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August 9, 1985

Mr. J. A. Zwolinski, Chief
Operating Reactors Branch #2
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Dresden Station Units 2 and 3
Additional Information on
Appendix R (Fire Protection)
NRC Docket Nos. 50-237 and 50-249

Reference: Letter from J. A. Zwolinski to D. L. Farrar dated July 1, 1985.

Dear Mr. Zwolinski:

The referenced letter transmitted five questions regarding our previous submittals on our approach for post-fire alternate shutdown and requested schedular exemptions from 10 CFR 50.48 requirements. Our responses to your questions are provided in the attachment.

Please direct any questions you may have regarding this matter to this office.

One (1) signed original and forty (40) copies of this transmittal and its attachment are provided for your use.

Very truly yours,

J R Wojnarowski

J. R. Wojnarowski
Nuclear Licensing Administrator

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Attachment

cc: Region III Inspector - Dresden
R. Gilbert - NRR



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ATTACHMENT

RESPONSE TO NRC QUESTIONS

APPENDIX R - DRESDEN

0020N

Question #1

Provide a summary of your reverification findings with regard to all associated circuit concerns. With regard to common power sources, your response should address the elimination of high impedance faults, i.e., opening of a common power supply (both safe and non-safe shutdown loads) circuit breaker prior to individual breakers of associated non-safe shutdown loads opening due to fire damage. Additionally, your summary should include Interim Compensatory Measures (ICMs) and permanent fixes in this regard, as needed.

RESPONSE

In the subsequent clarification to Generic Letter 81-12*, in regard to associated circuits, the NRC identified three categories of associated circuits whose fire induced failure could affect safe shutdown:

- o Common Power Source (See Section 2)
- o Common Enclosure (See Section 3)
- o Spurious Operation (See Section 4)

1. Assumptions for Circuit Failures

Fire damage to electrical power and control cables is assumed to cause either one or a combination of the following circuit failures:

a. Short - Individual conductors within a cable short to each other.

b. Ground - Individual conductors within a cable are grounded to the supporting raceway or other grounded structure.

*Memorandum to Mr. D. G. Eisenhut (NRR/DL) from Dr. R. J. Mattson (NRR/DSI) Subject: "Fire Protection Rule - Appendix R," dated March 22, 1982

c. <u>Open</u> - Individual conductors within a cable lose electrical continuity.

d. <u>Hot Short</u> - Individual conductor(s) within cable is shorted to individual conductor(s) of a different cable. This type of short includes the case of one deenergized circuit becoming energizing by shorting to an external source of electrical power through independent conductor-to-conductor shorts.

For the analysis of potential spurious operations, two types of hot short conditions are considered of sufficiently low likelihood that they are not credited as producing spurious component actuations. These are:

a. 3-phase ac power circuit cable-to-cable faults (4-kV and 480-V).

b. 2-wire ungrounded dc circuits cable-to-cable faults (125V/250V).

Cable-to-cable connections between one deenergized and one energized power circuit could cause spurious operations. In the case of the three-phase ac circuits, three electrically independent cable-to-cable shorts (hot shorts) must occur without ground, opens or shorts within a cable in order to power the associated device. Similarly, for the two-wire ungrounded dc circuit, two electrically independent cable-to-cable shorts (hot shorts) must occur without shorts within a cable.

The NRC staff has acknowledged that the events described for types (1) and (2) above have a sufficiently low probability of occurrence to permit exclusion of such conditions from consideration (Federal Register, Vol. 48, No. 86 at 19963). The basis for excluding the cable short conditions listed in types (1) and (2) as credible cause of spurious operations is that multiple cable-to-cable electrically independent faults are required in order for spurious operations to occur.

