Commonwealth Edison
Dresden Nuclear Power Station
R.R. #1
Morris, Illinois 60450
Telephone 815/942-2920

September 21, 1992

CWS LTR #92-576

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Attached please find Licensee Event Report #91-013-01, Docket #050249. This report is submitted to provide further information clarifying the nature of the root cause of the event.

Charles W. Schroeder 9/25/92
Station Manager
Dresden Nuclear Power Station

CWS/jmt

Enclosure

cc: A. Bert Davis, Regional Administrator, Region III
NRC Resident Inspector's Office
File/NRC
File/Numerical

(ZDVR/372)

IE22
1/1

LICENSEE EVENT REPORT (LER)

Form Rev 2.0

| Facility Name (1) | Docket Number (2) | Page (3) |
|---|---|---|
| Dresden Nuclear Power Station, Unit 3 | 0 5 0 0 0 2 4 9 | 1 of 0 6 |

Title (4) 250 Volt DC Battery Discharge Voltage Decreased Below Design Basis Limit Due to Inaccurate Vendor Data

| 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 Names | Docket Number(s) |
| 1 0 | 1 4 | 9 1 | 9 1 | 0 1 3 | 0 1 | 1 1 | 1 2 | 9 1 | Dresden Unit 2 | 0 5 0 0 0 2 3 7 |

| OPERATING MODE (9) | N |
|---|---|
| POWER LEVEL (10) | 0 0 0 |

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10CFR (Check one or more of the following) (11)

| | | | |
|---|---|---|---|
| ___ 20.402(b) | ___ 20.405(c) | ___ 50.73(a)(2)(iv) | ___ 73.71(b) |
| ___ 20.405(a)(1)(i) | ___ 50.36(c)(1) | ___ 50.73(B)(2)(v) | ___ 73.71(c) |
| ___ 20.405(a)(1)(ii) | ___ 50.36(c)(2) | ___ 50.73(a)(2)(vii) | ___ Other (Specify |
| ___ 20.405(a)(1)(iii) | ___ 50.73(a)(2)(i) | ___ 50.73(a)(2)(viii)(A) | in Abstract |
| ___ 20.405(a)(1)(iv) | X 50.73(a)(2)(ii) | ___ 50.73(a)(2)(viii)(B) | below and in |
| ___ 20.405(a)(1)(v) | ___ 50.73(a)(2)(iii) | ___ 50.73(a)(2)(x) | Text) |

LICENSEE CONTACT FOR THIS LER (12)

| Name | TELEPHONE NUMBER |
|---|---|
| | AREA CODE |
| Vikram Kanal , Technical Staff System Engineer Ext. 2349 | 8 1 5 9 4 2 -2 9 2 0 |

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

| CAUSE | SYSTEM | COMPONENT | MANUFAC-TURER | REPORTABLE TO NPRDS | | CAUSE | SYSTEM | COMPONENT | MANUFAC-TURER | REPORTABLE TO NPRDS | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |
| | | | | | | | | | | | |

| 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 fifteen single-space typewritten lines) (16)

On October 14, 1991, with Unit 3 in a refuel outage, the Unit 3 250 volt battery was removed from service in preparation for a discharge test as required by Technical Specification 4.9.A.3. Unit 2 was operating at power at this time. This placed Unit 2 in a 7 day Limiting Condition for Operation, in accordance with Technical Speficiation 3.9.B.4.a. During the first minute of the service test, the battery voltage dropped below the acceptance criterion of 210 volts. The voltage stabilized above 210 volts for the remainder of the four-hour test. A subsequent performance test indicated a battery capacity of 96% of rated value. A comprehensive review of the tested load profile was begun. Since resolution of the issue was still pending, and battery operability had not been re-instated, an orderly shutdown of Unit 2 was initiated on October 21, 1991. A review of the Unit 3 250 volt battery inter-tier cable resistances indicated that their resistances had increased since the replacement battery was originally installed in May, 1988. The inter-tier cables were replaced and their resistances were verified satisfactory. An abbreviated one minute service test was then performed on October 27, 1991; the battery voltage acceptance criterion was again not met. On November 1, 1991, a service test was successfully performed utilizing a revised load profile. The root cause of this event is attributed to inaccurate vendor one minute discharge curves. The use of this inaccurate information has been previously reported by the Nuclear Engineering Department per 10CFR21. The safety significance of this event is mitigated by availability of redundant equipment powered by separate sources. The safety significance of this event is mitigated by availability of redundant equipment powered by separate sources. Corrective actions include the installation of four more battery cells to the existing 116 cells of the 250 volt batteries and the installation of an auxiliary relay in the High Pressure Coolant Injection logic circuit. This is the first event of this type at Dresden Station.

