

U. S. NUCLEAR REGULATORY COMMISSION

REGION III

Report No. 50-341/87049(DRP)

Docket No. 50-341

License No. NPF-43

Licensee: Detroit Edison Company  
2000 Second Avenue  
Detroit, MI 48226

Facility Name: Fermi 2

Inspection At: Fermi Site, Newport, Michigan

Inspection Conducted: September 11 through November 25, 1987

Inspectors: W. G. Rogers

Approved By: *Edward G. Greenman*  
Edward G. Greenman, Deputy Director  
Division of Reactor Projects

12-17-87  
Date

Inspection Summary

Inspection on September 11 through November 25, 1987 (Report  
No. 50-341/87049(DRP))

Areas Inspected: Special safety inspection of the events that led to the loss of essential bus 72 CF on September 8, 1987, the evaluation by the licensee of the event, and the design basis for bus 72 CF.

Results: One violation was identified (Paragraph 6).

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## DETAILS

### 1. Persons Contacted

#### a. Detroit Edison Company

F. Agosti, Vice President, Nuclear Engineering and Services  
R. Anderson, Engineering  
P. Anthony, Licensing, Compliance  
E. Bosetti, Engineering  
L. Collins, Engineer  
M. Deora, Engineering  
S. Frost, Licensing  
D. Gipson, Plant Manager  
R. Gondek, Nuclear Engineering  
D. Hoffman, Licensing, Compliance  
R. Lenart, General Director, Nuclear Engineering  
T. McKelvey, Engineering  
J. Pendergast, Licensing, Compliance  
J. Plona, Operations Support Engineer  
J. Price, Licensing  
T. Randazzo, Director, Regulatory Affairs  
G. Shukla, Licensing Engineer  
B. R. Sylvia, Group Vice President, Nuclear Operations  
J. Thorpe, Engineer, Nuclear Engineering  
G. Trahey, Director, Nuclear Quality Assurance  
L. Wooden, Supervisor, Engineering Technology  
S. Zoma, Supervisor, Nuclear Engineering

#### b. Nuclear Regulatory Commission

W. Rogers, Senior Resident Inspector

### 2. Background

The Fermi 2 low pressure emergency core cooling system (ECCS) consists of two divisions of core spray with two pumps in each division injecting directly into the reactor vessel and two divisions of low pressure coolant injection (LPCI) with two pumps in each division injecting into each reactor recirculation loop. If a loss of coolant accident (LOCA) were to occur in a recirculation loop, one division of LPCI would be of minimal value (injecting out the break).

To maximize LPCI core cooling effectiveness, a sensing system was devised to detect which recirculation loop had the LOCA. Once the sensing system determines the faulted loop, the two LPCI injection valves to that loop are given a close signal and the non-faulted recirculation loop discharge valve is given a close signal. Since both LPCI divisions are physically connected through a normally open cross-tie valve, both divisions of LPCI would inject into the non-faulted loop.

To assure that one division of LPCI was operable with a single failure present, the seven valves (two Division 1 LPCI injection valves, two Division 2 LPCI injection valves, the two recirculation discharge valves and the LPCI cross-tie valve) associated with this LPCI loop selection had to have dual power sources. Assuming that the Division 2 recirculation loop had the LOCA and the Division 1 electrical system was lost through the single failure, the only way to have the Division 2 LPCI inject into the Division 1 recirculation loop would be to provide a power source to the Division 1 LPCI injection valves (to open), the Division 2 LPCI injection valves (to close), and the Division 1 recirculation discharge valve (to close) from the Division 2 electrical system. The same logic holds if the LOCA and the single failure were reversed. Therefore, a swing bus, 72CF, was designed capable of being powered from both Division 1 and 2.

