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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

APR 14 1986

Docket Nos: 50-456
and 50-457

MEMORANDUM FOR: Chairman Palladino
Commissioner Roberts
Commissioner Asselstine
Commissioner Bernthal
Commissioner Zech

FROM: Thomas M. Novak, Acting Director
Division of PWR Licensing-A

SUBJECT: BOARD NOTIFICATION REGARDING THE REGION III REVIEW OF THE CORRODED SMALL BORE PIPING ISSUE, THE REGION III REVIEW OF THE BRAIDWOOD SAFETY-RELATED MECHANICAL EQUIPMENT RETROFIT PROGRAM, A SUPPLEMENTAL SAFETY EVALUATION REPORT FOR PHYSICAL IDENTIFICATION AND INDEPENDENCE OF REDUNDANT SAFETY-RELATED ELECTRICAL SYSTEMS AND THE BRAIDWOOD SALP 5 REPORT (BN-86-16)

This notification is being provided to the Commission in accordance with the revised Commission's notification policy of July 6, 1984. The staff has also considered the Commission's March 24, 1986 COMTR-86-1 in preparing this Board Notification. The enclosed reports are applicable to Braidwood Station, Units 1 and 2. The parties to the proceeding are being notified by copy of this memorandum.

Corroded Small Bore Piping Issue

Region III conducted an investigation to assess the adequacy of the applicant's actions on previous inspection findings related to the engineering evaluation of corroded small bore piping and procedural control of piping materials. The results of the inspection are documented in Inspection Report Nos. 50-456/86008 and 50-457/86007 (enclosed). The report concluded that any segment of piping which had the potential to be adversely affected by corrosion has been removed from the Braidwood Plant. Region III has no remaining open concerns regarding the corroded small bore piping issue.

Braidwood Safety-Related Mechanical Equipment Retrofit Program

Region III conducted an inspection to assess the adequacy of the applicant's actions related to the Braidwood Safety-Related Mechanical Equipment Retrofit Program. The results of the inspection are documented in Inspection Report Nos. 50-456/86009 and 50-457/86008 (enclosed). The report concluded that the NRC has no disagreement with the results and conclusions identified in the applicant's final report on this issue.

Physical Identification and Independence of Redundant Safety-Related Electrical Systems

The NRC staff has evaluated the applicant's criteria established in the Byron/Braidwood Stations FSAR for separation between redundant Class 1E cables and raceways. The criteria for separation of non-Class 1E from Class 1E cables were established at reduced distances from those specified in Regulatory Guide 1.75. The applicant justified the lesser physical separation by testing and analyzing various test configurations. The NRC staff determined that the test program and results were acceptable; therefore, the subject cable separation criteria were found acceptable (SSER enclosed). The applicant must specify these lesser cable separation criteria in the Byron/Braidwood Stations FSAR.

Braidwood SALP 5 Report

Region III has issued the SALP 5 Report for the Braidwood Station covering the period of July 1, 1984 through November 30, 1985 (enclosed). Sixteen functional areas were evaluated. The applicant was rated Category 1 in one area, Category 2 in eleven areas, Category 3 in one area, and three areas were not rated. The report indicates that the applicant's overall regulatory performance has continued to demonstrate an improved trend.

The parties to the proceeding are being notified by copy of this memorandum.

Thomas M. Novak, Acting Director
Division of PWR Licensing-A

Enclosures:
1. IR 50-456/86008; 50-457/86007
2. IR 50-456/86009; 50-457/86008
3. SSER on Cable Separation
4. Braidwood SALP Report

cc: See next page

cc: P. Bloch, ASLB
W. Jordan, ASLB
K. McCollom, ASLB
E. Johnson, ASLB
H. Grossman, ASLB
SECY (2)
EDO
OGC
OPE
ACRS (10)
Parties to the Proceeding
See next page

MAR 3 1986

Docket No. 50-456
Docket No. 50-457

Commonwealth Edison Company
ATTN: Mr. Cordell Reed
Vice President
Post Office Box 767
Chicago, IL 60690

Gentlemen:

This refers to the routine safety inspection conducted by Messrs. J. W. Muffett and J. M. Jacobson of this office on August 8-10, 21, 27, and October 24-26, 1985, and February 18, 1986, of activities at Braidwood Station, Units 1 and 2 authorized by NRC Construction Permits No. CPPR-132 and No. CPPR-133 and to the discussion of our findings with Mr. M. J. Wallace at the conclusion of the inspection.

The enclosed copy of our inspection report identifies areas examined during the inspection. Within these areas, the inspection consisted of a selective examination of procedures and representative records, observations, and interviews with personnel.

No violations of NRC requirements were identified during the course of this inspection.

In accordance with 10 CFR 2.790 of the Commission's regulations, a copy of this letter and the enclosed inspection report will be placed in the NRC Public Document Room.

We will gladly discuss any questions you have concerning this inspection.

Sincerely,

J. J. Harrison, Chief
Engineering Branch

Enclosure: Inspection Reports
No. 50-456/86008(DRS);
No. 50-457/86007(DRS)

See Attached Distribution

8603070190 2pp

RIII	RIII	RIII	RIII	RIII
Little/mj	Harrison	Danielson	Muffett	Jacobson
2/28	3/3/86	3/2/86		

Distribution

cc w/enclosure:
D. L. Farrar, Director
of Nuclear Licensing
M. Wallace, Project Manager
D. Shamblin, Construction
Superintendent
E. E. Fitzpatrick, Station
Superintendent
P. L. Barnes, Regulatory
Assurance Supervisor
DCS/RSB (RIDS)
Licensing Fee Management Branch
Resident Inspector, RIII
Braidwood
Resident Inspector, RIII Byron
Phyllis Dunton, Attorney
General's Office, Environmental
Control Division
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Utilities Division
H. S. Taylor, Quality Assurance
Division
E. Chan, ELD
J. Moore, ELD
G. Berry, ELD
J. Stevens, NRR
The Honorable Herbert Grossman, ASLB
The Honorable A. Dixon Callihan, ASLB
The Honorable Richard F. Cole, ASLB

U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Reports No. 50-456/86008(DRS); 50-457/86007(DRS)

Docket Nos. 50-456; 50-457 Licenses No. CPPR-132; CPPR-133

Licensee: Commonwealth Edison Company
Post Office Box 767
Chicago, IL 60690

Facility Name: Braidwood Station, Units 1 and 2

Inspection At: Braidwood Site, Braidwood, IL

Inspection Conducted: August 8-10, 21, 27, and October 24-26, 1985, and February 18, 1986.

Inspectors: for J. W. Muffett — 2/24/86 Date

for J. M. Jacobson — 2/21/86 Date

Approved By: for D. H. Danielson, Chief
Materials and Processes Section — 2/24/86 Date

Inspection Summary

Inspection on August 8-10, 21, 27, and October 24-26, 1985, and February 18, 1986 (Report No. 50-456/86008(DRS); 50-457/86007(DRS))
Areas Inspected: Unannounced safety inspection of licensee action on previous inspection findings related to the engineering evaluation of corroded small bore piping and procedural control of piping materials. The inspection involved a total of 96 inspector-hours by two NRC inspectors.
Results: No violations or deviations were identified.

DETAILS

1. Persons Contacted

Commonwealth Edison (CECo)

*M. J. Wallace, Project Manager
*D. L. Shamblin, Project Construction Superintendent
*L. O. DelGeorge, Assistant Vice President Engineering and Licensing
*D. Skoza, Project Field Engineer

Sargent & Lundy Engineers (S&L)

A. Dermenjian, Assistant Head, Engineering Mechanics Division
C. S. Lim, Project Engineer

Phillips Getschow Company (PGCo)

J. R. Stewart, Project Engineer

National Board Audit Team

*S. Lindbeck, Audit Team Member

*Denotes those attending the final exit interview at the Braidwood Station on February 18, 1986.

2. Licensee Action on Previous Inspection Findings

a. (Closed) Open Item (456/84017-03; 457/84017-03); (Closed) 50.55(e) (456/84-10-EE; 457/84-10-EE): As discussed in NRC Inspection Reports No. 50-456/84017; No. 50-457/84017 it was discovered that some small bore piping which may have violated minimum wall thickness requirements due to corrosion or manufacturing defects (ribbon grooves) was installed. The licensee committed to perform an investigation of the significance of the installation of the potentially deficient pipe and to take the necessary actions determined by the results of the investigation. The purpose of this report is to document the NRC inspections of these activities. The licensee initiated Nonconformance Report (NCR) 633 to address this issue. The program to address NCR 633 consisted of four parts. They are, theoretical determination of maximum increase in stress due to pitting, physical and chemical testing, a program for statistically significant wall thickness measurements, and a final engineering evaluation. Each of these activities are addressed as follows:

(1) Theoretical Increase in Stress:

The stress intensification factor (SIF) was developed to account for the potential increase in stress due to the pitting. This SIF was developed employing certain conservative

assumptions. The first is that the worst pit depth measured was assumed to be in the same location on both the inside diameter and the outside diameter. The second is that this depth of metal was assumed to be removed from the entire circumference of both the inside diameter and the outside diameter. The third is that the pit shape was idealized to have sharp corners at the points at the beginning and end of the removed area. The SIF was then applied to the prior stress analysis results for all the piping systems in which the corroded pipe may have been installed. It was determined that six locations on these piping systems were not within applicable ASME Code allowable stresses when the SIF due to the corrosion pitting was employed. In addition, four locations which had stress levels close to the ASME Code allowable stress were also removed. The piping removed was as follows:

Six Overstressed Locations

Systems	Size/Schedule	Safety-Related
Component Cooling	2" Sch 80	Yes
Component Cooling	2" Sch 80	Yes
Steam Generator Blowdown	2" Sch 80	Yes
Steam Generator Blowdown	2" Sch 80	Yes
Chilled Water	3/4" Sch 80	No
Chilled Water	3/4" Sch 80	No

Four Additional Locations

Systems	Size/Schedule	Safety-Related
Component Cooling	2" Sch 80	Yes
Steam Generator Blowdown	2" Sch 80	Yes
Steam Generator Blowdown	2" Sch 80	Yes
Steam Generator Blowdown	2" Sch 80	Yes

These portions of the potentially affected (approximately a total of 30 feet) systems were removed and replaced with new sections of pipe. Based on this approach no piping remained in the plant which was not in compliance with ASME Code requirements for strength. The calculations which form a basis for this methodology have been reviewed by the NRC inspector and found to be an acceptable technique for conservatively estimating the stress increase due to corrosion. The calculations were

EMD-04966f4, "Stress Intensification Factors of 1/4"-2" Sch 80 Pitted and Corroded Pipe" and EMD-049655, "Stress Check of 1/2" and 3/4" Sch 80 Corroded Pipe."

(2) Chemical and Physical Testing:

A number of chemical and physical tests were performed to determine to what extent the pipe had been degraded by the corrosion. These tests were as follows:

(a) Tensile Test
(b) Chemical Analysis of Composition of the Piping
(c) Burst Test (Piping overpressurized to the point of bursting)
(d) Bend Test
(e) Fatigue Test
(f) Macro Etch Examination
(g) Metallographic Examination
(h) Outside Diameter Surface Deposit Analysis
(i) Pit Residue Analysis
(j) Residual Chemical Acidity Test

Taussig Associates, the testing laboratory, reached the conclusion based on their tests that all the samples met or exceeded the requirements for the specified materials (ASTM A106, Gr.B). In addition, Taussig expects no degradation in service performance or lifetime. It is important to note that CECo states that the samples tested were judged to exhibit the worst examples of pitting and corrosion. The results of these tests were reviewed by the NRC inspectors and the values for various mechanical properties were in compliance with the ASME code.

(3) Wall Thickness Measurements:

A random sampling program was performed on the affected population of piping. The population of affected piping was 28,723 pieces, of these 4,586 were installed in Unit 1 and common systems and 24,137 were in storage. The pieces were each uniquely identified by assigning sequential numbers. A random number generating process was used to determine 300 pieces for detailed measurement. Over 28,000 wall thickness measurements were made on the 300 piece sample. Of the sample of 300 segments of pipe, 218 contain no measurements below the minimum wall thickness allowed by the manufacturer's tolerance as stated in the ASTM specification A106. The remaining 82 contained no minimum wall thickness violations which would have caused the piping to violate the ASME Code stress allowables in the affected installations. All of these samples were visually inspected by the NRC inspectors. None of the samples were found to exhibit unusual properties.

(4) Final Engineering Evaluation

The final evaluation of the pipe corrosion problem at the Braidwood Station is contained in Commonwealth Edison Report "Braidwood Station - Units 1 and 2 Engineering Evaluation of the Pipe Corrosion Problem Identified in CECo NCR No. 633" dated January 1986. The report was reviewed and found to be an acceptable evaluation of the corrosion problem. The report makes the following conclusions:

(a) Confirmatory testing and wall thickness measurements indicate all pipe locations would meet the ASME code allowable stress limits.

(b) The corroded pipe still has adequate strength to perform its intended design function.

(c) Chemical tests indicate no surface residue which would tend to cause additional corrosion in the future.

(d) The corroded pipe is expected to perform in the same manner as a new pipe during its service life.

In addition to the NRC review of the results of this program, a National Board Audit Team member reviewed the disposition of Commonwealth Edison Nonconformance Report No. 633. This review determined that the report "Engineering Evaluation of Pipe Corrosion Problem Identified in CECo NCR 633," EMD-054247, complied to the ASME code requirements in the disposition of NCR 633. The test results were also reviewed by Steven Danylak Ph.D. a professor of Materials Science at University of Illinois at Chicago. Dr. Danylak stated:

> "There is no evidence to suggest that the chemical cleaning was overly aggressive. The surface morphology of the chemically cleaned pipe that had been corroded is not substantially different from the not chemically cleaned or new pipe. All pipe showed surface irregularities and depressions. The chemically cleaned and corroded pipe contained shallow pits not unexpected in carbon steel. Neither the pitted regions nor the corrosion products from these regions exhibit any unusual morphology based on the pit shape or chemistry, so there is no reason to expect that the chemically cleaned pipe would corrode more rapidly that the not chemically cleaned pipe. I have also evaluated the general service conditions to which the steel pipe will be subjected and, in my opinion, these conditions are relatively mild as, for example, compared to those in the Chemical Process industry which routinely uses this grade of pipe. My field experience of corrosion problems in the Power and Chemical Process industries has shown that the chemically cleaned pipe may continue to be used when the design calls for A106 grade B steel pipe."

In conclusion it appears that any segment of piping which had the potential to be adversely affected by the corrosion has been removed from the Braidwood Plant. Also it appears that based on the testing the corroded piping complied with applicable specification requirements. In addition there is no evidence that the installed corroded piping will behave in a substantially different manner than the non corroded piping.

b. (Closed) Violation (456/84017-02; 457/84017-02): The NRC inspection which identified the corroded piping problem also found CECo in violation of 10 CFR 50, Appendix B, Criterion XV (control of nonconforming material) and Criterion XVI (lack of adequate corrective action). In response to this violation Phillips Getschow Procedure QCP B4, which governs this activity was revised to more tightly control storage of piping. The NRC inspector has reviewed this procedure and has inspected the current manner of storing piping materials. Both items comply with applicable regulatory standards and are therefore acceptable.