PLANT AND SYSTEM IDENTIFICATION:

General Electric - Boiling Water Reactor - 2527 MWt rated core thermal power

Nuclear Tracking System (NTS) tracking code numbers are identified in the text as (XXX-XXX-XX-XXXXX)

EVENT IDENTIFICATION:

250 Volt DC Battery [EJ] Discharge Voltage Below Design Basis Limit Due to Inaccurate Vendor Data

A. CONDITIONS PRIOR TO EVENT:

Unit: 3 Event Date: October 14, 1991 Event Time: 2357 Hours

Reactor Mode: N Mode Name: Shutdown Power Level: 0%

Reactor Coolant System (RCS) Pressure: 0 psig

B. DESCRIPTION OF EVENT:

At 1042 hours on October 14, 1991, with Unit 3 in a refuel outage with all fuel removed, the Unit 3 250 volt battery was removed from service in preparation for a discharge test as required by Technical Specification (TS) 4.9.A.3. Unit 2 was operating at power at this time. This placed Unit 2 in a 7 day Limiting Condition for Operation (LCO) in accordance with Technical Speficication 3.9.B.4.a. Unit 2 Reactor Building 250 volt DC loads, which are normally fed from the Unit 3 250 volt battery (Refer to Figure 1), were transferred to the Unit 2 250 volt battery. A discharge service test was performed on the Unit 3 250 volt battery in accordance with Dresden Electrical Surveillance Procedure (DES) 8300-15, Unit 3 250 Volt Station Battery Service Test. This four-hour test challenges the ability of the 250 volt battery to supply the expected loads during a postulated Loss of Coolant Accident (LOCA) by applying a varying profile of loads over time, which simulates design basis accident conditions. At 2357 hours on October 14, 1991, during the first minute of the service test, the battery voltage decreased to 209.1 volts, which is below the established acceptance criterion of 210 volts, when subjected to a load of 1017 amperes. A 10CFR 50.72 notification was made at 0215 hours on October 15, 1991. The test was continued to completion, with the 210 volt acceptance criterion met for the remainder of the test.

At 2100 hours on October 18, 1991, following recharging of the battery, a performance discharge test was conducted in order to measure battery capacity. The test demonstrated a battery capacity of 96% of rated. The previous performance test, conducted in December, 1989, demonstrated a capacity of 102% of rated.

The Service test load profile was reviewed to assure that the load combinations used were realistic. The sequence of the loading was reviewed against FSAR accident scenarios and the 250V battery design basis; to assure that possible combinations had been taken into account. Actions to resolve the service test failure and battery operability status were in progress when the seven day out-of-service period allowed by Technical Specification (TS) 3.9.B.4.a expired on October 21, 1991. An orderly shutdown of Unit 2 was initiated at 1040 hours. Cold shutdown for Unit 2 was achieved at 1030 hours on October 22, 1991.

Review of Unit 3 250 volt battery inter-tier cable resistances indicated that they had increased slightly since installation of the replacement battery in May, 1988. The Unit 3 250 volt battery inter-tier connectors were then replaced, and at 1030 hours on October 27, 1991, an abbreviated service test with a first minute loading of 1017 amperes was performed. During the course of the first minute, the voltage decreased to slightly less than one volt below the acceptance criterion for approximately 22 seconds, and subsequently recovered to above 210 volts for the remainder of the minute.

