

Commonwealth Edison Company
Braidwood Generating Station
Route #1, Box 84
Braceville, IL 60407-9619
Tel 815-458-2801

ComEd

April 8, 1996
BW/96-0048

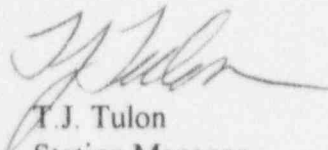
Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Gentlemen:

The enclosed Licensee Event Report from Braidwood Generating Station is being transmitted in accordance with the requirement of 10 CFR 50.73(a)(2)(i)(A), which requires a 30-day report.

This report is number 96-003-00, Docket No. 50-456.

Yours truly,


T.J. Tulon
Station Manager
Braidwood Nuclear Station

TJT/PS/ema
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Encl: Licensee Event Report
No., 456-96-003-00

cc: NRC Region III Administrator
NRC Resident Inspector
INPO Record Center
ComEd Distribution Center
I.D.N.S.
I.D.N.S. Resident Inspector

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LICENSEE EVENT REPORT (LER)

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33) U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT

FACILITY NAME (1)

Braidwood Unit 1

DOCKET NUMBER (2)

05000456

PAGE (3)

1 OF 7

TITLE (4)

Forced Unit One shutdown caused by 125V DC ESF Battery 112 failing to meet capacity requirements of Technical Specifications due to equipment degradation.

| 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 |
| 03 | 08 | 96 | 96 | 003 | 00 | 04 | 08 | 96 | FACILITY NAME | DOCKET NUMBER |
| OPERATING MODE (9) | | 1 | THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11) | | | | | | | |
| POWER LEVEL (10) | | 100 | 20.2201(b) | | | 20.2203(a)(2)(v) | X | 50.73(a)(2)(i) | 50.73(a)(2)(viii) | |
| | | | 20.2203(a)(1) | | | 20.2203(a)(3)(i) | | 50.73(a)(2)(ii) | 50.73(a)(2)(x) | |
| | | | 20.2203(a)(2)(i) | | | 20.2203(a)(3)(ii) | | 50.73(a)(2)(iii) | 73.71 | |
| | | | 20.2203(a)(2)(ii) | | | 20.2203(a)(4) | | 50.73(a)(2)(iv) | OTHER | |
| | | | 20.2203(a)(2)(iii) | | | 50.36(c)(1) | | 50.73(a)(2)(v) | Specify in Abstract below or in NRC Form 366A | |
| | | | 20.2203(a)(2)(iv) | | | 50.36(c)(2) | | 50.73(a)(2)(vii) | | |

LICENSEE CONTACT FOR THIS LER (12)

NAME

Carl Dunn, Regulatory Assurance

TELEPHONE NUMBER (include Area Code)

(815) 458-2801 x3210

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 |
|-------|--------|-----------|--------------|---------------------|-------|--------|-----------|--------------|---------------------|
| X | EJ | BTRY | A622 | Y | | | | | |

SUPPLEMENTAL REPORT EXPECTED (14)

| | | | | | | |
|---|---|----|---------------------|-------|-----|------|
| YES (If yes, complete EXPECTED SUBMISSION DATE). | X | NO | EXPECTED SUBMISSION | MONTH | DAY | YEAR |
|---|---|----|---------------------|-------|-----|------|

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

On 10/30/95 Battery 112, one of two Unit One batteries, failed a modified performance test. The test was determined to be invalid due to a failure to meet all initial conditions. On 11/6/95, a service test was successfully performed to prove operability. Additional regulatory commitments were made to perform individual testing of three cells by April 1996 and another performance test during the next outage of sufficient length. On 3/6/95 an individual cell test was performed on cell 32 with a resulting capacity of 62%. On 3/8/96 cell 7 was tested with a capacity of 63%. On 3/8/96 at 0820 Battery 112 was declared inoperable, LCOAR 8.2.1-1a entered, and Unit One shutdown started at 0920. At 0938 a one hour ENS phone call was made per 10CFR50.72(b)(1)(i)(A). Further tests were conducted and confirmed degraded capacity. On 3/15/96 Battery 112 passed a service test but failed a performance test with a capacity of 59%. The decision was made to replace Battery 112 with new cells available within ComEd. Replacement was completed on 3/19/96. A service test was successfully completed on 3/20/96, Battery 112 was declared operable, LCOAR was exited and preparations made for Unit One startup. The cause of the event was equipment degradation. Corrective actions included battery replacement, modifying recharge methodology, establishing on line discharge criteria, and further testing.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT

| FACILITY NAME (1) | DOCKET NUMBER (2) | LER NUMBER (6) | | | PAGE (3) |
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| | | | -- | | |

TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

A. PLANT CONDITIONS PRIOR TO EVENT:

UNIT: Braidwood Unit One EVENT DATE: 03/08/96
 EVENT TIME: 0820
 MODE: 1 RX POWER: 100%
 RCS [AB] TEMPERATURE/PRESSURE: NOT/NOP

B. DESCRIPTION OF EVENT:

There were no systems or components inoperable at the beginning of this event that contributed to the severity of the event.

