

U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Docket Nos: 50-456, 50-457  
License Nos: NPF-72, NPF-77

Report No: 50-456/99018(DRP); 50-457/99018(DRP)

Licensee: Commonwealth Edison Company

Facility: Braidwood Nuclear Plant, Units 1 and 2

Location: RR #1, Box 84  
Braceville, IL 60407

Dates: November 9 through December 20, 1999

Inspectors: C. Phillips, Senior Resident Inspector  
D. Pelton, Resident Inspector  
J. Roman, Illinois Department of Nuclear Safety

Approved by: Michael J. Jordan, Chief  
Reactor Projects Branch 3

## EXECUTIVE SUMMARY

### Braidwood Nuclear Plant, Units 1 and 2 NRC Inspection Report 50-456/99018(DRP); 50-457/99018(DRP)

This inspection included aspects of licensee operations, maintenance, engineering, and plant support. The report covers a 6-week period of resident inspection from November 9 through December 20, 1999.

#### Operations

- The inspectors concluded that the Braidwood Operating Department's controls in identifying, resolving, and preventing problems were effective. The inspectors also concluded that self-assessments performed by the operations department were critical, utilized a broad range of performance information, and provided appropriate improvement initiatives. (Section O7.1)

#### Maintenance

- The inspectors observed the performance of four surveillance tests. The inspectors concluded that the surveillance tests adequately tested the system, the operators followed the procedures, and that the procedures included the required testing discussed in the Technical Specifications. (Section M1.1)
- The inspectors concluded that the licensee's maintenance program for safety-related medium and low voltage circuit breakers was satisfactory in the areas of training, preventive maintenance, corrective maintenance, vendor interface, engineering calculations, and operating experience. (Section M2.1)

#### Engineering

- The inspectors concluded that staffing of the Braidwood engineering department was sufficient to maintain a minimal backlog of engineering work products. The inspectors determined that the minimal backlog was not simply due to few requests for engineering support but was, in fact, due to effective management and completion of outstanding engineering commitments. (Section E6.1)

#### Plant Support

- During a drill conducted on November 17, 1999, the licensee was initially unable to meet the minimum staff drill objective within an hour of the declaration of an alert in the Technical Support Center and the Emergency Operations Facility as called for in the emergency plan. However, the licensee successfully completed a remediation drill on December 7, 1999. The licensee demonstrated some weaknesses in the conduct of the drill including that station management personnel were slow in identifying and prioritizing repair work. (Section P1.1)

## Report Details

### Summary of Plant Status

Both units operated at or near full power for the entire period.

### I. Operations

#### **O7 Quality Assurance in Operations**

##### **O7.1 Effectiveness of Braidwood Operations Department Controls in Identifying, Resolving and Preventing Problems**

###### **a. Inspection Scope (71707)**

The inspectors reviewed operations department focus area assessments; operations department quarterly self assessments and recent operations-related problem identification forms (PIFs), apparent cause evaluation reports, root cause reports, and effectiveness reviews. The inspectors reviewed a recent licensee identified issue of station personnel not documenting problems on PIFs. Finally, the inspectors discussed the self-assessment process with operations department management.

###### **b. Observations and Findings**

The inspectors determined that recent operations-related issues were documented on PIFs, and that the operations department controls were effective in resolving identified problems. Root cause and apparent cause evaluation reports included actions that were commensurate with the stated root cause(s) of problems. Operations department management actions to address problems were generally effective in preventing recurrence of the problem. The licensee performed effectiveness reviews of corrective actions and identified examples of actions that were determined to have not been effective including actions taken to resolve human performance issues. In those instances, the actions were modified and/or additional actions were taken to improve future effectiveness.

The inspectors determined that self assessments performed by the operations department were critical, utilized a broad range of performance information (i.e., PIFs, Nuclear Oversight Department audit findings, NRC inspection findings, industry event information, etc.), and provided appropriate improvement initiatives.

###### **c. Conclusions**

The inspectors concluded that the Braidwood Operating Department's controls in identifying, resolving, and preventing problems were effective. The inspectors also concluded that self-assessments performed by the operations department were critical, utilized a broad range of performance information, and provided appropriate improvement initiatives.

**O8 Miscellaneous Operations Issues (92901)**

**O8.2 Review of 1999 Institute of Nuclear Power Operations Evaluation**

The inspectors reviewed the evaluation report and determined that the results were generally consistent with the results of similar evaluations conducted by the NRC.

