April 11, 2003

Mr. Alex Marion, Director of Engineering
Nuclear Energy Institute
1776 I Street, N.W., Suite 400
Washington, D.C. 20006-3708

SUBJECT: FLAW EVALUATION GUIDELINES

Dear Mr. Marion:

Enclosure 2 to the letter from Jack Strosnider to you dated November 21, 2001, contained flaw evaluation guidelines for control rod drive mechanism (CRDM) penetrations. These guidelines were developed by the Office of Nuclear Reactor Regulation (NRR) staff and were needed since no guidance or rules existed in the American Society of Mechanical Engineers (ASME) Code, Section XI to evaluate flaws found in the CRDM pressure boundary. While these guidelines have fulfilled a need, subsequent interactions with the industry and further information from multiple sources have rendered these guidelines obsolete. This situation was recognized in Footnote 1 to the February 11, 2003, NRC Order EA-03-009 establishing interim inspection requirements for reactor pressure vessel heads at pressurized water reactors. Footnote 1 states in part, "...The NRC has issued guidance to address flaw evaluations for RPV head penetration nozzles (see letter from J. Strosnider, NRC, to A. Marion, Nuclear Energy Institute) and will, as necessary, issue revised guidance pending the updating of the ASME code and related NRC regulations."

Attached to this letter as Enclosures 1 and 2 is revised guidance that is generally consistent with the recently approved action by Section XI at their meeting in San Francisco on February 27, 2003. That action consisted of a Code addition and an enabling Code Case to establish rules for flaw evaluation for PWR reactor vessel upper head penetration nozzles. The NRR staff, through their representation on the cognizant Section XI groups and committees, participated in the development and approval of these new flaw evaluation rules. Publication of the Code addition and Code Case and subsequent formal approval by the NRC will take time. In the interim, the staff intends to reference these guidelines in interactions with licensees during the current and future outage seasons. Note that we have modified the flaw acceptance criteria of Table 1 in Enclosure 1. Any plant specific considerations can be discussed with the staff as appropriate.

As additional information becomes available, further development or changes to these guidelines can be anticipated. The staff contact for flaw evaluation issues is Keith Wichman who can be reached at (301) 415-2785. Your continued cooperation is appreciated.

Sincerely,

/RA/
Richard Barrett, Director
Division of Engineering
Office of Nuclear Reactor Regulation

Enclosures: As stated

cc: See next page

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FLAW EVALUATION GUIDELINES AND ACCEPTANCE CRITERIA FOR PWR REACTOR VESSEL UPPER HEAD PENETRATION NOZZLES

PWR reactor vessel upper head penetration nozzles containing flaws may be evaluated to determine acceptability for continued service in accordance with the evaluation procedure and acceptance criteria specified herein. Application of the evaluation procedures shall be subject to review and approval by the U.S. Nuclear Regulatory Commission (NRC).

Scope

This evaluation procedure is applicable to upper head penetration nozzles with eight inch (200 mm) nominal outside diameter and less. This procedure shall not be used for J-groove welds.

Evaluation Procedure

- The acceptance standards of IWB-3500 of Section XI of the ASME Code (herein after referred to as Section XI) shall not be used to accept flaws in this region.

- A flaw growth analysis shall be performed on each detected flaw to determine its maximum growth due to fatigue, stress corrosion cracking or both mechanisms, when applicable, during a specified evaluation period. The minimum time interval for the flaw growth evaluation shall be until the next inspection.

- All applicable loadings shall be considered, including weld residual stress, in calculating the crack growth.

- The flaw shall be characterized in accordance with the requirements of IWA-3400 of Section XI including the proximity rules of Fig. IWA-3400-1 for surface flaws.

- The flaw shall be projected into both axial and circumferential orientations, and each orientation shall be evaluated. The axial orientation is the same for each nozzle, but the circumferential orientation will vary depending on the angle of intersection of the penetration nozzle with the head. As illustrated in Fig. I, any flaws within $\pm 10^\circ$ of the plane formed by the J-groove weld root shall be considered pure circumferential flaws.

- The location of the flaw, relative to both the top and the bottom of the J-groove attachment weld, shall be determined.