2. <u>Common Power Source</u>

Circuits sharing a common power source are isolated from essential equipment by breakers, fuses, or other isolation devices. Where isolation switches are used, special fusing arrangements are used (see response to question #2). Coordinated fault protection was a feature of the original plant design and is being reviewed to ensure its current applicability. With regard to high-impedance faults, we are assuming that all safe shutdown loads are operating at rated load and that non-safe shutdown loads on the same bus are experiencing fault-induced overloads ranging from 100% to 150% of their protective device ratings. We will summarize, for each safe shutdown bus, the quantity of such faults that would be needed to cause an unwanted trip of the main feed to the bus. Upon completion of this analysis, a report on this subject will be issued.

The vast majority of non-safe shutdown loads will normally be de-energized when an Appendix R shutdown path is implemented. Therefore, most such high-impedance power cable faults must be accompanied by a simultaneous spurious operation of the corresponding control circuit if they are to have any impact upon the bus. As a precaution, for the interim and for long term, safe shutdown procedures require tripping and disabling of all spuriously-activated 4kV breakers prior to loading the diesel onto the bus, and subsequent disabling of all remaining 4kV non-essential breakers to guard against potential spurious closure.

3. Common Enclosure

The hot shutdown paths at Dresden Station do not make use of redundant shutdown methods within a fire area, but instead use an alternative method which is independant of the fire area of concern. These unaffected fire areas may contain common enclosures, i.e., cabinets or raceways which contain essential and nonessential circuits. These circuits would not be affected by cable damage in another fire area. A non-safe shutdown cable that experiences a fault downstream of a common enclosure which contains safe shutdown cables will not overheat those cables and cause a fire in the common enclosure because the upstream protective devices are sized to protect the cable. Additionally these circuits will not provide a path for fire propagation out of a fire area or zone group since the areas are generally enclosed by substantial barriers to fire which have all electrical penetrations sealed or the circuits are clearly separated from the other zone groups due to other features.

On the ground floor of the turbine building, no physical boundary exists along the access corridor between TB-I, TB-II, and TB-III (i.e., the eastern, central, and western zone groups). In this part of the plant, automatic fire detection, automatic suppression, wrapping of selected cable trays, and physical distance provide assurance that the fire will not propagate via associated circuits. The modifications which are being installed will preclude the possibility of fire damaging necessary equipment used by the identified shutdown path. In the interim, credit is taken for the installed suppression systems providing adequate protection for cabling and equipment used by the interim shutdown path.

4. <u>Spurious Operation</u>

The spurious operation of the plant components and their associated electrical equipment (safe shutdown or otherwise) from fire-induced spurious circuit malfunctions could affect safe shutdown capability by leading either to an unrecoverable plant condition or the loss of a safe shutdown function. The effects of spurious operation were considered as follows:

a. The circuits that may affect the normal automatic and manual operation of safe shutdown systems and components due to fire induced faults were identified using the electrical schematic and wiring diagrams. These circuits include the normal control and power circuits for safe shutdown components and the interlocks between the safe shutdown component control circuit and other circuits.

   Figure 1 and 2 show typical schematic diagrams. After determining the cables of concern, the physical routing of these cables was determined by examining the Cable Tabulations and Cable Tray Diagrams. The cables for each component and their physical location were documented on the cable charts for hot shutdown and cold shutdown. The routing of these cables was also shown on the F-drawings.

   The hot and cold shutdown analysis considered the effects of these circuits on safe shutdown. Redundant fusing of control circuits is considered in the response to question 2.

b. Adverse spurious operation of valves and the potential effect on safe shutdown was analyzed. The results are shown in Table 1. The spurious operation of breakers and current transformer and control power transformers circuits has been addressed. While these components are not defined as part of safe shutdown systems, their malfunction could prevent safe shutdown.

