TOLEDO EDISON

A Centerior Energy Company

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A. Bert Davis
Regional Administrator
Region III
United States Nuclear Regulatory Commission
799 Roosevelt Road
Glen Ellyn, Illinois 60137

Subject: Reactor Protection System Instrumentation: Flux-ΔFlux-Flow Transmitter

Dear Mr. Davis:

The purpose of this letter is to request enforcement discretion from the Nuclear Regulatory Commission regarding Davis-Besse Nuclear Power Station (DBNPS) Unit No. 1, Operating License Appendix A, Technical Specification (TS) 3.3.1.1, Reactor Protection System (RPS) Instrumentation. Specifically, Action Statement 2.a for Technical Specification 3.3.1.1 Table 3.3-1, Item 4 flux-Δflux-flow instrument channel, requires an inoperable channel to be placed in the tripped condition within one hour. The DBNPS RPS design does not provide features for tripping individual functional channels and the entire RPS channel has been tripped to comply with the Action requirements. As discussed below Toledo Edison is requesting that RPS Channel 2 be allowed under enforcement discretion to be reset with the flux-Δflux-flow channel inoperable and not tripped. Toledo Edison believes that under the current condition this option provides the requisite level of protection while reducing the probability of a spurious plant trip putting the plant through an unnecessary transient thereby unnecessarily challenging safety systems and other plant systems.

The Reactor Protection System is designed to initiate a reactor trip when a sensed parameter exceeds a setpoint value. The RPS consists of four identical protection channels which are redundant and independent. Each RPS channel consists of contacts from eight trip bistables which are in series with the power supply to each of the RPS channel trip relays. The trip bistables include Reactor Coolant System (RCS) high pressure, RCS

low pressure, RCS pressure-temperature, flux-Δflux-flow, high flux, flux-pumps, RCS high temperature and containment vessel high pressure. When any sensed parameter exceeds its setpoint value the bistable contacts open causing a power interruption to the RPS channel trip relay (RPS channel trip). Two RPS channel trips are required to cause a reactor trip.

The function of the flux-Δflux-flow trip bistable is to provide both high power level and low RCS flow protection in the event the reactor power level increases or the RCS flow rate decreases. The power level setpoint produced by the flux-flow ratio provides overpower DNB protection for all modes of reactor coolant pump operation and provides protection for RCS flow decreasing transients from high power where protection is not provided by the flux-number of reactor coolant pumps trip bistable. For every RCS flow rate there is a maximum permissible power level, and for every power level there is a minimum permissible low flow rate. The Δflux limits are established in order to prevent reactor thermal limits from being exceeded. These thermal limits are either power peaking KW/ft limits or DNBR limits.

Each of the four flux-Δflux-flow channels receive two differential pressure signals (one from each reactor coolant loop). The signals are developed by differential pressure transmitters (one per reactor coolant loop RPS channel for a total of 8 transmitters) that measure pressure drop across gentile tubes mounted in the two reactor coolant loop hot legs. The analog output of the transmitters is proportional to the square of the flow. A square root extractor converts this analog signal to one directly proportional to flow. The proportional flow signals from both RCS loops are summed to produce a total RC flow signal in a summing amplifier.

Each flux-Δflux-flow channel also monitors reactor power imbalance (Δflux). This is the difference between the power measured in the top half of the core and the power measured in the bottom half of the core by the two separate power range neutron flux detectors.

The Δflux signal and the flow signal are combined in a function generator and the resultant function signal becomes the trip setpoint of the flux-Δflux-flow bistable. The total flux signal is compared with this trip setpoint in the bistable. The bistable will trip when the total reactor power signal exceeds the bistable trip setpoint. When this bistable trips, its relay contact opens, de-energizing (tripping) the RPS channel trip relay.

On January 12, 1990, with the reactor at full power, RPS Channel 2 Rosemount Flow Transmitter FTRC1B2 was declared inoperable due to the transmitter drifting high out of calibration specifications. The output of FTRC1B2 provides input to the flux-Δflux-flow functional unit of RPS Channel 2. The flux-Δflux-flow channel instrument string allowable calibration error is 41.3mV and the measured channel instrument string

error was determined to be 5.6mV above this limit (which corresponds to an increase in the flux-Δflux-flow trip setpoint of 0.07% full reactor power above the Technical Specification limit). The out-of-calibration value was reached after a slow, gradual increase in output since August 1989. Toledo Edison declared RPS Channel 2 inoperable, and in accordance with the requirements of Action 2.a of Table 3.3-1, Channel 2 was placed in the tripped condition.

The RPS operates on a two-out-of-four trip logic, i.e., whenever any two of the four RPS channels trip, the RPS will interrupt power to the control rods causing the reactor to trip. As stated above, individual trip bistables are not individually trippable without tripping the entire RPS channel. With an inoperable RPS channel tripped, the remaining RPS channels operate in a one-out-of-three configuration to cause a reactor trip. This logic results in a half-trip of the RPS and makes the plant susceptible to tripping should a spurious trip occur on any one of the eight trip bistables in the remaining three RPS channels (i.e., any one of the remaining 24 bistables). As presented in the Babcock and Wilcox Owners Group Topical Report BAW-10167 (dated May 1986) "Justification for Increasing the Reactor Trip System On-line Test Interval", this approximately doubles the probability of a spurious trip for this one-out-of-three configuration.

