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SUBJECT: Forwards response to NRC request for addl info re inservice testing program relief request & rev to previous submittal deleting portion of request for relief on accuracy of vibration amplitude measurements.

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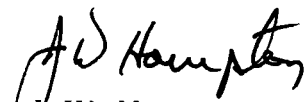
Subject: Oconee Nuclear Station, Units 1, 2, and 3
Docket Nos. 50-269, -270, -287
Reply to request for information on IST Relief Request

Gentlemen:

Please find attached (Attachment 1) Reply To Request For Additional Information On Oconee Nuclear Station Relief Request and (Attachment 2) a revision to the previous submittal that deletes the request for relief from the requirements of IWP-4520(b). The reasons for deleting this portion of the request for relief are supplied in Attachment 1 under item 2.

Should you have further questions, please feel free to contact M.E. Patrick at (803) 885-3292.

Very truly yours,


J. W. Hampton
Vice President

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Attachments

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March 19, 1992
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xc: (W/Attachments)

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Office of Nuclear Reactor Regulation
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Mr. P. E. Harmon
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Oconee Nuclear Station

ATTACHMENT I

Oconee Nuclear Station

REPLY TO REQUEST FOR ADDITIONAL INFORMATION ON

OCONEE NUCLEAR STATION RELIEF REQUEST

1. a) Discuss the difference in the instruments used for velocity and displacement measurements and the bases for differences in the accuracy for each instrument.

Answer:

The same vibration analyzer is used to take velocity and displacement measurements. The increased error in displacement is due to the instrument performing double integration on the signal. The instrument that is used is a Computational Systems Incorporated (CSI) Digital Vibration Analyzer Model 2110 with an accelerometer used as the transducer. Acceleration is the primary measurement from the accelerometer. The CSI Model 2110 integrates the signal to obtain velocity and displacement. Velocity requires a single integration and displacement requires a double integration.

1. b) Discuss whether the error introduced in the instrument readings could mask a degraded pump or cause a good pump to be declared inoperable by stretching or compressing the ASME Code Section XI allowable range. Provide the bases for the acceptability of the proposed instrument accuracies addressing the need for inservice testing to assess the operational readiness and detect degradation. Also, state and discuss whether instrumentation that meets Code accuracy is readily available for acquisition and field use.

Answer:

An accuracy statement of $\pm 7.37\%$ of "reading" is in most cases more accurate than the vibration accuracy requirement of IWP. IWP requires vibration instrument accuracy to be $\pm 5\%$ of "full-scale" and requires the full-scale range to be 3 times the reference value or less. Therefore IWP allows accuracy to be $\pm 15\%$ of "reading" at the reference value and greater than $\pm 15\%$ of "reading" at less than the reference value. There is not a significant difference in the total accuracy in the use of the digital versus accuracy allowed by code when comparing percent of "reading", instead of percent "full-scale". The use of digital vibration instrumentation allows for enhanced vibration monitoring and a better ability to monitor mechanical condition of a pump or detect degradation. Using digital vibration instrumentation enables spectral, waveform, and trend data to be used to analyze the condition of a suspect component. The benefits of enhanced monitoring more than compensate for slightly degraded accuracy. To the best of our knowledge, we are using the best equipment available for field use. Computational Systems Incorporated (CSI) has performed comparisons on other equipment and has assured us that they provide the best available equipment in the area of vibration analysis. The total predictive maintenance program, including vibration monitoring, at Oconee Nuclear Station was awarded second place in a nationwide predictive maintenance contest.

1. c) Discuss the basis for selecting displacement measurement acceptance criteria in lieu of the more accurate velocity data, particularly for pumps operating at 600 rpm or greater. Also, discuss if and how instrumentation inaccuracy beyond Code allowable limits are evaluated along with the acceptance criteria during the final data review.

Answer:

Displacement was selected for acceptance criteria due to current Code requirements as defined by Table IWP-3100-2. Displacement and velocity readings are taken at every measurement point and are documented in the test procedure. Velocity readings are reviewed by the Accountable Systems Engineer, however, no acceptance criteria is defined. No evaluation of instrumentation inaccuracy beyond Code allowable limits is currently performed during the final data review. It is our stand that the vibration program we have exceeds that defined in IWP Code, although some discrepancies exists between the two.

2. Discuss the basis or rational for not calibrating the instrumentation in order to include the lower frequency response range (<600 RPM). Also, discuss the assumed instrument accuracy and repeatability and the bases for these assumptions for measurements made in the lower frequency response range. Further, discuss the licensee's experience and confidence in the validity of these measurements.

Answer:

An accelerometer is used as the transducer for the CSI Model 2110 Vibration Analyzer. The shaft speed of the slowest pumps that are tested in the IWP program with the aforementioned vibration analyzer and accelerometer are the Low Pressure Service Water Pumps that operate at ~900 RPM (15 hz). Thus, half rotational speed would be 7.5 hz. At the time the relief request was submitted, 10 hz was the minimum frequency achievable by our standards lab. It is now possible to calibrate the accelerometer from 5 to 1000 hz. Future calibrations will reflect this widened band.

ATTACHMENT 2

Oconee Nuclear Station

8.

- (a) REQUIREMENTS: IWP-4110 requires the accuracy of vibration amplitude measurements to be $\pm 5\%$ of full scale and IWP-4120 requires the full-scale range of vibration instrumentation to be three times the reference value or less.
- (b) REASON: Experience has shown that measuring vibration as required by IWP is not the most effective way to determine the mechanical condition of a pump. In order to better determine the mechanical condition of pumps, multiple vibration displacement measurements will be obtained/evaluated and supplemented with velocity measurements. Also, spectral analysis will be used to evaluate vibration data when necessary. In order to facilitate this testing, digital vibration instrumentation will be used.

IWP does not provide adequate guidance or requirements for performing enhanced vibration monitoring, nor does it provide the ability to use state-of-the-art digital vibration instrumentation that is required for enhanced monitoring.

- (c) PROPOSED TESTING: In lieu of the vibration instrument accuracy requirements of IWP-4110, the loop accuracy of vibration instruments will be $\pm 6.56\%$ of reading for velocity and $\pm 7.37\%$ of reading for displacement. This accuracy is the best that can be reasonably obtained from state-of-the-art instrumentation that must be used to perform the enhanced testing. (The requirements of IWP allow vibration inaccuracies of greater than $\pm 15\%$ of reading.)

In lieu of the range requirements imposed on vibration instrumentation by IWP-4120, there will be no vibration instrumentation range requirement (digital vibration instrumentation is auto-ranging). It is not necessary to have a range requirement because the accuracy stated above and the readability of a digital gauge are not dependent upon instrument range.

In addition to vibration requirements of IWP-4510 which state that at least one peak-to-peak displacement amplitude be measured, peak-to-peak displacement and peak velocity will be measured at multiple points as defined per the test procedure. Multiple point measurements provide enhanced evaluation of overall machine condition. Acceptance criteria will be based on displacement as defined in Table IWP-3100-2. Although velocity vibration data will not have any acceptance criteria, the accountable engineer will review the data during the final procedure review. For high speed pumps, vibration velocity provides a better indication of machine mechanical condition.