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March 4, 1986

Herbert Grossman, Esq.
Chairman
Administrative Law Judge
Atomic Safety and Licensing Board
United States Nuclear Regulatory Commission
Washington, D.C. 20555

Dr. A. Dixon Callihan
Administrative Law Judge
102 Oak Lane
Oak Ridge, Tennessee 37830

Dr. Richard F. Cole
Administrative Law Judge
Atomic Safety and Licensing Board
United States Nuclear Regulatory Commission
Washington, D.C. 20555

Re: In the Matter of Commonwealth Edison Company
(Braidwood Station, Units 1 and 2)
Docket Numbers 50-456 and 50-457OL

Dear Administrative Judges:

Pursuant to the duty of full disclosure as articulated by the Appeal Board in Duke Power Company (William B. McGuire Nuclear Station, Units 1 and 2), ALAB-143, 6 AEC 623 (1973), enclosed are copies of the recent NRC Construction Assessment Team (CAT) inspection for Byron Unit 2, and Commonwealth Edison's response dated January 24, 1986. While I have not performed a comprehensive review of the Byron Unit 2 CAT inspection report to determine each way in which it may be relevant to the issues in Braidwood, it appears that violations 2 and 3b in that report, and Edison's responses to those violations, may be relevant to Intervenors' Amended Quality Assurance Contention, items 8.C and 10.D.

Sincerely,

Philip P. Steptoe

PPS:es
enc.

cc Service List (w/enclosures)

D303

Commonwealth Edison
One First National Plaza, Chicago, Illinois
Address Reply to: Post Office Box 767
Chicago, Illinois 60690

January 24, 1986

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

Subject: Byron Station Unit 2
IE Inspection Report No. 50-455/85-027

References (a): November 13, 1985 letter from J. M. Taylor to Cordell Reed

(b): December 12, 1985 letter from C. E. Norelius to Cordell Reed

Dear Mr. Keppler:

Reference (a) provided the results of the NRC Construction Appraisal Team (CAT) inspection conducted at Byron Station, Unit 2 on August 19-30, and September 9-20, 1985. During this inspection, certain activities were found in violation of NRC requirements. Attachment A to this letter contains Commonwealth Edison's response to the Notice of Violation appended to reference (b). Attachment B to this letter addresses the three construction program weaknesses identified in the CAT report. On January 8, 1986, Commonwealth Edison was granted a fourteen day extension on the due date for the response to the Notice of Violation.

With respect to certain findings identified during the CAT inspection, we do not believe these items represented a violation of NRC requirements. Our reasons for this are discussed in the detailed responses in Attachment A. In these particular areas, we request the NRC to reconsider these items in light of the information we have provided.

Please direct any questions regarding this matter to this office.

Very truly yours,

D. L. Farrar
Director of Nuclear Licensing

lm

Attachments

cc: Byron Resident Inspector

1155K

ATTACHMENT A

VIOLATION 1a

10 CFR 50, Appendix B, Criterion III as implemented by Commonwealth Edison Company (CECo) Quality Assurance Manual (QAM), Quality Requirement No. 3.0, requires that measures shall be established to assure that applicable regulatory requirements and design basis are correctly translated into specifications, drawings, procedures, and instructions.

Contrary to the above, at the time of this inspection, the licensee's program was not adequately implemented in that splicing of Class 1E wiring in panels has occurred at Byron Station contrary to the FSAR commitments to IEEE Standard 420, which prohibits the use of wiring splices in panels. FSAR commitments had not been translated into appropriate procedures and design documents.

RESPONSE

This concern was originally identified during the NRC CAT inspection at Braidwood Station (IE Inspection Report No. 50-456/84-44; 50-457/84-40, page II-13, copy attached). In response to this concern, a discussion of conformance to IEEE 420-1973, including our use of cable splices within control switchboards, has been provided on page 8.1-14 of the FSAR. An advanced copy of this FSAR revision was provided to the NRC in a February 6, 1985 letter from T. R. Tramm to H. R. Denton (copy attached). During the Byron CAT inspection, a copy of this letter was furnished to the inspector.

Since our intent to formally revise the FSAR by way of amendment was committed to in the February 6, 1985 letter referenced above, we believe this item would be more appropriately classified as an Unresolved Item pending issuance of the formal FSAR amendment.

The Braidwood Station FSAR commitment to IEEE Standard 420 prohibits the use of wire splices in Class 1E equipment. However, NRC CAT inspectors observed in-line butt splices in numerous electrical panels. As site procedures do not require the location of splices to be depicted on design documents, NRC CAT inspectors were unable to determine how extensively these splices have been utilized. Additionally, the licensee had previously issued NCR-598 to document hardware deficiencies in installed butt splices and reported this condition to NRC Region III in accordance with 10 CFR 50.55(e). The use of butt splices in Class 1E panels requires documentation in the FSAR as an exception to the IEEE standard.

The following are the isolated discrepancies noted by the NRC CAT inspector:

- Conductor insulation damage on the orange conductor of cable 1RH108-C1E in motor control center 1AP21E, cubicle F3. ICR-7610 was subsequently issued to document this condition.

- Several terminal screws were found loose in the Diesel Generator Control Panel 1A and in the Remote Shutdown Panel, section 1PL05J. ICR's 7646, 7644, and 7643 were subsequently issued to document these conditions.

- Internal motor lead T-9 was found damaged in motor operated valve 1CSQ01A. ICR-7867 was subsequently issued to document this condition.

- The red conductor of cable 1SI053-C1E, in motor operated valve 1SI8802A, was excessively bent and not meeting minimum bend radius criteria. ICR-7870 was subsequently issued to document this condition.

(8) Seepage of Oil From Okonite Cable

NRC CAT inspectors observed any oily substance seeping from jackets of numerous installed and terminated cables manufactured by the Okonite Company. This condition was observed in both Class 1E and non-Class 1E cables in various Class 1E equipment throughout the facility (motor control centers, main control boards, control panels, motor operated valves, etc.). Information obtained from NRC Region III, CECo, and S&L revealed the following:

- In a letter dated October 4, 1982, including an attached engineering report (No. 364), the Okonite Company informed CECo that, with reference to the identical condition identified at Byron Station, this seepage "will not affect the reliability or life of the cables."

Commonwealth Edison
One First National Plaza, Chicago, Illinois
Address Reply to: Post Office Box 767
Chicago, Illinois 60690

February 6, 1985

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Byron Generating Station Units 1 and 2
Braidwood Generating Station Units 1 and 2
FSAR Changes
NRC Docket Nos. 50-454/455 and 50-456/457

Dear Mr. Denton:

This letter provides advance copies of revised pages for the Byron/Braidwood FSAR. These changes are being made to provide more explicit descriptions of the design bases for these plants.

Enclosed is a revised page 8.1-14. It now includes a discussion of conformance to IEEE 420-1973 with regard to the allowed use of cable splices within control switchboards. This change is being made to resolve a concern identified during a recent I&E inspection at Braidwood Station.

Also enclosed are revised pages E.20-1, E.20-1a, and E.82-1 for Appendix E of the Byron/Braidwood FSAR. They now specify that the liquid source term used for shielding evaluation and environmental qualification of Byron and Braidwood does not include noble gases. Fission solids are the dominant contributor for long term doses so this does not significantly alter the radiological impact of postulated accidents.

Also included is a revised page E.21-3. It specifies that backup sampling is not provided for hydrogen because of the large volume required. These changes will be incorporated into the FSAR at the earliest opportunity. Please direct questions regarding these matters to this office.

One signed original and fifteen copies of this letter are provided for NRC review.

Very truly yours,

for T. R. Tramm
Nuclear Licensing Administrator

lm

cc: Byron Resident Inspector
Braidwood Resident Inspector

9738N

The physical identification of safety-related equipment is discussed in Subsection 8.3.1.3.

8.1.15 Shared Emergency and Shutdown Electric systems for Multi-Unit Nuclear Power Plants

The criteria followed in designing the two unit station is that each unit shall operate independently of the other and malfunction of equipment or operator error in one unit will not initiate a malfunction or error in the other unit nor affect the continued operation of the other unit.

8.1.16 Qualification of Class 1E Equipment for Nuclear Power Plants

With regard to environmental qualification of instrumentation, control, and electrical equipment important to safety, the Applicant complies with the intent of IEEE 323-1974. Additional information is provided in Section 3.11.

8.1.17 Availability of Electric Power Sources

During abnormal electric power source configurations, plant operations are limited as described in Subsection 16.3/4.8.

8.1.18 Conformance to IEEE 338-1975 (Periodic Testing of Nuclear Power Generating Station Class 1E Power and Protection System)

Conformance to this standard is addressed in Subsection 8.3.1.2 and 7.1.2.19.

8.1.19 Conformance to IEEE 344-1971 (Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Station)

Conformance to this Standard is addressed in Section 3.10.

8.1.20 Conformance to IEEE 387-1972 (Criteria for Diesel Generator Units Applied as Standby Power Supplies for Nuclear Power Generating Stations)

Vendor qualification tests, preoperational testing, and periodic testing during normal plant operation conform to those procedures described in this standard, except as noted in Subsections 8.3.1.2, 16.3/4.8, and Chapter 14.0.

8.1.21 Conformance to IEEE 420-1973 (IEEE Trial-Use Guide for Class 1E Control Switchboards for Nuclear Power Generating Stations)

Class 1E control switchboards conform to this standard with the following clarification to Paragraph 4.6.1.2: Splices may be used on individual conductors of field cables within switchboards for the purpose of extending individual conductors to their point of termination.

VIOLATION 1b

10 CFR 50, Appendix B, Criterion III as implemented by Commonwealth Edison Company (CECo) Quality Assurance Manual (QAM), Quality Requirement No. 3.0, requires that measures shall be established to assure that applicable regulatory requirements and design basis are correctly translated into specifications, drawings, procedures, and instructions.

Contrary to the above, at the time of this inspection, the licensee's program was not adequately implemented in that approximately one-third of the total A490 bolts tested by the NRC CAT were found to be below the pretension required by AISC. Installation and inspection requirements had not been translated into appropriate procedures for high strength bolted connections in structural steel and nuclear steam supply system joints which require pretension in the bolts.

CORRECTIVE ACTION TAKEN AND RESULTS ACHIEVED

Structural Steel Connections

There are sixty-five framing connections in the containment which have A490 bolts specified on design drawings. Twenty-nine of these connections are considered to be slip critical because the connection has slotted holes oriented parallel to the direction of the axial load. These twenty-nine slip critical connections require some level of bolt pretensioning in order to transfer axial load. The remaining thirty-six A490 connections have been qualified as bearing type connections, and therefore, bolt torque need not be verified.

The slip critical connections were reinspected to determine the actual in-place torque value for each bolt in the connection. The connections were then evaluated by reducing the capacity of the bolts based on the ratio of as-found torque to the specified torque. These reduced capacities were compared to design loads and the connection design was found to be within specified limits and the connections remain slip resistant. Therefore, although the as-found pretension was below that specified under the applicable AISC provisions to provide the full load carrying capacity of the bolt, it was adequate to meet the design.

Although the actual installed bolt conditions were evaluated and found to be acceptable, the bolts were brought up to specified pretension in order to restore margin.

Nuclear Steam Supply System (NSSS) Joints

An engineering evaluation was performed to assess the adequacy of as-found bolt pretension in the NSSS supports. The engineering evaluation shows that the as-found bolt pretension is adequate to preclude separation of connections under tension, and slip of friction type connections loaded in shear. Therefore, although the as-found pretension is below that specified under the applicable AISC provisions, it is adequate to meet the design.

CORRECTIVE ACTION TAKEN TO AVOID FURTHER VIOLATION

Structual Steel Connections

Although certain installation and inspection requirements were translated into the contractor's procedure, the following enhancement has been made to the procedure.

Blount Brothers Work Procedure Number 21 has been revised to clarify the installation requirements of high strength bolts by the turn-of-nut method. Snug tightening shall progress from the most rigid part of the connection to the free edges, and then bolts of the connection shall be retightened in a similar manner as necessary until all bolts are snugtight and the connection is compacted.

NSSS Joints

Although certain installation and inspection requirements were translated into contractor's procedures, the following enhancements have been made to the procedure for installation of NSSS support bolts requiring pretension.

(1) Hunter Procedure SIP 4.001, "Bolted Connections", has been revised to define snugtight as 15% of the torque required to achieve the final pretension. This definition of snugtight will be used for future work on NSSS support high strength bolting.

(2) Connections which employ shims in the connected parts have been evaluated for their ability to achieve the required bolt pretension when tightened using turn-of-the-nut method. Where turn-of-the-nut method may not achieve the required pretension due to compressibility of shims between the connected parts, the calibrated wrench method has been specified.

DATE WHEN FULL COMPLIANCE WILL BE ACHIEVED

The engineering evaluations of the as-found condition of the structural steel connections and the NSSS joints were completed October 23, 1985.

The accessible bolts in the twenty-nine structural steel connections were retightened by October 14, 1985.

Hunter Procedure SIP 4.001 was revised on October 15, 1985 and approved on January 9, 1986. Blount Brothers Work Procedure No. 21 was revised on November 13, 1985 and approved on January 5, 1986.

VIOLATION 1c

10 CFR 50, Appendix B, Criterion III as implemented by Commonwealth Edison Company (CECo) Quality Assurance Manual (QAM), Quality Requirement No. 3.0, requires that measures shall be established to assure that applicable regulatory requirements and design basis are correctly translated into specifications, drawings, procedures, and instructions.

Contrary to the above, at the time of this inspection, the licensee's program was not adequately implemented in that during the inspection, concrete expansion anchors were found which did not meet the required bolt diameter embedment depth. It could not be shown that embedment length requirements for concrete expansion anchors as specified in the concrete expansion anchor qualification report had been translated into appropriate installation and inspection procedures.

RESPONSE

The Standard Specification for Concrete Expansion Anchor Work, Form BY/BR/CEA, provides the installation and inspection requirements for concrete expansion anchors. Within this document is Figure 38-6, copy attached, which shows the embedded length (L_e) measured from the surface of the concrete to the bottom of the expansion ring. The qualification report for concrete expansion anchors is entitled, "Report on Static, Dynamic and Relaxation Testing of Expansion Anchors in Response to NRC IE Bulletin 79-02", dated July 20, 1981. We extracted two pages from Chapter III of this report, copy attached, which show the embedded length (l_{eb}) measured from the surface of the concrete to the bottom of the expansion ring. This consistently defines the embedded length.

The inspection to verify embedded length is a measurement of the projection of the anchor beyond the concrete in the installed position. Subtracting this measurement from the total anchor length establishes the embedded length. The installed position is defined as being after the anchor has been set by applying an installation torque. As the torque is applied, the anchor slips slightly, pushing the expansion ring outward to produce the wedging force between the ring and concrete. During this setting action, it is assumed that the ring remains stationary as the back of the anchor approaches the expansion ring. The inspection for the embedded length is therefore, consistent with the qualification report.

Based on the foregoing, we believe embedment length requirements were properly translated into appropriate installation and inspection procedures. We are not aware of any concrete expansion anchors found during the CAT inspection that did not meet the required embedment length. We request the NRC to reconsider whether this is an example of violation of 10 CFR 50, Appendix B, Criterion III.

TABLE 38-2

MINIMUM EMBEDDED LENGTH, SPACING AND EDGE DISTANCE
FOR EXPANSION ANCHORS

Nominal Bolt Diameter (inch)	Minimum Embedded Length * (inches) (L_e)	Minimum Spacing (inches) (S)	Minimum Edge Distance (inches)	
			(ED)	(ES)
1/4	5/8	2.5	3.25	1.75
3/8	3	4.5	5	2.5
1/2	4	6	7	3.5
5/8	5	7.5	8.5	4.25
3/4	6	9	10	5
1	8	12	13	6.5

*Minus 1/16" tolerance is allowed.

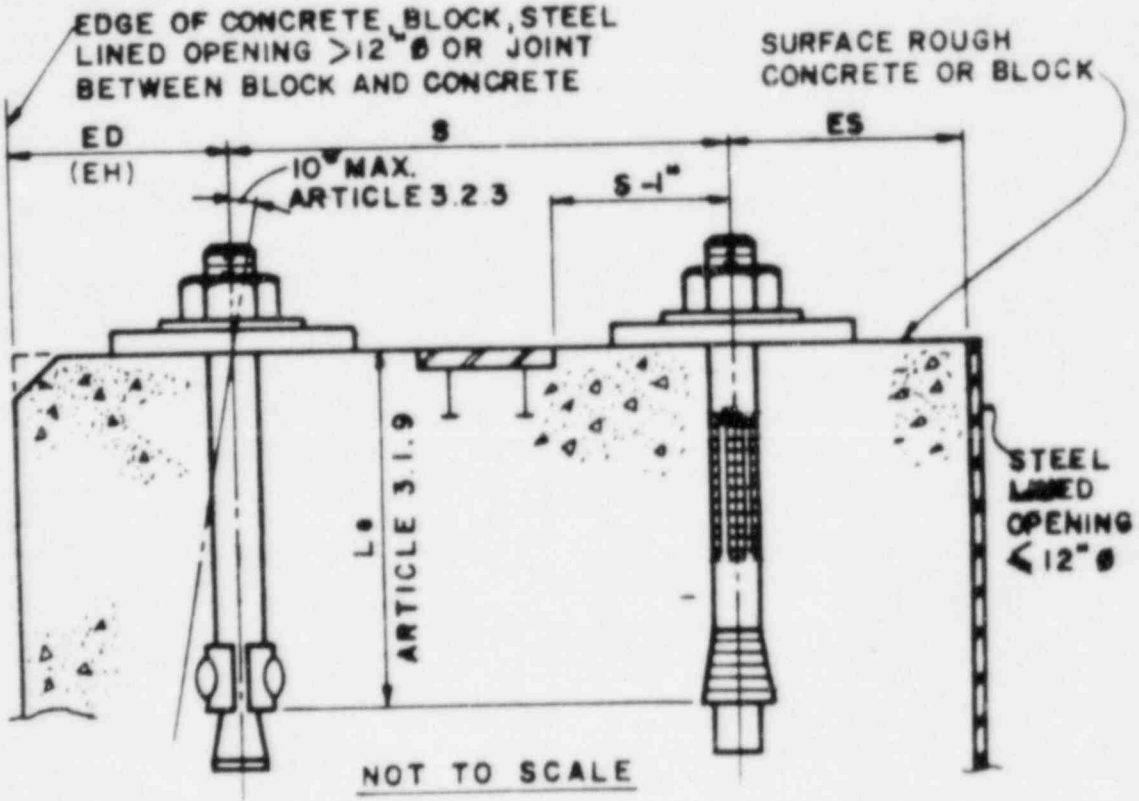


Figure 38-6

ATTACHMENT 2

REPORT ON STATIC, DYNAMIC AND RELAXATION TESTING OF EXPANSION ANCHORS IN RESPONSE TO NRC I.E. BULLETIN 79-02

JULY 20, 1981

CHAPTER III - MATERIALS AND TEST SPECIMENS

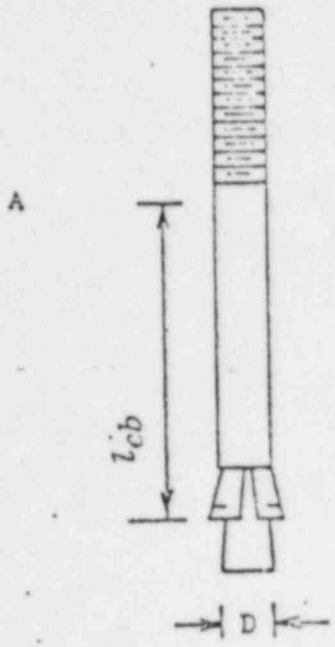
EXPANSION ANCHORS

Description of Generic Types. In this experimental program, four generic types of expansion anchors have been investigated. The generic types are classified into the following catagories: wedge, sleeve, self-drilling and drop-in.

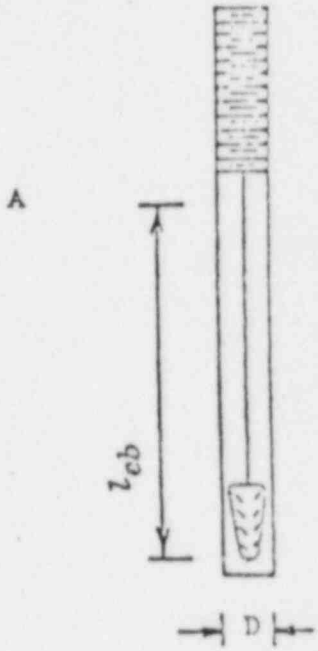
All the generic types listed above achieve load carrying capacity when embedded by having a wedge mechanism located at the bottom of the anchor. The wedge is expanded against the side walls of the embedment hole during the installation procedure. Figure 3.1 shows the four generic types of anchors that were tested and also identifies the manufacturer of the specific type investigated.

For each anchor, the embedment depth has consistently been defined as the distance from the surface of the embedding material to the bottom of the expanding part. Therefore, in the case of the wedge and sleeve type anchors, the distance from the end of the anchor to the surface of the embedding material does not represent the embedment depth. The embedment depth is defined on Fig. 3.1. For the self-drilling and drop-in type expansion anchors, the embedment depth is typically taken as the length of the anchor shell. This assumes that the anchor is flush with the embedding surface.

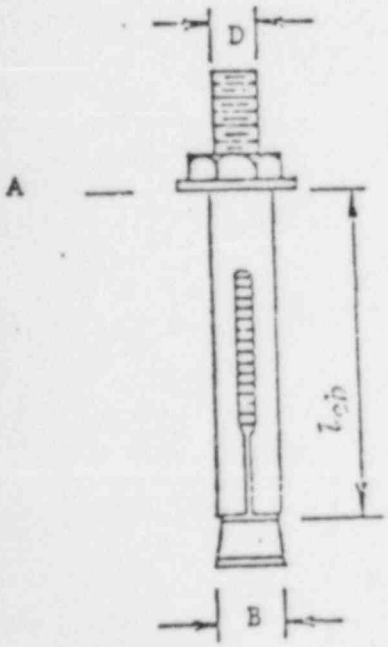
Hilti:Wedge



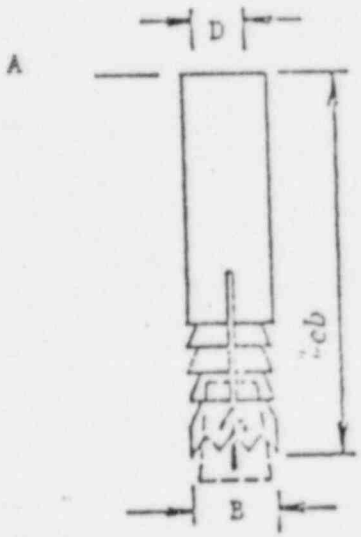
Hilti:Wedge



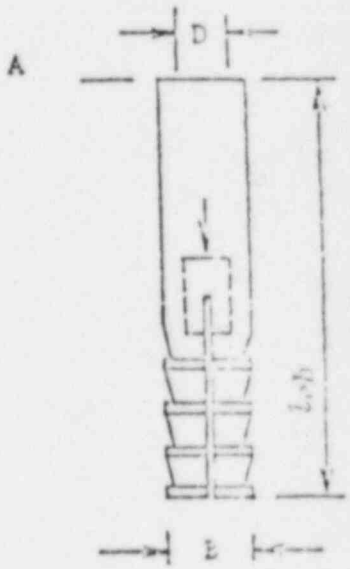
ITT-Phillips:Sleeve



ITT-Phillips:
Self-Drilling



Hilti:TKD
(Drop-In)



D = Bolt diameter
B = Drill bit diameter
A = Surface of embedding material
l_{eb} = Embedment depth

Fig. 3.1 Details of Generic Expansion Anchors

VIOLATION 2

10 CFR 50, Appendix B, Criterion VII, as implemented by CECo QAM, Quality Requirement No. 7.0, requires measures shall be established to assure that purchased material, equipment, and services conform to the procurement documents.

Contrary to the above, at the time of this inspection, the NRC CAT inspectors found several deficiencies in vendor supplied components. The deficiencies included: radiographic film stored by the component supplier in an off-site facility were not retrievable.

CORRECTIVE ACTION TAKEN AND RESULTS ACHIEVED

This violation involves the radiographs for the Unit 2 component cooling surge tank and volume control tank. The component cooling surge tank was fabricated, inspected, tested and shipped from the Westinghouse Orange Plant. Radiography was required and performed in accordance with ASME Section III Class 3 requirements. This product line was transferred to other Westinghouse facilities and Westinghouse considers the radiographic films for this tank to be lost in transit between facilities.

Although the actual radiographs are not available, the original radiograph procedures, shooting sketches, and reader sheets which document the performance and acceptance of the radiography are available. The reader sheets are permanent records which can be copied and do not degrade with time.

With respect to radiographs for the volume control tank, Westinghouse has confirmed that these films are present in their respective storage locations.

Since the radiographs for the component cooling surge tank are not retrievable, the Westinghouse Product Assurance Department conducted an inventory of the radiographs for Byron/Braidwood equipment for which they are responsible. The results of the inventory indicate that all radiographs that are required by Westinghouse quality release are either in the Westinghouse storage facility or in their vendors' storage facilities with the exception of the component cooling surge tank.

CORRECTIVE ACTION TAKEN TO AVOID FURTHER VIOLATION

Commonwealth Edison's Quality Assurance Department has added radiograph retrievability as a quality element in their next scheduled audit of Westinghouse.

DATE WHEN FULL COMPLIANCE WILL BE ACHIEVED

The Westinghouse inventory was completed October 18, 1985.

VIOLATION 2 (Cont'd)

10 CFR 50, Appendix B, Criterion VII, as implemented by CECo QAM, Quality Requirement No. 7.0, requires measures shall be established to assure that purchased material, equipment, and services conform to the procurement documents.

Contrary to the above, at the time of this inspection, the NRC CAT inspectors found several deficiencies in vendor supplied components. The deficiencies included: undersized welds were identified on tanks and heat exchangers.

CORRECTIVE ACTION TAKEN AND RESULTS ACHIEVED

Prior to the CAT inspection, undersized welds were identified by Commonwealth Edison on ten tanks and pressure vessels as a result of a walkdown performed in response to NRC Information Notice 85-33. Three Commonwealth Edison nonconformance reports (NCR's) were issued to track resolution of these deficiencies. These NCR's were evaluated by the Project Engineering Department and the equipment vendors and the as-found condition of the components was found acceptable.

During the CAT inspection, NRC inspectors identified additional tanks and pressure vessels with undersized welds. Hunter Corp. NR 1148 was issued to address these items and is currently under evaluation by Sargent & Lundy.

CORRECTIVE ACTION TAKEN TO AVOID FURTHER VIOLATION

Although the undersized welds which have been identified thus far have been found to not be design significant, approximately 20 other potentially affected tanks and pressure vessels have been inspected and deficiencies which were identified have been included into the scope of NR 1148. The welds in approximately six additional potentially affected tanks are not optimally accessible at this stage of construction. If the results of the engineering evaluation of the other components in NR 1148 indicate that there are no undersized welds of design significance, we do not believe any further inspection effort is warranted.

DATE WHEN FULL COMPLIANCE WILL BE ACHIEVED

The engineering disposition of Hunter Corp. NR 1148 is expected to be complete by June 30, 1986.

VIOLATION 2 (Cont'd)

10 CFR 50, Appendix B, Criterion VII, as implemented by CECo QAM, Quality Requirement No. 7.0, requires measures shall be established to assure that purchased material, equipment, and services conform to the procurement documents.

Contrary to the above, at the time of this inspection, the NRC CAT inspectors found several deficiencies in vendor supplied components. The deficiencies included: various vendor radiographs did not have complete weld coverage or did not show the required weld quality.

This response addresses the eight notes of Table IV-6 discussed on pages IV-21 and IV-22 of the CAT Inspection Report.

Note 1

The film packet for one of the welds which should have contained film for five intervals, contained film for only two intervals. The missing film for the other three intervals was later found and was reviewed with no problems identified.

RESPONSE

The film packet noted was previously transferred to the station vault from the Quality Assurance Department and during the station's indexing and boxing of the film, the film was divided and separated. This separation of documents was corrected during the CAT inspection and the complete set of film was reviewed and found acceptable by the CAT inspector. We believe we have demonstrated the required documents are retrievable and this item should not be considered as an example of violation of 10 CFR 50, Appendix B, Criterion VII.

Note 2

The reader sheets with the film indicated that this film was for Braidwood components. Further investigation of documentation indicated that the items had originally been scheduled for Braidwood but had later been transferred to Byron.

RESPONSE

Procurement specifications for Byron and Braidwood Stations are common documents. Materials and components which are procured under these common specifications are usable at either station. This component was originally planned for installation at Braidwood Station, but was subsequently transferred to Byron and installed. Transferring components from one site to the other is a common, acceptable practice. The transfer of this component from Braidwood to Byron was properly documented by Sargent & Lundy prior to the CAT inspection. A review of the reader sheets and associated film for this component indicated the weld's identification numbers and weld quality were acceptable. Therefore, we do not consider this item to be an example of violation of 10 CFR 50, Appendix B, Criterion VII and request the NRC to reconsider their disposition of this item.

Note 3

Reader sheets for weld WT 8549-64 were not in that packet but were found in film packet for weld WT 2158-64.

RESPONSE

A review of this item indicated that the reader sheet was inadvertently placed in the different packet (box). The radiographs are indexed by Sargent & Lundy transmittal numbers which, generally, list several different welds. Occasionally, it is not physically feasible to store all the radiographs and associated documentation in the same box. Therefore, when the CAT inspector requested a random sample of film associated with certain specifications, one box was provided. To preserve the randomness of the sample, the box selected was not reviewed to determine if the reader sheet was contained within the box prior to being presented to the CAT inspector. If the box would have been screened by plant personnel prior to being presented to the inspector, the misplaced reader sheet would have been included with the box selected. Therefore, we believe this item should not be considered an example of violation of 10 CFR 50, Appendix B, Criterion VII and request the NRC to reconsider their disposition of this item.

Note 4 (1st Paragraph)

Circumferential seam 1A1-6 showed added weld metal on interval A-B dated June 20, 1977, however the added metal does not show in interval M-A dated June 23, 1977. CECo reviewed the film and returned it supposedly in proper order. However, due to two different identifications on the film, it was impossible to tell whether one or two welds were represented by these film. Subsequently, CECo determined that the film actually were from only one weld, and that further repair in the M-A interval accounted for the difference in appearance of the two weld intervals.

RESPONSE

During the radiographic review, it appeared to the CAT inspector that weld metal was added subsequent to the initial acceptance of the weld. However, the proper indexing of the film package by plant personnel clearly demonstrated the sequence of repairs and resolved the inspector's concern. We do not consider this item to be an example of violation of 10 CFR 50, Appendix B, Criterion VII and request the NRC to reconsider their disposition of this item.