Normally, the swing bus was powered from Division 1 and upon loss of power the electrical feed to Division 2 would close providing power to the swing bus. The manner in which this power throw over logic was constructed is shown in Figure 1. For the Division 1 power feed, there was a breaker, 3C, and a contact, 1C, which must be closed. For the Division 2 power feed there was a breaker, 5C, and a contact, 5C, which must be closed. When breaker 3C opened and contact 1C opened, the closing coil for breaker 5C was energized, closing breaker 5C. Once breaker 5C was closed, the relay to contact 5C was energized, closing contact 5C. With the 5C breaker and contact closed, bus 72CF would be powered from Division 2. Power for the trip coil, for breaker 3C, and for contact 1C's relay was provided from Division 1 battery 2PA via 2PA2-14 position 2. Power for the trip coil, for breaker 5C, and for contact 5C's relay was provided from Division 2 battery 2PB.

The licensing bases of the ECCS was the ability to prevent core damage in the event of a LOCA, loss of offsite power (LOOP), and a single failure. Part of the licensing bases of the swing bus was that nothing other than a fault on the swing bus itself would be allowed to render the bus inoperable and those electrical loads on the swing bus would be limited to the minimum number. By establishing these swing bus design conditions, single failure protection was provided in the event of a LOCA, LOOP, and swing bus failure since both divisions of core spray would be capable of supplying adequate core cooling. Detroit Edison's single failure analysis did not identify any single failure that would render the 72CF bus inoperable and either division of core spray. The only electrical loads that were allowed on bus 72CF were the seven LPCI loop select valves. The design of bus 72CF was considered acceptable by NRR as noted in Section 8.3.1 of the Safety Evaluation Report (NUREG 0798) following a site visit.

### 3. The Event

While in cold shutdown on September 8, 1987, at 1255, operators started a tagout of equipment to support maintenance activities on the Division 1 emergency equipment cooling water pump (EECW). In the process of performing this tagout, numerous direct current loads including the DC control power to the EECW pump were deenergized by opening the disconnect

switch at 2PA2-14 position 2 instead of removing the control power fuses for the EECW pump. The operator who completed the tagout authorization improperly designated the electrical isolation for this maintenance.

When the switch at 2PA2-14 position 2 was opened, the Division 1 power to swing bus 72CF was lost and the automatic power feed transfer to the Division 2 power source did not occur. Opening 2PA2-14 position 2 caused a loss of power to the 1C relay deenergizing and opening the 1C contact. With the 1C contact open, the Division 1 electrical feed to bus 72CF was interrupted. Also, when 2PA2-14 position 2 was opened, power to breaker 3C's trip coil was lost. Without a powered trip coil, breaker 3C did not open. The 72CF automatic transfer to Division 2 only occurs when breaker 3C and contact 1C are open. Therefore, the automatic transfer did not occur and bus 72CF deenergized.

The control room operators observed the loss of position indication/motive power to the seven valves involved in LPCI loop selection powered by the 72CF bus, rendering both divisions of LPCI inoperable. Within five minutes, the 2PA2-14 position 2 switch was closed and the power to bus 72CF restored.

#### 4. Event Evaluation

Once power was restored, the licensee began evaluating the significance of the event. The loss of LPCI through one discrete act appeared to operations personnel to be outside the design bases of the plant. At 1500 that day the operations personnel concluded that the event was reportable under 10 CFR 50.72 (b)(2)(i) as the discovery of an unanalyzed condition. At 1634 the NRC was so informed via the emergency notification system.

A deviation report (DER) was written to provide review and corrective action to the situation. Engineering personnel were assigned the responsibility of reviewing the swing bus design. On September 10, 1987, during this more detailed review, engineering confirmed the concerns of the operations personnel. The evaluation determined that had power to the complete Division 1 direct current system been lost, the LPCI system and the Division 1 EDGs would no longer be able to perform their safety function. The Division 1 direct current system powers the field flash on the Division 1 EDGs, and without field flash capability, the EDGs are inoperable. Without the EDGs, the motive force for the Division 1 core spray pumps would be lost and Division 1 of core spray would be incapable of performing its safety function given a LOOP.

