February 29, 2000

MEMORANDUM TO: John A. Grobe, Director
Division of Reactor Safety
Region III

FROM: Suzanne C. Black, Deputy Director ***/RA/***
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

SUBJECT: D. C. COOK - TASK INTERFACE AGREEMENT (TIA) 99-031 - EVALUATION OF THE ACCEPTABILITY OF THE CLASSIFICATION AND FIELD INSTALLATION OF NON-SAFETY-RELATED CONTROL CABLES USED IN THE LOAD SHEDDING CIRCUITRY TO PERFORM THE SAFETY-RELATED FUNCTION OF SHEDDING LOADS OFF SAFETY-RELATED BUSES (TAC NOS. MA7376 AND MA7377)

By memorandum dated November 29, 1999, Region III requested technical assistance from the Office of Nuclear Reactor Regulation (NRR) in evaluating the acceptability of non-safety-related control cables used in the load-shedding circuitry to perform the safety-related function of emergency diesel generators (EDGs) load shedding, at the D. C. Cook Nuclear Power Plant, Units 1 and 2. The attached Safety Evaluation provides the NRR response to the TIA.

Specifically, Region III requested resolution of the following issues:

1. What is the D. C. Cook licensing basis with respect to designating load-shed cables (used to perform safety-related functions) as non-safety-related and routing them in common balance-of-plant (BOP) trays without physical separation?

2. Are the cables acceptable in the current configuration to meet the licensing basis?

3. If not, are the fault tests performed adequate to support safe plant restart with the present cable routing configuration?

At the time of the D.C. Cook licensing, industry standards, such as IEEE 279 and 308 pertaining to the design of the protection system and the emergency power systems, were just being developed. As documented in the Safety Evaluation of the D.C. Cook Nuclear Plant, Units 1 and 2, dated September 10, 1973, IEEE 308 served as the primary bases for judging the acceptability of the emergency power systems (SE Section 8.0), and IEEE 279 was used for evaluating the reactor protection and control system (Section 7.0).

CONTACTS: John Stang, NRR
(301) 415-1345

Paul Gill, NRR
(301) 415-3316

Units 1 and 2, dated September 10, 1973, IEEE 308 served as the primary bases for judging the acceptability of the emergency power systems (SE Section 8.0), and IEEE 279 was used for evaluating the reactor protection and control system (Section 7.0).

On the basis of our review of this issue, we conclude that the licensee met the requirements of the 1970 edition of IEEE-308 in establishing the control cables for the load-shed circuitry for the BOP loads powered from the safety buses to be non-safety-related. Therefore, D. C. Cook licensing basis with respect to designating load-shed cables as non-safety-related and routing them in common balance-of-plant (BOP) trays without physical separation was an acceptable design approach and consistent with the implementation of the existing standards. Also, it appears that the staff, at the time, reviewed this issue and concluded that the design was adequate.

To assess the safety significance of this issue, we reviewed the licensee's documentation supporting the adequacy of the design of the load-shed circuitry cables. The licensee has stated that all non-safety related control cables under discussion are protected from shorts by redundant safety grade isolation devices, thus, isolating the fault before it could damage other cables in the same tray even with a single failure. Further, the licensee has performed additional testing and studies to assure the functionality of these cables during a design basis event. We believe that the additional studies and testing performed by the licensee (to support that a single, sustained control cable overcurrent condition [single failure] would not significantly reduce the simultaneous EDG availability) provide added assurance that the BOP load-shed/conservation cables are adequate for safe plant restart and operation.

This completes our review and evaluation efforts under TIA 99-031 and TAC Nos. MA7376 and MA7377. In addition, the attached safety evaluation provides the NRR input for the resolution of Inspection Manual Chapter 0350, Case Specific Check List Item #7, and the resolution of Restart Action Matrix Item R.2.7.

