ATTACHMENT 2

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Nine Mile Point 2

Failure Modes and Effects Analysis of Non-Class 1E Devices Connected to the Reactor Protection System Power Supply

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CONTENTS

1. INTRODUCTION

This report provides a documented evaluation for all applications, in the General Electric design scope, of non-Class 1E devices in circuits powered by the RPS power supply.

All of these industrial or commercial grade devices were selected by the designer for the application and for the functional performance requirements. They represent an optimum selection by the designer, and where dictated by later system requirements, similar devices have been used under nuclear safety--related specifications. Similar components were installed on panels that were seismically tested and did not adversely affect the power supply and the safety-related function. These components, unless specifically noted in the FMEA, are located on panels in a controlled environment which is usually much less severe than the maximum rated operating temperature of these devices. These devices are identical to the devices of the same equipment part number used in various BWR 4's, 5's and 6's that have been operating over the past 15 years. GE is not aware of any failure attributable to these devices and their connection to the power source of Class 1E equipment. Subsequent to the NMP2 applications, many of these components have been qualified for similar Class 1E application.

The non-Class 1E devices analyzed in this report have been identified by a study of Elementary Diagrams and Elementary Diagram Device Lists for all NSSS systems containing components energized by the RPS power supply. These systems are the Reactor Protection System, the Nuclear Steam Supply Shutoff System, the Neutron Monitoring System, the Leak Detection System, and the Process Radiation Monitoring System. These systems are considered to be fail safe; that is, they perform their safety function on loss of power.

This Failure Modes and Effects Analysis (FMEA) evaluates the worst case failures of these devices.

The evaluations provide documentation of the fact that the use of these components in these systems does not affect plant safety. These devices will perform all required safety functions under all design basis events.

The following non-Class 1E devices are used in Class 1E RPS circuits. Analysis of acceptability of the application is as follows:

I. DIODES

A. Identification — PPD (Purchased Part Drawing)

C72A-CR1(A-D) 137C6234P004
C72A-CR2(A-D)

These devices are general purpose silicon diodes, symbol 1N4004, subject to burn in per MIL-STD-750, Method 1038, and subsequent electrical measurements. The diode is a 2.5 amp rated, axial-leaded general purpose rectifier, with dual heatsink construction; the silicon pellet PN junction is enclosed in solid glass; no organic materials are present within the hermetically sealed diode.

Subsequent to this NMP2 application, similar diodes have been dedicated for similar Class 1E applications under GE designation DA317A7898P001.

B. Function

Devices are used in the output of trip units to prevent feedback or interference between trip units. These circuits provide input to annunciate that a trip unit has failed upscale/downscale or is in calibration.

C. Failure Mode

1. Potential Fault Paths - All potential fault paths from supply voltage to common/ground (which include these diodes) have been evaluated.

2. Preoperational Test - The electronic industry recognizes a one week burn-in as adequate to detect and eliminate infant mortality. The devices containing electronic components are energized for several months during preoperational testing and startup, thereby identifying and correcting failures due to infant mortality.

3. Mechanical Stresses - Identical diodes were installed and energized on panels that were seismically tested and did not adversely affect the power supply (ref. 13).

4. Environmental Stresses - These diodes are located in a mild environment which is much less severe than the maximum operating temperature of these diodes (212°F).

5. Open circuit would prevent annunciation of "trip unit in calibration or gross failure". The failure would be detected during surveillance testing.

6. Short circuit would provide erroneous annunciation. Failure would be detected during surveillance testing, or when trouble shooting false annunciation caused by a "gross failure" event.

D. Conclusion

Loss of annunciation does not impair any safety function. In addition, the diode failure has no adverse effect upon the 24 Vdc power supply. This is because the diodes are between the power supply and the load so that no open or short conditions could increase the load current from the power supply beyond the maximum value that could exist without component failure. The devices have no failure mechanism that could aversely affect the power supply or the system safety function.

These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

II. FUSES

II.A Fuses, General

1. Device Description

Most of the fuses are identified by PPD No. 145C3039 and are Bussman type MIN with blown fuse indicators. Blown fuse indicator can be seen through window of the Bussman type HPC-C fuseholder. Subsequent to the NMP2 application, the 145C3039 fuses have been dedicated for similar Class 1E application under GE designation DA317A6159.

2. Device Function

The fuse provides current-limiting circuit protection by decoupling the power source from the load under fault conditions in the circuit.

3. Justification of Device Application

- Fuses have a fusible link which will limit current in the event of a short in the protected circuitry. The fuse is insulated from the panel by the Bussmann type HPC-C fuseholder. The fuseholder is phenolic and has a dielectric withstanding voltage rating of 1,800 volts. The fuse is designed to open circuit upon failure and will not affect the bus. Short circuit is not a credible failure of the fuse.

- Mechanical stresses. Identical fuses and fuseholders were installed on panels that were seismically tested per IEEE

344-1975 and did not adversely affect the power supply (References 3, 4 & 5) and the safety-related function.

- Environmental stresses. . These fuses are located on panels in a controlled environment which is usually much less severe than the maximum rated operating temperature of these fuses (185°F).

- This device is identical to the device of the same equipment part number used in various BWR 4's, 5's and 6's that have been operating over the past 15 years. GE is not aware of any failure attributable to this device and its connection to the power source or Class 1E equipment.

4. Failures Modes

a. Open Fuses. See discussion for each individual application.

b. Failure to Open. Should a fuse fail to open when expected to do so, all circuits are protected by other upstream fuses, breakers, or both. Between the UPS's and the subject fuses, there are the Electrical Protection Assemblies (EPA), circuit breakers in primary distribution panels 2VBS*PNLA100 (or B100), and fuses in secondary distribution panels 2VBS*PNLA103 (or B103), A104 (or B104), A105 (or B105), A106 (or B106), and A110 (or B110). These fuses vary in rating from 15A to 30A depending on application (Ref. 6 and 7).

If any of the subject fuses failed to open when expected to do so, there would be no effect on other circuits on the same bus until the voltage of the bus became degraded below the operating limits of the components connected to the affected bus. However, before the bus became degraded to this condition the Class 1E EPA would disconnect the bus and prevent damage to the other bus components. This is also true for failure of a fuse or breaker in a primary or secondary distribution panel.

5. Conclusion

The devices have no failure mechanism that could adversely affect the power supply or the system safety function. These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

II.B Fuses

1. Identification	PPD
C72A-F32, F35, F37, F39	145C3039P004

Subsequent to the NMP2 application, fuse 145C3039P004 has been dedicated for other Class 1E applications under GE designation DA317A6159P007.

2. Function

Fuses are used in circuits providing power to isolator input cards. The isolators are used to provide isolation between divisional input signals and non-divisional output signals to the annunciator and computer.

3. Failure Mode

Open circuit would deenergize the isolator input cards and prevent signals from being sent to the annunciator and/or computer. Failure detected by the "card out of file or power loss" annunciator being alarmed.

4. Conclusion

The devices have no failure mechanism that could adversely affect the power supply or the system safety function. These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

II.C Fuses

1. Identification

PPD
145C3039P004

C72A-F40(A-D)

Subsequent to the NMP2 application, fuse 145C3039P004 has been dedicated for other Class 1E applications under GE designation DA317A6159P007.

2. Function

Fuses are used in circuits providing power to status lights for "trip unit in calibration or gross failure" and "system out of service".

3. Failure Mode

Open circuit would result in loss of the status lights. Failure detected during surveillance testing.

4. Conclusion

The devices have no failure mechanism that could adversely affect the power supply or the system safety function. These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

II.D Fuses

1. Identification — PPD

C72A-F20 — 145C3039P004

Subsequent to the NMP2 application, fuse 145C3039P004 has been dedicated for other Class 1E applications under GE designation DA317A6159P007.

