UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
LONG ISLAND LIGHTING COMPANY	)	Docket No. 50-322
	)	
(Shoreham Nuclear Power Station)	)	

NRC STAFF TESTIMONY OF JOHN L. KNOX, RANDALL EBERLY AND JERRY L. MAUCK ON ELECTRICAL SEPARATION

SC CONTENTION 31 AND SOC CONTENTION 19(g)

OUTLINE OF TESTIMONY

The Staff's testimony in response to SC Contention 31 and SOC Contention 19(g) shows that, at present, the majority of the Shoreham design regarding physical independence of electrical cables and raceways meets Regulatory Guide 1.75 (Rev. 1). Thus, the "independence" requirement of GDC 17 and 21 and 10 C.F.R. § 50.55a have been met. The limited number of exceptions have been evaluated by the Staff and the Staff has either imposed the requirements of Reg. Guide 1.75 (Rev. 1), required additional documentation from Applicant or has determined there is an insufficient basis to require additional design modifications.

With respect to GDC 3, the plant has been reviewed and found acceptable in accordance with the requirements of Appendix R to Part 10 C.F.R., Part 50.

Accordingly, the contentions in question are without merit.

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ON SC CONTENTION 31 AND SOC CONTENTION 19(g)

Q. Please state your respective names and positions with the NRC.

A. My name is John L. Knox. I am employed by the U.S. Nuclear Regulatory Commission as a Senior Electrical Engineer in the Power Systems Branch, Division of Systems Integration, Office of Nuclear Reactor Regulation. A copy of my professional qualifications is attached hereto as Attachment 1.

My name is Jerry L. Mauck. I am a Reactor Engineer (Electrical) with the Instrumentation and Control Systems Branch, Division of Systems Integration, Office of Nuclear Reactor Regulation. A copy of my professional qualification is attached hereto as Attachment 2.

My name is Randall Eberly. I am a Staff Fire Protection Engineer with the Chemical Engineering Branch, Division of Engineering, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission. I have been in this position since February, 1982. Prior to that time, I was employed as a Fire Protection Engineer by the United States Coast Guard, Office of Merchant Marine Safety for approximately seven years. A copy of my professional qualification has been previously filed in this proceeding in connection with NRC Staff Testimony on SC Contention 17.

Q. What is the purpose of your testimony?

A. The purpose of this testimony is to respond to Suffolk County Contention 31 and Shoreham Opponents Coalition Contention 19(g). These contentions are identical except for their preambles which are:

> SC 31-Suffolk County contends that 10 C.F.R. § 50.57 and § 50.109 requirements have not been met because:
>
> SOC 19(g) - A major contributing factor in the TMI-2 accident was that operating plants were not required by the NRC Staff (Staff) to be in compliance with current regulatory practices (i.e., Regulatory Guides, Branch Technical Positions, and Standard Review Plans). The TMI-2 accident also demonstrated that the current regulatory practices, practices similar to those being applied by the Staff in their safety evaluation of Shoreham, were in a number of cases not suitably conservative to properly protect the health and safety of the public (i.e., hydrogen generation, radiation sheilding, source terms, and single failure criterion).
>
> SOC contends that the NRC Staff has not required LILCO to incorporate measures to assure that Shoreham conforms with the standards or goals of safety criteria contained in recent regulatory guides. As a result, the Staff has not required that Shoreham structures, systems, and components be backfit as required by 10 C.F.R. § 50.55a. § 50.57, and § 50.109 with regard to:
>
> Regulatory Guide 1.75 - The design of the Shoreham electrical system fails to provide adequate physical independence of electrical cables and raceways as set forth in Revision 2 to Regulatory Guide 1.75 and therefore does not comply with 10 C.F.R. §50.55a and Part 50, Appendix A, Criteria 3, 17 and 21. In addition, the minimum separation criteria for Shoreham stated in Section 3.12 of the FSAR have not been followed as noted in Inspection Report 50-322/79-07 dated August 21, 1979 and subsequent reports from the Office of

Inspection and Enforcement. Accordingly, each deficiency in separation for Shoreham electrical cables and raceways must be adequately demonstrated using one of the following options:

(i) Correct the deficiency by meeting the electrical equipment separation criteria set forth in Section 3.12 of the Shoreham Final Safety Analysis Report;

(ii) Correct the deficiency by meeting Regulatory Guide 1.75, "Physical Independence of Electrical Systems," Revision 2 dated September 1978;

(iii) Correct the deficiency by installing an acceptable barrier; or

(iv) Justify the deficiency by performing a specific analysis for each cable or raceway where the minimum separation is not met to demonstrate that a failure will not propagate because of the insufficient separation.