The licensee's postulated loss of six of the eight low pressure ECCS pumps from a single failure, the loss of the Division 1 direct current system during a LOCA and LOOP, is less than the number of components specified in Table 6.3-5 of the USAR. This table delineates the minimum ECCS components necessary to prevent a peak clad temperature of greater than 2200°F in the event of a LOCA/LOOP/single failure.

On September 11, 1987, the licensee informed NRR via telephone with the NRC resident inspector present of the design deficiency. In a Licensee Event Report (LER) dated October 8, 1987, the event was further reported to the NRC in accordance with 10 CFR 50.73.

5. Corrective Actions

Engineering personnel redesigned the swing bus electrical circuitry to conform to the appropriate regulatory requirements. An NRC Region III inspector and two representatives from the Electrical Systems Branch of NRR reviewed the new design and determined it to be acceptable. The new design was implemented under engineering design package 7906 prior to the licensee starting up from the maintenance outage which they had been in when the design deficiency was discovered. The NRC technical implementation review will be performed as indicated in Inspection Report No. 50-341/87042 by an electrical inspector during a future inspection. The resident inspectors attended operator training on the new swing bus design and considered the training acceptable.

6. Licensee Event Report (LER) Review

The resident inspector reviewed LER 87045 on this matter. In the course of the review, the inspector questioned the accuracy of the licensee's "Analysis of Event" section. This section states:

"General Electric was notified of the design deficiency and (was) requested to perform an analysis of the degraded ECCS using the current plant power history and other licensing basis assumptions. The analysis showed that under the worst situation with only two core spray pumps in Division II and the current power history power level not greater than 50% rated core thermal power, the peak cladding temperature does not exceed 1915°F. This is much less than the 2200°F safety limit."

The inspector reviewed the analysis and determined that the accident analyzed was for a break of a reactor recirculation loop. However, this accident does not appear to be the worst accident situation. A break of the Division 2 core spray injection piping appears to be the worst accident situation. A break of this nature eliminates all the low pressure ECCS pumps. Limiting the peak clad temperature to less than 2200°F following that LOCA is questionable without automatic low pressure cooling even with a low core exposure and a maximum power level of 50%. On November 16, 1987, the inspector discussed the core spray injection line accident situation with the cognizant Detroit Edison engineer who agreed that this condition may be the worst. Two days later the inspector informed the Corrective Action Review Board Vice-Chairman of the potential discrepancy and requested the Vice-Chairman to review the LER. At the exit, the inspector was informed by the licensee that an analysis on the core spray line break would be performed by General Electric and the LER would be revised if necessary. The General Electric results are expected during the first week of December 1987.

7. Conclusions

UFSAR subsection 8.3.1.1.4, "Engineering Safety Feature Bus Interconnections," discusses the automatic throwover function of bus 72CF, and states this automatic throwover is provided with positive interlocks, breakers, and series contractors to satisfy the "no single failure" criterion. From July 15, 1985 to October 6, 1987, the licensee's design of bus 72CF as documented on Drawing No. 617212573-11, Rev. L, did not meet the "no single failure" criterion described in the UFSAR in that a loss of Division 1 of the direct current system prevented the automatic throwover function. This matter is considered a violation of 10 CFR 50, Appendix B, Criterion III (341/87049-01).

8. Exit (30703)

The inspectors met with licensee representatives (denoted in Paragraph 1) on November 24, 1987, and informally throughout the inspection period and summarized the scope and findings of the inspection activities. The inspectors also discussed the likely informational content of the inspection report with regard to documents or processes reviewed by the inspectors during the inspection. The licensee did not identify any such documents/processes as proprietary. The licensee acknowledged the findings of the inspection.

