

LICENSEE EVENT REPORT (LER)

Facility Name (1) Byron, Unit 1 Docket Number (2) 0 5 0 0 0 4 5 4 Page (3) 1 of 0 4

Title (4) TWO UNIT ONE REACTOR TRIPS CAUSED BY LIGHTNING STRIKES

| 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) |
| 0 7            | 2 9 | 8 7  | 8 7            | 0 1 7             | 0 1             | 0 8             | 0 9 | 8 8  | NONE                          | 0 5 0 0 0 1 1    |
|                |     |      |                |                   |                 |                 |     |      |                               | 0 5 0 0 0 1 1    |

OPERATING MODE (9) THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10CFR (Check one or more of the following) (11)

|                             |  |   |   |  |
|-----------------------------|--|---|---|--|
| POWER LEVEL (10) <u>9 8</u> | <input type="checkbox"/> 20.402(b)         | <input type="checkbox"/> 20.405(c)        | <input checked="" type="checkbox"/> 50.73(a)(2)(iv) | <input type="checkbox"/> 73.71(b)                                      |
|                             | <input type="checkbox"/> 20.405(a)(1)(i)   | <input type="checkbox"/> 50.36(c)(1)      | <input type="checkbox"/> 50.73(a)(2)(v)             | <input type="checkbox"/> 73.71(c)                                      |
|                             | <input type="checkbox"/> 20.405(a)(1)(ii)  | <input type="checkbox"/> 50.36(c)(2)      | <input type="checkbox"/> 50.73(a)(2)(vii)           | <input type="checkbox"/> Other (Specify in Abstract below and in Text) |
|                             | <input type="checkbox"/> 20.405(a)(1)(iii) | <input type="checkbox"/> 50.73(a)(2)(i)   | <input type="checkbox"/> 50.73(a)(2)(viii)(A)       |  |
|                             | <input type="checkbox"/> 20.405(a)(1)(iv)  | <input type="checkbox"/> 50.73(a)(2)(ii)  | <input type="checkbox"/> 50.73(a)(2)(viii)(B)       |  |
|                             | <input type="checkbox"/> 20.405(a)(1)(v)   | <input type="checkbox"/> 50.73(a)(2)(iii) | <input type="checkbox"/> 50.73(a)(2)(x)             |  |

LICENSEE CONTACT FOR THIS LER (12)

Name L. Swes, Assistant Superintendent Operating Ext. 2213

TELEPHONE NUMBER  
 AREA CODE 8 1 5 2 3 4 - 5 4 4 1

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)

Yes (If yes, complete EXPECTED SUBMISSION DATE)  NO

Expected Submission Date (15) Month | Day | Year

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

On 7-29-87 at 2211, and again on 7-31-87 at 0153, lightning strikes were suspected the cause in the de-energization of power supplies in the Unit One rod drive system. This resulted in Unit One reactor trips from high negative flux rate on both dates. Investigative efforts were divided into three areas.

- 1) The rod drive system was thoroughly inspected and tested. No discrepancies were found. A modification was made to the ground scheme on the Unit One Rod Drive cabinets to match the Unit Two configuration. It is theorized this modification will minimize susceptibility of the rod drive system to circulating currents induced by lightning strikes.
- 2) The system ground grid was checked by the Operational Analysis Department. No anomalies were noted.
- 3) The lightning protection systems for both units were walked down and compared. No differences were noted and the precise location of the strike could not be determined.

On 7-13-85 a lightning strike caused a reactor trip and the failure of several other plant instruments. Modifications to the lightning protection system were made as a result of that strike. This was reported in LER 454/85-068.

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LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

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|                   |                               | Year           | Sequential Number | Revision Number |          |    |       |
| Byron, Unit 1     | 0   5   0   0   0   4   5   4 | 8   7          | -   0   1   7     | -   0   1       | 0   2    | OF | 0   4 |

TEXT Energy Industry Identification System (EIIIS) codes are identified in the text as [xx]

A. PLANT CONDITIONS PRIOR TO EVENT:

This LER contains two identical Reactor Trip events occurring within 2 days of each other.