Note 4 (2nd Paragraph)

On weld 1A1-1 (Job 2) interval 11-12 a linear indication, possibly a crack, was noted. CECo then did an ultrasonic examination of the area. However, the performed examination was a longitudinal examination and is not acceptable for this type and location of indication. An NCR is being written. This indication is in vessel 1CS01T (Byron 1).

CORRECTIVE ACTION TAKEN AND RESULTS ACHIEVED

This tank is a Unit 1 component and therefore, Action Item Record #6-85-351 was written to track resolution of this issue. The weld was re-radiographed, surface buffed and again re-radiographed. The indication was a surface condition, not a crack, which was removed during the buffing. The aforementioned repair film was subsequently reviewed by NRC Region III Inspector K. D. Ward and found acceptable.

CORRECTIVE ACTION TAKEN TO AVOID FURTHER VIOLATION

We believe the presence or absence of this indication was a matter of judgment by Level III interpreters. As a conservative measure, the weld was re-radiographed and the indication was removed. Based on the large number of radiograph films that were reviewed by the CAT and found acceptable (approximately 1980), we do not believe any further action is warranted.

DATE WHEN FULL COMPLIANCE WILL BE ACHIEVED

The second re-radiograph, which showed the surface condition was removed, was completed on November 5, 1985.

Note 4 (3rd Paragraph)

In vessel H1 tank 2 weld 3A1-1 interval F-G at the end of the seam in the transverse weld, an indication was noted. However, when the film of the transverse weld were located they showed no indication of a problem in the area mentioned.

RESPONSE

The radiographing of the transverse weld was performed subsequent to the seam weld radiograph and no indication was noted in the transverse weld. The indication was considered a surface condition and was removed prior to radiographing the transverse weld. This is an acceptable practice and we do not consider this item to be an example of violation of 10 CFR 50, Appendix B, Criterion VII. Therefore, we request the NRC to reconsider their disposition of this item.

Note 5

When the film was submitted, the reader sheets were so faint that it was impossible to read them. Subsequently, the original sheets in the QA file were produced and the film was read. No problems were noted.

RESPONSE

The onsite copy of the reader sheet for this film was reproduced from a document which was faintly printed. A better copy was made from the original reader sheets used for the initial review and acceptance by Sargent & Lundy. This legible copy was reviewed by the CAT inspector and found acceptable. We do not consider this item to be an example of violation of 10 CFR 50, Appendix B, Criterion VII and therefore request the NRC to reconsider their disposition of this item.

Note 6

A 3/8 inch slag line was noted in the 2-3 interval. After reviewing the receiving and issuing documents, it was determined that the item had never been issued to the job for installation.

CORRECTIVE ACTION TAKEN AND RESULTS ACHIEVED

This component was a Unit 1 pipe hanger (M-1RC120115) which was eliminated from the piping design. Although this hanger was originally accepted for use, elimination of it from the design will prevent it from being installed.

CORRECTIVE ACTION TAKEN TO AVOID FURTHER VIOLATION

This hanger was the only component supplied by ITT Grinnell which required a radiographic exam. Therefore, we do not believe any further action is warranted.

DATE WHEN FULL COMPLIANCE WILL BE ACHIEVED

This component was eliminated from the design on February 15, 1980.

Note 7

Area 3255-A OWX10D had a linear indication on each of the junction welds. Area 3244-A-2V2 OWX07 TV2 had the penetrameter shim into the area of interest.

RESPONSE

These two components are non-safety related tanks. Furthermore, we believe these concerns resulted from a subjective judgment involving interpretation of radiographs. These radiographs were originally reviewed by a Sargent & Lundy Level III interpreter and found acceptable. In response to this concern identified during the CAT inspection, the

radiographs were re-evaluated by Sargent & Lundy's Level III interpreter. With respect to tank OWK10D, the linear indication is considered to be a 1/4" long weld surface contour and is acceptable. The penetrameter shim in tank OWX07 is along the toe of the weld and does not impair the diagnostic capabilities of the radiograph. This is also considered acceptable. Therefore, we do not consider these items to be an example of violation of 10 CFR 50, Appendix B, Criterion VII and request the NRC to reconsider their disposition of these items.

Note 8

4901-9, weld 147 A-B, had an unacceptable slag line at Station A and the belt numbers appear to be inside the area of interest. Six welds did not have full coverage. The welds were identified as: 4901-9, - weld 103 G-H, weld 116 A-B, weld 160 G-H; 4901-10 - welds 147 A-B and 160 G-H; and 4902, weld 75 B-C. Item 4901-1D, weld 103 G-H, also did not have full coverage and there was a linear indication extending into the uncovered area.

RESPONSE

With the aid of additional drawings incorporated into an approved Engineering Change Notice (ECN) that was not available at the time of the CAT inspection, it can be demonstrated that the slag line and belt numbers discussed above are located in the base metal. The slag inclusion was actually a surface blemish caused during the final surface preparation. This additional information was used by Sargent & Lundy during their initial review of the radiographs and was found acceptable. The additional drawings also demonstrate that the radiographs obtained the required coverage of the area of interest. The ECN and radiographs were subsequently reviewed by NRC Region III Inspector K. D. Ward and found acceptable. Therefore, we do not consider these concerns to be an example of violation of 10 CFR 50, Appendix B, Criterion VII and request the NRC to reconsider their disposition of these items.

VIOLATION 2 (Cont'd)

10 CFR 50, Appendix B, Criterion VII, as implemented by CECo QAM, Quality Requirement No. 7.0, requires measures shall be established to assure that purchased material, equipment, and services conform to the procurement documents.

Contrary to the above, at the time of this inspection, the NRC CAT inspectors found several deficiencies in vendor supplied components. The deficiencies included: fasteners for various components (large pump-motor assemblies, battery racks, switchgear, other electrical equipment, and HVAC equipment) were not of the material required by specifications or drawings.

CORRECTIVE ACTION TAKEN AND RESULTS ACHIEVED

Large Pump-Motor Assemblies

Commonwealth Edison non-conformance report (NCR) F-1014 was issued to track resolution of the discrepancies regarding assembly and mounting bolts for large vendor supplied pump-motor assemblies. Sargent & Lundy and Westinghouse have reviewed the NCR and evaluated the installations where the as-found bolting either differed from specifications in design documents or could not be shown to meet the design specifications. Their conclusions are that the as-found bolting meets or exceeds the strength requirements intended by the design specifications, except for the motor-to-base bolts on the non-safety related positive displacement charging pump (2CV02P). Further analysis is necessary to determine the acceptability of the motor end-to-pump base bolts on the RHR pumps (2RH01PA and 2RH01PB) and the motor-to-skid bolts on centrifugal charging pump 2CV01PB.

The motor-to-base bolts on pump 2CV02P will be replaced with bolts which can be shown to meet design specifications. If the analyses of the motor end-to-pump base bolts on pumps 2RH01PA and 2RH01PB and the motor-to-skid bolts on pump 2CV01PB do not yield acceptable results, these bolts will also be replaced.

ASTM A307 Bolts for Electrical and HVAC Equipment

This issue concerns the installation of unmarked bolts in various components whose design requirements call for ASTM A307 bolts. The issue has been categorized into two subgroups: (1) unmarked bolts which were site procured and installed by site contractors; and (2) unmarked bolts provided with vendor supplied equipment. Commonwealth Edison issued NCR's F-1001 and F-1012 to address these subgroups, respectively.

As a result of these NCR's, a sampling plan has been devised to perform a Brinnell hardness test on unmarked bolts in a random selection of equipment in both subgroups. The correlation of Brinnell hardness to tensile strength will be used to establish the acceptance basis for the unmarked bolts.

All samples have been taken and the data has been evaluated by Sargent & Lundy. The unmarked bolts have been found acceptable.

CORRECTIVE ACTION TAKEN TO AVOID FURTHER VIOLATION

Large Pump-Motor Assemblies

In October 1982, the Commonwealth Edison Co. Quality Assurance Manual was revised to require the random inspection of bolting materials in all fabricated assemblies upon receipt of the equipment to assure compliance with design drawings. The equipment included in NCR F-1014 was received prior to 1982.

ASTM A307 Bolts for Electrical and HVAC Equipment

On August 19, 1985, the Byron Project Construction Superintendent issued a letter to the applicable onsite contractors concerning NCR F-1001. This letter directed the contractors to perform a sample inspection during receipt of future shipments of bolts to verify the bolts are marked per ASTM A307 requirements.

The revision to the Quality Assurance Manual discussed above also addresses vendor supplied electrical and HVAC equipment similar to the equipment included in NCR F-1012. The equipment included in NCR F-1012 was received prior to 1982.

DATE WHEN FULL COMPLIANCE WILL BE ACHIEVED

Large Pump-Motor Assemblies

The motor-to-base bolts on pump 2CV02P will be replaced by May 1, 1986. The analysis of the motor end-to-pump base bolts on pumps 2RH01PA and 2RH01PB and the motor-to-skid bolts on pump 2CV01PB will be completed by March 1, 1986.

ASTM A307 Bolts for Electrical and HVAC Equipment

Sargent & Lundy's evaluation of the Brinnell hardness data from the sample plan was completed on January 22, 1986. Aa a result of Sargent & Lundy's evaluation, the aforementioned unmarked bolts were determined to be acceptable. Commonwealth Edison NCR's F-1001 and F1012 were closed on January 24, 1986.

VIOLATION 3a

10 CFR 50, Appendix B, Criterion X, as implemented by CECo QAM, Quality Requirement 10.0, requires that a program for inspection of activities shall be established and executed to verify conformance with documented instructions, procedures, and drawings for accomplishing the activities.

Contrary to the above, at the time of this inspection, the licensee's inspection programs were not effectively implemented in that Unit 2 4160V switchgear and DC fuse panels were found not to be installed in accordance with requirements for seismic mounting of Class 1E equipment.

CORRECTIVE ACTION TAKEN AND RESULTS ACHIEVED

4160V Switchgear

Commonwealth Edison nonconformance report (NCR) F-1005 was issued to document the nonconforming hold down welds on switchgear 2AP05E and 2AP06E.

In addition, two field change requests (FCR's) were written. FCR F-26662 was written to allow revision of the hold down weld design from a four-sided weld to a two-sided weld. FCR F-26659 was written to allow an alternate hold down weld design where inspection was deterred due to the location of the two slots in the rear of the cubicles. These FCR's were evaluated by Sargent & Lundy and approved.

The nonconforming hold down welds were repaired and reinspected.

DC Fuse Panel

Hatfield Electric Co. Discrepancy Report No. 7373 was issued to address the mounting weld configuration for DC fuse panel 2DC11J. The mounting welds were repaired and reworked to meet the weld configuration requirements of the specification. This rework was reinspected and found acceptable.

CORRECTIVE ACTION TAKEN TO AVOID FURTHER VIOLATION

As a result of a stop work order regarding installation of electrical equipment that was issued in December, 1980, the installation and inspection practices in this area were significantly enhanced and became more prescriptive and rigorous. The switchgear and fuse panel discussed in this violation were installed prior to this overall upgrade to the electrical equipment installation process. Therefore, we believe current procedures and practices should be sufficient to prevent recurrence.

DATE WHEN FULL COMPLIANCE WILL BE ACHIEVED

NCR F-1005 concerning the hold down welds on switchgear 2AP05E and 2AP06E was closed on December 14, 1985.

Discrepancy Report No. 7373 concerning the mounting weld configuration for DC fuse panel 2DC11J was closed on September 9, 1985.

VIOLATION 3b

10 CFR 50, Appendix B, Criterion X, as implemented by CECo QAM, Quality Requirement 10.0, requires that a program for inspection of activities shall be established and executed to verify conformance with documented instructions, procedures, and drawings for accomplishing the activities.

Contrary to the above, at the time of this inspection, the licensee's inspection programs were not effectively implemented in that some Class 1E electrical raceways have not been installed in accordance with FSAR commitments for electrical separation.

RESPONSE

Commonwealth Edison commitments with regard to electrical separation are documented in Section 8.3 of the Byron/Braidwood FSAR. These commitments are supplemented with a description of conformance to NRC Regulatory Guide 1.75 which is documented in Appendix A of the FSAR. Byron's commitment to Regulatory Guide 1.75 allows for the use of analysis and/or test to justify separation distances less than those distances specifically stated in Section 8.3 of the FSAR. The use of analysis and/or test to justify electrical separation distances is also permitted in IEEE Standard 384-1974.

Prior to this CAT inspection, a Sargent & Lundy analysis justifying "worst case" separation distances between safety related and non-safety related cables was submitted to NRR for review. The specific configuration which was chosen for a "worst case" analysis was one in which a separation distance was established between a safety-related and a non-safety related cable when one is in free air and the other is in a raceway. The analysis justified that a separation distance of less than one inch is acceptable between the cable and the raceway. This analysis was based on a test performed for Byron Station.

The specific raceways which were identified by the CAT as being in violation of the FSAR commitments involved installations where either non-safety related conduits were installed with less than 12" vertical or 3" horizontal separation from safety related cable tray, or safety related conduits were installed with less than 12" vertical or 3" horizontal separation from non-safety related cable tray.

In order to satisfy the CAT inspector's concern for the type of installations identified, the CAT was presented with Sargent & Lundy Calculation 4391/Q-15, "Justification of Electrical Separation Distance Between Safety Related and Non-Safety Related Raceways". This calculation is based on the same test report which was submitted to NRR for review and justifies that separation of less than 12" vertical or 3" horizontal, but greater than one inch, is acceptable between a safety related conduit and non-safety related cable tray or between a non-safety related conduit and a safety related cable tray.

Since Sargent & Lundy Calculation 4391/Q-15, as well as the calculation previously submitted to NRR, justifies separation of greater than one inch between safety related and non-safety related cable tray and conduit, the only specific electrical separation inspection requirement which is required to be in the electrical contractor's inspection procedures is the requirement to verify that one inch separation is maintained. Hatfield Electric Co. Quality Control Procedure 9B has a requirement that specifies one inch separation between cable tray and conduit installations.

Based on the information provided above, we believe this item would be more appropriately classified as an Unresolved Item pending the outcome of NRR's review of the Sargent & Lundy analysis.

VIOLATION 3c

10 CFR 50, Appendix B, Criterion X, as implemented by CECo QAM, Quality Requirement 10.0, requires that a program for inspection of activities shall be established and executed to verify conformance with documented instructions, procedures, and drawings for accomplishing the activities.

Contrary to the above, at the time of this inspection, the licensee's inspection programs were not effectively implemented in that some Class 1E motor operated valve terminations were not accomplished in accordance with design documents in that wiring configurations did not match those specified on approved wiring diagrams.

CORRECTIVE ACTION TAKEN AND RESULTS ACHIEVED

As a result of the examples of wiring discrepancies identified during the CAT inspection, the electrical installation contractor initiated nonconformance report (NCR) 1697 to address this concern. Twelve valves were reinspected under this NCR. The as-wired condition in each valve was examined and it was determined that the valves would perform their design function. This is because each valve was properly wired in accordance with the control schematic diagram which is the governing design document. We acknowledge that in four valves, the wiring was not in accordance with the wiring diagram for the valve. Since a wiring diagram is also a design document and is used for QC inspection purposes, the affected wiring diagrams were revised to reflect the as-wired condition of the four valves.

CORRECTIVE ACTION TAKEN TO AVOID FURTHER VIOLATION

Training sessions will be conducted for onsite electrical contractor inspection personnel to re-emphasize the procedural requirements for documenting the installation of field changes that affect design documents issued for construction. In addition, training sessions will also be conducted for appropriate onsite Commonwealth Edison personnel to re-emphasize the established guidelines and methods for installing and documenting field changes that affect wiring diagrams issued for construction.

DATE WHEN FULL COMPLIANCE WILL BE ACHIEVED

Revisions to the affected wiring diagrams were initiated on October 21, 1985. The training sessions discussed above are expected to be completed by February 21, 1986.

ATTACHMENT B

CONSTRUCTION PROGRAM WEAKNESS 1

For two samples of radiographs for ASME components supplied by Westinghouse (W) and stored in (W) facilities which were requested by the NRC CAT for review, none were provided. This is indicative of a lack of retrievability for ASME Code required documentation and raises questions whether code documentation is available for the (W) supplied equipment. In addition, the NRC CAT review of audits by CECo and (W) indicated that audits had not addressed the area of retrievability of radiographs.

RESPONSE

In response to this concern, the Commonwealth Edison Manager of Projects and the Westinghouse Manager of Commonwealth Edison Projects became involved. The Westinghouse Product Assurance Department was directed to conduct an inventory of radiographs for all Byron and Braidwood equipment for which Westinghouse is responsible. The results of the inventory indicated that all radiographs that are required by Westinghouse quality release are either in the Westinghouse storage facility or in their vendors' storage facilities with the exception of the component cooling surge tank. Westinghouse considers these radiographs to be lost, however other documents related to these radiographs are available which support the acceptance of the radiography on this tank.

In addition, the Commonwealth Edison Quality Assurance Department has been directed to add radiograph retrievability as a quality element in their next scheduled audit of Westinghouse. They will check Westinghouse's audit activity in this area as well as their ability to retrieve radiographs.

We believe the appropriate level of management attention has been given to this issue and the actions taken address not only the Byron Project, but also the Braidwood Project.

CONSTRUCTION PROGRAM WEAKNESS 2

A significant number of A490 bolts used in structural steel connections and equipment hold-down applications were found by the NRC CAT to have less than specified torque values. Some of these connections are designed to rely on bolt induced clamping forces to carry a portion of the expected loads.

RESPONSE

As this issue was identified during the course of the CAT inspection, an engineering evaluation of the problem was performed. The evaluation considered the as-found condition of the affected bolted connections in Unit 2 structural steel and NSSS supports. The results of this evaluation indicated that the bolted connections found with torque values below the inspection torque had no design significance.

Since Byron Unit 1 was operating at the time of this inspection, this concern was further evaluated to determine any potential effect on Unit 1 operation. This was accomplished by applying the as-found torque values of the bolts in the affected Unit 2 connections to the corresponding bolted connection in Unit 1. From this evaluation, it was concluded that there should not be any hardware deficiencies of design significance in Unit 1.

In order to further support this conclusion, a commitment was made to reinspect the corresponding bolted connections on Unit 1 during the next scheduled outage. This was accomplished during the October - December, 1985 outage.

The as-found torque values in the corresponding Unit 1 structural steel bolted connections were similar to those found in Unit 2. The detailed engineering evaluation of these Unit 1 connections likewise concluded there was no design significance in the as-found condition. However, the bolts found to have torque values less than the inspection value were retensioned to restore margin.

The as-found torque values in the corresponding Unit 1 NSSS support steel connections were similar to those found in Unit 2, except some of the Unit 1 bolts exhibited lower as-found torque values than the corresponding connections in Unit 2. Therefore, all Unit 1 connections of this type were reinspected. A detailed engineering evaluation of the as-found condition of all these connections concluded there was no design significance. Nevertheless, all the bolts found to have torque values less than the inspection value were retensioned to restore margin.

Based on the discussion above for Unit 1 and the response to Violation 1b concerning Unit 2, we believe the appropriate level of management attention has been applied to this issue to assure that completed installations meet design requirements for bolted connections in structural steel and NSSS supports.

CONSTRUCTION PROGRAM WEAKNESS 3

Examples were found in which the electric wiring for motor operated valves were not in accordance with approved design drawings. This is of further concern in that the method used for QC to accept these installations was through the use of a "speed memo" (which is an uncontrolled document that does not receive the appropriate design review and approvals). Also in the electrical area, the foundation mounting welds of several pieces of Class 1E 4160V switchgear and 125V DC fuse panels were not in accordance with design requirements.

RESPONSE

Wiring for Motor Operated Valves

A number of motor operated valves identified by CAT inspectors contained wiring which was not terminated at the termination points identified on some design drawings. The as-found wiring terminations resulted in electrical circuitry which was functionally acceptable when compared to the control schematic diagram. However, the specific details of some termination points were not per the wiring diagram. These minor discrepancies were corrected by revising the wiring diagrams to reflect the as-wired condition.

During the CAT inspection, an evaluation of the as-found Unit 2 wiring discrepancies on the corresponding Unit 1 valves resulted in the same conclusion. The valves would perform their design function. During the October - December, 1985 Unit 1 outage, the affected valves in Unit 1 were reinspected to confirm this. It was determined that all the valves' wiring was terminated per the wiring diagram, as well as per the control schematic diagram.

The "speed memo" discussed above only provides wiring details which supplement design details shown on wiring diagrams. This memo does not provide any instructions or details which would result in a valve being wired such that it would not conform to approved wiring diagrams. Consequently, there is no requirement to control this memo as a design document.

Based on the preceeding discussion, we have concluded that the completed installations of motor operated valves meet design requirements and no further management attention is warranted.

Mounting of Electrical Panels and Switchgear

As identified in the CAT Inspection Report, deficiencies were observed by NRC inspectors in hold down welds associated with certain switchgear units and a fuse panel. The report further stated that similar deficiencies were previously identified by the licensee on Unit 1 equipment. These similar Unit 1 deficiencies had been identified as a result of the Quality Control Inspector Reinspection Program which was a corrective

Mounting of Electrical Panels and Switchgear (Cont'd)

action program executed as a result of NRC Violation 50-454/82-05-19. That program was executed to verify that inspections performed by Quality Control Inspectors prior to September, 1982 were valid inspections. The discrepancies found upon reinspection were evaluated and found to have no design significance. It was concluded that no further expansion of the reinspection effort was necessary. Further to this activity, as a result of the corrective actions taken in response to NRC Violation 50-454/80-25, the electrical installation procedures were revised in the 1981 time frame to be more prescriptive and detailed. As a result of the foregoing, we judge that no additional management action is warranted with regard to electrical equipment mounting and that completed installations in this area meet design requirements.

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

December 12, 1985

Docket No. 50-454
Docket No. 50-455

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

Gentlemen:

This refers to the Construction Appraisal Team (CAT) inspection (Report No. 50-455/85027) conducted by the Office of Inspection and Enforcement on August 19-29 and September 9-20, 1985, of activities at Byron Nuclear Power Station, Unit 2, authorized by NRC Construction Permit No. CPPR 131. Inspection Report No. 50-455/85027 was issued November 13, 1985.

During this inspection, certain of your activities appeared to be in violation of NRC requirements, as specified in the enclosed Notice. A written response is required.

The CAT report identified three construction program weaknesses that require increased management attention in the Executive Summary of Report No. 50-455/85027 under Overall Conclusions. Please address each of these concerns in your response.

In accordance with 10 CFR 2.790 of the Commission's regulations, a copy of this letter, the enclosure, and your response to this letter will be placed in the NRC Public Document Room.

The responses directed by this letter and the accompanying Notice are not subject to the clearance procedures of the Office of Management and Budget as required by the Paperwork Reduction Act of 1980, PL 96-511.

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

Sincerely,

Charles E. Norelius

Charles E. Norelius, Director
Division of Reactor Projects

Enclosure: Notice of Violation

See Attached Distribution

Distribution

cc w/enclosure:
D. L. Farrar, Director
of Nuclear Licensing
V. I. Schlosser, Project Manager
Gunner Sorensen, Site Project
Superintendent
R. E. Querio, Plant Manager
DCS/RSB (RIDS)
Licensing Fee Management Branch
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L. Olshan, NRR LPM
H. S. Taylor, Quality Assurance
Division

NOTICE OF VIOLATION

Commonwealth Edison Company
P.O. Box 767
Chicago, IL 60690

Docket No. 50-455
Construction Permit No. CPPR-131

As a result of the inspection conducted on August 19-30 and September 9-20, 1985, and in accordance with the General Policy and Procedures for NRC Enforcement Actions, (10 CFR Part 2, Appendix C), the following violations were identified (Section references are to the detailed portion of Inspection Report 50-455/85027):

1. 10 CFR 50, Appendix B, Criterion III as implemented by Commonwealth Edison Company (CECo) Quality Assurance Manual (QAM), Quality Requirement No. 3.0, requires that measures shall be established to assure that applicable regulatory requirements and design basis are correctly translated into specifications, drawings, procedures, and instructions.

   Contrary to the above, at the time of this inspection, the licensee's program was not adequately implemented in that:

   a. Splicing of Class 1E wiring in panels has occurred at Byron Station contrary to the FSAR commitments to IEEE Standard 420, which prohibits the use of wiring splices in panels. FSAR commitments had not been translated into appropriate procedures and design documents. (Section II.B.2.b.(6))

   b. Approximately one-third of the total of A490 bolts tested by the NRC CAT were found to be below the pretension required by AISC. Installation and inspection requirements had not been translated into appropriate procedures for high strength bolted connections in structural steel and nuclear steam supply system joints which require pretension in the bolts. (Section V.B.1.b)

   c. During the inspection, concrete expansion anchors were found which did not meet the required bolt diameter embedment depth. It could not be shown that embedment length requirements for concrete expansion anchors as specified in the concrete expansion anchor qualification report had been translated into appropriate installation and inspection procedures. (Section V.B.2.b)

   This is a Severity Level IV violation (Supplement II). (455/85027-01)

2. 10 CFR 50, Appendix B, Criterion VII, as implemented by CECo QAM, Quality Requirements No. 7.0, requires measures shall be established to assure that purchased material, equipment, and services conform to the procurement documents.

Contrary to the above, at the time of this inspection, the NRC CAT inspectors found several deficiencies in vendor supplied components. The deficiencies included: radiographic film stored by the component supplier in an off-site facility were not retrievable; undersized welds were identified on tanks and heat exchangers; various vendor radiographs did not have complete weld coverage or did not show the required weld quality; and fasteners for various components (large pump-motor assemblies, battery racks, switchgear, other electrical equipment, and HVAC equipment) were not of the material required by specifications or drawings. (Sections IV.B.11 and VI.B.1.b(2))

This is a Severity Level IV violation (Supplement II). (455/85027-02)

3. 10 CFR 50, Appendix B, Criterion X, as implemented by CECo QAM, Quality Requirement 10.0, requires that a program for inspection of activities shall be established and executed to verify conformance with documented instructions, procedures, and drawings for accomplishing the activities.

Contrary to the above, at the time of this inspection, the licensee's inspection programs were not effectively implemented in that:

a. Unit 2 4160V switchgear and DC fuse panels were found not to be installed in accordance with requirements for seismic mounting of Class 1E equipment. (Section II.B.3.b(4) and (6))

b. Some Class 1E electrical raceways have not been installed in accordance with FSAR commitments for electrical separation. (Section II.B.1.b.(1))

c. Some Class 1E motor operated valve terminations were not accomplished in accordance with design documents in that wiring configurations did not match those specified on approved wiring diagrams. (Section II.B.3.b(8))

This is a Severity Level IV violation (Supplement II). (455/85027-03)

Pursuant to the provisions of 10 CFR 2.201, you are required to submit to this office within thirty days of the date of this Notice a written statement or explanation in reply, including for each violation: (1) corrective action taken and the results achieved; (2) corrective action to be taken to avoid further violations; and (3) the date when full compliance will be achieved. Consideration may be given to extending your response time for good cause shown.

December 12, 1985
Dated

Charles E. Norelius
Charles E. Norelius, Director
Division of Reactor Projects

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

November 13, 1985

Docket No. 50-455

Commonwealth Edisor Company
ATTN: Mr. Cordell Reed
Vice President
P. O. Box 767
Chicago, IL 60690

Gentlemen:

SUBJECT: CONSTRUCTION APPRAISAL TEAM INSPECTION 50-455/85-27

Enclosed is the report of the Construction Appraisal Team (CAT) inspection conducted by the Office of Inspection and Enforcement (IE) on August 19-30 and September 9-20, 1985 at the Byron Unit 2 Station. The Construction Appraisal Team was composed of members of IE, Region III, and a number of consultants. The inspection covered construction activities authorized by NRC Construction Permit CPPR-131.

This inspection is the thirteenth in a series of construction appraisal inspections conducted by the Office of Inspection and Enforcement. The results of these inspections are being used to evaluate the management control of construction activities and the quality of construction at nuclear plants.

The enclosed report identifies the areas examined during the inspection. Within these areas, the effort consisted primarily of detailed inspection of selected hardware subsequent to quality control inspections, a review of selected portions of your Quality Assurance Program, examination of procedures and records, and observation of work activities.

Appendix A to this letter is an Executive Summary of the results of this inspection and of conclusions reached by this office. The NRC CAT noted no pervasive breakdown in meeting construction requirements in the samples of installed hardware inspected by the team or in the licensee's project construction controls for managing the Byron Unit 2 Station.

Deficiencies noted by the NRC CAT indicate that a number of construction program weaknesses exist which warrant additional management attention. The more significant areas of concern to the NRC CAT are: (1) the inability of Westinghouse to retrieve radiographic film for certain ASME components for which they had procurement responsibility, (2) a significant number of high strength structural steel and equipment bolted connections were found not to have specified torque values, and (3) the inadequate mounting of electrical panels and switchgear, and the wiring of motor operated valves not in accordance with approved design drawings.

We understand that an evaluation of the findings of this inspection has been made to determine the effect on Byron Unit 1 operations.

Appendix B to this letter contains a list of potential enforcement actions based on the NRC CAT inspection observations. These are being reviewed by the Office of Inspection and Enforcement and the NRC Region III Office for appropriate action. In addition, Region III will be following your corrective action for deficiencies identified during this inspection.

In accordance with 10 CFR 2.790(a), a copy of this letter and the enclosures will be placed in the NRC Public Document Room. No reply to this letter is required at this time. You will be required to respond to these findings after a decision is made regarding appropriate enforcement action.

Should you have any questions concerning this inspection, please contact us or the Region III Office.

Sincerely,

James M. Taylor, Director
Office of Inspection and Enforcement

Enclosures:
1. Appendix A, Executive Summary
2. Appendix B, Potential Enforcement Actions
3. Inspection Report

cc w/enclosures: See next page

cc w/enclosures:
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APPENDIX A

EXECUTIVE SUMMARY

An announced NRC Construction Appraisal Team (CAT) inspection was conducted at Commonwealth Edison Company's (CECo) Byron Unit 2 Station, during the period August 19-30 and September 9-20, 1985.

OVERALL CONCLUSIONS

Hardware and documentation for construction activities were generally in accordance with requirements and licensee commitments. However, the NRC CAT did identify a number of construction program weaknesses, which in most cases, have resulted in hardware deficiencies that require additional management attention. These include:

1. For two samples of radiographs for ASME components supplied by Westinghouse (W) and stored in (W) facilities which were requested by the NRC CAT for review, none were provided. This is indicative of a lack of retrievability for ASME Code required documentation and raises questions whether code documentation is available for the (W) supplied equipment. In addition, the NRC CAT review of audits by CECo and (W) indicated that audits had not addressed the area of retrievability of radiographs.