Numerous discussions were conducted between the Station and the CECo. Nuclear Engineering Department (NED) to finalize an acceptable and correct load profile. In addition, several meetings and discussions were held with NRR, Region III, and the Resident Inspectors relative to 250V battery sizing, testing, and actual load profile. The final load profile approved and the assumptions used, were the culmination of these meetings and discussions. A bounding - case load profile was created that bounds numerous LOCA, Loss-of-Offsite Power (LOOP), and equipment failure combination scenarios for the 250V batteries. The acceptance of the load profile and determination of battery operability are documented in On-Site Review 91-37.

Following recharging of the battery, at 1222 hours on November 1, 1991, a service test was performed utilizing the revised load profile provided by the NED. The battery was subjected to a load of 911 amperes during the first minute. The battery maintained a voltage of 211.6 volts during the first minute and maintained voltage of greater than 210 volts when subjected to various loads during the remainder of the four-hour test. The Unit 2 and Unit 3 250V batteries were declared operable on November 9, 1991.

C. APPARENT CAUSE OF EVENT:

This report is being submitted in accordance with the requirements of 10CFR50.73(a)(2)(ii)(B), which requires the reporting of any condition outside the design basis, since the battery voltage did not meet the acceptance criterion.

The root cause of the event was determined to be inaccurate one minute discharge characteristics curves for NCX-21 type battery cells which are used as a design input for battery sizing calculations. NED and the Battery manufacturer developed a test plan to validate the published one minute rating for these type of battery cells to an end voltage of 1.81 volts per cell (VPC) at 77 degrees F. The results of this test indicated that when a battery is subjected to loads of high magnitude, the battery voltage drops below its rated voltage and then recovers to its rated voltage typically in a short time. This is known as the coup-de-fouet effect, and is a typical response of lead acid batteries. From the test plan the battery manufacturer concluded that this type of battery should be rated for 1050 amperes at the one minute rate to an end voltage of 1.81 vpc at 77 degrees F. This is a deviation from the previously published rating of 1264 amperes.

D. SAFETY ANALYSIS OF EVENT:

Dresden Station utilizes two 250 volt batteries, each with an associated charger. Additionally, there is a third battery charger which has the capability to be connected to either battery bus (Refer to Figure 1). Under the normal 250 volt DC distribution system configuration, the Unit 2 battery (and associated charger) supplies power to the Unit 2 Turbine Building 250 volt DC loads and the Unit 3 Reactor Building 250 volt DC loads, while the Unit 3 battery (and associated charger) supplies the Unit 3 Turbine Building 250 volt DC loads and the Unit 2 Reactor Building 250 volt DC loads.

The 250 volt DC system provides power to the following safety-related systems:

a. High Pressure Coolant Injection (HPCI) [BJ] system

b. Isolation Condenser [BL] system.

c. 250 volt DC Motor Operated Valves (MOVs) functioning as Primary Containment Isolation Valves (PCIVs) in the following systems:

   i. Main Steam [SB] Line Drains

   ii. Shutdown Cooling [BO]

   iii. Reactor Water Cleanup [CE]

   iv. Isolation Condenser [BL]

   v. HPCI [BJ]

d. A backup power source to the Essential Service Uninterruptible Power Supply (UPS) [EF] .

In the unlikely event of a failure of the 250 volt DC system, the HPCI and Isolation Condenser systems would become inoperable. The HPCI system is credited in the mitigation of small break LOCAs. The Automatic Depressurization System (ADS) Main Steam Relief Valves act as a backup to HPCI to rapidly depressurize the reactor to the suppression pool and allow low pressure Emergency Core Coolant Systems (ECCS) to inject water into the reactor. The ADS system is not dependent on 250 volt DC power. HPCI and the Isolation Condenser can also be used for pressure control and decay heat removal during events which close the Main Steam Isolation Valves (Primary Containment Group I Isolation [JM] ). The Main Steam Relief valves in the manual mode are a backup system for reactor pressure control. The Main Steam Relief Valves are not dependent on 250 volt DC power. The Condensate/Feedwater [SJ] Systems and the Control Rod Drive System (CRD) [AA] provide a non-safety source of high pressure makeup water for reactor inventory control. If required, low pressure ECCS is available once the reactor is depressurized.

