DMB

Commonwealth Edison Co.
Braidwood Station
RR 1, Box 81
Braceville, IL 60407
Telephone 815/458-2801

January 13, 1986

Mr. James G. Keppler
Regional Administrator
U.S. Nuclear Regulatory Commission
799 Roosevelt Road
Glen Ellyn, IL 60137

Subject: Braidwood Generating Station, Units 1 and 2
Safety-Related Mechanical Equipment Retrofit Program - Final Report
10 CFR 50.55(e) No. 82-07 Final Report
NRC Docket Nos. 50-456 and 50-457

Dear Mr. Keppler:

The purpose of this letter is to transmit the Report on Braidwood Safety-Related Mechanical Equipment Retrofit Program. That program was undertaken to resolve the concerns documented by your Staff in Reference (a) with respect to the adequacy of the installation before September, 1982 of safety-related mechanical equipment at Braidwood Station. The attached report documents the results of that program which is now complete. Accordingly, it is judged that a review of this report and the supporting documentation justifies closure of your inspection report on this matter (82-05-04) as well as Braidwood 55(e) Report 82-07.

One signed original and 19 copies of this letter and 20 copies of the Report are submitted for your use.

If there are any questions on the Report or the Retrofit Program, please direct them to this office.

Very truly yours,

Louis O. DelGeorge

Louis O. DelGeorge
Assistant Vice-President

LOD/pav

Attachments

cc: Resident Inspector - Braidwood

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REPORT ON BRAIDWOOD

SAFETY-RELATED MECHANICAL EQUIPMENT

RETROFIT PROGRAM

Docket Nos. 50-456 and 50-457

January 1986

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REPORT ON BRAIDWOOD
SAFETY-RELATED MECHANICAL EQUIPMENT
RETROFIT PROGRAM

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I. INTRODUCTION

This report documents the results of reviews conducted by Commonwealth Edison Company (CECo) of the installation of safety-related mechanical equipment at Braidwood Station. The equipment reviewed was installed by the Phillips Getschow Company (PGCo). The installation of mechanical equipment, as stated in the Braidwood FSAR, was to be in accordance with the provisions of ANSI N45.2.8-1975 "Supplementary Quality Assurance Requirements for Installation, Inspection and Testing of Mechanical Equipment and Systems for the Construction Phase of Nuclear Power Plants". This commitment is contained in the Braidwood FSAR, Appendix A, reference to US NRC Regulatory Guide 1.116 dated May 1977 which endorses the provisions of ANSI N45.2.8-1975.

Although a total of 388 safety-related equipment items are included within the scope of PGCo's installation responsibility, this report will discuss only those 216 items for which installation began prior to September 2, 1982. On that date, PGCO implemented Procedure QCP-B22 governing installation of safety-related mechanical equipment, which was approved by CECo. Although various controls and procedures for installation of safety-related mechanical equipment had been utilized to some extent prior to September 2, 1982, neither CECo nor the NRC was satisfied with the adequacy of the installation program because of inadequacies both in the scope and implementation of those controls and procedures.

A historical discussion of the PGCo safety-related mechanical equipment installation procedures was provided by CECo in Reference 1 (55(e) Report 82-07), which documented the deficiencies in the PGCo program pursuant to the requirements of 10 CFR 50.55(e). That chronology will not be repeated herein. In addition, the NRC Staff documented its review of the controls originally imposed by PGCo on safety-related mechanical equipment in IE Report

50-456/82-05 and 50-457/82-05 (Reference 2)[1] at which time the deficiencies noted were characterized by the Staff as evidencing a breakdown in the CECo Quality Assurance (QA) program as it relates to the installation and installation inspection of mechanical safety-related equipment. In its response to that inspection report (Reference 3), CECo denied that these deficiencies in fact constituted a breakdown in QA as applied to the subject equipment installation. CECo had undertaken an extensive review of the PGCo equipment installation program, and work on that activity had been stopped prior to the NRC Staff inspection. That review was adjusted, as necessary, to address issues raised by the NRC Staff. The review of the PGCo equipment installation program included both an assesment of the adequacy of procedures for prospective implementation and a retrofit review of all previously installed equipment within the PGCo scope of work to verify the adequacy of those installations. It is the results of the retrofit effort (hereafter referred to as the Safety-Related Mechanical Equipment Retrofit Program, or Retrofit Program) that are documented in this report.

