

TOLEDO EDISON COMPANY,
DAVIS-BESSE UNIT ONE NUCLEAR POWER STATION
SUPPLEMENTAL INFORMATION FOR LER NP-12-77-16

DATE OF EVENT: September 24, 1977

FACILITY: Davis-Besse Unit 1

IDENTIFICATION OF OCCURRENCE: Half trip of the Steam and Feedwater Rupture Control System (SFRCS) causing a rise in Reactor Coolant System (RCS) temperature and pressure resulting in the pressurizer power relief valve to open, and this valve failed to close.

Conditions Prior to Occurrence: The plant was in Mode 1, with Power (NET) = 260 and Load (MW) = 0.

Description of Occurrence: At 2134 hours on Saturday, September 24, 1977, a "half-trip" of the SFRCS was initiated by an as yet unknown cause. This initiated the closure of the Startup Feedwater Valve FWS77A, which supplies water to the No. 2 Steam Generator (SG-2).

The reduction of water level in SG-2 resulted in a corresponding rise in RCS temperature and pressure. When the RCS pressure reached 2255 psig, the Pressurizer Power Relief Valve lifted nine times, then stuck open. The discharge from the Power Relief Valve goes to the Pressurizer Quench Tank and with the Power Relief Valve in the stuck open position, the Pressurizer Quench Tank Rupture Disc ruptured, and the escaping steam caused increase in Containment pressure.

The Reactor Operator observed the pressurizer level rising to above 290 inches, and he manually tripped the reactor. The system was now in a cooldown and depressurization cycle. Within six minutes, the pressure had reached the saturation pressure for the corresponding temperature and steam began to form within the RCS causing an insurge of water into the pressurizer. Pressurizer level went to its maximum (320 inches).

At approximately 2155 hours, the operators determined that the Power Relief Valve had stuck open, and they isolated it by closing the block valve. This action terminated the RCS depressurization, and recovery of RCS pressure and subsequent cooldown to Mode 5, Cold Shutdown followed.

The LIMITING CONDITIONS FOR OPERATION were exceeded for five Technical Specifications:

1. 3.4.1 Reactor Coolant Loops - Two Reactor Coolant Pumps were tripped during the incident to limit further heatup. The required action for Modes 3, 4 and 5 was met in that either a Reactor Coolant Pump (RCP) was in operation, or one Decay Heat Removal Pump was in operation at all times.

2. 3.4.5 Steam Generators - The level in both steam generators went below 18 inches.
3. 3.4.6.2 Operational Leakage - During the incident, there was a press boundary leakage and greater than 1 GPM unidentified leakage.
4. 3.6.1.4 Containment Systems Internal Pressure - The containment pressure exceeded the 25 inches W.C. allowable.
5. 3.7.1.2 Auxiliary Feedwater System - Auxiliary Feedwater Pump 1-2 failed to attain full speed upon receiving initial start signal.

NOTE: The ACTION items for the above specifications were met in that the unit was in Hot Standby within 6 hours and Cold Shutdown within the next 30 hours.

Designation of Apparent Cause of Occurrence: The apparent cause of this occurrence was determined to be a half trip condition from SFRCS Channel 2 causing valve FWS77A to close. The cause of the half trip was not positively determined although extensive investigation has revealed several loose connections at terminal boards which could have been the cause.

Analysis of Occurrence: There was no danger to the health and safety of the public or to station personnel. It was determined that the Steam Generator No. 2 was boiled dry during this incident. Babcock and Wilcox has reviewed the transients on the primary system and has determined that these transients are within the design transients allowance for the primary system.

Investigation into the failure of the power relief valve revealed that the close relay was missing from its control circuit. This relay provides a seal in the circuit which holds the Power Relief Valve open until the RCS pressure drops to 2205 psig. With the relay missing the Power Relief Valve closed when the RCS pressure dropped below 2255 psig and re-opened when pressure rose above 2255 psig. Thus, the valve cycled nine times in rapid succession causing failure of the pilot valve stem, resulting in the Power Relief Valve to remain open.

The No. 2 Auxiliary Feedwater Pump did not go to full speed due to binding in the turbine governor.

All other systems functioned as designed.

Corrective Action: Since there was no positive determination of the cause of the half trip in the SFRCS, this system will be monitored during the next power escalation to detect any spurious signals. Plans are also being developed to add additional annunciator alarm windows from the SFRCS and to seal in any alarm condition.

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The Power Relief Valve was repaired and returned to service. The missing relief valve was replaced. Testing of the Power Relief Valve will be completed prior to Mode 2.

The binding in the Auxiliary Feed Pump Governor was identified and the governors returned to the factory for modifications to prevent binding. Post modification testing will be completed on the Auxiliary Feed Pumps prior to Mode 2.

Failure Data: One previous occurrence of a half trip initiation of the SFRCS occurred.