Several of the PCIVs associated with group isolation signals are in-series MOVs. To provide redundancy in those cases, one of the two MOVs in series is powered from a 480 volt AC [ED] source and the other MOV is powered from a 250 volt DC source. This is the case for the Main Steam Line Drains, Shutdown Cooling, Reactor Water Cleanup, HPCI, and Isolation Condenser lines. In the unlikely event of a line break in one of the above systems, one of the two PCIVs would have to close to isolate the break. If there were a concurrent 250 volt DC power failure, the open 250 volt DC PCIVs would fail to close; however, the 480 volt AC MOVs are independent of the 250 volt DC MOVs and would close. The concurrent failures of a pipe, the 250 volt DC power source, and the associated 480 volt AC MOV are extremely unlikely.

The Essential Service Bus provides control power to the Standby Gas Treatment System [BH]. The Essential Service Bus is powered from an UPS. The preferred source of power is 480 volts AC power from Bus 39 which is powered from emergency bus 34-1 [EK]. The 250 volt battery provides a backup power source. In the event of failure of both emergency bus 34-1 and the 250 volt battery the Essential Service Bus is automatically powered from Motor Control Center (MCC) 38-2, which is powered from emergency bus 33-1.

E. CORRECTIVE ACTIONS:

1. The immediate corrective actions were to replace the inter-tier connectors. The resistances of these connectors were then verified to be satisfactory.

2. Modification M12-2(3)-91-021 has been installed to add four more cells to the existing 116 cells of the Unit 2 and 3 250 volt battery (249-200-91-08402). The purpose of these modifications were to increase the capacity of the 250 V Battery system.

3. Modification M12-2(3)-91-022 has been installed to add an interposing relay, 902(3)-39/2330-A1, in series with existing HPCI relays 2330-112A and 2330-100A, in order to achieve an approximate 40 millisecond delay in the close actuation logic of HPCI surveillance flow test valve 2301-10. The relay provides a delay in order that the 2301-10 valve and HPCI injection valve 2301-8 do not operate simultaneously. These modifications have been performed on both units 2 and 3 (249-200-91-08403). The purpose of the auxiliary relay is to enhance the load profile of the 250 volt batteries in such a way that the peak discharge current value is reduced.

4. The following actions were also initiated concerning the actuation point of the main turbine [TA] emergency bearing oil pump (EBOP), which is a high-current non-safety related 250 volt DC load:

   a. Operating procedures were revised to delete the prior practice of manually starting the EBOP after a turbine trip. This will allow the EBOP to automatically start, if necessary under loss of normal AC power conditions, approximately six minutes after the turbine trip upon receipt of its decreasing turning gear oil pump pressure signal.

   b. Modifications were initiated for installation of a separate non-safety related battery for the main turbine EBOP. These Modificatons are planned for the upcoming Unit 2 and Unit 3 refuel outages (D2R13 and D3R13) (249-200-91-08404).

5. Based on completion of the above modifications, a new load profile was generated and appropriate procedures are being revised (249-200-91-08405).

6. A Technical Specification change was initiated in May, 1992 to clarify the requirements for battery service and performance testing (249-200-91-08406).

7. A notification concerning the deviation in the published specifications, was made in accordance with the requirements of 10 CFR Part 21, Section 21.1.(b), 21.3a(3), and 21.3.d(4).

F. PREVIOUS OCCURENCES:

| LER/Docket Numbers | Title |
|---|---|
| None | N/A |

G. COMPONENT FAILURE DATA:

| Manufacturer | Nomenclature | Model Number | Mfg. Part Number |
|---|---|---|---|
| GNB Batteries Inc. | 250 Volt Battery | NCX-21 | N/A |

A review of 411 Nuclear Plant Reliability Data System (NPRDS) records revealed no instances of a similar occurrence.

FIGURE 1

250 VDC SYSTEM KEY DIAGRAM