

TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401

400 Chestnut Street Tower II

October 30, 1984

Director of Nuclear Reactor Regulation
Attention: Ms. E. Adensam, Chief
Licensing Branch No. 4
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Ms. Adensam:

In the Matter of the Application of) Docket Nos. 50-390
Tennessee Valley Authority) 50-391

By your letter dated August 22, 1984 to H. G. Parris, TVA was provided with additional NRC concerns related to use of deep draft pumps at Watts Bar Nuclear Plant. Enclosed are TVA's responses to each of these concerns.

If you have any questions concerning this matter, please get in touch with D. P. Ormsby at FTS 858-2682.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

L. M. Mills
L. M. Mills, Manager
Nuclear Licensing

Sworn to and subscribed before me
this 30th day of Oct. 1984

Paulette N. White
Notary Public
My Commission Expires 8-24-88

Enclosure

cc: U.S. Nuclear Regulatory Commission (Enclosure)
Region II
Attn: Mr. James P. O'Reilly Administrator
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30303

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ENCLOSURE

WATTS BAR NUCLEAR PLANT UNITS 1 AND 2
REQUEST FOR ADDITIONAL INFORMATION ON DEEP DRAFT PUMPS

Reference: Letter from L. M. Mills to E. G. Adensam dated November 3, 1981

Question 1

Indicate whether the pumps casings are laterally supported along their length.

Response 1

All pump casings are laterally supported along their length.

Question 2

Indicate whether there are deep draft pumps at WBN which do not run on a continuous basis during the power operation of the plant. If there are such pumps, identify them, their safety function, and the basis for assuring their long-term operability.

Response 2

Essential Raw Cooling Pumps (ERCW) Pumps

The eight ERCW pumps supply the cooling water which serves as the ultimate heat sink for the plant. System Operating Instruction (SOI) 67.1 (provided in the referenced November 3, 1981 letter) states that "Normally, there will be two pumps per train running." It further states that "ERCW pump operation will be alternated to distribute wear and to satisfy surveillance requirements." Surveillance Instruction (SI) 4.0.5.67.P (November 3, 1981 letter) requires that operability of each pump be verified quarterly. The above procedures assure operability of all ERCW pumps.

ERCW Screen Wash Pumps

There are four screen wash pumps, one for each of the ERCW System Intake Pumping Station (IPS) traveling water screens. During normal operation the screen wash pumps are automatically actuated once each 60 hours for a run duration of 18 minutes. The pumps may operate more frequently as actuated by a signal of abnormally high head loss across the traveling screen. The pumps are also started weekly in accordance with Operation Section Letter Administrative (OSLA) 27 and observed for proper operation as described in General Operating Instruction (GOI)-7J (attachment 1). Their safety function is to prevent excessive head loss across the traveling screens by washing accumulated debris into the trash sluice.

High Pressure Fire Protection (HPFP) Pumps

The HPFP pumps do not run on a continuous basis during power operation of the plant. In addition to providing fire protection, they supply feedwater to the steam generators during maximum possible flood conditions via cross connection spool pieces to the auxiliary feedwater system from the two HPFP seismic category I headers. To assure long-term operability, the pumps are tested in accordance with SI-7.50 in order to meet the surveillance requirements 4.7.11.1.e.2 and 4.7.11.1.e.3 in the WBN technical specifications.

Question 3

If the bearings on deep draft pumps are water cooled, indicate and discuss whether there is a filtering system to prevent suspended solids from affecting bearing water and pump operation.

Response 3

ERCW Pumps

On all standby ERCW pumps, the throttle bushing adjacent to the pump stuffing box as well as all column bearings above the sump water level are prelubricated with water taken from the ERCW strainer discharge. This water will have been strained of all suspended particles larger than 1/32-inch. On operating pumps, the throttle bushing and all column bearings will be lubricated by the water being pumped. This water will have been strained of particles larger than 3/8-inch by the traveling screens. Although the column bearings may be exposed to particulates in the process water, excessive wear is not anticipated. These bearings incorporate fluted passages on the bearing surfaces to flush out particles. Also, clearances in these bearings are rather liberal and not critical. Therefore, no unusual wear due to suspended matter is expected. The bottom bearing, located beneath the impeller, is permanently grease packed.

ERCW Screen Wash Pumps

The screen wash pump bearings are lubricated in a manner similar to the ERCW pumps. The throttle bushing and all column bearings above sump level are prelubricated with the ERCW strainer discharge which has been strained through 1/32-inch openings. During operation, the throttle bushing and all column bearings are lubricated by the water being pumped which has been strained through 3/8-inch openings of the traveling screens. The bottom bearing, sealed within the suction hub beneath the impeller, is packed permanently in water proof grease.

HPFP Pumps

The line shaft bearings on the HPFP pumps are product lubricated with no requirements for prelude. There is no filtering system needed to prevent suspended solids from affecting bearing wear and pump operation.