2. A significant number of A490 bolts used in structural steel connections and equipment hold-down applications were found by the NRC CAT to have less than specified torque values. Some of these connections are designed to rely on bolt induced clamping forces to carry a portion of the expected loads.

3. Examples were found in which the electric wiring for motor operated valves were not in accordance with approved design drawings. This is of further concern in that the method used for QC to accept these installations was through the use of a "speed memo" (which is an uncontrolled document that does not receive the appropriate design review and approvals). Also in the electrical area, the foundation mounting welds of several pieces of Class 1E 4160V switchgear and 125V DC fuse panels were not in accordance with design requirements.

The identified weaknesses require additional management attention to assure that completed installations meet design requirements.

AREAS INSPECTED AND RESULTS

Electrical and Instrumentation Construction

The electrical and instrumentation samples inspected generally met the applicable design requirements and installation specifications. However, several discrepancies were identified including some which will require additional management attention.

Wiring workmanship deficiencies were observed in several Class 1E components. Deficiencies included items such as, conductor bend radius, lug orientation and general configuration of wiring. The most significant concern involved deficiencies identified in QC accepted wiring for Class 1E valve operators. In this area over 50% of the sample exhibited wiring configurations which were not in accordance with approved wiring diagrams.

Some electrical raceway installations were identified in which the FSAR criteria for physical separation had not been met. Many of the deficiencies involved the spatial relationship between Class 1E and non-Class 1E components. The principal cause was the failure to translate FSAR requirements into appropriate inspection procedures.

The inspection of several pieces of Unit 2 4160V switchgear and 125V DC fuse panels indicates that hold-down welds do not meet requirements. The weld deficiencies on the switchgear were identical to ones which had been found by the licensee on switchgear of Unit 1, but had not been addressed on Unit 2 components.

Mechanical Construction

Piping, pipe supports/restraints, concrete expansion anchors, and mechanical equipment were found to be in general conformance to design and installation requirements.

The finding of undersize welds in structural support members and a relatively large number of minor discrepancies in the heating, ventilating, and air conditioning (HVAC) ducts and supports indicates that additional program review and attention is needed. These areas were previously subjected to reinspection without complete resolution of these discrepancies.

Welding and Nondestructive Examination

Welding and nondestructive examination activities were generally found to be conducted in accordance with the governing codes and specifications. However, a number of examples were identified where completed structural welds in pipe whip restraints, structural steel and HVAC areas were smaller than specified in the design drawings. The licensee has performed an engineering evaluation concerning these findings and concluded that the welds are structurally adequate for the intended application.

In the area of vendor supplied tanks and heat exchangers, some were found to have undersized weld reinforcement in nozzle to shell and manway to shell joints.

The NRC CAT inspectors also found radiographs for vendor supplied hardware that did not have adequate coverage and/or had unacceptable weld quality. In addition, film requested from the Westinghouse storage facility for review by the NRC CAT were not provided.

Civil and Structural Construction

In the structural steel installation area no major hardware deficiencies were identified. However, several minor design drawing deficiencies were identified and a significant number of high strength bolted connections for structural

steel and equipment supports did not meet inspection torque values. As a result, connection clamping force requirements were not met.

Reinforced concrete construction in general was adequate. Inconsistencies with embedment length requirements of concrete expansion anchors exist between the concrete expansion anchor qualification report and field inspection procedures. Data was not provided to determine whether sufficient preload exists in expansion anchors for those cases in which washers were not welded to support baseplates for oversized holes.

Masonry construction and prestressed, post-tensioned tendon installations were generally acceptable.

Material Traceability and Control

In general the material traceability and control program was considered to be satisfactory. Significant lack of traceability was found however, for fastener materials, including assembly and mounting bolts for large vendor supplied pumps/motors, bolts for battery racks, electrical switchgear and other equipment; and bolts attaching HVAC duct sections.

Design Change Control

Design change control was determined to be generally in conformance with applicable requirements. In this area the most significant finding was the failure to verify that installations were in accordance to current drawings when out of date design drawings were identified.

Corrective Action Systems

The licensee's corrective action program was found to be generally acceptable, except for concerns regarding failure to assure that fasteners of required materials were furnished with certain vendor supplied equipment, audits failed to assure that radiographs for welds on certain vendor supplied equipment were retrievable as required, and failure to provide for effective specification and control of preventive maintenance, particularly from the time of turnover for testing until turnover for operation.

APPENDIX B

POTENTIAL ENFORCEMENT ACTIONS

As a result of the NRC CAT inspection of August 19-30 and September 9-20, 1985, at Byron Unit 2 Station, the following items are being referred to Region III as Potential Enforcement Actions. Section references are to the detailed portion of the inspection report.

1. 10 CFR 50, Appendix B, Criterion III as implemented by Commonwealth Edison Company (CECo) Quality Assurance Manual (QAM), Quality Requirement No. 3.0, requires that measures shall be established to assure that applicable regulatory requirements and design basis are correctly translated into specifications, drawings, procedures and instructions.

   Contrary to the above, at the time of this inspection, the licensee's program was not adequately implemented in that:

   a. Splicing of Class 1E wiring in panels has occurred at Byron Station contrary to the FSAR commitments to IEEE Standard 420, which prohibits the use of wiring splices in panels. FSAR commitments had not been translated into appropriate procedures and design documents. (Section II.B.2.b.(6))

   b. Approximately one-third of the total of A490 bolts tested by the NRC CAT were found to be below the pretension required by AISC. Installation and inspection requirements had not been translated into appropriate procedures for high strength bolted connections in structural steel and nuclear steam supply system joints which require pretension in the bolts. (Section V.B.1.b)

   c. During the inspection, concrete expansion anchors were found which did not meet the eight bolt diameter embedment depth. It could not be shown that embedment length requirements for concrete expansion anchors as specified in the concrete expansion anchor qualification report had been translated into appropriate installation and inspection procedures. (Section V.B.2.b)

2. 10 CFR 50, Appendix B, Criterion VII, as implemented by CECo QAM, Quality Requirement No. 7.0, requires measures be established to assure that purchased equipment and services conform to the procurement documents.

   Contrary to the above, at the time of this inspection, the NRC CAT inspectors found several deficiencies in vendor supplied components. The deficiencies included: radiographic film stored by the component supplier in an off-site facility were not retrievable; undersized welds were identified on tanks and heat exchangers; various vendor radiographs did not have complete weld coverage or did not show the required weld quality; and fasteners for various components (large pump-motor assemblies, battery racks, switchgear cabinets, other electrical equipment, and HVAC equipment) were not of the material required by specifications or drawings. (Sections IV.B.11 and VI.B.1.b.(2))

3. 10 CFR 50, Appendix B, Criterion X, as implemented by CECO QAM, Quality Requirement 10.0, requires that a program for inspection of activities be established and executed to verify conformance with documented instructions, procedures, and drawings for accomplishing the activities.

   Contrary to the above, at the time of this inspection, the licensee's inspection programs were not effectively implemented in that:

   a. Unit 2 4160V switchgear and DC fuse panels were found not to be installed in accordance with requirements for seismic mounting of Class 1E equipment. (Section II.B.3.b.(4) and (6))

   b. Some Class 1E electrical raceways have not been installed in accordance with FSAR commitments for electrical separation. (Section II.B.1.b.(1))

   c. Some Class 1E motor operated valve terminations were not accomplished in accordance with design documents in that wiring configurations did not match those specified on approved wiring diagrams. (Section II.B.3.b.(8))

UNITED STATES NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT

DIVISION OF INSPECTION PROGRAMS
REACTOR CONSTRUCTION PROGRAMS BRANCH

Report No.: 50-455/85-27

Docket No.: 50-455

Licensee: Commonwealth Edison Company

Facility Name: Byron Station, Unit 2

Inspection At: Byron, Illinois

Inspection Conducted: August 19-30 and September 9-20, 1985

Inspectors:

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I. INSPECTION SCOPE AND OBJECTIVES

The objective of this inspection was to evaluate the adequacy of construction at the Byron Unit 2 Station. This objective was accomplished through review of the construction program, evaluation of project construction controls, and review of selected portions of the Quality Assurance Program, with emphasis on the installed hardware in the field. The scope and significance of identified problems were also determined.

Within the areas examined, the inspection consisted of a detailed examination of selected hardware subsequent to quality control inspections, a selective examination of procedures and representative records, and limited observation of in-process work.

For each of the areas inspected, the following was determined:

- Were project construction controls adequate to assure quality construction?
- Was the hardware or product fabricated or installed as designed?
- Were quality verifications performed during the work process with app' cable hold points?
- Was there adequate documentation to determine the acceptability of installed hardware or product?
- Are systems turned over to the startup organization in operable condition and are they being properly maintained?

II. ELECTRICAL AND INSTRUMENTATION CONSTRUCTION

A. Objective

The primary objective of the appraisal of electrical and instrumentation construction was to determine whether Class 1E components and systems were installed in accordance with regulatory requirements, Safety Analysis Report (SAR) commitments and approved vendor and construction specifications and drawings. Additional objectives were to determine whether procedures, instructions and drawings used to accomplish construction activities were adequate and whether quality related records accurately reflect the completed work.

B. Discussion

Within the broad categories of electrical and instrumentation construction, attention was given to several specific areas. These included electrical cable, raceways and raceway supports, electrical equipment, and instrumentation cable and components. Additionally, an examination of components which comprise a selected process system was accomplished.

A number of documents were generated by the licensee to record individual observations of the NRC Construction Appraisal Team (CAT) inspectors, these are referenced directly in the discussions that follow.

1. Electrical Raceway Installation

a. Inspection Scope

Fifty-seven segments of installed Class 1E cable tray representing a total length of about 1,100 feet, were selected from various plant areas for detailed examination by the NRC CAT inspectors. These segments were inspected for compliance to requirements relative to routing, location, separation, support spacing and configuration, identification, protection and physical loading. Additionally, 24 runs of installed conduit, with an aggregate length of about 850 feet, were inspected for compliance to specified requirements such as routing, location, separation, bend radii, support spacing and associated fittings.

Over 25 raceway supports were examined in detail for such items as location, material, anchor spacing, weld quality, bolt torque and installed configuration. Also examined were over 120 concrete expansion anchors.

See Table II-1 for a listing of cable tray, conduit and raceway support samples.

The following documents provided the basic acceptance criteria for the inspection:

- Sargent & Lundy (S&L) Specification F-2790, "Electrical Installation Work Byron Station - Units 1 and 2," Amendment 46.

- Hatfield Electric Company (HECo) Quality Control Procedure 9A, "Class I Cable Pan Hanger Installation," Revision 13.

- HECo Quality Control Procedure 9B, "Class I Cable Pan Installation," Revision 15.

- HECo Quality Control Procedure 20, "Class I Exposed Conduit System Installation," Revision 14.

- S&L "Standard Specification for Concrete Expansion Anchor Work," Revision 6.

b. Inspection Findings

In the area of electrical raceway, the NRC CAT inspectors observed that, in general, Class 1E raceway installations were in accordance with applicable design criteria. Quality attributes such as material type, location, identification and installed configuration were found to be as shown on approved construction drawings. However, several design and/or construction deficiencies were identified and are discussed below.

(1) Raceway Separation

The Byron Station Final Safety Analysis Report (FSAR) Section 8.3.1.4.2 "Physical Separation Criteria" provides the basic criteria for acceptable raceway and cable installations. This FSAR section describes commitments for physical arrangement of raceways pertaining to the requirements of Regulatory Guide (RG) 1.75 for independence of redundant systems.

In general, these FSAR criteria specify the physical separation that must be maintained between components of redundant electrical divisions. Additionally, separation is required between components performing Class 1E and non-Class 1E functions.

The NRC CAT examination of electrical raceways indicates that a number of installations are not in accordance with the FSAR requirements. See Table II-2 for a listing of specific raceway separation deficiencies.

Many of the deficiencies identified involve the spatial relationship between Class 1E and non-Class 1E components, and are the result of a failure to translate relevant FSAR requirements into contractor inspection procedures. The NRC CAT inspectors reviewed HECo Quality Control Procedure 9B, "Class I Cable Pan Installation," and noted that a requirement of only 1 inch separation had been specified between cable tray and conduit installations. This distance is not in accordance with FSAR requirements which specify 12 inches vertical and 3 inches horizontal separation. Consequently, many raceways which exhibit less than the FSAR required physical separation had not been identified by inspection personnel.

As a result of this observation the licensee has indicated that a walkdown will be performed to ensure that deficiencies are identified. Procedure PI-BB-53 will be implemented on a sampling basis to identify conduit to tray separation deficiencies. Additionally, during the inspection Sargent & Lundy prepared the calculation 4391/19Q-15, "Justification of Electrical Separation Distance Between Safety-Related and Non-Safety-Related Raceways." This calculation was prepared to justify separation distances of less than 12 inches vertical and 3 inches horizontal between Class 1E conduits and non-Class 1E cable trays or between Class 1E cable trays and non-Class 1E conduits. This analysis will be presented to NRR for evaluation.

Additional deficiencies were identified between raceway components which exhibited less than 1 inch of physical separation. Several of these raceways contain cables required for Unit 1 operation and as such, were installed in the early stages of Unit 2 construction. A review of more recent construction activities indicate that separation deficiencies had been identified and documented by inspection personnel.

As a result of these observations the licensee issued Conduit Separation Notification Reports CSNF-78 through CSNF-86 to identify and evaluate these conditions.

In summary, the review of construction activities indicates that quality verification programs have not been adequate to assure that FSAR commitments relative to electrical separation have been met. Additionally, recently completed analysis which provides technical justification for existing separation deficiencies will require additional evaluation by the NRC.

(2) Electrical Conduit

With the exception of the specific deficiencies listed below the conduit sample inspected conformed to applicable design and installation requirements relative to such attributes as size, routing, identification and supports. Conformance to separation requirements are discussed in Section II.B.1.b.(1), Raceway Separation, above.

Conduit C2R3452 was found to be missing the required segregation code marker at its entrance to junction box 2JB417R.

Several damaged flexible conduits were observed which terminate at cubicle coolers 2VA035A and 2VA025B. The damage to conduit 2VA035A had been previously identified by the licensee on DR-7261. However, damage to conduit 2VA025B had not been documented. As a result of this observation Rework Request 6970 and 6971 were issued to correct both deficiencies.

Damaged flexible conduit C2R1187 was observed at flow transmitter 2FT-415. The licensee subsequently issued Deficiency Report (DR)-8015 to document this condition.

No other deficiencies were identified in this area.

(3) Raceway Supports

The examination of raceway supports was accomplished for both conduit and cable tray applications. Attributes such as location, material type and size, anchor spacing, welds (location, size and general quality), and installed configuration were found to be in accordance with design requirements.

During the examination of cable tray supports, NRC CAT inspectors identified a loose attachment bolt on a horizontal member of support H060. As a result of this observation CECo has initiated DR-7810 to document and correct this condition.

Cable tray support H011 contained one spring nut which had been improperly installed. The licensee has issued Rework Request 07202 to document and correct this condition.

Concrete expansion anchor deficiencies were identified on several raceway supports. These included items such as missing washers on supports WS-32 and WCA-1 and anchors which failed to exhibit the required torque on support WCA-1 and junction box 2JB126R.

Although several deficiencies were identified in this area, NRC CAT inspectors consider them to be isolated and in general, the installation of raceway supports was in accordance with requirements.

c. Conclusions

Except as noted, raceway systems have been installed in accordance with applicable design and installation requirements. Physical separation criteria detailed in the licensee's FSAR have not been maintained in a number of raceway installations. Many of the deficiencies identified involve the spatial relationship between Class 1E and non-Class 1E components, and are the result of a failure to translate relevant FSAR commitments into contractor inspection procedures.

However, preliminary discussions with NRR and the results of recently completed tests and analysis by the licensee indicate that lesser separation may be acceptable. This matter remains open pending NRC final review and evaluation.

2. Electrical Cable Installation

a. Inspection Scope

The NRC CAT inspectors selected a sample of installed Class 1E cable runs that had been previously accepted by Quality Control (QC) inspectors. The sample included high voltage, power, control and instrumentation cabling. For each of the cable runs, physical inspection was made to ascertain compliance with applicable design criteria relative to size, type, location/routing, bend radii, protection, separation, identification and support.

Additionally, the NRC CAT inspectors selected approximately 300 cable ends for examination. These were inspected to applicable design and installation documents for items such as lug size and type, proper terminal point configuration, correct identification of cable and conductors, proper crimping of lugs or connectors and absence of insulation or jacket damage. See Table II-3 for a listing of cable terminations examined.

The following high voltage and power cable, totaling about 1,500 feet, were selected from different systems, electrical trains and locations:

Cable	Tray
2RH001-P1E	3/C #2 5KV
2RH008-P2E	3/C #2 5KV
2SI001-P1E	3/C #2 5KV
2AP288-P1E	3/C 500 MCM
2RC085-P1E	3/C #6 600V

The following control cables totaling approximately 1,050 feet were selected from different systems, electrical trains and locations:

Cable	Tray
2RH010-C2E	9/C #14 600V
2MS284-C1E	1/C #4 600V
2MS315-C1E	9/C #14 600V
2RC092-C1E	12/C #14 600V
2RH037-C2E	12/C #14 600V
2SI398-C2E	1/C #14 600V

The following instrument cable totaling approximately 1,050 feet were selected from different systems, electrical trains and locations:

Cable	Tray
2RC224-K4R	1 TW PR #16 600V
2RC428-K3R	1 TW PR #16 600V
2RY203-K2R	1 TW PR #16 600V
2RY210-K4R	1 TW PR #16 600V
2RC337-K1R	2 TW PR #16 600V
2RC376-K2R	1 TW PR #16 600V

The following documents provided the basic acceptance criteria for the inspection:

- S&L Specification F-2790, "Electrical Installation Work Byron Station - Units 1 and 2," Amendment 46.
- HECo Quality Control Procedure 11, "Class 1 Cable Termination and Splicing," Revision 21.
- HECo Quality Control Procedure 10, "Class I Cable Installation," Revision 23.

b. Inspection Findings

(1) Routing

In general, the routing of Class 1E cables through design designated raceway systems was found to be in accordance with specified criteria. Each of the Class 1E cables examined by NRC CAT inspectors had been installed in accordance with the routing detailed on the pull ticket.

(2) Separation

In general, separation of Class 1E cables was found to be in accordance with requirements. Several separation deficiencies were observed in cables and vendor wiring installed inside of electrical equipment. However, for each of the deficiencies identified the licensee had previously initiated the appropriate documentation to assure that the condition was subsequently evaluated or corrected.

The NRC CAT inspectors reviewed the separation of "Quasi-safety-related" cables. These are described by Sargent & Lundy as Class 1E cables which have been identified with non-Class 1E segregation codes and in some instances have been routed in non-Class 1E raceways. (Classification and use of "Quasi-safety-related" cables is discussed in Section II.B.2.b.(5) of this report).

Based upon discussions with the licensee, Interface Review Reports (IRR) are prepared to assure proper separation of "Quasi-safety-related" cables when they share an equipment enclosure with Class 1E cables. Cable Separation Criteria Violations (CSCV) are prepared for "Quasi-safety-related" cables which share a raceway with Class 1E cables. However,

NRC CAT inspectors noted that non-Class 1E raceway does not receive Quality Control inspection, and as such, electrical separation would not have been verified for the routing of these "Quasi-safety-related" circuits when routed in non-Class 1E conduits.

NRC CAT inspectors concluded that, additional licensee attention is required to assure that these cables maintain the degree of physical separation specified by the FSAR.

See Table II-4 for a listing of "Quasi-safety-related" cables.

Section II.B.2.b.(5) "Cable Identification" of this report details additional concerns regarding "Quasi-safety-related" cables.

(3) Power Cable Spacing and Derating

Byron Station power cable installations have been designed in accordance with Insulated Power Cable Engineers Association (IPCEA) publications P-46-426, 1962 "Power Cable Ampacities - Volume I - Cooper Conductors" and P-54-400, 1972 "Ampacities - Cables in Open Top Cable Trays." Power cables have been derated in accordance with the IPCEA standards such that cables sharing raceways may be in contact.

No deficiencies were identified in this area.

(4) Cable Damage

No specific instances of Class 1E cable damage were identified during the NRC CAT inspection. However, several Class 1E cables were observed whose ends had not been taped or sealed after installation thus exposing conductor ends to the environment and construction activities. While not a procedural requirement, NRC CAT inspectors consider this to be a workmanship weakness in that the potential for cable damage is increased when cable ends remain unsealed.

(5) Cable Identification

The identification of Class 1E cable generally conformed to the applicable requirements and for most of the samples examined was found to be in accordance with applicable design criteria. However, one area of deficiency was identified and is discussed in the following section.

The Byron Station FSAR section 8.3.1.3.4 describes requirements for cable identification as follows "...All power control and instrumentation cables are identified by a unique number of permanent color coded tags... The tags shall be color coded as in Table 8.3.4, allowing positive

identification of safety-related cables." Section 8.3.1.4.3 describes cable segregation codes and specifies that cables will be segregated based on the following categories:

E = Engineered Safety Features
B = Non-Safety-Related
R = Reactor Trip
N = Neutron Monitoring
A = Associated

Section 8.3.1.4.3 states, in part..."Each non-Class 1E cable which has any part of it's length in a Division 11 (21) or 12 (22) tray, connects to a Class 1E power system, shares an enclosure with a Class 1E circuit, or is not physically separated from Class 1E cables by acceptable distance or barriers, is a division associated cable (Category A)."

During the examination of Class 1E cables NRC CAT inspectors identified a number of "B" non-safety-related cables which had been installed in Class 1E raceways. Subsequent discussions with the licensee and Sargent & Lundy personnel disclosed that these were "Quasi-safety-related" cables and were installed in accordance with design requirements. NRC CAT inspectors were not able to determine the function of these cables because they are not defined in the Byron Station FSAR or on approved design documents. However, based upon discussion with Sargent & Lundy personnel "Quasi-safety related" cables are described as cables which are part of a Class 1E circuit, (serving a safety-related function) and have a portion of their routing in the Turbine building. Thus, safety-related cables have been identified as non-safety-related, because they are routed in a Category II structure.

NRC CAT inspectors concluded that this method of identification was not in accordance with the licensee's FSAR commitments which state that non-safety-related cables sharing an enclosure with safety-related cables become and are identified as division associated cable (Category A).

Additional concerns regarding separation of "Quasi-safety-related" cables are discussed in Section II.B.2.b.2 of this report. See Table II-4 for a listing of "Quasi-safety-related" cables.

As a result of this observation the licensee has proposed an amendment to the FSAR which would define the function and handling of these cables.

(6) Terminations

In general, cable termination activities performed by construction personnel conformed to requirements. However, several construction deficiencies were identified and are discussed in the sections which follow.

Termination of internal wires at terminal point TBR-24 of panel 2PA02J are improperly installed, due to spooning of terminal lugs. Subsequent to this observation the licensee has issued DR-7856 to document and correct this condition.

The terminal lug on the "Wht" conductor of cable 2IP023 in panel 2AP02J was observed to be excessively bent at terminal point TPT-2. As a result of this observation the licensee has issued DR-7855 to correct this condition.

Insulation on the "Blk" and "Wht" conductors of cable 2FW876 was found cut to the bare conductor at terminal points TBR-1 and TBR-2 of panel 2PA02J. The licensee has issued DR-7854 to correct this condition.

The "Blk" and "Wht" conductors of cable 2W0203 are landed on terminal points 32-3 and 32-7 instead of terminal points 33-2 and 33-7 as required on the approved design drawing 2-4054G, Revision F. Subsequent to this observation the licensee has issued DR-7857 to document and correct this condition.

Several violations of conductor minimum bend radius requirements were observed. These occurred predominantly in panel wireways, where there was congestion of field installed cable. Bend radius deficiencies were observed in several Class 1E panels but occurred frequently in sections of the Main Control Boards and the Diesel Generator Control panels. As a result of this observation the licensee issued the following Discrepancy Reports 7852, 7853, 7858 and 7860.

NRC CAT inspectors concluded, based upon the quantity and frequency of deficiencies identified that additional licensee attention will be required in this area to assure that Class 1E wiring configurations conform to requirements and general workmanship standards.

During the examination of internal wiring in panel 2PA13J, one wire with a blue outer jacket was observed. This wire was physically bundled with other Class 1E wires within the panel. Further investigation disclosed that this wire is General Electric type SI58101, which is not qualified for Class 1E service. As a result of this observation the licensee initiated the following actions:

- Rework Request 6937 was initiated to replace the subject wire with a qualified length of wire.

- Analysis IRR-2EF088-1 was presented which justifies the bundling of this non-1E wire with the 1E wiring within this panel.

- Correspondence was produced which instructs field forces to use only two types of switchboard wire at the Byron site. These are: Vulkene E-11352-1 (with yellow outer jacket) which may be used for drain wire extentions; and Rockbestos Firewall SIS, which shall be used for all other applications.

During the course of this inspection, NRC CAT inspectors found no additional instances of unqualified switchboard wire, and as such, have determined the above wiring to be an isolated case.

During the examination of Class 1E cable terminations NRC CAT inspectors identified numerous conductors which contained in-line butt splices. The use of in-line butt splices is not consistent with the licensee's FSAR commitment to IEEE 420, which prohibits the use of wiring splices in panels.

As a result of this observation the licensee has proposed an FSAR amendment to resolve this condition.

The NRC CAT inspectors examined the installation and use of Raychem heat shrink in Class 1E terminations. During the inspection several deficiencies were observed and are discussed below.

NRC CAT inspectors reviewed drawing (6E-2-3503) which specifies the use of Raychem heat shrink jacket tubing in Class 1E terminations. The drawing stipulates that use of this material is qualified by the following note:

"To obtain the required qualified version of this tubing the purchase order must state the following:

Raychem type WCSF-U shrinkable sleeve, documentation to include certification of compliance, (Raychem No. ENGC-154) certifying that material has been tested to the requirements of IEEE 323-1974 and IEEE 383-1974 for aging, radiation, and local environment, as indicated on Raychem reports EDR 2001 and EDR 5019."

NRC CAT inspectors observed that Raychem report EDR 5019 had tested type WCSF-N heat shrinkable tubing. However, the WCSF-U tubing specified on drawing (6E-2-3503) had not been tested by this report.

Discussions with the manufacturer (Raychem) indicates that the chemical/physical makeup of both WCSF-N and WCSF-U are identical. However, WCSF-N tubing contains an additional adhesive which is used to meet the requirements of Section 2.4.3 of IEEE 383 for environmental seal during LOCA simulation.

Based upon these discussions and review of the applicable portions of IEEE 383 NRC CAT inspectors concluded that Raychem type WCSF-U tubing was not qualified for LOCA conditions and as such could not meet the requirements specified on the licensee's design drawing.

In connection with this issue NRC CAT inspectors reviewed the Certificate of Compliance provided with WCSF-U type material and observed that the vendor (Raychem) had certified qualification per the instructions of the design drawing mentioned above. Based upon the information and discussions presented above, NRC CAT inspectors concluded that the Certificate of Compliance was in error in that, WCSF-U material does not meet the requirements of section 2.4.3 of IEEE 383.

As a result of this observation the licensee has initiated a design change to correct the wording of the note on drawing 6E-2-3503 and to assure that WCSF-U heat shrinkable sleeve will be used only as an outer jacket on nuclear qualified Class 1E terminations.

Additional deficiencies were observed in activities associated with wiring of Class 1E valve operators. This subject is discussed in detail is Section II.B.3.b.(8) of this report.

c. Conclusions

The identification and routing of some Class 1E cabling ("Quasi-safety-related) is not in accordance with FSAR commitments to Regulatory Guide (RG) 1.75 for "Physical Independence of Redundant Systems."

Increased licensee attention is necessary in the workmanship of cabling and terminations in that some terminal lugs were improperly installed, insulation cut, improper termination points, and minimum bend radius violations. Although each instance was not individually significant, additional attention is warranted.

The use of in-line butt splices on wiring in electrical panels is not in accordance with FSAR commitments.

3. Electrical Equipment Installation

a. Inspection Scope

Approximately 40 pieces of installed or partially installed electrical equipment and associated hardware items were inspected. Samples were selected based on system function and safety classification.

The following specific electrical components were inspected in detail:

(1) Motors

The installation of five motors and associated hardware was inspected for such items as location, anchoring, grounding, identification and protection. The motors inspected were:

Residual Heat Removal Pump Motor	2RH01PA
Residual Heat Removal Pump Motor	2RH01PB
Safety Injection Pump Motor	2SI01PA
Aux Feedwater Pump Motor	2AF01PA
Component Cooling Pump Motor	2CC01PB

(2) Electrical Penetration Assemblies

The location, type, mounting and identification of these penetrations were compared with the installation drawings and vendor manual.

The following containment penetration assemblies were inspected:

2SI02E-2P2E	Misc. Power
2NR01E-2KN	Neutron Monitoring
2SI04E-2C2E	Control
2SI03E-2C1E	Misc. Control
2LV10E-2K2E	ESF Instrumentation

(3) Circuit Breakers

Circuit breakers for the following Class 1E motors were examined to determine compliance with design and installation documents for size, type, system interface and maintenance.

Residual Heat Removal Pump Motor	(Bus 241 Cub. 19)
Safety Injection Pump Motor	(Bus 242 Cub. 19)

The use of circuit breakers with integral undervoltage trip attachments at this facility was also investigated.

(4) Switchgear and Motor Control Centers

The following switchgear and motor control centers were inspected:

Motor Control Center	2AP25E - MCC231X2
Motor Control Center	2AP26E - MCC231X4
Motor Control Center	2AP28E - MCC232X4
4160V Switchgear	2AP05E
4160V Switchgear	2AP06E

(5) Station Batteries and Racks

The 125V battery rooms including the installed batteries, battery racks and associated equipment were inspected. The location, mounting, maintenance and environmental control for

installation of the batteries were compared with the applicable requirements and quality records.

125V DC Battery	2DC01EA, 2DC01EB
125V DC Battery	2DC02EA, 2DC02EB

(6) 125V DC System Equipment

The following equipment comprising portions of the 125V DC systems were inspected for compliance to design documents for such items as location, mounting (welds, concrete anchors and bolting) and proper configuration.

Battery Charger	2DC03E
Battery Charger	2DC04E
DC Distribution Panel	2DC05E
DC Distribution Panel	2DC06E
DC Fuse Panel	2DC11J
NSSS Static Inverter	2IP06E

(7) Control Panels

A number of Class 1E electrical control panels were inspected for compliance to design requirements for items such as location, mounting and type. The panels inspected were:

Main Control Board	2PM06J
Main Control Board	2PM01J
Diesel Generator Control Panel	2PL08J
Aux Relay Cabinet	2PA31J
Aux Relay Cabinet	2PA27J
Remote Shutdown Panel	2PL04J

(8) Motor Operated Valves (MOVs)

Five motor operated valves were examined in detail.