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[1] Although the focus of the CECo response to the NRC Staff IE Report 82-05 was on the effective resolution of the identified deficiencies limited to the PGCO equipment installation program, a broader review of the entire PGCo safety-related work scope as well as the safety-related work then being conducted by other contractors in the area of electrical, structural and HVAC was also made by CECo to assess the generic implications of PGCo deficiencies to other activity areas. The results of those reviews have previously been discussed with the NRC Staff and documented (Reference 4) and will not, therefore be further discussed in this report except to observe that although limited deficiencies in certain procedures were identified and corrected, a lack of procedural control of the type determined to exist with respect to safety-related mechanical equipment installation was not identified.

Installation of certain safety-related equipment items, specifically the steam generators, are a part of the nuclear steam supply system (NSSS). Certain installation activities did not fall within the PGCo work scope defined in the mechanical equipment installation specification. The NSSS equipment was erected and installed by other contractors and appropriate installation and installation inspection procedures were in place at the time. However, PGCo had the responsibility of installing the cap screws which attach the steam generators to their supports, and asserted deficiencies in cap screw installation and traceability were also set forth in Inspection Report 82-05. Actions taken to resolve those deficiencies are discussed in Appendix C of this report.

II. METHODOLOGY

As has previously been documented in Reference 3, CECo implemented a verification review of all safety-related mechanical equipment installed prior to September, 1982. That review satisfied the procedural requirements of PGCo Procedure QCP-B22 Rev. 0 and was completed in December, 1982.

The scope of the program included all installation activities performed on safety-related mechanical equipment prior to September 1, 1982. 216 pieces of mechanical equipment were identified as being in various stages of installation from initial rough set to final set, aligned, grouted and piped as of that date. For each piece of equipment, PGCo engineering personnel reviewed applicable architect/engineer specifications and drawings and equipment vendor drawings, manuals, and instructions to determine all applicable equipment installation requirements. These requirements were documented on the Equipment Installation Record (EIR) form, QCP-B22-1. This form provided detailed steps necessary for the installation and inspection of a piece of equipment. Those steps which had been previously completed for the equipment, which were those requiring retrofit inspection, were highlighted on the form. These forms were sent to PGCo QC and CECo Site QA for the assignment of inspection hold points. The forms were then sent to the field to provide control, instruction, and to assure appropriate documentation of retrofit inspections. These inspections were performed by PGCo QC personnel and, as required, PGCo production personnel for each attribute required by the EIR. Findings of deviations from installation requirements (including inadequate documentation) and an identification of those installation attributes which were not recreatable at the time of the retrofit inspection were documented. For attributes which were partially reinspectable, such as foundation checks with the equipment set, reinspections were performed to the

extent possible. For attributes previously inspected and documented, reference to the previous documentation was provided. The attributes inspected are described in Appendix A.

The equipment installation verification program completed in December 1982 provided documented evidence of the quality of mechanical equipment installations completed prior to September 1982. Thereafter, installation activities continued with respect to some of the 216 pieces of equipment and PGCo Procedure QCP-B22 was revised. The data form which listed the inspection attributes for each piece of equipment became more detailed and it was decided to reinspect, as necessary, the 216 pieces of equipment in order to conform the installation inspection documentation to the applicable revision of QCP-B22 (i.e. Rev. 5). In addition, an inspection attribute, internal cleanliness, which had earlier been waived in the retrofit inspections based on system flushing, was re-established as a retrofit inspection attribute. Further, a more detailed retrofit inspection of grouting activities was initiated after December, 1982. A limited further number of discrepant installation attributes and incomplete documentation were identified and dispositioned by PGCo. This activity began on an expedited basis in July, 1985 and is now complete.

