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January 20, 2003

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
Response to NRC Request for Additional Information Regarding ASME Section XI Relief Request to Use Alternative Techniques for Reactor Vessel Head Repair

REFERENCE: (a) Letter from Mr. C. H. Cruse (CCNPP) to Document Control Desk (NRC), dated February 7, 2002, ASME Section XI Relief Request to Use Alternative Techniques for Reactor Vessel Head Repair

By letter dated February 7, 2002 (Reference a), Calvert Cliffs Nuclear Power Plant, Inc. submitted an American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) relief request to be used in the event that flaws requiring repair in the reactor vessel closure head penetrations are discovered during inspections. This letter provides Calvert Cliffs Nuclear Power Plant's response to a January 6, 2003, verbal request from the Nuclear Regulatory Commission for additional information regarding that relief request. The requested information and our responses are contained in Attachment (1) to this letter.

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

Very truly yours,

Peter E. Katz

PEK/GT/bjd

Attachment: (1) Response to NRC Request for Additional Information

cc: J. Petro, 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

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ATTACHMENT (1)

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION

NRC Request 1:

In your December 18, 2002, response (Reference 1) to our November 6, 2002, request for additional information (Reference 2), you referred to an American Society of Mechanical Engineers (ASME) Section III analysis performed to demonstrate the structural integrity of the weld repair. Provide the results of that analysis and indicating the margin with respect to ASME Code allowables.

CCNPP Response:

As indicated in Reference (1), the Section III analysis demonstrated that the weld repair design meets the stress and fatigue requirements of the design code, ASME Code, Section III 1989 Edition, no Addenda. The Section III analysis consisted of a 3-D ANSYS finite element model of a penetration with the largest hillside angle. Thermal stresses were determined for the appropriate design transients and a fatigue analysis was performed. Design, emergency, faulted, and test conditions cases were evaluated and compared against the appropriate ASME Section III stress limits. The ASME Section III requirements were met as shown below:

Design Conditions

American Society of Mechanical Engineers Section III criteria contained in NB 3221.1, NB 3221.2 and NB 3221.3 were checked and had significant margins to allowables. The reactor vessel head was the location that had stresses with the least margin to the allowable and are listed below.

General Primary Stress Intensity (NB-3221.1) = 14.8 ksi < 1.0 Sm = 26.7 ksi

Local Membrane Stress Intensity (NB-3221.2) = 25.9 ksi < 1.5 Sm = 40.1 ksi

Primary Membrane + Primary Bending Stress Intensity (NB-3221.3) = 29.2 ksi < 1.5 Sm = 40.1 ksi

Emergency (Level C) and Faulted (Level D) and Test Conditions

Had larger margins of safety than Design Condition case.

Primary + Secondary Stress Intensity

Primary + Secondary Stress Intensity (NB3222.4) = 54.0 ksi < 3 Sm = 80.0 ksi

Fatigue Analysis

Cumulative fatigue usage factor = 0.997 < 1.0 (ASME Criteria)

NOTE: This is for 40 years of design transient cycles

NRC Request 2:

In your December 18, 2002, response (Reference 1) to our November 6, 2002, request for additional information (Reference 2), you referred to a fracture mechanics evaluation performed to demonstrate the acceptability of a triple point anomaly modeled as a 0.1-inch long indication. Provide the results of that analysis and indicating the margin with respect to ASME Code allowables.

CCNPP Response:

As indicated in Reference (1), a fracture mechanics analysis was performed to evaluate a 0.100" semi-circular flaw extending 360 degrees around the circumference at the "triple point" location where the Alloy 600 (original nozzle), the Alloy 52 weld and the low alloy steel head meet. The flaw is assumed to propagate in each of the two directions on the uphill and downhill sides of the nozzle. Flaw acceptance is based on the 1998 ASME Code Section XI criteria for applied stress intensity (IWB-3612) and limit load (IWB-3642). The results are summarized below and the flaw propagation paths are shown on the attached Figure.

The flaw evaluation results for 25 years of fatigue crack growth (FCG) are as follows.

Flaw Propagation Paths 1, 2, 5, and 6

a. FCG analysis of a continuous external circumferential flaw in weld:

Initial flaw size, $a_i = 0.100$ in.
Maximum final flaw size, $a_f = 0.112$ in.

Maximum stress intensity factor, $K_I = 13.3$ ksi$\sqrt{in}$
Fracture toughness, $K_{Ia} = 200$ ksi$\sqrt{in}$
Fracture toughness margin, $K_{Ia} / K_I = 15.0 > \sqrt{10}$

b. Limit load analysis for a continuous external circumferential flaw inweld:

Bounding axial tube load, $P = 21{,}606$ lbs
Limit load, $P_O = 108{,}697$ lbs
Limit load margins, $P_O / P = 5.03 > 3.0$

c. FCG analysis of a semi-circular external axial flaw in weld:

Initial flaw size, $a_i = 0.100$ in.
Maximum final flaw size, $a_f = 0.113$ in.

