UNITED STATES
NUCLEAR REGULATORY COMMISSION
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SUPPLEMENTARY SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

CONTAINMENT ELECTRICAL PENETRATION OVERCURRENT PROTECTION

SYSTEM UNDER OVERLOAD CONDITIONS

ENTERGY OPERATIONS, INC.

ARKANSAS NUCLEAR ONE, UNIT NO.2

DOCKET NO. 50-368

1.0 INTRODUCTION

During the electrical distribution system functional inspection (EDSFI) at ANO-2, the inspection team raised a concern regarding circuitry isolation. By letter dated June 18, 1992, the NRC staff concluded that the design basis calculation for the coordination of primary and secondary containment penetration overcurrent protection devices to protect the electrical conductor from damage, indicates several instances where no protection exists for overload conditions. The staff requested that Entergy Operations (the licensee) reassess this situation and initiate appropriate corrective actions if necessary.

By letter dated September 4, 1992, the licensee responded to the containment penetration concern. The staff reviewed this response and asked for further clarification by letter dated February 26, 1993. The licensee provided additional information and a revised calculation on August 20, 1993.

2.0 EVALUATION

The following sections (2.1 through 2.4) address the items identified in the staff's February 26, 1993, letter and the licensee's August 20, 1993, response.

2.1 The staff noted the following problems associated with Calculation 85-E-0118-01, "RB Penetration Overcurrent Protection Study", Revision 1 dated April 22, 1991:

- In response to staff queries the licensee indicated that several graphs (denoted figures) which describe the overcurrent protection coordination did not have any applicability to circuits now installed in ANO-2.

- The conductor damage curve in the graphs of the calculation are drawn as straight lines which did not reflect damage limits for the sustained overload current region (i.e., lower current, longer time period).

- The licensee indicated that during the development of the calculation, numerous fuse types of each ampere rating were evaluated and the type exhibiting the slowest tripping characteristic was used to develop the coordination graphs. The fuse actually installed may not be shown on these coordination graphs.

Licensee Response:

By letter dated August 20, 1993, the licensee provided revised Reactor Building Penetration Protection Calculation 85-E-0118-01, Revision 2. The revised calculation determined a single conductor cable maximum safe overload capability over an intermediate range from a 10-second to a 1000-second period. The evaluation utilized the methodology described in Section 8.5.2.4 of IEEE Standard 242-1986. In response to the above staff concerns the following changes were noted in the revised calculation:

- The figures that were not applicable to the electrical penetration circuits installed in ANO Unit 2 have been removed from the subject calculation.

- The previous evaluation under Revision 1 of the calculation extrapolated the 250 °C damage curves beyond the applicable range. The damage curves used were generated from values provided in IEEE 317-1983, Table A5 and are only applicable for short periods of time (i.e. 2 seconds per IEEE 317-1983). The revised calculation, which covers the intermediate region (10 seconds to 1000 seconds), provides figures which show that the cable damage curves do not intersect the protective device trip curves in the overload region.

- The licensee compared the time versus current damage curves for the fuses associated with the figures of the revised calculation to the fuses used in various plant applications and to those available in the plant stockroom for veracity. In addition, per the licensee's conversation with staff personnel on April 30, 1993, a note has been added to Appendix V to the calculation indicating the worst fuse has been used to develop the figures listed in the revised calculation.

The staff finds that the methodology and changes provided in the revised calculation resolves the previously stated concerns regarding the primary and secondary containment overcurrent protective devices.

2.2 Please identify those figures of the revised calculation where the full range of overcurrent conditions (short circuits and overloads) are not covered by both a primary and secondary overcurrent protective device.

Licensee Response:

The revised calculation identified those figures representing circuits where the full range of overcurrent conditions (short circuits and overloads) are not covered by both a primary and secondary overcurrent protective device.

The staff finds that the revised calculation indicates that several penetration circuits are protected by only one overcurrent protective device from damage in the intermediate overload region.

2.3 For those figures identified in Item 2.2 above, that are to be credited with thermal overload heater protection against sustained overload conditions, please provide the penetration conductor ampacity or rating as well as the information cited in Table 1 of the September 4, 1992 submittal by the licensee.

