Commonwealth
Edison

Braidwood Construction Assessment Program (BCAP)

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BRAIDWOOD CONSTRUCTION ASSESSMENT PROGRAM

BCAP

EXECUTIVE SUMMARY

JUNE 1984

EXECUTIVE SUMMARY

Commonwealth Edison is undertaking a program of inspections and reviews as a prudent measure to answer any legitimate question concerning the overall quality of construction of the Braidwood Station. This effort is in addition to vigilant and aggressive implementation of Commonwealth Edison's Quality Assurance Program. These inspections and reviews comprise the Braidwood Construction Assessment Program (BCAP). The objectives of BCAP are to assure that:

- there are no programmatic design-significant problems in the construction of Braidwood, which have not been identified and addressed;

- the on-site contractors' procedures governing the ongoing safety-related construction and quality assurance activities address all applicable design and regulatory requirements; and

- where past construction problems have been identified which resulted in significant corrective actions (refer to Appendix D of the full report for a description of the term "significant corrective actions" as used in this context), such corrective actions have been adequately implemented and documented.

These objectives will be accomplished by conducting the reviews and performing inspections within three (3) principal elements of the BCAP. The first element consists of a review and reinspection of the completed construction work. Under this element a sufficient sample of completed safety-related construction activities will be reinspected to verify conformance to design requirements. In addition, the documentation for the sample reinspected will be reviewed to assure that it is complete and accurate. The results of this program will indicate the extent to which completed construction meets design requirements.

The second element of BCAP consists of a review of current installation and inspection procedures which govern ongoing and future safety-related construction work. Completion of this activity will provide a determination that essential specification requirements have been properly incorporated into these installation and inspection procedures.

The third element is composed of a review of the implementation, methodologies and resulting documentation associated with the significant corrective action programs which resulted from previously identified deficiencies. The completion of this element will assure that these specific areas of construction are of acceptable quality.

In order to assure that the results of the BCAP will be reliable, the BCAP will be conducted pursuant to the Commonwealth Edison Quality Assurance Program applicable to Braidwood. Personnel who will be performing the BCAP activities will be trained, qualified and certified (as applicable). The BCAP activities will be controlled through procedures and will be properly documented.

The BCAP will be implemented under the control of a Commonwealth Edison Company task force headed by the BCAP Director. Commonwealth Edison Company has established safeguards which assure that groups managing, implementing and reviewing the BCAP are different from those who have responsibility for the construction activities being verified. Commonwealth Edison Company has also established a group within its Quality Assurance Department to conduct reviews, assessments, verifications, audits and surveillances of the implementation of the BCAP. Furthermore, Commonwealth Edison Company has retained an independent third party group of experts, having no prior connection with Braidwood, to conduct oversight of the BCAP.

A final report documenting the implementation and results of the BCAP effort will be prepared at the conclusion of the program and provided to the NRC.

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I. INTRODUCTION

A. BACKGROUND

Commonwealth Edison Company started construction of the Braidwood Station in 1975. The construction activities were stopped in September 1979 due to corporate financial considerations. Construction resumed in April 1980 and is presently ongoing. Unit 1 is currently about 70% complete and Unit 2 is about 55% complete.

Commonwealth Edison's management has always been committed to attaining the requisite level of construction quality at the Braidwood Station. The design, construction and testing of the Braidwood Station is being conducted under the Commonwealth Edison Quality Assurance Program. This Quality Assurance Program complies with the criteria of 10CFR Part 50, Appendix B, and has been accepted by the NRC. Thus, the Commonwealth Edison Company Quality Assurance Program is designed to provide reasonable assurance that Braidwood construction activities conform with design drawings and specifications and to meet all applicable Nuclear Regulatory Commission (NRC) regulatory requirements; and that construction is, therefore, of acceptable quality.

Commonwealth Edison Company's Quality Assurance Program is being effectively implemented at Braidwood Station. Deficiencies were identified previously by Quality Assurance Department audits and by NRC inspections, including an inspection that resulted in an assessment of a civil penalty in 1982. Once these deficiencies were identified, Commonwealth Edison Company and its contractors took corrective actions to resolve these matters. Deficiencies in construction of nuclear power plants are not unexpected, given the complexity of the construction process. Commonwealth Edison Company believes that the critical questions are whether identified construction deficiencies have been corrected and whether there is a functioning quality assurance program so that there is reasonable assurance as to the overall integrity of the facility. It is in this context that both specific corrective actions at Braidwood have been and are being implemented and the Braidwood Construction Assessment Program (BCAP) is proposed.

B. OVERVIEW OF THE BCAP

The BCAP objectives are to assure:

-- that there are no programmatic design-significant problems in the construction of Braidwood which have not been identified and addressed;

-- that the on-site contractors' procedures governing ongoing safety-related construction and quality assurance activities address all applicable design and regulatory requirements; and

-- that where past construction problems have been identified which resulted in significant corrective actions (refer to Appendix D for a definition of "significant corrective actions" in this context), the corrective actions have been adequately implemented and documented.

These objectives will be accomplished by conducting reviews and performing inspections, as appropriate, within three (3) principal program elements. These elements involve:

-- a reinspection and review of completed construction work;

-- a review of current installation and inspection procedures which govern ongoing and future safety-related construction work; and

-- a review of implementation, methodologies and resulting documentation associated with the significant corrective action programs which resulted from previously identified deficiencies.

In order to ensure that the results of the BCAP will be reliable, the BCAP will be conducted in conformance with the Commonwealth Edison Quality Assurance Program applicable to Braidwood. Personnel who will be performing the BCAP activities will

be trained, qualified and certified (as applicable). The BCAP activities will be controlled through procedures and checklists and the BCAP activities will be properly documented.

The BCAP will be implemented under the control of a Commonwealth Edison Company Task Force headed by the BCAP Director. Commonwealth Edison has also established safeguards which assure that the groups managing, implementing and reviewing the BCAP are different from those who have responsibility for the construction activities being verified. Commonwealth Edison has also established a group within its Quality Assurance Department to conduct reviews, assessments, verifications, audits and surveillances of the implementation of the BCAP. Furthermore, Commonwealth Edison Company has retained an independent third-party group of experts, having no prior connection with Braidwood, to conduct overview of the BCAP.