4. Exit Interview

The Region III inspectors met with licensee representatives (denoted under Paragraph 1) at the conclusion of the inspection on February 18, 1986. The inspector summarized the scope and findings of the inspection. The licensee acknowledged this information. The inspector also discussed the likely informational content of the inspection report with regard to documents or processes reviewed during the inspection. The licensee did not identify any such documents/processes as proprietary.

MAR 7 1986

Docket No. 50-456
Docket No. 50-457

Commonwealth Edison Company
ATTN: Mr. Cordell Reed
Vice President
Post Office Box 767
Chicago, IL 60690

Gentlemen:

This refers to the routine safety inspection conducted by Messrs. J. W. Muffett and J. M. Jacobson of this office on September 12, 26, October 29, November 19-21, December 19, 1985 and February 18, 24, 1986, of activities at Braidwood Station, Units 1 and 2 authorized by NRC Construction Permits No. CPPR-132 and No. CPPR-133 and to the discussion of our findings with Mr. D. Shamblin at the conclusion of the inspection.

The enclosed copy of our inspection report identifies areas examined during the inspection. Within these areas, the inspection consisted of a selective examination of procedures and representative records, observations and interviews with personnel.

No violations of NRC requirements were identified during the course of this inspection.

In accordance with 10 CFR 2.790 of the Commission's regulations, a copy of this letter and the enclosed inspection report will be placed in the NRC Public Document Room.

We will gladly discuss any questions you have concerning this inspection.

Sincerely,

J. J. Harrison, Chief
Engineering Branch

Enclosure: Inspection Reports
No. 50-456/86009(DRS);
No. 50-457/86008(DRS)

See Attached Distribution

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RIII	RIII	RIII	RIII	RIII
Little/bls	Harrison	Danielson	Muffett	Jacobson
3/7/86	3/7	3/7/86	3/7/86	3/7/86

Distribution

cc w/enclosure:
D. L. Farrar, Director
of Nuclear Licensing
M. Wallace, Project Manager
D. Shamblin, Construction
Superintendent
E. E. Fitzpatrick, Station
Superintendent
P. L. Barnes, Regulatory
Assurance Supervisor
DCS/RSB (RIDS)
Licensing Fee Management Branch
Resident Inspector, RIII
Braidwood
Resident Inspector, RIII Byron
Phyllis Dunton, Attorney
General's Office, Environmental
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D. W. Cassel, Jr., Esq.
J. W. McCaffrey, Chief, Public
Utilities Division
H. S. Taylor, Quality Assurance
Division
E. Chan, ELD
J. Moore, ELD
G. Berry, ELD
J. Stevens, NRR
The Honorable Herbert Grossman, ASLB
The Honorable A. Dixon Callihan, ASLB
The Honorable Richard F. Cole, ASLB

U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Reports No. 50-456/86009(DRS); 50-457/86008(DRS)

Docket Nos. 50-456; 50-457 Licenses No. CPPR-132; CPPR-133

Licensee: Commonwealth Edison Company
Post Office Box 767
Chicago, IL 60690

Facility Name: Braidwood Station, Units 1 and 2

Inspection At: Braidwood Site, Braidwood, IL

Inspection Conducted: September 12, 26, October 29, November 19-21, December 19, 1985; February 18, 24, 1986

Inspectors: J. W. Muffett James W Muffett 3/7/86
Date

for J. M. Jacobson 3/7/86
Date

Approved By: D. H. Danielson, Chief
Materials and Processes
Section 3/7/86
Date

Inspection Summary

Inspection on September 12, 26, October 29, November 19-21, December 19, 1985 and February 18, 24, 1986 (Report No. 50-456/86009(DRS); 50-457/86008(DRS))
Areas Inspected: Licensee action on previous inspection related to the retroinspection of safety related mechanical equipment installation and procedural control of installation of safety related mechanical equipment installation. The inspection involved a total of 120 inspector-hours by two NRC inspectors.
Results: No violations or deviations were identified.

DETAILS

1. Persons Contacted

Commonwealth Edison (CECo)

*S. C. Hunsader, Quality Assurance Supervisor
*D. L. Shamblin, Project construction Superintendent
*P. L. Barnes, Regulatory Assurance Supervisor
*M. R. Dougherty, Project Construction Engineer

Sargent & Lundy Engineers

S. Putman, Structural Engineer

Phillips Getschow Company

J. R. Stewart, Project Engineer

*Denotes those attending the final exit interview at the Braidwood Station on February 24, 1986.

2. Licensee Action on Previous Inspection Findings

a. (Closed) Violation (50-456/82-05-04; 50-457/82-05-04); (Closed) 50.55E (456/82-07-EE; 457/82-07-EE) (Closed) Unresolved item (456/82-05-02; 457/82-05-02): Region III Tracking Item No. 50-456/82-05-04; 50-457/82-05-04 was assigned to all of the deficiencies related to the setting of safety related equipment identified in Sections 3.e.(1) through (7) of Inspection Reports No. 50-456/82-05; 50-457/82-05. The steam generator bolt (cap screws) traceability problems identified in Sections 3.e.(2) and (4) of Inspection Report 50-456/82-05; 50-457/82-05 are resolved and closed out based upon the closure of Tracking Item No. 50-456/82-05-01; 50-457/82-05-01 documented in Inspection Report No. 50-456/82052; 50-457/82050. These cap screws are unique to the steam generator design and the design specifications of no other equipment requires their use. The inspectors found no instances of steam generator bolts used in other applications. As documented in Inspection Reports No. 50-456/82-05; 50-457/82-05, deficiencies were found to exist in the Quality Assurance program for the installation and inspection of safety-related mechanical equipment. The licensee responded to the inspection report documenting their corrective actions in Cordell Reed's letter dated April 4, 1983 to James G. Keppler. The licensee developed new procedures to control this activity and in addition the licensee performed a program to reinspect safety-related mechanical equipment installed prior to the revision of the procedure. Another purpose of the reinspection program was to develop the Quality Assurance documentation required by Regulatory Guide 1.116 committed to by the licensee in the FSAR (Regulatory Guide 1.116 basically endorses ANSI N45.2.8 which therefore becomes the controlling regulatory requirement in the area

of mechanical equipment installation). Inspection Reports No. 50-456/85050; 50-457/85048 reviewed the Modified Procedure QCP-B22 and found this procedure an acceptable method for controlling compliance with ANSI N45.2.8. In Inspection Reports No. 50-456/85050; 50-457/85048 a sample of 26 documentation packages (taken from a total population of 216) developed by the reinspection program were reviewed. All of the packages reviewed conformed to the requirements of QCP-B22.

In January 1986, the licensee issued the final report on this issue, "Report on Braidwood Safety-Related Mechanical Equipment Retrofit Program." The purpose of this inspection report is to document the NRC review of the final report and the activities performed during the reinspection. The NRC review has revealed no disagreement with the results and conclusions of this final report. The internal cleanliness deficiencies discussed in Commonwealth Edison's final report will be reviewed and closed out as Region III tracking Item No. 50-456/84-21-07; 50-457/84-20-07 in a future inspection report. To clearly document the results of the NRC review individual topics will be discussed in the following paragraphs.

(1) ANSI N45.2.8

ANSI N45.2.8-1975 is the standard with details the Quality Assurance requirements for installation and inspection of mechanical equipment. Installation inspections which are required by the standard when appropriate are:

(a) Identification
(b) Location and Orientation of Components
(c) Levelling and Alignment
(d) Clearances and Tolerances
(e) Tightness of Connections and Fastenings
(f) Fluid levels and pressures
(g) Absence of leakage
(h) Physical integrity
(i) Cleanness
(j) Welding operations
(k) Adequacy of Protective Measures
(l) Adequacy of Housekeeping

The purpose of these inspections is to assure that safety-related mechanical equipment is installed and inspected in a manner that will provide adequate confidence that the equipment will perform its safety function Procedure QCP-B22 specifically calls for the inspection of the following items:

(a) Foundation check
(b) Bolt angularity
(c) Concrete expansion anchor documentation
(d) Torque on anchor bolts
(e) Thread engagement

(f) Weld procedure
(g) Grout Release
(h) Grout Complete
(i) Piping Release
(j) Internal Cleanliness
(k) Driveline Cleanliness
(l) Lubrication complete
(m) Alignment complete
(n) Lubrication/Cooling piping complete
(o) Verify Equipment I.D.

These items are abbreviations of more complete activities delineated in QCP-B22 which adequately comply with the requirements of ANSI N45.2.8.

(2) Retrofit Program Findings

The reinspection (retrofit) program discovered 156 discrepancies. The discrepancies have either been dispositioned by a engineering evaluation or modifications have been completed to assure compliance with the original specifications. The final result is that both the QA records and the equipment are in compliance with ANSI N45.2.8. The discrepancies are as follows:

Distribution of Installation Inspection Findings For All 216 Components Inspected

Component I. D.	# Findings	Type of Findings	Documentation Package Reviewed in Inspection Report No. 85050
0AB01PA	-		
0AB01PB	-		
0ABC2DA	3	AB(2), QC	
0AB02DB	4	AB(2), IC, QC	
0AB02FB	-		
1AF01PA	-		+
1AF01PB	2	HE, bowed piping	+
2AF01PA	-		+
2AF01PB	1	AB	
1BR01A	2	IC, DOC.	+
2BR01A	2	PR, NW	
1BR03A	-		
2BR03A	-		
0CC01A	2	GR, grout damage	
0CC01P	2	PR, IC	
1CC01A	4	GR, NW, Grout defect, found pad not completely supporting equipment	
1CC01PA	-		
1CC01PB	-		
2CC01A	-		
2CC01PA	-		
2CC01PB	-		
1CC01T	6	HS, GR, Sect. XI, DOC., Procedure conflict, A/E approv. missing	
2CC01T	2	Plate thick. incorrect, Sect. XI	
1CS01PA	3	GR, PR, PWM	
1CS01PB	3	GR, PR, PWM	
1CS01T	-		+
2CS01PA	1	PWM	
2CS01PB	1	PWM	
2CS01T	-		
1CV01AA	-		
1CV01AB	-		
2CV01AA	-		
2CV01AB	-		
1CV01DA	-		
1CV01DB	-		
1CV01FA	-		
1CV01FB	-		

Distribution of Installation Inspection Findings For All 216 Components Inspected

Component I. D.	# Findings	Type of Findings	Documentation Package Reviewed in Inspection Report No. 85050
1CV01PA	2	GR, Mnfr. inspection of install. not performed	
1CV01PB	1	GR	
2CV01PA	2	TE, EL	
2CV01PB	1	TE	
1CV01T	1	PR	+
2CV01T	-		
1CV02A	-		
2CV02A	-		
1CV02D	1	IC	
1CV02F	-		
1CV02P	2	GR, TE	
2CV02P	2	TE (2)	
1CV03AA	1	AB	
1CV03AB	1	AB	
2CV03AA	1	Shim for contact	
2CV03AB	-		
1CV03F	-		+
2CV03F	-		+
1CV04AA	3	HS, NW, HE	
1CV04AB	1	HS	
2CV04AA	-		
2CV04AB	-		
1CV05A	1	IC	
2CV05A	1	IC	+
1DG01KA	2	MRR, AB	
1DG01KB	1	MRR	
1DG01SA	-		
2DG01SA	-		
1DG01SA-C	-		+
2DG01SA-C	-		
1DG01SA-D	-		
2DG01SA-D	-		
1DG01SB	-		
2DG01SB	-		
1DG01SB-C	-		
2DG01SB-C	-		
1DG01SB-D	-		
2DG01SB-D	-		

Distribution of Installation Inspection Findings For All 216 Components Inspected

Component I. D.	# Findings	Type of Findings	Documentation Package Reviewed in Inspection Report No. 85050
1D001PA	-		
1D001PB	-		
1D001PC	-		
1D001PD	-		+
1D002TA	-		+
2D002TA	-		
1D002TB	-		
2D002TB	-		
1D010T	-		
2D010T	-		
1FC01A	1	HS	
2FC01A	2	IC, AB	
1FC01P	-		
2FC01P	-		
OGW01SA	1	IC	
OGW01SB	1	IC	
OGW01TA	1	GR	+
OGW01TB	1	GR	+
OGW01TC	1	GR	
OGW01TD	1	GR	
OGW01TE	1	GR	
OGW01TF	3	EL, GR, TE	
1PL50J	-		
1PL52J	-		+
OPL53JA	-		+
OPL53JB	-		+
1PL53J	-		
1PL54J	-		
1PL55J	-		
1PL56J	-		
1PL57J	-		
OPL60JA	-		
OPL60JB	-		
1PL60JD	-		
1PL61JC	-		
1PL61JD	-		
1PL66J	-		
1PL67J	-		
1PL69J	-		
1PL70J	-		
1PL71J	-		
1PL72J	-		

Distribution of Installation Inspection Findings For All 216 Components Inspected

Component I. D.	# Findings	Type of Findings	Documentation Package Reviewed in Inspection Report No. 85050
1PL74J	-		
1PL75J	-		
1PL76J	-		
1PL81JA	-		
2PL81JA	-		
1PL81JB	-		
2PL81JB	-		
1PL82JA	2	PR, IC	
1PL82JB	-		
2PL82JB	-		
1PL84JA	-		
2PL84JA	-		
1PL84JB	-		
2PL84JB	-		
2PL85JB	-		
1PL92J	-		
1RC01BA	1	PR	
2RC01BA	1	PR	
1RC01BB	3	DOC., MT, PR	
2RC01BB	1	PR	
1RC01BC	2	MT, PR	
2RC01BC	1	PR	
1RC01BD	1	PR	
2RC01BD	1	PR	
1RC01PA	-		
2RC01PA	-		
1RC01PB	-		
2RC01PB	-		
1RC01PC	-		
2RC01PC	-		
1RC01PD	-		
2RC01PD	-		
1RH01PA	2	GR, PWM	
2RH01PA	1	PWM	
1RH01PB	1	GR	
2RH01PB	-		
1RH01SA	-		
2RH01SA	-		
1RH01SB	1	PR	
2RH01SB	2	PR, IC	
1RH02AA	4	EL, SLP, IC, PR	+
2RH02AA	-		
1RH02AB	5	EL, SLP, IC(2), PR	+
2RH02AB	2	AB, Grt. thick	

Distribution of Installation Inspection Findings For All 216 Components Inspected

Component I. D.	# Findings	Type of Findings	Documentation Package Reviewed in Inspection Report No. 85050
1RY01S	3	DOC (2), TE	+
2RY01S			
1SI01PA	3	IC, IC, TE	
2SI01PA	-		
1SI01PB	2	IC(2)	
2SI01PB	1	TE	
1SI04TA	-		
2SI04TA	-		
1SI04TB	-		+
2SI04TB	-		+
1SI04TC	-		
2SI04TC	-		
1SI04TD	-		
2SI04TD	-		
1SX01FA	2	GR, TR	
2SX01FA	2	GR, ARc strike	
1SX01FB	2	GR,TR	
2SX01FB	1	GR	
1SX01PA	3	GR, TR, AB	
2SX01PA	-		
1SX01PB	3	GR, TR, work w/o doc.	
2SX01PB	-		
1VA01SA	3	TE, GR, IC	
2VA01SA	2	GR, IC	
1VA01SB	2	GR, AB	
2VA01SB	2	GR, IC	
1VA02SA	2	GR, IC	
2VA02SB	-		+
1VA02SB	2	GR, AB	+
2VA02SB	1	GR	
1VA03SA	1	GR	
2VA03SA	1	NW	
1VA03SB	1	GR	
2VA03SB	1	GR	
1VA04SA	2	HE, IC	
2VA04SA	-		
1VA04SB	2	GR, IC	
2VA04SB	-		+
1VA05S	3	TE, IC, NW	
2VA05S	-		
1VA06SA	1	IC	+
2VA06SA	-		

Distribution of Installation Inspection Findings For All 216 Components Inspected

Component I. D.	# Findings	Type of Findings	Documentation Package Reviewed in Inspection Report No. 85050
1VA07S	-		
2VA07S	-		
1VA08S	1	IC	
2VA08S	-		
1VP01AA	-		
1VP01AB	-		
1VP01AC	-		
1VP01AD	-		
0W001CA	-		
0W001CB	-		
0W001PA	-		
0W001PB	-		
0WX05T	-	AB	

TOTAL
216 Component 156 Findings*

*The findings presented in this table do not include findings reported under programmatic NCRs that were written to address a broad class of related issues such as storage and maintenance ((NCR 777), cleanliness (NCR 614), panel installation (NCR 6103), and grout inspection (NCR 560)).

