NRC FORM 366 (5-92) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 5/31/95

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0304), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Dresden Nuclear Power Station, Unit 2	05000237	1 OF 6

TITLE (4)
Unit Shutdown due to Degradation of Auxiliary Switches in 4kV Circuit Breakers Caused by Design/Manufacturing Deficiency

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
04	10	97	97	-- 008 --	00	05	09	97	Dresden Unit 3	05000249
									FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	1 (5)
POWER LEVEL (10)	100 (0)

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)

	20.2201(b)		20.2203(a)(3)(i)		50.73(a)(2)(iii)		73.71(b)
	20.2203(a)(1)		20.2203(a)(3)(ii)		50.73(a)(2)(iv)		73.71(c)
	20.2203(a)(2)(i)		20.2203(a)(4)	X	50.73(a)(2)(v)		OTHER
	20.2203(a)(2)(ii)		50.36(c)(1)		50.73(a)(2)(vii)	(Specify in Abstract below and in Text, NRC Form 366A)	
	20.2203(a)(2)(iii)		50.36(c)(2)		50.73(a)(2)(viii)(A)		
	20.2203(a)(2)(iv)	X	50.73(a)(2)(i)		50.73(a)(2)(viii)(B)		
	20.2203(a)(2)(v)		50.73(a)(2)(ii)		50.73(a)(2)(x)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
D. Spencer, Plant Engineering Lead Electrical Ext. 3292	(815) 942-2920

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
B	EB	52	G168	Y						

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

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

At approximately 1940 hours on April 10, 1997, with Unit 2 in Mode 1, inspection of the Golden Gate 4kV feed breaker [EB] from Bus 23 to Bus 23-1 revealed that the breaker's Merlin Gerin auxiliary switch mounting plastic had broken, resulting in the switch being detached from its mounting plate. There was no immediate assurance that the switch would have operated properly if the breaker were to be cycled. Also, it was determined that the Merlin Gerin type auxiliary switch is susceptible to cracking of the switch mounting plastic. Cracking of the switch mounting plastic was viewed as a precursor to the switch completely breaking free from the mounting plate. Conservatively, all equipment utilizing the Golden Gate type breaker with a Merlin Gerin auxiliary switch were declared inoperable at 2112 on April 10, 1997. This rendered various systems inoperable, Containment Cooling Service Water (CCSW) [BO] being the most limiting. Shutdown of Unit 2 commenced at 2226 on April 10, 1997. Unit 3 was already in the refueling mode, Mode 5, for a scheduled refueling outage. The root cause of this event is design/manufacturing deficiency of the breaker auxiliary switch. Corrective actions include breaker auxiliary switch inspections, strapping the switch in place to add additional support, and to review the Part 21 for long term repair.

This event was determined to be reportable pursuant to 10.CFR50.73(a)(2)(v) and (a)(2)(i)(a). The safety significance was determined to be minimal.

PLANT AND SYSTEM IDENTIFICATION:

General Electric - Boiling Water Reactor - 2527 Mwt rated core power.

Energy Industry Identification System (EIIS) codes are identified in the text as [XX] and are obtained from IEEE Standard 805-1984, IEEE Recommendation Practice for System Identification in Nuclear Power Plants and Related Facilities.

EVENT IDENTIFICATION:

Unit Shutdown due to Degradation of Auxiliary Switches in 4kV Circuit Breakers Caused by Design/Manufacturing Deficiency

A. PLANT CONDITIONS PRIOR TO EVENT:

Unit: 2(3) Event Date: 04/10/97 Event Time: 1940

Reactor Mode: 1(5) Mode Name: Run(Refuel) Power Level: 100(0)

Reactor Coolant System Pressure: 1000(0) psig

B. DESCRIPTION OF EVENT:

This report is being submitted in accordance with 10CFR50.73(a)(2)(v), which requires the reporting of any event or condition that alone could have prevented the fulfillment of a safety function of structures or systems that are needed to: a) shutdown the reactor and maintain it in a safe shutdown condition, b) remove residual heat, c) control the release of radioactive material, or d) mitigate the consequences of an accident. In addition, 10CFR50.73(a)(2)(i)(a), completion of a nuclear plant shutdown required by the Plant's technical specifications.

At approximately 1940 hours on April 10, 1997, with Unit 2 in Mode 1, a visual inspection of the Golden Gate 4kV feed breaker [EB] from Bus 23 to Bus 23-1 revealed that the Breaker's Merlin Gerin auxiliary switch mounting plastic had broken, resulting in the switch being detached from its mounting plate. This condition left the switch no means of physical support. Thus, there was no immediate assurance that the switch would have operated properly (i.e., changed states), if the breaker were to be cycled open or closed.