Docket Nos. 50-315 and 50-316

Attachment: Safety Evaluation

cc w/att: W. Lanning, Region I
C. Casto, Region II
A. Howell, Region IV

Units 1 and 2, dated September 10, 1973, IEEE 308 served as the primary bases for judging the acceptability of the emergency power systems (SE Section 8.0), and IEEE 279 was used for evaluating the reactor protection and control system (Section 7.0).

On the basis of our review of this issue, we conclude that the licensee met the requirements of the 1970 edition of IEEE-308 in establishing the control cables for the load-shed circuitry for the BOP loads powered from the safety buses to be non-safety-related. Therefore, D. C. Cook licensing basis with respect to designating load-shed cables as non-safety-related and routing them in common balance-of-plant (BOP) trays without physical separation was an acceptable design approach and consistent with the implementation of the existing standards. Also, it appears that the staff, at the time, reviewed this issue and concluded that the design was adequate.

To assess the safety significance of this issue, we reviewed the licensee's documentation supporting the adequacy of the design of the load-shed circuitry cables. The licensee has stated that all non-safety related control cables under discussion are protected from shorts by redundant safety grade isolation devices, thus, isolating the fault before it could damage other cables in the same tray even with a single failure. Further, the licensee has performed additional testing and studies to assure the functionality of these cables during a design basis event. We believe that the additional studies and testing performed by the licensee (to support that a single, sustained control cable overcurrent condition [single failure] would not significantly reduce the simultaneous EDG availability) provide added assurance that the BOP load-shed/conservation cables are adequate for safe plant restart and operation.

This completes our review and evaluation efforts under TIA 99-031 and TAC Nos. MA7376 and MA7377. In addition, the attached safety evaluation provides the NRR input for the resolution of Inspection Manual Chapter 0350, Case Specific Check List Item #7, and the resolution of Restart Action Matrix Item R.2.7.

Docket Nos. 50-315 and 50-316

Attachment: Safety Evaluation

cc w/att: W. Lanning, Region I
C. Casto, Region II
A. Howell, Region IV

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO THE RESOLUTION OF TASK INTERFACE AGREEMENT (TIA) 99-031

INDIANA MICHIGAN POWER COMPANY

D. C. COOK NUCLEAR POWER PLANT, UNITS 1 AND 2

DOCKET NOS. 50-315 AND 50-316

1.0 INTRODUCTION

By memorandum dated November 29, 1999, John A. Grobe, Director, Division of Reactor Safety, Region III, submitted to Suzanne C. Black, Deputy Director, Division of Licensing Project Management, Office of Nuclear Reactor Regulation (NRR), Task Interface Agreement (TIA) Request Number 99-031. By means of this TIA, Region III requested technical assistance in evaluating the acceptability of non-safety-related control cables used in the load-shedding circuitry to perform the safety-related function of emergency diesel generators (EDGs) load shedding. Specifically, Region III requested resolution of the following:

1. What is the D. C. Cook licensing basis with respect to designating load-shed cables (used to perform safety related functions) as non-safety-related and routing them in common balance-of-plant (BOP) trays without physical separation?

2. Are the cables acceptable in the current configuration to meet the licensing basis?

3. If not, are the fault tests performed adequate to support safe plant restart with the present cable routing configuration?

An NRR Division of Licensing Project Management work request dated January 7, 2000, requested the Electrical and Instrumentation and Controls Branch (EEIB) to evaluate this issue, taking into consideration the D.C. Cook licensing basis and the safety significance of the non-safety cables performing the safety-related function of EDG load shedding.

2.0 BACKGROUND

The D.C. Cook design has safety-buses feeding a mixture of safety-related and important non-safety related loads because the original designers of the plant considered the powering of important non-safety-related loads from the emergency buses as a needed design feature. A loss of offsite power (LOOP) results in the shedding of all of the 4-kV loads, both safety and non-safety loads, other than some permanently connected loads. The 4-kV safety buses consist of two redundant and independent trains, each supplied from its own EDG. After the EDGs have started and have assumed the unshed loads, the remaining required safety loads are automatically sequenced back onto the safety buses.