The following is background information to explain terminology used below in the narrative:

- This event involves a Unit One 125 volt battery bank (Battery 112) failing several single cell modified performance tests, resulting in a forced unit shutdown.
- The original Braidwood 125 volt batteries (rectangular cell, vertical plates, lead-acid) experienced degradation. It was determined that the batteries were nearing the end of their useful life and a decision was made to replace them. Braidwood installed a modification to switch to the AT&T round cell batteries (horizontal plates, high specific gravity, lead-acid) as a replacement. These modifications were completed March 1994 for Unit One and October 1994 for Unit Two.
- A service test for Battery 112 consists of a one hour duty cycle discharge at 564 amps for one minute and then 390 amps for 59 minutes.
- A performance discharge test consists of a constant specified discharge rate until 1.86 volts per cell is reached.
- A modified performance discharge test is similar to the performance test but with two specified discharge rates that envelope the service test profile. The discharge is continued until 1.86 volts per cell is reached.

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TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

B. DESCRIPTION OF EVENT (continued)

- The Technical Specification requirements discussed during the narrative refer to 4.8.2.1.2.d. and e. - Each 125 volt battery bank and its associated charger shall be demonstrated operable: (d) At least once per 18 months, during shutdown, by verifying that the battery capacity is adequate to maintain in operable status all of the actual or simulated emergency loads for the design duty cycle when the battery is subject to a battery service test. (e) At least once per 60 months, during shutdown, by verifying that the battery capacity is at least 95% of the manufacturer's rating when subjected to a performance discharge test or a modified performance discharge test. The modified performance discharge test and the performance discharge test may be performed in lieu of the battery service test.

On 10/30/95 during a battery modified performance test (1BwVS 8.2.1.2.e-112, Unit One 125 Volt Battery Bank 112 Operability Capacity Test), it was determined that Battery 112 capacity was 91.7% which did not meet the 95% capacity requirement of 4.8.2.1.2.e. This surveillance was determined to be invalid due to a failure to meet all the initial conditions for performing the surveillance. These conditions required the battery to be maintained on a constant float for 30 days prior to the surveillance being performed. On 10/24/95, an inadvertent discharge of Battery 112 of approximately 240 amp hours occurred over a two hour period. After the discharge, Battery 112 had been placed on a float until the 10/30/95 surveillance.

In order to prove operability after the performance test, it was decided that a battery service test would be performed. After the modified performance test, Battery 112 was recharged by placing on a float until current decreased to less than 5 amps, placed on a boost charge at 2.5 volts per cell for 23 hours, and then placed on a float. Battery 112 remained on a float until 11/6/95 when a battery service test (4.8.2.1.2.d.) was performed. Battery 112 passed this surveillance and was declared operable. Battery 112 was then recharged in a manner similar to the previous recharge, except the boost portion of the charge lasted for 10.5 hours. After completion of the service test, additional regulatory commitments were made. These commitments were: to test a representative number of individual cells (3) by 4/1/96; and to perform another modified performance test during the

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B. DESCRIPTION OF EVENT (continued)

next outage of sufficient duration.

On 12/12/95, an inadvertent discharge of approximately 4 amp hours occurred due to a failed amplifier card in the battery charger. On 1/5/96, another inadvertent discharge of approximately 14 amp hours occurred due to failed amplifier and current limiter cards in the battery charger. In preparation for single cell testing, two spare cells were charged and individual cell modified performance tests were successfully conducted. On 3/6/96, as part of the station's commitment for Battery 112, BwVS 820-1, 125V ESF Battery Single Cell Discharge Testing, was performed on cell 32. This test resulted in a cell capacity of 62%. Questions arose concerning test equipment and cell 32 was replaced and recharged. Another test was performed on the removed cell on 3/7/96. Capacity was determined to be 46%. Cell 32 was again recharged. On 3/8/96 BwVS 820-1 was performed on cell 7 resulting in a capacity of 63%. Based on the failed tests of cells 7 and 32, Battery 112 was declared inoperable at 0820 on 3/8/96 and LCOAR 8.2.1-1a was entered. At 0920 a shutdown of Unit 1 was started. At 0938 a one hour ENS phone call was made in accordance with 10CFR50.72(b)(1)(i)(A). Subsequent to the Unit One shutdown, a series of single cell modified performance tests were conducted on cells 7, 32, and 27, all of which confirmed degraded capacity. On 3/15/96 a modified performance test using the service test load profile was conducted on Battery 112. Battery 112 passed the service test but failed the modified performance test with a capacity of 59%. These tests helped validate the single cell test methodology and results. After completion of these tests the decision was made to replace Battery 112 with new cells intended for installation at Byron Nuclear Station.