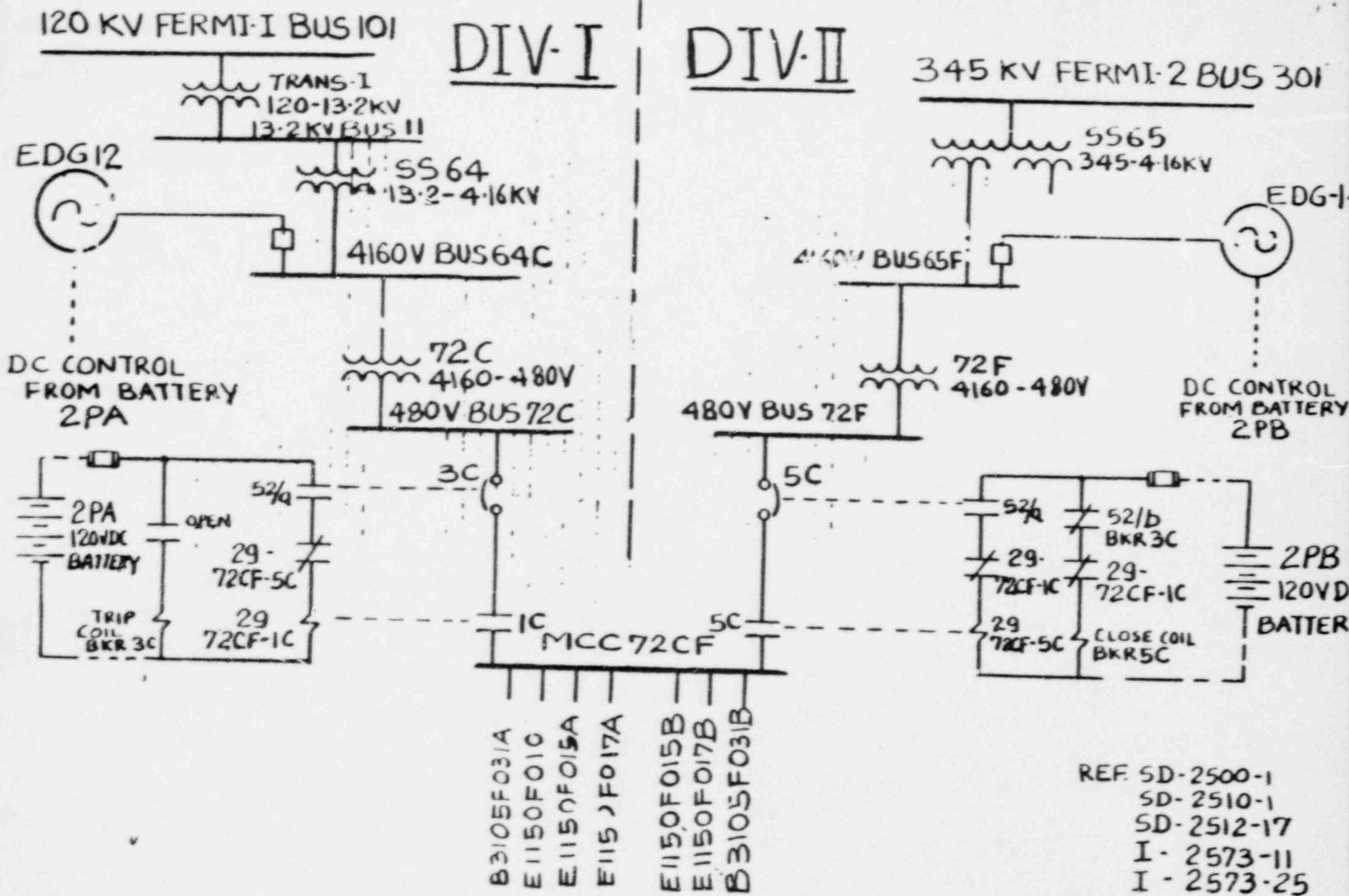


Fig. 1