Question 4

With regard to pump vibration measurement, discuss the following:

- a. Indicate the pump reference vibration level (i.e., baseline), warning vibration level, and shutdown vibration level.
- b. Discuss the margin between the warning vibration level and shutdown vibration level in terms of both available and required pump running time.
- c. Indicate the number of hours the pumps have been run to establish steady flows and the reference vibration level.

Response 4

a. ERCW and HPFP Pumps

The operating speed for the ERCW pump is 1180 rpm and the operating speed for the HPFP pumps is 1760 rpm. Each of these pumps must pass a 3 mil vibration limit at upper bearing during preoperational testing. The current operating vibration level for the ERCW pumps is approximately 60 percent of the warning level. For the inservice tests, vibration velocity will be monitored in accordance with Technical Instruction (TI) 31.2 (the November 3, 1981 letter). Data will be recorded on each operating pump at least monthly. If peak velocity should exceed the warning (alert) level of 0.3 inch/sec., the interval between tests will be reduced. If it should exceed the shutdown (alarm) level of 0.5 inch/sec., the pump will be shut down for repair or maintenance. Root Mean Square (RMS) velocities of 0.22 in/sec and 0.35 in/sec are also used to determine the warning and alarm levels, respectively.

ERCW Screen Wash Pumps

The operating speed for the ERCW screen wash pumps is 1760 rpm. The pumps are placed in service under GOI-7J including visual monitoring only for excessive vibration levels. A repeat of the visual monitoring for excess vibration occurs weekly. Reference vibration levels are not available for the screen wash pumps.

- b. The maximum time period between entering the alert level and the next monitoring period will be seven days. It is very unlikely that step changes in vibration level would occur during that period which would increase the vibrations to the alarm level. Although vibration tends to degrade at a faster rate as machine condition deteriorates, a sudden degradation would only be due to some unpredicted catastrophic event. Experience indicates that the vibration monitoring programs described above will ensure no cyclic fatigue failures of the deep draft pumps in the 40-year plantlife. Otherwise, no specific "time-to-failure" versus vibration level relationship has been established. Such a relationship would require extensive empirical correlation data for the pumps.
- c. ERCW pumps have been in routine daily operation for approximately three years.

Question 5

Discuss the relationship between the natural frequency of the pump assembly and the operating speed of the pump.

Response

ERCW Pumps

The operating speed of the ERCW pump is 1180 rpm (19.67 hz). From the seismic stress analysis of the pump, the first two vertical natural frequencies of the pump assembly are 16.35 and 25.00 hz and the first lateral natural frequency is 32.55 hz.

ERCW Screen Wash Pumps

The operating speed of the ERCW screen wash pump is 1760 rpm (29.3 hz). The calculated, first, second, and third mode lateral natural frequencies of the pump assembly are 19.41, 23.48, and 25.34 hz and the first two vertical natural frequencies are 21.74 and 38.44 hz.

HPFP Pumps

The operating speed of the HPFP pump is 1760 RPM (29.3 hz). From the pump seismic stress analysis, the first, second, and third mode lateral natural frequencies of the pump assembly are 13.24, 15.31, and 16.3 hz and the first two vertical natural frequencies are 22.88 and 45.28 hz.

For all of the above types of pumps, the natural frequencies are sufficiently separated from the pumps operation speed to maintain acceptable vibration levels.

Question 6

With regard to Maintenance Instruction MI-67.1 provided with the November 3, 1981, response:

- a. The maintenance instruction indicates that bearings and wear rings are to be replaced if wear is excessive. If wear exceeds the specified limits, indicate the cause of excessive wear and the effects on long-term operability of the pump (see item 3 above).
- b. When the pump is reassembled, indicate how shaft alignment is assured before returning the pump to service.

The only premature bearing failure to date has been attributed to failure of the nonreverse assemblies on the pump motors. TVA is in the process of resolving this issue with the pump vendor.

Response 6

a. ERCW Pumps

No excessive bearing wear has yet been experienced. However, normal operation will undoubtedly cause wear on these surfaces. Excessive wear will show up in the vibration tests of TI 31.2 which are performed monthly on operating pumps.

ERCW Screen Wash Pumps

The screen wash pumps are not included in MI-67.1. No excessive bearing wear has yet been experienced. Excessive wear should be evident as excess noise and vibration levels are noted in the weekly visual observations.

HPFP Pumps

For the HPFP pumps, the cause of excessive wear on bearings and wear rings would be due to normal operation. These parts are kept in stock as spare parts. HPFP systems are designed to have one pump as a spare. Therefore, one pump could be down for maintenance without any effect on long-term operability of the system.

b. ERCW Pumps

The pump is reassembled according to the manufacturer's installation, operation, and maintenance instructions.

Shaft misalignment following pump reassembly would be detected in the pump vibration baseline testing required after such maintenance.

ERCW Screen Wash Pumps

In the event the screenwash pump is disassembled, the proper shaft alignment is assured prior to returning the pump to service by strictly following the pump manufacturer's installation, operation, and maintenance manual.

HPFP Pump

The pump is reassembled in accordance with its manufacturer's installation, operation, and maintenance instructions in order to assure shaft alignment before returning the pump to service.