Docket No. 50-346

License No. NPF-3

Serial No. 1110

December 18, 1984

TOLEDO EDISON

Richard P. Crouse
Vice President
Nuclear
(419) 259-5221

Director of Nuclear Reactor Regulation
Attention: Mr. John F. Stolz
Operating Reactor Branch No. 4
Division of Licensing
United States Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Stolz:

On December 3, 1984, Toledo Edison (TED) submitted an application (Serial No. 1105) for an Amendment to Facility Operating License No. NPF-3 for the Davis-Besse Nuclear Power Station Unit No. 1. This application requested that the Technical Specifications be revised to allow the plant to complete reactor coolant system heat-up and conduct zero power physics testing prior to entering Mode 1 of the new fuel cycle (Cycle 5) using the existing configuration of the Startup Feedwater Pump (SUFP) system. During a telephone conference held on December 14, 1984, between yourself and Mr. A. W. DeAgazio of the NRC and Messrs. F. R. Miller, J. A. Easley and D. R. Wuokko of TED, you requested additional information be provided to facilitate the NRC Staff's review of TEDs request. Attached is the additional information which you requested.

As described in TEDs previous submittal (Serial No. 1105) to the NRC, it has been determined that the use of the SUFP system prior to the plant entering Mode 1 does not involve an unreviewed safety question or present a significant hazard. This additional information further supports that determination.

TED requests that this amendment, allowing operation of the SUFP system for reactor coolant heat-up and zero power physics testing, be approved by the NRC no later than December 21, 1984, to avoid delaying the restart of Davis-Besse.

Since this submittal is in response to a NRC Staff's request for additional information on a license amendment application for which TED has already provided license fee payment, no additional fee is incurred.

Very truly yours,

RPC:DRW:lah
attachment
cc: DB-1 NRC Resident Inspector

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TOLEDO EDISON

DAVIS-BESSE NUCLEAR POWER STATION UNIT NO. 1

RESPONSE TO NRC STAFF REQUEST FOR ADDITIONAL INFORMATION

Request No. 1: Describe the long-term capability of the plant's systems to continue removal of decay heat under the postulated accident conditions.

Response: As a minimum, the equipment available to respond, assuming single failures, includes two of the three reactor coolant system high point vents and one of two HPI pumps. Additional capabilities that would be available in this event include the seismic portion of the Reactor Coolant Makeup System once isolation is provided to the non-seismic portions of the system. The high point vent valves are qualified for containment accident conditions and therefore are available for long term capability. The HPI pump involved is available. The long term capability of the HPI pump for days of operability is not a normal application. However, quarterly tests are run on the HPI pumps using the flow through the seismic test line returning to the BWST. These tests are run to the point of stabilization of the bearing temperatures. This ensures proper pump lubrication and cooling is available. Any pump heating effect due to extended operation at shut off head through the recirculation line can be handled by adjusting flow through this seismic test line. No detrimental effects are postulated due to pump operation over prolonged periods.

Request No. 2: Describe where the relevant plant systems are operating with respect to their design; eg. High Pressure Injection (HPI) flow and other relevant characteristics.

Response: The two available alternatives using completely safety-grade system for the required decay heat removal are: (1) a combination of one HPI pump and two high point vents, and (2) a combination of one HPI pump and one high point vent. As described in USAR Subsection 6.3.1.4 and 6.3.2, HPI equipment is designed to operate during a small break loss of coolant accident which is similar to the situation of venting through a high point vent.

Request No. 3: At what time (i.e., how quickly) does the reactor coolant system reach the pressure where HPI initiated?

Response: It has been calculated that the RCS will depressurize from approximately 2200 psig to the HPI initiation setpoint of 1650 psig in approximately 2.5 hours, if only one hot leg high point vent is open; approximately 1.25 hours if two hot leg high point vents are open. If the pressurizer vent is open, the RCS will depressurize at a faster rate than with one hot leg high point vent open.

Request No. 4: What is the capability of the RCS hot leg high point vents to blow down the RCS? Provide calculations or testing information supporting the capability of these vents to handle expected flows.

Response: The venting capacities of the RCS high point vent system at 2250 psig are as follows:

	Hot Leg Loop 1	Hot Leg, Loop 2	Pressurizer
Reactor Coolant (GPM)	45	45	Not Applicable
Steam (lb/sec)	1.2	1.2	3.3

Under the postulated conditions, the hot leg high point vents would have only subcooled reactor coolant entering them.

The calculations supporting the capability of the RCS high point vents system were provided in Toledo Edison submittal dated April 13,1982 (Serial No. 804). Item 2 of Attachment 1 to that letter contains the pertinent design parameters of the reactor coolant makeup system and a calculation of the maximum rate of loss of reactor coolant through the RCS high point vent orifices (see enclosed Attachment to Response to Request No. 4).