Q. In regard to the guidelines set forth in Revision 2 of Regulatory Guide 1.75, will the Commission require backfitting for Shoreham?

A. (Knox) Under 10 C.F.R. § 50.109, the Commission may require the backfitting of a facility after a construction permit has been issued, if it finds that such action will provide substantial, additional protection which is required for the public health and safety. The Commission has found that backfitting to comply with Regulatory Guide 1.75, Revision 2, does not provide for substantial additional protection. This finding is inherently stated in the implementation section of Regulatory Guide 1.75 which provides: ". . . this guide will be used by the NRC staff in evaluating all construction permit applications for which the issue date of the Safety Evaluation Report is February 1, 1974 or after." The Shoreham CP-SER was issued February 20, 1970.

Q. What was the basis used by the Staff for evaluating the adequacy of physical independence of electrical cables and raceways at Shoreham and compliance with Criterion 17 of Appendix A to 10 C.F.R. 50?

A. (Knox) Criterion 17 of 10 C.F.R. Part 50 requires, in part, that the onsite electric power supplies and distribution systems shall have sufficient independence to perform their safety function assuming a single failure. The Staff had determined (as indicated in the Commission's Standard Review Plan, NUREG-0800) that conformance to the specific guidelines of IEEE Standard 384-1974, as augmented by Regulatory Guide 1.75, Rev. 1 or 2 (which provide identical positions) provides a sufficient basis for acceptance of the above stated independence requirement of Criterion 17.

Section 3.12 of the Shoreham Final Safety Analysis Report presents the Applicant's separation criteria that has been followed to assure that sufficient independence of redundant instrumentation, control, and electrical equipment will be maintained. The basis used by the Staff for judging the acceptability of the Applicant's separation criteria was conformance to the specific guidelines of IEEE Standard 384-1974 as augmented by Regulatory Guide 1.75 (Revision 1). The Staff had determined (as indicated in the Commission's Standard Review Plan, NUREG-0800) that conformance to the specific guidelines of IEEE Standard 384-1974, as augmented by Regulatory Guide 1.75, provides a sufficient basis for acceptance of the above stated independence requirements of Criterion 17.

Q. What was the basis used by the Staff for evaluating the adequacy of physical indenpendence of electrical cables and raceways for the Protection System at Shoreham and compliance with 10 C.F.R. 50.55 and Criterion 21 of Appendix A to 10 C.F.R. 50?

A. (Mauck) Criterion 21 of 10 C.F.R. Part 50 requires in part that independence designed into the protection system shall be sufficient to assure that no single failure results in loss of the protective function and Section 50.55a, "Codes and Standards", of 10 C.F.R. Part 50, "Licensing of Production adn Utilization Facilities", requires in paragraph (h) that protection systems meet the requirements set forth in the Institute of Electrical and Electronics Engineers "Criteria for Nuclear Power Plant Protection Systems", (IEEE 279). Section 4.6 of IEEE Std. 279-1971, "Criteria for Protection Systems for Nuclear Power Generating Stations", (also designated ANSE N42.7-1972) requires, in part, that channels that provide signals for the same protective function be independent and physically separated. The staff had determined (as indicated in the Commission's Standard Review Plan, NUREG-0800) that conformance to the specific guidelines of IEEE Standard 384-1974, as augmented by Regulatory Guide 1.75, Rev. 1, provides a sufficient basis for acceptance of the above stated independence requirements of Criterion 21 and 10 C.F.R. 50.55a.

Q. Has the Shoreham physical separation design for cables and raceways been implemented in a manner that meets the requirements of GDC 17, 21 and 10 C.F.R. § 50.55a?

A. (Knox and Mauck) Yes, with the possible exception of wiring in the NSSS cabinets as noted below. During the review of the Shoreham physical separation design, the Staff requested from the Applicant a comparison of Shoreham design requirements to those in IEEE Standard

384-1974 as augmented by Regulatory Guide 1.75 (Revision 1). In addition, where less stringent criteria are proposed, the Staff requested, from the Applicant, a discussion of the reasons for concluding that the less stringent criteria met the independence requirement of GDC 17, 21 and 10 C.F.R. § 50.55a.