Symbols Used In Reporting Type of Findings

SYMBOL	Description of Findings
GR	No Grout Release or Grout Release hold point bypassed
IC	Internal Cleanliness bypassed
PR	Piping Release bypassed or no piping release sign-off
AB	Anchor Bolt damage or out of tolerance or projection
TE	Thread engagement
PWM	No preweld measurement, or not QC verified
DOC	Documentation filed improperly, or missing initial or dates or wrong data
NW	Nut and washer concerns, loose nut, wrong nut, missing washer, washer obstruction
EL	Equipment off location, or wrong component on location
TR	No test release sign-off
HS	Anchor bolt hole size tolerances not met
HE	Anchor bolt hole elongation
SEC XI	Work not done under ASME Section XI where required
MRR	Work prior to MRR Approval
MT	Nozzle end prep not MT examined
SLP	No Special lifting procedure
QC	QC hold point bypassed

Approximately 10,000 attributes of the 216 pieces of equipment were inspected during the retroinspection program. Of the approximate 10,000 attributes 156 were found discrepant during the retroinspection (approximately 1.5% discrepant).

(3) Review of Additional Items

In addition to the random sample reviewed in Inspection Reports No. 50-456/85050; 50-457/85048, a number of other pieces of safety-related mechanical equipment were reviewed. These are:

Unit 1 Steam Generators
1RC01BA; 1RC01BB; 1RC01BC; 1RC01BD

Unit 2 Steam Generators
2RC01BA; 2RC01BB; 2RC01BC; 2RC01BD

Unit 1 RHR pumps
1RH01PA; 1RH01PB

Unit 2 RHR pumps
2RH01PA; 2RH01PB

Unit 1 Safety Injection pumps
1SI01PA; 1SI01PB

Unit 2 Safety Injection pumps
2SI01PA; 2SI01PB

Unit 1 Primary Reactor Coolant pumps
1RC01PA; 1RC01PB; 1RC01PC; 1RC01PD

Unit 2 Primary Reactor Coolant pumps
2RC01PA; 2RC01PB; 2RC01PC; 2RC01PD

Unit 1 Containment Spray pumps
1CS01PA; 1CS01PB

Unit 2 Containment Spray pumps
2CS01PA; 2CS01PB

The documentation packages associated with these pieces of equipment have been reviewed and the following components have been visually inspected by the NRC inspector: 1SI01PA, 2CS01PB, 2RH01PB, 1RC01PB, 1RC01PA, 2RC01PD, 2RC01BD. The documentation complies with the requirements of ANSI N45.2.8 and is acceptable. The visual inspection discovered no discrepancies.

Commonwealth Edison acknowledges that prior to 1982 an effective program to control and document the installation of safety-related mechanical equipment did not exist at the Braidwood Station. As a result the QCP-B22 procedure was developed and a retroinspection (reinspection) program was performed. These activities have assured that the required inspections have been performed and their associated documentation is properly controlled. Based on the reviews of the Procedure (QCP-B22), the documentation associated with inspection of installation activities, and the visual inspection of the equipment both the documentation and the safety-related equipment installed by Phillips Getschow Company prior the original violation are now in compliance with ANSI N45.2.8 and are acceptable. Also the controls contained in QCP-B22 should minimize the possibility of reoccurrence of these problems.

(4) Steam Generator Bolting

Inspection Reports No. 50-456/85052; 50-457/85050, tracking item 50-456/82-05-01; 50-457/82-05-01 documents review and closure of this issue. In addition, during this inspection two of the damaged steam generator bolts, removed by CECo during the repair have been acquired by the NRC. These bolts were inspected by two NRC inspectors, one a Mechanical Engineer the other a metallurgist. The inspectors came to the following conclusions:

(a) Either excessive force or improperly fitting wrenches were used on these bolts.

(b) There are marks on the head which appear to be caused by blow by a hammer.

(c) Both bolts exhibit thread damage.

(d) One probable explanation for this type of damage is misalignment, another is improperly manufactured threads.

In addition to the inspections documented in Inspection Reports No. 50-456/85057; 50-457/85050, the bolts on the following steam generators were inspected:

1RC01BA
1RC01BD
2RC01BD

The bolts were found to be full tightened and appeared to be properly seated with no deformation of the heads. The documentation review found that all steam generator bolts to have been removed, replaced, lubricated, and retorqued to the proper setting.

(5) Audits

Example 7 of the violation found in inspection report No. 50-456/82-05; 50-457/82-05, states that "no audits were performed by CECo prior to June 30 - July 9, 1980 relative to mechanical equipment erection and inspection activities of Phillips Getshow Company." During this inspection the NRC inspectors reviewed the audit records from this period. The CECo audit records shows the following:

(a) During the period of May 17-21, 1979, General Office Quality Assurance audited the Braidwood site and identified that PGCo Quality Control involvement in equipment setting was not evident. Equipment Erection Records were later produced that demonstrated QC involvement for equipment grouting and tightening of anchor bolts. Based upon this the observation was closed on August 31, 1979.

(b) On June 21, 1979, Site QA Audit No. 20-79-37 was performed that addressed equipment installation. The use of current documents, and the use of qualified personnel, procedures, materials, tools, and equipment were questioned. Also the presence of in-progress inspection of the work and work areas being done during equipment installation was checked. No items of non-compliance were identified.

Therefore it appears that audits of this activity were performed prior to June of 1980, however, subsequent NRC findings (Inspection Reports No. 50-456/82-05; 50-457/82-05) appear to indicate the audits may not have been effective.

Based on review of audit records for audits subsequent to inspection report 456/82-05; 457/82-05, review of installation and QC inspection documentation and visual inspection of safety related mechanical equipment it appears that Commonwealth Edison is performing acceptable audits of this activity.

b. (Closed) Unresolved item (50-456/82-05-03; 50-457/82-05-03): As documented in Inspection Reports No. 50-456/82-05; 50-457/82-05 certain discrepancies in the location of support columns for the Steam Generators and Reactor Coolant pumps were discovered. These discrepancies concern the direction that the support columns lean (toward the reactor or away from the reactor). The significance of the amount and direction that the columns lean is related to the amount of rotational freedom at the spherical hinges in the columns. The columns are designed so that they do not impede the thermal expansion of the reactor coolant piping. If the columns reach the rotational limit the thermal expansion stresses in the reactor coolant piping may increase.

Sargent and Lundy was asked to perform a detailed analysis of the "as-built" situation regarding the columns at Braidwood. Two columns were found to have the potential to reach their rotational limit. After the NRC inspector reviewed the "as-built" configuration and calculations, he posed three questions for the licensee to address. They are:

(1) Is the change in stiffness due to modification of the base attachment design significant?

(2) If the column reaches the rotational limit and is forced to bend will this be design significant?

(3) The cross over pipe is now extremely close to the support column. Will there be significant thermal effects on either the column or the piping?

In addition, Westinghouse Electric Corporation was asked to review the "as-built" configuration in response to the three questions and to review the "as-built" configuration in relation to any significant design concerns which may develop based on their experience. The three questions were adequately answered in a letter from Mr. J. L. Tain of Westinghouse Electric Corporation to MR. D. L. Leone of Sargent and Lundy on July 9, 1985. In addition a letter from J. L. Tain to D. L. Leone on September 12, 1985 states the following "Westinghouse has reviewed the as-built condition of the reactor coolant pump columns as described in your letters and finds it acceptable." These actions adequately resolve the unresolved item 50-456/82-05-03; 50-457/82-05-03.

3. Exit Interview

The Region III inspector met with the licensee representatives (denoted under Paragraph 1) at the conclusion of the inspection on February 24, 1986. The inspectors summarized the purpose and finding of the inspection. The licensee acknowledged this information. The inspectors also discussed the likely informational content of the inspection report with regard to documents or processes reviewed by the inspectors during this inspection. The licensee did not identify any such documents/processes as proprietary.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

FEB 25 1986

Docket Nos.: STN 50-454, STN 50-455
and STN 50-456, STN 50-457

Mr. Dennis L. Farrar
Director of Nuclear Licensing
Commonwealth Edison Company
Post Office Box 767
Chicago, Illinois 60690

Dear Mr. Farrar:

SUBJECT: BYRON/BRAIDWOOD, UNITS 1 and 2, SUPPLEMENTAL SAFETY EVALUATION REPORT FOR PHYSICAL IDENTIFICATION AND INDEPENDENCE OF REDUNDANT SAFETY-RELATED ELECTRICAL SYSTEMS

The enclosed Supplemental Safety Evaluation Report addresses the applicant's electrical separation criteria utilized in the design and construction of Byron and Braidwood Stations.

The NRC staff has evaluated the applicant's criteria established in the Byron/Braidwood Stations FSAR for separation between redundant Class 1E cables and raceways. However, the criteria for separation of non-Class 1E from Class 1E cables were established at reduced distances from those specified in Regulatory Guide 1.75.

The specific issues identified during the Construction Appraisal Team (CAT) inspection concerning electrical separation criteria were discussed during a site visit to Braidwood Station on May 21-23, 1985. As a result of this site visit, we found it necessary to reevaluate the applicant's separation criteria of Class 1E cables from non-Class 1E cables to eliminate any discrepancies and misinterpretation of the separation requirements in this area.

The applicant justified the lesser physical separation by testing and analyzing various test configurations. The NRC staff has evaluated the test program and results for the selected test configurations to assure that the cable arrangements tested satisfactorily represent actual plant design. Based on our review, the NRC staff has determined that the test program and results are acceptable. Therefore, the subject cable separation criteria have been found acceptable. These lesser cable separation criteria must be specified in the Byron/Braidwood Stations FSAR.

FEB 25 1986

Another issue identified during the CAT inspection involved the applicant's use of the term "quasi safety-related." The applicant has stated that the term is used to identify safety-related circuits qualified to Class 1E requirements which are installed in a non-Seismic Category I building. As previously discussed, this term must be defined in the Sargent and Lundy design criteria manual.

The enclosed evaluation will be incorporated in the next published Supplemental Safety Evaluation Report.

Original signed by
Vincent S. Noonan, Director
PWR Project Directorate #5
Division of PWR Licensing-A

Enclosure: SSER on Cable Separation

cc: See next page

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ENCLOSURE

BYRON/BRAIDWOOD, UNITS 1 AND 2
SUPPLEMENT TO SAFETY EVALUATION

8.4.4 Physical Identification and Independence of Redundant Safety-Related Electrical Systems

A site visit was conducted on May 21-23, 1985 at Braidwood Station, Units 1 and 2 in order to view the installation and arrangement of electrical equipment and cables. During this visit specific issues identified during the Braidwood Station Construction Appraisal Team (CAT) inspection were discussed. The CAT inspection revealed several items regarding physical separation, particularly between Class 1E and non-Class 1E cables. Commonwealth Edison Company has established the separation criteria between redundant Class 1E raceways in accordance with R.G. 1.75 for Byron and Braidwood Stations.

However, the applicant has established separation criteria of non-Class 1E from Class 1E raceways which deviates from the specific separation distances detailed in R.G. 1.75. Acceptability of the applicant's lesser separation distance with its bases and justification were not specifically addressed in the Byron/Braidwood Safety Evaluation Report (SER).

Therefore, the staff has performed the following evaluation of the applicant's separation criteria of Class 1E cables from non-Class 1E cables to eliminate any further differences in interpretation of separation requirements in this area.

The applicant instituted a test program conducted by Wyle Laboratories and performed calculations and analysis to justify lesser separation distances. By letter dated August 6, 1985, the applicant submitted the test results, with its associated information, and the analysis on the separation criteria.

The purpose of these tests was to establish a basis of analysis which could be applied in justifying a lesser physical separation distance. Any lesser separation distance than the separation criteria specified in RG 1.75 ~~must~~ be established by the test results.

In order to perform a test program to verify the adequacy of the raceway separation criteria, it was necessary to define the worst case electrical failure that could be postulated to occur in a raceway. The Byron/Braidwood raceway separation test program was based on the following failure assumptions:

(1) The cable or equipment in the circuit develops an electrical fault that is not cleared due to the postulated failure of the primary overcurrent protective device.

(2) The fault current used was the RMS value which produces the maximum possible credible heating effect without tripping the breaker by magnetic force.

(3) Load current effects from other loads on the same circuit was not considered to cause the next higher level overcurrent device to trip.

The worst case failure of a cable for which the electrical separation criteria must protect cables in an adjacent raceway is a sustained overload condition where the magnitude of the current is such that the cable would be able to

sustain the overload for a significant length of time. This condition would allow the cable to generate the greatest amount of heat over a period of time and, therefore, has the greatest potential for causing damage to nearby circuits. On the other hand, if the cables were exposed to the maximum short circuit current available at the bus, the higher fault current would lead to rapid clearing of the fault by a breaker. This condition causes less energy to be generated to the ambient and hence results in less temperature rise in the adjacent raceway. For the purpose of the test, the cables were subjected to the overload currents for the length of time it took to open the circuit through failure of the cable conductors. This is considered to be a very conservative test since no credit was taken for any current interrupting devices operating in the circuit.

The purpose of these tests was to establish an analytical basis for demonstrating the minimum acceptable separation distance. Any separation distance less than the separation criterion specified in RG 1.75 shall also be established by the test program.

In selection of the test configuration, the primary concern was to ensure that the quantity and types of raceway and cable arrangements tested would satisfactorily represent actual plant configurations and provide a basis for applying the results of the testing to similar configurations which were not tested. Using this criterion, the following representative configurations were selected for our evaluation:

a. Separation distances of one foot (12") vertical and three inches (3") horizontal between safety-related and nonsafety-related raceways.

