TOLEDO EDISON

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Docket No. 50-346

License No. NPF-3

Serial No. 524

July 3, 1979

Director of Nuclear Reactor Regulation
Attention: Mr. Robert N. Reid, Chief
Operating Reactors Branch No. 4
Division of Operating Reactors
United States Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Reid:

Attached is information about Davis-Besse Nuclear Power Station Unit 1 requested by your staff.

Lowell E. Roe

Very truly yours,

LER:TJM

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DAVIS-BESSE UNIT 1

AFW Pumps NPSH Information

NPSH Requirements for AFW pumps 1-1, & 1-2 @:

rated flow (1050 gpm)	≈ 19 ft.
550 gpm flow	≈ 11 ft.

Given: 1.5 psig on PSL 4929B

Is there sufficient NPSH for pump operation if switch-over occurs at this time?

1. Head available with 1.5 psig (16.2 psia) at switch	≈ + 37.4 ft.
2. Piping losses from switch to pump (excluding strainer) at rated flow (1050 gpm)	≈ - 3.3 ft.
3. Strainer losses variable from 2-10 ft; assume worst	≈ - 10.0 ft.
4. Elevation head due to piping elevation differences from switch to pump	≈ + 1.75 ft.
NPSH available at 1.5 psig switch indication assuming rated flow and maximum strainer losses	≈ + 25.85 ft.

NOTE: This calculation is representative of rated flow conditions with worst case strainer parameters. With these very conservative conditions, this shows an excess of NPSH of about 6.85 ft. Using nominal strainer losses of 4 ft. of head still at rated flow the excess NPSH would be about 12.85 ft.

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The following is submitted to summarize testing conducted on newly installed systems or requirements:

DYNAMIC BRAKING OF AFW PUMP TURBINE CONTROLS

Testing of Auxiliary Feedwater Pumps 1-1 and 1-2 was completed as of June 21, 1979, under a test procedure incorporated as a temporary modification to ST 5071.01. No deficiencies were noted. The Auto Essential Level Control Circuitry provides the governor speed changer motor with pulses of varying duration depending on OTSG level error. Drifting of the speed changer motor will have a deleterious effect on the level control system by continually forcing the governor to hunt for a specified speed setting.

Dynamic braking allows the motor field's residual magnetism to generate a current flow thru the braking resistor and produce a counter torque to effectively stop the motor. Because of the precision in which the motor is stopped with dynamic braking, it would take significantly more pulses to run the governor from the low to the high speed stops (or vice versa) than when the motor inertia was unchecked and drifting occurred. The test functionally proved this for both the opening and closing directions at all pulse lengths.

Test results demonstrated that on the average 250% more "braked" pulses were required to reproduce the same governor movement as when motor coasting existed, permitting much finer control characteristics for the governor.

ANTICIPATORY REACTOR TRIP SYSTEM

Testing of the Anticipatory Reactor Trip System (ARTS) was completed as of June 15, 1979. No test deficiencies were noted. Testing of the Loss of Feedwater Reactor Trip Circuitry was accomplished by simulating a reverse differential pressure on the feedwater check valves and verifying the CRD breakers opening. The Steam and Feedwater Rupture Control System (SFRCS) which uses the same differential pressure switch to sense a loss of feedwater was not degraded in any way as demonstrated by ST 5031.14, SFRCS Monthly Surveillance Test. Testing of the Turbine Reactor Trip Circuit was accomplished by simulating the turbine on line with the EHC Simulator, tripping the Master Trip Solenoid and verifying the CRD Breakers opening. The Block Switch to bypass the Turbine Reactor Trip was functionally tested. Additionally, all computer and annunciator alarms associated with the ARTS installation were tested.

The Reactor Protection System and Manual Reactor Trip was not degraded by the incorporation of the two additional reactors trips as demonstrated by ST 5030.12, Channel Functional Test of RX Trip Module Logic and CRD Trip Breakers and ST 5030.13, Channel Functional Test of Manual Reactor Trip.

Testing of ARTS has been incorporated into a new procedures, PT 5155.02, ARTS Monthly Functional Test.

AFW FLOW INDICATION

Testing of Auxiliary Feedwater Flow Indicators was completed as of June 23, 1979 under a test procedure incorporated as a Temporary Modifications to ST 5071.01. Indicated flow from the new ultrasonic flow detectors was compared with OTSG level increase and that flow obtained in the test recirculation loop under similar pump conditions. Data was obtained at two different flow rates to further corroborate results. The test demonstrated indication accuracy to be within 19% of calculated values, well within the 25% acceptance criteria.

