Enclosure

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

COMPLIANCE WITH ELECTRICAL CIRCUITRY ISOLATION REQUIREMENTS

ENTERGY OPERATIONS, INC.

ARKANSAS NUCLEAR ONE, UNIT NO. 2

DOCKET NO. 50-368

1.0 INTRODUCTION

During the electrical distribution system functional inspection (EDSFI) of ANO-2, the inspectors identified a concern that, with the failure of the primary Class 1E protective circuit breaker between the non-Class 1E load and the Class 1E battery, a possible fault could draw significantly higher than anticipated current but still remain below the actuation trip setpoint of the secondary protective device. The secondary protective device is the Class 1E feeder circuit breaker to the non-Class 1E distribution panel (2D21 or 2D22) which supplies various non-Class 1E loads. The inspectors reasoned that this condition could impose an unacceptable drain on the Class 1E battery. The licensee referred the inspectors to the updated safety analysis report (USAR) for verification that the installed configuration meets the licensing basis of the plant.

In addition, the inspectors noted that the electrical containment penetration overcurrent protection scheme was similar to the DC circuit protection design. Therefore, for containment penetrations, a similar concern exists that the primary protection device could fail and the fault current remain below the trip setpoint of the distribution panel feeder breaker. The licensee informed the inspectors that protection from overload situations assuming a failed primary protection device was beyond the design basis of the facility.

2.0 EVALUATION

Regulatory Guide (RG) 1.75 provides guidance regarding methods acceptable for the independence of circuits and electrical equipment contained in or associated with the Class 1E power system. However, the original design of ANO-2 was not required to meet the requirements of RG 1.75 regarding physical separation and isolation of Class 1E electrical circuits. The licensee states in Section 8.3.1.2 of the USAR that "the design criteria used for separation of redundant devices and circuits meet the requirements of the guide (Regulatory Guide 1.75) except for minor deviations" (emphasis added). One such deviation cited by the licensee is the use of two Class 1E breakers in

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series for all DC power circuits (except the non-Class 1E computer inverter) to act as isolation devices between Class 1E and non-Class 1E circuits. Breakers are not accepted by RG 1.75 as isolation devices. However, in some instances, the staff has accepted a design which provided two breakers or fuses coordinated with the bus feed breaker to be adequate protection against the failure of non-1E loads on 1E power supplies and loads.

Sheet 1 of Figure 8.3-16 of the ANO-2 USAR shows the Class 1E 125 volt DC system. The 125 volt DC control center 2D01 is supplied directly by the 125 volt Battery Bank #1 via a 800-ampere fuse (licensee has committed to replace the existing fuse with an 1800-ampere fuse at the next outage). DC control center 2D01 supplies distribution panels 2D25 and 2D21 via Class 1E breaker 72-0133 and auto transfer switch 72-0142. Distribution panel 2D21 is also connected to DC control center 2D01 via Class 1E breaker 72-0132, which is downstream of auto transfer switch 72-0142. Distribution panel 2D21 supplies the non-Class 1E loads for the engineered safety feature (ESF) load group associated with Battery Bank #1. The time current characteristic curves indicate calculated fault current values of approximately 9,000 amperes and 13,500 amperes for distribution panel 2D21 and DC control center 2D01, respectively. Circuit breakers 72-0133 and 72-0132 separating distribution panel 2D21 from the 125 volt Battery Bank #1 have both a long time delay and a short time delay direct acting trip device. A review of the time current characteristic curves for breakers 72-0133 and 72-0132 indicates proper coordination between DC control center 2D01 and distribution panel 2D21.

The long time delay setting for breaker 72-0133 is set at 480 amperes with a 30-second time delay. Battery charger 2D31, which normally supplies DC control center 2D01, has a current limiting output of 400 amperes. Therefore, in the event of the failure of breaker 72-0132, a fault current above the 400-ampere battery charger limit but below the long time delay trip setpoint of Breaker 72-0133 could drain down ESF Battery Bank #1. However, the staff does not believe the postulated fault to be a credible failure mechanism.

The potential to drain down the ESF battery by the postulated fault condition is contrary to the statement in Section 8.3.2.1.4 of the USAR that the existing protective scheme will prevent any fault in the non-ESF circuits of distribution panels 2D21 and 2D22 from affecting the DC supply to the ESF distribution panels 2D23 and 2D24.

