LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Fermi 2	0 5 0 0 0 3 4 1	1 OF 6

TITLE (4) ECCS System Outside Design Basis During ESF Bus 64C Undervoltage Protection Functional Testing

EVENT DATE (5)			LER NUMBER (6)					REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MON	DAY	YR	YR	SEQUENTIAL NUMBER		REVISION NUMBER		MON	DAY	YR	FACILITY NAMES	DOCKET NUMBER (5)
02	16	96	96	- 0 0 3 -		0	0	03	18	96		0 5 0 0 0
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OPERATING MODE (9)	POWER LEVEL (10)
1	0 9 6

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR (11)

X 10 CFR 10CFR50.73(a)(2)(ii)(B)

OTHER -

(Specify in Abstract below and in text, NRC Form 366A)

LICENSEE CONTACT FOR THIS LER (12)

Ken Riches - Compliance Engineer	TELEPHONE NUMBER AREA CODE	313 586-5529

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
[ ] YES (If yes, complete EXPECTED SUBMISSION DATE)	[X] NO				

ABSTRACT (16)

On February 16, 1996, Detroit Edison determined that during past performance of Bus 64C undervoltage protection scheme surveillance testing, the plant was outside the design basis. While in the test configuration, the automatic throwover of swing bus 72CF, which includes the Low Pressure Coolant Injection (LPCI) valves, would not occur and the function of one division of core spray pumps could have been unavailable if loss of offsite power had occurred concurrent with a design basis loss of coolant accident. This occurrence would result in only one core spray loop being available for emergency core cooling.

The consequences of the Bus 64C undervoltage testing lineup were not recognized during the development of the surveillance procedures due to the fact that the swing bus remains energized via the offsite power source during the testing and the complexity of the circuits. The testing lineup is unique in that the testing introduced a failure that affected both divisions of LPCI and one division of core spray.

Corrective actions taken include: (1) the interim action of stationing a dedicated licensed operator to monitor and perform manual actions for a loss of voltage to Bus 64C during the performance of surveillance testing will be proceduralized until a long term solution has been implemented; (2) other similar non-redundant systems will be reviewed to ensure that there are no surveillance testing design basis issues introduced; and (3) methods of undervoltage testing, potential plant modifications, and technical specification clarifications will be evaluated to provide a long term solution.

Initial Plant Condition:

Operational Condition:	1 (Power Operation)
Reactor Power:	96 Percent
Reactor Pressure:	1020 psig
Reactor Temperature:	540 degrees Fahrenheit

Description of the Event:

A. Background

The 4160 volt buses 64C and 65F [EB][BU] power the swing bus, Motor Control Center (MCC) 72CF [EJ][MCC], through 480 volt busses 72C and 72F [ED][BU], respectively. The 480 volt swing bus MCC 72CF in turn provides power to operate valves associated with the Low Pressure Coolant Injection (LPCI) system and the Residual Heat Removal (RHR) system. These valves include recirculation pump discharge valves [AD][V], a Residual Heat Removal (RHR) cross-tie valve [BO][V], RHR injection valves [BO][INV] and RHR inboard isolation valves [BO][ISV]. Bus 72C (Division I) is the normal feed and Bus 72F (Division II) is the alternate feed for the swing bus. The swing bus uses an automatic throwover [EJ][ASU], initiated by undervoltage relays [EJ][27], upon loss of voltage to the normal feed. Undervoltage relaying for Bus 72C or Bus 64C actuate associated lockout relays [EJ][86] which trip Bus 72C breakers [EJ][BKR][52], including the normal feeder breaker (breaker 72C-3C). The lockout relay for Bus 72C also provides a closure permissive [EJ][69] for the alternate feeder breaker (breaker 72F-5C). When breaker 72C-3C trips open, breaker 72F-5C closes and completes the swing bus load throwover from Division I to Division II.

On December 15, 1988, the Nuclear Regulatory Commission approved Amendment 29 to the Fermi 2 Operating License, which clarified the limiting condition for operation and action statement of the 480 volt MCC 72CF swing bus. These requirements are specified in Technical Specification (TS) 3/4.8.3, "Onsite Power Distribution Sources."

TS 3.8.3.1 Action Statement for Swing Bus automatic throwover inoperability requires both LPCI subsystems to be declared inoperable and to take Action per Technical Specification 3.5.1. The Action Statement for TS 3.5.1. requires Hot Shutdown within 12 hours.