2. Function

Fuse is used in circuit providing power to the scram discharge volume isolation valve position indicator lights.

3. Failure Mode

Open circuit would result in loss of the valve open/close lights. Failure detected by all four lights in this circuit being extinguished.

4. Conclusion

The devices have no failure mechanism that could adversely affect the power supply or the system safety function. These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

II.E Fuses

1. Identification — PPD

C72A-F27(A-D) — 145C3039P004

Subsequent to the NMP2 application, fuse 145C3039P004 has been dedicated for other Class 1E applications under GE designation DA317A6159P007.

2. Function

Fuses are used in circuits providing power to status lights which indicate when the scram trip logic circuits are energized.

3. Failure Mode

Open circuit would result in loss of the status light. Failure detected by the light being extinguished during non-trip conditions.

4. Conclusion

The devices have no failure mechanism that could adversely affect the power supply or the system safety function. These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

II.F Fuses

1. Identification — PPD

C72A-F82 through F89 — 145C3039P004

These fuses are analyzed in the discussion for the leak detection system.

II.G Fuses

1. Identification — PPD

C72A-F1(A-D), -F2(A-D),	145C3039P004
-F3(ACEG), -F3(BDFH),	"
-F3(JLNR), -F3(KMPS),	"
-F7(A-D), -F8(A-D)	"
-F10(ACEG) - F10(BDFH),	"
-F11(A-D), -F12(ACEG),	"
-F12(BDFH), -F13(A-D),	"
-F14(ACEG), -F14(BDFH),	"
-F14(JLNR), -F14(KMPS),	"
-F15(A-D), -F17(AB),	"
-F4(A-D)	145C3039P007
C72A-F18(A-H)	176A1619P032
C72A-F30, -F31, -F33, -F36,	145C3039P005
-F38, -F41, -F42, -F43	"
-F71(AB)	145C3039P004

Subsequent to the NMP2 application, fuses 145C3039P004, P005, and P007 have been dedicated for similar Class 1E applications under GE designation DA317A6159P007, P010, and P013. Fuse 176A1619P032 (Bussman type FNM) has been dedicated for similar Class 1E applications under DA317A6159P012.

2. Function

These fuses are used in circuits which provide power to devices (relays, solenoid valves, etc.) which are used to scram the reactor. These circuits are fail-safe; that is, they deenergize to perform the intended function.

3. Failure Mode

Open circuit would deenergize the associated device, thus performing the intended function. Failure would be detected by annunciation, status light and/or by surveillance tests.

4. Conclusion

Because of the fail-safe design of the circuits, fuse failure causes the desired safety action in the same manner that loss of the power

source causes the desired safety action. The devices have no failure mechanism that could adversely affect the power supply or the system safety function. These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

II.H Fuses

1. Identification — PPD

C72A-F51(A-D) — 145C3039P004

Subsequent to the NMP2 application, fuse 145C3039P004 has been dedicated for other Class 1E applications under GE designation DA317A6159P007.

2. Function

Fuses are used in circuits providing power to relays which energize to monitor MSIV and feedwater containment isolation valves off normal status in relation to the position of the reactor mode switch.

3. Failure Mode

Open circuit would prevent relays from energizing when mode switch contact is closed. RPS Ch A1 mode switch contact is closed in run mode. RPS Ch B1 mode switch contact is closed in hot standby mode. RPS Ch A2 mode switch is closed in refuel mode. RPS Ch B2 mode switch is closed in shutdown mode. Failure of fuse(s) could prevent off normal status lights for MSIVs and feedwater containment isolation valves depending on RPS channel affected and mode switch position status.

4. Conclusion

The devices have no failure mechanism that could adversely affect the power supply or the system safety function. These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

II.I Fuses

1. Identification — PPD

C72A-F28(A-D), -F29(A-D) — 145C3039P004

Subsequent to the NMP2 application, fuse 145C3039P004 has been dedicated for other Class 1E applications under GE designation DA317A6159P007.

2. Function

Fuses are used in circuits providing power to relays which momentarily energize to reset the scram trip logic circuits upon manual initiation of the reset switches.

3. Failure Mode

A. Open circuit of F28 would prevent the associated trip logic from being reset. Failure is detected by inability to reset the trip logic.

B. Open circuit of F29 would prevent the associated trip logic from being reset following a full scram until both trip logics of the redundant trip system have been reset. For example, if Fuse F29A fails, trip logic A1 cannot be reset until both trip logics B1 and B2 have been reset. Failure is not detectable unless the trip logic associated with the failed fuse happens to be the first attempted reset.

4. Conclusion

The devices have no failure mechanism that could adversely affect the power supply or the system safety function. These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

II.J Fuses

1. Identification	PPD
C72A-F70(A-D)	145C3039P004

Subsequent to the NMP2 application, fuse 145C3039P004 has been dedicated for other Class 1E applications under GE designation DA317A6159P007.

2. Function

Fuses are used in circuits providing power to relays which energize when full scram has occurred. These relays operate in the scram reset circuits which provide a 10-second time delay prior to allowing a manual RPS logic reset.

3. Failure Mode

Open circuit would inhibit the 10-second time delay in the associated reset circuit. Failure is not detectable.

4. Conclusion

Even though the trip logic associated with the failed fuse could potentially be reset without time delay, the scram function itself could not be reset without the 10-second delay. This is because the

companion trip logic within the same trip system must also be reset. That is, both trip logics A1 and A2 or B1 and B2 must be reset before the scram function is considered as reset. Reset cannot take place until the scram initiating event has been cleared and the scram discharge volume drained. In addition, the reset switches are Keylock and the keys are maintained under procedural control. The devices have no failure mechanism that could adversely affect the power supply or the system safety function. These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

II.K Fuses

1. Identification

	PPD
C72A-F16(A-D)	145C3039P004

Subsequent to the NMP2 application, fuse 145C3039P004 has been dedicated for other Class 1E applications under GE designation DA317A6159P007.

2. Function

Fuses are used in circuits providing power to relays which energize when the reactor mode switch is in shutdown position. The relays actuate to provide a time delay bypass of the mode switch shutdown trip.

3. Failure Mode

Open circuit would inhibit the bypass. The scram trip logic associated with the failed fuse could not be reset with the mode switch in shutdown position. Failure is detectable by inability to reset the associated trip logic.

4. Conclusion

The devices have no failure mechanism that could adversely affect the power supply or the system safety function. These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

III. SCRAM CONTACTOR AUXILIARY CONTACTS

A. Identification

	PPD
C72A-K14(ABCDEFGHJKLMNPRS)-1	209A6130P002
C72A-K14(ABCDEFGHJKLMNPRS)-2	209A6130P001

Subsequent to this NMP2 application, these auxiliary contacts (CR105X product line) have been dedicated for similar Class 1E applications under GE designation DA239B7208P001.

B. Function

The auxiliary contacts are used as follows:

1. Provide contact closure to Engineering Test Information System (ETIS).

2. Provide contact closure to annunciator circuits.

3. Provide contact opening to status lights which indicate when the trip logic is deenergized.

4. Provide contact closure to relays K70(A-D). This is indicative of a full scram.

C. Failure Mode

1. For functions 1, 2 and 3, a contact which fails to close or open upon deenergization of the scram contactor would prevent signals from being transmitted to ETIS and annunciator and the status light would give improper indication. Failure would be detectable during surveillance test.

2. For functions 1, 2 and 3, a contact which fails to open or close upon energization of the scram contactor would provide false inputs to ETIS and annunciator and status light. Failure would be detectable during surveillance tests.

3. For function 4, relay K70 energizes upon full scram to initiate the 10-second time delay before the trip logic can be reset. Failure of a single auxiliary contact to close would have no effect upon achieving the desired function since relay K70 is energized by auxiliary contacts from four separate contactors. The auxiliary contacts are arranged in a one-out-of-two-taken-twice logic with an input from each of the four trip logics. For example, relay K70A is energized by closure of auxiliary contacts from K14A or K14E and K14J or K14N. K14A is controlled by trip logic A1, K14E from trip logic A2, K14J from trip logic B1 and K14N from trip logic B2. The failure is not detectable.

