SAFETY EVALUATION REPORT
DOCKET NO. 50-272 & 50-311
SALEM UNITS 1 & 2
GENERIC LETTER 83-28, ITEM 4.3
REACTOR TRIP BREAKER AUTOMATIC SHUNT TRIP

INTRODUCTION AND SUMMARY

Generic Letter 83-28 was issued by NRC on July 8, 1983 indicating actions to be taken by licensees based on the generic implication of the Salem ATWS events. Item 4.3 of the generic letter requires that modifications be made to improve the reliability of the Reactor Trip System by implementation of an automatic actuation of the shunt attachment on the reactor trip breakers. By letter dated June 14, 1983 the Westinghouse Owners Group (WOG) proposed a generic design modification to implement the automatic shunt trip. By letter dated March 14, 1984, Public Service Electric and Gas Company (PSE&G) submitted its design for this modification which is based on the WOG generic design proposal. By letter dated June 7, 1984, the licensee provided additional information addressing the breaker position status light circuitry and the temporarily substitution of Struthers Dunn relays instead of Potter & Brumfield MDR series relays. 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.

The licensee notes that Unit 1 wiring modifications will be completed during the current refueling outage scheduled to be completed by August 1, 1984. The licensee has not specified the implementation date for these modifications for Unit 2.

EVALUATION

The following required plant specific information items were identified based on the staff's review of the WOG proposed generic design for this modification:

1. Provide the electrical schematic/elementary diagrams for the reactor trip and bypass breakers showing the undervoltage and shunt coil actuation circuits as well as the breaker control (e.g., closing) circuits, and circuits providing breaker status information/alarms to the control room.

The licensee provided the electrical schematic diagrams for the reactor trip breakers showing the undervoltage and the shunt trip circuits. The design of the electrical circuits have been reviewed and found to be consistent with the WOG generic proposed design which was previously reviewed and approved by the staff. In addition, the licensee has included an additional test switch to facilitate testing of the manual reactor trip function. We find this is acceptable.

2. Identify the power sources for the shunt trip coils. Verify that they are Class 1E and that all components providing power to the shunt trip circuitry are Class 1E and that any faults within non-class 1E circuitry will not degrade the shunt trip function. Describe the annunciation/indication provided in the control room upon loss of power to the shunt trip circuits. Also describe the overvoltage protection and/or alarms provided to prevent or alert the operator(s) to an overvoltage condition that could affect both the UV coil and the parallel shunt trip actuation relay.

Redundant Class 1E power sources are used for the shunt trip actuation of the reactor trip breakers and for the shunt trip of the bypass breakers. The additional shunt trip circuitry is powered from the reactor protection system regulated supply (48 Vdc). Class 1E circuitry provided to the shunt trip is separated from non-Class 1E circuitry. Therefore, a fault within non-Class 1E circuitry will not degrade the shunt trip function. This is in accordance with Regulatory Guide 1.75 and is, therefore, acceptable.

The added shunt trip circuitry relay is powered from the reactor protection system power supplies (48 Vdc). There are two power supplies in the solid state protection system and the auctioneered high power supply normally supplies the load. If an overvoltage condition exists (115% of nominal 48Vdc), the power supply supplying the load will turn off and the redundant supply will pick up the load. A control room annunciator will alert the operator of this condition. If an overvoltage condition still exists, the redundant power supply will remove the load, thus deenergizing both the undervoltage coil and the added shunt trip actuation relay which would trip the breaker. Also, normally the shunt trip coils in the reactor trip breakers are in deenergized condition. Since the current through the shunt trip coil is interrupted when the breaker trips, energization of the shunt trip coil is only momentary. A supervisory relay is located in series with the

shunt trip coil. The supervisory relay which monitors the trip circuit continuity does not carry a current which is large enough to actuate the trip coil armature.Contacts of the supervisory relay are used in an alarm circuit to annunciate a loss of the shunt trip capability. In addition a yellow light is provided on the control room console to indicate the loss of trip capability.

Individual breaker control switches and breaker position status lights are provided on the control console in the control room. An auxiliary relay cabinet provides an interface with the 28V dc control console circuits and 125V dc breaker control circuits. The breaker position lights are operated by an auxiliary latching relay located in the interface cabinet. Since power is required to operate this relay, a contact of the supervisory relay is used in series with the breaker close position status light. This precludes the potential of having a false indication of breaker position if 125V dc power is not available to reset the latching relay.

Based on our review, we conclude that appropriate consideration has been given to the aspects of the design described above and the design is, therefore, acceptable.

3. Verify that the relays added for the automatic shunt trip function are within the capacity of their associated power supplies and that the relay contacts are adequately sized to accomplish the shunt trip function. If the added relays are other than the Potter & Brumfield MDR series relays (P/N 2383A38 or P/N 955655) recommended by Westinghouse, provide a description of the relays and their design specifications.

The added relays specified by Westinghouse for the automatic shunt trip function are the Potter and Brumfield MDR series relays (P/N 2383A38 for 125 Vdc or P/N 955655 for 48 Vdc). The design at Salem 1 and 2 includes the Potter & Brumfield MDR series P/N 955655 relays as specified in the WOG generic design for the automatic shunt trip function. The relays are within the capacity of the SSPS power supplies and the relay contacts are adequately sized for the shunt trip function. By letter dated June 7, 1984, the licensee indicated that the Potter & Brumfiled relays are not scheduled for delivery until August and may not be available to permit completion of the shunt trip modification during the present Unit 1 refueling outage. Therefore, the licensee has proposed to temporarily use a Struther Dunn 219 series relay until such time that the generic design relays are available and plant conditions permit installation. The licensee has noted that the 219 series Struthers Dunn relays have been seismically qualified and will be located in an environment within the design specifications of the relays. We find this is acceptable.

