

October 22, 2001

MEMORANDUM TO: A. Randolph Blough, Director
Division of Reactor Projects
Region I

FROM: Ledyard B. Marsh, Acting Deputy Director */RA/*
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

SUBJECT: RESPONSE TO TASK INTERFACE AGREEMENT REGARDING
UNRESOLVED ITEM FOR WIRE SEPARATION INSIDE REACTOR
PROTECTION CABINETS (URI 05000247/2001-005-2)
(TIA NO. 2001-06 AND TAC NO. MB2577)

In a memorandum to Elinor Adensam dated July 18, 2001, you requested assistance from the Office of Nuclear Reactor Regulation (NRR) in addressing an unresolved item (URI) identified during an inspection of the reactor protection system (RPS) at Indian Point Nuclear Generating Unit No. 2 (IP2). The URI concerned two issues associated with wire separation inside the RPS cabinets. Specifically, you requested that NRR provide an answer, including the appropriate bases, to the following questions: (1) Do the wire separation requirements, as they apply to IP2, require separation of Instrumentation and Control (I&C) cables that carry safety-related signals from I&C cables that carry annunciator signals and computer signals inside RPS cabinets, and (2) Do the wire separation requirements within the RPS cabinets, applicable to IP2, allow non-safety-related I&C cables routed with Train "A" safety-related cables to cross over and be routed with Train "B" safety-related I&C cables?

The NRR staff has reviewed the information and supporting documentation provided in your request. As stated in the attached safety evaluation, the NRR staff concluded that the separation criteria applicable to IP2 is contained in Institute of Electrical and Electronic Engineers Standard 279, "Proposed IEEE Criteria for Nuclear Power Plant Protection Systems," dated August 28, 1968 (IEEE 279-1968). This standard does not contain requirements for separation of safety class and non-safety class wires. Therefore, the NRR staff finds that the as-found condition for nonsafety-related wires being routed with Train "A" and then Train "B" safety-related wires at IP2 is acceptable. Similarly, IEEE 279-1968 does not require separation of nonsafety-related I&C wires from safety-related I&C wires within the RPS cabinets. Thus, the NRR staff concludes the IP2 design is in conformance with the applicable design bases.

This completes action of TAC No. MB2577.

Attachment: Safety Evaluation

Technical Contact:
N. Trehan, NRR/EEIB
(301) 415-2777

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
REGARDING TASK INTERFACE AGREEMENT (TIA 2001-06)
CONCERNING UNRESOLVED ITEM ON WIRE SEPARATION
INSIDE REACTOR PROTECTION SYSTEM CABINETS
ENTERGY NUCLEAR OPERATIONS, INC.
INDIAN POINT NUCLEAR GENERATING UNIT NO. 2
DOCKET NO. 50-247

1.0 INTRODUCTION

In a memorandum dated July 18, 2001, the Division of Reactor Projects, Region I, requested assistance from the Office of Nuclear Reactor Regulation (NRR) in addressing an unresolved item (URI) identified during an inspection of the reactor protection system (RPS) at the Indian Point Nuclear Generating Unit No. 2 (IP2). The URI concerned two issues associated with wire separation inside the RPS cabinets. Specifically, you requested that NRR provide an answer, including the appropriate bases, to the following questions: (1) Do the wire separation requirements, as they apply to IP2, require separation of Instrumentation and Control (I&C) cables that carry safety-related signals from I&C cables that carry annunciator signals and computer signals inside RPS cabinets, and (2) Do the wire separation requirements within the RPS cabinets, applicable to IP2, allow non-safety-related I&C cables routed with Train "A" safety-related cables to cross over and be routed with Train "B" safety-related I&C cables?

2.0 BACKGROUND

Westinghouse designed the RPS and engineered safety features (ESF) for IP2. The protective-grade instrumentation and logic systems were designed in accordance with Institute of Electrical and Electronic Engineers Standard 279, "Proposed IEEE Criteria for Nuclear Power Plant Protection Systems," dated August 28, 1968 (IEEE 279-1968). Equipment compatibility and integration of component hardware were factored into the design by Westinghouse or under the direct supervision of Westinghouse.