D. Conclusion

Functions 1, 2 and 3 are non-safety-related functions. Function 4 requires multiple failures to prevent the intended function. Reset cannot take place until the scram initiating event has been cleared and the scram discharge volume drained. Additional conclusions presented in II.J for Fuse F70 also applies to function 4 since F70 is in the same circuit as relay K70. The devices have no failure mechanism that could adversely affect the power supply or the system safety function. These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

IV. RESISTORS

A. Resistors, General

1. Description

Generically, resistors are a MIL-type wire wound resistor. Resistors are used as voltage dropping and voltage limiting passive devices.

2. Justification for Device Application

Excessive current demand by these resistors is not deemed credible because:

- Potential Fault Paths - All potential fault paths from supply voltage to common/ground are evaluated. Resistors provide current limiting for series components and each, through experience, shows a low probability of failing in a mode that would draw excessive current. The epoxy encapsulated fixed resistors generally have a dielectric withstanding voltage of 1,000 volts rms minimum.

- Preoperational Test - The electronic industry recognizes a one week burn-in as adequate to detect and eliminate infant mortality. The devices containing electronic components are energized for several months during preoperational testing and startup, thereby identifying and correcting failures due to infant mortality.

- Mechanical Stresses - Identical resistors were installed and energized on panels that were seismically tested and did not adversely affect the power supply (ref. 8 and 9).

- Environmental Stresses - Resistors are located in a mild environment which is much less severe than the general maximum rated operating temperature.

B. Identification — PPD

C72A-R1(EGNR) — 137C6423P001
C72A-R1(FHPS)

Subsequent to this NMP2 application, this resistor has been dedicated for similar Class 1E applications under GE designation DA213A9103.

C. Function

Resistors (nominal value 1750 ohms) are used in series with scram group indicating lights and prevent hot shorts which may occur in the indicating light circuit from propagating back into the scram pilot solenoid circuits.

D. Failure Mode

1. A shorted resistor would allow a hot short to propagate back into the solenoid circuit. It would have to fail to a value less than 650 ohms in order for a hot short on the lamp wire to keep one solenoid energized, and to a value of less than 14.5 ohms in order to keep all solenoids in one rod group energized. Failure is detected by the associated light either being (1) illuminated brighter than the other lights, or (2) burned out by the overvoltage condition.

2. Open resistor would have no effect on the intended function. Failure detected by the indicating lamp being extinguished.

E. Conclusion

Failure of the resistor is immediately detectable. In addition, the resistor would have to fail at the same time as a failure of the wiring in order to produce a hot short. And this is still not a problem unless it all occurs at the same instant that a scram is required. Since the wiring is Class 1E and qualified, application of the single failure criterion would limit any potential impact to a single short affecting a single rod group which does not prevent a safe shutdown of the plant. The devices have no failure mechanism that could adversely affect the power supply or the system safety function.

V. VARISTORS

A. Identification — PPD

C72A-R3(A-H), -R7(A-D),	228B2023G001
-R12(A-H)	228B2023G001
-R14(A-H)	228B2131G001
-R19(A-D)	228B2171G001

Subsequent to this NMP2 application, these varistors have been dedicated for similar Class 1E applications under GE designation DA317A7853.

B. Function

Varistors are used in parallel with various relay coils to reduce voltage spikes when relays are deenergized. The relays involved are in fail-safe circuits which deenergize to perform their intended function.

C. Failure Mode

1. Open circuit of a varistor would not prevent the associated relay from performing the intended function. Without the varistor, noise could be introduced into low level NMS signal cabling. This may cause scram signals to be generated by the NMS. However, the noise would be the result of the associated relay being deenergized indicating a scram signal was already present. The failure is not detectable except by possible increased noise in the NMS.

2. Short circuit would result in zero voltage across the associated relay coil causing the relay to deenergize thus performing the intended function. Since the varistors are in fail-safe circuits connected to non-1E RPS power source, degradation or loss of the power source is in the safe direction. In addition, any partial degradation of the power source would be detected by the Class 1E Electrical Protection Assemblies (EPA) which would disconnect the power source.

D. Conclusion

A varistor failure either has no effect or creates a trip of the scram circuit which is a failure in the safe direction. There are no failure mechanisms inherent to these varistors that could adversely affect the power supply or the system safety function. These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

VI. JUNCTION BOXES

A. Identification	PPD
C72A-JB101 through -JB104, -JB201, -JB301, -JB401, -JB402	235A1543AAG001

B. Device Description

The junction box identified by PPD No. 235A1543AA consists of an enclosure (pull box) made by Hoffman (ASE 6x6x4) and GE terminal board assemblies (Type CR151). The pull box is identified by GE PPD No. 235A1322P002 and GE terminal board assemblies are identified by GE PPD No. 175A9132. The enclosure boxes are made of steel. Terminal boards are phenolic with screw terminals.

[illegible]

C. Function

The junction box is used as an interconnection point that provides electrical separation of adjacent connections on the terminal board which is insulated from the junction box enclosure.

D. Failure Mode

None Anticipated.

- The junction box is a passive device that contains a CR151 terminal board assembly and is grounded. The terminal boards are enclosed in the steel pull box which protects them against externally induced shorts. They are specifically designed to provide electrical separation of adjacent connections and to be insulated from the junction box enclosure. The terminal boards are made of phenolic, with a dielectric strength greater than 1,500 Vac rms (Reference 10). Both the junction box and the terminal boards are U.L. listed.

- Similar junction boxes (234A1533AA) with terminal strips were installed on panels that were seismically tested per IEEE 344-1975 to greater than 15g and did not adversely affect the power supply (Reference 11).

- Junction boxes are located in areas where the ambient environment is less severe than the maximum operating temperature of these devices - 250-300°F (Reference 12).

- This device has been used as an interface between field cables and PGCC cables since its conception in 1972. It has been used for this purpose in various BWR 4's, 5's, and 6's that have been operating or had power applied over the past 10 years. GE is not aware of any failure attributable to this device.

E. Conclusion

It is concluded from the above that since the junction box is a passive device and since it possesses no inherent failure mechanism, it will not jeopardize the power source or any system safety function. These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

VII. REFERENCES

1. RPS Elementary Diagram 807E166TY, Rev. 24

2. RPS EDDL/IDS DL807E166TY, Rev. 17

3. GE Design Record File DRF A00-1138 (Control Room Panels)

4. GE Design Record File DRF A00-1084 (Local Panels)

5. GE Design Record File DRF H13-61

6. SWEC Dwg. 12177-EE-M010-6, Rev. 6 "Plant Master One-Line Diagram, Normal 600 Vac and 120 Vac".

7. SWEC Dwg. 12177-EE-11K-4, Rev. 4 "120 Vac Wiring Diagram, Distribution Panels".

8. General Electric Design Record File DRF A00-1138

9. General Electric Design Record File DRF A00-1084

10. GE, General Purpose Control Department, Bloomington, Illinois (309) 662-4311 - Rich Mote (Engineering).

11. GE Design Record File DRF A00-794-5

12. Mechanical Engineers Handbook (copyright 1958)

13. General Electric Design Record File DRF A00-1138

The following non-1E devices are used in Class 1E circuits connected to the RPS power supply. Analysis of the acceptability of this application follows:

I.A FUSES, GENERAL

Refer to Section 2, II-A.

I.B FUSES

A. Identification — PPD

B22H-F021A,B; — 145C3039P004

Subsequent to the NMP2 application, fuse 145C3039P004 has been dedicated for other Class 1E applications under GE designation DA317A6159P007.