Licensee Response:

The penetration table provided in the licensee submittal dated September 4, 1992, listed the penetrations for which the conductor damage curve intersected the protective device trip curve in the overload region. Based on the revised approach taken in Revision 2 of the subject calculation, these curves no longer intersect in the overload region for ANO-2 penetration circuits. Therefore, the licensee has omitted the penetration table.

The staff finds that due to the revised approach, the deletion of the penetration table is acceptable.

2.4 Please identify for those circuits associated with the figures cited in Item 2.2 above, those design limitations and other rationale why overcurrent protection coordination cannot be improved for overload conditions. Please note also the technical basis for the safety assessment that the hazard from sustained overload conditions is insignificant.

Licensee Response:

By letter dated April 30, 1993, the licensee (with the concurrence of the staff) agreed to limit the request for information to the issues pertaining to the revision of the subject calculation. In the letter (and during conference calls conducted with the staff on April 9 and April 22, 1993), the licensee stated that the above information was beyond the ANO-2 licensing basis and this level of detail could not be readily provided without the expenditure of significant manpower resources and analysis. The licensee's position is further clarified in the August 20, 1993, letter where it states that these results (the revised calculation) indicate that the penetration circuits are protected from damage in the overload regions by at least one of the protection devices credited in the Technical Specifications.

The staff acknowledges that the licensee takes exception to protection from overload conditions as part of the ANO-2 licensing basis. However, the staff notes that the following excerpt from page 8.3-47 of the previous version of the SAR (the version that was in place when the staff review of this issue

started) illustrates some lack of clarity on this point (this SAR excerpt was revised with the last SAR update):

> The electric penetrations were purchased in 1972 and meet the intent of the requirements of IEEE 317-1971. Regulatory Guide 1.63, dated October 1973, was not considered in the design of the electric penetrations. However, the electrical penetrations are in compliance with Regulatory Guide 1.63. (emphasis added) Originally secondary (back-up) overcurrent and short circuit protection was provided for some circuits, but not for others. FSAR Amendment No. 34, in response to NRC Question 222.93, revised the design basis and requires backup protection for all circuits. The backup protection is not in full compliance with IEEE 279 concerning electrical independence, online testability, bypassing or manual initiation. The secondary protective device provides backup for the primary protective device (emphasis added) in the same electrical circuit and therefore the above features of IEEE 279 cannot be met.

The staff position is that Regulatory Guide 1.63 requires that the electric penetration assembly should be designed to withstand, without loss of mechanical integrity, the maximum short-circuit vs. time conditions that could occur given single random failures of circuit overload protective devices. The staff agrees that the primary area of interest is the maximum short circuit current values since this event has the greatest potential to impact safety. However, as stated in our June 18, 1992, Safety Evaluation, the protection from containment overcurrent protective devices should extend over the full range of fault currents, including anticipated overload currents that these devices would be exposed to based upon the system configuration. Since several figures of the revised calculation describe circuits where backup overcurrent protection is not provided over the intermediate overload region (10 seconds to 100 seconds), the staff concludes that the licensee is not in full conformance with Regulatory Guide 1.63.

3.0 CONCLUSION

Although the licensee does not meet Regulatory Guide 1.63, it is not clear, based upon the statements in the SAR, that compliance with Regulatory Guide 1.63 was part of the original licensing basis. Further, based on present plant operating experience and the likelihood of equipment failures due to overload current conditions, the staff believes that the safety significance of accident events given a failed primary protective device is low.

Nevertheless, similar EDSFI team findings at other nuclear power plants indicate that the existing staff position regarding containment overcurrent protection should be examined to assess the safety significance of overload current (fault) conditions and whether future revisions should be made to Regulatory Guide 1.63. Therefore, pending generic resolution on the safety significance of overload currents for containment electrical penetration overcurrent protection, the deviation to Regulatory Guide 1.63 is acceptable

at this time. However, the staff recommends that the licensee continue to assess its position with regard to only one protection device as sufficient for the overload region, while the staff conducts its generic assessment.

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