   Our analysis concludes that fire or failure resulting from electrical faults induced in nonsafety-related cables in a raceway would not cause electrical failure of safety-related cables in a raceway located 12" directly above or below or 3" horizontally away from the nonsafety-related

raceway. The analysis was based on actual results of tests performed to establish electrical separation distance. The cable failures addressed in the establishment of separation distance in this analysis are those which are induced by an electrical fault within the nonsafety-related cable only.

The raceway configuration chosen for the test is one in which an open top cable tray containing nonsafety-related power cables is located (2") below a cable tray containing safety-related cables. The configuration also included a 2" flexible steel conduit, containing safety-related cables running vertically, separated by 2" horizontally from the nonsafety-related cable tray.

The value of overload current which was selected for the test was approximately six and one half times the rated current overload value for the given cable size. This value is based on the fact that a stalled motor would draw about six and one half times rated current. The current of a stalled motor was selected because it was considered a credible overload current which may occur during normal operating conditions.

The target cables in the upper cable tray and vertical flex conduit were continually energized during the test with their rated current. The actual value of overload current which the faulted cables were exposed to during the test are 462A for 3/C #2AWG, 737A for 3/C 1/0, and 2070A for 3/C 350 MCM. These values are based on 6.5 times rated current over-current test. The length of time for which each of the faulted cables were energized with the overload is very conservative. As stated previously, the overload current value was selected because it was representative of the test current which a stalled motor may draw. This was evaluated as the most credible cause of a sustained overload current. In reality, the motor windings would eventually short together and result in a full short circuit which would be of a high enough magnitude to trip upstream circuit breakers even if a feeder breaker fails. Calculated

fault currents are 4600 amperes for the size 2 AWG cable, 5400 amperes for the size 1/0 AWG cables, and 6700 amperes for the size 350 MCM cables short circuit test. The test results demonstrated that these fault current values caused relatively minor damage to the fault cable insulation, particularly when compared to the extreme degradation incurred with the lower (6.5 times rated current) overcurrent tests. The major reason for the decreased insulation system damage is the fact that the conductor circuits open much faster at higher current values.

The acceptance criteria were specified by a review of applicable IEEE Standard, Underwriter Laboratories and American National Standard testing requirements in 600 Vac circuitry. At the completion of each cable test, functional tests for the target cables which consisted of the Insulation Resistance Test, High Potential Test, Overcurrent Test and Post-Test Functional Test were performed. The target cables passed the above tests in accordance with the acceptance criteria and cable manufacturer's specification.

The results of Wyle Laboratories Test Report demonstrate that all of the target cables in upper cable tray (located 12" above the cable tray containing the faulted cable) and in the vertical conduit (located 2" horizontally away from faulted cable tray) maintained their integrity to conduct specified current and voltage before, during and after the fault specimens were subjected to the overload currents. The target cables passed the post-functional insulation resistance tests at 500 Vdc and high potential withstand at 2200 Vac. The temperature which was measured on the target cables in the upper cable tray and in the flex conduit was much less than the temperature for which the cables are continuously rated and significantly less than the emergency temperature rating of 130°C of the power, control, and instrument cables.

The staff has reviewed the result of Test Report No. 46511-3 conducted by Wyle Laboratories and the applicant analysis. Based on the staff's

review, the staff concludes that the separation distance of 12" vertical and 3" horizontal between safety-related and nonsafety-related raceway is adequate to prevent a fault in nonsafety-related cable causing failure of safety related cables and is, therefore, acceptable.

b. Separation of a safety-related cable in free-air in contact with a raceway containing a nonsafety-related cable and of a nonsafety-related cable in free-air in contact with a raceway containing a safety-related cable.

The purpose of this analysis and test is to demonstrate that fire or failure resulting from electrical faults induced in nonsafety-related cables in free-air or in raceway will not cause electrical functional failure of safety-related cables in raceway or in free-air respectively.

This configuration consists of a test between two horizontal, rigid steel conduits and various free-air instrumentation cables. The faulted cable is a 3/C 500 MCM routed in a rigid steel conduit. Three target cables located in a 1" rigid steel conduit in contact with the conduit containing the faulted cable. Three other target cables, respectively, are mounted in free air in contact with the conduit of the faulted cable. This configuration test demonstrates the adequacy of separation design that: (1) two horizontal, rigid conduits are physically separated by zero inches vertically when a worst-case electrical fault occurs in the lower conduit, or (2) free air cables are physically separated from a horizontal rigid steel conduit by zero inches horizontally when a worst-case electrical fault occurs in the conduit. All instrumentation cables for use in both safety-related and nonsafety-related applications are rated for 600 volts with insulation tested to a minimum of 1500 volts with a overall jacket and are applied in circuits with a system voltage less than 30 volts. Control cables are applied in circuits with a system voltage of either 120 Vac or 125 Vdc. Low voltage power cables are applied in circuits with a system voltage of 480 Vac. Control and low power cables have insulation

rated at 600 volts. The cable is also tested to show that it can withstand voltage transients up to 1500 volts. Medium voltage power cables are applied in circuits with system voltages of 4160 V or 6900 V. These are required to have insulation rated at 5 kV and 8 kV respectively. The cable is also tested to show that it can withstand voltage transients of up to 16 kV and 22 kV respectively. Therefore, there is a conservative design margin in the cable to assure adequate isolation from voltage transients in the nonsafety-related circuit from adversely affecting a safety-related circuit.

For the purpose of the verification test, it was assumed that the circuit breaker feeding the overloaded cable fails to trip and the overcurrent will persist in the cable. The fault current which was considered the most credible severe overload condition which the cable may see during plant operation is that resulting from a motor failing to start but continuing to draw locked rotor current as described above. The actual test current values were selected from the largest motor which is fed with a 500 MCM 600 V cable at Byron or Braidwood. This motor is a 250 HP motor which has a locked rotor current of approximately 1700A. If the voltage drop is taken into consideration, the actual current which would be seen by the cable is approximately 1300A. The overcurrent test, therefore, consisted of energizing the 500 MCM size to 1300A for one hour and 1700A until the cable open circuited. The two step overcurrent test was selected in order to simulate a worst case condition by energizing the cables with a fault current which cause the cable to generate considerable heat but would not cause an open circuit, and then jump the fault current to a value which would eventually open circuit the cable. The one hour time limit on the 1300A portion of the test was considered conservative since a stalled motor would be alarmed and deenergized long before one hour. Alternatively, the motor winding would short together and result in a full short circuit which would be interrupted by the upstream breakers.

The target cables were energized continually during the test. The target cables passed pre and post functional tests which consisted of both insulation resistance and high potential withstand tests.

As previously stated, the primary objective in the selection of the test configuration was to ensure that the quantity of raceway and cable arrangements tested would satisfactorily represent actual plant configurations and provide a basis for applying the results of the testing to similar configurations which were not tested.

The results of these tests performed, Test Report No. 17769-1, by Wyle Laboratories indicate that all of the target cables maintained integrity to conduit specified current and voltage before, during and after the fault specimen was subjected to the overload current. At the completion of each cable test, the functional tests were performed for the target cables. The target cables passed the above tests in accordance with the acceptance criteria and cable manufacturer's specification.

The staff has reviewed the results of the Test Report No. 17769-1 conducted by Wyle Laboratories and the applicant's analysis of these configuration tests. Based on staff's review, the staff concludes that it is acceptable for (a) safety-related cables in free-air to come in contact with a raceway containing nonsafety-related cables and (b) nonsafety-related cable in free-air to come in contact with a raceway containing safety-related cables. This analysis has demonstrated that safety-related cable will not be degraded below an acceptable level due to the reduced separation as specified in the FSAR.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION III
799 ROOSEVELT ROAD
GLEN ELLYN, ILLINOIS 60137

FEB 28 1986

Docket No. 50-456
Docket No. 50-457

Commonwealth Edison Company
ATTN: Mr. Cordell Reed
Vice President
Post Office Box 767
Chicago, IL 60690

Gentlemen:

Enclosed for your review, prior to our scheduled meeting on March 14, 1986, is the SALP 5 Board Report for the Braidwood Station, Units 1 and 2, covering the period July 1, 1984 through November 30, 1985.

In accordance with NRC policy, I have reviewed the SALP Board assessment and concur with their ratings. Your overall regulatory performance at Braidwood was considered to be acceptable during this assessment period. Sixteen functional areas were evaluated. You were rated Category 1 in one area, Category 2 in eleven areas, Category 3 in one area, and three areas were not rated. Your performance showed an improved trend in six areas and your rating improved from Category 3 to Category 2 in three of these areas: Quality Programs and Administrative Controls Affecting Quality, Piping Systems and Supports, and Safety-Related Components. No declining performance trends were identified. Housekeeping and Equipment Protection was rated Category 3, based upon Unit 1 being in the preoperational test phase where an improved level of cleanliness is expected. This area was not rated in the previous assessment period.

In meetings and in correspondence with you following our inspections in 1982 and 1983 we had stated that we had serious questions about the quality of work at Braidwood and had expressed concern about the need for more aggressive CECo management involvement in and support of the CECo QA program. In the letter accompanying the SALP 4 Board Report we had noted that during the last part of that SALP period your overall regulatory performance was showing an improved trend. The current SALP 5 report indicates that this trend continued resulting in improved performance particularly in the three important areas in which you had been rated Category 3. The results of your efforts to date and the continuation of this level of effort will provide adequate assurance that construction deficiencies of the past have been corrected and that ongoing work is being properly carried out.

While you will have sufficient opportunity to present your comments at the meeting on March 14, 1986, we also solicit written comments within 30 days after the meeting to enable us to thoroughly evaluate your comments and provide you with our conclusions relative to them.

In accordance with Section 2.790 of the NRC's "Rules of Practice," Part 2, Title 10, Code of Federal Regulations, a copy of this letter and the SALP Report will be placed in the NRC's Public Document Room.

No reply to this letter is required at this time; however, should you have any questions concerning the SALP Report, we would be pleased to discuss them with you.

Sincerely,

A Bert Davis

for James G. Keppler
Regional Administrator

Enclosure: SALP 5 Board Reports
No. 50-456/86001;
No. 50-457/86001

See Attached Distribution

Distribution

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SALP 5

SALP BOARD REPORT

U.S. NUCLEAR REGULATORY COMMISSION

REGION III

SYSTEMATIC ASSESSMENT OF LICENSEE PERFORMANCE

50-456/86001; 50-457/86001
Inspection Report Nos.

Commonwealth Edison Company
Name of licensee

Braidwood Station, Units 1 & 2
Name of Facility

July 1, 1984 through November 30, 1985
Assessment Period

I. INTRODUCTION

The Systematic Assessment of Licensee Performance (SALP) program is an integrated NRC staff effort to collect available observations and data on a periodic basis and to evaluate licensee performance based upon this information. The SALP program is supplemental to normal regulatory processes used to ensure compliance to NRC rules and regulations. The SALP program is intended to be sufficiently diagnostic to provide a rational basis for allocating NRC resources and to provide meaningful guidance to the licensee's management to promote quality and safety of plant construction and operation.

An NRC SALP Board, composed of staff members listed below, met on January 22, 1986, to review the collection of performance observations and data to assess licensee performance in accordance with the guidance in NRC Manual Chapter 0516, "Systematic Assessment of Licensee Performance." A summary of the guidance and evaluation criteria is provided in Section II of this report.

This report is the SALP Board's assessment of the licensee's safety performance at Braidwood Station, Units 1 and 2, for the period July 1, 1984 through November 30, 1985.

The following personnel attended the SALP Board for Braidwood Station, Units 1 and 2

Name	Title
James G. Keppler	Regional Administrator
A. B. Davis	Deputy Regional Administrator
J. A. Hind	Director, DRSS
E. G. Greenman	Deputy Director, DRP
C. J. Paperiello	Director, DRS
L. A. Reyes	Branch Chief, DRS
W. D. Shafer	Branch Chief, DRSS
W. S. Little	Director, Braidwood Project
W. L. Forney	Section Chief, DRP
M. A. Ring	Section Chief, DRS
M. P. Phillips	Section Chief, DRSS
L. R. Greger	Section Chief, DRSS

R. N. Gardner	Acting Section Chief, DRP
E. R. Schweibinz	Section Chief, DRP
C. C. Williams	Section Chief, DRS
P. R. Pelke	Project Inspector, DRP
M. J. Farber	Project Inspector, DRP
W. B. Grant	Radiation Specialist, DRSS
L. G. McGregor	Senior Resident Inspector, DRP
W. J. Kropp	Resident Inspector, DRP
T. M. Tongue	Senior Resident Inspector, DRP
D. L. Williams	Reactor Inspector, DRS
J. L. Belanger	Physical Security Inspector, DRSS
R. D. Schulz	Senior Resident Inspector, DRP
R. Mendez	Reactor Inspector, DRS
C. M. Trammell	Senior Project Manager, NRR
J. A. Stevens	Project Manager, NRR

II. CRITERIA

The licensee's performance is assessed in selected functional areas, depending upon whether the facility is in a construction, preoperational, or operating phase. Functional areas normally represent areas significant to nuclear safety and the environment. Some functional areas may not be assessed because of little or no licensee activities, or lack of meaningful observations. Special areas may be added to highlight significant observations.

One or more of the following evaluation criteria were used to assess each functional area.

1. Management involvement and control in assuring quality

2. Approach to the resolution of technical issues from a safety standpoint

3. Responsiveness to NRC initiatives

4. Enforcement history

5. Operational and Construction events (including response to, analyses of, and corrective actions for)

6. Staffing (including management)

7. Training effectiveness and qualification

However, the SALP Board is not limited to these criteria and others may have been used where appropriate.

Based upon the SALP Board assessment, each functional area evaluated is classified into one of three performance categories. The definitions of these performance categories are:

Category 1: Reduced NRC attention may be appropriate. Licensee management attention and involvement are aggressive and oriented toward nuclear safety; licensee resources are ample and effectively used so that a high level of performance with respect to operational safety and construction quality is being achieved.

Category 2: NRC attention should be maintained at normal levels. Licensee management attention and involvement are evident and are concerned with nuclear safety; licensee resources are adequate and are reasonably effective such that satisfactory performance with respect to operational safety and construction quality is being achieved.

Category 3: Both NRC and licensee attention should be increased. Licensee management attention or involvement is acceptable and considers nuclear safety, but weaknesses are evident; licensee resources appear to

be strained or not effectively used so that minimally satisfactory performance with respect to operational safety and construction is being achieved.

Trend: The SALP Board has also categorized the performance trend in each functional area rated over the course of the SALP assessment period. The categorization describes the general or prevailing tendency (the performance gradient) during the SALP period. The performance trends are defined as follows:

Improved: Licensee performance has generally improved over the course of the SALP assessment period.

Same: Licensee performance has remained essentially constant over the course of the SALP assessment period.

Declined: Licensee performance has generally declined over the course of the SALP assessment period.