III. RESULTS

The implementation of the mechanical equipment retrofit program provides the basis for demonstrating that the erection of the 216 pieces of mechanical equipment installed prior to September 2, 1982 is in conformance with the requirements of ANSI N45.2.8-1975. This documented assurance of conformance with this ANSI standard is the primary result of the program. Evidence of this conformance is contained in documentation generated in accordance with PGCo procedure QCP-B22. This documentation is contained in "equipment packages" which are organized by equipment number and are currently located in the PGCo QA vault.

The program also provides for the identification and subsequent disposition, and corrective action, as appropriate, of deficiencies in the existing equipment erection status and associated documentation identified during the course of this retrofit inspection program. The documentation of these deficiencies is also contained or referenced in the previously identified equipment packages. It should be observed that some of the deficiencies identified were dispositioned on the basis of an NCR which dealt with the discrepancy programmatically, while others were identified on individual pieces of equipment. A tabulation of the individually identified deficiencies by equipment and deficiency type is provided in Appendix B. The following provides a summary of these discrepancies.

Anchor Bolts

Anchor bolts are used to secure equipment to the concrete equipment pad. These bolts are typically embedded in the concrete structure. Anchor bolting was inspected for bolt angularity, size, thread condition, hole size, nut engagement, nut torquing, and for sliding connections, location of the bolt relative to the slotted hole.

Out of the 216 pieces of equipment, only ten were identified in which anchor bolt nut thread engagement did not meet the requirement of the nut being at least fully engaged and flush with the end of the bolt. For four pieces, each had one of their 8, 12, 16 and 27 respective anchor bolt nuts with engagement one half thread less than flush. For another four pieces, each had one of their 10, 12, 16 and 27 respective nuts one thread less than flush. One piece had one of ten bolt nuts two threads below flush. One piece had hold down bolts of 1 1/2 inches in diameter which were engaged between 1 1/16" and 1 3/16" where 1 1/2 inches was required. All of these conditions were accepted-as-is, except in two cases in which washers were removed to increase thread engagement.

Damaged or out-of-tolerance bolts were identified for 12 of the 216 pieces of equipment. Four of these pieces of equipment had a total of 6 of 70 bolts with damaged threads. One piece of equipment had one bolt of 18 sheared while another piece had two of 12 bolts broken. One piece had one bolt of 18 with angularity greater than three degrees. Three pieces of equipment had bolt projections which were out of tolerance. Two of these pieces had 3 3/4 inch bolts which were up to 1/2 inch short. For the remaining piece, the projection was slightly greater than required. Two pieces of equipment utilized standard nuts on one bolt out of 8 and 12 respectively in lieu of the required heavy hex nuts. All of these discrepancies were accepted-as-is except for one piece of equipment in which the standard nut was replaced with the required heavy hex nut.

Anchor bolt holes or bolt-to-hole clearances out of tolerance were observed for six of the 216 pieces of equipment. Two of these involved deviations in the clearance of the bolt-to-hole for sliding connections. In each case, one of eight bolts was out of tolerance; one by 0.02 inches, and

one by 0.075 inches. Four involved bolt holes the dimensions of which were different from those shown on the drawing. In one case, 1 out of 18 1 1/8 inch diameter holes was elongated by 1/4 inch. In the three other cases, equipment as supplied by the vendor slightly deviated from the vendors' drawings. All were accepted-as-is except one bolt-to-hole clearance which was reworked by PGCo.

One additional discrepancy was identified in which two bolts on one piece of equipment lacked washers. This discrepancy was accepted as is.

Cleanliness

During the course of the retrofit inspection program, internal cleanliness inspections of equipment piping connection internals could not be performed for those pieces of equipment for which piping connections were completed. These cleanliness inspections were waived by CECo in September 1982 based on planned system flushing activities. In some cases, these bypassed inspection hold points were documented on NCR's and other deficiency documents.