7-29-87 2211  
 Event Date/Time 7-31-87 / 0153

Unit 1 MODE 1 - Power Operation Rx Power 98% RCS [AB] Temperature/Pressure Normal Operating

B. DESCRIPTION OF EVENT:

On 7/29/87 at 2211, and again on 7/31/87 at 0153, lightning strikes are suspected to have caused the de-energization of several Unit One rod drive system power supplies which resulted in subsequent Unit One reactor trips.

On 7/29/87, during a lightning storm, nine out of ten +25 Vdc power supply overvoltage protection circuits actuated (located in the Unit One rod drive (RD) [AA] power cabinets). This actuation resulted in loss of control power to the rod drive system and allowed the rods to fall into the core. The falling of control rods actuated the NIS Power Range Flux Rate High Reactor Trip [IG]. All safety systems responded as expected. Unit Two was unaffected.

On 7/31/87, during a lightning storm, three out of ten +25 Vdc power supply overvoltage protection circuits actuated. This actuation resulted in loss of control power to the rod drive system and allowed the associated rods to fall into the core. Again, the falling rods actuated the Unit One NIS Power Range Flux Rate High Reactor Trip. All safety systems again responded as expected. Again, Unit Two was not affected.

Prior to both reactor trips spurious alarms for the Switchyard Lockout Generator and the Unit Stability Generator [TB] were received.

Both times the Unit was stabilized and recovered in accordance with Station Emergency procedures. No systems or components were inoperable that contributed to these events. An actuation of the reactor protection system is reportable pursuant to 10CFR50.73(a)(2)(iv).

C. CAUSE OF EVENT:

The most probable initiating cause of these events is a lightning strike in the vicinity of Byron Station on both nights creating a voltage surge in the +25 Vdc output of the rod control power supplies. The path of this electrical disturbance is unknown. This surge actuated the overvoltage protection circuit on several power supplies which isolated the output of the supply. The loss of this output voltage to the rod control system caused the rods to fall.

D. SAFETY ANALYSIS:

The health and safety of the plant and public were not affected by these events. All required safety systems actuated as expected. No other equipment important to safety was affected by these storms.

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F. CORRECTIVE ACTIONS:

1. Control Rod Drive

a. Rod Drive Cabinets

1. The tripped power supply overvoltage protection circuits were reset by the Instrument Maintenance Department (IMD) and verified operable.
2. Additionally, the "Rod Urgent Failure" alarm circuit was verified to operate properly by the IMD.
3. Operating personnel verified the operability of the RD system by stepping each bank of rods out and in.
4. Concurrent with operating stepping rods, voltage monitoring equipment on the cabinet grounds and outputs verified no abnormal spiking or perturbations.
5. OAD simulated disturbances on main generator stability and lock-out annunciator circuits and adjusted the sensitivity of the control board annunciator. Concurrently, the RD system voltage monitors recorded no abnormalities. This shows there was no direct relation between spurious alarms received both nights on the generator output and the actual reactor trip.
6. Westinghouse was contacted for information regarding improvements to the Lambda Mfg 25 Vdc power supplies used in RD. Also, Zion Station RD System was compared to Byron's since both stations use the same equipment. No improvements were identified. Westinghouse determined that no actions should be taken to make the power supply less susceptible to voltage surges.
7. It was suggested that some type of low pass filter be installed on the output of the power supply to help eliminate voltage spikes and prevent tripping the O.V. protection circuit. SOAD investigated three options - installation of MOVs and zenor avalanche diodes across the plus and minus inputs to the protector, and the installation of a capacitor between the base and emitter of transistor Q1. The capacitor was found to provide the best protection and was installed in Unit 1 and in the O.V. protection devices in Stores. Furthermore, the O.V. setpoint was raised to 28V.
8. The RD cabinets were thoroughly inspected by the IMD, the EMD, System Operational Analysis department (SOAD) and Tech Staff. No discrepancies were identified. A voltage disturbance monitor was left connected in the RD cabinet to record disturbances during future storms.