TABLE 1

POTENTIAL SPURIOUS VALVE OPERATIONS THAT COULD AFFECT SAFE SHUTDOWN FOR WHICH A PREFIRE OR POSTFIRE ACTION WAS NECESSARY

| Potential Spurious Component | System | Mechanical Drawings | Concern with Malfunction | Resolution |
|---|---|---|---|---|
| AO2(3)-203-1A,B,C,D<br>AO2(3)-203-2A,B,C,D | MS | M-12, M-345 | Spurious opening will result in loss of reactor coolant through the main steam line. | Spurious opening of both MSIV's in series is possible only for faults resulting from a control room fire. For control room fire a procedure has been developed to positively insure at least one MSIV in each steam line closes and remains closed. |
| Target Rock Valve 2(3)-203-3A<br>or<br>Electromatic Relief Valves 2(3)-203-3B<br>or<br>2(3)-203-3C<br>or<br>2(3)-203-3D<br>or<br>2(3)-203-3E | MS | M-12, M-345 (sht. 1) | Spurious opening will vent RPV inventory to suppression pool. | A station procedure EPIP 200-20 has been developed to defeat spurious operation of the Target Rock and Electromatic Relief Valves for a fire in TB-V.<br><br>For a fire in other fire areas, an inhibit switch has been installed in the control room. See Subsections 6.2.1.8 and 6.2.2.8. |

TABLE 1

(continued)

| Potential Spurious Component | System | Mechanical Drawings | Concern with Malfunction | Resolution |
|---|---|---|---|---|
| SO2(3)-220-47<br>SO2(3)-220-46 | Head Vent | M-26, M-357 | Spurious opening of head vent valves could result in the loss of inventory. | A prefire action to remove power from either SO-220-46 or SO-220-47 to preclude spurious opening has been taken. |
| MO2(3)-0302-8<br>AO2(3)-0302-6A<br>AO2(3)-0302-6B | CRD | M-34, M-357 | Spurious closure prevents RPV makeup from cooling water line during shutdown using the isolation condenser. | Should MO2(3)-0302-8 or both AO2(3)-0302-6A and AO2(3)-0302-6B close, makeup water from the CRD pump via CRD cooling line to the RPV could be disrupted. The AO valves close on loss of air (i.e., loss of normal power). Makeup water is still available to the RPV from the CRD pumps via the charging water line and scram injection valves CV2(3)-0305-126 (typical of 177). These valves open for scram and fail open on loss of power. Instructions are included in shutdown procedures to insure that MO-0302-8 and either AO-0302-6A or AO-0302-6B and are open or another |