III. SUMMARY OF RESULTS

	Functional Areas	Rating Last Period	Rating This Period	Trend
A.	Plant Operations	X	NR	---
B.	Radiological Controls	2	2	Improved
C.	Preoperational Testing	2	2	Same
D.	Fire Protection	X	NR	---
E.	Emergency Preparedness	X	2	---
F.	Security	X	NR	---
G.	Quality Programs and Administrative Controls Affecting Quality	3	2	Improved
H.	Licensing Activities	2	2	Same
I.	Containment, Safety-Related Structures, and Major Steel Supports	2	2	Same
J.	Piping Systems and Supports	3	2	Improved
K.	Safety-Related Components - Mechanical	3	2	Improved
L.	Auxiliary Systems	2	2	Same
M.	Electrical Equipment and Cables	2	2	Same
N.	Instrumentation	2	2	Improved
O.	Braidwood Construction Assessment Program	X	1	Improved
P.	Housekeeping and Equipment Protection	X	3	Same

X = Not Rated Last Report

NR = Not Rated because of lack of activity in the area.

IV. PERFORMANCE ANALYSIS

A. Plant Operations

1. Analysis

Examination of this functional area consisted of two inspections by the resident inspection staff. Areas examined included preparation for new fuel receipt, Technical Specification review, operational preparedness, and station involvement in preoperational testing. No violations were identified.

During preparations for receipt of new fuel, management involvement was evident through good planning with adequate procedures, equipment, training, and area preparation. This was further evidenced in the Quality Control inspections of the new fuel after the SALP 5 period ended, when discrepancies in the fuel were identified by the licensee that were missed by the fuel supplier. These discrepancies were: foreign material in a fuel assembly, a dented fuel pin, and questionable orientation of the components of another fuel assembly.

A weakness in the coordination of station activities was evident in that some tests were conducted and equipment was energized by test personnel without the control room being informed.

Recent work on the reactor coolant pump seals is an example of good coordination between the quality control and maintenance departments; however, weakness was identified during the testing of a pressurizer safety relief valve when interface between station groups was not properly coordinated. Although the final test results were acceptable, the first test was unacceptable and had to be repeated.

The station is not presently fully manned and a large portion of personnel are on other assignments or in training; however, manpower has been sufficient for the ongoing activities. An effort is underway to meet future manning requirements as the station continues toward operation. This also includes changes in management personnel, such as the recent appointment of the Station Manager and Services Superintendent which should result in improved communications.

The station currently has or is developing programs for improved licensing exam results, radiation awareness, elimination of personnel errors in operations, meeting surveillance requirements, housekeeping, communications, and security.

2. Conclusion

Due to limited activity in this area, the licensee is not rated. The licensee was not rated in the previous assessment period. Due to limited activity, no trend during this assessment period can be determined.

3. Board Recommendations

The board notes that the licensee should continue to aggressively pursue the programs discussed in the analysis to ensure an orderly transition from construction to operations.

B. Radiological Controls

1. Analysis

Four preoperational radiation protection inspections were conducted during the assessment period by regional specialists. Additionally, the resident inspector reviewed health physics activities related to the receipt of new fuel and a radiography incident. No violations were identified. Inspections of the radiochemistry and radiological environmental monitoring programs were not conducted during this assessment period.

Continued management involvement in the staffing and development of the radiation protection program has resulted in significant progress in those areas. Management involvement is also evident in other related areas. The initial licensee rad/chem program audit, which was conducted during the assessment period, appeared thorough. Licensee corrective actions for this audit were adequate and timely. The licensee made excellent use of the first Radiation Occurrence Report (ROR) as a learning exercise for the entire station.

Training and qualification of personnel is progressing according to schedule. Staffing of the rad/chem department is over 90% complete. It is expected that a sufficient number of rad/chem personnel for shift staffing will receive required training and be shift qualified by fuel load. General Employee Training (N-GET) for all employees and contractors has been developed and initial training is being conducted. The radiation protection manager (RPM) has made significant progress toward completing licensee commitments for additional training and experience. The only commitment remaining is for the RPM to participate in the Byron refueling which is scheduled for 1986. A training and qualification weakness evidenced when three recently trained radiation protection technicians violated a radiographer's "Radiation Area" posting was addressed satisfactorily by the licensee.

The licensee's responsiveness to NRC initiatives has been good. Early NRC concerns about the RPM's training and experience, and rad/chem department staffing and training inadequacies resulted in licensee commitments to resolve those concerns. Proposed schedules for staffing and training have been followed and improvements are evident. Several health physics weaknesses related to the receipt of new fuel, identified by the resident inspector, were resolved prior to the receipt of the first shipment of fuel.

The licensee's resolution of technical issues is generally sound and timely. Some design weaknesses remain in the area designated for access control activities. The allotted space appears insufficient and will likely result in congestion during startup and refueling activities. Improvements are being evaluated by the licensee. Inadequacies with the respirator issue and decontamination facility due to its inaccessibility have been identified by the licensee. A new location has been selected and construction will commence soon. Construction modifications in the counting room and the high level chemistry lab are delaying installation, calibration, and testing of equipment in those rooms. The licensee is aware of these problems and is working on solutions. Installation of the NUREG-0737 mandated post-accident effluent monitors, sampling systems and radiation monitors is generally adequate. The modified Sentry high range radiation sampling system, the containment high range radiation monitors, and the General Atomic Wide Range Gas Monitors are inplace and power and sample lines are being installed.

2. Conclusions

The license is rated Category 2 in this area. This is the same rating as the previous assessment period. Licensee performance has improved during this assessment period.

3. Board Recommendation

None.

C. Preoperational Testing

1. Analysis

Examination of this functional area consisted of eight inspections by regional office staff members and portions of ten inspections conducted by the resident staff. Areas examined included (1) licensee action on previous inspection findings; (2) review of preoperational test procedures; (3) witnessing of preoperational test performance; (4) preoperational test procedure verification; (5) evaluation of preoperational test results; (6) verification of preoperational test results; and (7) implementation of the preoperational test program.

Two violations were identified:

a. Severity Level V - Adequate testing and acceptance criteria to verify that pump temperatures and vibrations were within design limits and the pump room cubicles do not exceed environmental qualification limits were not included in the Auxiliary Feedwater System test procedure (456/85026).

b. Severity Level V - Inadequate implementation of the test deficiency program; (1) failure to initiate a test deficiency when required by the implementing procedures; (2) inadequate description of deficient conditions; and (3) inadequate corrective action to resolve deficient conditions (456/85026).

Violation a. identified a failure to include adequate testing and acceptance criteria in a preoperational test. Licensee corrective action involved rescinding approval of the test and issuing a revised version which included the missing acceptance criteria. Since these acceptance criteria were included in the Byron test, to preclude further occurrences the licensee has re-emphasized the need for review and comparison of Braidwood tests with the corresponding Byron 1 test under their example test program. Violation b. involved failure to adequately implement the existing procedures for deficiency reporting. Corrective action by the licensee was thorough and involved retraining of personnel and a comprehensive review of previously completed test documents to correct any occurrences of similar errors.

In response to inspector concerns on both technical and procedural issues the licensee has occasionally required repeated discussions of the issue to assure clear understanding. As a result, responses and corrective actions, while generally acceptable and thorough, are sometimes delayed and require extensions of time. This is evidenced by the following issues:

a. The NRC requested identification of the guidelines (ANSI 18.7 or N45.2) used to control the quality assurance program for preoperational testing. As of January 1, 1986, approximately eleven months since the issue was identified, the licensee has yet to formally document their selection of quality assurance program guidelines.

b. The technical adequacy of the containment sump testing with respect to the demonstration of vortex control was first identified in March of 1985, and was the subject of a subsequent inspection in July. As of January 1, 1986, the licensee has not proposed a resolution of the issue.

In March of 1985, the licensee presented a comprehensive action plan designed to improve preoperational testing performance. Follow-up inspections have shown that the licensee has adequately implemented a majority of the program elements. The notable exception is the development, review approval, and issue of parallel Byron/Braidwood Startup Manuals. As of January 1, 1986, this effort had not proceeded beyond the review and comment phase.

Two 10 CFR 50.55(e) reports were submitted relating to this area regarding (1) failure of the diesel generators to sustain adequate fuel prime and (2) faulty diesel generator tachometers.

Preoperational testing activities have been restricted for the past eight months by Human Factors modifications to the control room. Prior to commencement of the control room modifications the licensee had conducted Engineered Safety Features (ESF) testing involving the Diesel Generators and the Emergency Core Cooling Systems. As of January 1, 1986, the results of these tests had not been accepted by the Project Engineering Department (PED). The potential impact on the test program schedule of possible retesting and resolution of issues resulting from the PED review is considered significant. NRC inspection efforts have been confined to the programmatic aspects of the organization and monitoring of action plan implementation. Review of certification training and personnel qualifications coupled with limited observation of testing activities indicate that staffing levels are adequate and personnel are adequately qualified and properly certified to conduct the preoperational test program.

2. Conclusion

The licensee is rated Category 2 in this functional area. This is the same rating as the previous assessment period. Due to limited testing activities, no trend during this assessment period can be determined.

3. Board Recommendations

None.

D. Fire Protection

1. Analysis

During this assessment period, one special inspection was conducted by Region III personnel to assess the licensee's conformance to fire protection requirements for receipt and storage of new fuel onsite. No violations or deviations were identified.

The scope of this inspection was limited to the new fuel storage area and certain specific fire protection features. For the areas assessed, the licensee's plans for making the required fire protection features operational prior to receipt of fuel onsite were determined to be satisfactory. An assessment of the Appendix R requirements of the licensee's fire protection program implementation was not made during this assessment period. Therefore, a comprehensive evaluation of the licensee's performance in this functional area is not being made.

2. Conclusion

The licensee is not rated in this area due to the limited scope of the one inspection that was conducted. The licensee was not rated in the previous assessment period. Due to the limited inspection activity, no trend during this assessment period can be determined.

3. Board Recommendations

None.

E. Emergency Preparedness

1. Analysis

Two inspections were conducted during the period. The purpose of the first inspection was to determine an appropriate period for conducting the preoperational Emergency Preparedness Implementation Appraisal. Based on the licensee's current schedule for completing training of all members of the onsite emergency organization, a two-week period beginning in late March or April 1986 was tentatively scheduled for conducting this appraisal. The second inspection was the observation of the licensee's first emergency preparedness exercise.

The exercise's scope and objectives and a complete scenario package were submitted by the deadlines set in NRC guidance. The licensee provided timely, technically sound responses to most of the staff's questions on the scenario information. However, the final scenario contained several errors which resulted in some confusion during the exercise. Revision 1 of the Braidwood Annex to the generic Generating Stations Emergency Plan (GSEP) had not been made available for staff review as early as had been anticipated. During preparation of Chapter 13.3 of the Braidwood SER, the staff noted some inconsistencies between statements contained in the GSEP and Revision 0 to the Braidwood Annex. The licensee's proposed changes to eliminate these inconsistencies were acceptable. However, Revision 1 to the Annex, which the licensee had stated would be issued about October 1985, was not received by the staff during the assessment period.

The licensee has adequate numbers of personnel to fill well-defined, key positions in the emergency organization. All emergency preparedness training for all members of the onsite emergency organization is scheduled to be completed by April 30, 1986. All emergency preparedness training had already been completed by those Station personnel who had been designated as exercise participants. With very few exceptions, exercise participants successfully demonstrated their abilities to adequately perform their emergency responsibilities, despite the fact that the Station's GSEP Coordinator had conducted the bulk of the specialized emergency preparedness training in addition to her other duties. The over-reliance on the GSEP Coordinator to personally conduct so much of the specialized training was due, in part, to a turnover in Training Department staff and a delay in the issuance of standardized lesson plans from the licensee's Production Training Center. The Coordinator's efforts were also hampered by the time demands placed on proposed members of the onsite emergency organization to complete other duties.

2. Conclusion

The licensee is rated Category 2 in this area. The licensee was not rated in the previous assessment period. Due to limited inspection activity, no trend during this assessment period can be determined.

3. Board Recommendation

None.

F. Security

1. Analysis

One routine preoperational inspection was conducted by a regional inspector during the early part of the assessment period. This initial inspection concentrated on the adequacy of the licensee's planning and scheduling for program implementation. The licensee's security requirements become effective upon issuance of an operating license; therefore, no violations were identified in the assessment period.

Major elements of the security program were identified and included in a program implementation schedule which was found to be acceptable.

The Physical Security Plan, the Security Personnel Training and Qualification Plan, the Safeguards Contingency Plan, and the Security Plan for Special Nuclear Material were approved by NMSS during the assessment period. There was evidence of prior planning by licensee (usually including corporate level) management. Responses regarding safeguards matters were technically sound and consistent, demonstrating the existence

of policies and procedures for control of security related activities. Solutions to technical safeguards issues were sound, timely, and conservative, indicating an understanding of the issues. Resolutions were submitted promptly, and in most cases, were acceptable the first time. Security organization management positions and responsibilities were well defined. The security staff is considered to be more than ample to implement the facility physical protection program.

2. Conclusion

Due to limited inspection activity in this area, the licensee is not rated. The licensee was not rated in the previous assessment period. Due to limited inspection activity, no trend during this assessment period can be determined.

3. Board Recommendations

None.

G. Quality Programs and Administrative Controls Affecting Quality

1. Analysis

Examination of this functional area consisted of nine inspections by the resident inspection staff, seven inspections by the regional based staff, and a portion of the CAT inspection. Areas examined included (1) cleanliness inspections of piping and safety-related components; (2) allegations; (3) Quality First Program; (4) alcohol and drug policies; (5) hydrogen recombiner power and control cabinet; (6) disposition of nonconformances; (7) material traceability; (8) design change control; (9) corrective action systems; (10) project management; (11) Quality Control Inspector Reinspection Program; (12) 10 CFR 50.55(e) reporting; (13) preoperational and operational quality assurance program; (14) procurement; (15) licensee auditing of contractor activities; and (16) trending.

Seven violations were identified:

a. Severity Level IV - CECo placed purchase orders for pipe cleaning with an unapproved bidder that did not have a quality assurance program. Furthermore, the purchase orders were not reviewed and accepted by the CECo Quality Assurance Department (456/84017; 457/84017).

b. Severity Level IV - 337,350 feet of pipe which was rejected due to rust, scale, and failure to cap the pipe ends was not placed on hold to prevent installation in safety-related systems. In addition, the rejected pipe was not properly dispositioned in that only 206,744 feet of pipe was chemically cleaned (456/84017; 457/84017).

c. Severity Level IV - Quality control inspections of internal cleanliness had not been formulated during the installation process to assure the absence of corrosion, pitting, and contaminants including foreign objects (456/84021; 457/84020).

d. Severity Level V - A hydrogen recombiner power and control cabinet was received without required documentation and was subsequently released for installation (456/84034).

e. Severity Level IV - Sargent and Lundy calculations which provided the original justification for the Ø factor design methodology and magnitude were not retrievable (456/84043; 457/84039).

f. Severity Level V - CECo employed designs for safety-related HVAC duct supports which did not limit the slenderness ratio for ceiling mounted duct supports (456/84043; 457/84042).

g. Severity Level IV - The licensee's QA organization inappropriately closed a nonconformance report (456/85015).

Violations a. and b. related to the pipe corrosion problem which was reported to the NRC prior to the assessment period per 10 CFR 50.55(e) (84-10). The purchase orders referenced in Violation a. were placed in mid-1981. Additionally, the deficiencies related to Violation b. occurred prior to the assessment period. The licensee's final report on the corrosion problem was issued subsequent to the assessment period.