4. State whether the test procedure/sequence used to independently verify operability of the undervoltage and shunt trip devices in response to an automatic reactor trip signal is identical to the test procedure proposed by the Westinghouse Owners Group (WOG). Identify any differences between the WOG test procedure and the test procedure to be used and provide the rationale/justification for these differences.

The licensee has confirmed that the test procedure sequence used to independently verify operability of the undervoltage and shunt trip devices in response to an automatic reactor trip signal is identical to the test procedure proposed by the WOG. Since no deviations were identified, we find this is acceptable.

5. Verify that the circuitry used to implement the automatic shunt trip function is Class 1E (safety related), and that the procurement, installation, operation, testing and maintenance of this circuitry will be in accordance with the quality assurance criteria set forth in Appendix B to 10 CFR Part 50.

The licensee confirmed that the circuitry used to implement the automatic shunt trip function is Class 1E (safety related) and the procurement, installation, operation, testing and maintenance of this circuitry will be in accordance with the quality assurance criteria set forth in Appendix B to 10 CFR Part 50. We find this is acceptable.

6. Verify that the shunt trip attachments and associated circuitry are/will be seismically qualified (i.e., be demonstrated to be operable during and after a seismic event) in accordance with the provisions of Regulatory Guide 1.100, Revision 1 which endorses IEEE Standard 344, and that all non-safety related circuitry/components in physical proximity to or associated with the automatic shunt trip function will not degrade this function during or after a seismic event.

The licensee notes that the WOG is working with Westinghouse to obtain seismic qualification of the shunt trip attachments. The licensee confirmed that the balance of the added circuitry will be seismic Class 1 and the non-safety related circuitry/components will not degrade the automatic trip function during or after a seismic event. We find this commitment to be acceptable.

7. Verify that the components used to accomplish the automatic shunt trip function are designed for the environment where they are located.

The licensee notes that the components used to accomplish the automatic shunt trip function are designed for the environment where they are located. We find this is acceptable.

8. Describe the physical separation provided between the circuits used to manually initiate the shunt trip attachments of the redundant reactor trip breakers. If physical separation is not maintained between these circuits, demonstrate that faults within these circuits cannot degrade both redundant trains.

The licensee confirmed that physical separation is maintained between the circuits used to manually initiate the shunt trip functions of the redundant reactor trip breakers. The shunt trip interposing relays and the reactor trip logic outputs are mounted in separate metal enclosures. All of the field cabling from the main control board and the reactor protection logic to the redundant trains A and B are routed separately as train A and train B circuits. All associations with nonsafety grade equipment are through coil to contact isolation. We find this meets the requirement of Regulatory Guide 1.75 and is, therefore, acceptable.

9. Verify that the operability of the control room manual reactor trip switch contacts and wiring will be adequately tested prior to startup after each refueling outage. Verify that the test procedure used will not involve installing jumpers, lifting leads, or pulling fuses and identify any deviations from the WOG procedure. Permanently installed test connections (i.e., to allow connection of a voltmeter) are acceptable.

The licensee notes that the operability of the control room manual reactor trip switch contacts and wiring will be adequately tested prior to startup. The test procedure does

not involve installing jumpers, lifting leads or pulling fuses. The test procedure will verify the independent operation of the undervoltage and shunt trip circuitry. We find this is acceptable.

10. Verify that each bypass breaker will be tested to demonstrate its operability prior to placing it into service for reactor trip breaker testing.

The licensee used a probabilistic analysis to support this conclusion that frequent testing of bypass breaker is not required and that based on this analysis there is no need for bypass breaker testing. The staff will require that the operability of bypass breaker under voltage trip attachment be demonstrated operable at a refueling outage frequency. Further the staff will require that the shunt trip attachment of bypass breakers be tested with the breaker in the test position prior to racking in and closing of bypass breakers for reactor trip breaker testing. The proposed technical specification should include these requirements.

11. Verify that the test procedure used to determine reactor trip breaker operability will also demonstrate proper operation of the associated control room indication/ annunciation.

The licensee notes that test procedures used to verify the operability of the reactor trip breakers will demonstrate the proper operation of control room indication/annunciation. We find this commitment to be acceptable.

12. Verify that the response time of the automatic shunt trip feature will be tested periodically and shown to be less than or equal to that assumed in the FSAR analyses or that specified in the technical specifications.

The licensee notes that test procedures used to verify the operability of the reactor trip breakers will be revised to include the response time of the automatic shunt trip feature. We find this commitment to be acceptable.

13. Propose technical specification changes to require periodic testing of the undervoltage and shunt trip functions and the manual reactor trip switch contacts and wiring.

The licensee has addressed the technical specification changes for Units 1&2 which will be proposed following implementation of the automatic shunt trip feature.

The changes to the technical specifications note specifically that the undervoltage and shunt trip circuits for the manual reactor trip and reactor trip breaker are to be tested independently prior to plant start up. However, the notation for the monthly functional test of the reactor trip breakers did not address testing in a manner which clearly indicates that an independent test for the operability of the shunt and U.V. trip features is required. The staff will require that notation reflect independent testing of shunt and U.V. trip features for the monthly functional test.

CONCLUSION

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

The staff requires that the licensee submit confirmation that the seismic qualification of the shunt trip attachment has been successfully completed as noted in item 6. Further the staff requires that proposed technical specification be submitted, which are responsive to the staff requirements noted in items 10 and 13, following implementation of this modification.