TABLE 1

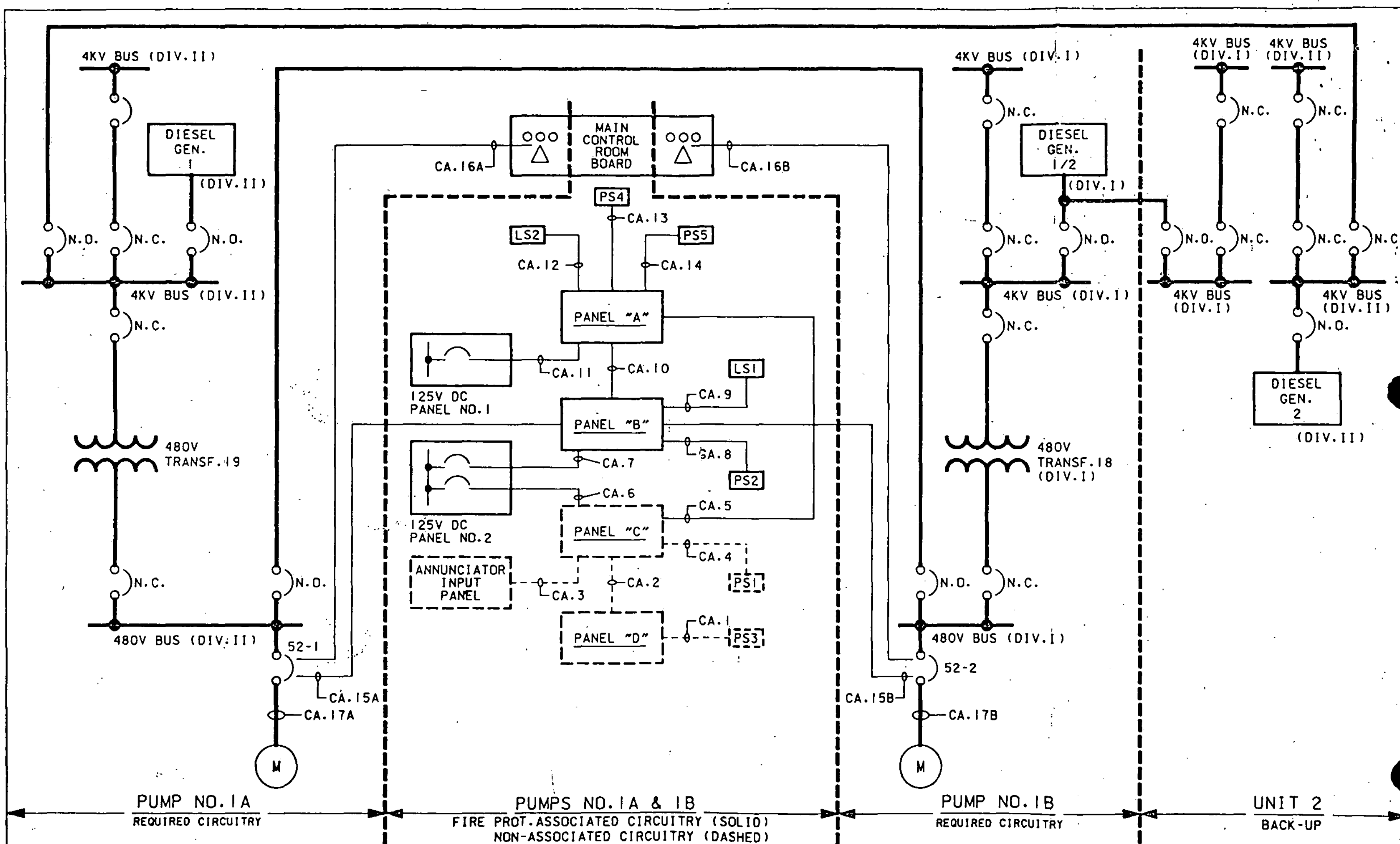
(continued)

| Potential Spurious Component | System | Mechanical Drawings | Concern with Malfunction | Resolution |
|---|---|---|---|---|
| | | | | RPV makeup water source is available before resetting the scram system. |
| MO2(3)-1201-1<br>MO2(3)-1201-1A<br>MO2(3)-1201-2<br>MO2(3)-1201-3<br>PCV2(3)-1217 | RWCU | M-30, M-361 | Failure in open position may cause pressure to build-up in low pressure piping downstream of PCV-2-1217 (with RO) and fluid loss to condenser and/or equipment drains via the relief valves. | A postfire action to isolate the RWCU system by closing normally open valve MO2(3)-1201-2 will be done to prevent loss of reactor coolant from relief valves in the low pressure portion of the RWCU system if the RWCU system does not automatically isolate. |
| MO2(3)-1301-1<br>and<br>MO2(3)-1301-4 | IC | M-28, M-359 | Spurious closure will isolate RPV from isolation condenser. NOTE: MO2(3)-1301-1 and MO2(3)-1301-4 are in the drywell and inaccessible. | An alternate feed and control arrangement has been developed for valves MO2(3)-1301-1 and MO2(3)-1301-4 which are in the drywell. A description of this modification and the protection provided is presented in Section 3.7 and 4.6 of Enclosure III to the August 10, 1984 submittal. |