II. ELEMENTS OF THE BCAP

The BCAP consists of three (3) principal elements. The first element of this program consists of a sample reinspection of safety-related construction work completed as of June 1, 1984 and a review of related quality documentation. The results of this reinspection will indicate the extent to which completed construction meets the design requirements. The second element consists of a review of current installation and inspection procedures which govern ongoing and future safety-related construction work. Completion of this activity will assure that these procedures provide for proper implementation of the design and regulatory requirements. The third element consists of reviewing the implementation, methodologies and resulting documentation associated with significant corrective action programs which resulted from previously identified deficiencies. Additionally, the results will be evaluated for significance to the quality of construction. Completion of this activity will assure that these specific areas of construction are of acceptable quality. A description of the activities associated with each element comprising the BCAP is provided in the remainder of this section.

A. FIRST BCAP ELEMENT - CONSTRUCTION SAMPLE REINSPECTION (CSR)

Under this element of the BCAP a significant sample of completed safety-related construction activity will be reinspected to verify conformance to design requirements. In addition, the quality documentation for the sample reinspected will be reviewed to assure that it is complete and accurate. The Tables given in Appendix A provide a list of the general categories of safety-related work for which a sample reinspection is planned to be included in the CSR effort.

As described in Section IIC and Appendix B, Commonwealth Edison Company has undertaken a series of corrective actions in response to deficiencies that have been identified previously. Some of these corrective actions are extensive and include reinspection of the entire population of a given construction activity. To the extent that the reinspections under these corrective actions satisfy the objectives and criteria for a CSR category, further reinspection of this category may not be performed.

Within each other safety-related construction category selected, each type of design-significant attribute of safety-related items will be verified by the following means:

-- Using approved procedures, qualified and certified inspectors from an engineering, construction, or testing organization will inspect accessible and recreatable attributes for each item included in the sample. These inspections will focus on design-significant attributes using as a guide a list of such attributes prepared in advance by the BCAP Task Force.

-- Qualified and certified (if applicable) personnel will conduct reviews of installation documents and quality records pertinent to these same items. These reviews will ensure that the requisite documentation exists and that it is complete and accurate.

Verification activities will be performed against the latest approved design drawings and specification requirements applicable to Braidwood. Any apparent deviation from the design drawings and specification requirements will be documented by the inspectors/reviewers as an observation in accordance with approved procedures.

All observations reported will be reviewed by the BCAP Task Force and a determination made whether or not a discrepancy exists. This review may include the use of Level III inspectors and will determine both whether the observation is a discrepancy in light of the requirements which applied at the time of the original inspection and whether the BCAP reinspection was conducted using the appropriate documents and criteria. Observations which have been previously identified through normal Quality Assurance activities (outside of BCAP) and are being appropriately addressed through normal Quality Assurance procedures will be excluded from the CSR program element.

The BCAP Task Force will forward the discrepancies (identified as above), along with other pertinent information, to Sargent and Lundy, the Architect/Engineer, for a review to determine whether the discrepancy is design-significant. Upon completion

of this review by the Architect/Engineer, the discrepancy documentation will be returned to the BCAP Task Force. The BCAP Task Force will determine, in light of the Architect/Engineer analysis, what further inspections, if any, are indicated.

All discrepancies (whether design-significant or non-design-significant) will also be designated as nonconformances (NCRs) and will be processed in accordance with the existing Quality Assurance systems and approved procedures. This includes appropriate corrective actions for removing the discrepant condition and trend analysis for identification of programmatic deficiencies, if any. Corrective actions on the NCRs, however, will be completed only after review of the discrepancy for design significance.

The Commonwealth Edison Quality Assurance Department will overview these activities to assure that the actions taken are appropriate.

It should be understood that the objective of the CSR is to demonstrate with high confidence that there are no programmatic design-significant discrepancies in the construction of the plant. The sample selection and expansion criteria described in the next section will fulfill this objective.

1. CSR Sample Selection Criteria

   The objective in this element of the BCAP is to establish a sample size which will support conclusions regarding the quality of the plant with high confidence.

   For a large population, it is well recognized that if no defects are found in a sample of 60, a conclusion can be supported with 95% confidence that at least 95% of the total population is defect free. Similarly, if a sample size of 315 is found to be defect free, a conclusion can be drawn with 95% confidence, that at least 99% of the total population is defect free. These two statements have a firm foundation in statistics if the sample selection process is random and the population is homogeneous.

Since the work activities in the plant are non-homogeneous, it is not appropriate to utilize a rigorous statistical sampling approach for the CSR. Therefore, the size of the sample as well as the factors applied in selecting specific sample items will be determined by the application of engineering judgment.

In this regard the selection of specific sample items within the specific construction categories of Appendix A will not be random. Rather, the selection process will be biased toward a greater likelihood of detecting design-significant discrepancies by emphasizing areas of plant construction which have greater potential for discrepancies and areas of the plant or systems which are more critical to the proper performance of the plant safety functions. The CSR sample will include representative examples of the accessible and recreatable safety-related construction work performed by each contractor. The sample will include contractor work for the total time period over which the contractor performed the activity on site.

Even though the populations of the construction categories are not homogeneous, engineering judgment indicates that sample sizes in the range of those discussed earlier in this section will support a conclusion about the quality of the work, with high confidence. This engineering judgment is based upon the conservatism of the sampling bias and the large number of categories into which the reinspection program will be divided. The sample sizes selected for the work categories will be at least as great as those which would be suggested for a random sampling of a homogeneous population to conclude with 95% confidence that at least 95% of the population is defect free. In most cases, the CSR sample size selected will be significantly larger in order to develop a representative sample over the time period that the work was originally performed. Samples of this size, which are found to have no design-significant discrepancies, support a conclusion with high confidence that there are no programmatic design-significant discrepancies in the entire population of that construction activity. Furthermore, it should be noted that the number of inspection points will generally be much greater than the sample size. For example, if the sample size utilized for cable pan hangers is 200, the reinspection could involve as many as 1,500 cable pan hanger welds and 3,000 or more attribute inspection points.

