UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION

WISCONSIN ELECTRIC POWER COMPANY

POINT BEACH NUCLEAR PLANT 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 the 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 1, 1984, the licensee, Wisconsin Electric Power Company, provided responses to the plant specific questions identified by the staff in its August 10, 1983 Safety Evaluation 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.

The licensee intends to install the modification in Unit 2 during the Fall 1984 refueling outage and in Unit 1 during the Spring 1985 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 WOG generic proposed design which was previously reviewed and approved by the staff. However, the Point Beach design does not include remote breaker position indication on the main control board for the bypass breakers. Bypass breaker position

indication is provided on the protection system racks; however the position indicating lights are not interlocked with breaker cell switches. The staff finds this unacceptable and that control board indication of the position of the bypass breakers should be provided including the cell switch interlock for all remote bypass breaker position indication. Our evaluation of item 11 provides additional comments on this matter.

The Point Beach design includes test jacks to facilitate the capability to perform response time tests during plant operation. This addition to the WOG generic design consists of test jacks wired directly to an auxiliary switch "a" contact and test jacks wired in series with resistors across the undervoltage coil. Thus test connections for an undervoltage trip signal and breaker tripped condition are available to perform the response time test. The resistors in series with the test connections to the undervoltage coil provide protection against potential accidental shorts or grounds during response time testing to assure that such events would not result in an inadvertent breaker trip or overload on the protection system power source for the undervoltage trip attachment. This aspect of the design will facilitate on-line response time testing without degrading safety and is, therefore, acceptable. However, it is the staff position that the licensee modify the design consistent with the typical design configuration for bypass breaker status indication provided by the Owners Group.

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 to actuate the shunt trip 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 logic voltage supply (125 Vdc). All components which provide power to the shunt trip circuitry are designed and installed in accordance with the criteria set for safeguard equipment.

There are 7 cables on Unit 1 and 4 cables on Unit 2 which are associated with both power supply circuits due to their presence in common enclosures or raceways. The licensee has analyzed these circuits and has demonstrated that Class 1E circuits are not degraded below an acceptable level. This is in accordance with IEEE Standard 384 and is therefore, acceptable.

The breaker position status lights are used to supervise the availability of power to the shunt trip circuits. 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 closed auxiliary switch contact of each breaker provides information to the Event Recorder when the breaker is opened. In addition, an annunciator in the control room indicates the over/undervoltage on either A train or B train safeguards 125 Vdc systems. Voltage indication is provided for each of the 125 Vdc safeguards trains.

Components in the added shunt trip circuitry have been selected based on their ability to perform their intended function up to a voltage of approximately 140 Vdc. The voltage source to both the undervoltage and shunt trip coils is from the station batteries and the voltage is therefore controlled by the battery voltage which is maintained at a level less than 135 Vdc.

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 Point Beach includes the Potter & Brumfield MDR series P/N 2383A38 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 has confirmed that the testing at Point Beach to independently confirm the operability of the UV trip and shunt trip will use the test procedures developed by the WOG and is, therefore, 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 Section 1.8 of the Point Beach FSAR which satisfies the quality assurance requirements of 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 is working with the WOG and Westinghouse to obtain seismic qualification of the shunt trip attachments and added circuitry. If qualification tests show that any of the added components do not perform their intended function during or after a postulated seismic event, these components will be replaced with qualified components during initial installation or replaced during the next scheduled outage of sufficient length. 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 selected to operate in the environment defined in the WOG generic design package table 1 which envelopes that of the location of the reactor trip switch gear at Point Beach. 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 field cables for the redundant trains between the reactor trip switchgear and the main control board are routed in separate raceways. The redundant circuits within the reactor switchgear are confined to separate metal enclosures. At present, the licensee has not maintained adequate separation for the wiring internal to the main control board, but has committed to provide six inches of free air space or an intervening barrier between the redundant trains. This is in accordance with IEEE Standard 384 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 test procedure will be developed to verify the operability of the control room manual reactor trip switch contacts and wiring. The testing will be performed prior to startup after each refueling outage. The procedure will utilize test connections, where required, to preclude the use of jumpers, lifted leads or pulled fuses. We find 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 during the refueling outage. 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.