TABLE 1

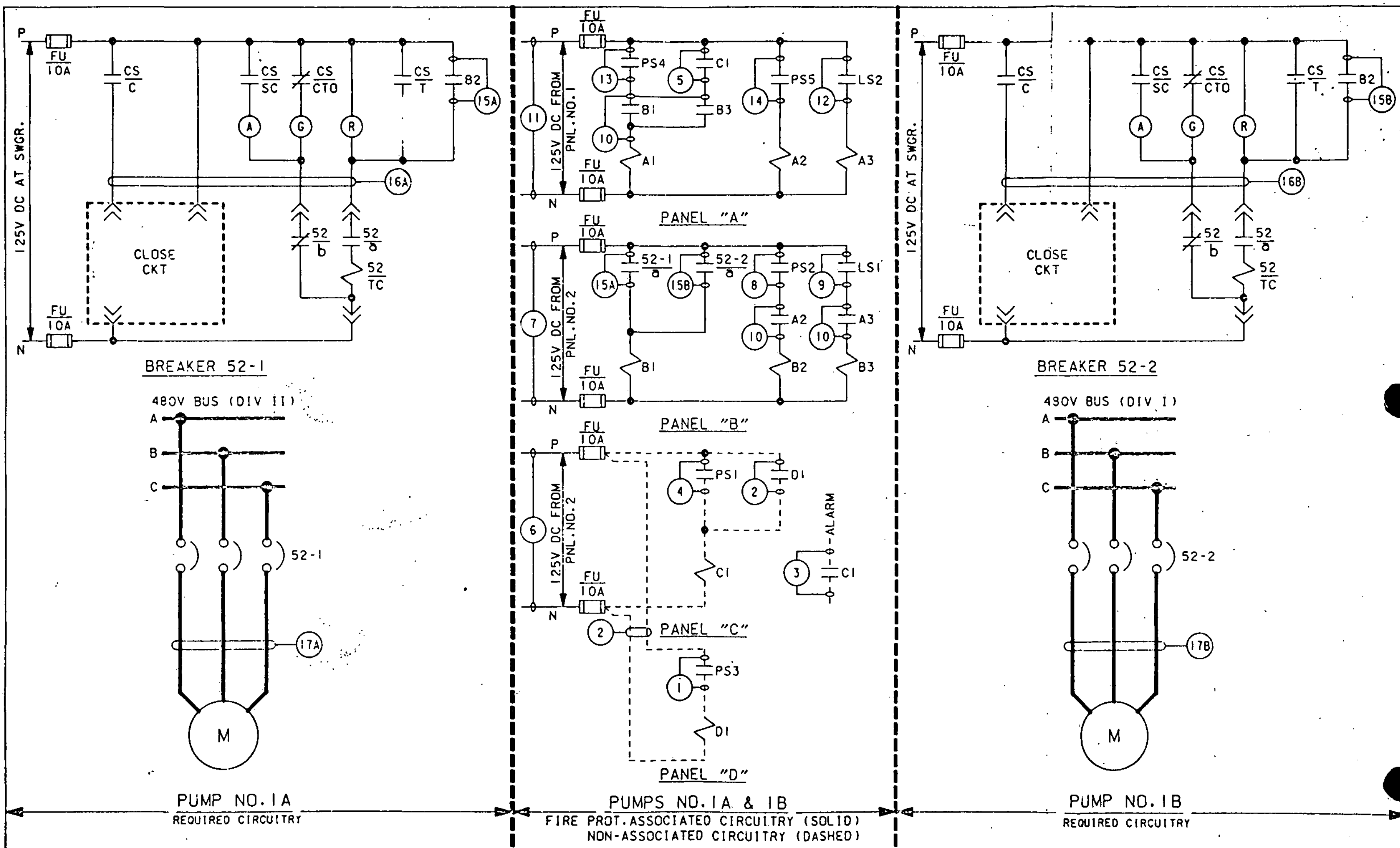
(continued)

