



UNITED STATES  
ATOMIC ENERGY COMMISSION  
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OCT 12 1973

H. D. Thornburg, Chief, Field Support & Enforcement Branch, RO

THREE MILE ISLAND UNIT 1, FAILURE OF VOLTAGE SUPPRESSION DIODES  
INSTALLED IN ENGINEERED SAFEGUARDS CIRCUIT BREAKERS - DOCKET NO. 50-289

This memo is in response to your request for review<sup>1</sup> of the above failures which occurred at the subject facility and to assess the related generic and safety implications. The licensee<sup>2</sup> reported that during testing of 480 volt AC safety related circuit breakers, numerous failures of the diodes (W IN 504) installed across the close and trip coils of the circuit breakers have occurred. Investigation into the problem disclosed that the voltage rating of the failed diodes is too low (400 volts) to handle the voltage transients occurring during actual circuit breaker operation. Based on this finding, the licensee has initiated a program to replace all potentially faulty diodes with a unit considered more suitable for this application. The replacement unit, a GE thyrector, Model 6 R20AP1B2 has a rating of 1500 volts.

We have discussed the diode problem with the knowledgeable people from the licensee; the AE, Gilbert Associates (GAI); the breaker manufacturer, Westinghouse; and personnel from Region I and Licensing.

The purpose of the voltage surge suppression circuitry is to protect sensitive instruments from voltage transients which can occur during the opening or closing of a circuit breaker. The reason for the licensee's concern of this interaction between the instruments and the circuit breakers is because the wiring for these components is installed in close proximity of each other. It is also worthy to note that the voltage suppression circuitry as discussed does not protect the relays nor contacts of the circuit breaker in which they are installed.

In our assessment of the related generic implications concerning these failures, our discussions with Westinghouse and GAI indicated that

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<sup>1</sup>Action Control Form FO#154, Thornburg to Reinmuth, dated 9/5/73.

<sup>2</sup>RO Inspection Report No. 50-289/73-11 (Paragraph 7).

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OCT 12 1973

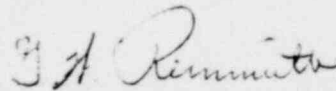
instrument protection from voltage "spikes" using diodes in circuit breaker control circuitry has not been used at other nuclear power plants. In view of this, we conclude that the diode problem as discussed should not be generic. We have not, however, contacted all facilities to confirm this conclusion.

Another design deficiency was noted during our investigation into the diode problem in that the status of the "availability" of control power for the closing circuitry of these essential circuit breakers is not being monitored in the control room; i.e., by visual and/or audible annunciation. Additional information relating to this type of design deficiency was initially discussed in RO Report No. 71/008 dated August 31, 1971 regarding site inspection of Pilgrim Unit 1.

With regard to the related safety implications of the diode failures, it was found that many failures resulted in blown fuses and subsequent loss of the control power which is needed to close the circuit breakers. These observations combined with improper monitoring of control power lead us to believe that there is a high probability a failure of a safety related circuit breaker could go undetected.

In view of the above findings and with the oral concurrence of Licensing, it is our opinion that the licensee should perform modifications and demonstrate adequacy through appropriate testing. Additional changes may be desirable to comply with Regulatory Guide 1.22 and 1.47 with respect to control room indication of circuit breaker availability. Since these are design changes which may require further evaluation, we are forwarding copies of this memo to Licensing for their consideration.

As follow through we recommend the regional office monitor corrective actions accordingly.



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