All considerations influencing the sample selection, both with respect to the total number of items included in the sample and also the selection of specifc items within the sample, will be properly documented.

2. CSR Sample Expansion Criteria

Discrepancies identified in the performance of the CSR will be evaluated by the Architect/Engineer for design significance. The evaluation will reference, when applicable, design calculations which were performed to support this analysis.

All discrepancies, including those determined to be non-design-significant, will be documented and processed as nonconformances (NCRs) in accordance with the existing QA procedures. This includes appropriate corrective actions for removing the discrepant condition and trend analysis for identification of programmatic deficiencies, if any.

The design-significant discrepancies will be evaluated by the BCAP Task Force and the Architect/Engineer for identification of probable root cause or causes. For example, root causes for welding discrepancies may include welder qualification, weld procedure misapplication, defective welding metal, a faulty welding machine, inspector error or lack of training and weldability of base material.

Based on the identification of root cause(s) of a design-significant discrepancy, a determination will be made of the population of items which may be affected by the root cause(s). This population will be identified by a review of the installation and inspection documentation. This population will then be subjected to further inspections.

Some root causes may be, by observation or analysis, found to be nongeneric and therefore unique. In such cases, further inspections may not be appropriate.

However, when a generic root cause is identified, further inspections will be performed on a sample of items from the affected population. These inspections will be of a type which is suitable for identifying other discrepancies similar to the design-significant discrepancy identified in the initial sample.

A sufficient number of items will be included in this expansion sample so as to conclude, with high confidence, that if no other similar design-significant discrepancies are identified by these sample inspections, then the initial discrepancy can be deemed to be an isolated case. If, however, one or more similar design-significant discrepancies are identified in this expansion sample, then the entire remaining population affected by the root cause will be reinspected. Typical examples of root causes and the resultant expansion samples are given in Table I.

Table 1
Example of Sample Expansion for
Discovery of Design-Significant Discrepancy by CSR

Contractor:	American Bridge	Phillips Getschow
Construction Activity:	Structural Steel Framing Erection	Small Bore Piping Installation
Specific Activity:	End connection (clip angle) welding	Check valve installation
Design-Significant Discrepancy Identified:	Cracked Fillet Weld	Check valve installed backwards
Root Cause Determination:	Insufficient Pre-Heat	P-G installation drawing has flow arrow not in accordance w/P&IDs
Description of Affected Population:	Welds requiring pre-heat (section thickness greater than 1 1/2")	All isometric drawing containing valves requiring specific orientation
Affected Population Size:	75	2000
Subsequent Sample Size:	75	300
Allowable Additional Design-Significant Discrepancies in Sample:	N/A	0
Type of Inspection:	Visual inspection for cracks	Compare P&ID with isometric drawing for direction of flow.

It is conceivable that in the course of reinspection of the expansion sample, a design-significant discrepancy will be observed which is unrelated to the root cause identified from the initial discrepancy. Inasmuch as such a discrepancy will be the first such discrepancy, it will not result in expansion of the sample to the entire population; rather it will result in a separate root cause analysis and, if appropriate, a sample reinspection from the corresponding affected population.

While Commonwealth Edison is confident that few design-significant discrepancies exist in the construction of Braidwood, it is possible that several such discrepancies will be identified through the implementation of the BCAP. All such discrepancies will be evaluated as a group at the conclusion of the BCAP effort to determine whether any additional corrective actions are needed.

B. SECOND BCAP ELEMENT - REVERIFICATION OF PROCEDURES TO SPECIFICATION REQUIREMENTS

This activity will consist of a review of all on-site contractors' current installation and inspection procedures for ongoing and future safety-related construction activities as of June 30, 1984. Completion of this activity will provide a determination of whether essential specification requirements have been properly incorporated into these installation and inspection procedures.

Before starting its review, the BCAP Task Force will develop and document in a procedure the criteria and methodology to be used. Commonwealth Edison Quality Assurance Department will review and concur in, and the BCAP Director will approve the procedure.

For each safety-related work activity, a review of the corresponding procedures will be performed to determine that:

-- the installation and inspection as well as personnel qualification and certification procedures adequately address the specifications, codes, standards and regulatory

requirements. Any areas of ambiguity in the procedures noticed in the course of these reviews will also be identified.

-- the installation and inspection procedures require appropriate records to be completed.

Any observation identified in the course of this procedure review will be evaluated to determine whether or not it represents a concern. An evaluation will be made of the impact of these concerns on completed, ongoing and future construction. Corrective actions in the form of procedural revisions, corrections or improvements will be identified and implemented in accordance with established procedures. Commonwealth Edison Quality Assurance Department will overview these activities to verify that the reviews and evaluations performed and corrective actions identified are appropriate.

C. THIRD BCAP ELEMENT - REVIEW OF SIGNIFICANT CORRECTIVE ACTION PROGRAMS

Appendix B provides a description of significant corrective action programs initiated by Commonwealth Edison Company and its contractors. The implementation of these programs, which began in the Fall of 1982, serves as corrective action to assure that the associated construction work is of acceptable quality.

Collectively, the results of these programs are expected to provide, through inspection of construction work and review of associated documentation, an extensive evaluation of a significant portion of the currently installed plant hardware. The BCAP activity associated with these corrective action programs will consist of reviewing each of the program methodologies, their implementation and the resulting documentation. The BCAP review will ensure that the conclusions reached through the activities conducted in each of these programs are valid. Any observation identified in the course of this review will be evaluated to determine whether it represents a discrepancy. Any discrepancy in program implementation identified in this review will be documented and evaluated, and may itself be the basis for subsequent corrective

actions. The Commonwealth Edison Quality Assurance Department will overview these activities to verify that the reviews and evaluations performed and corrective actions identified are appropriate. Finally, the BCAP Task Force will prepare a final report on these corrective action programs.