| Potential Spurious Component | System | Mechanical Drawings | Concern with Malfunction | Resolution |
|---|---|---|---|---|
| MO2(3)-1301-2 and MO2(3)-1301-3 | IC | M-28, M-359 | Failure to open or spurious close prevents condensed steam from returning from isolation coil to RPV. This defeats natural circulation path. | A procedure will be implemented to open MO2(3)-1301-2 and MO2(3)-1301-3 should they fail in closed position. MO2(3)-1301-3 is normally closed. |
| MO2(3)-1301-10 or MO2(3)-4102 | IC | M-28, M-359 | Spurious closure isolates makeup to isolation condenser from service water system. | These normally closed valves can be manually opened. |
| 2(3)-1301-17 2(3)-1301-20 | IC | M-28, M-359 | Spurious failure to open position would allow steam to vent to the main steam lines. | A procedure has been developed to insure these valves are closed or close manually valve 2(3)-1301-16. |
| MO2(3)-2301-3 | HPCI | M-51, M-334 | Spurious opening of this valve would result in loss of reactor inventory to the suppression pool. | Procedures have been developed to verify that MO2(3)-2301-3 is closed or to trip the HPCI turbine if the HPCI pump is not delivering water to the reactor. |




TYPICAL CABLING DIAG.

FIGURE 1




TYPICAL SCHEMATIC

FIGURE 2

NOTE: NUMBERS ENCIRCLED INDICATE CABLE NUMBERS AS INDICATED ON FIGURE 3.3-1

5. Permanent Fixes and ICM's

The modifications and related interim compensatory measures are addressed in the submittal Dresden 2 & 3 Appendix R Reverification - Interim Compensatory Measures and Exemptions Requests Enclosure II dated August 10, 1984.

The manual actions are addressed in station procedures.

Question #2

Provide a summary of your reverification findings with regard to elimination of the electrical isolation deficiency as identified in Reference 1. Your summary should include ICMs and permanent fixes as needed.

RESPONSE

Each safe shutdown equipment item for which local control is utilized was checked to determine whether a fault on the remote circuit (prior to isolation) can blow a fuse needed for local control. Several items were found to be deficient in this regard.

IEIN 85-09 suggests using separate fuses for the local and remote control circuits. Commonwealth Edison Company (CECo) is concerned that this would create an unnecessary personnel safety hazard. Dresden Station operators and maintenance personnel are accustomed to an environment in which the removal of a single fuse ensures the de-energization of an entire circuit. Separate fusing would leave some parts of a circuit hot when only one fuse is pulled. Therefore, an alternate solution consisting of storing properly-sized spare fuses in the immediate vicinity of the affected equipment will be used. Such spare fuses will be subject to periodic surveillance and will facilitate prompt replacement in the event of a remote cable fault occurring prior to the transfer of an isolation switch. This alternate method would provide protection to the equipment equivalent to redundant fusing since the properly sized fuses along with equipment necessary to replace the fuses would be located in the proximity of the equipment, would be periodically surveyed, and would be stored in such a manner as to allow operators easy access to the materials. Though the operator might have to replace a fuse, the availability of necessary equipment at the switchgear would eliminate any delays which might be incurred in repairing the equipment thereby accomplishing the same objective as redundant fusing.

REFERENCE

1) IE Information Notice No. 85-09, "Isolation Transfer Switches and Post-Fire Shutdown Capability" dated January 31, 1985.

Question #3

Provide the current status of your proposed modifications for overcoming the potential adverse consequences that result from a postulated fire coincident with loss of offsite power (see Pages 2-19, 2-21, 2-22 and 2-23 of Enclosure II, Reference 1 from a description of the proposed compensating features in this regard). Indicate whether your existing request (Reference 1), that a fire coincident with a loss of offsite power at the Dresden site not be assumed during the period August 1984 - March 1985, should be revised to include the additional period until modifications are made to cope with a loss of offsite power. If so, revise the request as appropriate.

RESPONSE

Appendix A to Enclosure II of Reference 1 presents arguments for the reliability of offsite power as an interim justification until proposed modifications are complete. This justification is no longer needed because the permanent alternative safe shutdown modifications which employed the offsite power reliability argument have been completed, also the suppression system installed in the lower level of the cribhouse ensures the availability of at least one diesel generator. Table 1 lists those modifications which employed the offsite power reliability argument and the justification for no longer using it.

REFERENCE

1) Commonwealth Edison Company submittal dated August 10, 1984 entitled "Dresden 2 & 3 Appendix R Reverification-Interim Compensatory Measures and Exemption Requests."

