink fit. The shrink fit limits ovalization and dilation stresses caused by weld shrinkage. Hence no cracking is expected in the shrink fit region.

RELAXATION REQUEST 2:

A. Order Requirement from Which Relaxation is Requested:

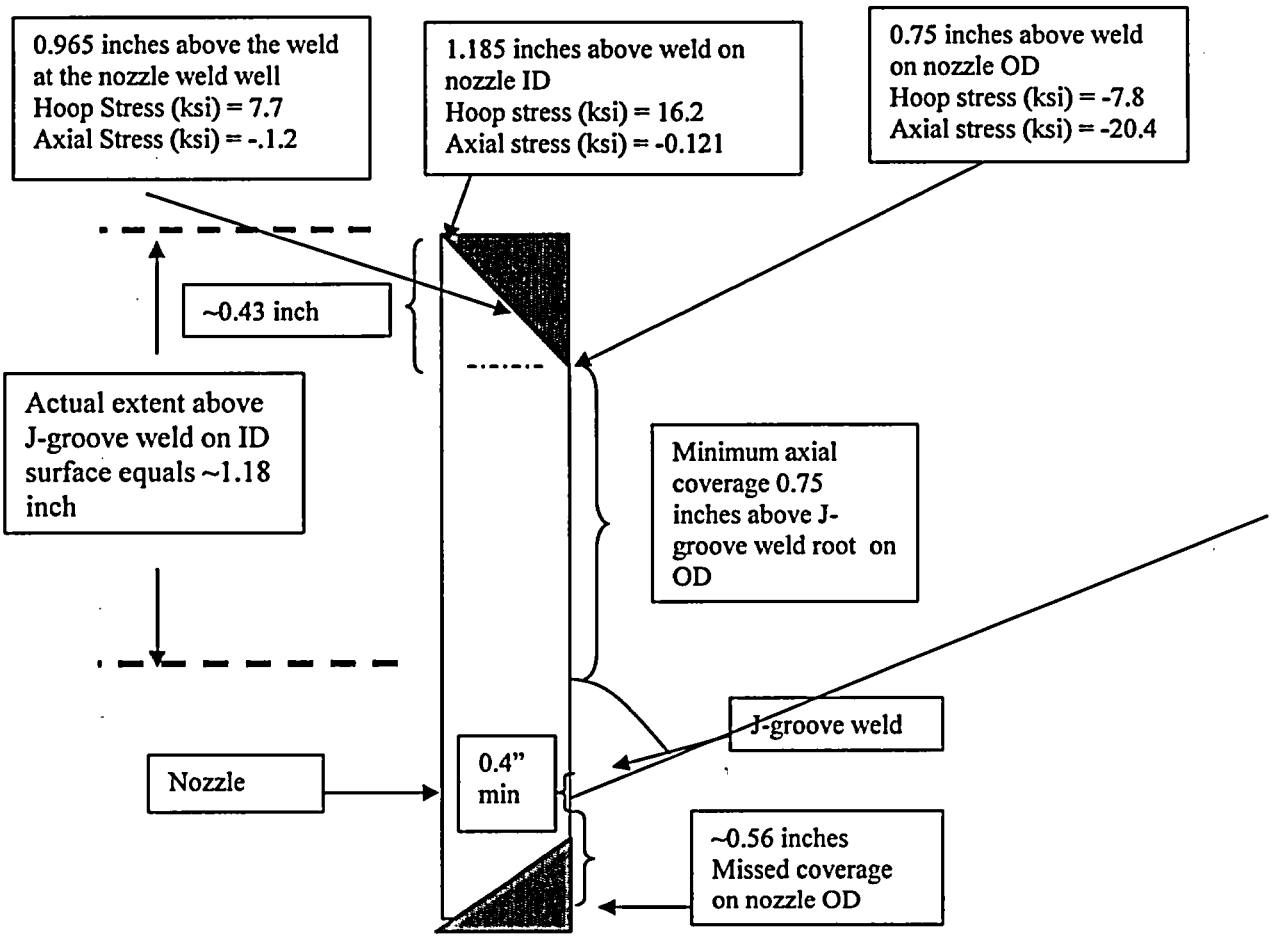
Requirement in Section IV.C(1)(b)(i) of the Order for ultrasonic testing of each RPV head penetration nozzle (i.e., nozzle base material) to the bottom of the nozzle, specifically, missed examination coverage near the bottom end of the CEDM nozzles due to instrument limitation. (Note: This relaxation request applies only to CEDM nozzles. The in-core instrumentation nozzles and vent line will be inspected using a rotating probe that does not have the limitations described for the blade probe.)

B. Specific Penetration Nozzles For Which Relaxation Is Requested:

This relaxation request applies to all CCNPP Unit 1 CEDM penetrations 1 through 65. The un-interrogated area at the bottom end of the CEDM nozzles is due to the configuration of the ultrasonic transducers in the probes used to examine the nozzles. These probes have separate transducers for sending and receiving the ultrasonic signal. The transducers are arranged one above the other nominally 0.86-inch apart. With this configuration, the lower transducer will not contact the inside wall on the nozzle until the upper transducer is inserted greater than approximately 0.86-inch into the nozzle. Since the scanning process requires that both transducers be in contact with the surface, the probe cannot scan the outer portion of the bottom of the nozzle. Based on the geometry involved in the transducer location and nozzle configuration, the portion that cannot be scanned is the portion extending from the bottom of the nozzle upward for a distance of approximately 0.56-inch. The value is half the distance between the two transducers plus a 1/8-inch radius at the bottom corner of the nozzle. The actual volume of unobtainable coverage is triangular in cross-section. The inside diameter of the nozzle receives relatively complete coverage (with a lateral wave), while the UT angle defines a triangle hypotenuse extending from the nozzle inside diameter lower end, to a spot on the nozzle outside diameter, located approximately 0.56-inch above the bottom of the nozzle. The other legs of the triangle are the lower portion of the nozzle outside diameter and the bottom surface of the nozzle. Figure (1) illustrates the un-interrogated area.