B. Function

Fuses are used in circuits providing power to status lights "Main Steam Line Drain Logic Test", "Isolation Logic Test", "Reactor Water Sample Valve Logic Test", and "Water Level Logic Test."

C. Failure Mode

Open circuit would result in loss of status lights. Lights would not illuminate when in test. Failure detected when logic is being tested.

D. Conclusion

The devices have no failure mechanism that could adversely affect the power supply or the system safety function. These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

I.C FUSES

A. Identification — PPD

B22H-F078A,B; — 145C3039P004

Subsequent to the NMP2 application, fuse 145C3039P004 has been dedicated for other Class 1E applications under GE designation DA317A6159P007.

B. Function

Fuses are used in circuits providing power to status lights "Trip Unit in Calibration or Gross Failure."

C. Failure Mode

Open circuit would result in loss of status lights. Failure detected during surveillance testing.

D. Conclusion

The devices have no failure mechanism that could adversely affect the power supply or the system safety function. These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

1.D FUSES

A. Identification — PPD

B22H-F008A,B; — 145C3039P004

Subsequent to the NMP2 application, fuse 145C3039P004 has been dedicated for other Class 1E applications under GE designation DA317A6159P007.

B. Function

Fuses are used in circuits providing power to relays which momentarily energize to reset isolation trip logic circuits upon manual initiation of the reset switches.

C. Failure Mode

Open circuit would prevent the associated trip logic from being reset. Failure is detected by inability to reset the trip logic.

D. Conclusion

The devices have no failure mechanism that could adversely affect the power supply or the system safety function. These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

I.E FUSES

A. Identification — PPD

B22H-F059; — 145C3039P004

Subsequent to the NMP2 application, fuse 145C3039P004 has been dedicated for other Class 1E applications under GE designation DA317A6159P007.

B. Function

Fuse is used in a circuit providing power to a temperature controller that provides the high temperature trip when the temperature at the

tube side outlet of the RWCU non-regenerative heat exchanger exceeds a predetermined temperature.

C. Failure Mode

Open circuit would result in loss of power to the temperature controller. The RWCU outboard isolation valve would close. Failure detected during surveillance tests.

D. Conclusions

The high temperature trip when the temperature at the tube side outlet of the non-regenerative heat exchanger exceeds the setpoint is a non-safety function. The purpose of the trip is to protect the filter-demineralizer resins from excess temperature. The devices have no failure mechanism that could adversely affect the power supply or the system safety function. These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

1.F FUSES

A. Identification	PPD
B22H-F002A,B,C,D; F003A,B,C,D; F006A,B,C,D; F011A,B,C,D; F017, F018, F023A,B; F028A,B; F030A,B; F060A,B,C,D; F064A,B,C,D; F076A,B; F096A,B,C,D; F097A,B,C,D; F098C,D;	145C3039P004

Subsequent to the NMP2 application, fuse 145C3039P004 has been dedicated for other Class 1E applications under GE designation DA317A6159P007.

B. Function

Fuses are used when circuits which provide power to devices (relays, solenoid valves, etc.) which are used to isolate the reactor vessel and other various systems. These circuits are fail-safe; i.e., they deenergize to perform the intended function.

C. Failure Mode

Open circuit would deenergize the associated device, thus performing the intended function. Failure would be detected by annunciation and/or by surveillance tests.

D. Conclusion

Because of fail-safe design of the circuits, fuse failure causes the desired safety action in the same manner that loss of the non-1E power source causes the desired safety action. The devices have no

failure mechanism that could adversely affect the power supply or the system safety function. These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

II. TEMPERATURE CONTROLLER AND ASSOCIATED TEMPERATURE PROBE

A. Identification

	PPD
G33-N007 (Thermistor probe)	136B3207P001
G33-N008 (Temperature controller)	136B2186P001

This is a Weed thermistor probe and a Fenwal controller. A similar controller has been seismically qualified for similar applications, (Ref. 6). The probe is installed in RWCU piping and is a pressure integrity instrument, Class C.

B. Function

The temperature controller provides a high temperature trip when the temperature at the tube side outlet of the RWCU non-regenerative heat exchanger exceeds a predetermined temperature. The purpose of this trip is to protect the filter-demineralizer resins from excess temperature.

C. Failure Mode

A failure of this device which would result in excessive current demand would cause fuse B22H-F059 to open causing the RWCU outboard isolation valve to close. Failure detected by status lights on controller and/or surveillance testing.

2. A failure of this device which would cause a premature high temperature trip would cause the RWCU isolation valve to close. Failure detected during surveillance testing.

3. A failure of this device to trip on high temperature would expose the filter demineralizer resins to a higher temperature than desired. Failure detected during surveillance testing.

D. Conclusion

The high temperature trip is a non-safety function. Exposing filter demineralizer resins to high temperature is not a safety concern. Closure of the RWCU outboard isolation valve is the desired action if a safety trip to the valve is initiated. This action would also result by loss of the power source. The devices have no failure mechanism that could adversely affect the power supply or the system safety function. The temperature controller is located in a mild environment. Both devices have been used for many years for similar applications in many BWR nuclear plants.

III. DIODES

A. Identification

	PPD
B22H-CR1A,B,C,D;	137C6234P004

Subsequent to this NMP2 application, similar diodes have been dedicated for similar Class 1E applications under DA 317A7898P001. See also Section 2.I for diodes used in the RPS.

B. Function

Devices are used in the output of trip units in relay circuits which provide input to annunciate that a trip unit has failed upscale/downscale or is in calibration.

C. Failure Mode

1. Open circuit would prevent annunciation of "trip unit in calibration or gross failure". The failure would be detected during surveillance testing.

2. Short circuit would provide erroneous annunciation. Failure would be detected during surveillance testing or erroneous alarm trouble shooting.

D. Conclusion

Annunciation is a non-safety-related function. In addition, the diode failure has no adverse effect upon the 24 Vdc power supply because the diodes are in series with the power supply and the load so that no open or short could increase the load current from the power supply beyond the maximum value that could exist without component failure. The devices have no failure mechanism that could adversely affect the power supply or the system safety function. These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

IV. JUNCTION BOXES

A. Identification

	PPD
B22H-JB101; JB102; JB208 JB303; JB308; JB401 JB403; JB503	235A1543AAG001

These junction boxes are identical to those analyzed in Section 2.VI for the RPS.

V. REFERENCES

1. NS^4 Elementary Diagram 807E152TY Rev. 23

2. NS^4 EDDL/IDS DL807E152TY Rev. 19

3. GE, General Purpose Control Department, Bloomington, Illinois (309) 662-4311 - Rich Mote (Engineering)

4. GE Design Record File DRF A00-794-5

5. Mechanical Engineers Handbook (copyright 1958)

6. GE Design Record File DRF A00-1084-26

The following non-Class 1E devices are used in Class 1E LDS circuits connected to the RPS power supply. Analysis of the acceptability of the application is as follows:

I.A FUSES, GENERAL

Refer to Section 2, II-A.

1.B FUSES

A. Identification — PPD

E31A-F01,F24 — 145C3039P005

Subsequent to the NMP2 application, fuse 145C3039P005 has been dedicated for similar Class 1E applications under GE designation DA317A6159PC10.

B. Function

These two fuses fuse the power supply E31-K600A,B, which supply 24 Vdc to isolators AT1 thru AT4, AT11, AT12, AT13, AT16, AT18 and the Reactor Water Cleanup High Differential Flow circuit consisting of E31-K604A,B, N605A,B, K602A,B, K603A,B, K605A,B, and E31A-SRU1,-SRU2.

C. Failure Mode

1. Open circuit would de-energize the isolator input cards and prevent signals from being sent to the annunciator. Failure detected by the "Card out of file or Power loss" annunciator being alarmed.