In February 1984, the NRC questioned the acceptability of waiving cleanliness hold points based on flushing alone. The NRC initiated open items 50-456/84-06-05 and 50-457/84-06-05 (Reference 5) to document their concern. The NRC later raised this open item to an item of noncompliance as documented in Inspection Reports 50-456/84-21 and 50-457/84-20 (Reference 6).

As a result of the NRC inspection in February 1984, CECo initiated NCR 614 dated April 4, 1984 to document that the waivers of internal cleanliness by CECo Project Construction Department lacked appropriate engineering concurrence. Engineering review of this NCR resulted in a disposition which recommended that additional visual inspections for equipment internal

cleanliness be performed. These reinspections were facilitated by the use of remote visual inspection devices (e.g. boroscopes), selected disassembly of pumps and piping flanges, and creating access holes in piping. However, for twenty-one pieces of equipment, the use of flow verification in conjunction with flushing for the verification of internal cleanliness of one or more equipment connections was specifically approved by engineering. Successful flushing and system flow has confirmed internal cleanliness for seven of these twenty-one pieces of equipment. The flushing and flow verification of the remaining 14 pieces is being tracked by individual CECo deficiency documents. The pieces of equipment for which flushing and flow verification was employed for verification of equipment cleanliness in lieu of visual inspections are documented in the disposition of NCR 614.

Grouting

Grout is used to provide for the uniform transfer of loads from the equipment base to the structure. It is placed between the equipment base and the concrete pad. Prior to the equipment retrofit inspection, procedures required a "grout release" form to be generated to indicate that equipment erection activities had progressed to the stage where equipment base plate grouting could proceed. Thirty-three findings were written for equipment grouted without evidence of a grout release.

Under the retrofit program, these pieces of equipment and all other previously grouted pieces of equipment were inspected for grouting to the extent possible.

As a result of questions raised by PGCo's grout retrofit inspections, G.K. Newberg, the contractor responsible for performing grout placement and inspections, performed a review of completed grouting of all equipment bases

for the presence of possible voids under base plates and grouting cracks. These inspections, performed between January and July 1983, resulted in CECo NCR 560 dated July 13, 1983. This NCR documented the presence of cracked or chipped grout and indicated that certain rotating equipment bases sounded hollow which suggested the possible presence of grout voids.

NCR 560 Rev. 1 was dispositioned to rework all of these grouting discrepancies. This rework consists of pumping grout into holes drilled in equipment bases where bases sound hollow and chipping and repair of grout cracks wider than 1/64 inch.

Other Findings

Six additional discrepancies related to equipment hardware were identified and appropriately dispositioned. An equipment pad for a heat exchanger was 3 inches too small, causing shims to be exposed through grouting. An arc strike was identified on a pedestal and leg for a strainer. Two identical heat exchangers were switched in their respective locations. A tank and a pump were 1/16 and 3-3/8 inches off design location, respectively. A gap of up to 7/32" existed between one leg of a heat exchanger and one portion of the embed upon which the heat exchanger was supported. One vendor weld on a heat exchanger support leg was oversized such that it created an interference with an anchor bolt washer.

During the equipment retrofit inspection program, deviations from programmatic and documentation requirements were also documented. There were 18 findings that components were released for piping without completing the installation inspection record showing release for piping sign-offs. In each case, initial installation documentation has been reviewed to determine the adequacy of the preparation for piping or the finally connected condition of the piping has been examined to waive the required piping release approval.

Six pump nozzle welds were completed without preweld QC verification of nozzle dimensions. Two steam generator nozzle weld preparations were not non-destructively examined prior to welding. In each case, acceptable measurements or examinations were made after welding. Welding was performed on two tanks without appropriate ASME code authorization. Documentation associated with six pieces of equipment were incomplete or incorrectly altered for which corrections were made. In one case, the vendor's requirement that a vendor representative be present during pump unpacking was not met. A change in plate dimensions for two tank supports was not approved prior to installation. All of the above items were appropriately dispositioned.