In addition, it was determined that the Merlin Gerin type auxiliary switch is susceptible to cracking of the switch mounting plastic. Cracking of the switch mounting plastic was viewed as a precursor to the switch completely breaking free from the mounting plate potentially resulting in switch non-performance. Conservatively, all equipment utilizing the Golden Gate type breaker with a Merlin Gerin auxiliary switch were declared inoperable at 2112 on April 10, 1997. This rendered various systems inoperable, Containment Cooling Service Water (CCSW) [BO] being the most limiting. Shutdown of Unit 2 commenced at 2226 on April 10, 1997. Unit 3 was already in the refueling mode, Mode 5, for a scheduled refueling outage. An Event Notification System (ENS) phone call (event number 32129) was performed at 2320 on April 10, 1997.

Background

During the period between 1994 and 1996, Dresden installed replacement breakers in several 4kV switchgear applications. The breakers were installed in Units 2 and 3 4kV Safety-Related Buses 23 24, 33, 34, and Station Blackout (SBO)[EK] Buses 61 and 71. The replacement breakers were manufactured under contract to Golden Gate Switchboard Company, by their supplier Pacific Breaker Systems, Incorporated (formerly Circuit Breaker Systems, Incorporated). The section within the breaker that includes the auxiliary switches was provided by Merlin Gerin.

Each of the 4kV breakers has two auxiliary switches which include "normally open" and "normally closed" contacts that exchange states as the breaker opens and closes. The contacts are used both for internal purposes (e.g., interlocks between the "open coil" and the "close coil" of the breaker controller) and external purposes (e.g., remote status lights, indicators or interlocks with other 4kV breakers). If the auxiliary switch breaks free of its mounting, its contacts may not be in the correct position (i.e., the contact position that corresponds to the position of the breaker). This mis-correlation could have an adverse affect not only on control of the breaker itself, but also the status of breaker interlocks and interfaces with other plant equipment.

Discovery of Failed Switches and Shutdown of Dresden Unit 2

On April 4, 1997, Quad Cities Station (docket numbers 05000254 & 265) notified Dresden Engineering personnel (non-licensed) that they had discovered failures of the auxiliary switches in three breakers (reference LER 1-97-011, docket number 05000254). The failures consisted of the complete breakage of the switch mounting plastic resulting in the switch being detached from its mounting plate, bring into question whether the switch would/could perform properly. Of the failures noted, one was discovered at the factory and two at the Quad Cities Station; none had yet been placed into service. Because the failures were similar in nature, a potential common mode failure was suspected.

Based on the Quad Cities identified failures, Dresden Station initiated an inspection of accessible affected breakers on April 7, 1997, and found 4 breaker auxiliary switches with indication of possible cracking on the switch mounting plastic. An Operability Evaluation in accordance with station procedures was initiated for the Merlin Gerin auxiliary switches on April 8, 1997. As part of this evaluation, an expanded inspection of the Merlin Gerin auxiliary switches associated with the 4kV switchgear breakers in Buses 23, 24, 33, 34, 61 and 71 was commenced (all applications using the Merlin Gerin switch). The initial results of these breaker inspections revealed only minor indications of hairline cracks in the switch mounting plastic on approximately 25 percent of the switches inspected, but no indication of switch separation from its mounting plate.

One of the Golden Gate 4kV feed breakers, with the Merlin Gerin auxiliary switch, was sent to ComEd's offsite testing facility on April 9, 1997. This sample breaker had indications of hairline cracks in the plastic portion of the auxiliary switch similar to the indications which had been observed on in-service breakers at Dresden. Quad Cities Station had also sent a breaker which exhibited a similar failure. Testing conducted on the breakers were unable to duplicate the failure and the breakers and auxiliary switches performed

properly. In one test, a breaker which contained a switch which was damaged much more severely than the switches identified as of April 9, 1997, was cycled 40 times (open/close cycles). The breaker operated normally during this test with no indications of additional switch degradation.

At the same time of this testing, inspections of all Merlin Gerin breakers was proceeding at Dresden Station. On April 10, 1997, when the feed breaker from Bus 23 to Bus 23-1 was opened for visual inspection, a complete separation of the auxiliary switch from its mounting plate was discovered. The plastic portions of the switch that are held by mounting bolts to a metal plate had cracked and broken free. This condition left the switch no means of physical support. This failure was similar to the failures which previously had been only observed on pre-service breakers. Thus, on April 10, 1997, no technical basis could be immediately formulated to determine whether any other breaker was at risk of imminent failure. Therefore, at 2112 hours on April 10, 1997, any equipment that utilized this type of breaker was conservatively declared inoperable. At 2236 hours, a shutdown of Unit 2 was commenced.

Following unit shutdown, as part of the investigation of the failed auxiliary switch on the feed breaker from Bus 23 to Bus 23-1, it was cycled (open and closed) three times on April 14, 1997. Each time, the breaker operated correctly. A mechanical "flag" that displays (locally) the position of the breaker did not stay aligned during the three cycles, however, remote status light indications (i.e., in the Control Room) did display the correct breaker position. Since the light circuit is in series with the closed and trip coil of the breaker, proper indication lighting demonstrates the auxiliary switch is properly changing state and in-line with actual breaker position. The proper light indication provides a high degree of confidence that the breaker would have performed its function, if required. Additionally, the interlocks that this breaker provides to the Diesel Generator output breaker are provided by a set of switch contacts which are mounted in the breaker cubicle and not subject to the observed failure. Therefore, subsequent to the shutdown of Unit 2, it was determined that the breaker which feeds bus 23-1 from bus 23 would have performed its design function.