2RH8702-A
2RC8001-B
2SI8808-D
2SI8809-B
2CS019-B

As the result of deficiencies identified in this area additional MOVs were inspected and are discussed in the body of the report.

The following documents provided the basic acceptance criteria for the inspections:

° S&L Specification F-2790, "Electrical Installation Work Byron Station - Units 1 and 2," Amendment 46.

° HECo Quality Control Procedure 12, "Installation of Class 1E Equipment," Revision 8.

- HECo Quality Control Procedure 12A, "Modification of Class 1E Equipment," Revision 10.

- S&L "Standard Specification for Concrete Expansion Anchor Work" Revision 6.

b. Inspection Findings

(1) Motors

In general, the installation of Class 1E motors was found to be in accordance with applicable design documents. Motors examined were of the size, type and configuration specified and construction maintenance activities had been performed in accordance with approved procedures. However, deficiencies in the areas of motor mounting and post-construction maintenance activities were identified.

Reference Section VI "Material Traceability and Control," for a detailed discussion of these deficiencies.

(2) Penetrations

Penetrations examined were found to have been installed in accordance with applicable design documents. Installation requirements including performance of required maintenance activities had been accomplished in accordance with approved construction procedures.

No construction or maintenance deficiencies were observed in this area.

(3) Circuit Breakers

The examination of the Westinghouse type 50DHP350 circuit breakers indicated that they had been purchased, installed and maintained in accordance with the applicable design documents. Important installation attributes such as proper alignment, main contact penetration and safety interlocks were verified by physical inspection and review of construction test records. Maintenance records were also reviewed and indicate that lubrication and set point verification had been performed.

NRC CAT inspectors also evaluated licensee initiated actions and review of NRC Information Notice 83-18 "Failures of the Undervoltage Trip Function of Reactor Trip System Breakers" and NRC Generic Letter 83-28 "Required Actions Based on Generic Implications of Salem ATWS Events." Byron Station Units 1 & 2 will utilize the Westinghouse type DS-416 breakers in the Reactor Trip System. Review of supplemental actions to Generic Letter 83-28 indicates that the licensee will implement Westinghouse proposed corrective actions and will ensure that all DS-416 reactor switchgear undervoltage attachments are replaced with a new design and tested prior to

the fuel load. This work will be controlled by Westinghouse Field Change Notice (FCN) CBEM 10685.

(4) Switchgear and Motor Control Centers

In general, the installation of Class 1E Motor Control Centers was found to be in accordance with applicable requirements. However, examination of the Class 1E 4160V switchgear units indicates that several construction deficiencies exist.

During the examination of switchgear units 2AP05E and 2AP06E NRC CAT inspectors observed that hold down welds do not match the configuration detailed on approved design drawings. Detail 47 on drawing 0-3391C specifies a four sided weld at each of six locations per cubicle. Actual field configurations were found to have welds on only two sides. Additionally, a detailed examination of these welds indicates in some cases insufficient weld metal due to gaps between the embed plate and the equipment sheet metal.

NRC CAT inspectors reviewed the associated QC inspection records for this equipment and observed that these deficiencies had not been identified by inspection personnel.

Similar deficiencies were previously identified by the licensee on Unit 1 equipment. However, they had not been reviewed for impact on relevant Unit 2 equipment.

As a result of this observation the licensee has initiated CECo Nonconformance Report (NCR) 1669 to document and correct this condition.

(5) Station Batteries and Racks

The condition of the battery rooms was found to be in good order, clean and free of debris. Ventilation systems were installed and in operation. Access to these areas was controlled by keyed entry, and the appropriate danger signs had been posted to prohibit smoking or open flames.

The 125V batteries were examined and found to be in good condition. Maintenance activities were reviewed and, in general, had been performed in accordance with requirements. During the review of battery maintenance records, NRC CAT inspectors noted that intercell resistance data had exceeded the acceptance level of 150 micro-ohms between cells 46 and 47 of battery bank 212. The review of associated surveillance records indicates that this deficiency had been properly documented and the condition had been corrected in accordance with the requirements of Deviation Report 06-02-84 and Nuclear Work Request B11357.

The inspection of the 125V battery racks disclosed that indeterminate bolting materials had been used in the assembly process. This issue is discussed in detail in Section VI, "Material Traceability and Control," of this report.

NRC CAT inspectors also identified two anchor bolts which did not have the required embedment length. Sargent & Lundy specification for concrete expansion anchors requires a minimum embedded length (Le) of four inches for a 1/2 inch nominal bolt diameter. Two of the bolts examined exhibited (Le) of only 3 1/2 inches. Discussions with the licensee indicate that original inspection requirements did not include verification of (Le), consequently, these deficiencies had not been identified.

As a result of this observation the licensee initiated a Deficiency Report to document and evaluate this condition. Based upon this evaluation it was determined that the anchors are structurally sound and will perform their intended function in the existing configuration.

No other deficiencies were identified in this area.

(6) 125V DC System

With the exception of the mounting deficiency discussed below, inspection of components which comprise portions of the 125V DC system disclosed no deficiencies relative to the installed configuration of the equipment.

During examination of 125V DC fuse panel 2DC11J NRC CAT inspectors observed that the mounting weld configuration did not match the details shown on approved design drawings. Detail 158 of drawing O-3391K specifies a maximum spacing of 10 1/2 inches between weld edges. Actual field measurements indicate that seven of ten weld to weld dimensions exceed this spacing requirements, some by as much as seven inches.

Discussions with the licensee indicates that these deficiencies may be the result of inadequate contractor interface and inspection responsibility changes.

As a result of this observation the licensee has issued Deficiency Report 7373 to document and correct this condition.

(7) Control Panels

The control panels examined were installed in accordance with applicable design documents. No deficiencies were identified in this area.

(8) Motor Operated Valves

In general motor operated valve termination activities performed by construction personnel conformed to requirements. However, several wiring deficiencies were observed and are discussed below.

The NRC CAT inspectors examined seven motor operated valves and found five which contained wiring not terminated at the correct termination points.

- The internal jumpers from termination points 3C to 17C and internal jumpers on termination points 3L to 13C were installed on MOVs 2RL 8001D, 2RL 8002D and 2RC 8002D. These terminations were in conflict with wiring diagrams 6E-4230B, 6E-4230C and 6E-4230D.

- Motor operated valve 2RC 8002D had termination points 11 (black/white) and 11C (blue/black) reversed on cable 2RC 171 (wiring diagram 6E-4230D).

- Motor operated valve 2CC-9438 had internal jumper termination points 17 and 17C reversed and 18 and 18C reversed (wiring diagram 6E-2-4861, speed memo between Steve Bindernagel and Tom Lamb dated 1-23-84).

NRC CAT inspectors reviewed relevant inspection reports and observed that Hatfield Quality Control inspectors had accepted the installation of these MOVs. During discussions with the NRC CAT, Hatfield inspection personnel indicated that this condition exists on numerous motor operated valves through the Byron site.

Discussions with the assistant supervisor of OAD indicated that the MOV wiring configurations had not been modified since construction turnover to OAD. As a result, NRC CAT inspectors concluded that inspection activities had not been adequate to assure the MOV wiring was in accordance with applicable design documents.

In connection with this issue NRC CAT inspectors determined that inspection ov MOV wiring to terminal points 17, 17C, 18 and 18C could not be accomplished without the aid of a speed memo dated January 23, 1984, from Steve Bindernagel to Tom Lamb. This memo provides wiring details which supplement design details shown on approved wiring diagrams. However, further investigation disclosed that the speed memo was uncontrolled and not incorporated into design documents or procedures.

Consequently, this area and associated inspection activities merit additional attention by the licensee.

(9) Equipment Idenficiation

The Byron Station FSAR section 8.3.1.3 "Physical Identification of Safety-Related Equipment" states, in part..."Color coded nameplates or labels are used to distinguish between Class 1E and non-Class 1E components and between components of different division, as shown in Table 8.3-4." Divisional color coding and identification of Class 1E equipment is required so that plant maintenance and operations personnel may readily identify components which serve Class 1E functions.

During the examination of Class 1E electrical equipment NRC CAT inspectors identified several components which had not been labeled in accordance with FSAR requirements. The Unit 2 Diesel Generator Control panels and certain Class 1E devices mounted on the Unit 2 Fire Hazards panel have been identified with black and white labeling which would indicate a non-Class 1E classification.

As a result of this observation the licensee has issued Design Information Transmittal (DIT) BB-EPED-0051 which proposes to revise FSAR section 8.3.1.3 to read "Nameplates with engraved characters identify each item of safety-related equipment. Each nameplate is either color coded as in Table 8.3-4 or has black characters on a white background."

This item will remain open pending further NRC evaluation.

c. Conclusions

The mounting of several pieces of Class 1E electrical equipment are not in accordance with design requirements. Components such as, the 4160V switchgear divisions 1 & 2 and the 125V DC fuse panel have been installed with hold down weld configurations which do not match the details shown on approved design drawings.

A number of deficiencies were observed in QC accepted wiring for Class 1E valve operators. In this area over 50% of the sample examined exhibited wiring configurations which were not in accordance with approved wiring diagrams. Consequently, this area and associated inspection activities will require additional attention by the licensee.

The identification labeling of several pieces of Class 1E electrical equipment is not in accordance with FSAR requirements.

4. Instrumentation Installation

a. Inspection Scope

The NRC CAT inspectors selected a sample of 13 completed runs of instrument piping, comprising about 940 feet, for a detailed examination in accordance with specification requirements and isometric drawings.

Three instrument racks and 18 piping supports were examined for conformance with requirements including installed configuration, mounting details, material conformance, identification, and location. Additionally, a process system was elected for a detailed inspection of signal path routing and associated equipment.

Thirteen instruments were examined for conformance with requirements for location, mounting details, and instrument type and range. The signal path of three instrument loops were traced from their process connections to their final output devices. Loops examined were Pressurizer Pressure Division I and II and Pressurizer Level Division II. Components inspected for each loop included sensing lines, pressure and level transmitters, signal conditioning and isolating devices, indicating and controlling instruments and the various connecting cable, electrical penetrations, panel wiring and terminal points along the signal path. Most instrument components were examined for such attributes as type, range, output, identification, qualification, location, mounting and physical separation of redundant components.

See Table II-5 for listing of piping runs, supports, racks, and instruments included in the sample.

The following documents provided the acceptance criteria for the inspection:

- S&L Specification F-2739/L2739, "Piping System Installation," Amendment 8.
- Powers-Asco-Pope (PAP) Procedure QC-9, "Quality Verification Procedure," Revision 3.
- PAP Procedure FP-9, "Design Change/Field Routing Control," Revision 10.
- PAP Procedure FP-13, "Hanger Installation and Control," Revision 14.
- PAP Procedure FP-16, "Identification and Marking of Pipe and Components," Revision 12.
- PAP Procedure FP-19, "As-Built Drawings and Documentation," Revision 3.
- Applicable design drawings and change documents.

b. Inspection Findings

No deficiencies were identified by the NRC CAT inspectors in the sample of instruments, racks, piping runs, and supports inspected.

c. Conclusions

The NRC CAT inspectors determined that, based on the above selected sample, instrumentation, piping, and support installations conform to applicable design requirements.

TABLE II-1

RACEWAY INSPECTION SAMPLE

Cable Tray:

21415A-P1E	2416CA-P1E	21424C-P1E	21327C-P1E
21326C-P1E	21334C-P1E	21333C-P1E	21330C-P1E
21329C-P1E	21328C-P1E	2R214-P1E	2R213-P1E
2525L-P1E	2513L-P1E	2761L-P1E	2511L-P1E
2R402-K1E	21891G-K1E	21890G-K1E	21889G-K1E
21884G-K1E	2R223-k1E	2SI02E-P2E	21462N-P2E
21461MN-P2E	21460M-P2E	21458M-P2E	2914M-P2E
2912M-P2E	2910M-P2E	2908M-P2E	2906M-P2E
2905M-P2E	290[illegible]-P2E	2898M-P2E	21536M-P2E
21537M-P2E	21539M-P2E	21540M-P2E	2R257K-C2E
2952K-C2E	2954K-C2E	2955K-C2E	2956K-C2E
2945K-C2E	2946K-C2E	2950K-C2E	2951K-C2E
2926K-C2E	2927K-C2E	2930K-C2E	2931K-C2E
2932K-C2E	2R301-C2E	21369K-C2E	21363K-C2E

Cable Tray Supports:

Support No.	Drawing No.
305H1	3032H (W)
H037	3052H (S)
H022	3053H (L)
H178	3062H (L)
H010	3241H (H)
H012	3254H (S)
H001	3041H (K)

TABLE II-1 (Continued)

RACEWAY INSPECTION SAMPLE

Conduit Supports:

2-3304-CC-32	2-3531A-WS-32
2-3321A-CC-24	2-3532A-WV-13
2-3321A-CC-25D	2-3533A-TS5-1
2-3322A-CC-35	2-3534-CC-13
2-3511-TS2-1	2-3534-CP-3
2-3513A-WCP-6	2-3534A-FC-15
2-3521-CC-15	2-3543-FC-5
2-3521A-CC-60	2-3544A-CC-19
2-3521A-CS-32	2-3544A-FC-9

Conduits:

C2A21A5 (P1E) 78'	C2A21H0 (P2E) 45'
C2A21B2 (P2E) 10'	C2A0401 (P2E) 45'
C2A14B1 (K2R) 37'	C2A2202 (C1E) 16'
C2R2170 (P1E) 30'	C2R2490 (C2E) 23'
2C2R3443 (C2E) 79'	C2R3463 (C1E) 31'
C2R2181 (C1E) 19'	C2R2152 (C1E) 14'
C2R1172 (P2E) 29'	C2R3365 (C2E) 32'
C2R3366 (P2E) 32'	C2R4326 (K1R) 56'
C2R4345 (P2E) 54'	C2R4479 (C1E) 32'
C2R4484 (P1E) 66'	C2R3452 (C1E) 20'
C2R1334 (P1E) 25'	C2R231[illegible] (P2E) 21'
2CR2225 (C2E) 12'	C2R320[illegible] (C2E) 6'

TABLE II-2

SEPARATION FINDINGS

Raceway segments listed in the A colums do not maintain required separation from the corresponding raceway segments in B columns. The (*) indicates physical separation of less than one inch between the two raceway segments.

Column A		Column B	Column A		Column B
2955L-C2E		COA32L3-2C1B	2955L-C2E		COA32L6-2C1B
2970D-C2B		2955L-C2E	COA3328-2K1R		2956L-C2E
2944B-P2E	*	COA3215-1P1B	2944B-P2E	*	COA3215
2924B-P2E	*	COA33C6	2926B-P2E	*	COA33B4
2926B-P2E	*	COA33D2	2922B-P2E	*	COA3317-1C1B
29922B-P2E	*	COA3318-1C1B	2921B-P2E	*	33JJ-1C1B
2921B-P2E	*	COA33JK-1C1B	21363K-C2E	*	C2A-51D3-2C1B
21363K-C2E		C2A-51D2-2K1B	2954K-C2E	*	COA3322-1C1B
2926L-C2E	*	COA33D2	2926L-C2E	*	COA33B4
2944A-P2E	*	COA3307			

TABLE II-3

CABLE TERMINATION INSPECTION SAMPLE

Fire Hazards Panel (2PL10J)

Cables: 2MS668, 2FW920, 2FW921, 2MS666, 2RY431, 2RY433, 2FW918, 2FW919, 2RY430, 2RY432.

Process I & C Rack (2PA01J)

Cables: 2FW705, 2FW704, 2RC350, 2RC355, 2RC360, 2RC365, 2FW874, 2FW875, 2MS104, 2MS108, 2FW304, 2FW038, 2SI653, 2CC288, 2IP007, 2LV079, 2RC342, 2RC336, 2MS096, 2MS666, 2MS100, 2RC345, 2RC339, 2RY433, 2SI467, 2AB030, 1FW919, 1RC353, 1RC538, 2RC363, 2RC368, 2RY432.

Process I & C Rack (2PA02J)

Cables: 2FW707, 2FW706, 2RC372, 2RC391, 2RC396, 2RC401, 2FW876, 2FW877, 2MS116, 2MS668, 2MS122, 2FW043, 2FW048, 2SI654, 2CC290, 2IP023, 2LV080, 2RC383, 2RC377, 2MS113, 2MS119, 2RC386, 2RC380, 2RY202, 2FW921, 2RC375, 2RC394, 2RC399, 2RC404, 2RY204, 2RC406, 2FW026.

E.S.F. Seq. & Act. Cabinet (2PA13J)

Cables: 2EF027, 2EF029, 2EF086, 2EF028, 2EF031, 2EF026, 2SX313, 2EF023, 2EF083, 2EF037, 2EF034, 2EF036, 2EF035, 2EF038, 2EF033, 2EF096, 2EF025.

E.S.F. Seq. & Act. Cabinet (2PA14J)

Cables: 2EF043, 2EF045, 2EF087, 2EF064, 2EF044, 2SX314, 2EF041, 1EF040, 2EF085, 2EF052, 2EF049, 2EF051, 2EF050, 2EF053, 2EF048, 2EF097, 2EF042.

Main Control Board (2PM06J)

Cables: 2MS529, 2DC117, 2MS532, 2MS318, 2FW215, 2FW842, 2FW226, 2EF018, 2MS527, 2DC126, 2MS524, 2FW227, 2MS519, 2MS356, 2MS531, 2SX008, 2SX010, 2SX465, 2SX312, 2SX232, 2SX033, 2SX009, 2MS275, 2MS288, 2FW570, 2FW279, 2FW775, 2AF008, 2AF011, 2AF009, 2AF248, 2AF147, 2AF019, 2SX065, 2WO203, 2CC023, 2CC241, 1CC007, 2CC026, 2CC004, 2CC239, 2CC002, 2CC008, 2CC150, 2SX041, 2CC174, 2WO176, 2WO177, 2AF121, 2PS479, 2CC127, 2AF097, 2SX004, 2CC005, 2CC021, 2CS005, 2VP013, 2VP012, 2VP057, 2VP056, 2AF010, 2CC064, 2VP040, 2CS034, 2EF014, 2SI654.

TABLE II-3 (Continued)

CABLE TERMINATION INSPECTION SAMPLE

Diesel Generator Control Panel 2A (2PL07J)

Cables: 2DG194, 2DG031, 2DG028, 2DG147, 2DG030, 2DG027,
2DG154, 2DG155, 2DG018, 2DG200, 2DG022, 2DG115,
2DG165, 2DG034, 2DG169, 2DG083, 2DO062 2DO064,
2DG074, 2DG167, 2DG023, 2DO003, 2DG024, 2DG216,
2DG204, 2DG020, 2DG126, 2DG120, 2DG219, 2DG218,
2DG113, 2DG085, 2DG084, 2DF114, 2DG026, 2DG029,
2DG011, 2DG010, 2DG009, 2DG012, 2DG013, 2DG014,
2DG162, 2DG112, 2DG086, 2DG161, 1DG033, 2DG032,
2DG025, 2DG073, 2DG071, 2DG070, 2DG173, 2DG082,
2DG168, 2DO058, 2DG117, 2DG111, 2DO002, 2DG094,
2DG119, 2DG118, 2DG206, 2DG207, 2SX294, 2SX290,
2SX295, 2DO005, 2VD004.

Diesel Generator Control Panel 2B (2PL008J)

Cables: 2DG066, 2DG195, 2DG063, 2DG038, 2DG065, 2DG062,
2DG166, 2DG151, 2DG156, 2DG053, 2DG201, 2DG057,
2DG104, 2DG051, 2DG172, 2DG089, 2DO063, 2DO065,
2DG080, 2DG077, 2DG058, 2DO008, 2DG059, 2DG217,
2DG205, 2DG055, 2DG141, 2DG135, 2DG221 2DG220,
2DG102, 2DG091, 2DG090, 2DG103, 2DG061, 2DG064,
2DG043, 2DG044, 2DG045, 2DG046, 2DG047, 2DG048,
2DG101, 1DG164, 2DG092, 2DG163, 2DG068, 2DG067,
2DG060, 2DG079, 2DG170, 2DG076, 2DG176, 2DG088,
2DG171, 2DO059, 2DG109, 2DG100, 2DO007, 2DG096,
2DG134, 2DG133, 2DG208, 2DG209, 2SX300, 2SX296,
2SX301, 2DO010, 2VD010, 2DG040, 2DG334, 2DG042,
2DG106, 2DG150, 2DG052, 2DG054, 2DG041, 2DG050,
2DG225, 2DG177.

TABLE II-4

"QUASI-SAFETY-RELATED" CABLES

Turbine Stop Valves	2EF065	2EF069		
	2EF066	2EF070		
	2EF067	2EF071		
	2EF068	2EF072		
Turbine Pressure Switches	2EF073	2EF076		
	2EF074	2EF077		
	2EF075	2EF078		
Feedwater Regulating and Bypass Regulating Valves	2FW771	2FW269	2FW111	
	2FW777	2FW270	2FW123	
	2FW807	2FW271	2FW116	
	2FW773	2FW272	2FW137	
	2FW779	2FW110	2FW186	
	2FW808	2FW121	2FW145	
	2FW774	2FW115	2FW191	
	2FW780	2FW135	2FW153	
	2FW809	2FW185	2FW775	
	2FW722	2FW143	2FW776	
	2FW728	2FW190		
	2FW810	2FW151		
Turbine Impulse Pressure	2MS095			
	2MS112			
Condenser Steam Dump Valves	2MS14B	2MS142	2MS174	2MS179
	2MS153	2MS158	2MS177	2MS182
	2MS155	2MS161	2MS180	2MS185
	2MS156	2MS164	2MS183	2MS188
	2MS159	2MS167	2MS186	
	2MS162	2MS170	2MS141	
	2MS165	2MS147	2MS173	
	2MS168	2MS171	2MS176	
Steam Generator	2AS118	2AS127		
	2AS119	2AS128		
	2AS120	2AS129		
	2AS122	2AS131		
	2AS123	2AS132		

TABLE II-5

INSTRUMENTATION INSPECTION SAMPLE

Instrument Racks:
- 2PL81JA
- 2PL81JB
- 2PL67J

Instrument Piping Supports:

2FT-0651-H143-6	2FIS-CC064-H237
2FT-0651-H215	2FT-CS-15-H153-1
2FT-660-H143-3	2FT-CS015-H153-2
2FT-660-H237	2FIS-611-H134-1
2LT-548-H234A	2LT-930-H244
2FT-445-H223	2FT-0657-H89E-13
2FT-415-H29A-6	2FT-0657-H234
2FT-415-H119A-23	2LT-528-H223
2FIS-CC064-H49-3	2FT-0654-H133-1

Instrument Piping Runs:

T537-2FT-CS013	T992-2FT-0654
T548-2FIS-611	T995-2FT-0657
T538-2FT-CS015	T971-2FIS-CC064
T564-2LT-930	T988-2FT-415
T982-2FT-0651	T1008-2LT-0460
T990-2FT-660	T1053-2LT-548
T1015-2LT-556	

Instruments:

2FT-CS013	2FT-0654
2FIS-611	2FT-0657
2FT-CS015	2FIS-CC064
2LT-930	2FT-415
2FT-0651	2LT-0460
2FT-660	2LT-548
2LT-556	

III. MECHANICAL CONSTRUCTION

A. Objective

The objective of the appraisal of mechanical construction was to determine if installed and Quality Control (QC) accepted mechanical items conformed to engineering design, regulatory requirements and licensee commitments.

B. Discussion

The specific areas of mechanical construction evaluated were piping, pipe supports/restraints, concrete expansion anchors, heating, ventilating and air conditioning (HVAC) systems and mechanical equipment. To accomplish the above objective, a field inspection of a sample of QC accepted hardware was performed in each area. In addition, certain programs, procedures and documentation were reviewed and responsible personnel were interviewed as required to support or clarify hardware inspection findings.

1. Piping

a. Inspection Scope

Piping depicted on the 15 Hunter Corporation (Hunter) drawings listed in Table III-1 was inspected by the NRC Construction Appraisal Team (CAT). Approximately 900 feet of large bore piping (greater than or equal to 2 inch diameter) was inspected. The piping was located in the Unit 2 Reactor Building, including the Steam Tunnel, and the Auxiliary Building. Component Cooling, Chemical and Volume Control, Feedwater, Main Steam and Reactor Coolant Systems piping were included. Pipe sizes ranged from 1/2 inch to 60 inches and classifications were ASME 1, 2 and 3. The piping was inspected for configuration (i.e., layout geometry, orientation and dimensions), component type and location, valve operator orientation, and support location, type and orientation. Additionally, site construction practices with regard to protection of installed hardware and maintenance of inservice inspection clearance criteria were observed on a random basis. Design change documents, including Engineering Change Notices (ECNs) and Field Change Requests (FCRs), were reviewed and compared to inspection data gathered in the field. The extent of this design change review is identified in Table III-1. All of the piping samples had been previously inspected and accepted by Hunter QC.

Thirteen hydrostatic/pneumatic pressure test packages were reviewed for compliance with procedural and code requirements and 1 pneumatic test was witnessed. Items reviewed consisted of applied pressure, duration, pressure adjustment calculations, type of gauges used, test boundaries, Discrepancy Reports, Field Change Requests and documented instances of overpressurization. All nonconformance reports (NCRs) involving overpressurization at the site were reviewed. The training program for personnel engaged in the performance, supervision and review of hydrostatic/pneumatic testing

was reviewed. Table III-2 provides a listing of the test packages reviewed.

Twenty-nine locations in Class 1 and 2 piping systems were selected as part of the NRC CAT sample to determine whether ASME requirements for pipe wall thickness were met. Seven different plant systems and 12 manufacturing firm's products were selected for the sample. The pipe wall thickness measurements were taken by ultrasonic methods with equipment and personnel provided by the licensee. The values obtained were compared against the minimum wall thickness requirements specified by ASME (12.5 percent below nominal thickness). Several measurements were taken at each location. Seven of the locations were on elbows. See Table III-3 for details and observations.

The following documents provided the acceptance criteria and background information for the NRC CAT inspection:

- Hurter Corp. Site Implementation Procedure No. 4.201, "Installation Verification," Rev. 11.
- Hunter Corp. Site Implementation Procedure No. 2.201, "Design Control," Rev. 13.
- Nuclear Power Services, Inc. Work Procedure No. 3.09, "As-Built Piping Subsystem Preparation," Rev. F.
- Sargent & Lundy (S&L) Instruction PI-BB-26, "Procedure for Preparation and Submittal of Piping 'As-Built' Information," Rev. 4.
- S&L Instruction PI-BB-27, "Receipt Review, Reanalysis (Where Applicable), Redesign (Where Applicable) and 'As-Built' Piping Reconciliation," Rev. 4.
- S&L Drawing No. M-535, "Piping General Notes, Byron Sta. Units 1 & 2," Rev. AJ.
- S&L Drawing No. M-679, "Single System General Notes, Byron Unit 1 & 2," Rev. D.
- S&L Drawing No. M-919, "Component Support Installation Guidelines and Tolerances" Sheet 4, Rev. L and Sheet 4A, Rev. D.
- Hunter Corp. Site Implementation Procedure No. 4.405, "Pressure Testing," Rev. 3.
- Hunter Corp. Site Implementation Procedure No. 4.406, "Piping Freeze Seals," Rev. 1.

b. Inspection Findings

In the review of piping, the NRC CAT inspectors found that in general piping met the design requirements; however, 3 minor discrepancies were found. The observations associated with specific

piping drawings are listed in Table III-1 and described in the following paragraphs.

The "as-built" dimension from a branch connection center line to the attached high point vent valve, Valve 2CC153, noted on the isometric drawing (Isometric Spool No. CC-52) was 1.25 inches. This dimension in the field measured 4.25 inches. This 3 inch discrepancy exceeds the inspection tolerance of 1 inch specified by S&L Drawing M-679 and the dimensional accuracy requirements of 1 inch specified by the S&L as-building procedure, PI-BB-26. The dimension as depicted is not physically possible and was determined to be a drafting error. This error would probably have been detected during the as-built reconciliation effort since the distance shown obviously requires more than the specified 1.25 inches to accomodate the fittings included. All other design and as-built dimensions checked during the NRC CAT inspection were found to be within 1/8 inch of acceptance criteria.

Isometric drawing for Spool No. S-CC-001-243 specifies a 2 inch, 45 degree socket elbow to be a 3000 psi rated fitting. The NRC CAT inspection found this elbow to be a 6000 psi fitting. Subsequent review by Hunter determined that the 6000 psi rating corresponded to design requirements and the traveler package installation records. Therefore, this discrepancy is attributable to drafting error. The The NRC CAT considers this discrepancy isolated and not safety significant.

The NRC CAT observed that one of four support points for a wood construction platform measuring approximately 4.0 ft. by 5.0 ft. was mounted on the operator for valve 2CV8106 (Ref. Isometric Spool No. CV-20). No damage was observed and because of the small size of the platform, damage was not likely. However, construction practices should prevent the potential damage of installed hardware. Hunter has on at least two previous occasions issued directives to its employees prohibiting the attachment of scaffolding to various types of hardware, including 2.0 inch and smaller pipe. The licensee should evaluate the need for additional precautions in this area and take appropriate action.

Hydrostatic/pneumatic testing was found to meet the requirements of SIP-4.405 and code requirements. Of the hydrostatic/pneumatic test packages reviewed three NCRs were identified to have been issued as a result of overpressurizations during testing on Unit 2. In the review of NCR-860 it was observed that the list of pipe and components that had been subjected to overpressurization was incomplete in that Auxiliary Feedwater Pump 2AF01PB had not been included. The effect of this oversight is that S&L did not evaluate overpressurization of this pump and consequently disposition of NCR-860 was incomplete. NCR-1136 was initiated to address this matter.

Similar instances of testing overpressurizations on Unit 1, a total of 10 NCRs, were also reviewed by the NRC CAT inspectors. It was found by the NRC CAT inspectors that the pipe and component list in

NCR 1022 was also incomplete in that 3 line segments and 8 valves had been left off the list. In this case however, S&L's evaluation of the NCR had included a review of the details and drawings pertinent to the overpressurization and had developed a complete list that included the 3 line segments and 8 valves.

Review of S&L's methods and calculations to resolve the overpressurizations appeared to be reasonable and technically adequate. However, the NRC CAT inspectors are concerned that procedures were not in place that would require that S&L perform an independent review, as was done in the one overpressurization case, to ensure that affected piping and components are included in the engineering evaluation.