**II. Maintenance**

**M1 Conduct of Maintenance**

**M1.1 Observation of Miscellaneous Surveillance Activities**

**a. Inspection Scope (61726)**

The inspectors observed all or portions of the following surveillance activities:

- Braidwood Operations Surveillance Procedure 1BwOSR 3.7.5.3-2, "Unit One Diesel Driven Auxiliary Feedwater Pump Monthly Surveillance," Revision 0E2;
- 1BwOSR 3.8.1.2-2, "Unit One 1B Diesel Generator Operability Monthly and Semi-Annual Surveillance," Revision 1E1;
- Braidwood Engineering Surveillance Procedure 1BwVSR 3.1.3.2, "Moderator Temperature Coefficient at Power," Revision 1E1; and
- 1BwVSR 5.5.8.RH.1, "American Society of Mechanical Engineering Surveillance Requirements for Residual Heat Removal Pump 1RH01PA," Revision 0E1.

**b. Observations and Findings**

The inspectors observed the performance of the above listed surveillance tests. For each surveillance test, the inspectors observed the establishment of initial conditions required for the surveillance test, the operation of equipment, the communications between the licensed operators in the control room and non-licensed operators in the auxiliary building, and the restoration of affected equipment. The inspectors determined that each of these activities were performed in accordance with the applicable procedure. The inspectors reviewed the data obtained during the surveillance tests and noted that it met the required acceptance criteria specified in the surveillance test procedures. The inspectors also reviewed the associated portions of the Updated Final Safety Analysis Report (UFSAR) and the Technical Specifications (TS) and determined that the surveillance test procedures demonstrated the systems performed as designed.

**c. Conclusions**

The inspectors observed the performance of four surveillance tests. The inspectors concluded that the surveillance tests adequately tested the system, the operators

followed the procedures, and that the procedures included the required testing discussed in the Technical Specifications.

## **M2 Maintenance and Material Condition of Facilities and Equipment**

### **M2.1 Medium and Low Voltage Circuit Breaker Maintenance**

#### **a. Inspection Scope (62707)**

The inspectors reviewed all or portions of the following documents:

- NRC Letter, "Insights from NRC Circuit Breaker Maintenance Program Inspections," dated May 19, 1999;
- NRC Information Notice 99-13, "Insights from NRC Inspections of Low-and Medium-Voltage Circuit Breaker Maintenance Programs;"
- NRC Inspection Report No. 50-454/455/99001(DRS);
- Westinghouse Maintenance Program Manual for Safety-Related Type DS Low Voltage Metal Enclosed Switchgear;
- Westinghouse Instructions for "Porcel-Line" Type DHP Magnetic Air Circuit Breakers;
- Braidwood/Byron Nuclear Power Stations 1998 Circuit Breaker Assessment;
- ComEd Procedure MA-AP-EM-4-00400, "Receipt Inspection of New or Refurbished Westinghouse Type DS 480V Circuit Breakers," Revision 0;
- ComEd Procedure MA-AP-EM-5-00100, "Preventive Maintenance of Westinghouse Type DS 480V Circuit Breakers," Revision 0;
- ComEd Procedure MA-AA-EM-4-00401, "Receipt Inspection of New or Refurbished Westinghouse Type DHP 4KV and 6.9KV Circuit Breakers," Revision 0;
- ComEd Procedure MA-AA-EM-5-00103, "Preventive Maintenance of Westinghouse Type DHP 4KV and 6.9KV Circuit Breakers," Revision 0;
- Braidwood Station Lesson Plans for Westinghouse Type DHP Circuit Breakers;
- Braidwood Station Lesson Plans for Westinghouse Type DS Circuit Breakers;
- CWPI-NSP-AP-1-2, "Quarantine of Areas, Equipment and Records," Revision 0;
- Braidwood Abnormal Operating Procedure 1BwOA ELEC-5, "Local Emergency Control of Safe Shutdown Equipment Unit 1," Revision 54;

- Braidwood Operating Procedure BwOP AP-5, "Racking-Out a 4160V or 6900V Air Circuit Breaker to the Disconnect Position," Revision 9E3;
- BwOP AP-6, "Racking-In a 4160V or 6900V Air Circuit Breaker," Revision 8E4;
- BwOP AP-52T1, "4160V or 6900V Breaker Problem Documentation," Revision 0;
- Byron Calculation Number 19AQ-16, "DC Control Circuit Voltage Drop," Revision 3;
- Byron Calculation Number 19AQ-43, "Review of Circuit Lengths for 4KV Switchgear Breaker Control," Revision 2; and
- Braidwood Calculation Number BRW-98-0006-E, "Calculation for Voltage Drop in Breaker Closing Control Circuits for Various 4.16KV and 480V Loads," Revision 0.