Maximum stress intensity factor, $K_I = 15.3$ ksi$\sqrt{in}$
Fracture toughness, $K_{Ia} = 200$ ksi$\sqrt{in}$
Fracture toughness margin, $K_{Ia} / K_I = 13.1 > \sqrt{10}$

Flaw Propagation Paths 3 and 4

FCG analysis of a semi-circular surface flaw at weld/head interface:

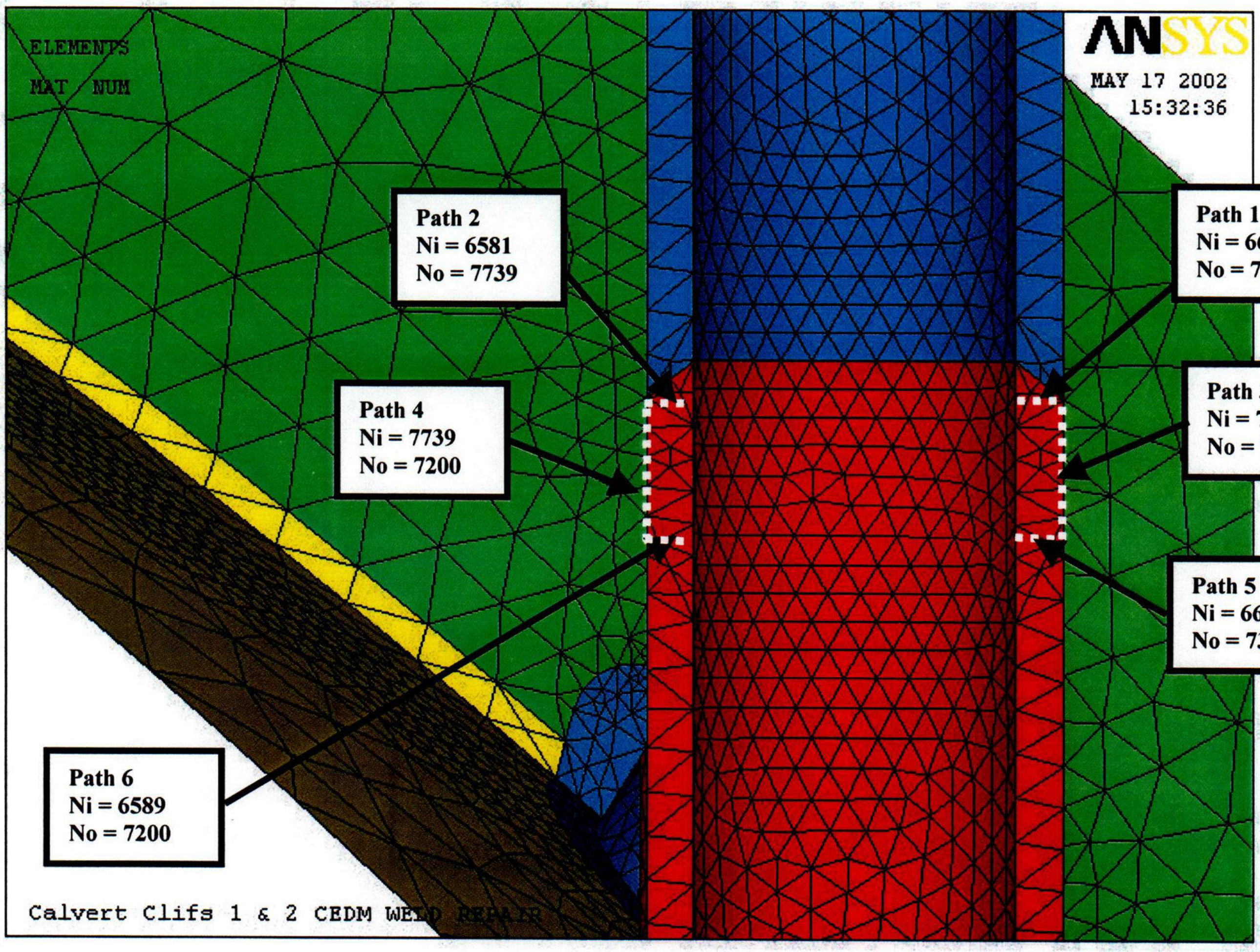
Initial flaw size, $a_i = 0.100$ in.
Maximum final flaw size, $a_f = 0.101$ in.

Maximum stress intensity factor, $K_I = 6.12$ ksi$\sqrt{in}$
Fracture toughness $K_{Ia} = 200$ ksi$\sqrt{in}$
Fracture toughness margin, $K_{Ia} / K_I = 32.7 > \sqrt{10}$

Therefore, the ASME Section XI requirements were met.

FIGURE 1
Crack Propagation Paths on the Finite Element Stress Model

Note: Paths 1, 3, and 5 are located on the downhill (0°) side of the nozzle and Paths 2, 4, and 6 are on the uphill (180°) side.



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