III. THE BCAP ORGANIZATIONS

The Commonwealth Edison Company organizations which will manage, implement and oversee the BCAP are structured to maintain their independence from those who have direct responsibility for the construction activities being verified. A Task Force specifically organized for this purpose will implement the BCAP activities. A separate Site Quality Assurance group will overview the BCAP activities. This section outlines the organization, responsibilities and duties of these groups. An organization chart depicting the various groups involved with BCAP is presented in Figure 1.

A. THE BCAP TASK FORCE

The Braidwood Project Manager has overall responsibility for the BCAP. Direct management responsibility for the implementation of the BCAP has been delegated to the BCAP Director. A group of personnel drawn from various Commonwealth Edison and consultant organizations comprise the BCAP Task Force. This group reports to the BCAP Director.

The duties of the BCAP Task Force include the following:

-- Developing the detailed BCAP element and activity plans.

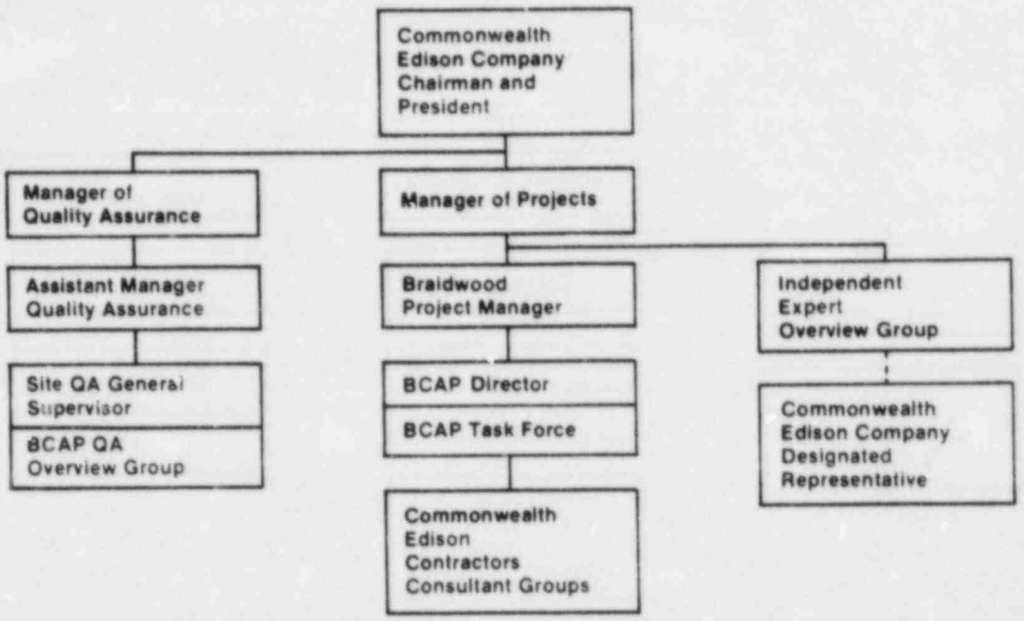
-- Developing and coordinating the review of and concurrence with the detailed BCAP implementing procedures and checklists.

-- Providing qualified and certified, as applicable, personnel to implement the BCAP elements.

-- Conducting the necessary inspections and evaluations.

-- Providing documented results of inspections and evaluations.

-- Coordinating the implementation of the BCAP activities with other groups.


Commonwealth Edison Company Chairman and President
Manager of Quality Assurance
Manager of Projects
Assistant Manager Quality Assurance
Braidwood Project Manager
Independent Expert Overview Group
Site QA General Supervisor
BCAP QA Overview Group
BCAP Director
BCAP Task Force
Commonwealth Edison Company Designated Representative
Commonwealth Edison Contractors Consultant Groups

-- Evaluating or obtaining evaluation of the BCAP activity results.

-- Providing periodic status reports.

-- Reporting the BCAP activity results.

The individuals assigned to the BCAP Task Force may be from other Braidwood project organizations, contractors or consultants, but they will have had no responsibility for the construction activity which they will be verifying. The Task Force members who are directly implementing the BCAP activities will be trained, qualified and certified, as applicable.

B. THE BCAP SITE QUALITY ASSURANCE OVERVIEW GROUP

The Assistant Manager of Quality Assurance has overall responsibility for overseeing the BCAP for conformance to Quality Assurance requirements. This overview of the BCAP has been delegated to the Site Quality Assurance General Supervisor. A team of Site Quality Assurance personnel has been established to overview the BCAP activities through program completion.

The BCAP Site Quality Assurance Overview Group will assure proper BCAP controls and implementation including the following duties:

-- Developing Quality Assurance BCAP plans.

-- Performing program reviews, assessments and verifications.

-- Performing the BCAP procedure reviews and providing concurrence.

-- Reviewing personnel training, qualifications and certifications.

-- Reviewing audits and surveillances conducted on the BCAP activities.

-- Establishing and performing in-process witness/hold points.

-- Performing scheduled and unscheduled audits and surveillances.

-- Reviewing and assessing completed program elements.

-- Reviewing documentation and resolution of observations and discrepancies.

-- Providing periodic status reports.

Commonwealth Edison Quality Assurance coverage of the BCAP will ensure compliance with applicable requirements, proper program implementation and an evaluation of the end results.

C. INDEPENDENT EXPERT OVERVIEW GROUP

In addition to the specific Site Quality Assurance Department team, implementation of the BCAP will be monitored by an Independent Expert Overview Group which will report directly to the Commonwealth Edison Manager of Projects. The purpose and functions of this third party are described in more detail in Section V.

IV. QUALITY ASSURANCE ELEMENTS FOR IMPLEMENTATION OF THE BCAP

The Commonwealth Edison Company Quality Assurance Program applies to Braidwood Station. It complies with 10CFR Part 50, Appendix B and has been accepted by the NRC. The BCAP will be implemented to meet the requirements of the Commonwealth Edison Quality Assurance Program and applicable industry quality standards.