The inspectors also reviewed various Westinghouse Technical Bulletins and the Braidwood Station breaker maintenance "pre-define" data base. Finally, the inspectors discussed 4160 volt and 480 volt breaker maintenance issues with electrical maintenance, operations, and engineering department personnel and toured the electrical maintenance breaker maintenance shop.

b. Observations and Findings

The inspectors completed observations in some specific areas of the licensee's maintenance program for safety-related medium and low voltage circuit breakers. The maintenance program for the areas reviewed was satisfactorily performed. The inspectors determined the licensee's performance based on the collective results of the following reviews:

- The inspectors determined that the licensee's circuit breaker training program provided the requisite information, on-the-job training, and training performance evaluations for electrical maintenance department personnel to perform required maintenance activities. The inspectors determined that this training included discussions of recent procedural changes, recent vendor manual changes, information from recent NRC generic correspondence, and incorporated recent industry events. Discussions with electrical maintenance department electricians and supervisors indicated that the training was helpful and prepared them to perform required tasks. The inspectors also determined that operators received periodic training on installation and removal of breakers from cubicles as well as the isolation and quarantine of failed breakers.
- The inspectors determined that the licensee's circuit breaker preventive maintenance program was well planned and reflected vendor recommended maintenance activities. The inspectors determined that preventive maintenance items that had not been performed by their listed completion date had been previously identified by the licensee, entered into their corrective actions

program, and tracked to completion. The licensee's preventive maintenance procedures ensured that as-found and as-left conditions of breakers were recorded for historical purposes, and tested breakers at reduced voltages.

The inspectors determined that the licensee's circuit breaker corrective maintenance program included symptom-based procedures for main control room operators to follow in the event of breaker failure as well as procedures for non-licensed operators to utilize in the plant for the isolation and quarantine of failed breakers.

The inspectors determined that the licensee maintained an active dialogue with circuit breaker vendors and ensures the latest revisions to factory manuals are maintained on-site.

The inspectors determined that licensee's calculations for voltage drops in breaker control circuits for various 4160 volt and 480 volt loads reflected design basis minimum voltage requirements and had been updated to reflect changes made to circuitry, subsequent to initial construction, to meet design basis voltage requirements (e.g., inclusion of interposing or "booster" relays and the use of parallel wiring to reduce circuit resistance).

c. Conclusions

The inspectors concluded that the licensee's maintenance program for safety-related medium and low voltage circuit breakers was satisfactory in the areas of training, preventive maintenance, corrective maintenance, vendor interface, engineering calculations, and operating experience.

**M8 Miscellaneous Maintenance Issues (92902)**

**M8.1 (Closed) Inspector Followup Item (IFI) 50-456/457/97018-05(DRS):** "Resolution of Repetitive Problems with 4160 Volt and 480 Volt Circuit Breakers at Braidwood." During the Maintenance Rule baseline inspection performed at Braidwood, the inspectors identified two repetitive circuit breaker issues for which adequate corrective actions had not been taken:

The licensee had identified seven examples of 4160 volt breakers that had experienced trip trigger and trip roller out-of-tolerances. Although these issues had been documented on problem identification forms, a root cause analysis had not been performed nor had actions been taken to address the out-of-tolerances; and

The inspectors reviewed vendor evaluations of Braidwood's 480 volt circuit breakers. The vendor's evaluations indicated that the lubrication was found to be stiff, and the operation became smoother after the breakers were cycled. The hardened grease appeared to result in failures of the spring release device,

motor cut out switch, and the operating mechanism of the breakers. At that time, the inspectors also noted that because these breakers were about 20 years old, the hardened grease could result in a potential common mode failure.