In a 1982 modification, Consolidated Edison Company of New York, Inc. (Con Edison)¹ added nonsafety-related annunciator and computer wires routed directly from a Train "A" cabinet to a Train "B" cabinet without separation from either Train "A" or Train "B" safety-related RPS and ESF wires. These nonsafety-related wires were bundled with Train "A" safety-related wires at

¹On September 6, 2001, the license for IP2 was transferred from Con Edison to Entergy Nuclear Indian Point 2, LLC, as owner, and Entergy Nuclear Operations, Inc., as operator.

one end and with Train "B" safety-related wires at the other end. This is not consistent with the current IP2 Updated Final Safety Analysis Report (UFSAR) Section 7.2.2.9 which states: "...separation was maintained by using separate wireways for safety signals, annunciator signals, and computer signals."

On March 12, 2001, Con Edison prepared Safety Evaluation (SE) 99-160-EV to change the UFSAR such that wire separation between safety and non-safety wires was no longer required (i.e., safety and non-safety wires can run together within a conduit inside the RPS cabinet). In the SE Con Edison stated that the purpose of the change was to correct an inaccurate statement contained in UFSAR 7.2.2.9 as compared to the existing field condition. Deleting the separation criteria in the UFSAR would allow a nonsafety wire to be physically in contact with Train "A" safety-related wires at one end and in contact with Train "B" safety-related wires at the other end. Con Edison stated that the separation criteria in UFSAR 7.2.2.9 was introduced incorrectly by Westinghouse during the design stage. During initial licensing of IP2, the NRC raised FSAR Question 7.3 concerned RPS signal isolations between safety and non-safety circuits. In response to questions from NRC inspector, Con Edison showed the answer to FSAR review Question 7.3, which was virtually identical to the wording now in UFSAR Section 7.2.2.9. Con Edison stated that the answer to Question 7.3 was moved into UFSAR Section 7.2.2.9 in the early 1980's. Con Edison contended that, because the wire separation criterion described in the response to Question 7.3 asked only about electrical isolation and not separation, the corresponding statement in UFSAR 7.2.2.9 was not a valid design basis for separation.

During a site visit conducted as part of the original licensing review for IP2, the NRC staff identified that cables for redundant systems enter ESF manual actuation panels (SB-1 and SB-2) through common openings in the control room floor and terminate on adjacent terminal boards. Connecting wires from the terminal boards to the controls for redundant systems were bundled together without separation. The Advisory Committee on Reactor Safeguards, in its 122nd meeting on June 11-13, 1970, agreed with the licensee that modifications of already-built panels (for connecting wires from terminal boards to the controls for redundant systems bundled together with no separation cables for redundant systems) were not justified. Therefore, the NRC staff decided, during the original licensing review, that there would not be a significant improvement in safety by requiring separation of these safety-related (Class 1E) cables. This exception to the installation criteria was made a part of the licensing basis for the IP2 plant.

3.0 EVALUATION

The NRR staff evaluated the issues addressed in TIA 2001-06 as follows:

- 3.1 Do the wire separation requirements, as they apply to the plant, require separation of I&C cables that carry safety-related signals from I&C cables that carry annunciator signals and computer signals inside RPS cabinets?

The original design was based on IEEE-279-1968, Section 4.6, "Channel Independence," which states the following:

Channels that provide signals for the same protective function shall be independent and physically separated to accomplish decoupling of the effects of

unsafe environmental factors, electric transients, and physical accident consequences documented in the design basis, and to reduce the likelihood of interaction between channels during maintenance operations or in the event of channel malfunctions.

The annunciator and computer circuits are designated as non-Class 1E circuits. IEEE 279-1968 does not describe any separation requirement between the Class 1E RPS and ESF circuits and the non-Class 1E annunciator and computer circuits. In fact, IEEE 279-1968 is silent about the existence of non-Class 1E circuits and describes only the separation between redundant Class 1E circuits. Separation criteria between the non-Class 1E wiring and the Class 1E wiring inside the control switchboard were introduced for the first time in Section 5.6.5, "Non-Class 1E wiring," of IEEE Standard 384, "Trial Use Standard Criteria for Separation of Class 1E Equipment and Circuits," dated 1974 (IEEE 384-1974). However, the licensee is not committed to IEEE 384-1974. Therefore, the NRC must evaluate the IP2 design against the requirements of IEEE 279-1968. Minimum separation requirements between safety cables and cables used for non-safety systems have not been defined in IEEE 279-1968. Therefore, the design basis at IP2 for routing of non-safety wiring is that they may be routed in the same wireways with the safety cables.