Additional discrepancies were identified for lack of documentation for release of equipment for system testing and for lack of documented use of a special lift procedure during heavy equipment setting. The reinspection of equipment under the retrofit program provided a resolution to these discrepancies. No hardware discrepancies resulted from these document deficiencies.

Additional inspections related to mechanical equipment, but not specifically a result of the mechanical equipment retrofit program, were controlled administratively by Procedure QCP-B22 and were performed in conjunction with the retrofit program. These inspections include the shim thickness verification of vendor equipment-to-skid connections; the resolution to CECo NCR 6103 regarding the verification of panel welding, mounting, and concrete expansion anchor details; and equipment maintenance and housekeeping activities relating to NCR 777. Any deficiencies identified during the course of these inspections are not within the scope of the retrofit program and as such are not discussed herein.

IV. CONCLUSIONS

Prior to 1982, PGCo did not effectively implement a program that provided documented evidence of the acceptability of the installation of mechanical equipment. As a result, a procedure PGCo QCP-B22 was developed to control the installation of mechanical equipment and to generate appropriate Q.C. documentation attesting to the acceptability of the installation process. In order to demonstrate the acceptability of mechanical equipment installed prior to September 1982, this procedure was used to retroinspect as required all previous installations. The results of this retrofit program indicated that most previous installations were acceptable, notwithstanding the previous lack of documentation.

As a result of these actions, both previously completed mechanical equipment installations and ongoing equipment installation activities can be demonstrated to be in conformance with the requirements of ANSI N45.2.8-1975.

The successful implementation of this retrofit program has provided CECo a sound basis for confidence in the acceptability of both the installation of mechanical equipment and the associated documentation generated to demonstrate acceptable installation quality. Accordingly, CECo activities deemed necessary to close IE Report Item 82-05-04 and 55(e) Report 82-07 have been completed and the supporting documentation is available at the plant site for NRC Staff review.

REFERENCES

1. W.L. Stiede letter to James G. Keppler; dated September 1, 1982.

2. IE Report 50-456/82-05 and 50-457/82-05; James G. Keppler letter to James J. O'Connor; dated February 2, 1983.

3. Cordell Reed letter to James G. Keppler; dated April 4, 1983.

4. L.O. DelGeorge letter to James G. Keppler; dated July 6, 1984.

5. IE Report 50-456/84-06 and 50-457/84-06; R.F. Warnick letter to Cordell Reed; dated April 27, 1984.

6. IE Report 50-456/84-21 and 50-457/84-20; R.F. Warnick letter to Cordell Reed; dated November 20, 1984.

7. IE Report 50-456/85052 and 50-457/85050; W.S. Little letter to Cordell Reed; dated December 5, 1985.

APPENDIX A

RETROFIT PROGRAM INSPECTION ATTRIBUTES

The inspections specified for the retrofit program are documented in procedure QCP-B22. The eighteen standard inspection attributes are:

1. Foundation - check concrete pads, supports, etc. for general condition.

2. Bolt angularity - check angularity of anchor bolts for perpendicularity with equipment surface. Acceptance allows 3° angularity or up to 10° angularity using beveled washer to achieve uniform bolting contact.

3. Concrete expansion anchor documentation - check completion of CEA documentation as specified by PGCo procedures.

4. Rough Set - check that equipment has been set in place, properly supported with packaging removed as necessary to permit installation, and aligned with the elevations and coordinate indicated on the location drawing. This check is not required if final set is completed or in process.

5. Final Set - check that equipment is bolted or welded down, level, on elevation, and its major openings or axes are located at the proper coordinate as indicated on the location drawing. Grout complete, torque thread engagement and welding complete and acceptable, must all be checked before final set can be signed off.

6. Torque - anchor bolt torque is checked for either "snug-tight" or other torque values required by the manufacturer or S&L.