TABLE 1

| ZONE/AREA | | COMMENT |
|---|---|---|
| Unit 2 CRD Pump floor Elev. 495'-0" (8.2.2.A) | 1. Supply secondary CRD Pump cooling water. (Previously identified in 1982 Associated Circuits Report.) | Prior to the installation of this modification, the CRD pumps could only be cooled by the Turbine Building Closed Cooling Water (TBCCW) system. This system could be aligned to the single diesel generator used for hot shutdown but doing so would overload the capacity of the diesel. The offsite power reliability argument was presented as an interim measure until the installation of the secondary cooling line from the service water system was completed. This cooling water line has been installed to both CRD pumps eliminating the need for the offsite power reliability argument as an interim measure. |
| Unit 3 CRD Pump floor Elev. 495'-0" (8.2.2.B) | 1. Supply secondary CRD Pump cooling water. (Previously identified in 1982 Associated Circuits Report). | |
| Cribhouse (11.3) | 1. Install transfer switch in one-hour barrier for 2/3 Diesel Generator Cooling Water Pump to ensure availability of at least one redundant power feed.<br>3. Curb the 2/3 Diesel Generator Cooling Water Pump to ensure availability of this pump if a fire affected the dedicated pumps, by preventing spread of flammable liquids.<br>4. Provide detection throughout the lower elevation to provide equivalent Appendix R separation for redundant service water pump and Diesel Generator (DG) 2/3 cooling water pump cabling.<br>5. Provide automatic, open-head suppression over 2/3 Diesel Generator Cooling Water Pump to ensure availability of this pump if a fire has affected either dedicated pump. | Though these modifications are not complete, the suppression systems which have been installed in the lower level of the cribhouse will ensure that one of the three cooling water pumps will not be damaged by fire. Also cross-ties have been installed in the CRD system enabling shutdown of both units from one diesel. Therefore, the offsite power reliability argument as an interim measure is no longer needed. |

Question #4

Correct apparent conflicts between Table 2.1-2 (Reference 1, Enclosure III) and Section 6.2.3 (Reference 1, page 6.2-2) for the entries listed for shutdown paths for Fire Zone 11.3 (Units 2 and 3 cribhouse). Also correct Table 2.1-2 as necessary for the shutdown path for Fire Zone 8.1 (turbine oil storage area).

RESPONSE

Table 2.1-2 will be corrected. The corrected information is as follows:

| Fire Zone | Equivalent Area/ Zone Group | Shutdown Path |
|---|---|---|
| 8.1 | Eastern | B1* |
| 11.3 | Cribhouse | E and F or<br>A and B |

Section 6.2.3 is correct as written.

REFERENCE

1) Commonwealth Edison Company submittal dated August 10, 1984 entitled "Dresden 2 & 3 Appendix R Reverification-Interim Compensatory Measures and Exemption Requests."

Question #5

For a fire in the Fire Zone 9.0.C (the swing diesel generator 2/3 room), until the four proposed modifications are completed, (see Reference 1, Enclosure II, Table 2, Pages 2-20 and 2-21) indicate whether shutdown paths E and F for Units 2 and 3 shutdown, respectively, are available in the interim period. These have been listed as long term shutdown paths in Tables 2.1-2. Indicate why it is necessary to utilize mechanical cross ties, procedures and Unit 3 equipment and power for achieving Unit 2 shutdown and vice versa for Unit 3 shutdown in the interim.

RESPONSE

For a fire in Fire Zone 9.0.C (swing diesel generator 2/3 room) shutdown paths E and F are available for the interim and the long term. No mechanical or electrical cross-ties are needed for either the interim or long term with these paths.

The mechanical and electrical cross-ties which presently exist at the plant enhance the fire protection features by allowing the operator the flexibility of shutting down by using only one diesel generator and one units power train.

REFERENCE

1) Commonwealth Edison Company submittal dated August 10, 1984 entitled "Dresden 2 & 3 Appendix R Reverification-Interim Compensatory Measures and Exemption Requests."