The requested comparison and discussions have been documented in the Shoreham FSAR (Applicant responses to questions 223.12 Part 1 and 223.67) (Attachment 3). Exceptions, to the guidelines of IEEE Standard 384-1974 as augmented by Regulatory Guide 1.72 (Revision 1), have been evaluated as follows:

a. (Knox) Connection of non-Class 1E loads to Class 1E busses and separation between Class 1E and non-Class 1E cables located in control panels have been evaluated in sections 8.4.4 and 8.4.10 of the Shoreham Safety Evaluation Report (NUREG-0420). I have reviewed the evaluations and concur that that the design meets Staff requirements and is acceptable.

b. (Knox) Minimum separation between redundant Class 1E cables at Shoreham has been specified to be 1 foot horizontal and 3 feet vertical in the cable spreading area (relay room) and 3 feet horizontal and 5 feet vertical in general plant areas. Where the minimum separation cannot be maintained, both redundant cables are run in enclosed raceways separated by one inch or a barrier is installed between redundant cables. This separation is the same as the guidelines of IEEE Standard 384-1974 as augmented by Regulatory Guide 1.75, Rev. 1, except that vertical separation is measured in a different manner. The separation at Shoreham is measured from cable tray top to top versus from the top of the lower tray to the bottom of the higher tray as recommended by IEEE Standard 384-1974.

Thus, the cables as a minimum could be separated by 2 feet 8 inches vertically versus 3 feet in the cable spreading area and 4 feet 8 inches versus 5 feet in general plant areas. The difference of 4 inches in vertical separation will not appreciably affect the independence of redundant Class 1E cables since separation guidelines of IEEE 384-1974 are based on open top trays. Trays at Shoreham are covered (solid tops) and redundant trays are never in the same vertical stack. The separation at Shoreham, thus, exceeds the guidelines of IEEE Standard 384 and is acceptable.

c. (Knox) Minimum separation between non-Class 1E and Class 1E cables at Shoreham has been specified to be 1 inch horizontal and 1 foot vertical with barriers or cable tray covers between cables. Even though the minimum separation guidelines of IEEE Standard 384-1974 (5 feet vertical and 3 feet horizontal for general plant areas and 3 feet vertical and 1 foot horizontal for the cable spreading area) have not been specified for the Shoreham design, the tray covers or barriers specified in addition to separation of 1 inch horizontal and 1 foot vertical meets the guidelines of IEEE Standard 384-1974 and is acceptable.

For cables with a separation greater than 1 inch horizontal and 1 foot vertical but less than 3 feet horizontal and 5 feet vertical recommended by IEEE Standard 384-1974, the Shoreham separation criteria has been interpreted to mean that the barrier or tray covers specified by Shoreham separation criteria will be installed between cables. This interpretation meets the guidelines of IEEE Standard 384 and will be imposed as a condition to the Shoreham operating license.

d. (Mauck) Physical separation has not been provided between non-Class 1E and Class 1E cables at Shoreham inside the NSSS cabinets. The Staff will require that the Applicant provide information to justify that physical separation inside the NSSS cabinets is not required to prevent failures in the non-Class 1E cables from adversely affecting the safety equipment and circuits.

(Knox-Mauck) It was previously concluded in the Shoreham SER and now we reaffirm that the physical independence of electrical cables at Shoreham have been evaluated in accordance with the guidelines of IEEE Standard 384-1974 as augmented by Regulatory Guide 1.75 (revision 1), meets the independence requirement of General Design Criterion 17 and 21 Appendix A to 10 C.F.R. Part 50, and 10 C.F.R. 50.55a and is acceptable, with the possible exception of the cables in the NSSS cabinets. As previously indicated the Applicant is to provide additional information on the cables inside the NSSS cabinets.

Q. 10 C.F.R. 50.57 requires, in part, that each operating license will include appropriate provisions with respect to any uncompleted items of construction and such limitations or conditions as are required to assure that operation during the period of the completion of such items will not endanger public health and safety. In regard to deficiencies identified in the separation of electrical cables at Shoreham, will they be corrected before fuel is loaded at the Shoreham plant?

A. (Knox) Yes. The Staff has required each deficiency to be corrected using one of four options presented in the contentions. The options either meet or exceed the separation criteria specified in the FSAR or the guidelines of Regulatory Guide 1.75. If option 4 is used, the specific analysis will have to be evaluated by the Staff and the results will be reported in a supplement to the Shoreham Safety Evaluation Report.

