SAFETY EVALUATION REPORT
DOCKET NO. 50-289
THREE MILE ISLAND UNIT 1
GENERIC LETTER 83-28, ITEM 4.3
REACTOR TRIP SYSTEM RELIABILITY - AUTOMATIC ACTUATION OF THE SHUNT TRIP ATTACHMENT FOR B&W PLANTS

INTRODUCTION AND SUMMARY

Generic Letter 83-28 entitled, "Required Actions Based on Generic Implications of Salem ATWS Events," was issued by NRC on July 8, 1983. By letter dated May 9, 1984, GPU Nuclear Corporation indicated that it would incorporate the generic design modifications endorsed by the B&W Owners Group for the incorporation of the automatic actuation of the shunt trip attachment for the reactor trip breakers and provided response to the plant specific questions identified by the staff in its September 1983 safety evaluation report of the generic design.

The staff has reviewed the licensee's proposed design for the automatic actuation of the reactor trip breaker shunt trip attachments and finds it acceptable.

EVALUATION

The following required plant specific questions were identified based on the staff's review of the B&W Owners Group proposed generic design for this modification:

1. A statement confirming that the UV sensor (high speed undervoltage relay) Model ITE-27H-211R, is environmentally and seismically qualified for its service conditions.

   The licensee has confirmed that the UV sensing relay is qualified in accordance with IEEE 501. The response spectra for the UV sensing relay envelops the TMI-1 required response spectra for the area in which the relay will be located. Environmental qualification of the sensors is not required because they are located in a controlled, mild environment. We find the licensee's confirming statement acceptable.

2. A statement confirming that all other additional components involved in the shunt trip circuits are environmentally and seismically qualified for their service conditions.

   The licensee states that all other additional components involved in the shunt trip circuits will be qualified to withstand a seismic event and will be mounted in accordance with the manufacturer's recommendations. Environmental qualification is not required because all these components and their associated wiring are located in a controlled mild environment. We find the licensee's response and commitment acceptable.

3. A statement confirming that the shunt trip attachment is or will be environmentally and seismically qualified for its service conditions.

The licensee notes that the shunt trip attachment was physically attached to the reactor trip breaker during the original seismic test. Because the shunt trip was not functionally tested as part of the seismic test, a separate seismic test or analysis will be performed on the shunt trip device to qualify the device for a seismic event. Alternatively, existing shunt trip seismic test data will be reviewed to determine applicability toward seismic qualification in lieu of actual seismic testing.

The seismic qualification tests did confirm that the shunt trip attachment did not detach or in any way interact with the undervoltage trip device. We conclude that the resolution of the seismic qualification of the shunt trip attachment should not delay implementation of the proposed modifications. We find acceptable the licensee's commitment to seismically qualify the shunt trip attachment. Environmental qualification is not required because the shunt trip device is located in a controlled, mild environment.

4. Identify the classification (safety related or not) and separation (train or channel identification) for the reactor trip shunt and UV trip circuits, power supplies, and any interface isolation devices.

The licensee has identified the power supplies and has confirmed that they are safety related and that channel separation has been maintained in the cable routing of the shunt and undervoltage trip circuits.

The original plant design included a feature to automatically trip the AC reactor trip breakers via the shunt trip attachment on overvoltage or loss of offsite power. This provided protection for the holding coils for the control rod drives and is not classified as a safety related circuit since this action is not essential to plant safety. The licensee has modified the design of the shunt trip circuit to include a qualified relay to provide isolation of the non-safety related power source trips and the safety related trip of the shunt trip attachment on reactor trip. The licensee has also noted that a qualified relay provides isolation between the DC control power circuit and the relay contact used to alarm a loss of this power source.

Based on our review of the change noted above, we find that safety classification and separation of the safety and non-safety related circuits by the use of qualified isolation devices is acceptable.

5. If the wiring to the UV sensor involves different separation groups (train or channel), identify the minimum separation (distance) between wiring of the different groups. Provide an analysis of the consequences of short circuits between wiring in different separation groups to confirm that the consequences do not adversely impact redundant safety related systems.

