



Watts Bar Nuclear Plant (WBN)  
Pre-submittal Meeting for Inservice Testing (IST) Program  
Request for Relief from Increased Frequency Testing of  
Residual Heat Removal (RHR) Pump 1B-B

July 28, 2020

# Agenda

- Introduction
- Pump Test History and Trends
- Assessment of Pump Condition
- Corrective Actions
- Description of Hardship
- Adequacy of Alternative Testing
- Schedule for Submittal

# Introduction

- Purpose of the meeting is to provide information for a planned request for relief due to hardship from the OM Code requirement to perform increased frequency testing of the WBN Unit 1 RHR 1B-B comprehensive pump test.
- This presentation summarizes the following:
  - Pump design
  - Pump test history and trends
  - Assessment of pump condition
  - Corrective actions
  - Description of hardship
  - Adequacy of alternative testing



# Pump Design

- RHR Pump 1B-B is a vertically mounted centrifugal pump with the pump impeller attached to the motor shaft.
- There are no bearings in the pump bowl area (only in the motor).
- The pump motor does not have its own support foundation or structure. The pump bowl is attached to a support table structure in three locations as shown in the following photos.













# Pump Test History and Trends

- Group A test vibration reference values at 700 gpm are higher than the comprehensive pump test (CPT) vibration reference values at 4262 gpm.
- Pump hydraulic values for both Group A and CPT are in the acceptable range with no adverse trend.
- Slightly elevated vibration levels<sup>1</sup> were first noticed in May 2018 during quarterly Group A pump testing.
- In October 2018 (U1R15 refueling outage), vibration levels were also slightly elevated during the CPT.

*1. Vibration measurement locations are on the pump motor. Vibration locations beginning with A are outboard (upper portion) and those beginning with B or inboard (lower portion nearest pump). The locations are marked and some may be seen in the photos).*

# Pump Test History and Trends (continued)

- After the U1R15 refueling outage, vibration levels on the quarterly Group A test exhibited a step change and plateaued except location A-H which increased just prior to U1R16 (May 2020).
- During the U1R16 refueling outage, vibration levels during the CPT vibration levels at four of the five locations exhibited an increase in level from the U1R15 CPT with locations A-H and A-V both entering the alert range.
- The quarterly Group A test on June 8, 2020 showed one vibration location with a step increase in level, one location with marked decrease in level, and the other three locations with slight increase in levels.

# Assessment of Pump Condition

- Troubleshooting of vibration levels of the pump/motor and associated support structure was performed during U1R16 refueling outage with the pump operating in RHR shutdown cooling mode at a flow rate near the CPT value.
- Identified some evidence of “looseness” in the support structure and indications were noted such as cracked and missing paint near certain mechanical fasteners on the northeast side of the support structure that indicated the framing had shifted.



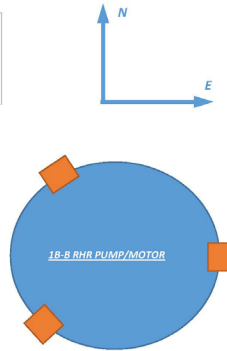
**NORTH EAST FOOT**

Cross Channel Phase Between Foot and Base : -158 deg(UNSAT)  
Foot(Vertical) : 0.048 in/sec  
Base(Vertical): 0.042 in/sec



**SOUTH EAST FOOT**

Cross Channel Phase Between Foot and Base : -8 deg(SAT)  
Foot(Vertical) : 0.044 in/sec  
Base(Vertical): 0.044 in/sec



**EAST FOOT**

Cross Channel Phase Between Foot and Base : -5 deg(SAT)  
Foot(Vertical) : 0.042 in/sec  
Base(Vertical): 0.043 in/sec



DATE COLLECTED: 5/27/20 by Jason Weaver, Ross Horvat, and Joshua Curtis

**PDM COMMENTS**

- The East Foot appeared to have no movement between the foot and Structural Base. The vibration difference between the two points is negligible.
- The South East Foot appeared to have no movement between the foot and Structural Base. The vibration difference between the two points is negligible.
- The North East Foot appeared to have some movement between the foot and Structural Base due to the phases being 158 degrees different. The vibration difference between the two points, in comparison, is much different than the East and South East feet. This foot appears to be less secure than the other two feet.

# Assessment of Pump Condition (continued)

- Spectral analysis of the vibration data did not identify any trend that points to a degrading bearing condition but the overall amplitude has experienced a slight increasing trend.
  - No bearing fault frequencies are present
  - No evidence of shaft rubbing
- Bearing oil analyses performed in December 2019 and May 2018 were compared.
  - No moisture present.
  - Viscosity, wear metals, and chemistry values were all within normal operating ranges.
  - Iron content rose from 30 to 53 ppm, likely due legacy material or content drawn into sample via the sampling pathway.

# Corrective Actions

- Another Group A test was performed on June 24, 2020, and the following actions were taken:
  - While the pump was running at the Group A test flow rate.
  - Vibration levels were monitored, and
  - Bolting of the support structure was re-torqued in the area that had shown evidence looseness / slippage.
- There was no appreciable change in vibration level after re-torquing of the support structure.
- Three of the five monitored bearing locations/directions (A-H, A-A, and B-H) exhibited an increase from the June 8, 2020, Group A test.



# Applicable Code Requirement

- WBN IST Program OM Code of record is the 2004 Edition through 2006 Addenda
- When a measured test parameter value falls within the alert range, ISTB-6200(a) requires the frequency of testing to be doubled until the cause of deviation is determined and the condition is corrected, or an analysis of the pump is performed in accordance with ISTB-6300(c).
- WBN RHR Pump 1B-B vibration levels entered the alert range of the CPT performed on May 2020 (U1R16 refueling outage)

# Description of Hardship

- Performance of the RHR 1B-B CPT requires the reactor vessel head to be removed in order to achieve the necessary flow rate.
- The alert frequency CPT (double the two year CPT frequency) is required to be performed in May 2021 per ISTB-6000(a).
- The frequency grace period of Code Case OMN-21 would allow the CPT to be deferred to August 2021.
- The next opportunity to perform the CPT during a scheduled refueling outage is U1R17 (October 2021).

# Description of Hardship (continued)

- Shutting down the unit and removing the reactor vessel head to perform the CPT is a hardship.
- Performing the CPT two to three months earlier than the regularly scheduled refueling outage does not provide a compensating increase in the level of quality and safety.



# Adequacy of Alternative Testing

- The Group A test vibration reference values are higher than the CPT vibration reference values
- Quarterly Group A testing has demonstrated capability to show the increasing trend in pump vibration levels in a similar manner as the CPT
- The corrective actions of ISTB-6200 will be followed if any of the Group A test measured values enter the alert or required action range.

# Schedule for Submittal

- TVA to submit request for relief to NRC by August 14, 2020
- TVA requests NRC approval before the increased test frequency due date of May 20, 2021. This date is based on the last comprehensive pump test date plus 12 months, which is double the two year comprehensive test frequency as required by ISTB-6200(a).