FIGURE 1

Bounding hoop and axial stresses at elevation of minimum coverage extent above the root of the J-groove weld.
(Stress values from 42.5° CEDM nozzle.)



During the 2003 inspection, the most limiting inspection area was the uphill side of nozzle 43. Coverage was limited to 0.95 inches above the weld. Reported stress values were based on finite element analyses (FEA) of the 42.5 degree nozzle, which bounds nozzle 43 (with regard to effects captured by the model). It is noted that the stress values presented in Figure 1 are lower then those originally provided with Figure 1 in our April 9, 3003 (Reference 3) submittal. The basis for these lower values is discussed in the paragraphs that follow.

Finite element analyses specific to Calvert Cliffs were originally performed in December 2001 to determine the operating stresses in the CEDM nozzles. Results from this finite element model were used to support both the original (Reference 3) and current submittals. However, for the current submittal,

improved post-processing of the FEA model results, were performed. A brief discussion of the original and improved post-processing is summarized as follows:

- Original Post-Processing. The original post-processing was based on model node numbering, and effectively treated a row of nodes running from the nozzle OD (outside diameter) to the nozzle ID as being at the same elevation. However, the FEA model's nodal mesh is such that nozzle nodes are "swept" at the nozzle set-up angle (i.e., the off-horizontal angle of the reactor vessel head ID at the location of the nozzle). Consequently, for a given row of nozzle nodes, the ID and OD nodal elevations are, in fact, offset vertically (and this offset increases as nozzle set-up angle increases, i.e., is most pronounced for nozzles closest to the head periphery). As a result, stresses originally reported for nozzle 43 at the nozzle ID above the weld on the uphill side were, in fact, actually at lower elevations (i.e., in closer proximity to the weld) and, consequently, higher values were used.

- Updated Post-Processing. The post-processing that is used to support the current submittal reports stresses based solely on the absolute elevation of each nozzle node. Consequently, stress values at both the nozzle ID and OD are reported as a function of absolute elevation (the absolute elevations of the top and bottom of the weld are also presented for clear comparison). This eliminates the effects of nodal mesh on reported results.

In summary, the current submittal presents more accurately reported results from the same FEA model that was used to support the April 2003 submittal (Reference 3). This improved post-processing (based on absolute elevation) shows that stresses computed by the model were lower than the values reported in the April 2003 submittal at the nozzle ID on the uphill side above the weld, at intended elevations.

C. Justification for Relaxation Request:

Compliance with the requirements specified in the Order would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Examination of the bottom of the nozzle could be accomplished by surface examination. However, this alternative has prohibitive surface worker dose implications without a commensurate increase in quality or safety. Removal of thermal guide sleeves to provide access for a rotating probe has similar dose implications that presents hardship with no commensurate increase in safety or quality.

The UT coverage area achieved provides an acceptable level of quality and safety because the un-interrogated area involves a portion of the nozzle at the very bottom, below the J-groove weld. Below the J-groove weld, the nozzle is essentially an open-ended tube and the nozzle wall in this portion is not part of the Reactor Coolant System pressure boundary. To determine the significance of an axial flaw that is contained in the non-pressure boundary nozzle material in the un-interrogated region of the nozzle, a flaw tolerance approach was used. A flaw evaluation was performed postulating an axial flaw at the bottom of the nozzle. A through-wall flaw could grow approximately 0.376 inches vertically during an additional two years of operation. Provided that the distance below the weld scanned with UT techniques exceeded 0.4 inches, no crack below this region could grow into the weld during the next two years of operations. Therefore, there is no possibility of leakage from an undiscovered flaw in the region for which relaxation is sought. Should we achieve examination of less than 0.4 inches, we will either justify a lower valve with an additional relaxation request or we will perform a surface examination of the nozzle.

CONCLUSION:

As described above, compliance with the Order requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Therefore, in accordance with the provisions of Section IV.F(2) of the Order, we request relaxation of the requirement described in Section IV.C(1)(b)(i).

REFERENCES:

(1) Letter from S. J. Collins (NRC) to Holders of Licenses for Operating Pressurized Water Reactors, dated February 11, 2003, "Issuance of Order Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors"(EA-03-009)

(2) Letter from S. A. Richards (NRC) to Mr. P. E. Katz (CCNPP), dated April 18, 2003, "Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2 – Relaxation of the Requirements of Order (EA-03-009), Regarding Reactor Pressure Vessel Head Inspections."

(3) Letter from R. E. Katz (CCNPP) to Document Control Desk (NRC), dated April 9, 2003, "Supplemental Data for Request for Relaxation from Certain Inspection Requirements in NRC Order (EA-03-009) for Reactor Pressure Vessel Head Penetration Nozzles," (TAC Nos. MB7752 and MB7753)