A two-out-of-three configuration (inoperable channel not tripped) provides greater safety than a one-out-of-three configuration (inoperable channel tripped). This is because the two-out-of-three configuration provides reliability to trip on demand as well as protection against spurious trips. The one-out-of-three configuration is intolerant of a single spurious channel trip since it results in an undesired reactor trip.

By having an inoperable flow transmitter without tripping the RPS channel, the RPS maintains the two-out-of-four logic for all RPS parameters except for the flux-Δflux-flow parameter, which becomes the equivalent of a two-out-of-three configuration. Again, as presented in BAW-10167, the probability of not tripping on demand for flux-Δflux-flow changes from 9×10^{-9} (for a two-out-of-four configuration) to 3×10^{-8} (for a two-out-of three configuration). This change is considered insignificant.

Plant safety depends both on the reliability of the RPS to trip on demand and its ability to prevent spurious trips. The best configuration balances the reliability of tripping on demand and a low spurious trip rate. This has been analyzed by Babcock and Wilcox (B&W) under the direction of the B&W Owners Group. BAW-10167 provides technical justification for bypassing one of the four RPS channels indefinitely (as currently allowed by other B&W plant Technical Specifications). Topical Report BAW-10167, Supplement 2 (dated September 1989), "Justification for Increasing the Reactor Trip System On-Line Test Intervals - Supplement Number 2 - Additional Information on Allowed Outage Time," was submitted

to the NRC by letter dated November 15, 1989. This report concludes that retaining an indefinite bypassing of one complete RPS channel is justifiable and in the interest of plant safety. The relief Toledo Edison is seeking is even more conservative than those RPS configurations described in B&W-10167 since only one parameter would be in a two-out-of-three configuration and the entire RPS channel would not be bypassed.

On January 17, 1990, a telephone conference call was held between Toledo Edison and NRC representatives to discuss the granting of relief from TS 3.3.1.1 requirements to place Channel 2 in the tripped condition which had created a one-out-of-three RPS trip configuration. Toledo Edison proposed that RPS Channel 2 be returned to the non-tripped state thereby essentially retaining a RPS two-out-of-four configuration to trip the reactor with the exception of the flux-Δflux-flow functional unit which would, in effect, be in a two-out-of-three configuration to trip the reactor.

During the present operating cycle (Cycle 6) three spurious trips of RPS channels have occurred at the DBNPS. Under the present RPS channel configuration (one channel tripped resulting in a one-out-of-three logic), each of these spurious trips would have caused the reactor to unnecessarily trip.

Replacement of Flow Transmitter FTRC1B2 to correct the transmitter drift problem during plant operation is not feasible for the following reasons. Flow Transmitter FTRC1B2 is located in an area on Reactor Coolant Loop B which has an estimated radiation field at full reactor power of 1Rem/hr. Approximately 4 to 12 hours would be necessary to replace the transmitter and perform applicable post-maintenance testing. In keeping with the concept of ALARA these doses are considered to be unacceptable. Due to the time in core life for Cycle 6 and the resultant xenon transient which would be incurred, a reduction in power to enter containment and perform this work is not practical because of the large volumes of boration/deboration water processing required and the delay in returning to power and its effect on the scheduled outage. Should enforcement discretion not be granted by the NRC, Toledo Edison plans to continue operation with the RPS in a one-out-of-three configuration for reactor trip in accordance with the Technical Specifications.

Should the NRC grant the requested relief, Toledo Edison plans to take the following compensatory action. Data on the eight Rosemount 1153 transmitters that provide flow information to the RPS will be gathered to determine a 24 hour average. This method has been successful in identifying a transmitter which was drifting previously and replaced in September 1989, and in identifying the transmitter which has now drifted out of calibration. Toledo Edison believes that the proposed monitoring would ensure that any other transmitter problem would be detected prior to degrading to the point of preventing the associated RPS channel from performing its intended function. If any other transmitter for RPS

Channels 1, 3, or 4 degrades beyond its Technical Specification limit, Toledo Edison will follov the appropriate Technical Specification action of Limiting Condition for Operation 3.0.3. The transmitters in RPS Channels 1, 3, and 4 have not shown any significant drift which would indicate the same degradation as seen in the RPS Channel 2 transmitter.

Enforcement discretion is appropriate for these circumstances for the following reasons: timely promotion of a safe course of action, a very limited time period of plant operation is affected, the situation was not reasonably foreseen by Toledo Edison and the timeliness of NRC action is of essence to preclude the potential imposition of a plant transient. As this is a limited circumstance, a permanent License Amendment would not be as appropriate as enforcement discretion. The effectivity of this enforcement discretion would be limited in duration until the next shutdown of the plant and in no case later than the commencement of the sixth refueling outage (presently scheduled for February 1, 1990).

Should you have any questions or require additional information, please contact Mr. Robert W. Schrauder, Manager - Nuclear Licensing, at (419) 249-2366.

Sincerely yours,

DRW/DJS/smm

cc: P. M. Byron, DB-1 NRC Senior Resident Inspector
T. V. Vambach, DB-1 NRC Senior Project Manager
State of Ohio