SAFETY EVALUATION REPORT
BEAVER VALLEY UNIT 1
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 July 16, 1984, the licensee, Duquesne Light Company, provided responses to the plant-specific questions identified by the staff in its August 10, 1983 Safety Evaluation Report of the generic Westinghouse 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. However, it is the staff's position that additional modifications should be implemented for bypass breaker position indication as noted in this safety evaluation report.

The licensee intends to install the modification during the fifth refueling outage.

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 and bypass breakers showing the undervoltage and the shunt trip circuits. The design of the electrical circuits for the automatic actuation of the shunt trip attachment have been reviewed and found to be consistent with the proposed WOG generic design which was previously reviewed and approved by the staff. However, the Beaver Valley design does not include remote breaker position indication on the main control board for the bypass breakers. The staff finds this inconsistent with the typical schematics provided with WOG generic design which included bypass breaker status indication. Because the capability of the control room operator to readily determine this open-closed position status of the reactor trip

and bypass breakers is safety significant, it is the staff's position that bypass breaker position status lights should be provided on the main control board. Further this indication should be interlocked with a breaker cell switch, consistent with the schematics provided with the generic design, such that it is only active when the bypass breaker is racked in the operate position.

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. Since the class 1E circuitry is separated from non-1E circuitry per criteria in effect at the time of licensing, 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 licensee notes that as part of the proposed shunt trip modification, breaker position indicating lights are to be added to the main control board for the reactor trip breakers and no lights are to be added for the bypass breakers since annunciation exists for bypass breaker position. The staff concludes that the annunciation circuits are not an acceptable alternative in lieu of direct status indication of the bypass position. Therefore, it is the staff's position that the licensee modify the design consistent with the WOG generic submittal including bypass breaker status indication.

The reactor trip breaker position status lights are used to supervise the availability of power to the shunt trip circuit of the reactor trip breaker. The red light which is connected in series with the shunt coil and the "a" auxiliary contact indicates that the breaker is closed and also indicates that the power is available to the shunt trip device and, therefore, provides detectability of power failure to the shunt trip coil. Also, normally open auxiliary switch contact of each breaker provides breaker status information to the plant computer.

Normally the shunt trip coils in the reactor breakers are in de-energized condition. When the trip breakers are closed, the red lamp current flows through the trip coil to monitor the circuit continuity which is not large enough to actuate the trip coil armature. Since the current through the shunt trip coils is interrupted when the breaker trips, energization of the shunt trip coil is only momentary. The maximum available voltage occurs during a battery equalizing charge at a maximum voltage of 115% of the nominal voltage. Due to the short duty cycle of the shunt trip coil, it can operate at this overvoltage condition without harmful effects.

The added shunt trip circuitry and UVTA are powered from the reactor protection logic voltage supplies. Two 48 Vdc power supplies (in one train) are auctioneered to form one 48V dc bus. If an overvoltage condition exists (115% of nominal 48 Vdc), the power supply will turn off and the redundant supply will carry the load. This condition will be annunciated in the control room and will light a warning lamp on the SSPS logic cabinet. If the overvoltage condition remains, the redundant power will be turned off thus removing the load and de-energizing undervoltage coil and shunt trip actuation relay. Since the power is removed from the UV coil and shunt trip actuation relay, it will not have any harmful effects on these components. This is in accordance with our requirements and is, therefore, acceptable.

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 design at Beaver Valley includes the Potter & Brumfield MDR series P/N 955655 relays as specified in the WOG generic design for the automatic shunt trip function. The relay contacts are adequately sized to accomplish the shunt trip function. We find this aspect of the design to be 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 notes that the details of the testing to independently confirm the operability of the undervoltage and shunt trip will be based on the procedure submitted by the WOG with the generic design propsal. We find this to be 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 Duquesne Light Company quality assurance program which satisfies the quality assurance requirements of Appendix B to 10 CFR Part 50. We find this to be 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 shunt trip attachments and associated circuitry will be seismically qualified. The WOG is working with Westinghouse to obtain seismic qualification of the shunt trip attachments and auto shunt trip panel in accordance with IEEE 344 as endorsed by R. G. 1.100. 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 has verified that the plant-specific environmental conditions defined in the WOG generic design package Table 1 envelope the Beaver Valley 1 motor-generator room conditions. We find this 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.