The individual elements of the BCAP will be subject to a common set of quality assurance provisions. In brief, the quality assurance provisions applying to the BCAP include the following:

Organization - Section III contains a description of the primary organizations responsible for implementation of the BCAP. Implementation of the BCAP is the responsibility of the BCAP Task Force. This Task Force is headed by the BCAP Director who reports to the Braidwood Project Manager. Overviewing this implementation effort within Commonwealth Edison Company will be a Site Quality Assurance Department group reporting to the Site Quality Assurance General Supervisor, who in turn reports to the Assistant Manager of Quality Assurance.

Programmatic Controls - The BCAP activities will be controlled through the use of written plans, procedures, instructions and checklists approved by the BCAP Director with Quality Assurance concurrence. These control documents will identify what is to be inspected or reviewed, specify how the inspection or review is to be conducted and identify the inspection acceptance criteria and requisite quality documentation.

Training, Qualifications and Certification of BCAP Personnel - Persons performing the BCAP inspection activities will be trained, qualified and certified in accordance with ANSI N45.2.6 (1978) and Regulatory Guide 1.58. Individuals performing other BCAP activities will be trained, qualified and certified (if applicable) in a manner appropriate for the activities they are performing.

Documentation of Results - The specific inspections and reviews performed under the BCAP, together with the results of those inspections and reviews with objective evidence for

traceability and reproducibility, will be documented in a manner suitable for auditing. Such documentation will be retained as permanent quality records.

Nonconformances - Discrepancies identified in the course of BCAP will be designated as nonconformances (NCRs). These nonconformances will be recorded, processed and necessary corrective action will be taken, in accordance with the existing Commonwealth Edison Quality Assurance procedures. The followup actions include analyses to determine if the condition is acceptable as is or a corrective action to remove the discrepant condition is required. Additionally, such nonconformances will also be subject to a trend analysis evaluation for identification of programmatic deficiencies, if any.

Audit and Surveillance - Implementation of the BCAP will be subject to audits and surveillance by the Commonwealth Edison Company Quality Assurance group, and as applicable, by the Quality Assurance departments of contractors conducting specific elements of the BCAP. Any need for corrective action in the performance of the BCAP will be identified and implemented.

Management Review - The BCAP Director will regularly notify Commonwealth Edison Company management, including the Braidwood Project Manager, Assistant Manager of Quality Assurance, the Manager of Projects, and the Manager of Quality Assurance, of the progress and results of the BCAP. Significant problems in the implementation of the BCAP or major discrepancies discovered through the BCAP will be brought to management's attention promptly. This will enable management to evaluate if further corrective actions beyond that recommended by the BCAP Task Force are warranted. Similarly, the Site Quality Assurance General Supervisor will also provide periodic reports to management.

This summary is by no means exhaustive of all the quality assurance provisions in the Commonwealth Edison Quality Assurance Program which will govern implementation of the BCAP. It is intended only to indicate the commitment which Commonwealth Edison Company has made to ensure that the BCAP will meet its objective.

V. INDEPENDENT EXPERT OVERVIEW GROUP

Commonwealth Edison Company has retained the services of Evaluation Research Corporation (ERC), of Arlington, Virginia as an outside organization that will bring together and direct a team of experts whose purpose will be to provide an independent overview of the BCAP. ERC has formed this team of senior experts and professional staff to work under the direction of a Principal Consultant. ERC team members are well qualified to perform the independent expert overview function. Summaries of key ERC team member qualifications can be found in Appendix C.

The Independent Expert Overview Group activities include the following:

-- Conducting an overall review of the BCAP scope document objectives and a review of each of the BCAP elements to determine if the BCAP elements will fulfill their objectives.

-- Ascertaining if the BCAP effort as identified in the scope documents, is properly focused and whether the goals of the BCAP are being fulfilled.

-- Conducting a minimum of two (2) audits that will address the implementation of each of the BCAP elements. Items to be specifically audited will be adherence to Program procedures, evaluation of Quality Assurance involvement, qualifications of the personnel performing inspections, and identification of nonconformances and adequacy of the corrective actions.

-- Performing an independent review of selected BCAP identified discrepancies to provide assurance that the engineering evaluation for design significance was adequately performed and documented.

-- Preparing in-depth audit reports.

The results of the overview will be submitted in periodic reports to the Manager of Projects with a copy to the President and Chairman of the Board of Commonwealth Edison. These

reports will not be discussed, in any manner, with non-authorized members of Commonwealth Edison Company management or personnel or with any management member or personnel of Commonwealth Edison Company associated contractors.

ERC personnel conducting the BCAP overview will be organized in task teams, consisting of a senior expert team leader and professional staff. The task team will operate independently of the various Braidwood organizations and will communicate with Commonwealth Edison through a designated Commonwealth Edison representative. The task team will have access to Braidwood Station and access to contractor personnel, facilities and records associated with the Braidwood Station.

In the event that the Independent Expert Overview Group discovers any discrepancies with potential significance relative to the BCAP implementation or observations with the potential for program changes, such discrepancies or observations will be properly documented and submitted to the designated Commonwealth Edison representative. All such discrepancies will be resolved to the satisfaction of the Independent Expert Overview Group.

An in-depth final report will be submitted to the Manager of Projects with a copy to the President and Chairman of the Board of Commonwealth Edison Company. This report will include all task team findings, observations and associated dispositions, along with overview group recommendations.

The Independent Expert Overview Group members will be free of any significant contacts with Commonwealth Edison Company. They will not have participated in the design, construction or quality assurance activities related to the Braidwood Station or with Braidwood site contractors within the past five years. Immediate family members will not be currently employed by Commonwealth Edison Company or a Braidwood site contractor. Members of their immediate family (parents, spouse, children and grandchildren) will not currently have a cumulative ownership and creditor interest in Commonwealth Edison Company or a Braidwood site contractor which exceeds 5% of the family annual income.

In short, the Independent Expert Overview Group will conduct a comprehensive third-party overview of the BCAP, thereby providing an added measure of assurance in the reliability of the results of the BCAP.