Violation c. resulted from deficiencies which existed prior to the assessment period and the licensee has implemented a system flushing program to resolve this item. The equipment referenced in Violation d. was received in mid-1981. Violations e. and f. are discussed below. Violation g. was an isolated case involving one NCR; however, NRC review of the licensee's corrective actions had not been completed at the end of the assessment period.

During the assessment period, the licensee implemented the Quality First program as a mechanism for employees to report safety concerns to the licensee. Interviews are conducted with employees on a scheduled basis and exit interviews are conducted with all persons terminating employment.

The Quality Control Inspector Reinspection program is designed to confirm, through reinspection, the effectiveness of contractors' certification programs for quality control inspectors for the period prior to late 1982. The reinspections are performed by qualified inspectors, other than those who did the original inspection. BCAP determined that when implemented, the program can be expected to provide the desired confidence in the adequacy of the inspector certification method which was used in the period of interest.

Several allegations were reviewed which did not result in violations relating to (1) deficiencies in the design calculations for the primary shield wall; (2) 1/4" expansion anchor bolts holding electrical, HVAC, instrumentation and mechanical panels to floors and walls being underdesigned; (3) use of salt in parking lots; (4) construction equipment damage and thefts; and (5) abuse/dealing of alcohol and drugs.

One allegation reviewed concerning inadequate piping wall thickness was previously identified by Violations a. and b.

One inspection reviewed concerns expressed by the expert witness for the Intervenors during the remanded ASLB hearing for the Byron Station related to Sargent and Lundy design criteria and calculations, computer programs, and several other areas. Two of the concerns resulted in violations e. and f. The licensee's response and corrective actions related to these violations were reviewed and found to be acceptable. In addition to the violations, a number of design practices were found to be in need of improvement. During the inspection, appropriate corrective actions were taken by the architect engineer to implement the needed improvements in the design process.

Two 10 CFR 50.55(e) reports were submitted in this area regarding (1) containment sump isolation valves were determined to not be seismically qualified in their installed configuration and (2) certain postulated high energy line breaks in the auxiliary building were evaluated for potential environmental effects on safety-related equipment using information which has been shown to be inaccurate.

On March 15, 1985, the licensee discussed actions which were taken to improve performance in this functional area. These included improvements in the CECo QA organization, staff size and experience, site audit program, and improved interface with operations QA. The actions taken appear to be effective. Additionally, the licensee implemented the Braidwood Construction Assessment Program which is discussed under Section O.

The CAT inspection concluded that there was no pervasive breakdown in meeting construction requirements in the samples of installed hardware inspected by the team or in the applicant's project construction controls for managing the Braidwood project.

2. Conclusion

The licensee is rated Category 2 in this area. The licensee was rated Category 3 in the previous assessment period. Licensee performance has improved during the assessment period.

3. Board Recommendations

None.

H. Licensing Activities

1. Analysis

During the evaluation period there was a significant level of activity. Substantial effort was expended in preparing for the Braidwood OL hearing, which commenced on October 29, 1985. The low power license for Byron 1 was issued on October 31, 1984 and the full power license was issued on February 14, 1985. Consequently, many issues common to both Byron and Braidwood were addressed during this evaluation period. A number of site-specific issues concerning Braidwood were also addressed. The first draft of the Braidwood Technical Specifications was issued on October 7, 1985 for review and comment; the second draft was subsequently issued on January 13, 1986.

The licensee's decision making is usually at a level that ensures adequate management review. The submittals needed to support licensing were generally timely, thorough and technically sound. Upper management was available to resolve concerns and took an active role on certain actions, such as the action concerning pipe whip restraints using energy absorbing material and safety-related D. C. systems.

The licensee demonstrated a good understanding of the technical issues under review. Their approach to the resolution of technical issues was generally sound and thorough; conservatism was exhibited and approaches were viable. In several instances, the licensee challenged staff positions, but only when it believed safety would not be compromised.

In the weeks prior to issuance of the low power and full power licenses for Byron Unit 1, the licensee had to respond to many NRC initiatives common to both Byron and Braidwood in a short period of time. The licensee responses were generally timely, sound and thorough.

Key positions are clearly identified and responsibilities and authorities are well defined for both the plant staff and the licensing department. The security organization positions and responsibilities are well defined; the security staff is considered to be more than ample to implement the facility physical protection program.

The licensee has developed a comprehensive Shift Experience Program for Braidwood Station. The program is designed to give senior operators on shift additional supervisory training at an operating PWR (Zion Station) such that they can satisfy the hot participation requirements of Generic Letter 84-16. This program is scheduled to be completed by June 1986.

2. Conclusion

The licensee is rated Category 2 in this area. This is the same rating as the previous assessment period. Licensee performance has remained the same during the assessment period.

3. Board Recommendations

None.

I. Containment, Safety-Related Structures, and Major Steel Supports

1. Analysis

Examination of this functional area consisted of nine inspections by the resident inspection staff, four inspections by the regional based staff, and a portion of the CAT inspection. Areas examined included (1) previous inspection findings and reportable items; (2) structural steel and supports; (3) allegations regarding defective block wall columns; (4) design change to a reactor coolant pump lateral support; (5) concrete drilling and coring; (6) IE Bulletin 79-02; (7) concrete; (8) masonry walls; (9) concrete expansion anchor bolts; (10) reinforcing steel configuration; (11) cadwelds; (12) allegation concerning undocumented removal of welds from structural steel; (13) modifications to beams; (14) battery room walls; (15) installed bolts for the steam generator inner frame support columns; (16) containment coatings; (17) apparent concrete deficiencies in the Unit 1 refueling water tunnel and its attachment to the refueling tank slab; (18) polar crane bolting; (19) structural bolting and welding; (20) grout testing; (21) trending; and (22) containment tendons.

Four violations and one example were identified:

a. Severity Level V - One example involving a welding procedure which was not approved by the architect engineer, but was released for use, and was used for cover plate welds (456/84017; 457/84017).

b. Severity Level IV - One hundred and twenty structural steel fillet welds were painted prior to acceptance of the work and the welds were subsequently visually inspected for acceptance, with 79 accepted in the painted condition; and visual weld inspections were not performed on full penetration welds (456/84021; 456/84020).

c. Severity Level IV - A reactor coolant pump lateral support anchorage was installed without certain records (456/84021; 457/84020).

d. Severity Level V - Three safety-related structural beams had openings cut into them to allow the routing of 4" diameter nonsafety-related drain pipe through the web of the beam (456/85015; 457/85016).

e. Severity Level V - Repairs to containment coatings were performed utilizing an unqualified coating system (456/85015; 456/85016).

The inadequate welding controls in Violation a. resulted in additional inspections by the licensee. As a result of the licensee's inspection a stop work order was issued for structural welding and a 10 CFR 50.55(e) report was submitted early in the assessment period. After the licensee completed the necessary corrective actions, including the retraining of engineering and craft personnel, the stop work order was lifted. The deficiencies did not result in defective hardware. One additional 10 CFR 50.55(e) report regarding concrete expansion anchor inspection deficiencies was submitted during this assessment period.

The inspection of painted welds in Violation b. was an isolated occurrence in that the deficient practice was limited to a one week period in 1980. The paint was removed and reinspections were performed. The licensee took prompt corrective actions to resolve the concern regarding lack of visual inspection of full penetration welds. The installation in Violation c. occurred in 1980 and the contractor is no longer on site. Violation d. resulted in a complete licensee inspection of the nonsafety-related drain piping system which identified 49 beams with unauthorized holes. The drain piping system was installed prior to the assessment period. None of the holes were determined to be design significant; however, two were reinforced to increase their design margin. The repairs identified in Violation e. occurred in 1978 and 1979.

An allegation regarding defective welding on block wall columns was substantiated; however, the licensee had previously identified and reported this deficiency to the NRC in 1982. A second allegation regarding the undocumented removal of welds from structural steel was substantiated and the contractor took appropriate corrective actions to resolve the concern. A third allegation concerning holes burred in steel was substantiated; however, the deficiencies were previously identified by the contractor on nonconformance reports.

Two corrective action programs in this area, the Quality Control Structural Steel Review and NSSS Component Supports Verification, were determined to be adequately implemented by BCAP.

The inspectors determined that significant deficiencies were reported in a timely manner, were accurately described, and the resulting reviews were effective and technically sound. Activities in this functional area were controlled through the

use of well stated and defined procedures. Installation and inspection records were found to be generally complete, well maintained and available. Licensee resources appeared to be appropriate for the activities performed in the area. The number of structural QC personnel was increased from 14 to 39 during the assessment period. Licensee management aggressively addressed the NRC identified violations, open items, and unresolved items.

2. Conclusion

The licensee is rated Category 2 in this area. This is the same rating as the previous assessment period. Licensee performance has remained the same during the assessment period.

3. Board Recommendations

None.

J. Piping Systems and Supports

1. Analysis

Examination of this functional area consisted of eleven inspections by the resident inspection staff, eight inspections by the regional based staff, and a portion of the CAT inspection. Areas examined included (1) activities as they relate to preservice inspection including review of equipment and material certifications, personnel qualifications and selected records of nondestructive examinations, and observation of the ultrasonic examination of several reactor coolant pump bolts; (2) a meeting with the National Board of Boiler and Pressure Vessel Inspectors to discuss NRC concerns about ASME work; (3) review questions concerning two radiographs of welds on ESW piping; (4) observation of piping system installations, visual examination of completed welds and review of installation records, radiographs, and associated documentation for reactor coolant pressure boundary and other safety-related piping; (5) examination of the installation and inspection of piping supports/restraints including a review of procedures and instructions, and selected installation records and associated documentation; (6) Material Traceability Verification (MTV) program and inspection of a randomly selected sample of "Stores Request" and associated documentation to verify the licensee actions concerning the MTV Program; (7) independent measurements of piping components; (8) followup on licensee actions related to previous inspection findings and IE Bulletins; (9) inservice inspection drawing control; (10) bolted connections; (11) 10 CFR 21 reportability procedure review; and (12) hydrostatic test review.

Four violations and two examples were identified:

a. Severity Level IV - A piece of pipe was found to violate minimum wall requirements and was not reported to the owner in accordance with 10 CFR 21.21 (456/84021; 457/84020).

b. Severity Level V - For AISC steel welds, not under the jurisdiction of the ASME Boiler and Pressure Vessel Code, Section III, the piping contractor did not have an AWS visual weld examination procedure (456/84034; 457/84032).

c. Severity Level IV - Inadequate control of diesel fuel oil piping which contained rust and scale (456/84042; 457/84038).

d. Severity Level IV - An example in which the licensee's inspection program did not identify some areas where weld sizes in structural pipe support/restraints did not have the weld configuration required by design (456/84044; 457/84040).

e. Severity Level V - One example concerning failure to have a procedure that stipulates the method for producing an accurate inservice inspection drawing (456/85007; 457/85007).

f. Severity Level IV - The piping contractor performed a design function by modifying several riser clamps without being directed by or receiving approval of the responsible design organization (456/85041; 457/85040).

Corrective actions for violation a. were completed and the issue was satisfactorily resolved. Violations b., d., and f. are currently being evaluated by the NRC for the acceptability of the corrective actions. Violations a., b., and d. required supplemental training of personnel to preclude additional deficiencies.

Three 10 CFR 50.55(e) reports were submitted in this area regarding (1) ASME NPT symbol nameplates were removed from piping subassemblies without proper controls and documentation and nondestructive examinations required by ASME Section III of the nameplate removal areas were not subsequently performed; (2) a sample review of records of past site procured ASME material has indicated that the records do not always indicate that the material was supplied in accordance with the ASME Material Manufacturers and Material Suppliers Quality System Program Requirements; and (3) during testing of energy absorbing material, it was discovered that some material used in pipe whip restraints had a lower than specified crush strength.

Several allegations were inspected during this assessment period including (1) pipefitters and supervisors of the mechanical contractor were unqualified; (2) pipe being improperly installed with a "come along," pipes were mishandled causing the pipe bevels to be banged and pipes were installed backwards; (3) a person who was a poor worker was working as a quality control inspector;

(4) an improperly terminated employee; (5) a pipe support was not producing a clamping force on the valve being supported and the support was unstable in compression; and (6) a piping thickness measuring technique was altered so that deficiencies were no longer apparent. None of these allegations were substantiated or resulted in violations.

The Material Traceability Verification Program (MTV) was established to provide 100% verification of ASME Section III large bore piping installed prior to January 1, 1983 and ASME Section III small bore piping installed prior to September 6, 1983. This program was completed and the final report was submitted during the assessment period. Subsequent to the assessment period, the NRC review of the licensee's final MTV report was completed. The review determined that the MTV program was acceptable, the unresolved items were adequately addressed, and the program established traceability for the items in question. The approach used to evaluate MTV discrepancies and findings was generally conservative, technically sound and thorough. BCAP determined that this program was adequately implemented.

Additionally, the safety-related Pipe Supports Program was reviewed by BCAP and determined to be adequately implemented.

Both in 1983 and 1984, the NRC identified concerns with piping clearance deficiencies. Not until September 1984 were there adequate provisions for contractor verification of clearances between piping and other components or structures. A final walkdown program is planned by the licensee to resolve these deficiencies.

During the first half of the assessment period, the Construction Appraisal Team and resident staff noted numerous cases of poor construction practices, such as scaffolding supported by piping lines or piping lines supported by other piping lines instead of by temporary supports. During the last half of the assessment period management involvement has been evident and the resident staff has noticed only isolated cases of unauthorized supports for piping lines or piping supporting scaffolding.

On March 15, 1985, the licensee discussed actions which were taken to improve performance in this functional area. The actions taken appear to be effective. The piping contractor has added a significant number of experienced personnel to their quality control department, which has resulted in an overall trend of self identification of nonconforming conditions for corrective action. The number of piping QC personnel increased from 147 to 305 during the assessment period. The new personnel are experienced in regulatory requirements and industry practices. This has resulted in a significant upgrading in the piping contractor's performance. Training of craftsmen and quality

control personnel has increased during the assessment period, resulting in added awareness of quality practices both in the installation and inspection disciplines. The actions taken indicate that management is responsive to NRC concerns and is committed to quality.

In the area of preservice inspection, inspection equipment was found to be appropriately certified and personnel performing the inspection's were trained and certified.

The NRC performed independent measurements of a selected sample of piping in resolving the allegation concerning the piping thickness measuring technique. The independent measurements were in agreement with the licensee's measurements.

In general, work activities in this functional area were adequately controlled through the use of well stated and defined procedures. The management control systems were effective in that activities had received prior planning and priorities had been assigned. Installation, inspection, and certification records were found to be generally complete, well maintained, and available. Observations indicate that personnel have an adequate understanding of work practices. Review of construction deficiency reports and IE Bulletin actions indicated that the licensee understood the issues and their reviews were generally timely, thorough, and technically sound.

The licensee requested the National Board of Boiler and Pressure Vessel Inspectors to conduct an independent audit to address specific NRC concerns regarding ASME work. No significant deficiencies have been identified by the National Board.

