From: <sepelakb@firstenergycorp.com>
To: "Lawrence Burkhart" <LJB@nrc.gov>
Date: 6/8/01 1:23PM
Subject: Revised Response to S/G RAI

The attached file is the revised response to the S/G RAI. Changes made to the first draft response are shown by rev bars.

(See attached file: attachment to L-01-073.doc)

Letter L-01-073 - Attachment A

NRC Request for Additional Information

In Section 3.6.7.3 (U-Bend Fatigue Evaluation) of Enclosure 1 of L-01-006, the licensee stated that "...a preliminary assessment indicates that the existing 40-percent through wall plugging criterion for steam generator tubes will remain adequate. FENOC will perform a calculation to substantiate the adequacy of the plugging criterion..." The licensee needs to discuss its preliminary assessment and pending calculation regarding the adequacy of the 40-percent through-wall plugging criterion under the power uprate conditions.

FENOC Response

At Beaver Valley Power Station, the 40% plugging criterion is applied only to anti-vibration bar (AVB) wear and cold leg thinning (CLT) degradation. All other degradation mechanisms are repaired on detection or per the requirements of tube support plate outside diameter stress corrosion cracking (ODSCC) alternate repair criteria. As previously committed to in L-01-006, calculations will be performed prior to increasing power above 2652 MWt to provide a formal revalidation of the 40% repair criterion. The preliminary assessment of the 40% plugging criterion is summarized in Section 3.6.7.5 of Enclosure 1 of L-01-006 and is supplemented with the information in the following paragraphs.

Cold leg thinning is related to flow stagnation conditions in the region of the lower peripheral tube support plate regions and localized chemistry conditions. The increase in operating temperature and changes in hydraulic conditions due to uprating are minimal. Therefore, changes in localized crevice chemistry will be insignificant. When considering these factors, the 1.4% uprating will have a negligible impact on cold leg thinning initiation or growth. Cold leg thinning degradation initiation and growth are included in the steam generator assessment/inspection program, and any changes in the rates will be evaluated in the condition monitoring/operational assessment reports. Unlike Unit 1, where cold leg thinning is an active degradation mechanism, no cold leg thinning indications have been reported at Unit 2. The condition monitoring and operational assessment process will continually re-validate the 40% repair limit following the uprating, once inspection data is available at the uprated conditions.

Experience with upratings at other plants has shown that a significant increase in steam flow (>5%) and a significant decrease in steam pressure (>100 psi) can potentially impact the flow-induced tube vibration and result in increased wear at the tube-AVB intersection sites. However, the 1.4% uprating only slightly increases the steam flow rate (1.6%) and slightly decreases the steam pressure. Therefore, the 1.4% uprate will have a negligible impact on the projected AVB wear rate and will not significantly impact future tube wear at the AVB sites. In the unlikely event that AVB wear rate does increase, there remains sufficient margin to detect this condition and effect repairs under the existing inspection/assessment program.

NRC Request for Additional Information

In Section 3.6.7.5 (Inspection Program and Tube Repair Criteria) of Enclosure 1 of L-01-006, the licensee discussed the impact of the power uprate on steam generator tube degradation mechanisms such as anti-vibration bar wear and degradation at the tube support plate intersections. As discussed in the licensee's inspection reports and phone calls, the following degradation was identified in Beaver Valley Unit 1 during the tube inspection performed in the Spring 2000: primary water stress corrosion cracking (PWSCC) in row 1 U-bend, PWSCC at the top of the tubesheet, outside diameter stress corrosion cracking (ODSCC) in the sludge pile region, ODSCC at the tube support plate intersections, and cold leg thinning. The following degradation was identified in Beaver Valley Unit 2 during the inspection performed in the Fall 2000: anti-vibration bar wear, ODSCC at tube support plate intersections, outside diameter degradation at the top of the tubesheet. The licensee needs to discuss the impact of the power uprate on those degradation mechanisms that were not discussed in the January 18, 2001, submittal.

FENOC Response

Besides anti-vibration bar (AVB) wear, tube support plate outside diameter stress corrosion cracking (ODSCC) and cold leg thinning, both Beaver Valley Power Station steam generators have experienced stress corrosion cracking (SCC) degradation that includes sludge pile and expansion transition ODSCC, expansion transition primary water stress corrosion cracking (PWSCC), and small radius U-bend PWSCC.

Initiation and growth of stress corrosion cracking degradation mechanisms are significantly influenced by temperature. The increase in T_{HOT} due to the 1.4% uprating is relatively insignificant ($< 1.0^0$ F) and is expected to have a negligible impact on SCC initiation and/or growth. As stated in Enclosure 1 of L-01-006, the steam generator inspection program will include consideration of increases in T_{HOT} in crack growth rate analyses. Observed changes in degradation initiation and growth will be integrated into the operational assessments that are prepared following each steam generator inspection.

Chemistry conditions can also influence SCC initiation and growth. There are no planned changes to the primary or secondary water chemistry regimes associated with the 1.4% uprating. Additionally, there are no significant effects of the 1.4% uprating on primary or

secondary water chemistry conditions that would adversely affect steam generator tube degradation. Again, any observed change in steam generator tube degradation initiation or growth would be integrated into the operational assessments performed following each steam generator inspection.

A limited number of tubes at both units have exhibited wear from loose parts. However, changes in hydraulic conditions associated with the 1.4% uprating are not expected to have an adverse effect on steam generator tubes affected by loose parts wear. Assurance that no adverse effects are experienced is provided by revalidation of the existing loose parts wear analysis.

All degradation mechanisms identified during an inspection are evaluated in the condition monitoring and operational assessments. An integral part of a comprehensive assessment is an understanding of the causes of degradation and the actions necessary to either mitigate the degradation or provide other compensatory measures to ensure structural integrity will be maintained. The Beaver Valley Power Station degradation, condition monitoring and operational assessments will consider and address changes in degradation mechanism initiation and growth that could arise following the uprate in rated thermal power. Observed changes will be evaluated for association with potential effects related to the uprating. Expansion of inspection sampling plans and repairs will be implemented if the results of condition monitoring and/or operational assessments warrant such changes. The operational assessments will demonstrate continued steam generator tube structural integrity at the uprated conditions.

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