2. The RWCU differential flow circuit alarm E31-N605A,B relay would de-energize allowing timer E31-R621A,B to time-out, energizing relays K7A,B. Relays K7A,B would cause RWCU isolation.

D. Conclusion

The RWCU differential flow circuit alarm and timer will operate in a fail-safe manner, that is, RWCU isolation on loss of power. The devices have no failure mechanism that could adversely affect the power supply or the system safety function. These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

I.C FUSES

A. Identification — PPD

E31A-F02A,B — 145C3039P004
C72-F84,F88

Subsequent to the NMP2 application, fuse 145C3039P004 has been dedicated for other Class 1E applications under GE designation DA317A6159P007.

B. Function

These fuses are used in circuits (A thru D) providing power to the relay logic for each power division.

C. Failure Mode

Open circuit would de-energize relays K5A,B and K26C,D, K25C,D, K3A,B, K1A,B, and K4A,B. De-energizing K5A,B & K26C,D would produce "card out of file or power loss" annunciator being alarmed. De-energizing relays K1A,B, K3A,B, K4A,B, and K25C,D would produce isolation signals.

D. Conclusions

The relay logic, for loss of power condition, operates in a fail-safe manner. The devices have no failure mechanism that could adversely affect the power supply or the system safety function. These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

I.D FUSES

A. Identification — PPD

E31A-F03A,B, F04A,B, F06A,B, F07A,B — 145C3039P004
E31A-F34A,B
C72A-F82,F85,F86,F89

Subsequent to the NMP2 application, fuse 145C3039P004 has been dedicated for other Class 1E applications under GE designation DA317A6159P007.

B. Function

These fuses are used in circuits providing power to the differential temperature (ΔT) and temperature switches.

C. Failure Mode

Open circuit would de-energize the internal relay in the temperature and ΔT switches which de-energize relays K1A,B, K3A,B, K4A,B. This

action produces isolation signals. An open circuit for E31A-F06A,B would de-energize K6A,B and shut off ΔT switches N603A,B, N613A,B and temperature switches N602A,B and N612A,B.

De-energizing K6A,B would produce "card out of file or power loss" annunciator being alarmed. The internal relay in the ΔT and temperature switches would change state causing relay K5A,B to energize producing an isolation signal to the RCIC steam supply system.

D. Conclusion

The logic in which the ΔT and temperature switches are used operate in a fail-safe manner. The devices have no failure mechanism that could adversely affect the power supply or the system safety function. These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

I.E FUSES

A. Identification	PPD
E31A-F14,F33	145C3039P005

Subsequent to the NMP2 application, fuse 145C3039P005 has been dedicated for similar Class 1E applications under GE designation DA317A6159P010.

B. Function

These fuses are used in circuits providing power to recorders E31-R608 and R611.

C. Failure Mode

Open circuit would inhibit the recorders and their alarm only function. However, the temperature measurements monitored by the recorders are also provided by the meter modules M2A-D.

D. Conclusions

The devices have no failure mechanism that could adversely affect the power supply or the system safety function. These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

I.F FUSES

A. Identification

	PPD
E31A-F29,F30,F31	145C3039P004
E31A-F35,F36	145C3039P003

Subsequent to the NMP2 application, fuse 145C3039P004 has been dedicated for other Class 1E applications under GE designation DA317A6159P007.

B. Function

These fuses are used in circuits providing power to isolators AT1 thru AT7, and AT10 thru AT13, AT16 thru AT20.

C. Failure Mode

Open circuit by failure of fuse F29 would inhibit isolator input cards AT1 thru AT4, AT11, AT16 and AT18.

Open circuit by failure of F30 would inhibit isolator input cards AT5 thru AT7, AT10 and AT17.

Open circuit by failure of F31 inhibits analog isolator input cards AT12 and AT13.

Open circuit by failure of F35 inhibits isolator input card AT19.

Open circuit by failure of F36 inhibits isolator input card AT20.

The loss of any of the above fuses would prevent signals from being sent to the annunciator. Failure would be detected by the "Card out of file or power loss" annunciator being alarmed.

D. Conclusions

The devices have no failure mechanism that could adversely affect the power supply or the system safety function. These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

I.G FUSES

A. Identification

	PPD
C72A-F83,F87	145C3039P004

Subsequent to the NMP2 application, fuse 145C3039P004 has been dedicated for other Class 1E applications under GE designation DA317A6159P007.

B. Function

These fuses are used in circuits providing power to meter modules M2C,D.

C. Failure Mode

Open circuit would inhibit meter modules M2C,D, and the various temperature measurements could not be monitored. These meter modules provide a readout function only. (Other devices detect adverse conditions and produce the required isolation function.)

D. Conclusion

The devices have no failure mechanism that could adversely affect the power supply or the system safety function. These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

II. JUNCTION BOXES

A. Identification	PPD
E31A-JB01, JB02, JB03	235A1543AAG001

These junction boxes are identical to those analyzed in Section 2.VI "Junction Boxes" of the preceding RPS discussion.

III. METER

A. Identification	PPD
E31-R620A,B	159C4540P261030

These meters are similar in type, material and construction to Class 1E meters identified by PPD 164C5288.

B. Device Description

The basic GE Type 180 meter is an edgewise panel meter with D'Arsonval movement. These meters are configured as voltmeters with an internal resistor (20K ohm) in series with a movable coil.

The above devices have the following design features in common:

- Identical devices (PPD 159C4540) were installed on the seismically-tested panels (Ref. 6).
- These devices are located in the control room environment.
- These devices are connected in low energy circuits (0 to 10 volts, milliamp current).

C. Function

This device provides an indication of RWCU differential flow.

D. Failure Mode

Open circuit will not inhibit the RWCU differential flow circuit. Flows in the suction and blowdown lines are monitored by meters G33-R602 and R609 respectively. This failure mode would be detected by comparing E31-R620A,B with G33-R602 and R609 during surveillance testing. An internal short in the meter results in the series resistor limiting the current from summers E31-K604A,B. If the series resistor shorts, this component will fail open and the meter will not inhibit the RWCU ΔQ circuit operation.

E. Conclusions

The devices have no failure mechanism that could adversely affect the power supply or the system safety function. These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

IV. TEMPERATURE MONITOR

A. Identification	PPD
E31-M1A-D, M2A-D E31-M3A-B, M4A,B	164C5686P001,P002

This is a Riley Model 86 temperature monitor. A similar device has been seismically qualified for similar applications (Ref. 5).

B. Function

These devices are used to provide indications of temperatures in various locations.

C. Failure Mode

There is one set of devices (M1A - Temperature Monitor Meter and M2A - Temperature Monitor Meter Module) per power division. M3 and M4 units monitor temperature in the Reactor Building Radioactive Pipe Chase.

If any shorted conditions occurred, these would be identified and corrected during surveillance testing. An internal short would cause a rectifier bridge diode to open and produce a failure to operate. The failure to operate mode can be identified by comparison with the other assemblies since each assembly monitors the same area but with different devices.

D. Conclusions

The devices have no failure mechanism that could adversely affect the power supply or the system safety function. These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

V. RECORDERS

A. Identification

Identification	PPD
E31-R608	163C1879P002
E31-R611	163C1880P002

This device is a Westronics (M11E, M5E) multipoint temperature recorder. It is widely used in industry and has been generally applied for temperature monitoring on BWR's.

B. Function

These devices provide temperature indications and alarms.

C. Failure Mode

Any fault current demand in the chart motor or servo motor winding and the transformer secondary circuits will be limited by an internal fuse and E31A-F14 or F33. These conditions will be detected by surveillance testing.

D. Conclusions

The devices have no failure mechanism that could adversely affect the power supply or the system safety function. These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

VI. REFERENCES

1. Elementary Diagram 807E154TY Rev. 28.
2. Elementary Diagram Device List DL807E154TY Rev. 18.
3. GE Design Review File A00-0794-2.
4. Design Specification 22A2870 Rev. 7.
5. GE Design Record File DRF A00-1084-224-9.
6. GE Design Record File DRF H13-61.