Q. Does the design and location of the Shoreham electrical system components meet GDC 3 requirements?

A. (Eberly) Yes, on May 23, 1980, the Commission issued a Memorandum and Order (CLI-80-21) which indicated that a proposed fire protection rule was to be published and stated that: "The combination of the guidance contained in Appendix A to Branch Technical Position, ASB 9.5-1 and the requiremetns set forth in this proposed rule define the essential elements for an acceptable fire protection program at nuclear power plants docketed for construction permit review prior to July 1, 1976, for demonstration of compliance with General Design Criteria 3 of Appendix A to 10 C.F.R. 50." On October 27, 1980, the Commission approved a rule concerning fire protection. The rule and its Appendix R were developed to establish the minimum acceptable fire protection requirements necessary to resolve certain areas of concern in contest between the Staff and licensees of plants operating prior to January 1, 1979. The physical independence requirements for the purpose of conforming to GDC 3 are contained in Section III.G of Appendix R.

The Shoreham station was reviewed to the guidelines of Appendix A to Branch Technical Position ASB 9.5-1, the requirements of Appendix R to 10 C.F.R. 50, and GDC 3 of Appendix A to 10 C.F.R., Part 50. Our evaluation concerning electrical components and cables and safe shutdown capability is set forth in Sections 9.5.5.2, 9.5.5.3, 9.5.5.5 and 9.5.6 of Supplement 1 to the SER (NUREG-0420). In sum, the Staff determined that the Applicant's programs were acceptable.

John L. Knox
Professional Qualifications
Power Systems Branch
Division of, Systems Integration
Office of Nuclear Reactor Regulation

I am a Senior Electrical Engineer (Reactor Systems) in the Power Systems Branch in the Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission. In this position I perform technical reviews, analyses, and evaluations of reactor plant features pursuant to the construction and operation of reactors.

Education

In 1962, I received an Associates of Arts degree in Electrical Power System Technology from Montgomery College. In 1971, I received a Bachelor of Science degree in Electronic Systems Engineering from the University of Maryland. Since 1974, I have taken a number of courses on PWR and BWR system operation, equipment qualification, and reactor safety.

Experience

From 1971-1974, I worked for Potomac Electric Power Company in Washington, D. C. I was assigned to the underground power Transmission Engineering Group and my duties included relocation and restoration of underground power and transmission cables due to the subway construction project. (Prior to this, I spent four years in the Air Force working on the F4 aircraft electronic weapons control systems.)

From 1974 to the present, I have worked for the Nuclear Regulatory Commission involved in the technical review of electrical systems (onsite and offsite power, instrumentation and control). Through 1976, I was a member of the Electrical Instrumentation and Control Systems Branch. This branch was split in January 1977 into an I&C branch and a power branch. Since this split, I have been a member of the Power Systems Branch. My present responsibilities include review and evaluation of onsite and offsite electric power systems.

JERRY L. MAUCK

DIVISION OF SYSTEMS INTEGRATION

U.S. NUCLEAR REGULATORY COMMISSION

PROFESSIONAL QUALIFICATIONS

I have been with the U.S. Nuclear Regulatory Commission since September 1980. I am a Reactor Engineer (Instrumentation) in the Instrumentation and Control Systems Branch, Division of Systems Integration, Office of Nuclear Reactor Regulation.

I serve as a reviewer in the area of nuclear power plant instrumentation and control systems in performing and coordinating reviews and evaluations of those portions of the applications for Contruction Permits and Operating Licenses and submittals regarding proposed modifications in licensed nuclear power plants for which the branch has responsibility to assure public health and safety and protection of the environment. I serve as project leader and coordinator of other reviewers for the resolution of highly complex technical issues and licensing problems and provide technical assistance and authoritative advice in the areas relating to the safety aspects of reactor plant instrumentation and control systems and components.

I received a Bachelor of Science degree in Electrical Engineering from Virginia Tech University in 1967. Additional graduate studies were subsequently performed at George Washington University where I received a Masters of Science degree in Engineering Administration. Other educational background includes: CFC Instrumentation School, 1968; Interdata Computer School, 1972; Hewlett Packard Computer School, 1978; Boiling Water Reactor Technology - NRC sponsored - 1980; Boiling Water Reactor Simulator School - NRC sponsored - 1981; Pressurized Water Reactor Simulator Technology - NRC sponsored - 1982.