B. Event Description

On February 13, 1996, prior to performance of surveillance test procedure 42.302.08, "Calibration and Functional Test of Division I 4160 Volt Bus 64C and Bus 12EB Undervoltage Relays," a Detroit Edison licensed Nuclear Shift Supervisor questioned whether the 480 volt swing bus connected through bus 72C would be affected by undervoltage protection testing for Engineered Safety Feature (ESF) Bus 64C. This was the first time the calibration was to be performed during power operations. The surveillance was stopped until the issue could be resolved.

The subsequent investigation determined that during the performance of Procedure 42.302.08 for Bus 64C, the 4160 volt and 480 volt load shed trip functions are defeated. The functional tests require the 4160 volt lockout relays to operate. To inhibit the lockout relay load shedding action during normal plant operation, knife switches [ED][HS] are opened to prevent associated 4160 volt and 480 volt bus trip string relays from operating, thereby defeating the undervoltage trips for breakers associated with Busses 64C and 72C. One of the loads affected is the swing bus MCC 72CF. When the undervoltage trips are defeated, the normal feed breaker (72C-3C) would not load shed trip on undervoltage and the swing bus would not be automatically transferred to its alternate feed breaker (72F-5C). In addition, tripping the lockout relay during the surveillance directly inhibits the Core Spray Pump C [BM][P] auto-start logic preventing Core Spray Pump C from running if needed even with offsite AC power available. The Emergency Diesel Generator (EDG) 12 [EK][EDG] output breaker automatic closure circuit is also defeated by tripping the lockout relay, and Bus 72C would not be energized following a loss of offsite power. Therefore, the Division I core spray injection valves would not operate from Bus 72C during a loss of offsite power. These same concerns exist during performance of Procedure 42.302.11, "Channel Functional Test of Division I 4160 Volt Bus 64C and Bus 12EB Undervoltage Circuits." The monthly surveillance has been performed numerous times during normal power operations. It should be noted that manual breaker alignments from the control room could re-energize the swing bus if required during an emergency.

On February 16, 1996, Detroit Edison determined that during past performance of Bus 64C undervoltage channel functional tests the plant had been operated outside the design basis. The situation places the plant beyond the analyzed conditions for the design basis large-break Loss of Coolant Accident (LOCA) coincident with a Loss of Offsite Power (LOP) while Bus 64C has the undervoltage load shed relay protection defeated. During the performance of the undervoltage testing for Bus 64C, the automatic throwover of swing bus MCC 72CF and the Division I Core Spray function would have been prevented if a loss of offsite power had occurred. With the swing bus de-energized, LPCI injection valves and reactor recirculation pump isolation valve could not operate if needed. Without the LPCI injection flow path, all core spray pumps are required for design basis minimum Emergency Core Cooling System (ECCS) flow. This configuration results in only one core spray loop (two pumps) available for emergency core cooling. For a small to intermediate sized LOCA, the concern is not as significant because the

high pressure coolant injection system [BJ] and automatic de-pressurization system [AD] would also be available to mitigate the consequences of an accident.

Cause of the Event:

The consequences of the Bus 64C undervoltage relay testing lineup with the undervoltage protection defeated, thereby disabling the swing bus automatic throwover scheme were not recognized during the development or review of the surveillance procedures due to the fact that the swing bus remains energized via the offsite source during the testing and the complexity of the circuits. The testing lineup is unique in that the testing introduced a failure that affected both divisions of LPCI and one division of Core Spray.

Analysis of the Event:

Swing bus MCC 72CF is unique within the Fermi 2 auxiliary power system for the reason that it represents the only connection between two safety related divisions at the 480 volt level. Section 8.3.1.1.4 of the Updated Final Safety Analysis Report describes the swing bus arrangement and acknowledges that this is one part of the electric power system where loads can be powered from either redundant division of power by automatic throwover. Upon loss of offsite power, this bus is re-energized by EDG 12 or EDG 14. A simultaneous loss of power to both divisions would result in EDG 14 re-energizing the swing bus. Upon a loss of power the breaker from 72C to 72CF is tripped. After restoration of power to Bus 72C, there is a five second delay before the trip for the breaker powering Bus 72CF is reset. Since the breaker from 72F was not closed initially, the simultaneous undervoltage trip to it has no effect. As soon as the transfer is complete and power to Bus 72F is restored by EDG 14, swing bus MCC 72CF is re-energized.