In previous reviews of the Westinghouse design, the staff has required that the shunt trip attachments of bypass breakers be tested with the breaker in the test position prior to racking in and closing of a bypass breaker for reactor trip breaker testing. The basis for this requirement was that it provided a readily available means to confirm the operability of the shunt trip attachment of the bypass breakers. Also it was recognized that, in general, the Westinghouse design for bypass breakers does not include features which would readily permit testing of the undervoltage trip attachments. Therefore, although the shunt trip attachments for bypass breakers are not actuated on an automatic reactor trip, verification of its operability provides assurance that bypass breakers could be tripped via the manual reactor trip switches in the control room.

The design of the reactor trip scheme for the Point Beach units does not include operation of the shunt trip attachments of the bypass breakers on a manual reactor trip. However, the undervoltage trip attachment which is de-energized on both manual and automatic trips includes the provision to be tripped individually from the reactor protection system racks. Therefore, this feature provides a readily available means to demonstrate the operability of the bypass breaker when they are closed for breaker testing. Therefore, the staff finds that testing of shunt trip attachments of bypass breakers at a refueling outage frequency is acceptable; however, testing of the undervoltage trip attachment will be required as an initial step when bypass breakers are closed for surveillance tests of reactor protection system logic and reactor trip breakers. The proposed Technical Specifications 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 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 is acceptable.

Based on a review of the schematic diagram of the bypass breakers, it is noted that breaker position (open-closed) indication is provided only on the reactor protection systems racks and not on the main control board. 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, the licensee should confirm that the test used to determine bypass breaker operability will also demonstrate proper operation of this control board breaker position indication.

There are two possible alternatives for testing bypass breakers prior to testing the reactor trip breakers. The alternatives involve whether the bypass breaker is in the "test" position or is in the "operate" position. In the former case, the operability of the breaker mechanism can be verified without bypassing the reactor trip breaker while in the latter case the reactor trip breaker is bypassed when the bypass breaker mechanism is in the closed position. Either alternative is acceptable for confirming the operability of the bypass breaker.

However, if the bypass breaker is tested in its test position, the status of remote breaker position indication should be considered, In the typical schematics for breaker position indication submitted by the Westinghouse Owners Group with the generic design modifications, bypass breaker position indication included an interlock with a breaker cell switch. When the breaker is in the test position or is completely racked out, all remote position indication is extinguished. Thus, there is remote position indication only when the bypass breaker is in the "operate" position.

The Point Beach design of the bypass breaker circuits does not follow the typical WOG design since the remote breaker position indication on the protection system racks is not interlocked with a breaker cell switch. With this design, the remote indication would indicate that the breaker is closed if the breaker is in fact in the test position with the mechanism closed but its associated reactor trip breaker is not bypassed. When a breaker cell switch is used to defeat remote indication, the remote breaker position indication is not ambiguous with regards to a reactor trip breaker being bypassed.

The typical design removes this indication ambiguity by activating the bypass breaker "open or closed" indicating lights only when the bypass breaker is in the "operate" position. The operator can then readily determine if the reactor trip breaker is bypassed by observing that the bypass breaker "closed" lamp is lit. Therefore, it is the staff's position that the licensee should implement the breaker cell switch interlock to remove this ambiguity in the remote indication of bypass breaker position.

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 it is not their intention to perform periodic response time testing and are monitoring the results of the Westinghouse life cycle testing of the reactor trip breakers. Should life cycle testing show that breaker trip response time degrades with operation, periodic on-line response time testing of the automatic shunt trip feature will be considered. We find this 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 submitted the proposed changes to the plant technical specifications. However, the technical specification changes do not explicitly state that the periodic testing of the undervoltage and shunt trip function will be done independently. Additional guidance on these changes will be provided to the licensees and applicants. Following implementation of the shunt trip modifications, the staff will require proposed technical specifications appropriate for this change to the trip system design.

Conclusion

Based on the review of the licensee's response to the plant specific questions identified in the staff's evaluation of 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:

(i) provision of bypass breaker position status lights on the main control board.

(ii) inclusion of cell switch interlock for bypass breaker position indication as detailed in items 1 and 11.

This item remains open pending the staff's review.

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

(c) Confirmation that testing of bypass breaker undervoltage trip attachments will be performed as defined 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 of each unit 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 of each unit, but no later than the following refueling outage of each unit.

Principal Contributor:

Faust Rosa, ICSB