From 1967 to 1980 I was employed by the Naval Ship Research and Development Center (David W. Taylor Model Basin) as an Electronic Engineer with such duties as specifying, processing, and operating highly sophisticated instrumentation systems for use during naval ship trials (conventional and nuclear powered).

Request 223.12 (3.12.3) (8.3.1.):

Section 3.12.3 of the FSAR sets forth separation criteria for electrical systems and equipment which in various cases seems to satisfy equivalent requirements and recommendations as those in the IEEE Std 384-1974 and Regulatory Guide 1.75, Revision 1. In this regard provide the following:

1. Compare your separation design requirements to those in the IEEE Std 384-1974 as augmented by Regulatory Guide 1.75, Revision 1 and identify those requirements and aspects of your design which are not in accordance with either the standard or the Regulatory Guide. Where less stringent criteria are proposed, discuss the reasons for concluding that the less strirgent criteria are adequate.

Response:

1. As stated in Appendix 3B-1.75, the electrical systems do not fully comply with Regulatory Guide 1.75, Revision 1, and IEEE Std 384-1974 due to the advanced stage of design of the plant at the time of issuance of this guide and the IEEE Standard. However, within the limitations imposed by the systems equipment and plant design, all effort was made, to the maximum extent practicable, to comply with the intent of Regulatory Guide 1.75 and IEEE 384-1974.

   The comparison of the SNPS-1 separation design to the requirements of IEEE Std 384-1974 and Regulatory Guide 1.75 is as follows:

   a. Associated Circuits and Isolation Devices

      Although not specifically addressed in the FSAR, the SNPS-1 design utilizes the concept of isolation devices and associated circuits.

      The degree of compliance with IEEE Std 384-1974, Sections 4.5 and 4.6 and Regulatory Guide 1.75 Positions C.1 and C.7 is discussed below:

      (i) Power Circuits

      4,160 V System

      The 4,160 V system circuits comply with both the IEEE Standard and the Regulatory Guide noted above. The non-Class IE feeders to the control rod drive water pump motors connected to Class IE buses remain with and follow the same rules as the Class IE circuits of the respective separation division and are uniquely marked. Moreover, these motors are tripped on a loss of coolant accident.

<u>480 V a-c and 125 V d-c Systems</u>

Non-Class IE 480 V a-c and 125 V d-c loads connected to the Class IE power supplies are grouped to reduce the number of points at which non-Class IE loads are connected to Class IE buses. These non-Class IE load groups are supplied through two circuit breakers physically separated from each other and connected in series. Tables 223.12-1 and 223.12-2 show the groupings of the 480 V a-c and 125 V d-c loads respectively.

The two breakers in series (also RPS motor generator set and inverters for the uninterruptible power supply buses) although not fully complying with Regulatory Guide 1.75, Position C.1, are considered acceptable isolation devices. The cables up to the second breaker (also RPS motor generator starter and input breaker of the inverter for the uninterruptible power supply) are treated in the same way as safety-related cables. The trip setting of feeder breakers to the buses to which non-Class IE load groups are connected are coordinated with the Class IE feeder. Two breakers in series ensure that for any fault on the secondary side of the second breaker, the feeder will be tripped should one of the breakers fail to open.

(ii) <u>Control and Instrument Circuits</u>

Wherever practicable, non-Class IE circuits which cannot be separated from Class IE circuits have been assigned the same color code as the Class IE circuits and wired accordingly. One example is the control rod drive pump motor. The 4,160 V breaker for this motor is part of a safety related bus. Therefore, both the main power feed and the control circuitry are color coded.

Current transformer and potential transformer circuits on 4,160 V Class IE switchgear which have to be wired to devices on Class IE portions of the main control board, have been assigned the Class IE color code and wired accordingly. The exception to the above occurs for the 4,160 V supply breaker circuits which are connected to the NSS and RSS transformer differential relays. The differential relay is non-Class IE, although the design does not permit separation due to the nature of the circuit itself.

Where the above is not practicable, every effort has been made to separate the Class IE and non-Class IE wiring. Examples of these follow.

For normal and reserve station service transformer feeders to 4,160 V emergency buses, an additional trip coil has been added with a separate non-Class IE control power supply for such trip signals. This trip coil, its auxiliary switches, and its wiring, are physically separated to the maximum degree possible within the limitations of the breaker design. "Block close" signals are multiplied through a multiplier relay, and the contacts of the multiplier relay are in the breaker closing circuits, so that contact to coil separation can be achieved.