7. Thread engagement - thread engagement is checked that the nut shall be at a minimum, flush with the end of the anchor bolt.

8. Weld procedure - check for Class I, II, and III equipment requiring welding of component supports that a weld map drawing containing all welding information required by PGCo procedures has been completed.

9. Grout release - check that the superintendent has requested the grout release.

10. Grout complete - check that equipment has been grouted and that grout is undamaged.

11. Release for piping - equipment nozzle designation as shown on a manufacturer's drawing of the equipment shall be listed for release sign-off. Those conditions which affect alignment shall be signed-off upon completion of alignment requirements.

12. Internal cleanliness - internal cleanliness check for foreign material and debris in the equipment is performed at each piping connection to the equipment prior to final connection.

13. Driveline cleanliness - check that all areas containing lubricants are clean.

14. Lubrication complete - check that proper lubricant has been obtained and that all lubrication required by the manufacturer has been completed.

15. Alignment complete - check that equipment has been properly cold aligned.

16. Lube Cooling Sub-Piping complete - check that all sub-piping joints are tight for piping supplied by the manufacturer with the subject equipment.

17. Equipment I.D. - check that serial number found on the equipment matches the serial number determined from the MRR and manufacturer's Data Reports.

18. Externally mounted hardware - check that required externally mounted hardware is in place, free from damage, and properly tightened.

In addition to the above standard installation inspection attributes, the Field Engineer may specify additional inspection attributes by assessing equipment manufacturer's installation instructions, project design drawings, project requirements and other applicable PGCo procedures. Special lifting procedures may also be specified for installation.

QCP-B22 has been revised since 1982 to improve the clarity and documentation of specified inspections. Rev. 8 of that procedure is currently in place for installation of safety related mechanical equipment.

APPENDIX B

DETAILED RESULTS OF THE RETROFIT PROGRAM

The attached tables present the detailed documented findings of the Retrofit Program.

These findings are contained in various nonconformance reports (NCRs), field problem reports (FPRs), information requests (IRs), and discrepancy reports (DRs), issued during the retrofit inspection of the 216 components identified as being in various stages of installation prior to September 1, 1982. The retro-fit inspection findings are the result of inspections conducted from September through December 1982 and supplemented with additional inspection and documentation review from July to December 1985.

A number of different reporting forms were used e.g. NCR, FPR, IR, or DR, depending on the type of deviation encountered and the type of effort required to achieve conformance with requirements.

Because the program was to establish conformity with FSAR and program regulatory requirements, only the end result has been documented, i.e. acceptable equipment installation. This retrofit inspection program is therefore to be distinguished from other reinspection programs, where the focus of the program is to evaluate prior activities. Thus, specific findings have not been recorded in instances where the process of retrofit inspection and re-installation resulted in conformance, regardless of the initially found condition.

Table 1 presents the type of findings reported and the symbols used to represent the classes of findings. Other findings outside these categories are specifically described in words. Table 2 provides the complete list of finding for all 216 components inspected and Table 3 shows the distribution of findings by type of finding.

TABLE 1

Symbols Used In Reporting Type of Findings

SYMBOL	Description of Finding
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	Equip. 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
Sect 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

TABLE 2

Distribution of Installation Inspection
Findings For All 216 Components Inspected

Component I.D.	# Findings	Type of Findings
OAB01PA	-	
OAB01PB	-	
OAB02DA	3	AB(2), QC
OAB02DB	4	AB(2), IC, QC
OAB02FB	-	
1AF01PA	-	
1AF01PB	2	HE, bowed piping
2AF01PA	-	
2AF01PB	1	AB
1BR01A	2	IC, DOC.
2BR01A	2	PR, NW
1BR03A	-	
2BR03A	-	
OCC01A	2	GR, grout damage
OCC01P	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 (Con't)

Component I.D.	# Findings	Type of Findings
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 (Con't)