The inspectors reviewed the licensee's root cause analysis of the 4160 volt breaker trip mechanism out-of-tolerances and determined that the assigned corrective actions, including procedural and training revisions, were commensurate with the stated root cause and have been completed. The inspectors determined that the licensee continued to effectively track subsequent breaker problem trends as evidenced by the root cause reports and actions taken in regard to breaker latch check switch and motor cutout switch issues. The inspectors reviewed the licensee's root cause analysis of the 480 volt breaker lubrication issue. The inspectors determined that assigned corrective actions taken by the licensee, including the development of a refurbishment schedule for 480 volt breakers and the bolstering of the periodic maintenance program based on vendor recommended maintenance activities, were commensurate with the stated root cause. Refurbishment of safety-related, electrically operated, 480 volt breakers was completed in November 1999. Seven of a total of 28 safety-related, manually operated, 480 volt breakers were refurbished to date with the remainder to be refurbished during refueling outages in the years 2000 (12 breakers) and 2001 (9 breakers). This item is closed.

### **III. Engineering**

#### **E6 Engineering Organization and Administration**

##### **E6.1 Engineering Staffing**

###### **a. Inspection Scope (37551)**

The inspectors reviewed Braidwood Engineering Department staffing and staffing requirements, and Braidwood Station Business Plan Performance Reports. The inspectors reviewed the status of engineering requests, drawing updates, modification packages (both outage and non-outage), vendor manual updates, and maintenance rule A(1) system action items. The inspectors also interviewed station engineering department management.

###### **b. Observations and Findings**

The inspectors determined that the staffing of the engineering department was sufficient to maintain a minimal backlog of engineering work products such as engineering requests, drawing updates, modification packages, and vendor manual updates. The inspectors determined that the minimal backlog was not simply due to few requests for engineering support but was, in fact, due to effective management and completion of outstanding engineering commitments.



c. Conclusions

The inspectors concluded that staffing of the Braidwood engineering department was sufficient to maintain a minimal backlog of engineering work products. The inspectors determined that the minimal backlog was not simply due to few requests for engineering support but was, in fact, due to effective management and completion of outstanding engineering commitments.

**E8 Miscellaneous Engineering Issues (92903 - 92700)**

- E8.1 **(Closed) Licensee Event Report (LER) 50-457/99003-00**: "Unit 2 Trip Caused By Spiking Of Intermediate Range Neutron Flux Channel N36 Due To Unknown Reasons." On May 19, 1999, Unit 2 tripped during a reactor startup because of electronic noise spiking on the intermediate range nuclear instrument channel N36. Noise on the Unit 2 N36 channel had been a problem since 1997. The licensee was unable to identify the source of the noise during multiple troubleshooting attempts. All equipment had been checked or walked down. Another instrument drawer was prepared for exchange if the problem persists. The detector was scheduled for replacement during the next refueling outage. The inspectors agreed with the licensee's conclusion that there was no human performance error during the reactor startup that lead to the trip. This item is closed.

**IV. PLANT SUPPORT**

**P1 Conduct of EP Activities**

**P1.1 After Hours Emergency Planning Drill Conduct**

a. Inspection Scope (71750)

The inspectors reviewed the licensee's scenario and observed the after hours drill conducted on November 17.

b. Observations and Findings

While observing the after hours emergency drill conducted on November 17, 1999, the inspectors identified that the licensee was unable to meet the minimum staff drill objective within an hour of the declaration of an alert in the Technical Support Center and the Emergency Operations Facility as called for in the emergency plan. The licensee completed a remediation drill on December 7, 1999, and was able to augment the Technical Support Center and the Emergency Operations Facility with minimum staffing in less than 1 hour of the simulated declaration of an alert.

The inspectors identified some weaknesses in the conduct of the drill. First, the exercise began with a simulated release of Tritium greater than 10 times the Offsite Dose Calculation Manual limit which would meet the entry conditions for an alert classification. However, the drill started without the simulated control room crew having access to an Offsite Dose Calculation Manual. In addition, the drill controller had a copy

of the simulated radwaste liquid release package but was not supposed to give it to the operating crew unless asked. This gave the crew information that there was a potential entry condition into the emergency plan without a method to assess the condition. Second, the drill scenario called for an explosion of the Unit 1 main generator bus duct. The conditions were not adequately described to the operator in the field such that the control room could determine that an explosion had occurred. The effective conduct of a drill scenario impacted the ability to successfully assess the licensee's performance.