As noted, in the licensee's response to Generic Letter 91-06, "Adequacy of Safety-Related DC Power Supplies," if the ESF battery begins to discharge because the load exceeds the current supplying capacity of the battery charger, then the DC bus will eventually fall to the terminal voltage of the battery. The DC bus voltage indication and undervoltage alarm is available in the control room. The licensee feels that periodic surveillance of the battery and battery charger as well as of the bus voltage instrumentation is adequate and sufficient to indicate a battery discharge condition. Since the postulated fault is considered an unlikely failure mechanism and existing provisions are being utilized by the licensee to detect a discharge condition on the battery, the staff finds that the concern in question does not impact the safe operation of the plant and that the existing configuration is, therefore, acceptable.

The staff reviewed calculation 85E-0118-01, "Reactor Building Overcurrent Protection Study," Revision 1, dated April 4, 1991, and noted that the conductor damage curves (time vs. current) had been extrapolated into the long time period versus low current area. Although the overcurrent protective devices (primary and secondary) would clear the fault associated with high energy short circuits (high current over short time period), several curves were identified where the low current/long time period part of the conductor damage curve would not be protected by either the primary or backup overcurrent protective device. The licensee identified eight non-Class 1E loads in containment that are powered from 1E buses. Two of the eight non-Class 1E loads had extrapolated conductor damage curves outside the trip setpoint of the secondary protective device in the 14-16 amperes range. Since the licensee did not commit fully to RG 1.75, the principal requirement for the design in question is the coordination of electrical protective devices to protect against the loss of the safety-related bus and associated ESF function.

The licensee states that the present design is in compliance with RG 1.63. Contrary to the statement by the licensee that "protection from overload situations, with the assumption of a failed primary protection device, was beyond the design basis of the facility," RG 1.63 requires that the electric penetration assembly be designed to withstand, without loss of mechanical integrity, the maximum short-circuit vs. time conditions that could occur in case of single random failures of circuit overload protection devices. In addition, the circuit overload protection system should conform to the criteria of IEEE Standard 279-1971.

IEEE Standard 279-1971 states that judgment on protection system functional adequacy shall be based on generating station variables that the licensee is required to monitor to provide protective actions. IEEE Standard 308-1971, which is also applicable to the ANO-2 licensing basis, requires that protective devices shall be provided to isolate failed equipment automatically. With this regulatory and technical background, the staff has held that the protection of containment overcurrent protection devices should extend over the full range of fault currents or overload currents that these devices could be exposed to based on the system configuration. Since several curves associated with the subject calculation were identified where neither the primary or back-up overcurrent protective device provides protection over the full range of the extrapolated conductor damage curve, the staff concludes that the licensee is not in conformance with IEEE Standard 308-1971 or RG 1.63 and recommends that the licensee determine whether ANO-2 is in compliance with these criteria and take appropriate corrective actions.

3.0 CONCLUSION

The staff believes that the existing electrical protection schemes for the Class 1E DC power supply could be further improved by providing trip setpoints of the protective devices to cover the low fault current region or possible overload conditions as discussed in the evaluation section. However, the existing design for Class 1E DC power supply does meet the intent of the requirement to provide adequate protection against credible faults in non-Class 1E loads from affecting Class 1E power supplies. Therefore, the existing configuration for protection against faults in non-Class 1E loads from affecting the Class 1E DC power supplies is acceptable.

Since several instances were noted where neither the primary or back-up containment overcurrent protective device provides protection over the full range of the extrapolated conductor damage curve, the staff concludes that the licensee is not in conformance with RG 1.63.

The staff recommends that the licensee:

(1) Revise USAR Section 8.3.2.1 to address the remote possibility of an inadvertent battery discharge caused by overload conditions and modify the assertion that the DC supply to ESF distribution panels 2D23 and 2D24 is not affected by <u>any</u> fault in the non-ESF circuits of panels 2D21 and 2D22.

(2) Reassess the existing coordination of the primary and secondary containment penetration overcurrent protective devices to assure that adequate protection is provided for the full range of overcurrent conditions (short-circuits and overloads) for the affected circuits and initiate appropriate corrective actions if warranted.

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