The licensee has confirmed that AC and DC control circuits for AC reactor trip breakers do not involve different power trains associated with divisional separation of circuits. The DC reactor trip breakers do, however, involve different power trains that require divisional separation of the AC and DC control circuits. Consistent with the guidance provided in Regulatory Guide 1.75, "Physical Independence of Electric Systems," a minimum separation distance of six inches is maintained with two exceptions. The exceptions are the shunt and undervoltage trip attachments on the DC reactor trip breakers and the terminal

connections for the undervoltage sensor. For these two cases, the licensee has provided an analysis of potential shorts between the circuits involving different power trains. The conclusions of this analysis are that shorts would not preclude the capability of the reactor trip system from performing its safety function.

Based on our review of the licensee's separation of divisional power trains and associated short circuit analysis, we find that the design is in accordance with the guidance of Regulatory Guide 1.75 and is, therefore, acceptable.

6. Provide an outline of the test procedures to independently verify the operability of the shunt and UV trip circuits and components. Identify the sequence of actions to be performed. Address your intent regarding periodic surveillance to confirm the operability of the power failure alarms.

The licensee has provided test/isolation switches to test each of the breaker tripping mechanisms (undervoltage and shunt trip) independent of one another's action. All test/isolation switches are key operated by the same key and the

key is removable only in the center position. Indicating lights are provided to indicate the presence of voltage across the UV sensors and for the shunt trip circuit. These indicating lights are connected downstream of the test/isolation switches in order to provide indication that switches have been returned to the normal position. Loss of dc,or test/isolation switch not in normal position for any of the four CRDM trip circuits is annunciated in the control room. White indicating lights are provided to indicate the presence of voltage in the source interruption circuits for each ac circuit breaker. These are provided to supervise the additional fuses added to isolatethe non-IE circuit from the IE circuit.

The licensee has committed to incorporate the diverse tripping mechanisms and their associated circuit components for the CRDM circuit breakers in the existing plant surveillance procedures. The testing for these circuit breakers shall include separately tripping them via the undervoltage trip device and via the shunt trip mechanism independent of one another. To test the UV trip devices, the associated test/isolation switch will be held in the "UV Trip" position while the reactor trip signal is given. To test the

shunt trip mechanism, the only action required is to move the test/isolation switch to the "Shunt Trip" position. Surveillance testing on a monthly basis is performed to verify the operability of the reactor breaker trip function.

Based on our review of the test procedure outline, we conclude that it includes the appropriate steps to independently confirm the operability of the shunt and undervoltage trip circuits and is, therefore, acceptable.

7. Provide a draft of any proposed technical specifications changes as a result of this modification.

The licensee notes that the current technical specifications require a monthly test of the control rod drive trip breakers including tripping of the breakers via the shunt trip circuit. The licensee should propose a revision to Table 4.1-1 of technical specification to explicitly note that the testing should independently confirm the operability of the shunt and undervoltage trip attachments consistent with the test procedure outline provided by the licensee. The staff will require that revised technical specifications be proposed prior to restart following the implementation of these changes.

8. Provide the electric schematics for the shunt and UV trip circuits.

The licensee has submitted the electrical schematics for the shunt and UV trip circuits. Based on our review of the schematics for these circuits, we find that they adequately reflect the description of the proposed changes and are, therefore, acceptable.

CONCLUSION

Based on the review of the licensee's response to the plant specific question identified in the staff's evaluation of the proposed modifications, we find that the design modifications are acceptable.

The UV sensor has been seismically qualified and, in item 2 above, the licensee has committed to seismically qualify the additional components involved in the shunt trip circuits. In item 3 above, the licensee has also committed to seismically qualify the shunt trip attachment. We find these commitments acceptable.

We require the licensee to revise the TSs to explicitly require testing that independently confirms the operability of the shunt trip and the UV trip, as discussed in item 7 above.