The RCS high point vents have been surveillance tested in accordance with the proposed Technical Specifications to ensure operability.

Each of the three high point vents are independently powered by Class 1E sources (see attached diagram) that ensures no single failure results in the loss of more than one high point vent.

Request No. 5: Provide details ensuring consideration that an adequate supply of borated water from the Borated Water Storage Tank (BWST) is available.

Response: Conservatively, the BWST capacity is approximately 340,000 gallons of borated water at a minimum concentration of 1800 ppm boron. At a primary system pressure of 1650 psig, the HPI pumps will be automatically started and the HPI discharge valves opened. The discharge from the hot leg high point vents at this pressure is 38.5 gpm. The HPI pumps normally take suction from the BWST. Given the flow rate for one HPI pump under the postulated accident conditions, a BWST volume of approximately 340,000 gallons will provide 6.1 days of borated water flow with one hot leg high point vent.

As described in USAR Subsection 6.3.2.1', prior to the exhaustion of the BWST, if LPI flow is not initiated the operator will connect the Low Pressure Injection/Decay Heat (LPI/DH) pumps to operate as booster pumps for the HPI pumps. This line-up will utilize the emergency sump as a water source and provide 250 psig water to the suction of the HPI pumps (also see response to Request No. 6). This connection is necessary to ensure adequate NPSH for the HPI pumps to operate from the Emergency Sump and results in continued flow from the sump even though RCS pressure may be above the discharge pressure of the LPI system.

Request No. 6: Describe the RCS discharge flow routes from the hot leg high point vents and the capability of the containment building systems to handle this flow (e.g., HPI recirculation.

Response: The RCS discharge flow routes from the RCS high point vents were provided in TEDs April 13, 1982 (Serial No. 804) submittal. Attached is TEDs response to Item 6 of the April 13, 1982 submittal. The NRCs Safety Evaluation for NUREG-0737 Item II.B.1 Reactor Coolant System Vents for Davis-Besse was issued on October 5, 1983 (Log No. 1384).

Reactor Coolant passing from the High Point Vents collects in the Containment Vessel Sumps. Reactor coolant initially collects in the Quench Tank. When the Quench Tank Rupture Disc ruptures, then the reactor coolant collects in the Containment Vessel Sumps.

Also, see Response to Request No. 5.

Request No. 7: Address consideration of any pressurized thermal stress to the reactor vessel, i.e., discuss expected temperatures, flow volumes and circulation patterns in the RCS.

Response: In cases involving the loss of secondary heat transfer, pressurized thermal stresses in the primary system were discussed in a report submitted to the NRC from the B&W Owners Group dated June 30, 1983 "Generic Evaluation of Pressurized Thermal Shock (PTS) Events".

In this report, exceptionally conservative conditions were placed on the system with significant cooldown scenarios as initiating events. The specific identified conditions of concern have no major cooldown initiator. During the initiating events with one HPI pump and two hot leg high point vents, the first few hours will be utilized in depressurizing to the initiation of HPI. Essentially, no RCS cooling will take place. HPI initiation will not cause a PTS problem because:

1. Absence of longitudinal welds.
2. No problem with atypical weld material.
3. Low shutoff head of the HPI pumps.

ATTACHMENT TO RESPONSE TO REQUEST NO. 4

(SERIAL NO. 804, DATED APRIL 13, 1982)

2. Demonstrate that the RCS high point vent system (including the pressurizer vent) flow restriction orifices are smaller than the size corresponding to the definition of a loss-of-coolant accident (10 CFR Part 50, Appendix A) by providing the pertinent design parameters of the reactor coolant makeup system and a calculation of the maximum rate of loss of reactor coolant through the RCS high point vent orifices. For those new portions of the RCS high point vent system that are within the LOCA definition (i.e , upstream of the flow restriction orifices), verify that previous analysis or a new analysis has been performed to demonstrate compliance with 10 CFR 50.46 (reference NUREG-0737, Item 11.B.1, Clarification A.(7)). Justify why the flow restriction orifices are not placed upstream of the RCS high point vent valves to limit the amount of new piping that is within the LOCA definition (reference Clarification A.(4)).

Response

A loss-of-coolant accident is defined as a hypothetical accident that would result from a loss of reactor coolant at a rate in excess of the capability of the reactor coolant makeup system, from breaks in pipes in the reactor coolant pressure boundary up to and including a break equivalent in size to a double ended rupture of the largest pipe in the reactor coolant system.

The excess capacity of the reactor coolant makeup system during normal operation is 45 gallons per minute (GPM) at 2500 psig and 200°F. The venting path of the RCS high point vents is through 1" pipe, 2 control valves and the flow restriction orifice.