5. NEUTRON MONITORING SYSTEM

The following non-1E devices are connected to the RPS power supply. Analysis of acceptability of the application is as follows:

I. APRM BYPASS SWITCHES

A. Identification

	PPD
C51B-S03 (APRM A,C,E)	112D2188G002
C51B-S06 (APRM B,D,F)	112D2188G002

These devices are Square D joystick switches. Subsequent to this NMP2 application, a similar switch was qualified for similar Class 1E applications under GE designation 163C1716.

B. Function

Each manually operated switch is used to bypass one of the APRM channels; preventing a scram trip and sending signals to the computer, indicating light and annunciator to indicate the bypass condition. (The APRM bypass function and its compliance with requirements of IEEE Standard 279 is discussed in Section 2.2.17 of Reference 5.)

C. Failure Mode

1. Neutral short before (hot side of power supply) or after the switch contact prevents the bypass function.

2. A hot short across one set of switch contacts will energize relays K10, K12, K16, K17 and K27 in the affected APRM channel causing channel bypass. A second short across another set of switch contacts will be unable to energize identical relays in another APRM channel, causing a second bypass, because of an interlock established by relay K17 which was energized by the first short.

   The above relays are installed in NMS panel P608. Identical panels with identical relays have been qualified by testing (Ref. 6).

D. Conclusion

Not bypassing a channel has no safety consequences since a half scram is the desired safety action. An unintended bypass will have no effect since the remaining channels will perform the safety function. The devices have no failure mechanism that could adversely affect the power supply or the system safety function. These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

II. RECIRCULATION FLOW BYPASS SWITCHES

A. Identification

	PPD
C51B-S07	112D2188G003
C51B-S08	112D2188G004

These devices are Square D joystick switches. Subsequent to this NMP2 application, a similar switch was qualified for similar Class 1E applications under GE designation 163C1716.

B. Function

The manually operated switches are used to bypass flow channel A or C, and flow channel B or D. Signals are sent to the computer, annunciator, indicating light and interlocking circuits to indicate the bypass condition.

C. Failure Mode

1. Neutral short before or after the switch contact prevents the bypass capability.

2. A hot short across one set of switch contacts will energize relays K5 and K6 in the affected flow channel. A second short across another set of contacts will be unable to energize identical relays in a second channel, causing a second bypass, because of an interlock established by relay K5 which was energized by the first short.

   The preceding relays are installed in NMS panel P608. Identical panels with identical relays have been qualified by testing (Ref. 6).

D. Conclusion

Failure to bypass a channel could result in a half scram, the desired safety action. An unintended bypass will have no effect since the remaining channels can perform the safety function. The devices have no failure mechanism that could adversely affect the power supply or the system safety function. These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

III. RBM BYPASS SWITCH

A. Identification

	PPD
C51B-S02	328X453G013

These devices are Square D joystick switches. Subsequent to this NMP2 application, a similar switch was qualified for similar Class 1E applications under GE designation 163C1716.

B. Function

The manually operated switch is used to bypass one of the RBM channels. Signals sent to the computer, annunciator, rod block and null sequence card indicate the bypass condition.

C. Failure Mode

1. Neutral short before or after the switch contact prevents the bypass capability.

2. A hot short across one set of switch contacts will energize relays K10 and K12; therefore, the channel will be bypassed without any operator action.

   The preceding relays are installed in NMS panel P608. Identical panels with identical relays have been qualified by testing (Ref. 6).

3. Hot shorts across both sets of switch contacts result in both RBM channels bypassed. Redundancy for the rod block function is provided by the no-rod-movement, APRM rod block. The rod block function is not a safety function.

D. Conclusion

The devices have no failure mechanism that could adversely affect the power supply or the system safety function. These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

IV. RECIRCULATION FLOW RECORDER

A. Recorders, General

The Bailey Model 722 recorder is a narrow strip chart type identified by Bailey Catalog No. 772111AAAA1. It is located in the control room which provides a Class 1E HVAC environment (mild). The current limiting components can withstand temperatures of at least 185°F and remain functional. An identical recorder was installed and energized on a panel that was seismically tested (Ref. 7); there was no adverse effect on the power supply.

B. Identification	PPD
B35-R614 (Bailey Model 772)	163C1871P5AGAG00

C. Function

The device records recirculation flow.

D. Failure Modes

1. A 15V common short at the Recorder signal input will result in a lower Square Root Converter output to the Summer, therefore, the average signal by the Summer will be lowered by approximately 4%. Setpoint will be lower which means it is in the conservative direction.

2. A 15V hot short at the Recorder signal input terminals will cause non-1E fuse (F1) at the Square Root converter to be blown. This will not result in any system operation changes. Shorts (common or hot) do not affect the power supply.

E. Conclusion

The devices have no failure mechanism that could adversely affect the power supply or the system safety function. These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

V. LPRM LEVEL METER

A. Identification	PPD
C51-R604A → S	157C4570P001

This is a basic GE Type 180 meter. See Section III.B for device description.

B. Function

The meter provides LPRM level information.

C. Failure Mode

System operation will not be affected by any mechanical or electrical failure of the meter because of the low power levels involved. Resistors in Panel P608 provide circuit protection against meter shorts. These resistors are installed in panel P608. Identical panels with identical resistors have been qualified by testing (Ref. 6). The RPS power supply is not affected.

D. Conclusion

The devices have no failure mechanism that could adversely affect the power supply or the system safety function. These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

VI. IRM/APRM SELECTOR SWITCH

A. Identification — PPD

C51A-S03A → F — 158B7192G001

This device is a GE type CR2940 switch. A similar switch has been qualified for similar Class 1E applications under GE designation 169C9490.

B. Function

The manually operated switch selects between, and passes through, to a recorder, the IRM or APRM level signals.

C. Failure Mode

A switch failure could cause erroneous recorder reading (other recorders still can give correct information). Circuit cannot be damaged by the short because of the low power levels. Resistors and fuses in panel P608 provide circuit protection against shorts. These devices are installed in panel P608. Identical panels with identical devices have been qualified by testing (Ref. 6).

D. Conclusion

The devices have no failure mechanism that could adversely affect the power supply or the system safety function. These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

VII. ALARM LEVEL RECORDER SWITCH

A. Identification — PPD

C51R-S01A → D — 158B7193G001

This device is a GE type CR2940 switch. A similar switch has been qualified for similar Class 1E applications under GE designation 169C9490.

B. Function

The manually operated switch selects between, and passes through, APRM or IRM signals to a Recorder.

C. Failure Mode

1. Mechanical failure at the contacts prevents APRM or Alarm level reading.

2. Circuit cannot be damaged by any electrical failure at the switch because of the low power levels (0 to 10 Vac, milliamp current). Resistors in Panel P608 provide circuit protection against shorts. Identical panels with identical devices have been qualified by testing (Ref. 6).

D. Conclusion

The devices have no failure mechanism that could adversely affect the power supply or the system safety function. These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

VIII. IRM/APRM RECORDER

A. Recorders, General

Refer to Section 5.IV.A.

B. Identification	PPD
C51A-R603A → D	163C1871P5989800

C. Function

The device records selected IRM and APRM levels.

D. Failure Mode

No electrical failure in the recorder can propagate back to the RPS power supply because of the low power level (0 to 10 Vac, milliamp current). Resistors and fuses in panel P608 provide circuit protection against shorts. Identical panels with identical devices have been qualified by testing (Ref. 6).

E. Conclusion

The devices have no failure mechanism that could adversely affect the power supply or the system safety function. These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

IX. FUSES

A. Fuses, General

Refer to Section 2, II-A.