Regarding the 29 piping locations where ultrasonic thickness measurements were taken to verify minimum wall thickness values, the measurements were acceptable in that they exceeded the minimum wall values specified for the size and schedule of pipe involved.

c. Conclusions

Piping was found to generally conform to design documents. Engineering and inspection personnel were knowledgeable of procedures, requirements and responsibilities.

With respect to hydrostatic/pneumatic testing, the overall program was found to be functioning in accordance with the procedural and code requirements. The noted failures to include pipe segments, valves and a pump on the NCR description of the overpressurization event are considered isolated cases. However, steps should be taken to ensure that any future overpressurizations receive an independent review so as to reduce the likelihood of the type of oversights identified by the NRC CAT inspectors.

2. Pipe Supports/Restraints

a. Inspection Scope

Twenty-five ASME Class 1, 2 and 3 and eight Class D pipe supports/restraints were selected for detailed inspection. These supports/restraints represented various types, sizes, systems and locations. All had been inspected and accepted by the mechanical contractor, Hunter Corp. These supports/restraints were inspected by the NRC CAT for proper configuration, clearances, member sizes, location, damage, weld size and proper fasteners. See Table III-4 for a listing of the inspection sample.

In addition, approximately 60 other supports/restraints were observed at random in the field for obvious deficiencies such as loose or missing fasteners, improper clearances or angularity, improper locking devices, disassembled items, damage and improper concrete expansion anchor spacing.

Documentation packages for the supports/retraints in the primary sample were examined for completeness, accuracy and conformance to procedural requirements. Drawing revisions and ECNs used in the inspection were verified to be the latest design documents with vendor drawing/design change master lists.

Acceptance criteria for these inspections were contained in the following documents:

- Hunter Corp. Site Implementation Procedure (SIP) 4.201, "Installation Verification," Rev. 11.
- Hunter Corp. Site Work Instruction (SWI) 2, "Installation of Hanger Speciality Items," Rev. 9.
- S&L Drawing M-919, "Component Suppport Installation Guidelines and Tolerances."
- ITT Grinnell and Elcen Metal Products catalogues and engineering specification sheets.
- Applicable design drawings and change documents

b. Inspection Findings

At the time of this inspection, approximately 95 percent of the approximately 11,000 large bore supports/restraints had been installed and QC accepted. Approximately 70 percent of the approximately 10,000 small bore supports/restraints had been installed and QC accepted.

No significant hardware discrepancies were identified in the NRC CAT inspection sample of supports/restraints.

Support material and configuration generally conformed to design requirements. Workmanship was good and QC inspections appeared to have been thorough. See Table III-5 for a summary of inspection observations.

Five instances of loose strut locknuts were noted indicating a possible lack of attention to detail for this feature. Discussions with responsible personnel and review of procedures governing future support/restraint inspections (Type 4 and 79-14 walkdowns) indicate that these discrepancies should be identified and corrected. However, because of the number of these discrepancies noted, the NRC CAT inspectors considered that additional emphasis needs to be placed on proper installation and inspection of fasteners, especially during the final walkdown inspections.

The NRC CAT inspectors had a concern with regard to pipe stress due to point contact between a pipe saddle and pipe on a particular restraint. It was determined that no specific inspection criteria existed for this feature. Westinghouse engineering evaluated this specific installation as acceptable and developed and issued

criteria to be used for installation and inspection of this type of support/restraint detail.

No discrepancies were noted in the review of documentation packages. The drawing revisions and design change documents used in the NRC CAT inspections were the latest design documents as evidenced in the current S&L and Westinghouse master lists. Twenty-three of the supports/restraints in the primary sample had open ECNs that had not yet been incorporated onto the drawing. There were no discrepancies noted by the NRC CAT inspectors that would indicate inadequacies in implementation of the design change process with respect to supports/restraints.

Discussions were held with responsible engineers relating to seismic interaction programs, design and inspection of Class D support/restraints and the piping thermal expansion test and inspection programs. No concerns were identified.

c. Conclusions

Pipe supports/restraints were found in general to be in conformance with drawing, design change and procedural requirements. Site engineering, construction and inspection personnel were knowledgeable of procedures, requirements and responsibilities.

3. Concrete Expansion Anchors

a. Inspection Scope

One hundred and six concrete expansion anchor bolts on 23 pipe supports/retraints were examined for proper length, marking, embedment depth, spacing, residual torque (an indication of anchor preload), damage and bolt hole to plate edge distance. Various systems, sizes and locations were included in the anchor sample. Table III-6 provides a listing of the anchors inspected. Anchors were torqued to the 15 day-3 month test torque specified in site procedures. This represented approximately 50-60 percent of installation torques.

Acceptance criteria for these field inspections were contained in the following documents:

- Form BY/CEA, "Standard Specification for Concrete Expansion Anchor Work," Rev. 22.
- Hunter Corp. SIP 20.513, "Installation of Concrete Expansion Anchors," Rev. 16.
- Detail drawings for pipe supports/restraints.

b. Inspection Findings

Only three of the 106 anchor bolts required rotation to reach the test torque. Only one of these three required significant rotation to reach the full installation torque (2 turns). Even considering

that the test torques were relatively low, no significant installation deficiency is indicated.

All other characteristics examined were either within tolerance or had been previously identified and evaluated.

c. Conclusions

The concrete expansion anchors installed in pipe supports/restraints were installed in accordance with design and procedural requirements.

4. Heating, Ventilating and Air Conditioning (HVAC)

a. Inspection Scope

Twelve safety-related seismic HVAC duct supports and two fan supports were inspected for configuration, dimensions, location, damage, weld size and member size. Due to the application of fire protection coating many of the auxiliary steel connections in the sample was not readily accessible for clip angle and weld size inspection. However, as a result of welding discrepancies noted on the accessable joints in this sample, the auxiliary steel connection details for an additional eight duct supports were examined for the specified weld size.[1] Approximately 15 duct segments were also inspected for size, stiffener and support location, fasteners and joint makeup, damage and weld size. Five fire dampers were inspected for fusible links, specified location and type per drawing and damper list, sleeve to damper welding and damage or corrosion to blade operating mechanisms. The inspection of HVAC equipment is discussed in section III.B.5 of this report. See Table III-7 for observations and listing of supports and fire dampers inspected.

The following documents provided the acceptance criteria for HVAC hardware installations:

- S&L Drawing M-1261, "Safety-Related HVAC Hanger Details."
- S&L Safety-Related HVAC Hanger Lists.
- Reliable Sheet Metal (RSM) Works, Inc. Procedure 23, "Installation Verification," Rev. 2.
- RSM Procedure 30A, "Bolted Connections," Rev. 4.
- RSM SWI 2, "Inspection and Acceptance Criteria for Fire Damper Assemblies (FDA)," Rev. 1.
- S&L Specification F-2782.
- S&L Fire Damper List.

[1] See Section IV-B.6 for further details.

- RSM Duct Construction Manual and Construction Details.
- HVAC duct design location drawings.

b. Inspection Findings

Several minor dimensional, orientation and drawing discrepancies were noted during the duct and fan support inspections. None of these were considered significant. Several undersize welds were identified on clip angle to tube steel and clip angle to in-place steel welds for three duct supports. As a result of these observations, the connection joints for eight additional duct supports were inspected. Five of these were also found to be undersize. Some of these welds were shop welds made off-site and may not have been inspected by site personnel; some were field welds that had been inspected by site personnel. Typically, welds specified to be 1/4 or 5/16 inch fillets were 1/16 to 1/8 undersize for one or more of the eight welds on each auxiliary steel installation. As a result of these findings nonconformance report NCR-118 was issued.[2]

From an overall standpoint the discrepancies noted were not considered to be major structural concerns. However, the number of discrepancies noted in QC accepted hardware, most of which have already been through a complete reinspection program, is a concern. This indicates a need for additional management review and attention to detail by QC inspectors.

The inspection of fire dampers identified one damper that was installed with a standard fusible link instead of the electro-thermal link required by the specification damper list. Licensee personnel indicated that the electro-thermal link was not yet installed by the electrical contractor but was scheduled to be. A check of the companion Unit 1 damper revealed that the electro-thermal link there had been installed. Other damper features conformed to design requirements.

With regard to duct inspections, one 73 inch long duct segment did not have stiffeners installed as required by the Duct Brochure and Specification. Other attributes examined on duct work conformed to design requirements.

c. Conclusions

The QC program failed to identify support auxiliary steel connection welds that did not meet design size requirements on eight of 20 supports inspected by the IAT.[2]

[2]See Section IV-B.6 for a list of specific findings and disposition of NCR-118.

5. Mechanical Equipment

a. Inspection Scope

Seventeen pieces of equipment located in seven systems were inspected for ASME class, capacity, temperature, pressure rating and for compliance with foundation details such as bolting arrangement, number and size of bolts. Installation documentation was checked for compliance with Quality Assurance/Quality Control (QA/QC) requirements. The inspection sample included pumps, tanks, heat exchangers and HVAC cubicle coolers that were reported to be completely installed and QC accepted. Table III-8 provides a listing of inspected items.

Listed below are the major documents that provided the acceptance criteria for inspection.

- Applicable vendor drawings and foundation details
- Vendor manuals
- Hunter Corp., SIP-4.000, "Control of Construction Processes," Rev. 14.
- Hunter Corp., SIP-4.001, "Bolted Connections," Rev. 2.
- Hunter Corp., SIP-4.201, "Installation Verification," Rev. 11.
- Hunter Corp., SIP-6.001, "Visual Examination & Verification," Rev. 4.

b. Inspection Findings

Generally, the mechanical equipment inspected by the NRC CAT was procured and installed in accordance with vendor and design requirements. However, a discrepancy was identified with four heat exchangers supplied by Westinghouse. It was observed that the installation procedures used by the installation contractor for tightening foundation bolts at the sliding end of these four heat exchangers was not in agreement with the Westinghouse equipment manual. The Westinghouse manual states that these specific bolts should be backed off to allow for expansion, but the installation contractor's procedure states they are to be snug tight.

To investigate this concern the licensee performed torque checks on the equipment foundation bolts and found some of the bolts to have been tightened to 250 to 280 ft-lbs; values considerably in excess of the 100 ft-lbs assumed for a snugtight installation. The licensee subsequently issued ECN 27982 to eliminate bolt torquing requirements on specified sliding connections. Westinghouse correspondence (CAW-9141) states that these bolts should be backed off on Unit 2 shortly and on Unit 1 during the first refueling. Westinghouse has evaluated the present condition on Unit 1 and determined that it is acceptable to wait until fuel loading for corrective action.

c. Conclusion

Mechanical equipment installations, except certain heat exchanger sliding connections, generally conformed to design and installation requirements. Installation documentation reviewed was in accordance with requirments.

TABLE III-1

PIPING INSPECTION SAMPLE

Drawing Number	Revision	Pipe Class (ASME)	Diameter (Inches)	Notes	Observation
Large Bore:					
CC-52	4H	2	3	1	1¼" as-built dim measures 4¼"
CC-57	4G	3	3	1	
CC-61	4G	2	3	1, 2	
CV-19	7N	2	4, 3	1	
CV-20	6C	2	4, 3		Scaffolding supported by operator for Valve 2CV8106
FW-70	8G	2	6, 4, 3		
FW-72	4D	2	3		
Small Bore:					
S-CC-001-243	6	3	2, 3/4		3000# socket elbow specified is 6000#
S-CC-001-253	1B	3	2		
S-CV-001-212	2B	1, 2	3/4		
S-CV-001-233	1B	2	2		
S-CV-001-292	1C	2	2		
S-MS-001-224	7B	2	1/2		
S-RC-001-221	2C	1	2		
S-RC-001-234	3A	1	3/4		

NOTES:

1. Design changes specified by Engineering Change Notices and/or Field Change Requests identified at the revision block of this drawing were reviewed. The changes were compared to field data compiled during the NRC CAT inspection.

2. Piping located inside the heat exchanger cavity was not inspected by the NRC CAT.

TABLE III-2

HYDROSTATIC/PNEUMATIC TEST PACKAGE SAMPLE

Test Package ID	System
SG-21 Retest	Main Steam - Feedwater
CS-37	Containment Spray
BR-6	Boron Therm.-Gen.
SX-102 Retest	Essential Service Water
PS-8	Process Sampling
SI-26	Safety Injection
CS-38	Containment Spray
NT-3	Nitrogen
DO-93	Diesel Oil
IA-4	Instrument Air
OG-11	Off-Gas
RY-17	Reactor Coolant Pressurizer
WM-4	Makeup Demin.

TABLE III-3

PIPE WALL THICKNESS MEASUREMENTS

[1]Manufacturer/ (Heat No.)	Pipe Size/ Schedule	ASME Class	Nominal/ Minimal Wall Thickness (Inches)	[2]Measured Wall Thickness (Inches)
SW (MRR 10264)	29"	1	2.425/2.330	2.5
Sandvik (750557)	2"/160	1	.344/.301	.35
B&W (M1629)	8"/160	1	.906/.792	.91
B&W (M1656)	8"/160	1	.906/.792	.99
CE (BZE26D)	3"	1	.438/.383	.43
C-W (3109-8-2)	10"/140	1	1.00/.875	1.03
C-W (3109-8-2)	10"/140	1	1.00/.875	1.01
C-W (3109-12-2)	6"/160	1	.719/.629	.74
B&W (M-2417)	6"/160	1	.719/.629	.74
Cameron (L4328)	12"/140	1	1.125/.984	1.14
C-E (5835)	3"/160	1	.438/.383	.45
T-T (94584)	6"	2	[3]	1.59
T-F (EICL)	28"	2	1 3/16	1.30
USS (N15150)	8"/160	1	.906/.792	.94
USS (N15150)	8"/160	2	.906/.792	.91
USS (L45353)	16"/120	2	1.219/1.066	1.24
USS (L62803)	6"/120	2	.562/.491	.56
C-W (2799-4-2)	12"/40	2	.375/.328	.43
C-W (1210-3-2)	12"/40	2	.375/.328	.48
SWEPCO (8034857)	8"/40	2	.322/.281	.35
Armco (781055)	24"/40	2	.687/.601	.77
Armco (61266)	16"/STD.WT.	2	.375/.328	.43

TABLE III-3 (Continued)

PIPE WALL THICKNESS MEASUREMENTS

[1]Manufacturer/ (Heat No.)	Pipe Size/ Schedule	ASME Class	Nominal/ Minimal Wall Thickness (Inches)	[2]Measured Wall Thickness (Inches)
ASP (83540) Elbow	2"/160	1	.344/.301	.35
T-F (7297) Elbow	8"/160	1	.906/.792	1.03
T-F (ERPC) Elbow	12"/140	1	1.125/.984	1.27
T-F (JHZH) Elbow	12"/40	2	.375/.328	.40
T-F (JIFM) Elbow	8"/40	2	.322/.281	.35
T-T (713894) Elbow	24"/40	2	.687/.601	.88
G-W (624063) Elbow	16"/STD.WT.	2	.375/.328	.42

NOTES:

[1] B&W - Babcock & Wilcox Tubular Products Division
C-W - Curtis-Wright Corp.
C-E - Combustion Engineering
T-T - Tube Turns
T-F - Taylor Forge
USS - United States Steel
SW - Southwest
ASP - Alloy Stainless Products

[2]Thickness measurements were made by Krautkramer UT Instrument, Model USK6 SR. No. 27593-3926 using 3/8" and 1/2" diameter transducers. Couplant: Ultrajel; Operator: Ebasco level II.

[3] Nonstandard part - bought to specified dimensions

TABLE III-4

PIPE SUPPORT/RESTRAINT INSPECTION SAMPLE

S/R Number	Type	Pipe Class	Size (Inches)	Location
2SI01004X	Box	1	10	Reactor
2SI10003S	Snubber	1	2	Reactor
2SI04035X	Strut	2	8	Reactor
2RY20011X	U-bolt	2	3	Reactor
2RH02006X	Strut	1	12	Reactor
2RC10008X	Strut	1	3	Reactor
2SI03025V	Spring	2	8	Reactor
2SI04019X	Strut	2	10	Reactor
2RH06004V	Spring	2	3	Aux.
2RH09B005A	Anchor	2	2	Aux.
2RH04010X	Strut	2	8	Aux.
2RH09B012X	U-bolt	2	2	Aux.
2SI05035X	Box	2	4	Aux.
2RY09089S	Snubber	D	6	Reactor
2RY20013X	Box	D	3	Reactor
2RY09020C	Spring	D	12	Reactor
2RY09013S	Snubber	D	6	Reactor
2RY08034X	Strut	D	4	Reactor
2RY08011X	Strut	D	4	Reactor
2RY08008X	Strut	D	4	Reactor
2CC22004X	Strut	3	6	Reactor
2CC22009X	Strut	3	6	Reactor
2RH07019V	Spring	2	8	Aux.
2AB23B013X	U-bolt	D	3	Aux.

TABLE III-4 (Continued)

PIPE SUPPORT/RESTRAINT INSPECTION SAMPLE

S/R Number	Type	Pipe Class	Size (Inches)	Location
2SI06239V	Spring	2	24	Aux.
2RH07013S	Snubber	2	8	Aux.
2RC11009X	Strut	1	3	Reactor
2CC23015X	Strut	3	4	Reactor
2RC10009X	Strut	1	3	Reactor
2RC10016X	Strut	1	3	Reactor
2RC10020X	Strut	1	2	Reactor
2RC11010X	Strut	1	3	Reactor
2CC10001R	Rod	3	8	Aux.

Reactor - Reactor Building

Aux. - Auxiliary Building

TABLE III-5

PIPE SUPPORT/RESTRAINT INSPECTION OBSERVATIONS

Support/Restraint	Observations
Primary Sample	
2SI10003X	Weld length of rear bracket to embed was 4 5/8 inches long vs. 5 1/2 specified
2RY08011X	Loose strut locknut
2RC11009X	Unspread cotter pins
2RC23015X	Loose locknut
2RC10016X	Loose locknut
2RC20020X	Piece 2 oriented 90 degrees from specified position
2RC11010X	Backed off locknut
Adjacent Sample	
2CV65015, 2CV66017, 2CC28010X, 2CV63019	Loose locknuts
2RC11011X, 2CCV15011	Unspread/missing cotter pins
2FW1900312, 2FW19009R	Gaps between lubrite plate and restraining bars not per design tolerance

TABLE III-6

CONCRETE EXPANSION ANCHOR INSPECTION SAMPLE

Support/ Restraint	Number-Diameter (Inches) of Anchors Inspected	Observations
2RH02007X	12-3/4	One turned at 6 ft-lbs.
2FW93E010X	4-5/8	
2MS91B008A	4-1/2	
2SI30A002X	12-3/8	
2CV15013S	4-3/4	
2CV15041S	4-1/2	
2RC23034X	4-1/2	
2RC90B024X	4-1/2	One turned at 35 ft-lbs
2CV13034S	4-3/4	
2CV09025X	4-1	
2RC29002X	4-1/2	
2MS94B001	4-3/4	
21Y094H4G20933	2-1/2	
21Y094H4G20911	2-1/4	One turned at 30 ft-lbs
2SI93B024	4-3/4	
2W009A033X	4-1/2	
2CS03B77X	4-3/4	
2SI06223	4-1	
2SX50009X	4-1	
2SI06259	4-1	One turned at 180 ft-lbs
2AB62005R	4-3/4	
2SI06263X	8-5/8	
2CS06010X	4-3/4	

TABLE III-7

HVAC INSPECTION SAMPLES AND OBSERVATIONS

Item Inspected	Observations
Duct Supports:	
H3856	Undersize auxiliary steel welds.
H3837	
H3854	Duct spacer to horizontal member missing one of two welds.
H3855	
H3853	
H922	
H2174	
H3749	Undersize auxiliary steel welds.
H3822	
H3652	Undersize auxiliary steel welds.
H1395	Discrepancy as to hanger type affecting horizontal member attachment.
H8624	Minor dimensional/tolerance discrepancy.
[1]	
Fan Supports:	
2VD03CA	Incorrect brace orientation.
2VD01CA	Missing washers on foundation bolts and foundation bolt spacing not per vendor drawing.
Fire Dampers:	
2VX03Y	
2VD17YB	
2VD17YA	
2VD63Y	
2VD53Y	

[1]See Section IV-B.6 for additional supports inspected

TABLE III-7 (Continued)

HVAC INSPECTION SAMPLES AND OBSERVATIONS

Item Inspected	Observations
Duct Segments:	
Fifteen segments shown on portions of drawings M-1281 and M-1283.	Segment M-1283-2-18 does not have required stiffener.

TABLE III-8

MECHANICAL EQUIPMENT SAMPLE

Boric Acid Transfer Pump	2AB03P
Boric Acid Tank	2AB03T
Diesel Generator Oil Transfer Pump	2DO01PA
Diesel Generator Day Tank	2DO02TA
Residual Heat Exchanger	2RH02AA
Residual Heat Removal Pump	2RH01PA
Letdown Reheat Heat Exchanger	2BR03A
Letdown Heat Exchanger	2CV05A
Volume Control Tank	2CV01T
Excess Letdown Heat Exchanger	2CV01AA
Seal Water Heat Exchanger	2CV02A
Containment Spray Additive Tank	2CS01T
Safety Injection Pump	2SI01PA
Safety Injection Pump Room Cubicle Cooler	2VA04SA
Centrifugal Charging Pump 2B Cubicle Cooler	2VA06SB
Safety Injection Pump Room Cubicle Cooler	2VA04SA
Centrifugal Charging Pump 2A Cubicle Cooler	2VA06SA

IV. WELDING AND NONDESTRUCTIVE EXAMINATION

A. Objective

The objective of the appraisal of welding and nondestructive examination (NDE) was to determine if Quality Control accepted work related to welding and NDE activities was controlled and performed in accordance with design requirements, Safety Analysis Report commitments, and applicable codes and specifications.

An additional objective was to determine if personnel involved in welding and NDE activities were trained and qualified in accordance with established performance standards and applicable code requirements.

B. Discussion

To accomplish the above objectives, welds and welding details for piping; pipe supports/restraints; field and shop fabricated tanks; structural steel installations; heating, ventilating, and air conditioning (HVAC) installations; electrical supports; and instrumentation and control tubing and supports were inspected. The inspected welds were selected to provide a representative sample of the licensee's contractor welding activities in terms of welding processes used, materials welded and existing weld-joint configurations. Considerations such as physical location, difficulty of welding and limited accessibility were also used in the sample selection. Design changes related to welding such as increase or decrease of weld sizes and changes in the welding process or procedure were also reviewed for technical adequacy.

NDE activities were appraised through the review of radiographs for both field and vendor fabricated welds, the review of NDE procedures and personnel qualifications, the inspection of the calibration status of NDE equipment and the witnessing of in-process NDE activities. The NRC Construction Appraisal Team (CAT) inspectors reviewed a sample of radiographic film in final storage in the vault of the licensee's facility. In addition, a sample of film for Westinghouse supplied components was requested for review which were stored in the Westinghouse storage facility.

During the inspection of structural welds in the pipe whip restraint, structural and HVAC areas, the NRC CAT inspectors identified welds which did not meet some of the requirements specified by the AE Sargent & Lundy Engineers (S&L). S&L has evaluated most of these welds and determined that the welds are adequate for their intended application. Undersized weld reinforcements were also found in nozzle to shell joints (ASME Code Category D Joints) on tanks and heat exchangers. A detailed discussion concerning these welds is included later in this section.

In the area of NDE, the NRC CAT inspectors requested to review a sample of radiographs which were stored at the Westinghouse storage facility. Two items were requested for review. Initially, the radiographs for the Boric Acid Transfer Pump (2AB03P) and the Let Down Chiller Heat Exchanger (2BR03A) were requested. Westinghouse, however, provided

radiographs for the Let Down Heat Exchanger and the Moderating Heat Exchanger which were fabricated by Atlas Industrial Manufacturing. A further review of the items requested established that the Boric Acid Transfer Pump and the Let Down Chiller were exempt from radiography because their wall thickness was less than the thickness requiring radiographic examination under the rules of the ASME Code for Class 3 components. As a result of this, the NRC CAT requested the radiographs for the Component Cooling Surge Tank (2CC01T) and Volume Control Tank (2CV01T). The film for the Component Surge Tank and Volume Control Tank were not received during the NRC CAT inspection period. The licensee stated that radiographs for these Westinghouse supplied components would be reviewed and further reviews performed to ensure that code requirements were met.

The NRC CAT inspectors also identified some radiographs which showed that some welds did not have the required weld quality or the film or other documentation did not accurately identify the proper hardware. A detailed discussion concerning the welds and their associated deficiencies are provided later in this section.

The welding and NDE activities were examined in order to ascertain compliance with the governing construction codes and specifications. This effort involved the review and inspection of the following contractors:

Field Activities

1. Sargent & Lundy Engineers: Architect-Engineer.

2. Hunter Corporation: piping installation and piping supports/restraints, fire protection fabrication and installation.

3. Chicago Bridge and Iron Company (CB&I): containment liner and containment penetration fabrication and installation, pipe whip restraints.

4. Pittsburgh Des Moines Corporation (PDM): reactor pool fabrication and installation.

5. Reliable Sheet Metal (RSM): heating, ventilating and air conditioning.

6. Nuclear Installation Service Co. (NISCo): reactor internals modification and installation.

7. Powers-Azco-Pope (PAP): instrumentation installation and instrumentation supports.

8. Hatfield Electric Company (HECo): electrical installation and supports.

9. Blount Brothers (BBC): structural steel modification and erection.

10. Ebasco Services Inc.: preservice inspection and examination.

Shop Fabrication

1. Southwest Fabricating & Welding Company, Inc.: shop fabricated piping spools.
2. Harnischfeger Corporation: crane manufacturer.
3. Westinghouse: nuclear steam supply system.
4. Anchor/Darling Valve Company: valve manufacturer.
5. Teledyne Brown: NSSS supports fabricator.
6. Carrier Corporation: chillers and coolers manufacturer.
7. Phillips Steel Company: liquid radwaste evaporators supplier.
8. Graver Corporation: tank fabricator.
9. Jamesbury Corporation: valve body supplier.
10. Dresser Industries: valve manufacturer.
11. G&W Energy Product Corporation: spray eductors supplier.
12. TRW Mission Manufacturing Co.: containment spray system supplier.
13. Farr Company: reaction chamber filter supplier.
14. Continental Boiler: return air riser supplier.
15. Yuba Heat Transfer Corporation: high pressure heater manufacturer.
16. McQuay Perfex Inc.: condenser shell and hot well tank shell supplier.
17. Pall Trinity Micro Corporation: cartridge filters supplier.
18. ACF Industries: valve body supplier.
19. Cleaver Brooks: steam boilers fabricator.
20. Mannings Lewis: miscellaneous heat exchangers shell supplier.
21. Cooper-Bessemer: air receiver tanks supplier.
22. Greer Hydraulics: pulsation damper suppliers.
23. ITT Grinnell: snubber support assembly fabricator.
24. Rockwell International: hydrogen recombiner manufacturer.
25. Atlas Industrial Manufacturing: heat exchanger manufacturer.

26. W. J. Wooley Company: containment vessel hatches fabricator and supplier.

27. Bingham-Willamette: pump manufacturer.

28. Plant Management Corp.: surface condenser tanks supplier

29. Borg Warner: valve manufacturer

30. Aerojet Energy: expansion joints supplier

The results of the inspection activities involving each of these areas and contractors are documented as follows:

1. Pipe and Pipe Support Fabrication

a. Inspection Scope

(1) Welding Activities

The NRC CAT inspectors reviewed activities relating to fabrication in the areas of piping system welds, support/restraint welds, welding procedures, welder qualifications, NDE procedures, personnel qualifications, and the review of radiographic film for shop and field fabricated welds. Field welding involving pipe fabrication was performed by Hunter. Southwest Fabricating and Welding supplied the shop fabricated piping spools.

The NRC CAT inspected 47 pipe supports/restraints involving approximately 450 welds in order to verify conformance of welding to drawing requirements and confirm the visual acceptability of the welds. See Table IV-1 for a listing of supports subjected to detailed inspection. Additionally, another 22 supports/restraints involving 600 welds were visually inspected to verify the quality of the completed welds (See Table IV-2). The NRC CAT inspectors also inspected the welds on the lateral supports for Steam Generator #7.

The NRC CAT inspection of piping welds consisted of visual inspection during walkdown of piping systems and inspection of pipe welds located near the supports/restraints being inspected. Approximately 51 piping spools involving 1700 ASME Class 1, 2 and 3 welds were inspected. Twenty-four of those piping spools were subjected to detailed inspection which included the review of pertinent QC documentation while the remaining 27 spools were only visually inspected. Both field and shop welds were inspected in order to assure compliance with the requirements of the ASME Code. See Tables IV-3 and IV-4 for listings of piping spools inspected. In addition, 50 welding filler metal test reports, 45 welder qualification test records and 4 welding procedures were reviewed for compliance with applicable specifications, procedures and the ASME Code requirements.

(2) Nondestructive Examination Activities

The NRC CAT inspection of NDE activities for the pipe fabrication area included the review of 89 shop and 63 field fabricated welds which involved 1953 film. Field NDE activities are performed by an independent third party, Pittsburgh Testing Laboratory. In addition, 5 NDE procedures and 6 NDE personnel qualification records were reviewed in order to verify compliance with the governing codes and specifications. Four NDE technicians were observed while performing in-process inspections and were evaluated for their ability to follow the applicable inspection procedures. Fifteen pieces of NDE equipment were inspected for calibration and one quality assurance NDE procedure was reviewed for adequacy.

b. Inspection Findings

(1) Welding Activities

In general, the inspected pipe and pipe supports/restraints welding activities were found to comply with the governing codes and specifications. However, minor discrepancies were identified involving undersized welds in pipe whip restraints. Twenty-nine of 1050 structural welds inspected, involving 69 pipe supports/restraints, were found to be deficient with respect to the specified acceptance criteria. Twenty-six of the inspected welds were undersized, two welds were short in length and one pipe did not have full contact with the contoured tube steel saddle. As a result of this finding the applicant issued Nonconformance Reports (NCRs) and the welds were subsequently determined to be adequate for the intended application. See Table IV-1 for details. The inspection of the Steam Generator lateral support welds showed areas which were overground by 1/16 to 1/8 inch. Discrepancy Report QA-MISC-083 was written to document this condition.

No deficient pipe welds were identified during this inspection. However, during the review of piping documentation, it was observed that the actual width of weld buildup on the inside surface of MS-56A, field weld 334, had not been documented adequately to confirm that all buildup was actually included in the radiograph of the adjacent butt weld. The review of the radiographs revealed an acceptable weld buildup condition.

