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10 CFR 50.55a

ATTN: Document Control Desk
United States Nuclear Regulatory Commission
Washington, D. C. 20555-0001

SUBJECT:
Davis-Besse Nuclear Power Station, Unit 1
Docket No. 50-346, License No. NPF-3
Response to Request for Additional Information Regarding Summary of Design and Analyses of Weld Overlays for Pressurizer and Hot Leg Nozzle Large Bore Dissimilar Metal Welds (TAC No. MD8105)

By correspondence dated February 8, 2008, FirstEnergy Nuclear Operating Company (FENOC) submitted a summary of design and analyses of weld overlays for pressurizer and hot leg dissimilar metal welds at the Davis-Besse Nuclear Power Station. The submittal satisfied part of the commitment provided in Relief Request RR-A30, Revision 2, submitted by letters dated February 15, 2007, June 28, 2007, September 28, 2007, and November 19, 2007. By letter dated June 20, 2008, the Nuclear Regulatory Commission (NRC) staff requested additional information to complete its review. The attachment provides responses to the NRC staff's questions.

There are no regulatory commitments contained in this letter. If there are any questions or if additional information is required, please contact Mr. Thomas A. Lentz, Manager – Fleet Licensing, at (330) 761-6071.

Sincerely,

Barry S. Allen

Attachment: Response to Request for Additional Information Regarding Summary of Design and Analyses of Weld Overlays for Pressurizer and Hot Leg Nozzle Large Bore Dissimilar Metal Welds

cc: NRC Region III Administrator
NRC Resident Inspector
NRR Project Manager
Utility Radiological Safety Board

A140
A047
NRR

Attachment
L-08-233

Response to Request for Additional Information Regarding
Summary of Design and Analyses of Weld Overlays for
Pressurizer and Hot Leg Nozzle Large Bore Dissimilar Metal Welds

To complete their review, the Nuclear Regulatory Commission (NRC) staff has requested additional information regarding the summary of design and analyses of weld overlays for pressurizer and hot leg nozzle large bore dissimilar metal welds for Alloy 600 mitigation. The FirstEnergy Nuclear Operating Company (FENOC) response for Davis-Besse Nuclear Power Station (DBNPS) to this request is provided below. The NRC question is presented in bold followed by FENOC's response.

1. **In Table 2-3, the licensee shows that the time for a postulated circumferential flaw to reach the design basis flaw size for the hot leg surge nozzle weld and hot leg decay heat nozzle weld are 2.58 years (31 months) and 6 years, respectively. The postulated flaw is 75 percent through wall and the design basis flaw is 100 percent through wall of the original alloy 82/182 weld. RR [Relief Request]-A30, Revision 2, requires that the overlaid dissimilar metal welds be inspected during the first or second refueling outage after the overlay installation. If no indication is detected, the weld will be included in a sample population. Twenty-five percent of the sample population will be inspected every 10 years. The NRC staff notes that once the weld overlay is installed, the current ultrasonic examination is not qualified to inspect the inner 75 percent of the wall thickness of the dissimilar metal weld.**

   (a) **The staff is concerned that the 10-year inspection interval may be inadequate (i.e., too long) to monitor the structural integrity of the hot leg surge nozzle weld and hot leg decay heat nozzle weld. If an actual flaw exists, it may grow to the design basis flaw size (i.e, 100 percent through wall of the weld) in less time than the inspection interval. If the actual flaw is caused by fatigue, the 100 percent through wall flaw may grow into the weld overlays of the subject welds. If the flaw is caused by primary stress corrosion cracking, it may be blunt by the weld overlays. If not blunted, it may grow into the weld overlays also. Discuss the adequacy/effectiveness of the 10-year inservice inspection frequency for these two welds.**

   Response:

   A 10-year inspection interval is not used to monitor the structural integrity of the hot leg surge nozzle weld overlay. Based on the crack growth

results, FENOC decided not to place the hot leg surge nozzle weld overlay into the standard inspection interval of 25% of the sample population every 10 years. This weld is scheduled for examination at a time that is less than the time for the postulated 75% through wall flaw to reach the weld overlay. Presently, the hot leg surge nozzle weld overlay is scheduled for examination every refueling outage, which is every 2 years.