Component I.D.	# Findings	Type of Findings
1DO01PA	-	
1DO01PB	-	
1DO01PC	-	
1DO01PD	-	
1DO02TA	-	
2DO02TA	-	
1DO02TB	-	
2DO02TB	-	
1DO10T	-	
2DO10T	-	
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	PL, 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 (Con't)

Component I.D.	# Findings	Type of Findings
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
2TC01BD	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 (Con't)

Component I.D.	# Findings	Type of Findings
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 (Con't)

Component I.D.	# Findings	Type of Findings
1VA07S	-	
2VA07S	-	
1VA08S	1	IC
2VA08S	-	
1VP01AA	-	
1VP01AB	-	
1VP01AC	-	
1VP01AD	-	
OWO01CA	-	
OWO01CB	-	
OWO01PA	-	
OWO01PB	-	
OWX05T	1	AB

TOTAL
216 Components 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).

TABLE 3

DISTRIBUTION OF FINDINGS BY TYPE OF FINDING

TOTAL FINDINGS = 156 *

TYPE	#FINDINGS
GR	33
IC	27
PR	18
AB	14
TE	11
PWM	6
DOC.	5
NW	5
EL	4
TR	4
HS	4
HE	3
SECT XI	2
MRR	2
MT	2
SLP	2
QC	2
OTHERS-	
Work w/o doc.	1
Arc Strike	1
Bowed piping	1
Proc. conflict, A/E apprv. Mnfg. inspection	3
Found. pad, plate thick, shim for contact, Grt. defect, Grt thick.	5

* 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).

APPENDIX C

STEAM GENERATOR BOLTING

CECo has implemented certain corrective actions specifically addressing the steam generator bolting issue raised by the NRC Staff in IE Report 82-05. These corrective actions are described herein.

The first shipment of steam generator bolts (cap screws) was received at Braidwood on March 10, 1978. These cap screws were supplied by Teledyne Brown as part of the NSSS support package. Byron also received the same type of cap screws from Teledyne Brown, which was the common supplier of that portion of the NSSS support package for both sites. Between June 24, 1978 and June 14, 1979, a number of these cap screws were shipped between Byron and Braidwood, as current construction needs dictated.

At Byron some problems were encountered with the installation of the cap screws. As a result, a field change request (FCR 591) was initiated at Byron on November 13, 1978 to resolve those installation difficulties by allowing shortening of the cap screws. To take account of the problem encountered at Byron, the Sargent & Lundy structural drawing that specifies these cap screws at Braidwood (Rev. K of S1112) was modified to incorporate FCR 591, allowing shortening of the cap screws, as necessary, to facilitate installation.

Phillips, Getschow Co. Quality Control personnel inspected all the cap screws in stock at Braidwood and on February 9, 1979 initiated PGCo NCR 334, which required cleaning and special inspections prescribed by Westinghouse for the cap screws. Purchase Orders 722186 and 727837 were

issued to Rockwell Engineering Co. on March 27, 1979 and June 14, 1979, respectively, for the cleaning, special inspection, and shortening of all cap screws on site, both those originally received from Teledyne Brown and those shipped from Byron. These actions were similar to those taken at Byron. The last shipment of cap screws from Rockwell after cleaning, inspection, and shortening was received on site on June 27, 1979. Bolts that were considered unacceptable by Rockwell after inspection were scrapped and new bolts were ordered from Teledyne Brown to take their place. The last shipment of cap screws used for replacements at Braidwood was received on January 1, 1982 from Teledyne Brown.

Between May of 1979 and January of 1981 the cap screws were completely trial fit in the Unit 1 and partially trial fit in the Unit 2 steam generators prior to the setting of the steam generators. Subsequently, it was determined by Phillips, Getschow Co. that some of the new cap screws received from Teledyne Brown required shortening. During the shortening operation, which was carried out by Phillips, Getschow Co., the material heat traceability identification numbers on 19 cap screws were not properly transferred. On October 13, 1981, PGCo initiated PGCo NCR 612 to correct this condition. It was determined that all 19 cap screws came from the same material heat and the disposition of NCR 612 was to reapply the proper heat number.