In general where interface occurs, non-Class IE circuits are separated from Class IE circuits by the use of multiplier relays and/or contact to contact separation.

All possible motor feeder ammeters have 0-1 milliamp dc movements. A transducer is provided at the switchgear to provide electrical separation.

Wherever possible Class IE motor-operated valves, air-operated valves, motor-operated dampers, and air-operated dampers whose limit switches or position switches interface with both Class IE and non-Class IE circuits, have metal barriers or separate metal boxes between the Class IE and non-Class IE contacts for separation purposes.

The isolation devices which separate the Shoreham Startrec system from the reactor safety systems are manufactured by Validyne. These isolators provide electrical - to - electrical isolation and are identical to those that have been Class IE qualified for use at the Zimmer and LaSalle power stations.

b. BOP Panels Internal Wiring Separation

Redundant Class IE circuits are separated by barriers or 6 in. physical separation. Electrical separation of Division I or Division II output logic signals interfacing with Division III equipment actuation control circuits is achieved by buffer relays mounted in such a manner that the relay coil wiring is separated from the relay contacts by means of a metal barrier.

Wherever possible non-Class IE circuits are not run in the same wire bundles or wireways used by any group of the redundant Class IE cables.

To maintain separation between Class IE and non-Class IE wiring on the same control board, devices are enclosed in can type boxes where necessary and their wiring is run in metal conduits to separate terminal blocks.

c. NSSS Panels Internal Wiring Separation

Separation of a pair of redundant control devices that must be located in close proximity is achieved by totally enclosing the wiring to one of the devices within a fire-resistant material. In a few specific cases the criterion for separation within the metallic enclosure, (cabinet or panel) is relaxed. This relaxation of the criterion is allowable since an analysis for the particular system shows that the complete failure of the equipment within the enclosure will not compromise the system's redundant counterpart or the redundant power supply (refer to the single failure analysis in GE Report NEDO-10139, "Compliance of Protection Systems to Industry Criteria-General Electric BWR Nuclear Steam Supply System").

The requirements for physical separation are documented on each system elementary diagram (for example, 791E420TF Note 13 which is used to denote those switch contacts and lights that shall be enclosed in a metal container). All applicable elementaries may be found in Section 5.1 of "Safety Related Schematics and Drawings" submitted February 10, 1976.

d. Cables and Raceways

The comparison of cable tray separation in nonhazardous areas between SNPS-1 design and that of IEEE Std 384 and Regulatory Guide 1.75 is given in Table 223.12-3.

The cable trays are generally arranged either by voltage class level with non-Class IE and Class IE cable trays interlacted or arranged in groups of non-Class IE cable trays at the top and Class IE cable trays at the bottom. Cable trays are generally run with the highest voltage cable at the top.

TABLE 223.12-1

480 V a-c NON-CLASS IE LOAD GROUPS SUPPLIED FROM CLASS IE BUSES

Non-Class IE Load Group	Connected to Class IE Bus	Isolation Device	Remarks
1. Division I Power Source			
Turbine Building MCC 1R24-MCC111B	Emergency Switchgear Room MCC 1R24*MCC1115	Two breakers in series	Tripped on LOCA with loss of offsite power
Reactor Building MCC 1R24-MCC111A	Reactor Building MCC 1R24*MCC1113	Two breakers in series	Tripped on LOCA
Emergency Lighting Distribution Panel 1X40-PNL-AC2	480 V Emergency Swgr. Bus 111	Two breakers in series	Tripped on LOCA with loss of offsite power
UPS Inverter (for vital nonsafety bus) 1R36-1NV-01	Emergency Switchgear Room MCC 1R24*MCC1115	Two breakers in series and UPS	Second breakers in rectifier and regulator section of UPS
24 V Battery A Chargers 1R41-BC-A2-1&2	Emergency Switchgear Room MCC 1R24*MCC1115	Two breakers in series and charger	Tripped on LOCA
RPS Motor/Generator Set	Emergency Switchgear Room MCC 1R24*MCC1115	One breaker and M/G set with motor starter and generator output breaker	
2. Division II Power Source			
Turbine Building MCC 1R24-MCC112B	Emergency Switchgear Room MCC 1R24*MCC1125	Two breakers in series	Tripped on LOCA with loss of offsite power
Reactor Building MCC 1R24-MCC112A	Reactor Building MCC 1R24*MCC1123	Two breakers in series	Tripped on LOCA
24 V Battery B Chargers 1R24-BC-B2-1&2	Emergency Switchgear Room MCC 1R24*MCC1125	Two breakers in series & charger	Tripped on LOCA
RPS Motor/Generator Set	Emergency Switchgear Room MCC 1R24*MCC1125	One breaker and M/G set with motor starter and generator output breaker	