Physical separation between the circuits used to manually initiate the shunt trip attachments of the redundant trip breakers is maintained by routing the field cabling from the main control board and reactor protection logic to redundant train A and train B reactor trip switchgear as train A and train B circuits. Main control board manual reactor trip switches are provided with fire barriers between the redundant train switch actions. The interposing relays used to actuate the shunt trip attachments and their associated terminal blocks are mounted in separate metal enclosures. The reactor protection system logic output energizing the interposing relays are enclosed in existing separate metal enclosures. This meets the guilines of R.G. 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 verification of the control room manual reactor trip switch contacts and wiring is to be included into plant procedures. The test procedure will not include installing jumpers, lifting leads or pulling fuses. The testing will be performed prior to startup after each refueling outage. This is in accordance with our requirements and is, therefore, 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 notes that each bypass breaker is tested to demonstrate its operability every 18 months. Since bypass breakers are closed only during testing of main trip breakers and it is only during this time that the bypass breaker could be called upon to provide a protective action, the licensee concludes that the probability of complete failure of the reactor trip system due to failure of the bypass breaker during testing is remote and does not appear to warrant testing of the bypass breakers prior to placing them into service for reactor trip breaker testing. The licensee further notes that a local trip pushbutton is used to open the bypass breaker after bimonthly testing of the trip breakers, thus

verifying the shunt trip function through breaker opening. Based on the review of the licensee's submittal, the staff finds that the bypass breaker undervoltage trip attachment to be demonstrated operable at a refueling outage frequency is acceptable. However, the staff requires that the shunt trip attachments of bypass breakers be tested with the breaker in the test position prior to closing of a bypass breaker for reactor trip breaker testing instead of after the bimonthly testing of the trip breakers. The proposed technical specifications should include this requirement.

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 the test procedures used to determine reactor trip breaker operability also demonstrates proper operation of the associated control room indication/annunciation. The red light indicates that the breaker is closed and the green light indicates that the breaker is open. We find this acceptable. Further, the licensee should confirm that the test used to determine the bypass breaker operability will also demonstrate proper operation of position indication.

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 neither the FSAR nor the technical specifications identifies a response time specifically for the reactor trip breakers, however, independent testing of the shunt and undervoltage trip attachments is performed during the 18 month overall response time testing required by Technical Specification 4.3.1.1.3. We find this 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 provided the changes to the plant technical specifications which will be submitted for approval following installation of the shunt trip modification. These changes include notation to require the independent testing of the UV and shunt trip functions of the reactor trip breakers at 18-month intervals rather than the specified bimonthly functional test interval. We find this to be unacceptable and inconsistent with the WOG test procedures for on-line testing of the reactor trip

breakers. The proposed Technical Specifications should reflect the requirement for independent verification of the operability shunt and undervoltage attachments during the bimonthly functional test.

CONCLUSION

Based on the review of the licensee's response to plant-specific questions identified in the staff's evaluation of the proposed design modifications, we find that the proposed modifications are acceptable. However, the staff's resolution of this matter is conditioned on the following:

(a) Submission of revised information including revised electrical schematics showing provision of bypass breaker position status lights on the main control board as noted in item 1.

This item remains open pending the staff's review.

(b) Confirmation that shunt trip components have been seismically qualified as noted in item 6.

(c) Confirmation that testing of bypass breaker undervoltage trip attachments will be performed as noted in item 10.

(d) Confirmation that bypass breaker testing will demonstrate proper operation of control board bypass breaker position indication as identified in item 11.

(e) Submission of proposed technical specifications noted in items 10 and 13, following implementation of this modification.

It should be noted that this evaluation satisfies the preimplementation review requirements for Item 4.3 of Generic Letter 83-28. Therefore, the modification for the automatic actuation of the shunt attachments of the reactor trip breakers should be implemented during the next refueling outage as presently planned.

With regard to the staff's position on bypass breaker status indication noted in item (a) above, these modifications should be implemented if possible during the next refueling outage, but no later than the following refueling outage.

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