AFW PUMP 72 HOUR ENDURANCE TEST

The endurance test runs of the Auxiliary Feedwater Pumps (AFP) was completed on June 27, 1979. The test was performed in three parts consisting of:

1. A 72 hour endurance run with the AFPs at their high speed stops for 1 hour and at their low speed stops for the remaining 71 hours.

2. A 6 to 8 hour cooldown period during which the AFPs were shutdown.

3. An additional 1 hour run.

The flowpath used for this test recirculated water between the AFPs and a Condensate Storate Tank. The test was completed without difficulty, and with no prior system grooming.

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HPI LINE BREAK ANALYSIS

An analysis of a break in the High Pressure Injection (HPI) line has been performed for Davis-Besse 1. The analysis was performed using the B&W ECCS evaluation model described in BAW-10104. A single failure in the HPI system was modeled, with the break considered in the active HPI train. Under these conditions, operator action is required to detect and isolate the broken HPI line, or to balance the available HPI flow in the active train to assure and maintain core cooling. The following paragraphs describe the results of analyses which were performed to establish the reaction times required of the operator.

The RCS depressurized slowly to approximately the secondary side pressure of the steam generator which is regulated by the safety valves to approximately 1050 psig. The RCS pressure remained at this pressure for the remainder of the transient because the leak flow out the break was insufficient to overcome the steam generation rate from the decay heat in the core.

Since the analysis assumes a failure of one HPI train and a complete severance of the HPI line of the other train, no ECCS water is capable of entering the cold legs, without operator action, above system pressure of approximately 1000 psi.

In the analysis which was performed, operator action at 30 minutes to close the HPI valve in the broken line was modeled. With the isolation of the broken line at 30 minutes, the core never uncovered, and compliance to the criteria of 10CFR50.46 is ensured.

A review of the analysis was performed to establish whether throttling and balancing of the HPI flows between the broken and unbroken HPI lines was sufficient to mitigate the consequences of an HPI line break. That review determined that operator action by 20 minutes to balance the flows between the HPI lines was sufficient. The basis for that conclusion is detailed below.

The system pressure in the analysis was 1070 psia at 1800 seconds. Assuming that the system will not depressurize after 1800 seconds, the HPI will match the core boil-off at 5400 seconds and therefore assure long-term cooling. The core decay heat energy addition between 1800 seconds and 5400 seconds is 1.695×10^8 BTUs. The HPI water that would be injected between 1200 seconds and 5400 seconds is capable of removing 1.76×10^8 BTUs. Thus the earlier operator action at 20 minutes to balance the HPI flow assures that, prior to the establishment of long-term cooling, adequate heat removal is provided. It should also be noted that, at 30 minutes, the results of the analysis indicate that there is ~60,000 lbm of liquid remaining above the top of the core. Furthermore, due to the effect of steam generator heat removal and subsequent steam condensation, only about 50 lbm/sec of liquid is being lost from the system. Thus, it would take an additional 20 minutes (50 minutes transient time) for the top of the core to start to uncover if no HPI flow is delivered to the reactor vessel. Therefore, operator action by 20 minutes to balance flows between the broken and unbroken HPI lines provides adequate ECC injection to assure that the core never uncovers and that long-term cooling is established. Hence, compliance to the criteria of 10CFR50.46 is demonstrated.

Calculations

The minimum required HPI flowrate, using information in a letter from B&W/Luken to Toledo Edison Company/Domeck, DB-79-42 dated May 23, 1979, is 267 gpm at 1070 psia (system pressure for HPI line break at 1800s).

Energy absorption capability of HPI between 1200 and 5400 seconds is as follows:

$$E_{ABS} = (267\ \text{gal/min})\left(\frac{1\ \text{min}}{60\ \text{Sec.}}\right)(.1337\ \text{ft}^3/\text{gal})(62.2\ \text{lbm/ft}^3)(\overset{hg-hf}{1190-58}\ \text{BTU/lbm})(5400-1200\text{s})$$

$$= 1.76 \times 10^8\ \text{BTUs}$$

Integrated core decay heat (1.2 ANS) between 1800 and 5400 seconds is as follows:

$$E_{core} = (63.23\text{s})(1.02)(2772\ \text{MW})(948\ \text{BTU/s-MW}) = 1.695 \times 10^8\ \text{BTU},$$

where 63.23 s is obtained from $\int_{1800}^{5400} (P/P_o)\, dt$ and includes 1.2 X the ANS decay heat in the calculation, and where 1.02 is a standard safety factor for a power level of 102% of rated thermal power.

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