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June 10, 1985
VP-85-0132

Mr. James G. Keppler
Regional Administrator
Region III
U. S. Nuclear Regulatory Commission
799 Roosevelt Road
Glen Ellyn, Illinois 60137

Dear Mr. Keppler:

Reference: Fermi 2
Docket No. 50-341
NRC License No. NPF-33

Subject: Detroit Edison Response
Inspection Report 50-341/85009

This letter responds to an Unresolved Item described in your Inspection Report No. 50-341/85009. The Unresolved Item (85-009-01) deals with separation of BOP and divisional/RPS circuits.

In a follow-up inspection regarding this item, Detroit Edison was requested to provide additional information to support conclusions reached in a review performed on these circuits. The enclosed report provides the requested information.

We trust this letter satisfactorily addresses the Unresolved Item. If you have any questions regarding this matter, please contact Mr. Lewis Bregni, (313) 586-5083.

Sincerely,

Wayne H. Jens

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THE DETROIT EDISON COMPANY

FERMI 2

NUCLEAR OPERATIONS ORGANIZATION

RESPONSE TO NRC INSPECTION REPORT NO. 50-341/85009

DOCKET NO. 50-341 LICENSE NO. NPF-33

INSPECTION AT: FERMI 2, NEWPORT, MICHIGAN

INSPECTION CONDUCTED: FEBRUARY 12-22, 1985

RESPONSE TO NRC INSPECTION REPORT NO. 50-341/85009

Unresolved Item 85-009-01

While reviewing the licensee's as-built program the inspector identified several cases where Balance of Plant (BOP) cables are tied electrically into Division II (two) cables in the HPCI system logic circuitry.

Schematic diagram 6I721-2225-3 Revision "I" contains the logic circuitry for the HPCI system. The HPCI initiation signal seal in circuit contains BOP cables 218387-OC, 218384-OC and Division II cable 225303-2C in same circuit.

The HPCI initiation from the remote shutdown panel contains BOP cable 218384-04 and Division II cable 218386-2C in same circuit.*

The inspector informed the licensee that a review of safety-related circuits on schematic and loop diagrams is needed to assess the significance of this item.

*NOTE: This case is addressed in representative sample No. 12 in Attachment A of this report.

Response to Unresolved Item 85-009-01:

Background and Summary:

The Fermi 2 electrical separation principles were developed in the early to mid-seventies. They are initially described in PSAR Section 6 and reflected in GE Specification 22A3777; Edison Design Instructions DI-50 and DI-112; Design Specifications 3071-33 and 3071-128; and submitted to NRC in FSAR Section 3.12, and answers to reviewer's questions in Appendices A and E notably Question 222.2.

The design was reviewed by an Edison review group established in October 1974, who issued a series of reports. A comprehensive review of the Fermi 2 design was done by a Safety Review Task Force (SRTF) from April 1979 until January 1980. This review and the recommended follow-up actions included checking the adequacy of electrical separation and a field walkdown that was completed in early 1981.

The electrical separation design was discussed with the NRC during the early licensing stages of Fermi 2, and was documented in the Interim Safety Evaluation Report in 1977

(NUREG 0314). A final NRC review of electrical separation was conducted in 1981 and various examples of separation concepts were discussed as the respective schematics were reviewed. The favorable conclusion of this review was subsequently recorded in section 8.3.4 of the SER (NUREG 0798).

The Fermi 2 Plant has not committed to full compliance with Regulatory Guide 1.75 since this Guide was issued after the design criteria of Fermi 2 were established. However, the intent of Regulatory Guide 1.75 as embodied in IEEE Standard 384-1974 has been met. The Fermi 2 Plant does not identify associated circuits as a class but has performed sufficient analyses to show that adequate electrical separation exists between IE and non-IE circuits. The analysis was done as part of the design process without maintaining formal documentation.

Fermi 2 design criteria allow non-IE circuits in class IE trays under certain conditions. This is acceptable because wherever non-IE cables are installed in IE trays the installation is controlled as IE. In addition, non-IE cables in IE trays will not impact the IE cables because the current source is limited to low levels or is fused. The non-IE cables in Fermi 2 were purchased to the same technical specifications as IE cables,and the cable insulation was selected and tested to demonstrate that it would not propagate a fire. Appropriate fire stops have been used in cases where non-IE cables cross over into IE trays. This design has been reviewed previously by the NRC and found acceptable (Region III Inspection Item 81-12-02).

The effects of fires on electrical circuits have been evaluated previously as part of the fire protection study. The circuit analysis was performed to the criteria established in 10CFR50 Appendix R. The analysis established the systems and circuits necessary for hot and cold shutdown of the plant, and included an analysis of those circuits associated with the shutdown circuits. The report shows that reactor shutdown can be achieved with a fire in any fire zone. The analyses were reviewed by the NRC at the plant and found acceptable as indicated in Inspection Reports 84-16 (DRS), 84-49 (DRS), and 85-014 (DRS), and supplement No. 5 to the SER, Appendix E.