During the review of 50 Material Test Reports for welding filler metal, it was observed that the purchasing specifications did not specifically address the requirements of ASME Section III pertaining to heat treated tensile strength and the minimum required impact test values. As a result, the test reports had not been reviewed against the applicable code requirements. Discrepancy Report QA-Misc-081 was issued and the welding filler metal test reports were reviewed against the applicable Code requirements. Subsequent reviews by Hunter and the NRC CAT inspectors did not reveal any unacceptable material.

(2) Nondestructive Examination Activities

In general, the inspected NDE activities were found to comply with the applicable codes and specifications. However, during the review of the radiographic film some minor irregularities were identified which involved the following five welds:

- Three Field Welds, P-1A-275FW14, CU-28FW2846 and OG-60-1 FW563 had one set of film and each film had artifacts in the area of interest. These conditions were not identified on the reader sheet by the interpreter or the S&L reviewer. The welds were re-radiographed and the weld quality was determined to be acceptable.

- Field Weld RH-13FW135 station 30 had a linear indication. This was not recorded on the reader sheet. The weld was re-radiographed and the indication was determined to be an acceptable root surface condition.

- Shop Weld SI-43-2 Weld 4, contained some views which were identified as being Weld 6. In other cases Weld 6 was crossed out and Weld 4 written instead. The dates on the weld 6 views did not correspond with the reader sheet dates and there was no explanation on the reader sheet to identify the correct status of the weld. After careful comparison of indications and film marks on a film-by-film basis, it was determined that the correct weld was radiographed in its entirety and there were no rejectable indications in the area of interest.

One ultrasonic (UT) procedure QC-UT-1 did not state how the inspector was to perform UT thickness calibrations. Section V of the ASME Code paragraph T-561 states that "The instrument shall be calibrated on a block of the same material and product form as the material to be measured." The procedure did not incorporate this Code requirement. However, the NDE manager stated that they do verify the calibration using the same material and product form as the material to be measured. The manager also stated that the procedure will be revised to incorporate this requirement.

c. Conclusions

(1) Welding Activities

In general, the inspected welding activities were found to comply with the requirements of the applicable codes and specifications. However, the NRC CAT found structural welds on pipe supports and pipe whip restraints which did not meet the weld specifications. The conditions were evaluated by S&L and determined to be adequate for the intended application.

(2) Nondestructive Examination

In general, the inspected NDE activities were found to comply with the requirements of the governing codes and specifications. However, the NRC CAT inspectors found some film (1 weld) which was misidentified. Other film (3 welds) had artifacts in the area of interest and the readers sheets did not record these conditions. One weld has a linear indication not noted on the reader sheet.

2. Reactor Internals Modification and Installation

a. Inspection Scope

Approximately 25 welds on the improved rod cluster control guide tubes were visually inspected. The welds and documentation packages for the lower internals storage rack modifications were also reviewed. In addition, one welding procedure and the qualification test records for two welders were also reviewed for adequacy. The modification work was performed by NISCo.

b. Inspection Findings and Conclusions

No problems were identified in the area of inspected welding activities. Activities were found to meet the specified acceptance criteria.

3. Preservice Inspection (PSI)

a. Inspection Scope

Approximately 20 welds requiring preservice and inservice inspections were visually inspected (VT) in order to verify compliance with the requirements of Section XI of the ASME Code. Four of those welds were also ultrasonically (UT) and liquid penetrant (LP) examined using the applicable project NDE procedures. Two closure plates and 2 welds were LP and VT examined in accordance with the original preservice requirements. In addition, the qualification test records for four NDE technicians were reviewed and 4 technicians were observed while performing UT and PT inspections. Three NDE procedures and 15 equipment calibration records were reviewed for adequacy. The NRC CAT inspectors also examined 30 thickness check reports and witnessed the performance of thickness measurements. The calibration of UT equipment for thickness measurements was also reviewed and witnessed. The preservice inspections were performed by Ebasco.

b. Inspection Findings

During the review of the Ebasco's UT thickness verification procedure, it was noted that the equipment is calibrated using a IIW Block. The IIW block (standard industry block) did not have any identification, therefore, it was not possible to determine the material and product form of the block. Section V of the ASME Code requirement T-561 states that: "The instrument shall be

calibrated on a block of the same material and product form as the material to be measured." As a result of this finding Ebasco inspected the block by applying a magnet and determined that the block is made from an austenetic stainless steel material.

Twenty (20) thickness reports were also reviewed. The review revealed that the tested pipes had 20 to 30 percent thicker pipe wall thickness that the minimum required design thickness. The thickness examinations are not an ASME Section XI requirement and the project performs these thickness checks as an additional verification of the minimum design thickness.

c. Conclusions

No problems were identified in the inspected preservice inspection activities. Activities were found to comply with the requirements of the governing codes and specifications.

4. Electrical Installation and Electrical Supports

a. Inspection Scope

The NRC CAT inspectors reviewed approximately 180 field and 50 shop welds in the area of electrical installation. Three welding procedures and the qualification test records for seven welders were reviewed. In addition, the personnel qualification test records for four welding inspectors were also reviewed and two inspectors were observed and evaluated for their ability to follow the visual inspection procedures. The welding activities in the electrical area were performed by Hatfield Electric Company.

b. Inspection Findings

During the inspection of hanger H543 no weld detail drawing was found for the installed type of weld attachment. In addition, the weld joining the angle iron to the Tee shape section was found to have lack of fusion and insufficient throat. As a result of this finding NCR 1687 was issued and the weld detail was found to be acceptable.

The review of radiographic film for welder qualification testing revealed that the film for welder stamp #LG did not meet the requirements of the AWS D1.1, Structural Welding Code. Further examination of QC records established that this welder has welded a total of 18 hangers. The NRC CAT inspectors reinspected seven of these hangers and the licensee reinspected all 18 hangers. The inspected welds were found to be of acceptable quality.

c. Conclusions

With the exception of the minor discrepancies of one hanger and one welder qualification radiograph the inspected activities were found to comply with the applicable construction codes and specifications.

5. Instrumentation Tubing Installation and Instrumentation Supports

a. Inspection Scope

Approximately 120 welds involving 18 instrumentation supports, 2 panels, and 30 tubing welds were visually inspected to ascertain compliance with the specified acceptance criteria. Seven welding procedures and qualification test records for seven welders were reviewed. NDE procedures and qualification records for five NDE inspectors were also reviewed. Two visual welding inspectors and one liquid penetrant inspector were observed and evaluated for their ability to follow the applicable inspection procedures. The welding in the instrumentation area was performed by Powers-Azco-Pope (PAP).

b. Inspection Findings and Conclusions

No deficiencies were identified in the area of instrumentation welding and NDE activities. Activities were found to comply with the applicable construction codes and specifications.

6. Heating, Ventilating and Air Conditioning Installation and Supports

a. Inspection Scope

Approximately 140 welds involving 16 supports were inspected for compliance with the specified acceptance criteria. Three welding procedures and the qualification test records for six welders were reviewed. In addition, four personnel qualification test records were also reviewed and two welding inspectors were observed and evaluated for their ability to follow the visual inspection procedures. The welds on eight duct pieces, two air blowers, one air filter and four dampers were also included in this inspection. The welding in the HVAC area was performed by Reliable Sheet Metal (RSM).

b. Inspection Findings

During the inspection of duct piece M1285-4-44 a burn-through the duct was observed near the welded joint between the duct and the duct companion flange. As a result of this finding, RSM issued Discrepancy Report (DR) #M1285-4-7689 and the duct was repaired. On duct piece M1287-4-C-10 a three sided stiffener was found to be installed with staggered stitch welds 1 inch long on 11 inch centers instead of the required 1 inch long on 9 inch centers as specified on design drawings. As a result, DR #M1287-4-T690 was written and a four sided stiffener was added to correct the deficiency. It should be noted that both of these items had not been subjected to the Type 2 inspection which is performed by RSM after the first line QC inspection is completed.

The NRC CAT inspectors identified auxiliary tube steel welded connections on eight hangers to be deficient with respect to the

specified acceptance criteria. The eight hangers and their associated welding deficiencies are listed below:

- Hanger H3824 - Undersized weld was found on the section end of the east clip to the tube steel connection.
- Hanger H3827 - Clip to tube steel weld was found to be undersized.
- Hanger H3749 - The return welds were found to be undersized.
- Hanger H3820 - The return welds and the top east weld to clip were found to be undersized.
- Hanger H3856 - East side of the auxiliary steel to clip weld was found to be undersized.
- Hanger H3652 - Top weld on east end clip to tube steel and the top return weld on the north clip were found to be undersized.
- Hanger H3754 - Vertical weld and top and bottom welds on tube steel were found to be undersized.
- Hanger H3753 - Clip to tube steel welds and north auxiliary steel return were found to be undersized.

As a result of these findings, RSM issued NCR 118. The deficiencies were reviewed by S&L and found to be adequate for the intended application. See Section III of this report for additional details.

c. Conclusions

With the exception of the findings (burn-through duct in one isolated case, deficient stitch welds and undersized welds in auxiliary steel connections) the inspected welding activities were found to comply with the applicable codes and specifications. The undersized welds on auxiliary steel has been reviewed and been found acceptable by S&L.

7. Structural Steel Fabrication, Erection and Modification

a. Inspection Scope

Approximately 120 welds comprising 70 field and 50 shop welds involving 21 structural beams were visually inspected in order to ascertain compliance with the specified acceptance criteria.

Five welding procedures and the qualification test records for six welders were reviewed. Visual inspection procedures and the qualification test records for four inspectors were also reviewed. Two welding inspectors were observed and evaluated for their ability to follow the visual inspection procedures. The structural steel field welding was performed by Blount Brothers. American Bridge and Inland Steel Company supplied the structural steel to the project.

b. Inspection Findings

No problems were identified in the area of inspected welding activities involving the modification of structural steel. However, several original welds involving clip to beam web connection welds were found to be deficient. Specifically, the design drawings required fillet welds all around, while the connection was seal welded on the top and bottom of the clip angle due to coping of the beam web. The deficient connections are identified as follows: North end of beam A457B8; West end of beam A457B5; South end of beam 499B2; and West end of Beam B482. The connection on the left end of beam 43501 was found to be undersized with respect to the specified sizes on the design drawings. These welds were completed by American Bridge.

As a result of these findings Discrepancy Reports Q3-946 and Q3-947 were issued. The deficiencies were reviewed by S&L and determined to be adequate for the intended application.

c. Conclusions

With the exception of the undersized clip angle to web welds the inspected welding activities were found to comply with the specified requirements. The undersized welds were reviewed by S&L and determined to be adequate for the intended application.

8. Refueling Cavity Liner Fabrication

a. Inspection Scope

The NRC CAT inspectors visually inspected approximately 60 feet of welded seam and 12 slot welds on the Reactor Pool Liner. The attachment welds for six brackets and the welds on the reactor vessel head guide pin rack drive shaft tool brackets were also inspected in order to ascertain compliance with the specified acceptance criteria. Two welding procedures and 3 welder qualification test records were reviewed for adequacy. In the area of NDE the NRC CAT reviewed the radiographs for 27 spot welds involving 54 film. The Refueling Cavity Liner fabrication was completed by Pittsburgh Des Moines Corporation (PDM).

b. Inspection Findings and Conclusions

No discrepancies were identified in the areas of inspected welding and NDE activities. Activities were found to comply with the applicable construction codes and specifications.

9. Fire Protection System Fabrication and Installation

a. Inspection Scope

Approximately 60 welds involving 10 pipe supports and 15 pipe welds involving 2 pipe spools were visually inspected. One welding

procedure and the qualification test records for two welders were also reviewed for adequacy. One Engineering Change Notice (ECN 247916) was reviewed for adequacy. This ECN pertained to increase of weld sizes on support 2FP2045X. The fire protection installation was completed by Hunter.

b. Inspection Findings and Conclusions

No deficiencies were identified in the area of inspected welding and NDE activities. Activities were found to comply with the governing construction codes and specifications.

10. Containment Liner and Containment Penetration Installation

a. Inspection Scope

The NRC CAT inspectors visually inspected approximately 40 feet of liner seam, welds on two pad plates, the attachment welds for one Emergency Air Lock, the welds on an construction opening, and the attachment welds for two mechanical and two electrical penetrations. Two welding procedures and the qualification test records for two welders were also reviewed. In the area of NDE, the NRC CAT reviewed the radiographs for 197 feet of welded seam which involved 349 film. One radiographic examination procedure was also reviewed as a part of this inspection. The containment liner and penetrations were installed by Chicago Bridge and Iron (CB&I).

b. Inspection Findings

No problems were identified in the area of inspected welding activities. However, during the review of radiographs the NRC CAT inspectors identified welds which did not meet the required weld quality. The welds and their associated deficiencies are listed as follows:

- Weld (92-A)-(92-1) had a crack at the end of the weld near station 0. This was not noted on the reader sheet.

- Weld 46-4-11 to 46-12-1 had a rejectable linear indication. The indication appeared on film RS3 and was not recorded on the reader sheet. The reader sheet recorded RS2 as being the final repair shot for the weld.

c. Conclusions

In general, the inspected welding and NDE activities were found to comply with the governing codes and specifications. However, two welds were found to contain unacceptable indications. As a result of this finding, the applicant has committed to review and evaluate this item.

11. Vendors and Shop Fabricators Other Than Those Previously Addressed

a. Inspection Scope

The NRC CAT inspectors visually inspected six vendor supplied tanks and heat exchangers (See Table IV-5). In addition to the welds inspected and listed in Table IV-5, the NRC CAT inspectors reviewed radiographs related to work performed by 28 vendors which have supplied various equipment and hardware to the Byron Power Station project. A total of 350 feet of welded seam involving 889 radiographs and 28 welds involving 245 film were reviewed. The radiographs for 19 valves and pumps involving 304 film, and the radiographs for 60 spot welds involving 93 film were also reviewed for compliance with the governing codes and specifications (See Table IV-6).

b. Inspection Findings

During the inspection of tanks and heat exchangers supplied by the vendors listed in Table IV-5, the NRC CAT inspectors found that the size of the nozzle and manway weld reinforcement did not meet the requirements stated in the vendor drawings. In addition, the welds on some of the inspected supports were also found to be undersized. A total of six tanks and heat exchangers were found to deviate from the required drawing sizes. See Table IV-5 for details. The NRC has issued Information Notice 85-33 on the subject of undersized weld reinforcement in ASME Code nozzle to shell joints. As a result of the Information Notice, the licensee had inspected the nozzle welds on ten pressure vessels and tanks prior to this inspection. Undersized weld reinforcement on the nozzle to shell welds were identified on the ten tanks. The licensee issued NCRs on this issue. It was identified that some of these welds violate ASME Code requirements for minimum size of welds.

In the area of NDE, the NRC CAT inspectors identified deficiencies relating to NDE documentation and radiographs supplied by vendors. Specifically, unacceptable indications were found in radiographs supplied by ITT Grinnell (one weld), Graver (one weld), Phillips Steel (two welds), and Teledyne Brown (one weld). Irregularities with the NDE documentation were noted in the documentation supplied by G&W Energy, Continental Boiler, Cleaver Brooks and Harnischfeger Corporation. See Table IV-6 for details. In addition, the film for the Component Cooling Surge Tank (2CC01T) and the Volume Control tank (2CV01T) which were stored by Westinghouse were not available to the NRC CAT inspectors for review during the inspection period. This indicates a lack of retrievability for ASME documentation.

c. Conclusions

In general, the inspected welding and NDE activities were found to comply with the requirements of the governing codes and specifications. However, six tanks and heat exchangers were found to deviate from the requirements stated in the applicable drawings and specifications. In addition, the radiographs and NDE documentation

supplied by vendors were found to be deficient with respect to the required quality. The film for two components supplied by Westinghouse were not provided during the inspection period.

TABLE IV-1

LIST OF SUPPORTS WHICH WERE INSPECTED AGAINST DRAWING REQUIREMENTS

2SI03001X	2SI13020X	2CC22004X
2SI42001X	2SI23003X	2RH02073X
2CC19018X	2CV03009S	2SI03025V
2RY06015S	2SI09006X	2RH02050X (6)
2SI03041X	2CC23009X	2RH02069X
2SI26010X	2CC19013X (1)	2W002014X
2FW05018X	2RY09086S	2FW03012S
2SI16020X	2FW03008X	2RH02027X
2W003003X	2MS03079S	2SX08037X
2SI06261X	2SI06258X	2CS06033A
2SI06263X	2SI06262X	2CS03A099X
2CS104014A	2SI06238X	2CS08020X
2SI06241X	2SI06236X	2CS01200X
2CV47044A	2CV74004X	2SI03011X (6)
2SI9R555B (2) (a)	MS-P16 (a)	RC-4-4 (3) (a)
RY-7 (4) (a)	2SI13R-655B (5) (a)	

NOTES:

(1) Two fillet welds 1/2" short on length along web of W-section. Discrepancy Report DR-QC-2CC19003. See Section II of this report for additional discussion.

(2) Ten welds undersized by more then 1/8". Whip restraint deleted prior to CAT inspection by Westinghouse.

(3) Four welds 1/16" undersized one leg. NCR 1131.

(4) Three 3/8" fillet welds undersized by 1/16" and short 3/8" on length. NCR 1133.

(5) Nine welds undersized on one leg by as much as 3/8". NCR 1132.

(6) Pipe not in full contact with contoured tube steel saddle.

(a) Pipe Whip Restraints - shop welds only.

TABLE IV-2

SUPPORTS WHICH WERE VISUALLY INSPECTED

2CV74005	2CV7400X	2CV16034V
CV28003X	CV16033S	2SI30A029X
2SI30A003X	2FP02055X	FW93E010A
2SI03042X	2CV47079R	2RH20011X
2RH20010X	2RH10000G	2FW08022X
2MS01079S	2MS01074S	2MS01205X
2MS01206X	2MS05002C	2MS05001X
2MS05006R		

TABLE IV-3

LIST OF PIPING WHICH WAS VISUALLY INSPECTED

ITEM	DESCRIPTION	PIPE SIZE (IN.)	MATERIAL
2CV-44-2	Chemical Volume Control	3	Stainless Steel
2RC-16-2	Reactor Coolant	3	Stainless Steel
2FC-24-2	Fuel Pool Cooling	4	Stainless Steel
2RC-19-2	Reactor Coolant	4	Stainless Steel
2RC-0010231-1A	Reactor Coolant	2	Stainless Steel
2RC-51-1	Reactor Coolant	3	Stainless Steel
2SI-37-3	Safety Injection	18, 24	Stainless Steel
2RH-9-4	Residual Heat Removal	14	Stainless Steel
2CS-18-3	Containment Spray	12, 16	Stainless Steel
2CS-17-2	Containment Spray	18	Stainless Steel
2CS-17-4	Containment Spray	14, 16, 18	Stainless Steel
2RH-14-4	Residual Heat Removal	8	Stainless Steel
2CV-17-4	Chemical Volume Control	8	Stainless Steel
S-CV-100-241	Chemical Volume Control	2	Stainless Steel
S-CV-100-242	Chemical Volume Control	2	Stainless Steel
S-CV-100-243	Chemical Volume Control	2	Stainless Steel
2SX-20-5	Essential Service Water	6	Carbon Steel
2SI-56-4	Safety Injection	3	Stainless Steel
2SI-37-2	Safety Injection	24	Stainless Steel
2SI-40-1	Safety Injection	8	Stainless Steel
2RC-13-3	Reactor Coolant	4	Stainless Steel
2FC-21-2	Fuel Pool Cooling	4	Stainless Steel
2RE-13-7	Containment Equipment Drain	4	Stainless Steel
2SI-32-3	Safety Injection	12	Stainless Steel
2RH-10-8	Residual Heat Removal	4	Stainless Steel
2RH-10-7	Residual Heat Removal	8	Stainless Steel
2RH-10-5	Residual Heat Removal	8	Stainless Steel

TABLE IV-4

PORTIONS OF PIPING SYSTEMS VISUALLY EXAMINED AND FOR WHICH DOCUMENTATION WAS REVIEWED

ITEM	DESCRIPTION	PIPE SIZE (IN.)	MATERIAL
2MS-60-1	Main Steam	30	Carbon Steel
2MS-60-2	Main Steam	30	Carbon Steel
2MS-60-3	Main Steam	30	Carbon Steel
2MS-60-4	Main Steam	30	Carbon Steel
2MS-60-5	Main Steam	30, 12, 4	Carbon Steel
2MS-60-6	Main Steam	28	Carbon Steel
2MS-60-7	Main Steam	28, 6	Carbon Steel
2MS-60-8	Main Steam	8	Carbon Steel
2MS-60-9	Main Steam	8	Carbon Steel
2PC-78	Main Steam Penetration	30, 42	Carbon Steel
2FW-25-7	Feedwater	16	Carbon Steel
2FW-25-6	Feedwater	16	Carbon Steel
2FW-25-5	Feedwater	16	Carbon Steel
2FW-25-4	Feedwater	16	Carbon Steel
2CS-17-1	Containment Spray	16	Stainless Steel
2CS-17-2	Containment Spray	16	Stainless Steel
2CS-17-3	Containment Spray	16	Stainless Steel
2CS-17-4	Containment Spray	6, 14, 16	Stainless Steel
2CS-17-5	Containment Spray	14	Stainless Steel
2CS-16-1	Containment Spray	10, 8	Stainless Steel
2CS-16-2	Containment Spray	10	Stainless Steel
2CS-16-3	Containment Spray	10	Stainless Steel
2CS-16-4	Containment Spray	10	Stainless Steel
2CS-16-5	Containment Spray	10	Stainless Steel

TABLE IV-5

TANKS AND HEAT EXCHANGERS WHICH WERE VISUALLY INSPECTED

ITEM	MANUFACTURER
Accumulator Tank 2SI04TA (1)	Southwest Fabricating and Welding
Letdown Heat Exchanger 2CV01AA (2)	Atlas Industrial Manufacturing
Volume Control Tank 2CV01T (3)	Lamco Industries, Inc.
Component Cooling Surge Tank 2CC01T (4)	Westinghouse Corporation
Spray Additive Tank 2CS01T (5)	Graver Tank Company
Fuel Oil Day Storage Tank 2D001TA (6)	Chicago Bridge and Iron Company

(1) Bolting ring fillet weld 1/16" undersized on one leg. NCR-1148

(2) One nozzle reinforcing fillet weld 1/8" undersized. NCR-1148

(3) One nozzle reinforcing fillet weld size 1/16", 1/4" required. NCR-994.

(4) Manway fillet welds undersized, nozzle welds undersized, saddle and stiffening ring fillet welds undersized. NCR-994.

(5) Support leg fillet welds undersized. NCR-996.

(6) Bolting ring to tank fillet weld 1/16" undersized, stiffener fillets intermittently undersized, and two nozzle reinforcing fillets undersized. NCR-1148

TABLE IV-6

VENDOR RADIOGRAPHS REVIEWED

Contractor	Welds	Valve Pumps	Spot Welds	Feet of Welds	Film	Notes
G&W Energy Products	5				56	(1)
TRW Mission Manufacturing		8			48	
Anchor Darling		2			55	
Farr Company				7	94	
Continental Boiler			8		8	(2)
McQual Perfex			5		12	
Pall Trinity	2				28	
ACF Industries		1			20	
Jamesbury Corp.		2			19	
Cleaver Brooks				42	36	(3)
Graver Corp.				75	180	(4)
Yuba				59	120	
Harnischfeger				19	63	(5)
Dresser Industries				11	44	
Bingham Willamette		1			62	
Manning Lewis			1		1	
Cooper-Bessemer			4		4	
Carrier Corp.			9		9	
Greer Hydraulics				8	32	
ITT Grinnell				5	8	(6)
W. J. Wooley	13				48	
Atlas Industrial				28	108	
Plant Mangement Corp.			5		5	

TABLE IV-6 - (Continued)

VENDOR RADIOGRAPHS REVIEWED

Contractor	Welds	Valve Pumps	Spot Welds	Feet of Welds	Film	Notes
Phillips Steel			27		54	(7)
Borg Warner		5			100	
Teledyne Brown				96	204	(8)
Rockwell International	5				71	
Aerojet Energy	3				42	

NOTE

(1) The film packet for one of the welds which should have contained film for five intervals, contained film for only two intervals. The missing film for the other three intervals was later found and was reviewed with no problems identified.

(2) The reader sheets with the film indicated that this film was for Braidwood components. Further investigation of documentation indicated that the items had originally been scheduled for Braidwood but had later been transferred to Byron.

(3) Reader sheets for weld WT 8549-64 were not in that packet but were found in film packet for weld WT 2158-64.

(4) Circumferential seam 1A1-6 showed added weld metal on interval A-B dated June 20, 1977, however the added metal does not show in interval M-A dated June 23, 1977. CECo reviewed the film and returned it supposedly in proper order. However due to two different identifications on the film, it was impossible to tell whether one or two welds were represented by these film. Subsequently, CECo determined that the film actually were from only one weld, and that further repair in the M-A interval accounted for the difference in appearance of the two weld intervals.

On weld 1A1-1 (Job 2) interval 11-12 a linear indication, possibly a crack, was noted. CECo then did an ultrasonic examination of the area. However, the performed examination was a longitudinal examination and is not acceptable for this type and location of indication. An NCR is being written. This indication is in vessel 1C80IT (Byron 1).

In vessel H1 tank 2 weld 3A1-1 interval F-G at the end of the seam in the transverse weld, an indication was noted. However, when the film of the transverse weld were located they showed no indication of a problem in the area mentioned.

TABLE IV-6 - (Continued)

VENDOR RADIOGRAPHS REVIEWED

NOTES:

(5) When the film was submitted, the reader sheets were so faint that it was impossible to read them. Subsequently, the original sheets in the QA file were produced and the film was read. No problems were noted.

(6) A 3/8 inch slag line was noted in the 2-3 interval. After reviewing the receiving and issuing documents, it was determined that the item had never been issued to the job for installation.

(7) Area 3255-A OWX10D had a linear indication on each of the junction welds. Area 3244-A-2V2 OWX07 TV2 had the penetrameter shim into the area of interest.

(8) 4901-9, weld 147 A-B, had an unacceptable slag line at station A and the belt numbers appears to be inside the area of interest. Six welds did not have full coverage. The welds were identified as: 4901-9, - weld 103 G-H, weld 116 A-B, weld 160 G-H; 4901-10 - welds 147 A-B and 160 G-H; and 4902, weld 75 B-C. Item 4901-1D, weld 103 G-H, also did not have full coverage and there was a linear indication extending into the uncovered area.

V. CIVIL AND STRUCTURAL CONSTRUCTION

A. Objective

The objective of the appraisal of civil and structural construction was to determine by evaluation and review of Quality Control (QC) accepted work and documentation whether civil and structural construction areas were completed in accordance with regulatory requirements, Safety Analysis Report commitments, and project specifications, drawings and procedures.

B. Discussion

The specific areas of civil and structural construction evaluated were structural steel installation, high strength bolting for structural steel connections and Nuclear Steam Supply System (NSSS) support connections, general concrete surface quality, cadwelds, concrete placements, concrete expansion anchor (CEA) qualification report, masonry and containment prestressed, post-tensioned tendons.

A physical or hardware inspection and a review of QC documentation and field procedures were conducted for the following activities: structural steel installation, high strength bolting for structural steel connections and NSSS support connections, general concrete surface quality, masonry and containment prestressed post-tensioned tendons. For concrete expansion anchors, cadwelds, and concrete placement, this portion of the NRC Construction Appraisal Team (CAT) review was limited to a review of QC documentation and field procedures. The qualification report for CEAs was also reviewed. The installation of concrete expansion anchors was also reviewed in the mechanical and electrical construction areas (see Sections II and III).

1. Structural Steel Inspection

a. Inspection Scope

Installed and QC accepted structural steel were inspected by the NRC CAT. Attributes inspected were member size, configuration, and bolted connections. For bolted connections, both friction and sliding connections were tested by using a calibrated torque wrench to determine whether the bolts had proper pretension.

The sample used in the structural steel verification for correct member size and configuration is described in Table V-1. A total of 85 structural steel members and 38 connections were inspected.

High strength bolting for structural steel connections and NSSS support connections which were checked for pretension are shown in Tables V-2 and V-3a, respectively. A total of 699 high strength bolts were tested for proper pretension. These included 7/8 inch diameter A325 and 1 inch and 1 1/8 inch diameter A490 bolts. As a result of NRC CAT inspection findings, the licensee inspected additional A490 bolts for structural steel connections and NSSS support connections (See Table V-3b). The A325 bolts were sampled from structural steel connections. Test torque values were obtained

by using a Skidmore Wilhelm tension tester to establish the proper torque-tension relationship. In addition, a total of 62 bolts sampled from 17 sliding connections were checked for installation torque.

The requirements and acceptance criteria for structural steel installation are included in the drawings listed in Table V-4 and in the following specifications and procedures:

- Blount Brothers QA/QC Work Procedures #21, "Structural Steel Fabrication, Repair, Modification and Erection," Rev. 16, May 8, 1984.
- Powers-Azco-Pope Procedure No. FP-21, "Bolted Connections," Rev. 2, June 17, 1983.
- Hunter Corporation Site Implementation Procedure #4.001, "Bolted Connections," Rev. #2, May 26, 1983.
- Pittsburgh Testing Laboratory Procedure No. QC-SR-1, "Structural Steel Inspection," Rev. #2, July 24, 1984.

b. Inspection Findings

For the 85 structural steel members and 38 connections, no significant hardware deficiencies were identified. There were seven minor design drawing or hardware discrepancies. However, none of these resulted in a significant hardware deficiency and were evaluated to be acceptable in the installed condition. These findings are described below.

The seven minor design drawing or hardware discrepancies were:

1. Design drawing (S-1015, Rev. AJ) showed a W14x90 was to be used for the radial beam (Modification No.94204) at radial line R42 of the Containment Unit 2 Building. However, a W14x78 was actually installed. Apparently, the original design drawing specified a W14x78 which was not available at the time of installation. Field Change Request (FCR) 696 was issued to allow the use of a W14x90 (which was readily available) instead of the W14x78 originally specified. A change to the design drawing to reflect the FCR was done. Following this, a W14x78 became available and was subsequently installed as originally intended. FCR 696 was voided, but followup was not done to revise the design drawing to show the installed W14x78. There was no hardware deficiency.

2. Design drawings incorrectly showed the left connection of Beam No. 94203 as Detail 2329-17 only. Based on comments from the NRC CAT inspectors, FCR 44354 was issued to correctly describe the actual connection as Detail 3 and Detail X on Drawing S-2228 and Detail 2329-17. There was no hardware deficiency.

3. Beam No. 3.6AB1012N-2 had four abandoned flame-cut holes in the bottom flange at about mid-span. These four holes had not been identified previously. Deviation Report (DR) 949 was issued to correct this deficiency. The resolution was to plug weld the holes.