- The flaw shall be evaluated using analytical procedures, such as those described in Appendix A (Enclosure 2), to calculate the following critical flaw parameters:

  a_f = the maximum depth to which the detected flaw is calculated to grow at the end of the evaluation period

  l_f = the maximum length to which the detected flaw is calculated to grow at the end of the evaluation period.

Acceptance Criteria

The calculated maximum flaw dimensions at the end of the evaluation period shall be compared with the maximum allowable flaw dimensions in Table I.

Table I Reactor Vessel Upper Head Penetration Nozzle Acceptance Criteria[1] [3]

Location	Axial		Circumference	
	a_f	l_f	a_f	l_f
Below Weld (ID)[2]	t	No Limit	t	0.75 Circ. (4)
At and Above Weld (ID)	0.75 t	No Limit	repair	repair
Below Weld (OD) [2]	t	No Limit	t	0.75 Circ. (4)
At and Above Weld (OD)	repair	repair	repair	repair

Notes:
(1) Surface flaws of any size in the attachment weld are not acceptable.
(2) Intersecting axial and circumferential flaws in the nozzle are not acceptable.
(3) t = wall thickness of head penetration nozzle
(4) 75 percent of the circumference

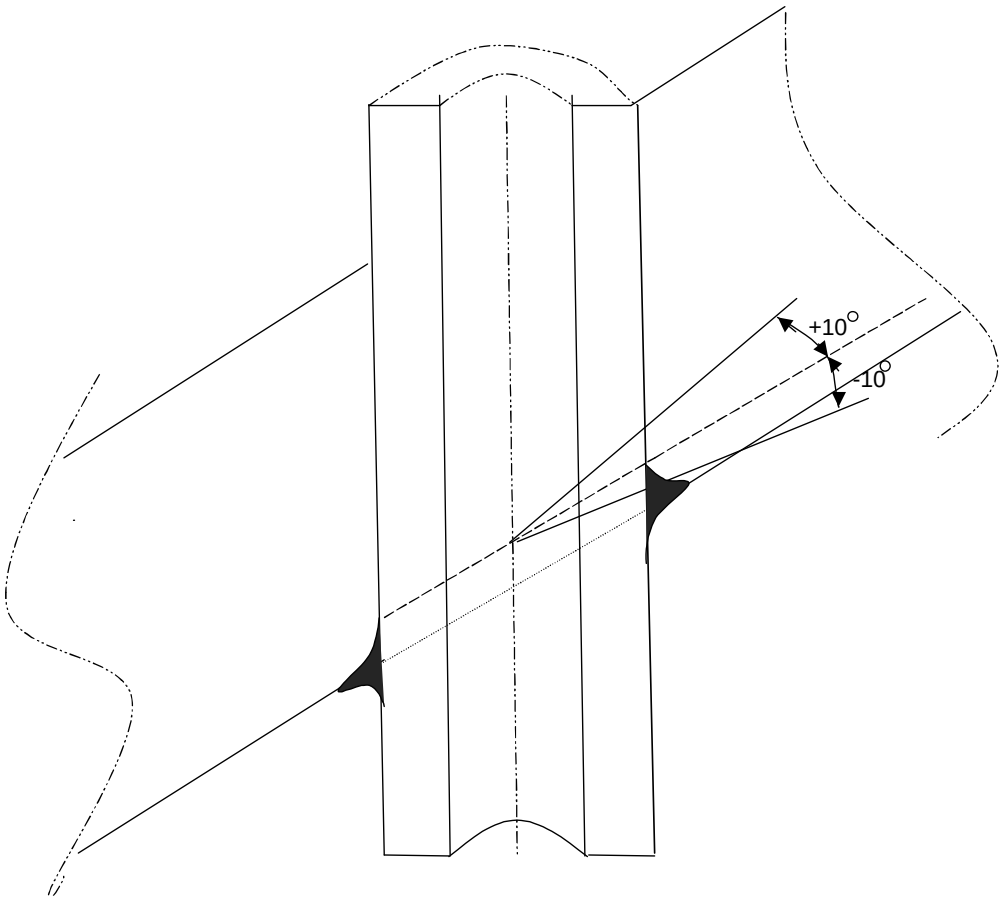

Fig. I Definition of Circumferential Orientation for Flaw Characterization

Note: Planar flaws within +/- 10° of the plane formed by the J-groove weld root, shown as the dashed line, shall be considered circumferential flaws.