TABLE 223.12-1 (CONT'D)

Non-Class IE Load Group	Connected to Class IE Bus	Isolation Device	Remarks
3. Division III Power Source			
Turbine Building MCC 1R24-MCC113A	480 V Emergency Swgr. Bus 113	Two breakers in series	Tripped on LOCA with loss of offsite power
Emergency Lighting Distribution Panels 1X40-PNL-AC1 and 1T51-PNL-AC2	480 V Emergency Swgr. Bus 113	Two breakers in series	Tripped on LOCA with loss of offsite power
UPS Inverter (for computer) 1R36-1NV-02	Emergency Switchgear Room MCC 1R24*MCC1133	Two breakers in series and UPS	Second breakers in rectifier and regulator section of UPS

Table 223.12-2

125 V D-C NON-CLASS IE LOAD GROUPS
SUPPLIED FROM CLASS IE BUSES

Non-Class IE Load Group	Connected to Class IE Bus	Isolation Device	Remarks
1. Division I Power Source			
Turbine Building and Relay Room Distribution Panels 1R24-PNL-A3 & 1R24-PNL-A4	125 v d-c Switchgear 1R42*SWG-A1	Two breakers in series	One common feed for both panels
UPS Inverter (for vital nonsafety bus) 1R36-INV-01	125 v d-c Switchgear 1R42*SWG-A1	Two breakers in series	Second breaker in inverter section of UPS
2. Division II Power Source			
Turbine Building and Relay Room Distribution Panels 1R42-PNL-B3 & 1R42-PNL-B4	125 v d-c Switchgear 1R42*SWG-B1	Two breakers in series	One common feed for both panels
3. Division III Power Source			
Emergency Switchgear Room Distribution Panel 1R42-PNL-C2	125 v d-c Switchgear 1R42*SWG-C1	Two breakers in series	
Turbine Building Distribution Panel 1R42-PNL-C3	125 v d-c Switchgear 1R42*SWG-C1	Two breakers in series	
UPS Inverter (for Computer) 1R36-INV-02	125 v d-c Switchgear 1R42*SWG-C1	Two breakers in series	Second breaker in inverter section of UPS

TABLE 223.12-3

CABLE TRAY SEPARATION IN NONHAZARDOUS AREAS

Redundant Class IE Trays	IEEE Std. 384 and Req. Guide. 1.75	SNPS-1
Cable Spreading Area		Redundant trays never in same vertical stack
Vertical	3 ft(1)	
Horizontal	1 ft	1 ft
Tray Covers	none required	solid(3)
General Plant Areas		
Vertical	5 ft(1)	Same as above
Horizontal	3 ft	3 ft
Tray Covers	none required	solid(3)
Non-Class 1E & Class 1E Trays		
Cable Spreading Area		
Vertical	3 ft(1)	1 ft(1)
Horizontal	1 ft	1 in.
Tray Covers	none required	solid(3)
General Plant Area		
Vertical	5 ft(1)	1 ft(1)(2)
Horizontal	3 ft	1 in.
Tray Covers	None	solid(3)
Cable Specification	no requirement except for associated circuits	Same as Class 1E
Fire Protection	none required	Auto CO_2 in Cable Spread. Area, Diesel Generator Rooms, Emergency and Normal Switchgear Rooms

NOTES:

(1)Vertical separation for SNPS-1 is measured from the bottom of the top tray to the bottom of the side rail of the bottom tray instead of the bottom of the top tray to the top of the side rail of the bottom tray as stated in IEEE Std. 384.

(2)In certain isolated cases, 9 in. separation is used in the reactor building due to limitation of available space.

(3)Tray covers for H and L trays are solid side ventilated; covers of K, C, and X trays are solid nonventilated.

Request 223.67 (3.12.3):

Provide the following information pertaining to the response to request item 223.12:

1. Identify those non-Class IE control and instrument circuits which are not practicable or possible to separate from Class IE circuits. Describe the analyses and tests that have been performed to demonstrate that Class IE circuits will not be degraded below an acceptable level.