b. Rod Drive Ground Connections

1. Unit One's Rod Drive system was compared to Unit Two's. One difference was noted. On Unit One each RD cabinet is independently grounded to a cable tray in the Lower Cable Spreading Room (LCSR), while Unit Two has only two ground conductors from the cabinets to the LCSR. Modification M6-1-87-105 was implemented to remove the excess ground cables from Unit One. This made the two units identical. This Modification should minimize to possibility of circulating currents affecting the 25 Vdc power supplies.
2. Continuity checks were performed by the EMD on both units RD ground systems. No unexplainable differences were noted.

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TEXT Energy Industry Identification System (EIIS) codes are identified in the text as [xx]

E. CORRECTIVE ACTIONS: (Continued)

3. Voltage measurements were taken between the Rod Drive Motor Generator (M/G) sets neutral signal common bus and earth ground on both Unit One and Two. No differences were found. The filter capacitors between the signal common and ground were also checked and found acceptable.

2. System Ground Grid

SOAD and EMD completed a continuity check of the station ground grid. Continuity was measured between the top of each containment and the grid (0.1 ohm); cooling tower to cooling tower (0.15 ohm); release vent stacks to ground (0.1 ohm); and the Switchyard to Station (0.2 ohm). In each case, the readings were below the acceptable limit of 0.25 ohm. It was concluded that the ground grid did not contribute to the significance of the lightning strike.

A voltage disturbance monitor has been installed on the Unit One containment penetration ground cable. This will help determine the path of the disturbance and quantify it in the event of another storm.

3. Lightning Protection

The Lightning Protection System that was installed to prevent recurrence of the previous lightning strike event was walked down and one discrepancy was identified. A broken ground cable at a 34KV tower near the U-1 cooling tower was repaired. No further modification is required at this time.

4. Miscellaneous

a. Previous modifications and those in progress were reviewed for possible affect on the rod drive system. Only one was identified. That modification lifted leads in the RD cabinets which were to be used for connection of the automatic rod drop test machine. This modification is in place on both units. It was again verified to be in place on both units and determined to have no apparent affect on the significance of the lightning strike.

b. A computer listing of the history of work performed on the rod drive system was reviewed for possible impact. There were no items of significance identified.

F. PREVIOUS OCCURRENCES:

| LER NUMBER | TITLE                                   |
|------------|---|
| 85-068     | Reactor Trip on High Negative Flux Rate |

G. COMPONENT FAILURE DATA:

| a) MANUFACTURER      | NOMENCLATURE | MODEL NUMBER | MFG PART NUMBER |
|----------------------|--------------|--------------|-----------------|
| No Components Failed |              |              |                 |

b) RESULTS OF NPRDS SEARCH:

None



**Commonwealth Edison**  
Byron Nuclear Station  
4450 North German Church Road  
Byron, Illinois 61010

August 9, 1988

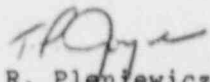
U. S. Nuclear Regulatory Commission  
Document Control Desk  
Washington, D.C. 20555

Dear Sir:

The enclosed Licensee Event Report from Byron Generating Station is being transmitted to you as a supplemental report.

This report is number 87-017-01; Docket No. 50-454.

Sincerely,

*for*   
R. Ploniewicz  
Station Manager  
Byron Nuclear Power Station

Enclosure: Licensee Event Report No. 88-017-01

cc: A. Bert Davis, NRC Region III Administrator  
P. Brochman, NRC Senior Resident Inspector  
INPO Record Center  
CECo Distribution List

Ltr: BYRON 88-0855 (1021M/0206M)

(1588M/0187M)

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