B. Identification	PPD
C51B-F11, -F12 -F22, -F31 -F32, -F41 -F51, -F52	145C3039P005

C. Function

The fuses protect the Neutron Monitoring System divisionalized circuits and the RPS power supply from each other.

D. Failure Mode

1. An open failure does not affect the system. It will cause an APRM inop scram and a trip will occur, which is the safety action.

2. If the fuse does not open, we still have internal protection for each LPRM group, APRM channel, RBM channel, Flow Units and 20V power supplies.

E. Conclusion

The devices have no failure mechanism that could adversely affect the power supply or the system safety function. These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

X. REFERENCES

1. Startup Range Neutron Monitoring System ED - 807E162TY, Rev. 15.

2. Startup Range Neutron Monitoring System EDDL - DL807E162TY, Rev. 5.

3. Power Range Neutron Monitoring System ED - 807E163TY, Rev. 22.

4. Power Range Neutron Monitoring System EDDL - DL807E163TY, Rev. 8.

5. General Electric Licensing Topical Report NEDO-10139, June 1970 "Compliance of Protection Systems to Industry Criteria: GE BWR Nuclear Steam Supply System".

6. General Electric Design Record File DRF H11-00009.

7. General Electric Design Record File DRF A00-1138.

6. PROCESS RADIATION MONITORING SYSTEM

The following non-Class 1E devices are powered from the RPS power supply. The acceptability of the application is analyzed as follows:

I. FUSES

A. Fuses, General

Refer to Section 2, II-A.

B. Identification — PPD

D13-F1A,B — 145C3039P004
D13-F2A,B

Subsequent to the NMP2 application, fuse 145C3039P004 has been dedicated for other Class 1E applications under GE designation DA317A6159P007.

C. Function

The devices are used to provide isolation between the four gamma detection channels of the PRMS and the RPS power supply. One fuse is in each channel. Additional protection is provided for each channel by a dedicated fuse in the RPS fuse panels (BOP scope of supply; references 3 and 4).

D. Failure Mode

1. An open circuit would de-energize one of the PRMS detection channels. Failure would be detected by a PRMS channel INOP annunciator.

E. Conclusion

Failure (open) would deenergize the PRMS channel and cause a half-scram in the respective RPS logic channel, which is the desired safety action. The devices have no failure mechanism that could adversely affect the power supply or the system safety function. These devices are located in a mild environment (main control room) and have been used for many years in similar applications in other BWR nuclear plants.

II. REFERENCES

1. Process Radiation Monitoring System ED - 807E168TY, Rev. 13.

2. PRMS EDDL/IDS - DL807E168TY, Rev. 5.

3. SWEC Dwg. 12177-EE-M010-6, Rev. 6 "Plant Master One-Line Diagram, Normal 600 Vac and 120 Vac".

4. SWEC Dwg. 12177-EE-11K-4, Rev. 4 "120 Vac Wiring Diagram, Distribution Panels".

7. PANEL MOUNTED PASSIVE DEVICES

I. DEVICE DESCRIPTION	DRAWING NUMBER
Terminal Board	174B9231P001 175A9132P006 198B6330P004 198B6331 136B1774P012
Fuse Block	175A9132P008
Fuse Block (Pullout)	167B2512P001,2 (See Section 7.D)
Lamp Assembly	209A5610 204B6586
Panel Wiring	262A7898 262A6527 175A1102
Cable Assemblies	235A1470 272A7919

A. Conformance to Separation Requirements of Regulatory Guide 1.75

The above generic passive devices used in various safety systems are covered under this section. These devices are demonstrated by test and analysis to be adequate for their functional requirements.

B. Device Function

These panel-mounted devices are functionally described as non-active in that their function is to maintain continuity and electrical isolation of various electrical signals but they do not modify and/or redirect the signals being connected to them.

The only parameters to be considered for functional behavior of these devices are dielectric strength, insulation resistance of the insulated parts, and continuity of their terminations.

C. Justification of Device Application (Except Fuse Block - Pullout Type)

These panel-mounted passive devices were demonstrated to be adequate for their functional requirements by means of tests performed to establish an operational durability. Such tests were performed by General Electric and the results are contained in Reference 1. The following is a brief summary of these tests:

1. Test Specimen

The testing was performed to provide the base data using GE-controlled stock items which represent those panel mounted passive devices.

The test samples used were strictly representative of the passive devices used in the panel design. The test sample units are identified by nomenclature and applicable drawing number as listed. The test samples were mounted on a test panel in a manner representative of their end use when used in compliance with GE designs and specifications.

2. Test Methodology

The following test sequence was followed for the operational life durability test:

a. Base line functional measurements

b. Thermal aging exposure

c. Post-thermal aging functional measurements

d. Design Basis Earthquake (DBE) seismic exposure

e. Post-seismic functional measurements

An investigation of the applicable end use, site, and environmental specifications was performed to address all specified environmental parameters which could cause degradation of the functional parameters of the subject test sample.

It was determined that the device panel locations (Class 1E HVAC) made all environmentally induced aging negligible except for the thermal and seismic environment. The panel wiring and cable assemblies were separately qualified under other programs (Reference 2).

3. Test Exposure Parameters

The following thermal aging exposure was used on the test samples:

Temperature (°C)	Relative Humidity (°C)	Exposure Time (Hr)
105	60	67
- 110	Uncontrolled	93
110	Uncontrolled	103

The test samples were subjected to a series of 20 OBE and four random multi-frequency, 20 second, simultaneous horizontal and vertical, phase-coherent motions.

4. Test Conclusions

The test results and analysis established that the passive devices used in GE design are adequate for their applications.

D. Fuse Block (Pull Out)

The pullout type fuse blocks (less fuse) were tested to establish seismic withstand capabilities. These tests demonstrated that the seismic capabilities of the pullout type fuse blocks exceed the applicable seismic requirements. Furthermore, the original equipment furnished met the functional requirements identified by the panel design criteria.

II. REFERENCES

1. GE Design Record File DRF A00-794-2.

2. GE Design Record File DRF 912-H12-6.

ATTACHMENT 3

REQUEST FOR EXEMPTION

A. Introduction

Niagara Mohawk Power Corporation's letter of May 18, 1987 (NMP2L 1035) contained a Failure Modes and Effects Analysis ("FMEA") report evaluating the effect of certain non-Class 1E devices in Class 1E circuits. That report considered system circuits where non-Class 1E components are connected to Class 1E circuits which are energized by the Reactor Protection System (RPS) power supply. The RPS is powered by a non-Class 1E power source. After discussions with the NRC Staff and further evaluation, Niagara Mohawk has committed to upgrade certain non-Class 1E components to Class 1E components and to make certain other design and hardware changes prior to completion of the first refueling outage as indicated in Attachment 1. Niagara Mohawk has been advised by the Commission Staff of its view that installation of these devices and components may be required to achieve full compliance with 10 CFR 50.55a(h).

In accordance with the provision of 10 CFR 50.12(a), Niagara Mohawk Power Corporation hereby requests an exemption for Nine Mile Point Unit 2 from the requirements set forth in Title 10, Code of Federal Regulation (10 CFR) 50.55a(h) for the components listed in Attachment 1 and discussed herein.

This attachment demonstrates that the requested exemption presents no undue risk to the public health and safety, and that special circumstances are present that justify granting the exemption. This exemption has been reviewed and found to be authorized by law and consistent with the common defense and security.

With regard to the "common defense and security" standard, the grant of the requested exemption is consistent with the common defense and security of the United States. The Commission's Statement of Considerations in support of the exemption rule note with approval the explanation of this standard as set forth in Long Island Lighting Company (Shoreham Nuclear Power Station, Unit 1), LBP-84-45, 20 NRC 1343, 1400 (October 29, 1984). There, the term "common defense and security" refers principally to the safeguarding of special nuclear material, the absence of foreign control over the applicant, the protection of Restricted Data, and the availability of special nuclear material for defense needs. The granting of the requested exemption will not affect any of these matters and, thus, such grants are consistent with the common defense and security.