2. Conclusion

The licensee is rated Category 2 in this area. The licensee was rated Category 3 in the previous assessment period. Licensee performance has improved during this assessment period.

3. Board Recommendations

None.

K. Safety-Related Components - Mechanical

1. Analysis

Examination of this functional area consisted of seven inspections by the resident inspection staff, three inspections by the regional based staff, and a portion of the CAT inspection. Areas examined included (1) eddy current examination of steam generator tubes; (2) review of reactor vessel fabrication documentation and radiographs; (3) licensee actions on IE Bulletins; (4) mechanical

equipment installations; (5) environmental qualification of containment spray pumps; (6) previous inspection findings; (7) preventative maintenance; (8) reactor vessel internals; and (9) welding of tanks and heat exchangers.

One violation and one example were identified:

a. Severity Level IV - Welding on a number of vendor procured tanks and heat exchangers was not in accordance with the vendor drawings, and a number of vendor supplied radiographs did not have the film quality required by the vendor specifications (456/84044; 457/84040).

b. Severity Level V - One example regarding the inadequate installation of the Containment Spray pump support and anchor bolt hold down plates (456/85007; 457/85007).

Violation a. resulted in a 10 CFR 50.55(e) report and the licensee's corrective actions have not yet been reviewed. The base supports for the Containment Spray pumps, identified in Violation b., are being modified to conform to drawing requirements.

One other reportable deficiency was identified in this area concerning preservice nondestructive examination which identified one rejectable indication in the Loop 2 inlet nozzle-to-vessel shell weld on the Unit 2 reactor vessel.

Prior to September 1982, the piping contractor had installed safety-related mechanical equipment without adequate procedures. The piping contractor wrote new equipment installation procedures which contained more detailed installation and inspection criteria specified by the design drawings and specifications. The piping contractor used these new procedures to inspect all safety-related mechanical equipment installations performed prior to September 1982. These inspections have been completed. Installations are being reworked where necessary to conform to drawing and specification requirements, including replacement of anchor bolts due to deficiencies in either the original installation or documentation. The Reinspection of Safety-Related Equipment program is procedurally controlled and is staffed with experienced personnel. This program was in the process of being upgraded at the time of the BCAP review; however, a followup review by BCAP indicated that as a result of the upgrading, the program will be effective.

Nondestructive examinations were controlled through the use of well stated and defined procedures. Installation and inspection records were found to be generally complete, well maintained, and available. Nondestructive examination equipment certifications were current and complete and the personnel performing these examinations were trained and certified. Licensee resources appeared to be appropriate for the activities performed in this

area. Deficiencies, when identified, were promptly reported and the analyses of these reported deficiencies were consistently found to be adequate. Management showed aggressive involvement in the resolution of identified deficiencies.

On March 15, 1985, the licensee discussed actions which were taken to improve performance in this functional area. These actions are discussed further in Section J., Piping Systems and Supports. The actions taken appear to be effective.

2. Conclusion

The licensee is rated Category 2 in this area. The licensee was rated Category 3 in the previous assessment period. Licensee performance has improved during the assessment period.

3. Board Recommendations

None.

L. Auxiliary Systems

1. Analysis

Examination of this functional area (HVAC) consisted of four inspections by the resident inspection staff, two inspections by the regional based staff, and a portion of the CAT inspection. Areas examined included (1) the HVAC contractor's QA program; (2) procedures; (3) welding activities; (4) previous inspection findings; (5) documentation packages; (6) hardware installations; and (7) nonconformance reports and corrective action requests.

Two violations were identified.

a. Severity Level V - Several companion angle to duct welds were completely cracked resulting in no bonding (456/84034; 457/84032).

b. Severity Level V - Failure to follow procedures in that two Corrective Action Requests were closed by Pullman QA prior to verifying that the corrective action was implemented; and the Pullman nonconformance procedure does not require potentially reportable deficiencies to be submitted to the licensee (456/85038; 457/85037).

In response to Violation a., the licensee has established a reinspection and testing program to address the structural adequacy of the HVAC duct supports. In response to Violation b., the licensee promptly performed surveillances and revised the applicable procedure.

Three HVAC 10 CFR 50.55(e) reports and NRC inspection findings identified prior to the assessment period, have been combined into the HVAC Retrofit program. BCAP determined that this program was effectively implemented and documented.

The HVAC contractor has upgraded their quality control program in the area of welding controls and inspections. The number of HVAC QC personnel increased from 21 to 32 during the assessment period. HVAC supports/restraints generally conformed to design and procedural requirements. Inspected welding activities were found to comply with the requirements and were controlled through the use of well stated and defined procedures. Records were found to be generally complete, well maintained, and available. The records also indicate that welders were trained and certified.

2. Conclusion

The licensee is rated Category 2 in this area. This is the same rating as the previous assessment period. Licensee performance has remained the same during the assessment period.

3. Board Recommendations

None.

M. Electrical Equipment and Cables

1. Analysis

Examination of this functional area consisted of eight inspections by the resident inspection staff, thirteen inspections by the regional based staff, and a portion of the CAT inspection. Areas examined included (1) review of previous inspection findings; (2) welder qualifications; (3) observation of work activities, review of records, and QC personnel qualifications, (4) cable pulling, routing, and terminations; (5) raceway and conduit installations, (6) welding procedures; (7) electrical equipment installations; (8) welding; (9) reinspection programs and inspection backlog; (10) allegations; (11) corrective action programs; (12) electrical separation; (13) independent design review; (14) calibration and control of electrical test and measuring equipment; (15) motor operator valve (MOV) torque switch settings; (16) equipment protective relay settings; (17) DC distribution panel breaker testing; and (18) control room chillers.

Eleven violations and one example were identified:

a. Severity Level V - Two cables were not routed per the pull cards, and the quality control inspector accepted the cable pulls (457/84029).

b. Severity Level V - No corrective action documents were written for loose crimps at penetration terminal blocks; cables were not terminated and were tagged with uncontrolled tags (457/84036).

c. Severity Level IV - Wire had been installed without qualification; Class 1E seismic cable tray hangers did not utilize ASTM A307 fasteners in some cases; and Class 1E battery racks were found to have bolting material that did not meet the requirements of ASTM A307 (456/84044; 457/84040).

d. Severity Level IV - An example in which the licensee's inspection program did not provide sufficient electrical separation acceptance criteria to verify that design requirements had been met (456/84044; 457/84040).

e. Severity Level IV - The electrical contractor's corrective actions for two NCRs were inadequate (456/84044; 457/84040).

f. Severity Level V - Failure to follow procedures in that a welder qualification record was signed and dated prior to testing of the welder's coupons and welder qualification records exhibited numerous clerical errors and omissions (456/85009; 457/85009).

g. Severity Level V - The electrical contractor inspected and accepted a junction box which was later determined to have deficiencies in the location of the anchors (456/85015).

h. Severity Level V - Failure to qualify personnel in accordance with procedures (456/85021; 457/85022).

i. Severity Level V - The licensee could not provide documented evidence that rejected hanger welds were appropriately dispositioned (456/85021; 457/85022).

j. Severity Level IV - Failure to set MOV torque switch settings in accordance with engineering or vendor required set point values (456/85048; 457/85047).

k. Severity Level IV - Several instances were identified where a reinspection program failed to identify replacement of butt splices in control panels and replacement of unqualified internal wiring inside MOV limit switch compartments (456/85048; 457/85047).

l. Severity Level IV - Several wiring discrepancies were identified between connection diagrams and field installations (456/85048; 457/85047).

Violation a. was an isolated occurrence, the cable routings have been corrected, reinspection was performed, and retraining was conducted. Violation b. was an isolated occurrence and the contractor promptly issued documents to track the deficiencies.

The first example of Violation c. resulted in the licensee removing all unqualified switchboard wire inside containment (harsh environment); however, the licensee has stated that they will not replace the wire in the auxiliary building. Acceptability of this position is under review by NRR. The second example of Violation c. resulted in the issuance of two nonconformance reports. One of the nonconformance reports has been dispositioned.

Licensee identification and resolution of the electrical separation violations related to Violation d. is an ongoing program. Resolution of all separation violations will be completed by fuel load.

Violations e. and f. occurred prior to the assessment period and were determined to be isolated. Violation g. occurred during the assessment period but was determined to be isolated after the licensee reinspected all junction boxes which were accepted by the involved inspector. Violation h. was determined to be isolated after the contractor QC Manager performed a review of inspector certifications. Violation i. occurred prior to the assessment period and the contractor issued documentation to repair the deficiencies.

The corrective actions for Violations j., k., and l. have not been reviewed since the inspection report was issued after the assessment period.

As noted in the previous assessment period, numerous problems were identified with QC inspections, drawings, installation of hardware and missing or incomplete QC records. The previous report documented an increase in licensee and contractor QC personnel. The increase in staff was necessary to maintain pace with the numerous and comprehensive electrical reinspection programs. During this assessment period QC personnel staffing was further increased from 83 to 122. The reinspection and corrective action programs are briefly described below:

- LKC Records Review - During previous NRC inspections, CECo QA Audits and LKC QA audits, it was identified the the LKC quality records were incomplete, missing or misfiled. LKC determined that the total number of documents to be reviewed was 105,708. The contractor completed their review of all quality documents in December 1985. The scheduled completion date for the reconciliation of those documents found unsatisfactory is planned by March 1986. The BCAP review of this program determined that it is being properly implemented.

- Electrical Butt Splices - The licensee and the NRC identified that LKC procedures did not include the manufacturer's installation instructions or inspection criteria for conductor butt splices. The licensee is approximately 90% complete in the butt splice corrective action program. This item was reported per 10 CFR 50.55(e) during the assessment period.

- Hanger Configuration Inspection - Prior to November 1982, LKC QC was only inspecting 35% of the installed electrical raceway hangers for proper configuration. Presently, S&L personnel and LKC QC inspectors are walking down all the electrical raceway hangers in the plant and documenting the as-built configuration.

- Avoid Verbal Orders (AVO) Inspection Program - The licensee identified that work activities were being directed by AVO's with no subsequent QC inspection to verify that work had been accomplished. The licensee identified approximately 4400 AVO's that had been prepared to direct work. The licensee estimated an expected completion date of March 1986.

- Interaction Analysis - During previous inspections it was observed that the licensee did not have an interaction analysis program to address Regulatory Guide 1.29 "Seismic Design Classification." Sargent and Lundy's final walkdown is planned to start six months prior to fuel load.

- Drawing Review Program - The electrical contractor has had difficulties in the past assuring that all installations have been accomplished in accordance with the latest revision of the drawing. This program is being developed to assure that installations and inspections were done to the current drawing revision.

Two 10 CFR 50.55(e) reports were issued in this area (1) electrical butt splices were not installed per the manufacturer's installation instructions; and (2) certain breakers supplied with Westinghouse motor control centers did not meet the specification.

One inspection was conducted early in the assessment period to review 10 allegations from an electrical QC inspector who was terminating employment. Eight of these were substantiated. The allegations related to reports being misfiled; multiple inspection reports on hangers; corroded hangers, cable pan, conduit ground straps, and junction boxes; hangers mislabeled or misplaced and conduits installed on wrong hangers; housekeeping; weld rod control; in-process welding; stud welding; document control; cracks in floors and walls; and drug and alcohol abuse. No violations were identified.

One inspection was conducted to review 27 allegations concerning electrical contractor welding activities. Some of these allegations were substantiated. Two of the allegations resulted in Violation f.

Other allegations reviewed and substantiated include a QC supervisor who was not certified as a Level II inspector in certain areas; two QC inspectors who were selected as lead inspectors were not qualified (this resulted in Violation h); some QC inspectors are being qualified and certified in the areas of welding and configuration in one week; a QC supervisor was constantly intimidating and harassing the electrical inspectors to sign off documents (the supervisor was subsequently dismissed and a supervisor training program was implemented); and Quality First had not addressed the electrical inspectors' concerns (it was determined that Quality First had not finished their review at the time the allegations were made).

Other allegations reviewed and not substantiated include the electrical rework program was full of loopholes, documentation flow through QC was not clear in the procedure, and basemetal inspections were not done; recently certified inspectors were rushed through the training program; QC was under production pressure; QC inspectors were not properly trained in conduit specifications; numerous inspections involving 1100-1200 welds were signed off in one day (Violation i. was identified during the review); a QA engineer was assigned to the records vault for the sole purpose of closing nonconformance reports; hangers were not inspected; a QC inspector was constantly watched and was transferred to the record vault after visiting the NRC office; a QC inspector cannot remain proficient in all areas without a decrease in the quality of inspections; the electrical contractor promised more money to inspectors who were certified in multiple areas; lead inspectors were picked as leads based on who was signing off the most documents; NCRs have been dispositioned as "retrain inspectors", some NCRs had been dispositioned by Field Engineering without involvement of QC inspectors; overtime was not paid to inspectors who did not meet quotas; the inspectors were going to walk out if three inspectors were terminated; two NCRs were inappropriately dispositioned; a QC supervisor continually violated procedures during inspector certifications; there were no certified calibration inspectors; a QC supervisor lied to get a QC inspector fired; and inadequate Mylar and ECN controls.

In general, most of the allegations reviewed did not result in violations for one or more of the following reasons: (1) the licensee was in the process of taking corrective action; (2) the alleger was not knowledgeable in procedures or specifications; or (3) the concern did not violate a commitment or regulatory requirement.

Procedure controls for electrical work activities appear to be adequate. A comprehensive, documented craft training program was established and implemented during the assessment period. The program was reviewed by the NRC and was found to be satisfactory. The above reinspection and corrective action programs indicate multiple discrepancies pertaining to electrical construction activities due to ineffective quality programs in previous assessment periods. However, licensee management has taken aggressive steps to resolve these quality issues. Many of the violations issued during the assessment period were for deficiencies which existed in previous assessment periods and have been corrected or were isolated occurrences. The licensee generally takes adequate corrective action on technical issues and has been responsive to NRC initiatives. Personnel staffing appears to be adequate to complete the corrective action and reinspection programs without degrading the quality of ongoing work activities.

2. Conclusion

The licensee is rated Category 2 in this area. This is the same rating as the previous assessment period. Licensee performance has remained the same during the assessment period.

3. Board Recommendations

None.

N. Instrumentation

1. Analysis

Examination of this functional area consisted of eight inspections by the resident inspection staff, seven inspections by the regional based staff, and a portion of the CAT inspection. Areas examined included (1) instrument piping and tubing; (2) previous inspection findings; (3) licensee audits; (4) procedure reviews; (5) Instrumentation Installation Verification Program; (6) instrument supports and racks; (7) transmitter installations; (8) procurement; (9) instrument cables and terminations; (10) instrument loop testing; (11) procurement and receipt inspection; and (12) an allegation concerning the nonsafety-related portion of the instrument air system.

One violation and one example were identified.

a. Severity Level V - One example regarding two completed socket weld joints which did not have records identifying the welder or weld filler metal (456/84017; 457/84017).

b. Severity Level V - Two flexible metal hoses which were installed with traps (456/85032).

The piping contractor has developed an approved final document review program which should identify any record deficiencies which are similar to Violation a. Violation b. was identified late in the assessment period; therefore, the adequacy of the licensee's corrective actions has not yet been reviewed.