Finally, licensee management was slow to list and prioritize repair items as they were reported. For example, security reported equipment problems causing them to enter into compensatory actions. This problem was never discussed as to the impact on the plant and repair prioritization. In addition, priorities established in the Technical Support Center and the Offsite Support Center were different. For example, station management personnel were unable to get a crew into the field to sample the effluent from the steam generator power operated relief valves even though it was the third highest priority and there was sufficient staff available. The ability to identify and prioritize work items impacts the ability of the licensee to recover from an event.

c. Conclusions

During a drill conducted on November 17, 1999, the licensee was initially unable to meet the minimum staff drill objective within an hour of the declaration of an alert in the Technical Support Center and the Emergency Operations Facility as called for in the emergency plan. However, the licensee successfully completed a remediation drill on December 7, 1999. The licensee demonstrated some weaknesses in the conduct of the drill including that station management personnel were slow in identifying and prioritizing repair work.

## V. Management Meetings

### **X1 Exit Meeting Summary**

The inspectors presented the inspection results to members of licensee management at the conclusion of the inspection on December 20, 1999. The licensee acknowledged the findings presented. The inspectors asked the licensee whether any materials examined during the inspection should be considered proprietary. No proprietary information was identified.

## PARTIAL LIST OF PERSONS CONTACTED

### Licensee

\*M. Cassidy, Regulatory Assurance - NRC Coordinator  
\*R. Francoeur, Interim Maintenance Manager  
\*R. Graham, Work Control Manager  
L. Guthrie, Maintenance Manager  
A. Haeger, Radiation Protection Manager  
\*C. Herzog, Services Manager  
\*D. Hoots, Operations  
T. Luke, Engineering Manager  
\*J. Madden, Assistant System Engineer  
\*J. Nalewajka, Assessment Manager  
\*T. Simpkin, Regulatory Assurance Manager  
K. Schwartz, Station Manager  
\*T. Tulon, Site Vice President  
R. Wegner, Operations Manager

### NRC

M. Jordan, Chief, Reactor Projects Branch 3  
T. Tongue, Project Engineer  
\*C. Phillips, Senior Resident Inspector  
\*J. Adams, Resident Inspector  
\*D. Pelton, Resident Inspector

### IDNS

J. Roman

\*Denotes those who attended the exit interview conducted on December 20, 1999.

## INSPECTION PROCEDURES USED

IP 37551: Onsite Engineering  
IP 61726: Surveillance Observations  
IP 62707: Maintenance Observation  
IP 71707: Plant Operations  
IP 71750: Plant Support Activities  
IP 92700: Onsite Followup of Written Reports of Non-Routine Events at Power Reactor Facilities  
IP 92901: Followup - Plant Operations  
IP 92902: Followup - Plant Maintenance  
IP 92903: Followup - Engineering

## ITEMS OPENED, CLOSED, AND DISCUSSED

### Opened

None.

### Closed

50-456/457/97018-05	IFI	"Resolution of Repetitive Problems with 4160 Volt Circuit Breakers at Braidwood"
50-457/99003-00	LER	"Unit 2 Trip Caused by Spiking of Intermediate Range Neutron Flux Channel N36 Due to Unknown Reasons"

### Discussed

None.

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### Licensee

- \*M. Cassidy, Regulatory Assurance - NRC Coordinator
- \*R. Francoeur, Interim Maintenance Manager
- \*R. Graham, Work Control Manager
- L. Guthrie, Maintenance Manager
- A. Haeger, Radiation Protection Manager
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- \*T. Simpkin, Regulatory Assurance Manager
- K. Schwartz, Station Manager
- \*T. Tulon, Site Vice President
- R. Wegner, Operations Manager

### NRC

- M. Jordan, Chief, Reactor Projects Branch 3
- T. Tongue, Project Engineer
- \*C. Phillips, Senior Resident Inspector
- \*J. Adams, Resident Inspector
- \*D. Pelton, Resident Inspector

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J. Roman

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## LIST OF ACRONYMS USED

BWOA	Braidwood Abnormal Operating Procedure
BwOP	Braidwood Operating Procedure
BwOSR	Braidwood Operations Surveillance Procedure
BwVSR	Braidwood engineering Surveillance Procedure
CFR	Code of Federal Regulations
EP	Emergency Preparedness
NRC	Nuclear Regulatory Commission
PIF	Problem Identification Form