The proposed exemption has been analyzed as discussed below and determined not to cause additional construction or operational activities that may significantly affect the environment. It does not result in a significant increase in any adverse environmental impact previously evaluated in the Final Environmental Impact Statement-Operating License Stage, a significant change in effluents or power levels or a matter not previously reviewed by the Nuclear Regulatory Commission that may have a significant adverse environmental impact.

Niagara Mohawk requests an exemption to 10 CFR 50.55a(h) be granted until such time as the first refueling outage is completed for the installation of certain Class 1E components and isolation devices for those cases where non-Class 1E components are presently used in Class 1E circuits which are energized by the Reactor Protection System power supply. These components are identified in Attachments 1 and 2.

B. Discussion

In the present design of certain Nine Mile Point Unit 2 safety-related systems, a limited number of non-Class 1E components are connected to Class 1E circuits which are energized by the Reactor Protection System power supply. These cases are specifically identified in the attached Failure Modes and Effects Analysis (see Attachment 2). The RPS is powered by the Uninterruptible Power Supply (UPS), a non-1E power source.

A plant unique Failure Modes and Effects Analysis (FMEA) was performed for the Nine Mile Point Unit 2 systems to demonstrate that the failure of each non-Class 1E component would not adversely affect the connected Class 1E circuit, or any other safety function. This analysis considered all circuits containing non-Class 1E devices and components installed in Class 1E circuits which are energized by the Reactor Protection System power supply. The analysis confirmed that each non-Class 1E device analyzed has no credible failure mode that would adversely affect the connected Class 1E circuit or the safe operation of the plant. General Electric has stated that the current Nine Mile Point Unit 2 design meets or exceeds the same standards for safety systems at other BWR plants, including recently licensed plants.

As a result of a recent meeting and preliminary review of the FMEA, the NRC staff stated its preliminary position that the current design does not meet the full requirements of IEEE 279. Therefore, Niagara Mohawk has decided to implement the design and hardware changes identified in Attachment 1 for those cases where non-Class 1E components are presently used in Class 1E circuits which are energized by the Reactor Protection System power supply. These protective components will be installed prior to the completion of the first refueling outage. The resolution for each item identified in the analysis is identified in Attachment 1.

C. Justification For Implementation Schedule

The non-Class 1E devices presently installed are essentially identical in design to qualified Class 1E devices. The current design of Nine Mile Point Unit 2 meets or exceeds the same standards reviewed by the NRC for other plants supplied by General Electric, including recently licensed plants. Based on their performance history in operating BWR's and seismic test report information on essentially identical components, these non-Class 1E devices do not have any different inherent failure mechanisms from that of similar qualified devices which could degrade the Class 1E bus or the safety-related function. Additional specific justification for each class of components and for interim operation of Nine Mile Point Unit 2 is provided in the attached Failure Modes and Effects Analysis (Attachment 2).

A delay until the first refueling outage is required to implement the resolutions identified in Attachment 1 because of the long lead time to procure certain qualified Class 1E components. In addition, the plant must be shut down in order to perform those changes requiring component replacement. Therefore, the first refueling outage would be the first scheduled shutdown of the plant after the qualified Class 1E components are available.

D. Conclusion

Deferral of the installation of certain Class 1E components until the completion of the first refueling outage does not present an undue risk to the public health and safety. As stated in the attached FMEA report, the failure of the present non-Class 1E components has no adverse effect on the Class 1E devices, or any other safety function. The systems containing the non-Class 1E components are de-energizing to operate systems which will fail safe. The current design meets the same standards for conforming to the requirements for safety systems as other BWR plants, including recently licensed plants. These non-Class 1E components are essentially identical in design to that of the qualified Class 1E components. Based on their past performance history in operating BWR's and seismic test report information on identical parts, these non-Class 1E components do not have any different inherent failure mechanisms from that of similar qualified devices which could degrade the Class 1E bus, any safety-related function, or the safe operation of the plant.

E. Special Circumstances Are Present

Special circumstances are present which warrant issuance of this requested exemption. These special circumstances are discussed in accordance with the classification contained in 10 CFR 50.12(a)(2):

(iii) Compliance would result in undue hardship or other costs that are significantly in excess of those contemplated when the regulation was adopted, or that are significantly in excess of those incurred by others similarly situated.

Compliance with 10CFR50.55a(h) would result in undue hardships that are significantly in excess of those incurred by others similarly situated. The current design meets the same standards for conforming to or exceeds the regulatory requirements within the General Electric safety systems at other BWR plants, including recently licensed plants. These non-Class 1E components are similar in design to that of the qualified Class 1E components. Based on their long history of satisfactory performance in operating BWR's and seismic test report information on identical parts, these non-Class 1E components do not have any different inherent failure mechanisms from that of similarly qualified devices which could degrade the connected Class 1E circuit, or any safety-related function. Compliance at the present time would result in significant financial hardship to Niagara Mohawk Power Corporation since the low power testing of Nine Mile Point Unit 2 of up to 5% of rated power will be completed by June 20, 1987, and Niagara Mohawk will be awaiting the full power license at that time. Any delay in issuing the full power license or delays required to install the components will directly impact the commercial operation of Nine Mile Point Unit 2.

(v) The exemption would provide only temporary relief from the applicable regulation and the licensee or applicant has made good faith efforts to comply with the regulation.

This exemption request would provide Nine Mile Point Unit 2 with only temporary relief from compliance with the requirement of 10CFR50.55a(h). Niagara Mohawk has made good faith efforts to comply with the regulation as soon as informed of the Staff's position in this matter. Niagara Mohawk has previously committed to change out non-Class 1E protective devices and non-Class 1E components in Class 1E circuits which are connected to Class 1E power sources. Additional non-Class 1E components in Class 1E circuits energized by the Reactor Protection System power supply was only recently discovered by Niagara Mohawk. A Failure Modes and Effects Analysis for non-Class 1E devices connected to the Reactor Protection System power supply was performed and an information copy was submitted to the Nuclear Regulatory Commission on May 18, 1987. This submittal was voluntary in order to assure a complete record. On June 10, 1987, Niagara Mohawk met with members of the Nuclear Regulatory Staff at which time we were informed that the analysis may not be acceptable and the current design may not meet the NRC staff's interpretation of IEEE 279. Therefore, Niagara Mohawk has committed to install the identified Class 1E components or provide qualified Class 1E isolation devices prior to the completion of the first refueling outage. The Nine Mile Point Unit 2 design is similar to the design of other recently licensed BWRs and Niagara Mohawk could not have reasonably anticipated the need for further design and component upgrade.

Thus, special circumstances exist warranting the grant of the exemption.

Environmental Impact

The exemption request would allow operation of the plant for a specified time to allow the installation of certain devices and components in Class 1E circuits powered by the Reactor Protection System power supply. The installation of these devices (or lack of them) would not affect the processing of any effluents including radioactive effluents from the plant during normal operation of the plant. The installation of additional circuit components, such as protective devices, diodes, and resistors, has no impact on normal power operational releases.

The proposed exemption has been analyzed and determined not to cause additional construction or operational activities which may significantly affect the environment. It does not result in a significant increase in any adverse environmental impact previously evaluated in the Final Environmental Impact Statement-Operating License Stage, a significant change in effluents or power levels, or a matter not previously reviewed by the Nuclear Regulatory Commission which may have a significant adverse environmental impact.

The proposed exemption does not alter the land use for the plant, any water uses or impacts on water quality, air or ambient air quality. The proposed action does not affect the ecology of the site and vicinity and does not affect the noise emitted by station. Therefore, the proposed exemption does not affect the analysis of environmental impacts described in the environmental report.