As part of the hot leg decay heat nozzle weld crack growth reanalysis referred to in Item 1(e), the flaw growth duration was extended. The original analysis conservatively used a higher design temperature for the crack growth rate evaluation. The new analysis uses a more realistic lower temperature that more accurately reflects the temperature at the hot leg decay heat nozzle location. This lower temperature results in reduced crack growth rates, which resulted in the crack growth duration for the hot leg decay heat nozzle increasing. The crack growth durations for all flaws were determined to be greater than 10 years. Therefore, a 10-year inspection interval is adequate for this weld. Presently, the hot leg decay heat nozzle weld overlay is scheduled for examination every 10-year inspection interval.

(b) Because the postulated circumferential flaw is predicted to reach the design basis flaw size in less time than the inspection interval, discuss whether an analysis was performed to predict how far the flaw would grow into the weld overlay at the end of the 10 year inspection period. If not, provide the technical basis to support the structural integrity of the subject welds.

Response:

As noted in the response to (a), the inspection interval for the hot leg surge nozzle weld was based on the time for the postulated 75% through wall flaw to reach the weld overlay. Therefore, an analysis to predict how far the flaw would grow into the weld overlay at the end of the 10-year inspection interval was not performed.

As noted in response to item (a), the crack growth durations for all flaws in the hot leg decay heat nozzle weld were determined to be greater than 10 years. Therefore, a 10-year inspection interval is adequate for this weld.

(c) Table 2-3 shows that the time for the postulated circumferential flaw and axial flaw to reach the design basis flaw size for the two pressurizer relief nozzles (i.e., the 3-inch nozzle and 2.5-inch nozzle) is the same (> 60 years). However, for other nozzles (e.g., pressurizer surge and spray nozzles, hot leg surge and decay heat nozzles) the time for the circumferential and axial flaw to reach the design basis flaw size is much different. Discuss why for the pressurizer 2.5 and 3-inch relief nozzles the time period is the same.

Response:

In the fatigue crack growth analyses, design cycles representing 60 years of service for each applied transient were assumed. Because the calculated crack growth durations for the pressurizer 2.5-inch and 3-inch relief nozzle circumferential and axial flaws exceeded the assumed design cycles for 60 years, both durations are indicated in the report as > 60 years.

(d) Discuss the analytical input parameters and degradation mechanisms that cause the circumferential flaw to reach the design basis flaw size for the pressurizer surge nozzle, pressurizer spray nozzle, hot leg surge nozzle, and hot leg decay heat nozzle. Discuss why the time for the circumferential flaw to reach the design basis flaw size is a much shorter time than the axial flaw in the hot leg surge nozzle, hot leg decay heat nozzle, pressurizer surge nozzle, and pressurizer spray nozzles.

Response:

There are many factors that go into the calculation of crack growth durations including loads, geometry, thermal transients, and residual stress due to the overlay. The weld overlay thickness affects the compressive residual hoop stresses, which influences axial flaw crack growth rates, and the weld overlay length affects the compressive axial residual stresses, which influences the circumferential flaw crack growth rates. Weld overlay length is typically limited by nozzle configurations and obstructions such as nozzle slope and elbow intrados. The reduced weld overlay length reduces the benefit of axial residual stresses (stresses will be less compressive), which results in increased circumferential flaw crack growth rates, and shorter durations than a weld overlay for which length is not limited. However, the ability to place sufficient overlay thickness to produce compressive residual hoop stresses is typically not limited. As a result, the time for a circumferential flaw to reach the design basis flaw size may be less than that for an axial flaw.

(e) In a letter dated February 5, 2008, the licensee reported an axial flaw that caused leakage in the hot leg decay heat nozzle during welding of the overlay. Discuss whether this flaw was used in the stress analysis. If not, provide the reason for not modeling the actual flaw in the analysis.

Response:

The hot leg decay heat nozzle axial flaw was repaired prior to placement of the weld overlay. A revised crack growth analysis of the subject overlay was performed. This analysis considered the as-left condition following overlay application and ultrasonic examination of the weld overlay and outer 25% of the base metal. Therefore, the revised stress analysis does take into account the reported axial flaw in the hot leg decay heat nozzle.