The installation criteria set by Westinghouse for IP2 required the separation of Train "A" and Train "B" channels and did not require the separation between the non-Class 1E wires or cables from Train "A" or Train "B" wires or cables.

The NRC inspectors reviewed the Con Edison's Operability Determination (OD) 01-002, "Ensuring the Functional Capability of a System or Component," on February 12, 2001, to determine that the RPS can perform its safety function, in spite of wiring deficiencies. This document included the RPS test procedures and test results, the licensee's effort in translating the RPS design requirements to the Component Functional Matrix Database, the modification for replacing the relays in the RPS, and a sample of condition reports associated with the RPS wiring issues. The inspectors reviewed the RPS test results to confirm that the RPS successfully passed all tests. The licensee tests Train "A" and Train "B" RPS trip logics monthly.

The NRR staff also considered the following design considerations:

- a. Circuit protection and coordination are provided for ESF and RPS circuits within the rack by qualified protective devices. Licensee's calculations FEX-00146 and SGX-00007 demonstrate that a fault would be isolated to prevent cable damage within the logic racks. This would limit the failure to the faulted cable only, and the redundant component could perform its safety function.
- b. The ESF annunciation and computer circuits are low energy, 125 volts or less, circuits. The cable insulation for RPS and ESF systems is rated at 600 volts; that is above the operating voltage of 125 volts. Thus, this cable insulation rating provides protection between circuits in wireways. There are no higher voltage (potential insulation damaging voltage) wires being routed with the ESF, annunciation and computer wires.
- c. The wires within the racks are qualified to IEEE Standard 383, "Type Test Of Class 1E Electric Cables, Field Splices, and Connections For Nuclear Power Generating

Stations,” or equivalent and exhibit fire retardant properties. This also limits the propagation of a fire within the racks. In Westinghouse paper ECES-217, “Supervisory Panels SB1-SB2 Mechanistic Failure Analysis,” Westinghouse tested cables by injecting currents far in excess of the source’s cable rating within a bundle of other cables. This test was performed to understand the impact of the as installed cables in SB-1 and SB-2, a condition similar to the as found condition of the RPS cabinets. The test proved that the other cables in the bundle were still functional upon total failure of the source cable. The configuration in the SB-1 and SB-2 panels is similar to that in the logic racks. Therefore, a fire due to electrical fault in a non-Class 1E wire (carrying milliampere current) is considered unlikely to propagate fire in the neighboring Class 1E RPS or ESF wires.

Based on the above, the NRR staff concluded that the separation requirements applicable to IP2 do not require separation of safety-related and nonsafety-related I&C wires.

3.2 Do the wire separation requirements within the RPS cabinets and applicable to IP2 allow nonsafety-related I&C cables routed with Train “A” safety-related cables to cross over and be routed with Train “B” safety-related I&C cables?

Nonsafety-related wires routed directly from RPS Train “A” cabinet to Train “B” cabinet, without separation from either Train “A” or Train “B” safety-related wires inside the RPS cabinets meet the separation criteria as stated above. The original licensing and design basis of the RPS and ESF system is the separation criteria applied to the redundant channels. The requirements within IEEE 279-1968 are maintained by the existing configuration.

The NRR staff finds that the as-found condition (with nonsafety-related wiring) meets the design requirements of IEEE 279-1968 applicable to IP2 for the same applicable design considerations addressed in Section 3.1 above.

4.0 CONCLUSION

The NRR staff concludes that the separation criteria applicable to IP2 are contained in IEEE 279-1968. This standard does not contain requirements for separation of safety class and nonsafety class wires. Therefore, the as-found condition for nonsafety-related wires being routed with Train “A” and then Train “B” safety-related wires, while not acceptable in later standards, is acceptable based on the original design requirements. Similarly, the standard does not require separation of nonsafety-related I&C wires from safety-related I&C wires within the RPS cabinets. The NRR staff concludes that the IP2 design is in conformance with the applicable design bases and conforms with Section 4.6, “Channel Independence,” of IEEE 279-1968. Thus, the NRR staff finds it to be acceptable.

Principal Contributor: N. Trehan

Date: October 22, 2001