As discussed with the NRC, Detroit Edison is formalizing, with this submittal, the review of approximately 550 schematics where IE and non-IE circuits interface electrically without the intrinsic separation provided by isolation

devices as described in Regulatory Guide 1.75. As a result of this review, a total of 656 cases where IE and non-IE circuits interface electrically were identified, and these cases were categorized in 13 representative samples for the purpose of the analysis and documentation. These analyses were then documented for each representative sample shown on Attachment A to this report. The analysis addresses the impact of electrical faults in the non-IE circuit on the function of the IE circuit.

Analysis:

See Attachment "A" for the summary analysis of each representative sample. Each analysis is broken down into a description of the representative sample and the number of cases involved, a discussion of the failure modes and effects, and pertinent conclusions. The applicable failure modes considered were the maximum short circuit current, and circuit shorts, opens and grounds. All failure modes were considered to initiate in the BOP non-IE circuit and were analyzed for effects on the applicable IE circuits.

Conclusion:

The analysis of the representative samples of IE and non-IE circuits shows that the ability of the IE system to perform its assigned functions is not impaired by the postulated electrical faults in the non-IE circuits that are associated with them.

The safety of the Fermi electrical design is enhanced by rigorous electrical separation between the two redundant ESF divisions. These divisions are each electrically separated from the four channel reactor protection system which is itself separated into two divisions. Each electrical division as well as the balance-of-plant electrical designs are segregated by voltage/power levels into three distinct groups: power, control, and instrumentation circuits. Segregation by voltage/power within each electrical division significantly improves the electrical integrity of the basic separation design and is enforced through the use of separate tray, conduit and cabling systems for each group. Within each group are both ac and dc operating systems. The ac system is normally grounded, but the dc system is maintained ungrounded to substantially improve its independence and integrity.

ATTACHMENT "A"

ANALYSIS OF THE REPRESENTATIVE SAMPLES

ELECTRICAL SEPARATION

INDEX FOR THE REPRESENTATIVE SAMPLES ANALYSIS

Representative Sample No. 1	Class IE and Non-IE Interface in the Annunciator System
Representative Sample No. 2	Class IE and Non-IE Interfaces of the Isolation Valve Mimic
Representative Sample No. 3	Interface of Class IE Motor Circuit with Non-IE Load Monitoring
Representative Sample No. 4	Non-IE Thermocouple Circuits Sharing Class IE Pre-Fabricated Cables to the COP's
Representative Sample No. 5	Class IE Motor Circuit Interface with Class Non-IE Motor Heater Circuit
Representative Sample No. 6	A Circuit Fed from Non-IE Power with a Permissive Tied to Circuit Divisional (IE) Cable
Representative Sample No. 7	Class IE and Non-IE Interface of the Process Computer
Representative Sample No. 8	Interface of Flasher Circuit (Flashing CMC Quadrant) with Class IE Flasher Bus
Representative Sample No. 9	Interface of Class IE Power Feed with Non-IE Suction Pressure Switches
Representative Sample No. 10	Interface of Class IE Switchgear Buses Feeding Non-IE Load with Non-IE Control Circuits for the Non-IE Load
Representative Sample No. 11	Interface of Class IE and Non-IE Switchgear Bus Potential Circuits
Representative Sample No. 12	Class IE and Non-IE Interface in the HPCI Control Circuitry
Representative Sample No. 13	Interface of Class IE Circuits with Non-IE Reactor Recirculation MG Set

Representative Sample No.: 1

Number of Cases Identified: 360

1. DESCRIPTION:

Class IE and Non-IE interfaces in the Annunciator System.

The Annunciator System collects alarm status information from plant systems and provides that information to the plant operators on a visual annunciator, sequentially on printers and a CRT, and also to the Process Computer.

The Annunciator/Sequential Recorder has been designed to meet the IEEE Guidance for Surge Withstand Capability. Electrical integrity of the alarm system is enhanced by the use of an ungrounded 24V dc alarm bus which is monitored actively for grounds by a dedicated ground detection circuit.

Alarm status dry contacts are wired from other plant systems into panel H11-P827. A typical cabling scheme utilizes two conductors in a multi-conductor IE control cable to carry alarm information as far as a relay room termination cabinet. The other conductors of this cable provide a IE control function. From the termination cabinet, the Non-IE cable system carries the alarm status to H11-P827. Thus interfaces between IE and Non-IE exists at these points:

1. Between conductors in the multi-conductor IE cable. The cable insulation is the separation barrier.

2. The alarm sensing device, which, for example, is a IE relay whose coil is in the IE control circuit, but one of whose contacts provides the alarm status, wired to H11-P827. Isolation is provided by coil-to-contact separation.