4. The top connection of the double angle brace to Beam No. 5AB1026N was to be a 10 bolt connection, but only 8 bolts were installed. The missing two bolts had not been identified previously. DR #Q3-951 was subsequently issued. Sargent and Lundy Engineers (S&L) evaluated the existing condition to be acceptable as-is; however, the 2 bolts missing would be installed.

5. The brace to column connection directly below Beam 8.6AB235 at elevation 467 was installed with four bolts in a six bolt connection and welded where the bolts had not been installed. Previously, FCR F-41049 had identified the as-built condition and was acceptable as-is. However, the FCR was not clearly incorporated onto the design drawing. The as-built condition (correctly shown on the FCR) was welded across the top 1 inch on both corners of the plate. However, on the design drawing it appears that the weld is to be across the entire top side of the plate.

6. The right end connection of Beam 8.6AB218R had been welded in lieu of bolted. However, the design drawings showed the connection as bolted. This condition was not identified previously. FCR F-44359 was issued to document the as-built condition on the design drawing. There was no hardware deficiency.

7. Beam 3.6AB1102N had a cope in the bottom side of the flange which did not meet the American Institute of Steel Construction (AISC) requirements for minimum 1/2 inch radius. Deviation Report for Correctable Items (DRC) No. 2C-374-23 was then issued to repair this condition to meet the AISC requirements.

It was noted that the licensee had previously identified similar deficiencies as described above in the Quality Control Structural Steel Review (QCSSR) Program and in the resolution of NCR F-743 (reportable deficiency 82-08).

For the installed torque inspection of 7/8 inch diameter A325 bolts, 294 and 185 bolts were sampled from the Containment Unit 2 and Auxiliary Building, respectively. Of these, 15 had been installed at torques significantly below the inspection torque values. Six (5-Containment and 1-Auxiliary Building) were installed with zero torque. In addition, two 7/8 inch diameter A307 bolts were used in a connection which should have been A325 bolts. See Table V-2.

For the inspection of 1 1/8 inch diameter A490 bolts, 112 bolts in the Containment Unit 2 were inspected. Of these, 36 (approximately 32%) were determined to be at torque levels significantly below the inspection torque value. It was determined by S&L that

there are 29 connections requiring tension in the bolts to transfer axial loads. The licensee field tested the bolts on 25 of the 29 connections. The remaining four connections were determined to be inaccessible. It was determined that 95 out of 228 (approximately 42%) bolts tested were significantly below the inspection torque. The lowest average torque value in a connection was 67% less than the average inspection torque. See Table V-2.

For the 1 inch diameter A490 bolt inspection, 208 bolts were sampled from NSSS support connections. Of these, 49 (approximately 23%) were at torque levels significantly below the inspection torque value. The licensee field tested 56 additional bolts of the NSSS support connections. It was determined that 20 (approximately 36%) were at torque levels significantly below the inspection torque. See Table V-3a, b.

S&L design drawings allow the substitution of M4x13 structural steel sections for W4x13 structural steel sections for pipe supports. The resulting vertical weld configuration shown on the design documents for the M section is shorter than that for the original W section. The licensee indicated that a review would be conducted to show that this substitution would not cause an overstress condition.

The sliding connections were generally found to be acceptable. A few bolts were found to be installed at torque values below 50 ft-lbs. Installation requirements at the time of inspection specified the bolts be installed between 50 and 100 ft-lbs.

c. Conclusion

In general, structural steel installation was found acceptable. Although several design drawing and hardware discrepancies were identified, they were considered isolated cases and did not significantly affect the installed hardware. A significant number of bolted connections were found by the NRC CAT inspectors to be below inspection torque levels indicating less tension in the bolts than specified by the American Institute of Steel Construction (AISC).

The sliding connections were found to be acceptable.

2. Reinforced Concrete Construction

a. Inspection Scope

Reinforced concrete construction areas inspected were general surface quality, cadweld documentation, concrete pour packages and the qualification report for the wedge type concrete expansion anchors (CEAs). General concrete quality was examined from surrounding areas of completed concrete construction for conformance to site specifications.

Cadweld documentation covering the initial site cadweld splicing production performed by Delta-Delta Midstates were reviewed. Cadweld documentation was also reviewed for the period covering June

11, 1980 thru July 31, 1980, performed by Blount Brothers Corporation.

The qualification records for eight cadwelders of Delta-Delta Midstates were reviewed. The records showed proper qualification of cadwelders by visual and tensile testing in each position and bar size.

The following cadweld records or QC documentation were reviewed:

- "Sample Selection Log"
- "Requests for Sister Splices T-Vertical"
- "Tensile and Visual Reports for Samples U-I"
- "Cadweld History T-Horizontal," thru December 31, 1977.
- "Cadwelding Cadweld History."

Nine concrete pour packages were reviewed. A list of those reviewed is provided in Table V-5. Records reviewed and associated with the concrete placements were field concrete control log sheets, concrete placement checkout sheets, quality control report preplacement checklists, quality control report surveillance of concrete placement and compression tests of 6x12 inch concrete cylinders. The records were checked for adequate completion by the QC inspectors, the existence of senior QC inspectors' signature for evaluation of completed forms, and acceptable coverage of attributes by the documentation.

The following qualification test report for the wedge type CEAs was reviewed:

- Summary Report-Static, Dynamic and Relaxation Testing of Expansion Anchors in Response to Bulletin 79-02, July 20, 1981.

The requirements and acceptance criteria for reinforced concrete construction are contained in the following drawing, specifications, and procedures:

- Drawing S-693, Rev. AF, "Auxiliary Building Floor Framing Plan El. 383 ft-0 inches Area 6."
- BY/BR/MCS, "Specification for Making and Inspecting Mechanical (Cadweld) Splices," Rev. 7, July 5, 1978."
- BY/BR/CEA, "BY/BR Standard Specification for Concrete Expansion Anchor Work Byron Units 1 and 2 and Braidwood Units 1 and 2."
- CECo Specification F/L-2722, "General Structures Work," Rev. 41, June 21, 1985.

b. Inspection Findings

General concrete surface quality was found to be acceptable. Concrete openings were being recorded on a Miscellaneous Opening Identification Walkdown computer log. No concrete opening or chip out was identified by the NRC CAT that was not either recorded on the miscellaneous opening computer log or field repaired with backup engineering evaluation by S&L.

QC documentation kept for cadweld splicing production by Delta-Delta Midstates did not clearly show that Part B.2.3.4 of the FSAR was met for tensile testing frequency. As a result, the licensee committed to reconstruct the tensile testing sequence of each cadweld operator to verify that the FSAR commitments were met.

Cadweld records provided for cadweld splices performed by Blount Brothers Corporation from June 11, 1980 to July 31, 1980 indicated that the tensile testing requirements were met.

The concrete pour packages reviewed were found to meet FSAR, specification and procedure requirements. Proper QC inspection attributes were listed in the documentation.

The NRC CAT identified that in some cases for oversized holes in pipe support base plates, washers were not required by procedures to be welded to the base plate. These support assemblies rely on the induced friction between the mounted plates and concrete surface to prevent lateral movement of the pipe support. Tensile preload in the CEAs is critical for these supports. Neither the CEA qualification test report nor other documents provided by S&L provided a correlation between tensile preload in the CEAs and installed torque or the amount of residual tension in the CEA with time.

The torque to preload relationship was determined using the Marks Engineering Handbook formula using a coefficient of friction of 0.3 and a correlation was made with test results from another site. However, this does not adequately demonstrate that the residual tension in the CEAs installed at Byron is sufficient to prevent excessive pipe support movement. Using the formulas in the Marks Engineering Handbook with a low coefficient of friction will yield results that may not be conservative. The coefficient of friction for steel on steel can be as high as 0.8. The preloads calculated using this coefficient would not be conservative.

In the CEA qualifications test report the embedment depth of the concrete expansion bolts was measured from the bottom of the wedge to the face of the concrete. Site QC inspectors, however, measure the embedment depth from the bottom of the anchor to the face of the concrete. The difference between these measurements is approximately one anchor bolt diameter. As a result, for all size CEAs except the 1/4 inch diameter ones, the embedment depth could be seven diameters instead of the eight diameters required by the qualification report. For the 1/4 inch diameter CEAs the embedment depth could be 2.25 diameters instead of the six diameters required

by the qualification report. It appears that design requirements were not properly translated into installation and inspection procedures.

c. Conclusions

General concrete surface quality and concrete pour packages were found to be acceptable. The licensee has committed to reconstruct the cadweld records to verify conformance to FSAR, specification and procedure requirements for those performed by Delta-Delta Midstates.

The licensee has not demonstrated that the installation torque for CEAs will produce adequate preload in the bolt when installed in materials similar to those used on site.

It appears that the CEA embedment depth was not measured conservatively especially with the smaller anchors (i.e., 1/4 inch diameter). An evaluation of site practice and inspection methods should be made to ensure that the embedment depths are consistent with the qualification report.

3. Masonry Wall Construction

a. Inspection Scope

Masonry wall construction activities reviewed included controlling procedures, specifications, and inspection of installed masonry walls. For the installed masonry walls, the inspection concentrated on exterior column modifications. The masonry work reviewed was in the Auxiliary Building and included 4 column modifications and the inspection records for 3 masonry walls.

The requirements and acceptance criteria for masonry construction and inspection are listed in Table V-6 and the following specification:

° CECo Specification F/L-2722 "General Structures Work," Rev. 41, June 21, 1985.

b. Inspection Findings and Conclusions

Examination of inspection records and completed work showed that masonry wall installations generally conformed with design drawings and specifications.

c. Conclusions

In general, masonry walls inspected were found to be acceptable.

4. Prestressed Tendon Installation

a. Inspection Scope

The installation records of 15 prestressed tendons of the Containment Unit 2 were reviewed for conformance to the project specifica-

tion. The tendons reviewed were five vertical, five horizontal and five dome. The vertical, dome and three of the six horizontal tendon galleries were inspected for evidence of leaking grease.

The requirements and acceptance criteria used for inspection of prestressed, post-tensioned tendon installation were included in the following specification:

° CECo Specification F/L-2722 "General Structures Work," Rev. 41, June 21, 1985.

b. Inspection Findings

One horizontal grease cap was found to be leaking grease. The grease was collected, measured and found to be one-tenth of a gallon. This is within specification limits. In order to more accurately monitor the grease loss in any tendon, the licensee plans to revise procedures and keep a running log of grease loss in each tendon.

c. Conclusions

In general, the prestressed, post-tensioned system was found to be acceptable.

TABLE V-1

STRUCTURAL STEEL INSTALLATION SAMPLE

Building	Approximate Elevation and Area	Beam	Brace	Column	Connection*
Containment Unit 2	Elev. 450 ft. Area 5 and 8	26	-	3	14
Auxiliary	Elev. 374 ft. to 376 ft. Area 7	15	-	1	8
	Elev. 383 ft. to 401 ft. Area 7	11	3	3	8
	Elev. 451 ft. to 459 ft. Area 7	5	2	4	3
	Elev. 467 ft. Area 7	6	-	-	3
	Elev. 477 ft. Area 7	4	1	1	2
	TOTALS	67	6	12	38

*This sample is separate from the high strength bolt torque sample.

TABLE V-2

HIGH STRENGTH BOLTING OF STRUCTURAL STEEL CONNECTIONS

7/8 inch diameter A325 bolts[1]:

Building	Elevation	No. of Bolts Checked	Number of Bolts Found Unacceptable	Comments
Containment Unit 2	401 ft.	52	None	Sample taken from connections along radial lines R29, R31, R38 and R40.
	407 ft.	24	6 - 1 each @ 0,250, 350 and 400 ft-lbs; 2 @ 300 ft-lbs.	Sample taken along lines R39 and R40.
	412 ft.	99	3 - 1 each @ 250 and 300 ft-lbs; 1 @ 400 ft-lbs.	Sample taken along lines R22, R38, R39 and R40.
	426 ft.	119	4 - All four @ 0 ft-lbs.	Sample taken along radial lines R22 thru R26 and R32 thru R34.
Auxiliary	451 ft.	73	None	Sample taken from column lines U21, V21 S23 to S25.
	459 ft.	85	1 - One @ 175 ft-lbs	Sample taken from column lines U21, V21 and S7-23. two 7/8 inch dia. A307 bolts were installed where A325 bolts should have been.
	467 ft.	27	1 - One @ 0 ft-lbs	Sample taken from column lines U21 and V21.
TOTAL		479	15	3% found unacceptable

TABLE V-2- (Continued)

HIGH STRENGTH BOLTING OF STRUCTURAL STEEL CONNECTIONS

1 1/8 inch diameter A490 bolts[2]:

Building	Elevation	No. of Bolts Checked	Number of Bolts Found Unacceptable	Comments
Containment Unit 2	401 ft.	66	25 - One each @ 200, 425, 550, 600, 625, 700, 825, 850, 900, 1025, 1050, 1125, 1150 ft-lbs. Two each @ 300, 525, 800 ft-lbs. Three @ 500 and 1200 ft-lbs.	38% found unacceptable. Sample taken from connections along radial lines R23, R25, R29, R31 R38 and R40.
	407 ft.	14	8 - One each @ 250, 300, 600, 800, 1150 and 1200 ft-lbs. Two @ 1175 ft-lbs.	57% found unacceptable. Sample taken along radial lines R23, R25, R31, R38 and R40.
	412 ft.	32	3 - One @ 600 ft-lbs. Two @ 750 ft-lbs.	Sample taken along radial lines R23, R25, R33, R38 and R40.
TOTAL		112	36	32% found unacceptable.

NOTE:
1. Inspection torque value used was 425 ft-lbs.
2. Inspection torque value used was 1250 ft-lbs.

TABLE V-3a

HIGH STRENGTH BOLT INSTALLED TORQUE INSPECTION
FOR CONNECTIONS OF NUCLEAR STEAM SUPPLY SYSTEM SUPPORTS

1 inch diameter A490 bolts:[1]

Building	Location	No. of Bolts Checked	Number Found Unacceptable	Comments
Containment Unit 2	Steam Generator No. 5 Lower Lateral Support	24	12 - 200 to 600 ft-lbs.	
	Steam Generator No. 6 Lower Lateral Support	32	10 - 300 to 600 ft-lbs.	
	Steam Generator No. 8 Lower Lateral Support	24	24 - 100 to 700 ft-lbs.	
	Tower Restraint	28	2 - One each @ 650 and 700 ft-lbs.	
	TOTAL	108	48	44% found unacceptable.

NOTE:
1. Inspection torque value used was 750 ft-lbs.

TABLE V-3b

LICENSEE'S RESULTS OF INDEPENDENT INSPECTION OF HIGH STRENGTH BOLTS OF NSSS SUPPORT CONNECTIONS

Location	Bolt Size and Type	Number of Bolts Inspected	Number of Bolts Not Accepted - Torque Value Range for Bolts Not Accepted [1]	Comments
Containment:				
Pressurizer Column Support No. 1	1 1/4 inch diameter A490	8	4 - 1050 to 1300 ft-lbs.	
Pressurizer Column Support No. 2	1 1/4 inch diameter A490	8	2 - 800 and 1200 ft-lbs.	
Pressurizer Column Support No. 3	1 1/4 inch diameter A490	8	3 - 1400 to 1425 ft-lbs.	
Pressurizer Column Support No. 4	1 1/4 inch diameter A490	8	1 - 800 ft-lbs	
Pressurizer Column Support No. 1	1 1/2 inch diameter A490	4	0 - Not Applicable.	Hydraulic torque wrench utilized.
Pressurizer Column Support No. 2	1 1/2 inch diameter A490	4	1 - 2353 ft-lbs.	Hydraulic torque wrench utilized.
Pressurizer Column Support No. 3	1 1/2 inch diameter A490	4	0 - Not Applicable.	Hydraulic torque wrench utilized.
Pressurizer Column Support No. 4	1 1/2 inch diameter A490	4	1 - 2157 ft-lbs.	Hydraulic torque wrench utilized.

TABLE V-3b - (Continued)

LICENSEE'S RESULTS OF INDEPENDENT INSPECTION OF HIGH STRENGTH BOLTS OF NSSS SUPPORT CONNECTIONS

Location	Bolt Size and Type	Number of Bolts Inspected	Number of Bolts Not Accepted - Torque Value Range for Bolts Not Accepted [1]	Comments
Reactor Coolant Pump Loop No. 7	2 1/2 inch diameter A490	8	8 - 3937 to 5118 ft-lbs.	Hydraulic torque wrench utilized.
TOTAL		56	20	36% found unacceptable.

NOTE:
[1]Inspection torque values used were for 1-1/4, 1-1/2 and 2-1/2 inch diameter bolts 1450, 4745 and 5570 ft-lbs, respectively.

TABLE V-4

DRAWINGS USED FOR STRUCTURAL STEEL INSPECTION

American Bridge

Drawing No.	Rev.	Order No.
A251	B	K6776
A252	D	K6776
A281	D	K6776
A410	A	K6777
A419	A	K6777
A423	A	K6777
A424	A	K6777
A528	0	K67777-X14
E216	D	K6776
FWA503	C	K6777-X14
585	E	K6777
586	A	K6777
588	0	K6777
589	A	K6777
593	A	K6777
1002	A	K6777
1004	0	K6777

TABLE V-4 - (Continued)

DRAWINGS USED FOR STRUCTURAL STEEL INSPECTION

Sargent and Lundy Engineers

Drawing No.	Rev.	Title
M-913	Sheet 35	Containment Building Pressure Sensor Galleries
S-482	E	Auxiliary Building Standard Connection Details Sheet 2
S-686	AG	Auxiliary Building Floor Framing Plan El. 374'-0" Area 7
S-687	W	Auxiliary Building Floor Framing Plan El. 374'-0" Area 5 and 7
S-701	BT	Auxiliary Building Floor Framing Plan El. 401'-0" Area 7
S-719	T	Auxiliary Building Anchor Plate Schedule and Details
S-764	R	Auxiliary Building Foundation Sections and Details
S-798	M	Auxiliary Building Steel Column Schedule
S-1015	AJ	Containment Building Plan El. 461'-10" Areas 5 & 8
S-1322	AH	Auxiliary Building Floor Framing Plan El. 467'-0" Area 7
S-1330	Y	Auxiliary Building Roof Framing Plan Area 7
S-1344	W	Auxiliary Building Sections and Details
S-1645	H	Auxiliary Building Sections and Details
S-2135	AF	Typical Modification Details
S-2138	S	Typical Modification Details
S-2143	W	Typical Modification Details
S-2146-BY	R	Auxiliary Building Framing Modification Plan El. 374'-0" Area 7
S-2147-BY	Y	Auxiliary Building Framing Modification Plan El. 374'-0"

TABLE V-4 - (Continued)

DRAWINGS USED FOR STRUCTURAL STEEL INSPECTION

Sargent and Lundy Engineers

Drawing No.	Rev.	Title
S-2152	AJ	Auxiliary Building Framing Modification Schedule for El. 374'
S-2160	AC	Auxiliary Building Framing Modification Schedule for El. 374'
S-2161	U	Auxiliary Building Framing Modification Schedule El. 374'-0"
S-2171	Y	Auxiliary Typical Modification Details
S-2173-BY	AC	Auxiliary Building Framing Cover Plate Schedule
S-2175-BY	AC	Auxiliary Building Framing Cover Plate Schedule
S-2180	AW	Auxiliary Building Framing Modification Schedule for El. 375'-6"; 376'-0"; 391'-6"; 392'-0"; 394'-6"; 401'-0"; 409'-6"; 414'-0"; 415'-0"; 417'-0"
S-2190	M	Framing Modification Sections and Details
S-2228	Z	Containment Building Framing Modification Schedule for El. 461'-10"
S-2305	C	Framing Modification Sections and Details
S-2311	C	Framing Modification Sections and Details
S-2316	E	Framing Modification Sections and Details
S-2321	D	Framing Modification Sections and Details
S-2329	E	Framing Modification Sections and Details
S-2343	D	Framing Modification Sections and Details
S-2346	C	Framing Modification Sections and Details
S-2348	E	Framing Modification Sections and Details
S-2359	C	Framing Modification Sections and Details
S-2396	B	Framing Modification Sections and Details
S-2397	D	Framing Modification Sections and Details

TABLE V-5

CONCRETE POUR PACKAGES REVIEWED

Document Record No.	Pour No.	Description of Pour
5.02.01.01	2-A-353'-9"-7-F-1	1/3 Tendon Tunnel Slab
5.02.01.02	2-A-353'-9"-6-F-4	1/3 Tendon Tunnel Slab
5.02.01.03	2-A-353'-9"-5-F-4	1/3 Tendon Tunnel Slab
5.03.01.02	1-C-329'-4"-3-F-12 1-C-329'-4"-2-F-11 1-C-324'-5"-4-F-22 1-C-324'-5"-3-F-22	2/3 Auxiliary Building Slab and Sumps @ 330 ft. elev.
5.04.01.04	1-D-401-0-1-F 2-D-401-0-2-F	Part of Fuel Handling Building Foundation

TABLE V-6

DRAWINGS USED FOR MASONRY WALL INSPECTION

Dwg No.	Rev./Date	Title
A220	BJ 8/4/85	Auxiliary Building Upper Basement Floor Plan El. 364'-0" Area 3
A223	BE 5/10/85	Auxiliary Building Upper Basement Floor Plan El. 364'-0" Area 6
A224	K 3/1/79	Auxiliary Building Upper Basement Floor Plan El. 364'-0" Area 7
S680	BF 8/9/85	Auxiliary Building Floor Framing Plan El. 364'-0" Area 3
S682	BH 6/21/85	Auxiliary Building Floor Framing Plan El. 364'-0" Area 6
S683	AU 8/9/85	Auxiliary Building Floor Framing Plan El. 364'-0" Area 7
S1141	AH 8/7/85	Column Bracing Rows 6" and 30"
S1727	AD 1/19/84	Auxiliary Building Block Wall Steel Column Sections and Details
S1728	AG 11/8/84	Auxiliary Building Block Wall Steel Column Sections and Details
S1730	AV 5/31/85	Auxiliary Building Block Wall Steel Column Schedule
S1738	G 4/26/85	Auxiliary Building Block Wall Steel Column Sections and Details

VI. MATERIAL TRACEABILITY AND CONTROL

A. Objective

The objective of this portion of the NRC Construction Appraisal Team (CAT) inspection was to examine traceability and control of material and equipment, and to determine the adequacy of the licensee's program relative to these activities.

B. Discussion

The method utilized to perform the inspection included selecting samples of various types of material and equipment for examination. Most of the samples were selected and identification markings were noted from installations in the plant. Some samples of installed material, such as cadweld sleeves, that were not accessible were selected from records. Also, some samples of delivered material, such as protective coating materials, not yet installed, were inspected in warehouses or shops. A total of 271 samples were examined to varying extents. Table VI-1, "Summary of Samples," indicates the major contractors involved and the types of samples examined.

Selected procedures from on-site organizations were reviewed, including the following:

Commonwealth Edison Company (CECo)

° BSI-101, Purchase Request, Rev. 4.

° BSI-102, Material and Equipment Receiving, Receiving Inspection, Storage and Removal from Storage, Rev. 7.

° BSI-102a, Supplement A - Hatfield Receiving & Inspection of Site Requisitioned Material, Rev. 2.

° BSI-113, Storage Requirements and Surveillance Plan, Rev. 0.

Hatfield Electric Company (HECo)

° Procedure No. 5, Class I Material and Equipment and Receiving and Inspection, Rev. 14.

° Procedure No. 14, Handling and Storage of Safety Related Material and Equipment, Rev. 8.

Hunter Corporation (Hunter)

° SIP 3.102, Material and Services Procurement, Rev. 2.

° SIP 3.602, Material Receiving Inspection, Rev. 3.

° SIP 3.801, Storage of Mechanical Components and Materials, Rev. 5.

° SIP 3.802, Material Requisitions, Rev. 2.

° SIP 4.000, Control of Construction Processes, Rev. 14.

Powers-Azco-Pope (PAP)

° FP-2, Control of Procurement and Requisition of Materials and Services, Rev. 4.

° FP-3, Material Receiving Inspection Control, Rev. 13.

° FP-4, Material Storage, Rev. 9.

° FP-16, Identification and Marking of Pipe and Components, Rev. 12.

Reliable Sheet Metal (RSM)

° Procedure No. 4, Field Material Receiving and Inspection, Rev. 7.

° Procedure No. 8, Storage of Components and Materials, Rev. 7.

° Procedure No. 30, Control of Construction Processes, Rev. 1.

Midway Industrial (MIC)

° QCP-4, Container Marking and Material Control, Rev. 4.

Blount Brothers Company (BBC)

° Procedure No. 2, Procurement Control, Rev. 7.

° Procedure No. 10, "Receiving, Storage and Handling, Rev. 9.

A total of 271 samples were selected to verify traceability to: (1) the design drawings and specifications, and (2) the supply source. Verification was performed by review of drawings and procurement specifications, and by matching material and equipment markings with vendor certifications, other documentation and heat numbers. Table VI-2, "Sample Breakdown by Contractors," indicates the types and quantities of samples applicable to each contractor. Table VI-3, "Weld Filler Material Compliance," contains a list of weld filler material samples.

The following sections describe the inspection results.

1. Material Traceability and Control

a. Inspection Scope

In addition to review of in-place procedures, the 271 samples of material and equipment were examined for traceability to drawings, specifications, procurement records, Certified Material Test Reports (CMTRs), Certificates of Conformance (C of Cs), heat numbers or other required documentation. Samples included equipment (electrical, mechanical and instruments), pipe, structural steel, weld joints, electrical cables, fasteners, and other materials as indicated in Table VI-2.

b. Inspection Findings

In general, it was found that satisfactory procedures were in place for material traceability and for control of material at the site. Except for the lack of traceability for certain fastener materials, the material traceability program was found to be generally acceptable. The following observations were made by the NRC CAT inspector:

(1) Sixteen samples of weld filler material listed in Table VI-3 were examined for traceability and compliance with specifications and codes, and were found to be acceptable. Also, 11 weld filler material holding ovens in 8 issue stations were examined and found to meet requirements for temperature control and thermometer calibration records. In addition, 8 portable ovens were examined and found to be operating satisfactorily.

(2) Some deficiencies were found regarding the traceability and control of equipment mounting bolts for large vendor-supplied ASME pump-motor assemblies, various electrical equipment, and HVAC equipment as follows:

(a) Equipment assembly/mounting bolts for each of the 10 large vendor supplied pump-motor installations examined were found to have unmarked bolts or bolts with markings indicating incorrect or indeterminate materials. The discrepancies are as follows:

° Chemical Volume Positive Displacement Pump (2CV02P) - Motor mounting bolts required to be A325; no markings found.

° Chemical Volume Centifugal Charging Pump (2CV01PA) - Motor mounting bolts required to be SAE Grade 5; SAE Grade 8 found.

° Chemical Volume Centifugal Charging Pump (2CV01PB) - Motor mounting bolts required to be SAE Grade 5; unmarked bolts found.

° Residual Heat Removal Pumps (2RH01PA & PB) - Pump casing studs required to be SA 453, Grade 660; untraceable marking "TP" found.

° Pump casing stud nuts required to be SA 194, Grade B6X; untraceable markings "7B" and "MR 5178" found.

° Motor base to motor casing bolts required to be A449, Grade 5; A325 bolts found.

° Containment Spray Pumps (2CS01PA & PB) - Casing stud nuts required to be SA 194, Grade 2H, Trace N-20; untraceable markings found.

Motor mounting bolts to attachment required to be SA 193, Grade B7; markings found indicate A325 or SA 325.

Bolts from motor attachment to adaptor required to be SA 193, Grade B7; found A307 markings.

Anchor bolts, per seismic report, should be A325; records indicate A36 installed. Records included a prior Sargent & Lundy analysis indicating that A36 is acceptable, but no design change was made.

- Auxiliary Feedwater Pump (2AF01PB) (diesel motor) - Bolts from gear box to skid required to be SAE Grade 5; markings found for A325. Requirement for anchor bolts not known; no markings found, records indicate A36 installed.

- Safety Injection Pumps (2SI01PA & PB) - Pump mounting bolts indicated by Westinghouse Pump and Valve Engineering (memorandum revised 9/12/85) required to be SA 307; markings found indicated SAE Grade 5 installed.

As a result of these CAT findings, the licensee issued Nonconformance Report (NCR) No. F-1014 to initiate further examination of the discrepancies and corrective action.

The numerous discrepancies between drawings, manuals, seismic qualification reports and markings on installed fasteners indicate a generic lack of attention to fastener details by the licensee and vendors. This matter requires management attention.

(b) Equipment assembly/mounting bolts for certain electrical equipment were found to have unmarked bolts indicating indeterminate materials. The conditions are as follows:

- Battery rack assembly bolts in battery rooms 211 and 212 were inspected. It was found that of 460 bolts inspected, 69 were marked to indicate SAE Grade 5 material, and the rest were unmarked and thus were of indeterminate material. The licensee indicated that ASTM A307 bolts were required, although documentation specifying the material required was not provided.

- Interconnection bolts for 4KV Switchgear cabinets (2AP06E) were inspected and some bolts were found marked to indicate A307 material, but others were unmarked and thus of indeterminate material.

- Assembly bolts for Fire Hazards Panel (2PL10J) were inspected and five were found to be properly marked for A307 material, but five of the ten bolts were unmarked and thus of indeterminate material.

As a result of these CAT findings, the licensee issued NRC No. F-1012 to initiate further review of the traceability of fasteners of various vendor supplied equipment and to provide for corrective action.

It was noted that the licensee recently issued NCR No. F-1001 (August 16, 1985) to initiate review of site procured and contractor installed bolts which do not conform to ASTM A307 requirements and to initiate corrective action.

(c) Nuts for studs in the trapeze assembly portion of pipe hanger 2RY05009 were specified to be of SA194, Grade 2H material. Markings found by the NRC CAT inspectors were not traceable. Records indicated that A307 nuts were installed. Four additional hangers: 2RY28002, 2RY28003, 2CV25021 and 2CV15016 were found to have nuts installed with proper 2H markings. The incorrect nuts on hanger 2RY05009 is considered an isolated case.

As a result of this CAT finding, the contractor (Hunter) issued NCR No. 1141 to initiate corrective action to replace the nuts on hanger 2RY05009.

(d) Bolts for attaching HVAC Diesel Generator Service Room Vent Fans 2VD02CA & B to adjacent duct sections were inspected. It was found that A307 bolts were required, but approximately 50% of the bolts were unmarked and thus material was indeterminate. The licensee stated that NCR No. F-1001 mentioned under VI.B.1.b(2)(b) above was also applicable to this finding.

b. Conclusions

In general, except for certain fastener hardware, the material traceability and control program was considered to be satisfactory.

