



TOLEDO EDISON COMPANY  
DAVIS-BESSE NUCLEAR POWER STATION UNIT ONE  
SUPPLEMENTAL INFORMATION FOR LER NP-32-79-03

DATE OF EVENT: January 3, 1979

FACILITY: Davis-Besse Unit 1

IDENTIFICATION OF OCCURRENCE: Inoperability of High Pressure Injection Pumps 1-1 and 1-2 due to minimum recirculation line freezing

Conditions Prior to Occurrence: The unit was in Mode 1, with Power (MWT) = 2384, and Load (Gross MWE) = 763.

Description of Occurrence: At 1400 hours on January 3, 1979, High Pressure Injection (HPI) Pump 1-1 was started per "Emergency Core Cooling System Subsystem Monthly Test" ST 5051.01. At 1406 hours, HPI Pump 1-1 was stopped due to a low flow indication on the HPI pump to the Borated Water Storage Tank (BWST) minimum recirculation line (3" HCC-91). Further investigation discovered that this line had frozen outside somewhere between the BWST Pipe Tunnel and the top of the BWST. Maintenance personnel were immediately notified.

Maintenance personnel increased the thermostat setting for the HPI pump minimum recirculation line heat trace and built a temporary heated enclosure around the exposed line. The recirculation line was thawed and ST 5051.01 was successfully completed for HPI Pump 1-1 at 1105 hours on January 5, 1979.

At the time of the incident, an analysis of the frozen recirculation line by the station indicated that the minimum flow rate required for pump cooling would flow through the injection line if the HPI pumps were started during a loss of coolant accident. As a result, both HPI Pump 1-1 and HPI Pump 1-2 were considered operable, and the unit was not in violation of any Technical Specifications.

2 | On March 12, 1979, in a discussion between station personnel and TECo Power Engineering personnel, Power Engineering personnel stated that they had done an analysis of a previous HPI initiation event (see Licensee Event Report NP-32-77-16 dated September 24, 1977) which indicates that the minimum required HPI flow may not have existed if the recirculation line was plugged. As a result of this initial analysis, both HPI pumps must now be considered to have been inoperable between 1406 hours on January 3, 1979 and 1105 hours on January 5, 1979.

2 | In April 1979, a detailed safety evaluation was performed which determined the HPI pumps would have performed their intended safety function and would not have been damaged for any actual Reactor Coolant System (RCS) leak that the HPI pumps are required. See the attached safety evaluation for details.

The inoperability of the HPI pumps placed the unit in violation of Technical Specification 3.5.2 which requires that two independent Emergency Core Cooling System subsystems shall be operable with each subsystem comprised of one operable HPI pump, one operable Low Pressure Injection Pump, one operable Decay Heat Cooler, and one operable flowpath capable of taking suction from the BWST.

Designation of Apparent Cause of Occurrence: This incident was caused by the inability of the heat trace on the HPI pump to BWST minimum recirculation line, 3" HCC-91, to maintain a pipe temperature above freezing. As a result, this line froze during sub-zero weather and rendered the HPI pumps inoperable.

2 | Analysis of Occurrence: There was no danger to the health and safety of the public or to station personnel. No event requiring the actuation of the HPI pumps occurred. The HPI pumps would have performed their intended safety function and would not have been damaged for any actual RCS leak for which the HPI pumps are required. See the attached safety evaluation for details.

Corrective Action: Maintenance personnel increased the thermostat setting for the HPI pump to BWST minimum recirculation line heat trace and built a temporary heated enclosure around it. The recirculation line was thawed and ST 5051.01 was successfully completed for HPI Pump 1-1 at 1105 hours on January 5, 1979.

2 | Facility Change Request 79-168 has been written to request a design change for the recirculation line heat trace to prevent recurrence.

Failure Data: There have not been any previous reportable occurrences with the HPI pumps recirculation line.

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SAFETY EVALUATION FOR AN INOPERABLE HPI RECIRCULATION LINE

## 1.0 Reactor Coolant System pressure at time of HPI start

The HPI pumps are automatically started at a RCS hot leg pressure setpoint of  $1650 + 25$  psig. Maximum instrument string inaccuracy including setpoint drift is 50.75 psig. Therefore, the HPI pumps may be started at a hot leg pressure range from 1575 to 1725 psig.

Since the HPI pumps discharge into the cold legs of the RCS, the core pressure drop and the static pressure due to the difference in elevation of hot legs and cold legs must be considered. The core pressure drop with all four Reactor Coolant Pumps running (worst case) is approximately 100 psig and the static pressure due to difference in elevation amounts to approximately 20 psig. Accounting for the above correction, the cold leg pressure range within which SFAS will actuate the HPI pumps is 1695 to 1745 psig.

## 2.0 Reactor Coolant System depressurization rate after HPI start

To aid in this analysis, data from the September 24, 1977 depressurization transient was analyzed. This data represents a very small break in the RCS piping caused by the pressurizer electromatic relief valve being stuck open, and is a conservative representation of a small RCS break leading to HPI initiation with a very low depressurization rate. The rate of depressurization was approximately 3.4 psi per second.

## 3.0 Time until minimum flow into Reactor Coolant System is obtained

The HPI pumps require a minimum flowrate of 34 gpm to prevent the pumps from heating up. By evaluating the pump head curves and suction pressure, it was determined the HPI pumps would attain the 35 gpm injection rate at an RCS cold leg pressure of 1680 psig. Since the HPI pumps would be started within the range of 1695 to 1845 psig cold leg pressure, and the rate of depressurization is at least 3.4 psi per second, 1680 psig will be reached anywhere from 4.4 to 48.5 seconds after the pumps are started.

## 4.0 Time until pump damage would occur

Based on the information from the HPI pump manufacturer (B&W Canada, now Hayward Tyler), if the minimum flow of 35 gpm was not obtained, boiling will eventually occur in the HPI pumps which could cause damage to them. The vendor has stated that with zero pump flow the pump seal temperature will raise 17°F per minute, and the pump would be damaged at a seal temperature of 230°F. Assuming that the pump started at an ambient temperature of 122°F (50°C), it would take approximately six minutes to damage the pump.

5.0 Summary

2 For any actual RCS leak for which the HPI pumps are required, it would have taken at most 48.5 seconds after the pump was started to establish the minimum required injection. HPI pump damage would not occur until approximately six minutes without flow. Therefore, the HPI pumps would perform their intended safety function and would not be damaged if they were actuated with the recirculation line frozen.

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