2. FAILURE MODE AND EFFECTS ANALYSIS:

External line-to-line or multiple line-to-ground fault could cause a maximum current of approximately 24mA because of the current limiting of the annunciator system. Since this is very much less than the IE-routed cable ampacity (about 15 amps), and a typical control relay contact rating (about 1 amp), there is no effect on safety, since the insulation barrier's rating are not exceeded.

An open circuit will have no effect on safety because the annunciator performs no safety-related function.

3. CONCLUSION:

The results show that on any external faults the maximum current is 24mA which is far less than the cable ampacity of about 15 amperes and relay contact rating of 1 amp. This is not a safety concern because of the insignificant fault current levels.

Representative Sample No.: 2

Number of Cases Identified: 108

1. DESCRIPTION:

The Isolation Valve Mimic Network collects status information from those systems controlling primary containment isolation, and routes that status information to the appropriate indicator unit on the Isolation Valve Mimic at H11-P601. There are three ways that the information is wired to the Isolation Valve Mimic.

CASE A. A limit switch contact on a IE valve is wired to a Non-IE interposing relay which is fed from a fused Non-IE grounded source of 24V dc. The interposing relay contacts are, in turn, monitored by the 48V dc ungrounded power supply of the Isolation Valve Mimic Network.

CASE B. A limit switch contact on a IE valve is routed through a IE cable and terminated in a Relay Room cabinet. The two conductors are then extended as a Non-IE cable to the Isolation Valve Mimic Network where they are monitored by the network's 48V dc ungrounded supply.

CASE C. The third scheme uses a qualified IE signal isolation device to provide a signal to the mimic panel by Non-IE cables.

The information provided by the Isolation Valve Mimic is also provided on Control Room panel inserts, appropriate to their particular system function. The interface of the mimic's circuitry with safety-related circuits are at the originating IE device (e.g., valve limit switch contact); in the IE cable, two of whose conductors are used by the mimic; in the IE raceway systems (e.g., the "1C" or "2C" tray systems); and in the termination cabinet where the circuit connection is made to the Non-IE raceway system (i.e., the "OC" system).

2. FAILURE MODE EFFECTS ANALYSIS:

Case A

The field cabling for Case A is wired from the limit switch using a 12 AWG wire. The limit switch is wired to the relay coil using a fused Non-IE 24V dc grounded supply. The maximum fault on these circuits is postulated to be a direct short across the relay coils. However, these circuits are protected by 5A and 10A fuses, which will limit any fault current to protect the 12 AWG wire.

Case B

a. Any line-to-line or multiple line-to-ground short circuit at external points will produce the same result as a sensing contact closure. The resulting current produced is limited by the optical isolator impedance to about 30mA not considering the limiting cable impedance. 30mA at 48V dc will not degrade the sensing contacts, which typically are rated for 1 amp or greater, and is much less than the smallest conductor ampacity, which is typically 15 amps. Thus no device damage or cable damage can occur due to fault energy, and there is no effect on safety. Since the 48V dc power supply is ungrounded, a single line-ground short has no effect.

b. Open circuits would result in no current flow, with no possible damage, therefore, and no effect on safety.

Case C

No analysis needed as a qualified IE isolator is used.

3. CONCLUSIONS:

Faults do not degrade safety.

Representative Sample No.: 3

Number of Cases Identified: 87

1. DESCRIPTION:

Non-IE load monitoring circuits used to provide operator indication of motor current on the IE 260 volt, 480 volt and 4160 volt motors' interface with the respective IE switchgear circuits. The Non-IE circuits are routed from the switchgear to the control panels by various Non-IE trays and IE-Divisional trays. Where the Non-IE circuit is routed in the IE divisional trays the circuit also can interface with IE cables in that tray.

2. FAILURE MODES:

The failures that might take place in this Non-IE circuit and affect the IE associated equipment or cables are:

(1) Open, short, or ground on the interfacing load monitor cable.

(2) Failure of the milliamp indicating meter and thus apply the 24V dc flasher bus output on the interfacing load monitor cable.

3. FAILURE EFFECTS:

Failure mode (1)-an open, short or ground on the interfacing load monitor cable will not reflect through the isolation transducer which is located in the switchgear and therefore cannot affect the IE equipment operation. This failure mode will not increase the current flow in the cable and thus the cable will not affect any adjacent cables in the IE tray system.

Failure mode (2)-a failure of the milliamp indicating meter applying the 24V dc flasher bus output to the interfacing load monitor cable will not affect any IE equipment due to the relatively low current and voltage available. The circuit of the 24V dc flasher is fused at six (6) amperes thus limiting the available current to well below the capacity of #16 wire used in the circuit and the 24V dc will not be reflected through the transducer isolation device.

4. CONCLUSIONS:

The Non-IE load monitoring circuits are isolated from the IE equipment by isolation transducers. Where the load monitor circuit cables are routed in the IE trays the energy levels available are well below the cable ratings and thus the non-IE load monitor circuits will not degrade any IE equipment.