On March 23, 1998, with Unit 1 and Unit 2 in cold shutdown, a licensee system engineer determined that the control cables that are used to shed non-safety loads from both safety-related buses had been classified during initial plant design as non-safety-related. Therefore, these control cables used for EDG load shedding are installed in BOP trays without physical separation. These control cables perform the safety function of load shedding non-safety loads from safety-buses on loss of offsite power and on loss of offsite power with a safeguards initiation signal. Load shedding of non-safety loads is required because the EDGs can not start or carry all of the loads that are normally on the safety buses. The safety buses carry both safety and non-safety loads. The concern is that since the control cables that shed non-safety loads for each safety train's EDG are run next to each other without physical separation, a fault in one control cable might propagate into the control cables of the opposite train. If enough non-safety loads are not shed, both trains of EDG power could be degraded.

3.0 RESPONSE TO QUESTIONS

NRR provides the following responses to the questions listed in TIA 99-031:

1. What is the D. C. Cook licensing basis with respect to designing load-shed cables (used to perform safety-related functions) as non-safety-related and routing them in common BOP trays without physical separation?

   During the design and licensing of the D. C. Cook plant, the licensee classified the load-shed circuitry (cables) associated with non-safety loads as non-1E since these cables did not serve safety-related loads. At the time of the D.C. Cook licensing, industry standards such as IEEE 279 and 308, pertaining to the design of the protection systems and the emergency power systems were just being developed. As documented in the Safety Evaluation of the D.C. Cook Nuclear Plant, Units 1 and 2, dated September 10, 1973, IEEE 308 served as the primary bases for judging the acceptability of the emergency power systems (SE Section 8.0) and IEEE-279 was used for evaluating the reactor protection and control system (SE Section 7.0). The design of the cables under discussion was consistent with the requirements of IEEE-308 and was made before and without the benefit of subsequent standards such as IEEE-384 and 379, which further developed separation and single-failure criteria for Class 1E systems and associated circuits. The D. C. Cook plant design allows control cables for the non-1E loads to be installed in common trays with other BOP cables.

   On the basis of our review of this issue, we conclude that the licensee met the requirements of the IEEE 308 standard at the time in establishing the control cables for the load-shed circuitry for the BOP loads powered from the safety buses to be non-safety-related. Therefore, D. C. Cook licensing basis with respect to designating load-shed cables as non-safety-related and routing them in common BOP trays without physical separation was an acceptable design approach and was consistent with the implementation of existing standards.

2. Are the cables acceptable in the current configuration to meet the licensing basis?

   During the design and licensing of the D. C. Cook plant, the licensee classified the load-shed circuitry (cables) associated with non-safety loads as non-1E since these cables did

not serve safety-related loads. According to the licensee, the control circuits for the associated non-safety related loads are run in raceways designed to meet Class 1E standards. The licensee contends that the non-1E load-shed control cables carry very low current relative to their thermal rating and, therefore, do not increase cable temperature appreciably over ambient temperature; the cable jackets are made of fire-retardant materials such that in the unlikely event of a short, the cable jackets will not provide a combustible material; and non-1E power and control cables are routed in separate trays with the same physical separation as exists between Class 1E power and control cable trays. Further, the licensee states that the non-safety related control cables under discussion are protected from shorts by redundant safety grade isolation devices, thus, isolating the fault before it could damage other cables in the same tray even with a single failure. The design of load-shed cables rely on electrical protective devices and similar cable construction as Class 1E to support circuit independence. In addition, the licensee has performed the cable separation study, the diesel generator reliability study, and the cable testing program to support the conclusion that the absence of physical separation for the load shed/conservation control cables for the BOP loads will not significantly degrade the performance of the emergency power systems. Therefore, we believe that BOP load shed/conservation cables in their current configuration meet the D. C. Cook plant licensing basis and are acceptable.