Battery 112 cell removal was completed on 3/17/96. Fully charged replacement cells from Byron Station were installed on 3/19/96. After installation, the battery was placed on a float charge in preparation for service testing. On 3/20/96, a service test was conducted on Battery 112 with satisfactory results. Battery 112 was recharged by constant current methodology on 3/22/96 and the battery was placed on a float charge. On 3/22/96, 1BwOS 8.2.1.2.b-2, Unit One 125V DC ESF Battery and Charger 112 Operability Quarterly Surveillance, was successfully completed. On 3/22/96

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TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

B. DESCRIPTION OF EVENT (continued)

at 1335, Battery 112 was declared operable, LCOAR 8.2.1-1a was exited, and preparations were begun for Unit One startup.

Potential concerns for Batteries 111, 211, and 212 were also addressed during the course of this investigation. All three of these batteries had successful acceptance tests (at the vendor's facilities) and service tests (after installation) completed. Battery 111 had a successful modified performance test conducted on 10/15/95 with a capacity of 112%. These batteries have not had discharge histories in service similar to the discharges experienced by Battery 112. On 3/28/96, 1BwVS 8.2.1.2.e-212 was performed on Battery 212 with a capacity of 112%. A surveillance on Battery 211 will be performed during the current refueling outage.

This event is being reported pursuant to 10CFR50.73(a)(2)(i)(A) the completion of any nuclear plant shutdown required by the plant's Technical Specifications.

C. CAUSE OF EVENT:

The apparent cause of this event was equipment degradation due to successive significant discharges.

Following the failure of individual cell modified performance tests on Battery 112, cells 32 and 7, a list of six possible root causes for the reduced capacity of those cells was developed. Input included discussions with Commonwealth Edison engineering resources, AT&T-Lucent Technologies representatives, Arizona Public Service battery engineers, and a private contractor (a former AT&T battery design engineer) and an extensive review of records and testing results. These possible causes were:

- Improper charger function adversely affecting state of charge.
- A combination of cell temperature and float voltage causing continuous gassing which might impede plate energy transfer.
- Long boost charges following the October and November 1995 testing causing long term gassing which blocked battery plate energy transfer.

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C. CAUSE OF EVENT (cont.):

- Electrolyte contaminants.
- Successive significant discharges in October and November 1995.
- Recharge methodology.

Each of these six possible causes were investigated to determine its effect on Battery 112 capacity. Based on the ComEd investigations the apparent cause of the Battery 112 degradation is as follows:

Successive significant discharges in October and November 1995. A series of successive discharge tests of six strings of L1SH round cells was performed by AT&T-Lucent Technologies at Conshohocken, Pennsylvania between October 1995 and February 1996. This testing, in support of Arizona Public Service, clearly identified that successive full capacity discharges resulted in capacity reductions of 10 to 15% per discharge cycle. Battery 112 experienced significant successive discharge cycles. Both Battery 111 and 212 have passed modified performance tests with 112% capacity and have nearly the identical history as Battery 112 with the exception of 112's three closely spaced discharges occurring in October and November 1995.

D. SAFETY ANALYSIS:

Braidwood Unit One Battery 112 did not meet a Technical Specification (1BwVS 8.2.1.2.e-112) surveillance requirement. However, even in the degraded condition the 112 battery bank was still capable of supplying DC power to its loads. Excess capacity designed into the battery provided sufficient margin to feed its design basis loads. The service tests performed on 11/6/95 and 3/15/96 demonstrated that Battery 112 had sufficient capacity to supply its duty cycle loads. In addition, the associated battery bank charger was operable and supplying DC power to the associated DC bus following the outage except after the two charger trips addressed above. Crosstie capability between the respective Unit One and Unit Two battery banks was also available. Because the service test demonstrated sufficient capacity for Battery 112 to meet its duty cycle loads this event is not safety significant.

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E. CORRECTIVE ACTIONS:

Immediate corrective actions were to declare Battery 112 inoperable and perform a shutdown of Unit One. Additionally, subsequent testing was performed to verify degraded capacity and based on these test results Battery 112 was replaced on 3/19/96. After performing a service test and recharging per manufacturer's recommendations, Battery 112 was declared operable.

A criteria has been established for on line discharges. Potential actions if this criteria is exceeded are still being formulated. This will be tracked to completion by NTS item #456-180-96-00301.

An improved methodology was implemented for recharges after discharges associated with modified performance and service testing. This methodology is based on manufacturer's test data.

Further testing and/or evaluations will be performed on cells removed from Battery 112 to identify any potential manufacturing defects. This will be tracked to completion by NTS item #456-180-96-00302.

Further testing will be performed on additional cells to validate the apparent cause (on line discharge) and the improved recharge methodology. This will be tracked to completion by NTS item #456-180-96-00303.

Braidwood Station will address a potential Part 21 issue with National Technical Services (the battery supplier). This will be tracked to completion by NTS item #456-180-96-00304.

F. PREVIOUS OCCURRENCES:

A review of the RABR database revealed numerous items concerning 125 volt DC batteries but none that concerned reduced capacities.

G. COMPONENT FAILURE DATA:

| MANUFACTURER | NOMENCLATURE | MODEL | MFG PART NO. |
|--------------|--------------|-----------|--------------|
| AT&T | Lineage 2000 | KS-20472, | None |
| | Round Cell | List 1SH | |
| | Battery | | |