Design for a Short Term Repair

As an immediate corrective measure, it was determined that a strap could be placed around the auxiliary switch to hold it in place. The function of the strap would be to add additional structural support to the switch mounting, and to secure the switch in case the auxiliary switch mounting plastic broke.

In order to verify the effectiveness of this measure, a breaker was tested to conditions bounding the expected number of operations for one fuel cycle, including a seismic test. Throughout this test, the breaker operated normally.

On April 11, 1997, Golden Gate Switchboard Company issued a Notification of Potential Defect under the Requirements of 10CFR21.21(b).

No other system or component inoperabilities have been identified which contributed to the event.

C. CAUSE OF THE EVENT:

The root cause of this event is design/manufacturing deficiency of the auxiliary switch (NRC cause code B). There is a design weakness in the auxiliary switch mounting that manifests itself in cracks in the switch mounting channels. In extreme cases, sufficient cracking can occur to cause the switch to separate from the mounting plate with the possible result of breaker failure.

D. SAFETY ANALYSIS:

The breaker which was observed to have the auxiliary switch broken free of its mounting plate is the feed to bus 23-1 from bus 23. Proper operation of this breaker is essential to ensure that offsite power is available to Division 1 loads on bus 23-1. Additionally, the breaker must open on a loss of power to bus 23-1 prior to the Diesel Generator automatically closing onto the bus. Following the identified auxiliary switch failure, the breaker was successfully cycled in the switchgear three times. This effort provided a degree of confidence that, despite the failed mounting of the auxiliary switch, the breaker would have operated properly if called upon to perform its safety-related function during a design basis accident (DBA).

All other observed off-normal indications were minor hairline cracks in the auxiliary switch mounting plastic. In repeated laboratory testing of the breakers, there have been no indications that the size of the hairline cracks has increased. The laboratory facility was unable to duplicate the failure condition of an auxiliary switch broken free of its mounting, nor to induce any other failure of the breakers. This testing process provided a degree of confidence that any of the remaining breakers' auxiliary switches (i.e., for which the only indications of degradation were hairline cracks in the plastic) would have been unlikely to degrade further (i.e., to a complete disconnection from their mounting) over the next operating cycle.

However, if the Bus 23 to 23-1 breaker was unable to perform its function, a loss of the normal or emergency AC feed to Division 1 loads on bus 23-1 could have occurred. Mitigating this would be the availability of Emergency Diesel Generators 2 and the ability to crosstie off-site power from Unit 3. In addition, Division 2 off-site power would be available.

Because the feed breaker from Bus 23 to Bus 23-1 was tested and found able to perform its function and the availability of alternate offsite power feeds and the Emergency Diesel Generator, the safety consequence of this event is considered to be minimal.

E. CORRECTIVE ACTIONS:

1. All equipment that utilized a breaker with a Merlin Gerin auxiliary switch was conservatively declared inoperable, and a shutdown on Unit 2 was completed. (Complete)

2. All 4 kV breakers which utilize a Merlin Gerin auxiliary switch were inspected for broken switch mounting plastic. Only the Bus 23 to 23-1 breaker was identified with broken switch mounting plastic. (Complete)

3. The breaker that was identified with broken switch mounting plastic has been removed from service. (Complete)

4. Degraded breaker auxiliary switch testing was performed at ComEd's offsite testing facility. This testing identified that the breakers could have performed their function with cracking present in the switch mounting plastic and that the design change to install a strap on the auxiliary switches would be effective. (Complete)

5. Straps were installed on Unit 2 breakers on Busses 23, 24, and 61, prior to startup from the current forced outage. (Complete)

6. Engineering has implemented a quarterly review of the number of breaker cycles and spring discharges to ensure that the number of cycles for which the repair has been tested and qualified is not exceeded on Unit 2 & 3 4kV breakers in Buses 23, 24, 33, 34, 61, and 71. (Predefine surveillance Complete)

7. Straps will be installed on Unit 3 breaker auxiliary switches on Busses 33, 34, and 71, prior to startup from the current refueling outage (D3R14). (2371809700801)

8. On April 11, 1997, Golden Gate Switchboard Company issued a Notification of Potential Defect under the Requirements of 10CFR21.21(b). The final report will be reviewed by ComEd to address a permanent repair to the auxiliary switch mounting. (2371809700802)

F. PREVIOUS SIMILAR OCCURRENCES:

None

G. COMPONENT FAILURE DATA:

Component Description: 4kV Breaker Auxiliary Switch

Manufacture: Merlin Gerin

Model Number: (Fluarc FG2) AMHG

Part Number: 7183404A