Licensee management attention was evident during the implementation of the Instrumentation Installation Verification Program initiated as a result of deficiencies in the piping contractor's installation/inspection program identified in the previous assessment period. The program is procedurally controlled, has been reviewed by the NRC, and was found to be acceptable. The program as implemented should correct past deficiencies and assure that installations meet all specification and regulatory requirements such as pitch, clearances, color coding, and separation criteria. The BCAP review of this program determined that it was adequately implemented.

Present staffing levels and licensee responsiveness to NRC initiatives appear to be adequate as evidenced by the minor significance of the identified violations and the licensee's implementation of timely corrective actions.

2. Conclusions

The licensee is rated Category 2 in this area. This is the same rating as the previous assessment period. Licensee performance has improved during the assessment period.

3. Board Recommendation

None.

O. Braidwood Construction Assessment Program (BCAP)

1. Analysis

Examination of this functional area consisted of ten inspections by a full time inspector assigned to the BCAP program. Areas examined included (1) the review of BCAP plans and procedures; (2) personnel training and qualifications; (3) hardware and documentation reinspections; (4) procedure reverifications; (5) corrective action program reviews; and (6) the identification and review of deficiencies. Additionally, two inspections were performed by the regional based staff to evaluate the licensee's disposition of BCAP discrepancies in the structural, mechanical, electrical, and instrumentation areas. An allegation concerning the qualifications of a BCAP civil QC inspector was not substantiated.

The basis for this assessment was the licensee's performance in implementing the three elements of the BCAP program. These elements are summarized as follows:

- Construction Sample Reinspection - This element consisted of a visual reinspection of a sample of safety-related construction work completed and QC accepted through June 30, 1984.

- Reverification of Procedures to Specification Requirements - This element consisted of a review of on-site contractor's installation, inspection, and personnel qualification and certification procedures for ongoing and future safety-related construction activities as of June 30, 1984.

- Review of Significant Corrective Action Programs - This element consisted of a review of methodologies, implementation, and resulting documentation associated with nine significant corrective action programs.

Two violations were identified:

a. Severity Level V - Reviews and approvals of BCAP procedures and instructions were performed by BCAP QA personnel who had not completed required site orientation (456/84025; 457/84024).

b. Severity Level IV - Thirty-seven BCAP observations were improperly invalidated (456/85006; 457/85006).

Violation a. was identified during the initial review of the BCAP QA organization and appeared to be of minor significance. Corrective actions were prompt and thorough. Subsequent review of BCAP QA revealed that organization to be staffed with qualified individuals who performed in a highly satisfactory manner.

Violation b. was considered significant because of the improper invalidation of observations. Corrective actions included a 100% review of all invalidated observations by BCAP QA.

The BCAP organization was adequately staffed with qualified and experienced personnel. Morale was consistently high with evidence that the BCAP staff had confidence in the quality of the BCAP effort. Training programs for BCAP personnel were well defined and implemented. Experience and educational requirements for personnel entry into the BCAP organization were maintained at a high standard.

Management involvement in the BCAP program was evident in day-to-day BCAP activities. BCAP implementing procedures, instructions, and checklists were comprehensive, well organized

and adequately addressed all areas of the BCAP program. Procedures and policies were adhered to with BCAP records being complete, well maintained, and readily available.

A conservative approach was routinely exhibited in resolving NRC concerns. In response to adverse findings by the NRC Construction Appraisal Team and the assigned NRC inspector, the licensee conducted reinspections of items previously reinspected, revision of checklists, and additional training of BCAP personnel. The approach used to evaluate BCAP discrepancies and findings was generally conservative, technically sound and thorough.

2. Conclusion

The licensee is rated Category 1 in this area. The licensee was not rated in the previous assessment period. Licensee performance has improved during the assessment period.

3. Board Recommendations

None.

P. Housekeeping and Equipment Protection

1. Analysis

Examination of this functional area consisted of portions of eight inspections by the resident inspection staff, portions of four inspections by regional based inspectors, and a portion of the CAT inspection.

Four violations were identified:

a. Severity Level V - Failure to maintain cleanliness and equipment protection in that there was (1) excess accumulation of trash in a charging pump room; (2) inadequate or nonexistent protective covers for permanent spool pieces; and (3) failure to maintain cleanliness requirements for containment sumps during testing activities (456/85008).

b. Severity Level IV - Failure to control storage and preservation of material (456/85023; 457/85024).

c. Severity Level V - Failure to control the cleaning and preservation of electrical equipment (456/85036; 457/85035).

d. Severity Level IV - Failure to take timely corrective action to protect safety-related equipment (456/85045; 457/85044).

Violation a. contained three examples of inadequate housekeeping/equipment protection practices. Licensee corrective action included retraining of personnel, issuing memos to contractor foremen, and issuing a letter discussing the violation to a contractor. Violation b. also contained three examples of improper conditions. Licensee corrective action included issuing letters on cleanliness to site contractors and assigning additional surveillances. Violation c. identified bolts, screws, debris, and rust in diesel generator junction boxes. The licensee immediately cleaned the junction boxes. Violation d. involved failure by the licensee to take timely corrective action on equipment protection discrepancies identified by NRC inspectors and the failure of previous corrective actions to prevent the intrusion of large quantities of masonry dust into safety-related electrical cabinets and panels. Licensee corrective action consisted of a program to protect electrical equipment from dust created by ongoing masonry work in and adjoining the control room. The specific deficiencies identified by the inspectors were corrected.

In addition to the violations discussed above, the following houskeeping/equipment concerns were identified:

a. Five ASME Section III, Class I valve bonnets and discs were stored in an undesignated storage area (cargo box) and two of the discs were not readily traceable to their respective valves (456/85052; 457/85050).

b. The room containing safety injection pump 1SI01PA contained bags of sand, soda-pop cans, nuts and bolts, angle iron, tube steel, pieces of concrete, and fittings (456/85038; 457/85037).

c. The pressurizer code safety relief valves, 1RY8010A, 1RY8010B, and 1RY8010C, were removed from the pressurizer in preparation for the primary hydrostatic test and left in a high traffic area without adequate protection (456/85032; 457/85031).

d. The CAT concluded that there were an excessive number of incidents of damage to installed equipment caused by ongoing construction activities (456/84044; 457/84040).

The licensee has demonstrated the ability to significantly improve plant conditions as evidenced by the high state of cleanliness that was achieved just prior to the site visit by the Chinese delegation. Subsequent to the Chinese visit the licensee did not maintain plant conditions but allowed them to deteriorate back to the previously existing state.

Housekeeping and equipment protection have been an ongoing problem during the construction and preoperational test phases. Corrective action in response to violations and

concerns has not been effective, as evidenced by the repetitive nature of the deficiencies. These corrective actions addressed specific examples identified by NRC inspectors and were apparently narrow in scope and application.

Shortly after the conclusion of the assessment period the licensee presented a comprehensive action plan to improve plant conditions in preparation for operation. The plan includes a thorough cleaning from top to bottom and a "Model Areas Program" which will prepare three specific plant areas for operation and then use them as examples for plant personnel.

2. Conclusion

The licensee is rated Category 3 in this area. The licensee was not rated in the previous assessment period. Licensee performance has remained the same during the period; however, during the transition from construction to operations more stringent housekeeping and equipment protection standards are required.

3. Board Recommendations

Increased attention by licensee management is recommended to improve housekeeping/equipment protection performance. The action plan presented by the licensee appears to be an adequate first step; however, attention should be given to programs for maintaining plant conditions and equipment protection after satisfactory conditions are achieved.

V. SUPPORTING DATA AND SUMMARIES

A. Licensee Activities

Units 1 and 2 were reported by the licensee to be 90% and 59% complete, respectively, at the end of the assessment period. Fuel load dates are estimated by the licensee to be September 30, 1986 for Unit 1 and January 31, 1988 for Unit 2. Preoperational testing of Unit 1 is estimated to be 62% complete. The human factors control room upgrade essentially stopped testing for a six month period during the spring and summer of 1985. Major milestones/activities which occurred during the assessment period included:

- Quality First was implemented in December 1984, to investigate quality concerns by site employees.
- ACRS Subcommittee - January 29, 1985.
- ACRS Full Committee - February 8, 1985.
- Letter from the ACRS supporting issuance of an OL was issued on February 11, 1985.
- ECCS full flow test (Unit 1) - March 1985.
- Secondary hydro (Unit 1) - September 1985.
- ASLB hearings commenced on October 29, 1985.
- Gene Fitzpatrick filled the position of Station Manager in November 1985.
- The emergency plan exercise was conducted on November 6, 1985.
- BCAP was developed, staffed, implemented, and completed with the final report submitted to the NRC.
- The Material Traceability Verification Program was implemented and completed, with the final report submitted to the NRC.

B. Inspection Activities

1. Inspection Data

Facility Name: Braidwood Station, Unit 1 Docket No. 50-456

Inspections: 50-456/84016 through 50-456/84044
50-456/85001 through 50-456/85054

Functional Area	Number of Violations in each Severity Level* I	II	III	IV	V	Total
A. Plant Operations						
B. Radiological Controls						
C. Preoperational Testing					2	2
D. Fire Protection						
E. Emergency Preparedness						
F. Security						
G. Quality Programs and Administrative Controls Affecting Quality				5	2	7
H. Licensing Activities						
I. Containment, Safety-Related Structures, and Major Steel Supports				2	2.5	4.5
J. Piping Systems and Supports				3.5	1.5	5
K. Safety-Related Components-Mechanical				1	0.5	1.5
L. Auxiliary Systems					2	2
M. Electrical Equipment and Cables				5.5	4	9.5
N. Instrumentation					1.5	1.5
O. Braidwood Construction Assessment Program				1	1	2
P. Housekeeping and Equipment Protection				2	2	4
Totals				20	19	39

*A value of 0.5 was assigned to violation examples which were separated between functional areas.

Inspection Data

Facility Name: Braidwood Station, Unit 2 Docket No. 50-457

Inspections: 50-457/84016 through 50-457/84040
50-457/85001 through 50-457/85052

Functional Area	Number of Violations in each Severity Level* I	II	III	IV	V	Total
A. Plant Operations						
B. Radiological Controls						
C. Preoperational Testing						
D. Fire Protection						
E. Emergency Preparedness						
F. Security						
G. Quality Programs and Administrative Controls Affecting Quality				4	1	5
H. Licensing Activities						
I. Containment, Safety-Related Structures, and Major Steel Supports				2	2.5	4.5
J. Piping Systems and Supports				3.5	1.5	5
K. Safety-Related Components-Mechanical				1	0.5	1.5
L. Auxiliary Systems					2	2
M. Electrical Equipment and Cables				5.5	5	10.5
N. Instrumentation					0.5	0.5
O. Braidwood Construction Assessment Program				1	1	2
P. Housekeeping and Equipment Protection				2	1	3
Totals				19	15	34

*A value of 0.5 was assigned to violation examples which were separated between functional areas.

2. Inspection Summary

The inspections at Braidwood were conducted by the resident inspection staff, regional based staff, BCAP inspector, and the Construction Appraisal Team. Eighty-two inspection reports were issued during this assessment period representing 12,465 hours of direct inspection effort. The CAT inspection was conducted on December 10-20, 1984 and January 7-18, 1985, and is documented in Inspection Reports No. 456/84044; 547/84040.

C. Investigations and Allegations Review

Twenty-nine allegation files were opened during this assessment period. Seventeen of these were closed at the end of the assessment period. The allegations reviewed during the assessment period are discussed in the individual functional areas. The majority of the allegations were in the electrical area.

D. Escalated Enforcement Actions

1. Civil Penalties

None.

2. Orders

None.

E. Licensee Conferences Held During Appraisal Period

The following meetings were conducted during this assessment period:

September 6, 1984	Public meeting to discuss BCAP.
September 7, 1984	Meeting to discuss the status of the Regulatory Performance Improvement Program.
October 4, 1984	Public meeting to discuss BCAP.
November 8, 1984	Public meeting to discuss BCAP.
November 26, 1984	Meeting to discuss the results of the SALP 4 assessment.
December 6, 1984	Public meeting to discuss BCAP.
January 3, 1985	Public meeting to discuss BCAP.
January 18, 1985	Meeting to discuss various items related to emergency preparedness at all CECo sites.
February 14, 1985	Public meeting to discuss BCAP.
March 14, 1985	Public meeting to discuss BCAP.
March 15, 1985	Meeting to discuss actions which CECo has taken and/or initiated in three SALP 4 areas which were rated Category 3.
April 11, 1985	Public meeting to discuss BCAP.

June 25, 1985	Public meeting to discuss BCAP.
June 25, 1985	The licensee presented the results of the Material Traceability Verification Program.
October 15, 1985	Public meeting to discuss the final results and conclusions of BCAP.

F. Confirmation of Action Letters

None.

G. Construction Deficiency Reports and 10 CFR 21 Reports Submitted by the Licensee

1. Construction Deficiency Reports (CDRs)

During this SALP period 15 CDRs were submitted by the licensee under the requirements of 10 CFR 50.55(e). The contents of these reports were acceptable. Submitted reports were as follows:

a. ASME NPT symbol nameplates were removed from piping subassemblies without proper controls and documentation. Nondestructive examinations required by ASME Section III of the nameplate removal areas were not subsequently performed (84-12).

b. Electrical butt splices were not installed per the manufacturer's installation instructions (84-13).

c. Boeing steam generator snubber defects (84-14).

d. G. K. Newberg Welding Program Deficiencies (84-15).

e. A sample review of records of past site procured ASME material has indicated that the records do not always indicate that the material was supplied in accordance with the ASME Material Manufacturers and Material Suppliers Quality System Program Requirements (84-16).

f. Concrete expansion anchor inspection deficiencies (84-17).

g. Preservice nondestructive examination identified one rejectable indication in the Loop 2 inlet nozzle-to-vessel shell weld on the Unit 2 reactor pressure vessel (84-18).

h. During testing of energy absorbing material (EAM), it was discovered that some material used in pipe whip restraints had a lower than specified crush strength (84-19).

i. The 480 volt, 10 amp breakers supplied with the Westinghouse Motor Control Centers did not meet the specification (85-01).

j. Welding on certain safety-related ASME Section III tanks and heat exchangers did not meet drawing, specification and in some cases code requirements (85-02).

k. Instrumentation Installation Reverification Program - instrumentation deficiencies were identified which involved criteria for line separation, segregation color coding, and the performance of inspections which were not thoroughly documented nor complete as to design significant attributes (85-03).

l. Containment sump isolation valves were determined to not be seismically qualified in their presently installed configuration (85-04).

m. Certain postulated high energy line breaks in the auxiliary building were evaluated for potential environmental effects on safety-related equipment using information which has been shown to be inaccurate (85-05).

n. Failure of the diesel generators to sustain adequate prime (85-06).

o. The diesel generator tachometers have, at times, indicated an rpm reading while the engines were in a standby mode (85-07).

The number of CDRs has decreased from 26 (SALP 4) to 15 for this assessment period.

2. Part 21 Reports

No 10 CFR Part 21 reports were submitted by the licensee during this assessment period. No situations were identified where the licensee should have submitted a report.