Representative Sample No.: 4

Number of Cases Identified: 2

1. DESCRIPTION:

The wiring from the Non-IE thermocouple converter circuits in the Relay Room are run in IE prefabricated cables to make the transition from the Relay Room to the Control Room operating panel.

2. FAILURE MODE EFFECTS ANALYSES:

The prefabricated cables have size #16 AWG wire and maximum postulated fault current is 50mA at 30V dc due to the output characteristics of the converter. The cable is rated for 600V ac and approximately 15 amperes.

In consideration of this small fault current, no degradation of the wire insulation is postulated.

3. CONCLUSION:

Because of low fault currents there is no degradation of insulation, and the circuits in their present state are acceptable.

Representative Sample No.: 5

Number of Cases Identified: 9

1. DESCRIPTION:

A Class IE motor has a motor heater which is energized only when the motor is not running. The local Non-IE motor heater contactor is interlocked with the IE motor circuit breaker via a 2 conductor #12 AWG cable run as a IE circuit. This cable connects a breaker auxiliary switch with the local contactor control circuit. The function of this interlock is non-safety related even though the interconnecting cable is designed as IE.

2. FAILURE MODES:

The only electrical failure which can affect the IE portion of this circuit is a fault to ground which bypasses the M coil producing the maximum available fault current. This fault for a size 1 contactor and a control transformer of 100VA produces a maximum 12 amp fault current. This represents the maximum current the control transformer can deliver with a short placed directly at its secondary terminals due to its own internal impedance.

3. FAILURE EFFECTS:

A two conductor #12 cable can sustain a fault of this magnitude indefinitely without reaching its maximum continuous operating temperature of 90°C even in a 40% full cable tray. Therefore, there will be no effect on the adjacent cables in the same IE raceways even if the control fuse on its circuit does not open.

4. CONCLUSION:

No subsequent loss of any safety function can result from this type of failure since the interconnecting cables can safely carry the maximum fault current continuously without damage.

Representative Sample No.: 6

Number of Cases Identified: 1

1. DESCRIPTION:

A skid mounted Non-IE component uses two conductors of a twelve conductor IE cable to an intermediate point. The circuit for the Non-IE component is powered from a Non-IE 130V dc source via a 5 amp fuse. The Non-IE component was originally powered from a IE source but was moved when the component was found to be not qualified. The control scheme is wired with the IE cable due to the lack of Non-IE conduit and trays in the skid area.

2. FAILURE MODE EFFECTS ANALYSIS:

The worst case fault on the Non-IE circuit is 254A for 0.016 sec. before it will be cleared by the 5A fuse. (Note this fuse will be added to the fuse control program).

3. CONCLUSION:

Any fault on Non-IE wires has no detrimental effect on the remaining IE circuitry as it will be cleared by the fuse before cable damage can occur.

Representative Sample No.: 7

Number of Cases Identified: 5

1. DESCRIPTION:

IE and Non-IE circuits interface in the Process Computer and low current instrument signal loop.

The Process Computer collects analog and digital signals for data acquisition and calculation but is not used for controlling any process.

The computer system is Non-IE equipment. Five analog computer points are taken from IE circuits via dropping resistors. Non-IE cables routed in seismic trays are used to connect the flow/speed loops and the rocess Computer.

The five loops are treated in three groups.

1. RHR Flow Loops
2. HPCI/RCIC Speed Loops
3. RWCU Flow Loop

The RHR flow and HPCI/RCIC turbine speed loops are for indication only, i.e. they do not have any control function.

The RWCU flow loop is associated with a flow detection loop that provides an isolation signal to the RWCU isolation valves. A redundant RWCU temperature leak detection also provides an isolation signal to the same valves.

2. FAILURE MODE EFFECTS ANALYSIS:

The worst-case fault will result in the indication to go either upscale or downscale, depending upon the individual loop. These changes in indication do not result in changes in control function except in the case of the RWCU where an inadvertent isolation could occur. The fault does not result in any other loop failures due to the design of the power supply.

3. CONCLUSION:

The use of Non-IE cables for the Process Computer interface with RHR and RWCU flow loops and with HPCI/RCIC speed loops is acceptable. None of the failures of the Non-IE cables can jeopardize the safe operation of the systems. In the event of loss of flow or speed indication in the Control Room, the operator will have various information sources i.e., valve position, pump amperes, etc. which can be used to take appropriate operator action.

Representative Sample No.: 8

Number of Cases Identified: 2

1. DESCRIPTION:

The circuits in these cases are interconnected alarm circuits which are designed to provide an alarm (flashing CMC quadrant) when both Division I and II SGTS CMC switches are in the off position. CMC switches are backlighted rotary control switches located on panels in the Control Room.

A Non-IE cable is used as part of the flasher circuits to connect one contact each from Division I and Division II -IE CMC switches. The flasher circuits are protected by a 1A fuse.