During installation of the cap screws, certain problems were encountered. On December 12, 1981, CECo NCR 332 was initiated to document the fact that a number of cap screws could not be fully engaged. NCR 332 also referenced the same loss of material heat traceability identification subsequently corrected under NCR 612, as

described above. The disposition noted on NCR 322 required the removal, reinspection, and replacement of all steam generator cap screws which could not be fully engaged. In addition, after removal of the bolts, the NCR required inspection of the heli-coils, which are threaded inserts that can be removed and replaced if installation problems occur.

A routine NRC safety inspection was conducted during the period April 19 through July 20, 1982, and a special NRC inspection was conducted on September 8-10, 1982, of activities at Braidwood Station, Units 1 and 2. The results of the inspections were discussed during an enforcement conference conducted at the NRC Region III office on August 31, 1982, and at the Commonwealth Edison Company Corporate offices in Chicago Illinois on November 19, 1982. The reports setting forth the results of the inspections and the enforcement conferences are documented in Inspection Report 50-456/82-05; 50-457/82-05. As a result of these inspections and as discussed at the enforcement conferences, the NRC inspector expressed concern in relation to the installation of the Steam Generator cap screws. This concern, as stated in NRC inspection report 82-05, dealt with the areas of damage to the cap screws, installation methods, cap screw traceability, cap screw installation procedures and timeliness of corrective actions regarding the cap screws.

In response to this concern, Commonwealth Edison committed to remove and reinspect all the cap screws and replace the ones which were not acceptable. Phillips, Getschow Procedure PGCP-33 controlled the cap screw removal and Procedure PGCP-34 their reinstallation. Additionally, the bolt holes and heli-coils were also to be inspected and the heli-coils replaced if necessary. This inspection and replacement were also controlled by PGCP-33 and PGCP-34, respectively.

Concurrently, CECo NCR 413 documented some problems with the alignment between the steam generator pads and the vertical supports which are joined by the cap screws. The disposition of NCR 413 directed that the top support plates be slotted to facilitate bolt installation. The disposition of this NCR, when finally implemented, completed resolution of the cap screw issue. The removal and reinstallation of the Unit 2 bolts started in October of 1982 and finished in April of 1983. The removal and reinstallation of the Unit 1 bolts started in August of 1983 and finished in January of 1984.

The other area of concern which had been expressed by the NRC during the previously referenced inspections and enforcement conferences dealt with traceability documentation for cap screws which were transferred from Byron to Braidwood and from Braidwood to and from Rockwell Engineering. Records exist on site which establish traceability and control of the steam generator support cap screws transferred to and/or from Braidwood and track those bolts and their respective movements back and forth. At the time of NRC Inspection 82-05, the proper records correlation had not been accomplished, so that the data was not readily auditable by the NRC inspector. A correlation to establish traceability of the steam generator bolts utilized at Braidwood has since been accomplished. Results of this correlation establish that, for all bolts transferred to and/or from Braidwood, records were maintained and exist today which demonstrate control and traceability. No transfers of bolts between Braidwood and either Byron or Rockwell Engineering occurred after June 27, 1979. The only steam generator bolts received at Braidwood after June 27, 1979 were new purchases from Teledyne Brown Engineering.

The correlation for all steam generator bolts utilized at Braidwood is complete at this time.

Through the above cap screw traceability correlation and the documented bolt removal/reinstallation in accordance with PGCo procedures PGCP-33 and 34, the acceptability of all 384 bolts currently installed in the Braidwood Unit 1 and Unit 2 Steam Generators has been positively affirmed.

The NRC has reviewed the documentation developed as part of the cap screw installation review and "found the documentation to be accurate, reflecting acceptable field installations". The NRC closed the inspection report finding (82-05-01) related to these cap screws in IE Report 50-456/85052 and 50-457/85050 (Reference 7).