3. If not, are the fault tests performed adequate to support safe plant restart with the present cable routing configuration?

   Although the cable routing configuration meets the licensing basis, the licensee performed a cable testing program to explore the effects of sustained high currents in the control cabling to address the concern that a faulted BOP control cable associated with load-shed circuitry will not propagate to adjacent control cables in the same tray and degrade their function. A total of 11 tests were conducted on cables obtained from stores and installed spares that were representative of actual plant configurations used in the load shed/conservation circuit cabling. Results of this testing program demonstrated that for sustained currents in excess of the control cable conductor ratings, the adjacent cables were not significantly affected. On the basis of these tests, the licensee concluded that the control cable, when subjected to extreme overload (fault condition), produces excessive smoke, but does not damage proximate cables within the same raceway. We believe that the testing program undertaken by the licensee provides added assurance that the BOP load shed/conservation cables are adequate for safe plant restart and operation.

In addition, Region III via telephone request, asked that NRR review the D. C. Cook licensee's response to Questions 40.6 and 7.5 regarding its conformance to Regulatory Guide 1.75 and paragraph 4.6 of IEEE 279, respectively, as it applies to load-shed cables associated with non-safety loads supplied from safety buses. The response to these two questions is documented as follows:

- In response to question 40.6 on conformance to Regulatory Guide 1.75, the D. C. Cook licensee gave the following response:

  > The design of the D. C. Cook plant complies with the separation requirements of Regulatory Guide 1.75 as applied to Class 1E equipment and circuitry. The design does not comply with the safety guide in the treatment of associated

circuits. Non Class 1E cables are routed with Class 1E cables in cable trays. The cable numbers of these associated circuits are modified to include a letter designation identifying the train association. These cables are allowed to leave the Class 1E cable trays and be routed with non-safety cables, but are not allowed to be again routed with Class 1E cables.

As discussed in our response to Question 1, above, the D. C. Cook licensing basis with respect to designating load-shed cables as non-safety was acceptable, and conforms to Regulatory Guide 1.75 to the extent described in D. C. Cook response to Question 40.6.

- Question 7.5 asked the licensee to submit the criteria and the associated bases that establish the minimum requirements for preserving the independence of redundant reactor protection systems, engineered safety feature systems and Class 1E electrical systems through physical arrangement and separation and assure minimum availability during any design basis event.

  Paragraph 4.6 of the 1968 edition of IEEE 279 addresses channel independence, in that it requires signals for the plant protective function to be independent and physically separated to reduce the likelihood of interactions between channels during maintenance, operations or in the event of channel malfunction.

  As documented in our response to Question 1, above, the IEEE 279 was used for evaluating the reactor protection system (SE Section 7.0). Therefore, we believe that the requirements of paragraph 4.6 of the 1968 edition of IEEE 279 were not applied to the electrical system load-shed circuitry for the BOP loads powered from the safety buses.

4.0 CONCLUSION

The D. C. Cook plant design for the EDG load shed/conservation circuitry meets industry standards which were existing at the time of its licensing. Section 7.2.2.2.8, of the Updated Final Safety Analysis Report provides the D. C. Cook plant's design criteria for the associated circuits. We believe that the licensee established that the control cables for the load shed circuitry for the BOP loads powered from the safety buses to be non-safety-related in conformance with standards existing at the time. At that time, the staff reviewed the issue that non-safety-related electrical loads are powered from the safety-related buses, and a portion of non-safety electrical loads are shed and locked out upon transfer to the emergency onsite generation system. On the basis of its review at the time, the staff concluded that this aspect of the electrical design was adequate and acceptable. The additional studies and the BOP cable testing performed by the licensee as previously discussed demonstrates that the design of the load shed/conservation circuitry provides added assurance that the design is acceptable.

Principal Contributor: P. Gill

Date: February 29, 2000