VI. BCAP FINAL REPORT

It is expected that major activities associated with the BCAP implementation will be completed by the end of the first quarter, 1985. Following completion of the BCAP elements, a final report of the BCAP will be prepared by the BCAP Task Force. This report will describe the methodology used to collect data and the techniques used to analyze the data. This report will also summarize the results of each BCAP element and will present conclusions for each element of the BCAP.

The final report will also contain an evaluation of the results of the BCAP elements as a whole. Based on this evaluation, the final report will offer conclusions regarding the overall quality of construction at Braidwood. In the event that the BCAP discovers any significant conditions adverse to quality, the final report will also identify these conditions and describe the completed or ongoing corrective action for them.

The BCAP Final Report will be provided to the NRC.

APPENDIX A
CSR SAMPLING PLANS

Under the BCAP, a sample of safety-related construction activities will be subjected to inspections and reviews of supporting documentation. Within each construction category typical attributes to be inspected and typical attributes for which the documentation will be reviewed are identified. Note that this list of attributes is not intended to be complete, but rather it is intended to exemplify the attributes to be examined by the BCAP.

The items marked with an asterisk (*) in these Tables have been or are being reinspected to varying extents, under the corrective actions described in Section IIC and Appendix C. To the extent that the reinspections under these corrective actions satisfy the objectives and criteria for a CSR category, further reinspections of this category may not be performed. The decision whether to use the results from these corrective action programs in fulfillment of the CSR sample will be made by the BCAP Director after a thorough review of the respective program to ensure that these inspections and documentation reviews were performed on a sample representative of the entire population in that category. The basis for this decision along with all supporting information will be documented.

Table A.1
CSR Sampling Plan for
Piping/Mechanical Discipline

	Construction Category	Unit for Review	Attributes for Inspection/Review
1.	Small Bore Piping		
	a. Welding	1 socket weld	Size, shape, weld quality, welder qualification, weld procedure qualification, filler material type, NDE documentation
	b. Bending	1 bend	Wall thickness, ovality, bend procedure
	c. Configuration	1 isometric drawing	Elevation, size, slope, identification, dimension
	d. Supports	1 support	Location, configuration, welding, bolting, CEAs
	e. Material Traceability*	1 pipe piece or fitting	Component marked or documentation supporting traceability
2.	Instrumentation Piping*		
	a. Welding	1 weld	Size, shape, weld quality, welder and procedure qualification, filler material type, NDE documentation
	b. Bending	1 bend	Wall thickness, bend procedure, ovality
	c. Configuration/ Separation	1 isometric drawing	Elevation, size, slope, separation, identification dimension
	d. Supports	1 support	Location, configuration, welding, CEAs

Construction Category	Unit for Review	Attributes for Inspection/Review
3. Large Bore Piping		
a. Welding	1 butt weld	Weld profile, welder and weld procedure qualification, filler material type, NDE documentation
b. Configuration	1 spool	Elevation, size, dimensions, identification
c. Supports	1 support	Type, location, configuration, welding, bolting, CEAs
d. Whip Restraint	1 restraint	Welding, NDE documentation, location, configuration, material
e. Snubbers	1 snubber	Type, identification, cold position setting, location, configuration
f. Material Traceability*	1 spool, fitting, or piece of pipe	Material markings or documentation traceable to certified material test report or Certificate of Compliance or Conformance
4. Mechanical Equipment	1 piece of equip.	Foundation, bolting, setting, welding, grouting, cleanliness, alignment, CEAs
5. Instrumentation	1 instrument	Instrument identification, location, orientation, welding, separation, tubing support tracks, crimp connections, and bends.

Table A.2
CSR Sampling Plan for
Electrical Discipline

Construction Category	Unit for Review	Attributes for Inspection/Review
Conduit	1 conduit run	Size, routing, bend radius, fittings, grounding, identification, damage, material, installation and inspection document review.
Conduit Hanger	1 conduit hanger	Material type, configuration, spacing, location, field welding, bolting, identification, dimensions, CEAs. Welder qualification, installation. and inspection document review.
Cable pan Hanger	1 pan hanger including auxiliary steel	Material type, configuration, spacing, location, field welding, bolting, identification, dimensions, CEAs. Welder qualification, installation and inspection document review.
Cable Pan and Wireways	1 pan section	Size, material, identification routing, fittings, grounding, covers, cable protection, spices, damage. Installation and inspection document review.
Cables	1 cable	Type, configuration, identification, routing (entry and exit at conduits, pan, and equipment), channel separation, bundling, damage (in air and in panels), lugs, connectors, crimps, bend radius, support, termination tightness, installation and inspection document review.
Equipment (panels, penetrations, motors, junction boxes, MCCs, etc.)	1 piece of equipment	Identification, location, mounting, grounding, damage welding, bolting, CEAs, storage maintenance, installation and inspection document review.

Table A.3
CSR Sampling Plan for
Civil/Structural Discipline

Construction Category	Unit for Review	Attributes for Inspection/Review
Structural Framing*	1 beam and end connections	Beam configuration, clip configuration, bolting, field welding, material identification, documentation review.
Concrete	1 placement	Surface inspection, cylinder test report
Equipment Grouting	1 placement	Surface inspection, cube strength reports
Concrete Expansion Anchors (CEAs)	1 plate employing CEAs	Bolt type, size, length, embedment, spacing, edge distance, hole size, thread engagement, spalling, shimming, grouting, damage, abandoned hole distance, angularity, washers, torque, and installation and inspection documentation review.

Table A.4
CSR Sampling Plan for HVAC Discipline

Construction Category	Unit for Review	Attributes for Inspection/Review
Duct	1 piece of duct	Configuration, welding, material traceability, documentation review, damage, identification.
Hangers	1 hanger including auxiliary steel and longitudinal bracing	(Same as above)
HVAC Equipment (fans, turning vanes dampers, filter trains, etc.)	1 piece of equipment	Identification, configuration, location, damage, CEA's, gaskets/sealants, fasteners.