2. FAILURE MODE EFFECTS ANALYSIS:

Any fault on the Non-IE cable which is run in a conduit, will be cleared by the fuses in less than .01 seconds. The only postulated effect will be the loss of flasher indicator which does not affect any safety function.

3. CONCLUSIONS:

The flasher power supply (source) is unaffected by any failure of the Non-IE cable, as fuses clear the fault in less than .01 sec.

Loss of any flasher indication does not affect any control capabilities. The Control Room operator has other information that supplements the lack of information from the flasher indicator on the CMC.

Representative Sample No.: 9

Number of Cases Identified 2

1. DESCRIPTION:

A set of unqualified pressure switches are wired into an alarm logic powered by the IE control batteries. The logic was not redesigned as previous Case #6 since the unqualified switches are seismically mounted in seismic racks. The circuit is protected with a 5A FRN fuse. This circuit provides operators information in the form of alarm and display only.

2. FAILURE MODE EFFECTS ANALYSIS:

a. Any line-to-line or multiple line-to-ground shorts on the pressure switch contacts and associated wiring will have the same result electrically as contact closure.

b. A single short-to-ground has no effect as the IE power supply is ungrounded.

c. An open in the pressure switch circuitry would result in loss of the alarm function.

3. CONCLUSION:

A failure in the Non-IE circuits does not impair the ability of the IE systems to perform their intended functions.

Representative Sample No.: 10

Number of Cases Identified: 22

1. DESCRIPTION:

The 480 volt breakers feeding Non-IE loads from Class IE busses are fully qualified and controlled entirely from the Class IE battery. Since these are supplying non-essential loads, the control cables between the switchgear and control room are treated as Non-IE cables. Control fuses in the switchgear protect the Class IE battery.

2. FAILURE MODES:

The maximum fault current condition would be a positive to negative 130V dc fault immediately downstream of the fuse. This fault current would represent the worst case power drain on the Class IE dc power system.

3. FAILURE EFFECTS ANALYSIS:

The maximum dc fault current value at the 480V switchgear busses is calculated to be 770 amperes. The Bussman FRN-30 fuses specified for this application will clear a fault of this magnitude in less than .01 seconds. Thus, the fuses in the individual switchgear positions feeding Non-IE loads, will serve as adequate isolation devices to isolate the Non-IE circuit from the IE dc power supply as stated in FSAR item E222.2, Article (5).

4. CONCLUSION:

The fuse sizes are sufficiently low in comparison to the capability of the IE dc power supply that there is no realistic condition where the Non-IE cables will jeopardize the integrity of the IE dc power supply.

All fuses for the control circuits on the IE 480V breaker positions, including the breaker positions feeding Non-IE loads, have been included in Specification 3071-128, Section EJ so that they are maintained under the Fermi 2 Fuse Control Program.

Representative Sample No.: 11

Number of Cases Identified: 54

1. DESCRIPTION:

The 4160V and 480V bus potential circuits have IE and Non-IE cables terminated in IE termination cabinets to terminal points which are jumpered together. The cables feeding the potential monitor lights and bus synchronizing scheme are Non-IE.

2. FAILURE MODES: (Refer to Attached Sketch)

a. Short circuit in Non-IE circuits

b. Open circuit in Non-IE circuits

3. FAILURE MODE EFFECTS ANALYSIS:

a. All branch circuits are individually fused and the fuse sizes are selected to coordinate with the potential transformer secondary fuses.