For conservatism in the calculation of the maximum flow through the restriction orifices the pressure drop across the valves and piping was neglected. Also, the downstream pressure of the restriction orifices was taken to be absolute zero instead of containment atmosphere pressure. Credit is not taken for the fact that the volume of water provided by the makeup system expands once discharged into the RCS. Consequently, the flow restriction orifices are sized for a flow rate of 45 GPM at 2500 psig and 670°F (3.5 lb./sec.). The makeup water is supplied at a minimum of 45 GPM at 2500 psig and 200° (6.03 lb./sec.).

The design parameters used in this analysis for the hot leg vents and the results are as follows:

Upstream pressure of restriction orifice

lbs/in^2	= 2,500
lbs/ft^2	= 360,000

Downstream pressure of restriction orifice

lbs/in^2	= 0
lbs/ft^2	= 0

Maximum temperature, °F = 670

Makeup flow, normal

Gallons per minute	= 45
lbs/sec	= 6.03

Formulas used

$$W_1 = CYA_2 \left[\frac{2g_c \quad (P_1 - P_2) \quad p_1}{1 - B^4} \right]^{\frac{1}{2}}$$

W_1 = flow rate through restriction orifice, lbs/sec

C = coefficient of discharge of restriction orifice, dimensionless

A_2 = cross sectional area of restriction orifice bore, ft^2

g_c = dimensional constant, $\frac{lb_m \cdot ft}{lb_f \cdot sec^2}$

P_1 = pressure upstream of restriction orifice, lb_f/ft^2

P_2 = pressure downstream of restriction orifice, lb_f/ft^2

p_1 = density of fluid upstream of restriction orifice, lb/ft^3

Y = expansion factor of steam, dimensionless

B = beta ratio, ratio of restriction orifice bore to internal pipe diameter, dimensionless

$W_2 = V_s A p_2$

W_2 = flow rate of hydrogen, ft^3/sec

V_s = maximum velocity, ft/sec

A = orifice area, ft^2

p_2 = density of hydrogen, lb/ft^3

$R_e = \left[\frac{D \quad V \quad p_1}{\mu}\right]$orifice

R_e = Reynolds number, dimensionless (needed for calculating C)

D = diameter of restriction orifice bore, ft

v = velocity of fluid upstream of restriction orifice

μ = absolute dynamic viscosity, centipoise

RESULTS

Beta ratio required, B = 0.2364
In 1 inch schedule 160 pipe, the required flow restriction orifice bore is 0.1927 inches.

The pressurizer vent is sized so as to relieve 3.3 lb./sec. of steam as outlined in response to item 9 below. This is within the capability of one make up pump and therefore inadvertent opening of this vent path during normal operation will not result in a LOCA.