2. With regard to BOP panels internal wiring separation, identify those non-Class IE circuit wirings which are not possible to segregate from Class IE wire bundles or wireways. Describe the analyses and tests that have been performed to demonstrate that Class IE circuits will not be degraded below an acceptable level.

3. Confirm that the non-Class IE cables running in the same underground duct banks as the Class IE cables follow the same rules as Class IE circuits or respective separation division.

Response:

1. A further review of the BOP instrument and control circuits confirms the following:

   a. All non-Class IE control circuits are separated from Class IE circuits by the use of coil-to-contact and/or contact-to-contact separation.

   b. All Class IE motor-operated valves, air-operated valves, motor-operated dampers, and air-operated dampers whose limit switches or position switches interface with both Class IE and non-Class IE circuits have metal barriers or separate metal boxes between the Class IE and non-Class IE contacts for separation purposes.

   c. Any non-Class IE load (instrument or control) which is not separated from a Class IE source has been assigned the same color code as the Class IE source and wired accordingly. The non-Class IE loads are seismically analyzed and/or tested so as to demonstrate that the Class IE source is not degraded. Similarly, the non-Class IE device is mounted in or on a Seismic Category I panel, instrument rack, or process line, and seismic analysis and/or tests are being performed to ensure structural integrity.

   d. Radiation monitoring instrument circuits utilize optical isolation for separation between Class IE monitors and the non-Class IE computer.

e. In reference to Item 1a, some wire bundles internal to equipment are not separated due to physical limitations and/or equipment design. These bundles are:

(i) 4,160 Volt Emergency Switchgear,

(ii) 480 Volt Emergency Switchgear,

(iii) Diesel Generator Control Panels,

(iv) AC and DC Motor Control Centers (MCCs),

(v) HVAC Filter Train 1T46*FLT-0/A, B and 1X61*FLT-02A, B, and

(vi) Hydrogen Recombiner Control Cabinets A and B.

Non-Class IE wiring outside of the equipment above is run in separate raceways from Class IE.

The majority of circuits where wire bundles are not separated between Class IE and non-Class IE wiring involves inputs to the station annunciator and computer systems. Both these systems involve low level circuits, failure (open, short) of which will not damage that cable or adjacent Class IE cables (maximum current of 10 ma for the annunciator or computer). Fire propagation along the non-Class IE cable is not a hazard, since all wire used within Class IE equipment, whether used for Class IE or non-Class IE functions, is the same and is qualified in accordance with Class IE requirements.

The balance of circuits involved other than those listed in the response to Request 223.12 are:

(1) Space Heater Wiring in 4,160 V Switchgear breaker cubicles to the Service Water Pumps

(2) Space Heater Wiring in 4,160 V Switchgear breaker cubicles to the RHR Pumps

(3) Space Heater Wiring in 4,160 V Switchgear breaker cubicles to the Core Spray Pumps

(4) Space Heater Wiring in 4,160 V Switchgear breaker cubicles to the CRD Pumps

(5) Space Heater Wiring in DC MCCS for RCIC and HPCI Pumps

(6) Fire Protection Detector Circuit for Filter Trains

(7) Contacts to Reactor Water Cleanup System isolation logic (Class IE) from a non-Class IE MCC

Most non-Class IE control and instrumentation circuits in NSSS control panels are associated with annunciators and computer inputs.

There are no sources of energy within NSSS control room panels of sufficient magnitude to cause failures to both redundant safety system divisions from a non-Class IE circuit fault. Therefore, a circuit by circuit analysis and/or testing is not deemed necessary to assure safety system operation.

The Shoreham NSSS control room panels have been designed to be in full conformance with IEEE 279-1971 thus assuring the separation of redundant Class IE safety system circuits.

Whenever new design changes are incorporated, the requirements of Regulatory Guide 1.75 (including separation of Class IE and non-Class IE circuits) are considered and incorporated to the maximum extent possible.

2. Reference Item 1e above.

3. Non-Class IE cables installed in underground duct banks are designed, installed, and tested to the same criteria as the safety related cables with the following exceptions:

   a. Class IE cables are sized more conservatively than non-Class IE cables. However, cable derating and cable protection criteria are the same for both classes of cable.

   b. Non-Class IE cable pulling tension is monitored on a sample basis. Pulling tension is monitored for all Class IE cables installed by machine in underground ducts. The maximum allowable pulling tension is the same for both Class IE and non Class IE cables.