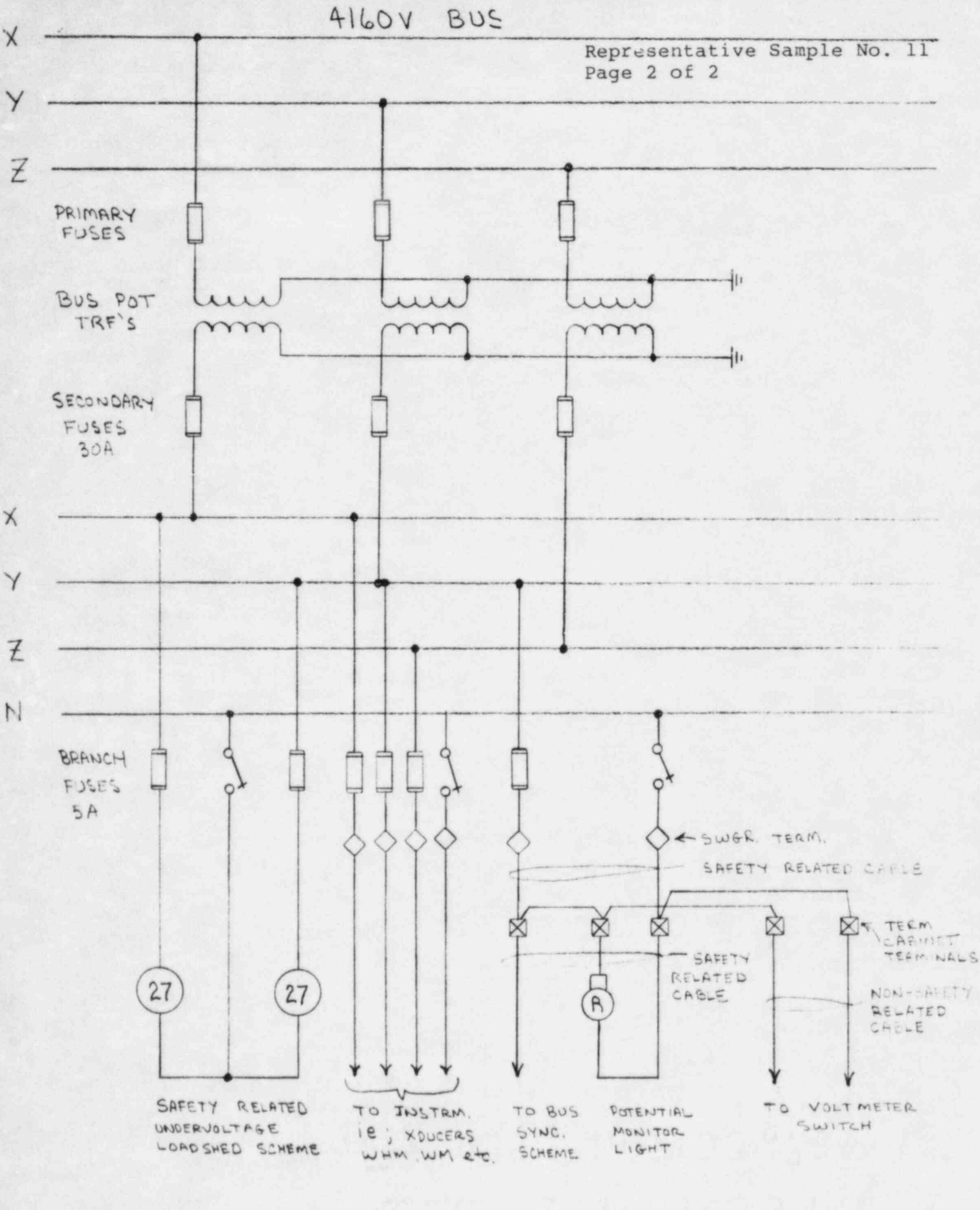
b. All circuits being fed from the termination cabinet are functionally Non-IE i.e., indicating and recording instruments or a bus synchronizing scheme which are not needed for safe shutdown of the plant.

c. The IE bus undervoltage load shed scheme located in switchgear is isolated from other branches by selective fuses. The undervoltage load shed scheme will not be affected by faults on the Non-IE circuits, as the scheme has a built-in two second delay to override transient effects of the faults.

d. Open circuits in any of the branch circuit cables of the Non-Class IE systems will not affect safe shutdown of the plant.

4. CONCLUSION:

All branch circuits are electrically isolated and therefore a failure on a Non-Class IE cable will not affect a Class IE system.



TYPICAL 4160V BUS POTENTIAL DIAGRAM

Representative Sample No.: 12

Number of Cases Identified: 2

1. DESCRIPTION:

IE and Non-IE circuits interface in the HPCI control circuitry.

The Fermi commitment to mitigate the effects of an exposure fire in the Control Room adjacent to Panels H11-P601 and H11-P602, required the design of an alternate means to start the HPCI from a local, shutdown panel (Division II Shutdown Panel). The circuitry and panel were designed as Non-IE equipment with the exception of the isolating devices consistent with the requirements of Appendix "R".

The circuits in question include the "manual initiate" pushbutton which is located in the Non-IE shutdown panel. This pushbutton is isolated through the use of qualified relay contacts M_1-T_1 and M_3-T_3 of relay C35-K73. The isolation relay is normally deenergized and is located in a qualified panel. It is controlled by Non-IE 130V battery power via a key locked transfer switch.