Under the current scenario, only one division of core spray will be available to provide injection following a Design Basis Accident (DBA) LOCA. This condition is the resultant configuration during Bus 64C undervoltage testing, assuming a loss of offsite power. A modified Probabilistic Safety Assessment (PSA) evaluation assessed the risk of a DBA LOCA concurrent with the total loss of offsite power or the loss of Division I offsite power that would occur while performing the undervoltage testing on Bus 64C. A large break LOCA would rapidly de-pressurize the reactor pressure vessel and leave only Core Spray Division II available for injection. The annualized Core Damage Frequency (CDF) due to a large break LOCA occurring while performing an undervoltage functional test on Bus 64C concurrent with a loss of Division I of offsite power is less than one percent of the total Fermi 2 CDF. In accordance with the PSA Applications Guide (EPRI TR-105396) this level of risk can be classified as non-risk-significant.

Furthermore, NEDC-30936P, "BWR Owner's Group Technical Specification Improvement Methodology," analysis shows that one core spray loop is sufficient to provide core cooling for a LOCA. Therefore, General Electric concluded that based on the existing available Fermi 2 margin and the conclusions from various studies, if a LOCA had occurred at Fermi 2 prior to discovery of the swing bus problem, a peak clad temperature of 2200 degrees Fahrenheit would not have been exceeded.

Therefore, the health and safety of the public would not be adversely affected by this condition.

Corrective Actions:

A. Immediate Corrective Actions

1. As an interim measure, consistent with Generic Letter 91-18, a dedicated Licensed Operator with no other duties will be stationed in the control room to monitor and perform manual actions if required during the performance of surveillance test procedure 42.302.11. If Bus 72C voltage degrades as indicated by a sustained (30 seconds or greater) voltage reading of less than 114 volts on the bus volt meter, or if Bus 72C loses power as indicated by a voltage reading of near zero volts on the bus volt meter and loss of the bus power monitor light, then procedural steps will be performed to power MCC 72CF from Bus 72F. Procedure 43.302.08 was "placed in suspense" and will not be performed until revised to include the interim measures similar to those developed above for Procedure 42.302.11.

2. Testing on the other 4160 Volt ESF busses has been evaluated, and only Bus 64C testing results in the plant being outside design basis for a normal plant alignment (i.e., Division I normal feed to the swing bus).

3. A single failure analysis of the swing bus throwover scheme was performed to determine whether there is any single failure during normal plant operations (i.e., not in a test configuration) that can simultaneously cause loss of the swing bus and loss of any core spray pumps or loops. This analysis did not identify any single failure that would result in losing both the swing bus and a division of core spray.

B. Corrective Actions to Prevent Recurrence

1. The interim action of stationing a dedicated licensed operator to monitor and perform manual actions if required during the performance of surveillance test procedure 42.302.11 has been proceduralized. Procedure 42.302.08 will be similarly revised prior to the next performance of the procedure. These interim procedural requirements will remain in effect until a permanent solution has been implemented.

2. Other similar non-redundant systems, such as LPCI Loop Select and the high pressure coolant injection system, will be reviewed to ensure that there are no design basis issues introduced as a result of surveillance testing.

3. Methods of undervoltage protection scheme testing and potential plant modifications will be evaluated to provide a long term solution that will not disable the swing bus while the Bus 64C undervoltage protection scheme is being tested. Additionally, the technical specifications will be evaluated for possible clarifications that may address the 64C Bus surveillance testing deficiency as it relates to the swing bus.

Additional Information:

Previous LERs on Similar Problems:

LER 87-045-02: On September 8, 1987, an operator removed a fuse which de-energized the DC control power to Bus 72C while attempting to de-energize a component for maintenance activities. The loss of DC control power resulted in the loss of the power supply to the swing bus and consequently to the LPCI Loop Select Valves. Subsequently, the design was reviewed by engineering and it was determined that the DC control circuitry for MCC 72CF equipment was inadequate. The LPCI operation could be prevented by either of two independent failures external to the swing bus. The design of the throwover circuit requires that the Bus 72C position from Division I and associated DC coil magnetic contactor be open as a permissive to close the Division II supply breaker to the swing bus. The DC control circuitry for the MCC 72CF was redesigned to meet the plant design basis. The design error was the result of the design engineers believing that the bus would swing over to Division II under all LOP plus single failure scenarios for single failures to the swing bus associated equipment. Subsequently, an analysis was performed and as a result a design change was implemented to address the potential undervoltage condition. A review of the plant design relative to the throw over buses was performed, however no other design flaws of this type were identified. In October 1989, a new scenario was postulated which involved degradation of the voltage on the 480 volt bus supplying MCC 72CF, due to an EDG voltage regulator failure, such that the swing bus loads might not operate properly and the bus would not transfer to its alternate supply. A Probabilistic Safety Analysis was performed and determined that degraded bus voltage had a very low frequency of occurrence (8.8E-9 to 1.5E-10 events/year).