APPENDIX B

ONGOING CORRECTIVE ACTION PROGRAMS

Commonwealth Edison has established a number of corrective action programs to confirm the quality of specific areas of past construction work through a series of special inspections and documentation reviews. Many of these areas of past construction were previously identified by Commonwealth Edison Quality Assurance audits or NRC inspections. Other areas were identified for additional quality confirmations based on Commonwealth Edison experiences at other nuclear construction projects.

These programs should provide the requisite corrective action to demonstrate that past construction work is of acceptable quality, or that the deficiencies are identified and appropriately dispositioned. It should be noted that many of these programs have already been implemented to provide corrective action for past deficiencies, and are now at various stages of completion. A brief description of each of these quality confirmation programs is provided in this appendix.

Reinspection of Safety-Related Mechanical Equipment

Prior to September 1982, Phillips Getschow Company (PGCo) had installed safety-related mechanical equipment without adequate procedures. Commonwealth Edison Quality Assurance Department initially identified this deficiency through a series of audits, and later the deficiency became an NRC item of noncompliance. PGCo wrote new equipment installation procedures which contained more detailed installation and inspection criteria specified by the design drawings and specifications. PGCo used these new procedures to inspect all safety-related mechanical equipment installation work performed by them prior to September 1982. These inspections have been completed.

QC Inspector Reinspection

Commonwealth Edison Company instituted a reinspection program at Braidwood to demonstrate the effectiveness of site contractor QC inspector qualification and certification

programs. This reinspection program was designed to address questions raised at other nuclear plant sites by the NRC staff with respect to QC inspector qualification and certification under ANSI N45.2.6.

Each site contractors' programs for the qualification and certification of inspectors was revised in late 1982 to reflect the NRC's latest interpretation of ANSI N45.2.6 (1978). A program was established to validate, through reinspection, the certification and qualifications of contractor QC inspectors established prior to these program upgrades. The first three months of accessible and recreatable inspections for every fifth inspector for the five major site contractors are being reinspected. Based upon agreement between the results of the inspector's initial inspections and those of the reinspection, the acceptability of an inspector's qualification and certification is established. If agreement to predetermined acceptance criteria cannot be established for these inspections, provisions exist to expand the sample of reinspections for that inspector whose initial inspections were deemed deficient. If the expanded sample of inspections for this inspector cannot establish reasonable agreement for the reinspections, then the sample of inspectors is also expanded.

This program is designed to confirm the acceptability of the historical inspector qualifications and certifications at Braidwood. In addition this program is also expected to provide, through reinspection, an additional indication of the quality of a significant fraction of previously installed plant systems.

The reinspections required by this program were started in July 1983 and are now approximately 80% complete. It is expected that the reinspection effort will be completed in late 1984.

Piping Heat Number Traceability

In June 1983, the Phillips Getschow Company procedure for the maintenance of ASME piping material traceability was enhanced to require quality control verification of heat numbers at the point of installation. In order to reconfirm that all ASME piping materials installed prior to June 1983 were traceable, PGCo established a program for the 100% reinspection for traceability markings of all accessible piping and a 100% review of material traceability

documentation supporting previously installed large and small bore ASME piping systems. The program is intended to establish that material traceability requirements were met; that is, that each piece of ASME Code piping material is uniquely traceable to material certifications, either through the documentation traceable to the piping installation, or by identification markings physically on the piping material. The results of the program should verify that only acceptable material was installed and should validate the existing material documentation supporting traceability.

PGCo began implementation of this program in March 1984. The expected duration of this program is approximately one year.

Quality Control Structural Steel Review (QCSSR)

In late 1982, based on experiences at other nuclear plant construction sites, Commonwealth Edison Company undertook a program to reinspect, on a statistical sampling basis, various design attributes of structural steel erected by the various contractors responsible for this work. The initial sampling and the criteria for expansion of the sample are based on MIL STD 105D. The reinspection by site contractor QC personnel of essential attributes against design drawings and specifications will provide Sargent & Lundy with information to analyze any differences between the design and the as-constructed condition.

Work on QCSSR was initiated in early 1983 and is approximately 70 percent complete. Completion of this program is intended to confirm that the installed structural steel meets the design requirements.

Electrical Installation Document Review

During 1982, Commonwealth Edison Quality Assurance audits identified deficiencies relative to the control of electrical installation and associated quality control records. As a result, in February 1983, Commonwealth Edison Company directed its electrical contractor, L. K. Comstock (LKC), to enhance their procedure governing documentation of electrical installations and to perform a comprehensive review of their quality documentation for prior electrical installations. This program is intended to confirm that each completed LKC

installation is supported by required installation and quality control inspection documentation. It should also confirm that LKC quality control documentation is legible, accurate, and complete, and is sufficient to document the significant design specification attributes. This program is currently underway and is scheduled for completion in late 1984.

Safety-Related Pipe Supports

As a result of Commonwealth Edison Company QA audits and surveillances in late 1982, PGCo installation and QC procedures for safety-related pipe supports were substantially revised to require more comprehensive inspection and documentation of piping support installations. Additionally, Commonwealth Edison directed PGCo to reinspect safety-related pipe support installed prior to September 1982 to verify that these supports were in conformance with the design drawings and specifications. The results of this program, when completed, should provide documented evidence that safety-related piping supports are installed in accordance with the design drawings and specifications.

HVAC Welding

Prior to the construction shutdown in September 1979, the quality program of the HVAC contractor, Pullman Sheet Metal (PSM) required 100% inspection of field welds by production personnel, with a 10% quality control inspection conducted by PSM QC inspectors to validate the production inspections. When construction resumed in March 1980, Commonwealth Edison Company directed PSM to perform 100% QC inspections of new field welds, and to inspect all previously installed field welds which were not previously inspected by QC inspections. In February 1982, PSM indicated that they had misinterpreted a welding detail for fabricated hangers. Further reinspections were conducted to identify and repair cases of welding detail misinterpretation. The completion of inspections of previously completed HVAC field welds should ensure that this welding conforms with the design requirements or that any deficiencies are identified and appropriately documented.