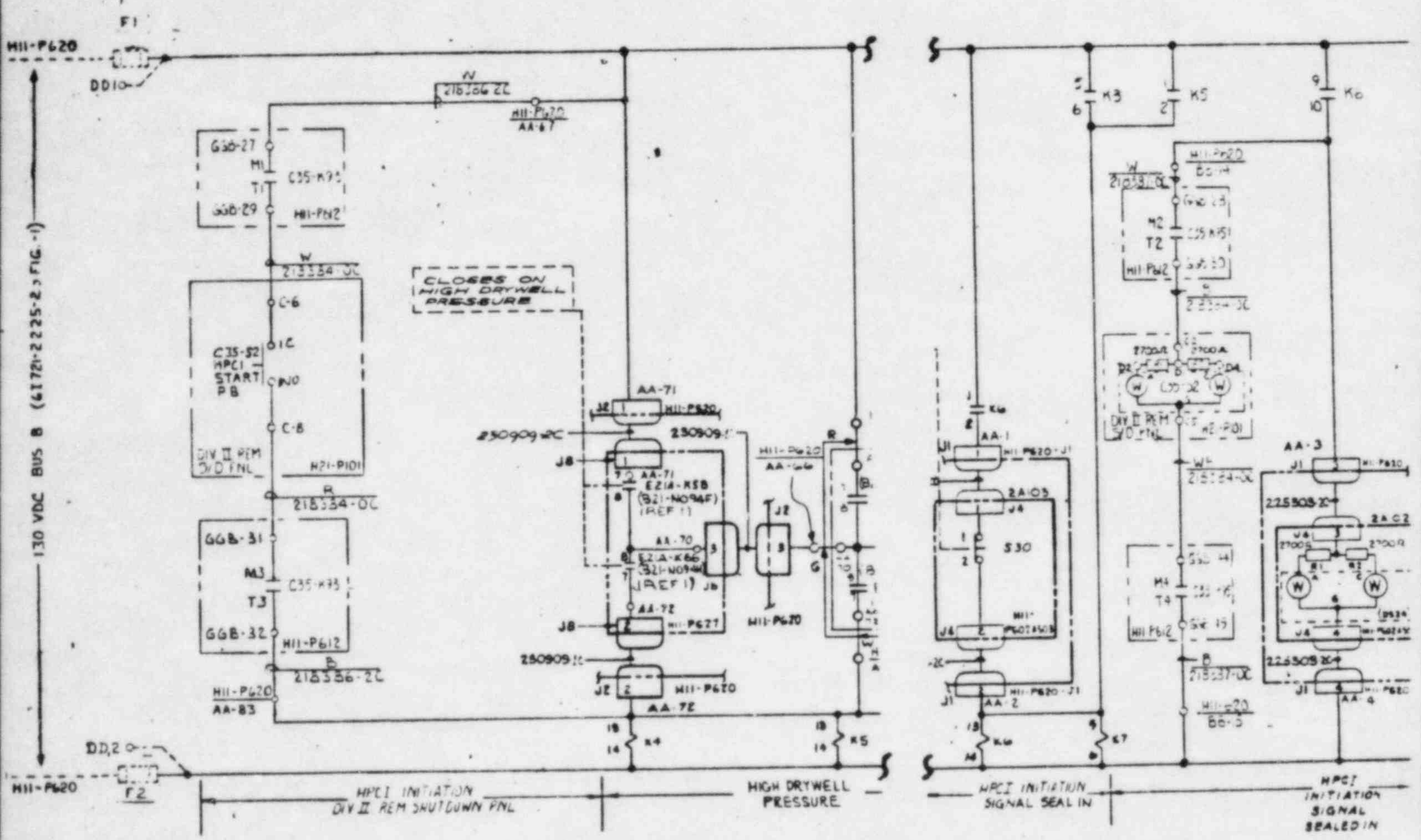
Associated with the pushbutton is the "HPCI INITIATED" lamp located on the Non-IE shutdown panel. The lamp is isolated by a circuit similar to the pushbutton except that contacts M_2-T_2 and M_4-T_4 of a separate relay C35-K35 are used.

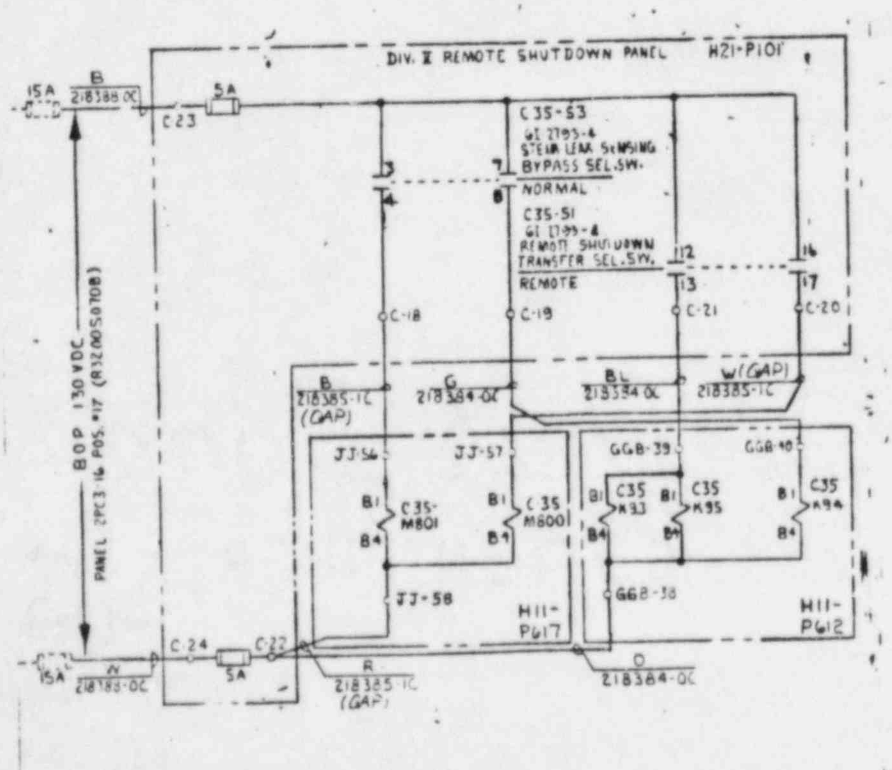
2. FAILURE MODE EFFECTS ANALYSIS:

A fault may take place in the Non-IE shutdown panel circuits. Since these circuits are normally deenergized, except during the specified fire mitigation, the two open contacts in series constitute adequate isolation of the Non-IE remote shutdown panel from the HPCI logic.

3. CONCLUSION:

For this specific case the level of isolation provided (relay contacts of a qualified relay in a Class IE equipment panel) is adequate to maintain the integrity of the HPCI system.


H11-P620
F1
DD10
130 VDC BUS B (6I72I-2235-2; FIG.-1)
CLOSES ON HIGH DRYWELL PRESSURE
C35-S2 HPCI START PB
DIV II REM S/D PNL
H21-P101
C35-K93
C35-K73
H11-P612
H11-P620
AA-83
DD,2
F2
HPCI INITIATION DIV II REM SHUTDOWN PNL
HIGH DRYWELL PRESSURE
HPCI INITIATION SIGNAL SEAL IN
HPCI INITIATION SIGNAL SEALED IN
K3
K5
K6
K4
K7
S30
AA-71
AA-72
AA-1
AA-2
AA-3
AA-4


DIV. II REMOTE SHUTDOWN PANEL H21-P101
15A
5A
C23
C24
C22
C35-S3
STEAM LEAK SENSING BYPASS SEL.SW.
NORMAL
C35-S1
REMOTE SHUTDOWN TRANSFER SEL.SW.
REMOTE
C-18
C-19
C-21
C-20
BOP 130 VDC
PANEL 2PC3-16 POS. #17
218385-1C (GAP)
218384-0C
W(GAP)
JJ-56
JJ-57
JJ-58
C35-M801
C35-M600
GGB-39
GGB-40
GGB-38
C35 K93
C35 K95
C35 K94
H11-P617
H11-P612
218383-0C
218385-1C (GAP)
218384-0C

Representative Sample No.: 13

Number of Cases Identified: 2

1. <u>DESCRIPTION:</u>

Divisional cables in Non-IE Reactor Recirculation MG Set Drive Motor Trip Circuit.

The original G.E.-designed Reactor Recirculation MG Set trip provided for ATWS mitigation installed two relays qualified for IE service in each of the two drive motor trip circuits. These relays are controlled by IE relays that respond to RPV Water Level-Low, and RPV Pressure-High. Since the ATWS control is a backup to the Reactor Protection System, G.E. specified that the cabling from the sensors to the trip circuit be independent of the RPS cabling. In order to meet this requirement, the channels were assigned to the divisional cabling systems, 1C and 2C. Due to the system requirement that either divisions' sensors trip both motors, it is inevitable that the opposite division's cables, 1C and 2C, be connected together, in parallel, at the trip circuit of each motor. The trip circuit is fed from Non-IE 130V dc batteries, through fuses installed at the switchgear. Non-IE cabling connects the trip circuit to a IE Relay Room cabinet, where the ATWS relays are located. Trip contacts from sensor channels are cabled through divisional cables to electrically join the trip circuit and ATWS relays at the same cabinet. Each sensor trip contact is locally fused before connecting to the IE-routed cable.

The safety analysis no longer takes credit for this trip mitigating an ATWS accident. Credit now depends on the trip of the MG-Set's Generator Field Breaker. G.E. recommended however, retaining the trip of the drive motor to obtain a higher reliability of the trip function. All of the components supplied to perform the function up to the interface with the Non-IE trip circuit, are qualified for safety application: namely the sensors, trip units, relays and cables.

2. FAILURE MODE EFFECTS ANALYSIS:

Fuse protection is provided between the 130V dc Non-IE feed and the IE-routed cabling, and will therefore prevent any fault in the non-qualified circuitry from damaging the cabling. Energy levels will be low enough to prevent any cable damage, which precludes the possibility of compromising divisionally redundant functions that have cables sharing the divisional raceways in question. The relays at the trip unit cabinets, that perform IE functions, are further isolated from any faults originating in this circuit by local, 1 amp fuses. No effect on safety can result from any credible fault hypothesized.

3. CONCLUSIONS:

There is no effect on safety for any hypothesized, credible fault in the Non-IE system with which the subject equipment is interfaced.