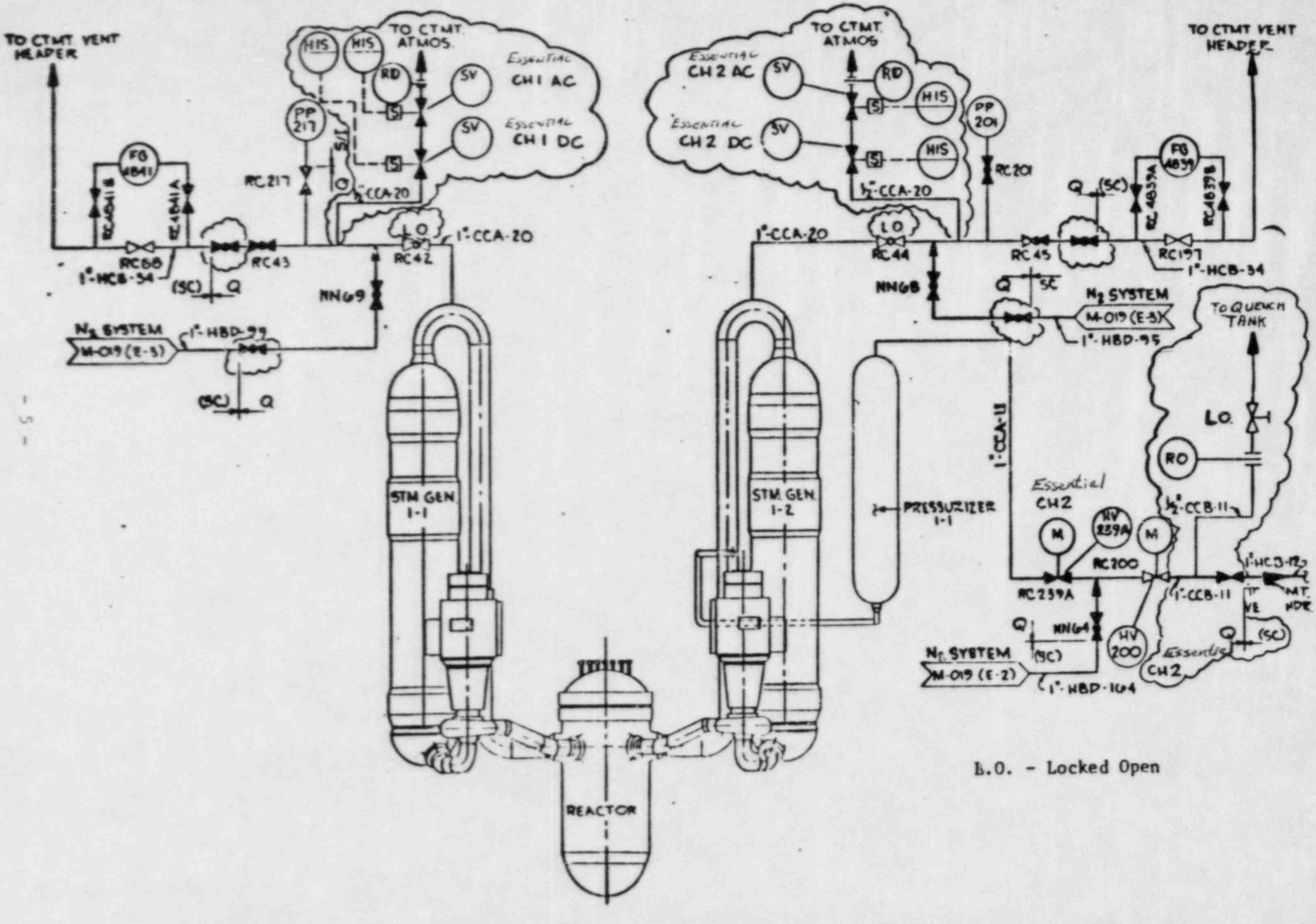
REFERENCES

1. 'Fundamentals of Classical Thermodynamics' 2nd Ed., by Gordon J. Van Wyler and Richard E. Sonntag; John Wiley and Sons.

2. 'Chemical Engineers Handbook' 5th Ed., by Robert H. Perry and Cecil H. Chilton; McGraw-Hill.

The flow restriction orifices are placed so that maximum protection from flashing and cavitation is afforded to the RCS high point vent valves.

Also, Clarification A.(4) requires double valve isolation for new or existing vent lines whose smallest orifice size is larger than the LOCA definition. The flow restriction orifices are sized smaller than the LOCA definition. In addition, the vent on the pressurizer is designed such that the inadvertent opening of both valves could not cause the RCS to depressurize when all pressurizer heaters are energized. This along with double valve isolation for each vent is above and beyond the requirements of NUREG 0737, Item II.B.1, Clarification A.(4). The new piping for the RCS high point vents is the minimal amount required to have the hot leg vents exhaust to the containment atmosphere and the pressurizer vent exhaust to the pressurizer quench tank (see Toledo Edison letter, Serial No. 795 dated March 22, 1982 for details of the pressurizer vent routing). Since the design of the RCS high point vent system allows for adequate protection provided by the isolation valves and the routings of the vent system are short, placing the restriction orifices upstream of the isolation valves would not have limited the amount of new pipe within the LOCA definition substantially.



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ATTACHMENT TO RESPONSE TO REQUEST NO. 6

(SERIAL NO. 804, DATED APRIL 13, 1982)

6. Demonstrate, using engineering drawings (including isometrics) and design descriptions as appropriate, that the normal RCS high point vent paths to the containment atmosphere discharge into areas:

   a. That provide good mixing with containment air to prevent the accumulation or pocketing of high concentrations of hydrogen, and

   b. In which any nearby structures, systems, and components essential to safe shutdown of the reactor or mitigation of a design basis accident are capable of withstanding the effects of the anticipated mixtures of steam, liquid, and noncondensible gas discharging from the RCS high point vent system (reference NUREG-0737, Item II.B.1, Clarification A.(9)).

Response

a. The hot leg high point vents discharge inside the steam generator compartments, where the mixture of noncondensible gases will rise due to natural circulation to the top of the compartments at elevation 653'-0" and into the containment atmosphere where the containment air coolers will provide mixing and disperse any remaining concentration.

   The pressurizer vent will discharge into the pressurizer quench tank where it will mix in the 250 cubic feet vapor space of the tank till the pressure in the tank reaches approximately 85 psig. At this point the noncondensible gases from the pressurizer vent will flow to the containment atmosphere from elevation 585 feet by natural circulation.

b. Both hot leg high point vents discharge close to a 1" nitrogen line (Figures 2 and 3). The nearby structures, systems and components are capable of withstanding the effects of the anticipated mixtures of steam, liquid and noncondensible gases which would be discharged from the RCS high point vent system.

   The pressurizer high point vent will discharge to the pressurizer quench tank. All vent paths have been analyzed and designed so as not to preclude the essential operation of safety-related systems required for safe shutdown or mitigation of the consequences of a design basis event.