HVAC Configuration

In October 1982, Commonwealth Edison Company directed Pullman to perform 100% configuration inspections for all new hanger installations and to inspect all previously installed hangers. Prior to this date, Pullman procedures did not require a QC inspection of installations for confirmation. Completion of this element should confirm that hangers, braces, and auxiliary steel installed by PSM are of the proper material and meet the design drawings and specification requirements.

HVAC Duct Stiffener and Fitting Detail

Commonwealth Edison Company QA determined in February 1982 that shop welding by Pullman Sheet Metal (PSM) of corner joints on HVAC duct stiffeners was not being performed in accordance with approved welding details.

In June 1983, Commonwealth Edison QA also determined that certain shop-fabricated duct fittings were not fabricated in accordance with approved design documents.

To address the possible effects of both of these deficiencies on already installed ductwork, Commonwealth Edison directed PSM to conduct reinspections and/or repairs to approved design drawings. As a result of this reinspection, the ductwork stiffener welding and duct fittings should be brought into conformance with approved design drawings and specifications. This program is currently underway and will be completed by late 1984.

Instrumentation Installation Verification

As a result of Commonwealth Edison Company QA audits and NRC inspections, deficiencies in the PGCo QC inspections of instrumentation installations were identified. These deficiencies involved criteria for line separation and segregation color coding, and the performance of inspections which were not thoroughly documented nor complete as to all design significant attributes. In January 1984, PGCo installation and inspection procedures were revised to include all specification requirements. Previously installed instrumentation will be reinspected and associated documentation will be reviewed to ensure that these

installations adhere to the design requirements and to the requirements of the revised procedures. The results of this program should ensure that PGCo instrumentation installations conform with the approved design. This program is currently underway and is expected to be completed by early 1985.

NSSS Component Support Verification

In 1982 it was recognized, through an NRC inspection, that Steam Generator and Reactor Coolant Pump Support Columns were not installed in accordance with ASME Code as committed in the FSAR.

Consequently, an ASME accredited site contractor, who was not responsible for the initial installation of these supports, will perform detailed inspections and provide sufficient additional supporting documentation. This should ensure that these support columns are installed in accordance with an approved design and the ASME Code.

This program is currently ongoing and will be completed by late 1984.

APPENDIX C

SUMMARY OF EXPERIENCE OF KEY PEOPLE IN INDEPENDENT EXPERT OVERVIEW GROUP

John L. Hansel — (Principal Consultant) Thirty years of experience in quality assurance, reliability, maintainability, system safety, systems management, and project management/control. Served as Director of Quality Assurance and Reliability on the NASA Apollo Program and as a consultant to the President's Commission on the Three Mile Island accident.

Robert V. Laney — (Senior Expert) Thirty-five years of experience in nuclear construction, energy research, and quality assurance. Served as Deputy Director of Argonne National Laboratory and Vice-President and General Manager of General Dynamics Shipyard for construction of nuclear power naval ships.

Nicholas A. Petrick — (Senior Expert) Over thirty years of experience in management, design, procurement, and quality assurance for nuclear projects. Served as Executive Director of SNUPPS Project.

Wayne L. Chase — (Senior Expert) Over thirty years of experience in engineering and management in the nuclear field, including design, hardware procurement, construction and development.

APPENDIX D

DEFINITIONS

Observation - An apparent difference in an attribute from that defined as acceptable by the applicable checklists, instructions or drawings which is observed by an inspector or document reviewer while verifying the acceptability of that attribute.

Discrepancy - An observation which has been reviewed by the BCAP Task Force against the design drawings and specifications, lists of existing discrepancies, and the construction status reports to ensure that the observation is not incomplete work, the subject of a design change, or a duplication of an already documented discrepancy.

A discrepancy is a difference in an attribute of completed QC accepted construction between that required by approved design drawings and specifications and that observed by inspection or review of quality documentation.

Design-significant discrepancy - A discrepancy in the construction of an item from the approved design which, if uncorrected, could impair the item's ability to perform its safety-related design function under design loadings and conditions.

Programmatic discrepancy - A discrepancy whose root cause lies in a procedural or programmatic deficiency. This type of discrepancy is likely to be repetitive in nature in that the discrepancy is expected to occur wherever the deficient procedure or program is applied.

Significant corrective actions- Programs which have been or will be established to provide corrective action for specific areas of past construction work which exhibited significant programmatic discrepancies. These programs will provide the requisite corrective action to demonstrate that past construction is of acceptable quality, or that the deficiencies are identified and appropriately dispositioned. These programs are designed to address discrepancies in both hardware and in the requisite supporting documentation. These programs are established for discrepancies of a programmatic,

repetitive, or generic nature. Programs identified in Appendix B are representative of such significant corrective actions.

Sample - A selection of specific items from a popu'ation of similar items on which tests, inspections, or reviews are performed. A sample is chosen, usually randomly, such that the results of inspections, etc., for the sample are representative of those results expected for the population.

Accessible - Those items which can be inspected without removing or invalidating previously installed work. Accessible items include those items for which scaffolding must be erected or for which fireproofing or insulation must be removed. It does not include those items which must be disassembled, such as valve and piping internals, items embedded in concrete, or root passes on welds.

Recreatable inspections - Inspections which can be performed with meaningful results after construction has been completed for an item of interest. Examples include configuration, visual weld inspection, and location. Inspections are deemed non-recreatable if these inspections cannot be performed after construction on that item progresses. Examples of non-recreatable inspections include in process inspections such as verification of welding preheat, interpass, and Post Weld Heat Treatment temperatures.

Acceptable quality - An item is of acceptable quality if it is constructed in accordance with approved design drawings, specifications, and procedures and is supported by documentation.

Design drawings and specifications - Those design documents approved by the architect/engineer which define requirements, attributes, and characteristics necessary for the construction of systems, structures, and components.

Design-significant attribute - A characteristic of the construction of an item which, if not in accordance with the design drawings and specifications, could impair the item's ability to perform its safety-related design function under design loading and conditions.