Significant lack of traceability was found for fastener materials, including assembly and mounting bolts for large vendor supplied pumps with motors mounted on skids; bolts for battery racks, switchgear cabinets and other electrical equipment; and bolts for HVAC equipment as noted above.

TABLE VI-1

SUMMARY OF SAMPLES

Contractors	Activities	No. of Samples
Hatfield (HECo)	Electrical	37
Hunter (Hunter)	Piping/Mechanical	136
Powers-Azco-Pope (PAP)	Instrumentation	43
Reliable Sheet Metal (RSM)	HVAC	14
Blount Brothers (BBC)	Structural	22
Chicago Bridge & Iron (CB&I)	Containment Liner	8
Midway Industrial (MIC)	Coatings	11
	TOTAL	271

TABLE VI-2

SAMPLE BREAKDOWN BY CONTRACTORS

ITEM	HECo	HC*	PAP	RSM	BBC	CB&I	MIC	TOTAL
Equipment	14	19	10	3	-	-	-	46
Pipe	-	21	8	-	-	-	-	29(L)**
Tubing	-	-	4	-	-	-	-	4(L)
Steel-Structural	-	-	-	2	2	-	-	4(L)
Steel-Rebar	-	-	-	-	5	-	-	5(L)
Steel-Plate	-	-	-	-	2	3	-	5(L)
Steel-Tube	-	5	-	-	1	-	-	6(L)
Hangers/Supports	-	4	-	2	-	-	-	6
Embedments	-	-	-	-	3	-	-	3
Weld Filler Material	2	9	2	-	-	3	-	16(L)
Weld Joints	-	31	19	4	-	2	-	56
Electrical Cables (Reels)	5	-	-	-	-	-	-	5
Fasteners (Sets Installed)	6	44	-	3	-	-	-	53
Fasteners (Lots in Storage)	-	3	-	-	5	-	-	8(L)
Cadweld Sleeves	-	-	-	-	4	-	-	4(L)
Coatings	-	-	-	-	-	-	11	11(L)
Conduit	5	-	-	-	-	-	-	5(L)
Cable Raceway	5	-	-	-	-	-	-	5(L)
TOTALS	37	136	43	14	22	8	11	271

*Hunter Corp.
**(L) = Lots

TABLE VI-3

WELD FILLER MATERIAL COMPLIANCE

Material Designation & Size		Heat No./ Material ID	Compliance Comments
E308-16	3/32"	74882	Acceptable
E308-16	3/32"	11343	Acceptable
E308-16	1/8"	J1711	Acceptable
E308L-16	5/32"	64901	Acceptable
E309-16	3/32"	10440	Acceptable
E309-16	3/32"	Lot 90075-3	Acceptable
E309-16	1/8"	Lot 90069-1	Acceptable
E502-16	3/32"	431C4621	Acceptable
E502-16	1/8"	01P124	Acceptable
E6010	3/16"	645S481	Acceptable
E6010	5/32"	L02103	Acceptable
E6010	5/32"	11270	Acceptable
E7018	3/32"	34422	Acceptable
E7018	1/8"	33641	Acceptable
E7018	1/8"	401S7441	Acceptable
E7018	5/32"	402X9551	Acceptable

VII. DESIGN CHANGE CONTROL

A. Objective

The primary objective of the appraisal of design change control was to determine whether design change activities were conducted in compliance with regulatory requirements, Safety Analysis Report (SAR) commitments and approved licensee, architect-engineer and constructor procedures. An additional objective was to determine that hardware modifications described in a sample of design change documents were properly implemented in the field.

B. Discussion

10 CFR 50, Appendix B, Criterion III "Design Control" and Criterion VI "Document Control" establish the overall regulatory requirements for design change control. These requirements are elaborated in Regulatory Guide (RG) 1.64, Rev. 2, June 1976, "Quality Assurance Requirements for the Design of Nuclear Power Plants" which endorses American National Standards Institute (ANSI) Standard N45.2.11-1974 "Quality Assurance Requirements for the Design of Nuclear Power Plants." The licensee's commitment to comply with RG 1.64 is stated in Appendix A of the Byron/Braidwood Stations Final Safety Analysis Report (FSAR).

The areas of design change control evaluated by the NRC Construction Appraisal Team (CAT) inspectors were control of changes to design documents and control of design changes. In each of these areas, interviews were conducted with personnel responsible for the control of activities, procedures were reviewed, and a sample of the controlled documents was reviewed. In addition, a sample of the design changes which had been inspected and accepted by onsite contractor quality control personnel was verified in the field by the NRC CAT inspectors.

1. Control of Design Documents

The specific aspects of the control of design documents inspected were the availability to the users of the latest approved design documents and design change documents and the methods of assuring that approved changes not yet incorporated into design documents are provided to the users prior to work being performed.

a. Inspection Scope

(1) The following procedures related to distribution and control of design documents and design change documents were reviewed:

- Commonwealth Edison Company (CECo) Quality Requirement (QR) 3.0 "Design Control," Rev. 15, August 15, 1984.
- CECo QR 6.0, "Document Control," Rev. 9, August 15, 1984.
- CECo Quality Procedure (QP) 6-1, "Distribution of Design Documents," Rev. 7, October 10, 1983.

- CECo QP 6-2, "Procedure for Station Construction Department Design Document Control," Rev. 3, May 12, 1983.

- CECo Braidwood Nuclear Station Project Procedure PCD-03, "Field Change Request," Rev. 0, June 15, 1984.

- Sargent & Lundy Engineers (S&L) General Quality Assurance Procedure (GQ) 3.07, "Sargent & Lundy Drawings," Rev. 6, October 21, 1981.

- S&L GQ-3.13, "Engineering Change Notices," Rev. 6, October 21, 1981.

- S&L GQ-6.01, "Project Distribution List and Project File Indexes," Rev. 5, October 21, 1981.

- S&L Project Instruction for Byron/Braidwood (PI-BB) 29, "Distribution and Control of Design Documents for S&L Field Personnel at the Byron/Braidwood Stations," Rev. 2, August 2, 1985.

- Hatfield Electric Company (HECo) Procedure No. 4 "Drawing Control," Rev. 13, April 10, 1985.

- Reliable Sheet Metal Works, Inc. (RSM) Procedure No. 7A, "Document Control," Rev. 1, March 20, 1984.

- RSM Procedure No. 7, "Design Drawing and Design Change Control," Rev. 7, March 20, 1984.

- Powers-Azco-Pope (PAP) Field Operating Procedure FP-1, "Document and Drawing Control," Rev. 6, August 29, 1984.

- Hunter Corporation Site Implementation Procedure 2.101, "Document Control," Rev. 5, December 12, 1984.

(2) CECo and contractor Quality Assurance (QA) audit and surveillance reports concerning design document control were reviewed for findings, trends and corrective actions.

(3) CECo, S&L and contractor document control, engineering, construction and QA personnel were interviewed concerning distribution, control and use of design documents and design change documents.

b. Inspection Findings

S&L design documents and Engineering Change Notices (ECNs) are distributed by S&L to CECo, contractor and S&L organizations and personnel in accordance with PI-BB-29 and the S&L distribution lists. Field Change Requests (FCRs), which are CECo design change documents, are distributed by the CECo Project Construction Department (PCD) to S&L, contractor and CECo organizations and personnel.

CECo, S&L and the contractors each control the redistribution and use of design documents and design change documents within their organizations in accordance with their separate and individual document control procedures. In general, receipt of design documents is recorded on control cards or log sheets, the latest revisions of design documents and design change documents are issued to the (satellite) document control stations and the superseded revisions destroyed or stamped. All four contractors' (HECo, RSM, PAP and Hunter) document control systems reviewed by the NRC CAT inspectors control the use of approved, unincorporated design change documents by annotating the design change identification numbers on the controlled copies of the affected design documents.

The CECo PCD document control station is the "master" against which other document control station records were evaluated. Typically, possible contractor discrepancies concerning the latest approved and issued revision of a design document and the correct annotated design change documents are resolved by comparison to the design documents and document receipt logs in the CECo PCD Document Control Station. The document control list(s), ECN status list and FCR status list are updated every 30 days in accordance with procedures; however, the PCD document control clerk maintains a more current master list by manually entering new issuances as they occur.

(1) The NRC CAT inspectors reviewed approximately 200 S&L drawings at the CECo PCD document control station for legibility and correct indication of controlled status (no stamping). Sixty drawings were reviewed for correct revision and correct annotation of FCRs/ECNs against the S&L status list of drawings.

No incorrect design document revisions were identified. However, a large number of FCRs and ECNs were listed on controlled drawings. The NRC CAT inspectors selected 6 structural drawings which had 39 FCRs listed as open. Review of the FCR master log indicated that 35 of the 39 FCRs had been incorporated . As a result, the inspectors identified a concern that PCD was not deleting FCRs/ECNs from construction drawings in a timely manner after the FCR or ECN was incorporated into the drawing. Further review indicated that QA Surveillance Report No. 5872 had previously identified a similar concern. CECo QA had commited to reauditing PCD's document control program during QA Audit No. 6-84-212. However, a review of this audit by the NRC CAT inspectors indicated that the concern of not deleting FCRs/ECNs from construction drawings in a timely manner had not been addressed. CECo QA conducted audit No. 6-85-204 during the inspection period to address this concern. This audit revealed that over 60 percent of the FCRs and ECNs listed on the drawings had already been incorporated. PCD has committed to remove all closed design changes posted on drawings by November 1, 1985.

(2) The NRC CAT inspectors reviewed about 75 S&L design documents at five Hatfield Electric Company (HECo) document control stations in the Auxiliary Building, Containment Building and QC trailer for legibility and appropriate stamping (i.e., "controlled"). The revision numbers and FCRs/ECNs annotated were recorded for about 20 design documents and checked against the HECo master files. No incorrect design documents were identified, although several cases were identified where field personnel had not deleted FCRs or ECNs from their controlled drawings. Inspection and installation records were reviewed by HECo and no outdated FCRs or ECNs were recorded as having been used in construction or inspection activities.

The NRC CAT inspectors also reviewed document control audit and surveillances for procedure requirements and adequate corrective actions. The following deficiences were noted:

- HECo Procedure No. 4 drawing "Drawing Control", states "Hatfield QA will perform a monthly surveillance of this procedure using Form HP-47". The surveillance reports for April and May 1985 could not be located. HECo performed three surveillances during the month of September to verify adequate document control.

- HECo special surveillance dated July 26, 1985, identified that HECo was not maintaining current mechanical drawings. Installation reports had not been reviewed to assure that installation was in accordance with the current drawings. HECo performed this review during the inspection period and determined that installations had been completed in accordance with current design documents.

(3) The NRC CAT inspectors reviewed about 50 S&L design drawings at three Powers-Azco-Pope (PAP) document control stations, for legibility and correct stamping (i.e., "controlled"). The revision numbers and FCRs/ECNs annotated were recorded for about 15 design documents and checked against the PAP master files.

No incorrect design document revisions were identified. During the inspection a controlled copy of S&L Drawing No. GE-2-3543604, Rev. C had been maintained on the engineering stick file, however, the drafting controlled copy could not be located. Further review by PAP indicated that this drawing was voided. PAP stated that S&L electrical drawings were used for reference purposes and had not affected installation. PAP was subsequently removed from distribution of S&L electrical drawings.

c. Conclusion

For the sample inspected, the control of design documents is considered adequate.

2. Control of Design Change

The specific aspects of the control of changes to design inspected by the NRC CAT were the change control systems for ECNs and FCRs, and the implementation and verification of the changes.

a. Inspection Scope

(1) The following procedures relating to the control of design changes were reviewed:

- CECo QR 3.0, "Design Control," Rev. 15, August 15, 1984.
- CECo QP 3-1, "Design Control," Rev. 5, October 5, 1984.
- CECo QP 3-2, "Design Change Control," Rev. 13, October 5, 1984.
- CECo PCD-02, "Engineering Change Notices," Rev. 0, May 24, 1984.
- CECo PCD-03, "Field Change Request," Rev. 0, June 15, 1984.
- S&L GQ 3.07, "Sargent & Lundy Drawings," Rev. 6, October 21, 1981.
- S&L GQ 3.08, "Design Calculations," Rev. 5, January 31, 1985.
- S&L GQ 3.13, "Engineering Change Notices," Rev. 6, October 21, 1981.
- S&L PI-BB-13, "Procedure for Processing Commonwealth Edison Company Field Change Requests (FCRs)," Rev. 12, September 27, 1984.
- S&L PI-BB-18, "Procedure for Handling Commonwealth Edison Company Field Change Requests Transmitting 'As-Built' Information," Rev. 1, May 7, 1984.
- S&L PI-BB-23, "Byron/Braidwood Electrical Field Personnel," Rev. 7, October 25, 1983.
- S&L PI-BB-25, "Activities of the On-Site Structural Design Group," Rev. 0, August 29, 1983.
- S&L PI-BB-28, "Activities of the Byron/Braidwood Station Mechanical Engineering, Piping Design, Support Design and Analysis Field Personnel," Rev. 3, August 4, 1983.
- Westinghouse Electric Corporation (W) Instruction PED-B-1.2, "Byron Unit 1 and Unit 2 Engineering Change Notices," Rev. 0, April 1, 1985.

- W Instruction PED-B-1.3, "Byron Unit 1 and Unit 2 Field Change Requests," Rev. 0, April 1, 1985.

- Nuclear Power Services, Inc. (NPS) Procedure 3.0.5, "Design Control - Revisions and Holds," Rev. D, July 23, 1985.

- HECo Procedure #29, "Field Initiated Requests for Design Changes," Rev. 8, January 30, 1985.

- RSM Procedure No. 7, "Design Drawing and Design Change Control," Rev. 7, March 20, 1984.

- PAP Field Operating Procedure FP-9, "Design Change/Field Routing Control," Rev. 10, April 17, 1984.

- Hunter Site Implementation Procedure 2.201, "Design Control," Rev. 13, June 11, 1984.

(2) CECo and contractor QA audit and surveillance reports concerning design change were reviewed for findings, trends and corrective actions.

(3) Interviews were conducted with personnel from CECo, S&L, W, NPS, HECo, RSM, PAP and Hunter concerning initiation (origination), review, approval and implementation of design changes.

b. Inspection Findings

S&L has approximately 166 people in their Byron site organization, of whom about 145 are assigned in engineering and design groups. The majority of the engineering and design personnel are engaged in resolving field problems by clarifying design documents and making design changes.

The contractors perform no engineering or design function; however, RSM, PAP and Hunter prepare supplementary drawings/sketches from S&L approved design drawings for use as aids in fabrication and construction. Generally, such aids are prepared by the contractor field engineers and both contractor engineering and QC personnel review them for conformance with the S&L approved drawings.

Design changes are accomplished through design change documents such as FCRs, ECNs, Field Change Notices (FCNs) and through revision of design documents without an intermediate design change document. FCRs are a CECo design change document generally originated in the field by CECo or contractor personnel and approved by both CECo and S&L. ECNs are an S&L design change document originated in the field or S&L's Chicago office and approved by S&L. FCNs are a Westinghouse Electric Corporation (the nuclear steam supply system vendor) change document originated and approved by offsite Westinghouse personnel. Roughly 42,000

FCRs/ECNs have been issued for both units. Presently, an average of about 100 FCRs and 50 ECNs are being issued each month and the trend is decreasing.

Problems, conflicts and items requiring clarification of the approved design documents identified by the contractors are forwarded to S&L for resolution. HECo uses Field Problem Sheets, RSM uses Ventilation Field Problem Sheets, PAP uses Field Work Requests, and Hunter uses Piping and Support Field Problem Forms. These contractor documents are generally not controlled or considered QA documents. When resolution requires a design change, a FCR, ECN, or drawing revision is prepared and issued to the contractor.

(1) Approximately 46 ECNs and FCRs were selected and reviewed for procedural compliance, adequacy of problem description and resolution. These ECNs and FCRs are listed in Table VII-1.

One minor procedural deficiency was identified. The "Request Class" blocks for "Limited Construction" or "Plant Modification" and "Major" or "Minor" changes were not checked on a number of FCRs. Examples are:

FCR-70113, January 22, 1985
FCR-35607, April 30, 1985
FCR-35608, April 30, 1985

This appears to be inconsistent with the requirements of Attachment B to CECo QR 3-2.

(2) Six FCRs/ECNs for which the work had been completed and accepted by contractor QC were selected for verification. Prior to inspection of physical changes, the base design drawings, applicable change notices and backup calculations and QC inspection reports were reviewed by the NRC CAT inspectors. The physical changes were then inspected in the field to verify that the changes were implemented as described. Each design change was found to have been properly completed.

- FCR-35607 and 35608, April 30, 1985 - The change required additional mounting holes to support instrumentation.

- FCR 21637, August 11, 1983 - The change required the addition of a shuttle pan to support cables.

- ECN 22400, July 25, 1984 - The change required the addition of a flex hose to the Component Cooling System piping. Snubbers were eliminated and piping was rerouted.

- FCR 33510, September 20, 1984 - That change required screen stiffeners to be cut to facilitate installation of security bars.

- FCR-25855, March 18, 1985 - The change provided location and mounting of isolation transformers.

(3) The calculations for about 28 ECNs/FCRs were reviewed for conformance with applicable requirements. These ECNs and FCRs are denoted in Table VII-1 by an asterisk.

All the calculations were changes to previously approved designs, and thus were in effect partial revisions to previous calculations. They consisted of both hand and computer calculations, involving mostly structural attachments, core drilling and pipe supports/restraints. Examples are:

FCR 35607, April 30, 1985
ECN 22400, July 25, 1984
FCR 33510, September 20, 1984

The calculations were reviewed for technical adequacy, compliance with regulations and commitments and meeting procedure requirements. The calculations in the sample inspected were found to be prepared, checked and reviewed in conformance with procedural requirements. They had been reviewed and approved prior to the approval date on the ECNs/FCRs. No calculation errors were observed in the sample inspected.

(4) In addition, the NRC CAT inspectors in the technical discipline areas reviewed approximately 50 design change documents (ECNs/FCRs). The design changes verified were selected after work had been completed and accepted by contractor QC. Each design change was reviewed for technical adequacy and the installation was verified in the field.

c. Conclusions

For the sample inspected, the control of the design change process is adequate.

TABLE VII-1

Design Change Document	Date Issued	Responsible Contractor
*ECN 22400	07/25/84	Hunter
*ECN 244686	10/14/84	Hunter
*ECN 245144	12/13/84	Hunter
FCR 21637	08/11/82	HECo
FCR 22915	06/07/83	HECo
FCR 24976	06/11/84	HECo
FCR 24979	06/12/84	HECo
*FCR 25115	07/13/84	HECo
*FCR 25761	01/03/84	HECo
FCR 25762	01/03/84	HECo
FCR 25855	03/18/85	HECo
*FCR 25949	02/11/85	HECo
*FCR 25993	03/07/85	HECo
FCR 26081	03/25/85	HECo
FCR 30546	01/05/84	Hunter
FCR 31994	04/20/84	Hunter
*FCR 33137	10/09/84	PAP
*FCR 33510	09/20/84	RSM
FCR 33706	09/20/84	RSM
FCR 33771	10/25/84	RSM
*FCR 34005	10/11/84	PAP
FCR 34712	02/11/85	RSM
FCR 34986	06/10/85	Hunter
*FCR 35081	02/21/85	RSM
FCR 35377	04/05/85	RSM
*FCR 35378	04/29/85	RSM
FCR 35383	04/09/85	RSM
*FCR 35601	04/29/85	PAP
*FCR 35602	04/29/85	PAP
*FCR 35607	04/30/85	PAP
*FCR 35608	04/30/85	PAP
*FCR 35706	05/23/85	RSM
*FCR 35732	06/26/85	RSM
*FCR 35827	05/17/85	PAP
*FCR 35833	05/29/85	PAP
*FCR 35834	05/29/85	PAP
*FCR 35835	05/31/85	PAP
*FCR 35914	07/30/85	RSM
*FCR 35935	08/13/85	RSM
*FCR 35970	06/12/85	PAP
*FCR 36017	08/12/85	PAP
*FCR 36018	08/12/85	PAP
FCR 70111	01/21/85	Hunter
*FCR 70113	01/22/85	Hunter
FCR 70114	01/23/85	Hunter
FCR 70123	02/21/85	Hunter

NOTES:
Hunter - Hunter Corporation
HECO - Hatfield Electric Company
PAP - Powers-Azco-Pope
RSM - Reliable Sheet Metal Works, Inc.

*Indicates that calculations were reviewed.

VIII. CORRECTIVE ACTION SYSTEMS

A. Objective

The objective of this portion of the NRC CAT inspection was to verify, through selected samples, whether measures were established and implemented to assure that nonconformances and other conditions adverse to quality were promptly identified and corrected.

B. Discussion

An examination was made of the licensee's program for identification and control of nonconformances and corrective actions, including review of documents and inspection of some material/equipment for verification of actual corrective actions in the plant. Items such as the following were reviewed:

- Procedures and organizational interfaces
- Trend analyses
- Audit and surveillance reports
- Nonconformance reports
- Deviation reports
- Inspection reports
- Control of actual material and equipment corrections in the plant
- Control of open nonconformances at turnover for testing or operation

Table VIII-1, "Corrective Action Samples," contains a list of samples that were randomly selected.

The following procedures of on-site organizations were found in place, and applicable portions pertaining to corrective action were reviewed:

Commonwealth Edison Company (CECo)

- SQI-6, On Site Contractor Nonconformance Reports, Rev. 0.
- SQI-7, QA Handling of CECO Nonconformance Reports, Rev. 1.
- SQI-12, Byron Site QA Audits, Rev. 2.
- SQI-31, Byron QA Training Program, Rev. 1.
- SQI-38, Performance and Reporting of Deficiency Trending Analysis by Site QA, Rev. 1.

Sargent and Lundy (S&L)

- GQ-16.01, Corrective Action Reports, Rev. 6.

° MAS-30, Technical Monitoring of Quality Related Design Activities, Rev. A.

Hatfield Electric Company (HECo)

° Quality Assurance Manual, Rev. 16.

° Procedure No. 1, Method of Preparing Procedures, Rev. 13.

° Procedure No. 6, Reporting Damaged or Nonconforming Material or Equipment, Rev. 14.

° Procedure No. 8, Audits, Rev. 5.

° Procedure No. 12, Installation of Class 1E Equipment, Rev. 8.

Hunter Corporation (Hunter)

° Quality Assurance Manual, Rev. 7.

° SIP-3.801, Storage of Mechanical Components and Materials, Rev. 5.

° SIP-4.201, Installation Verification, Rev. 11.

° SIP-11.101, Nonconformance Processing, Rev. 4.

Powers-Azco-Pope (PAP)

° Quality Assurance Manual, Rev. 3.

° QC-4, Nonconformance Control, Rev. 11.

° QC-5, Site Audit, Rev. 11.

Reliable Sheet Metal (RSM)

° Quality Assurance Manual, Rev. 0.

° Procedure No. 5, Site Quality Assurance Audits, Rev. 5.

° Procedure No. 10, Nonconformance and Corrective Action, Rev. 4.

° Procedure No. 23, Installation Verification, Rev. 2.

Blount Brothers Company (BBC)

° Quality Assurance Manual, Rev. 1.

Pittsburgh Testing Laboratories (PTL)

° QC-1A-1, Internal Audits, Rev. 8.

° QC-CRN-1, Control and Reporting of Nonconformances, Rev. 2.

1. Corrective Action

a. Inspection Scope

A review was performed of applicable portions of project procedures. In addition to QA manuals and procedures, a total of 218 samples of corrective action documents were reviewed, and six material/equipment samples were inspected for verification of corrective actions in the plant. Table VIII-1, "Corrective Action Samples," contains a list of documents and material/equipment samples that were randomly selected and inspected.

b. Inspection Findings

In general, it was found that satisfactory procedures were in place for corrective action systems to identify and control the correction of conditions adverse to quality at the site. Except for concerns discussed below, the corrective action systems and implementing measures were found to be acceptable. The six material/equipment samples requiring rework in the plant were inspected, and corrective action control was verified.

(1) Numerous problems with fastener material discrepancies on large vendor-supplied ASME pump/motor assemblies and other vendor equipment were found by the NRC CAT for which effective corrective actions were not performed. See Section VI.B.1.b(2) for details. These problems indicate a lack of effective quality control at vendors' plants, and also a lack of vendor surveillance with attention to verification of proper fasteners prior to shipment.

(2) Radiographs for certain ASME equipment were not provided by the vendor, Westinghouse Electric Company. Radiographs requested by NRC CAT inspectors had not been located during the inspection period. See Section IV.B.11.b for details. A review of audits performed by both Commonwealth Edison Company and Westinghouse Electric Company indicated that the retrievability of radiograph records had not been addressed during the audits.

(3) A review of four Preoperational Test Release (turnover) packages revealed that the turnover procedure and release forms did not include a record of preventive maintenance status or any related deficiencies. In a limited review of the licensee's preventive maintenance program, it was found that the preventive maintenance program was fragmented among CECo and contractor organizations, and that effective coordinated control was lacking.

The preventive maintenance program for mechanical equipment was discussed with Hunter Quality Assurance (QA) personnel and CECo project construction, startup and operations personnel.

Shaft rotation records for the following five pumps were reviewed: 2CC01PA, 2CC01PB, 2CS01PA, 2CS01PB, 2AF01PA.

Hunter Procedure SIP-3.801, Storage of Mechanical Components and Materials, addresses maintenance of mechanical equipment prior to establishment of the full surveillance program at turnover to CECo operations. This procedure does not clearly define programmatic requirements or responsibilities during periods in which equipment is undergoing flushing or testing by the CECo staff. Although the equipment has not yet been formally turned over to CECo at these stages, there is some confusion as to maintenance responsibility during this time frame. For example, Hunter apparently terminates periodic pump/motor shaft rotations at the time of final coupling and alignment of pumps to motors. Normally this equipment would then be flushed by CECo startup personnel and then turned over to CECo startup/testing personnel. During these periods, regular pump operations and monitoring of basic parameters is conducted by test personnel.

The NRC CAT inspectors identified that for the Containment Spray Pumps (2CS01PA and 2CS01PB) the scheduled shaft rotation stopped in March and April of 1985, and due to flushing delays these pumps had not yet been flushed, run or otherwise monitored as of September 20, 1985. The Auxiliary Feedwater Pump (2AF01PA) was coupled and last rotated by Hunter in January 1985 and was flushed in May 1985 but has not been turned over to startup or run since then. The potential long term effects of this lack of maintenance has not been addressed, and it does not appear that measures were in place to provide for an evaluation of this condition.

The overall requirements and responsibilities of the preventive maintenance program need to be better defined for the interface period between construction and operation.

c. Conclusions

The licensee's corrective action program was found to be generally acceptable, except for the following concerns:

a. Failure to assure that fasteners of required materials were furnished with vendor supplied equipment.

b. Failure to assure that radiographs for certain vendor supplied equipment were properly stored and retrievable as required.

c. Failure to provide for effective specification and performance of preventive maintenance, particularly from the time of turnover for testing until turnover for operation.

TABLE VIII-1

CORRECTIVE ACTION SAMPLES

ITEMS	QUANTITY EXAMINED									
	CECo	S&L	W	HECO	HC	PAP	RSM	BBC	PTL	TOTAL
Trend Reports	3	-	-	1	3	3	3	2	1	16
Audit Reports	18	2	16	3	7	7	5	7	1	66
Nonconformance Reports	10	-	-	16	10	12	9	10	10	77
Deviation Reports	-	-	-	10	10	-	-	1	-	21
Inspection Reports	-	-	-	10	3	-	4	5	-	22
Surveillance Reports	-	-	-	-	-	10	-	-	-	10
Samples for Field Verification of Corrective Action	-	-	-	2	2	-	1	1	-	6
Turnover Packages	4	-	-	-	-	-	-	-	-	4
Unit Concept Report	-	-	-	-	-	-	-	-	1	1
Over Inspection Report	-	-	-	-	-	-	-	-	1	1
TOTAL	35	2	16	42	35	32	22	26	14	218

CECo = Commonwealth Edison Comapny

S&L = Sargent and Lundy

W = Westinghouse Electric Company

HECo = Hatfield Electric Company

HC = Hunter Corporation

PAP = Pope-Azco-Pope

RSM = Reliable Sheet Metal

BBC = Blount Brothers Corporation

PTL = Pittsburgh Testing Laboratories

A. Persons Contacted

The following list identifies licensee discipline coordinators and key individuals contacted during the inspection for each area.

1. Licensee Coordinators and Contacts

Area	Names
Team Leader	K. Ainger D. Tuetken
Electrical and Instrumentation	J. Binder S. Vovos L. Stern
Mechanical	B. Moravec, J. Porter, B. Somsag, R. Irish D. Geddings
Welding and NDE	D. McCarty, E. Wolber J. Porter
Civil and Structural	J. Mihovilovich, R. Guse R. Hardison
Material Traceability	B. Klinger E. Briette
Corrective Action Systems	E. Martin D. Felz
Design Change Controls	B. Klinger, P. Donavin B. Byrne

In addition to the above personnel, numerous other inspectors, engineers and supervisors were also contacted.

B. Documents Reviewed

The types of documents listed below were reviewed by the NRC CAT members to the extent necessary to satisfy the inspection objectives stated in Section I of this report. There are additional references within the body of the report to specific procedures, instructions, specifications and drawings.

1. Final Safety Analysis Report

2. Quality assurance manual

3. Quality assurance procedures and instructions

4. Quality control procedures

5. Administrative procedures

6. General electrical installation procedures and specifications

7. General instrumentation installation procedures

8. General piping and pipe support installation procedures and specifications

9. General mechanical equipment installation procedures and specifications

10. General concrete specifications

11. As-built drawings

12. Welding and NDE procedures

13. Personnel qualification records

14. Material traceability procedures

15. Procedures for processing design changes

16. Procedures for document control

17. Procedures for controlling as-built drawings

18. Procedures for processing nonconformances

GLOSSARY OF ABBREVIATIONS

AISC - American Institute of Steel Construction
ANSI - American National Standards Institute
ASME - American Society of Mechanical Engineers
ASTM - American Society for Testing and Materials
AWS - American Welding Society
ATWS - Anticipated Transient Without Scram
BBC - Blount Brothers Company
BY/BR - Byron/Braidwood
CAT - Construction Appraisal Team (NRC)
CB&I - Chicago Bridge and Iron Company
C of C - Certificate of Conformance
CEA - Concrete Expansion Anchor
CECo - Commonwealth Edison Company
CMTR - Certified Material Test Report
CSCV - Cable Separation Criteria Violation
CSNF - Conduct Separation Notification Report
DIT - Design Information Transmittal
DR - Deviation Report
DRC - Deviation Report for Correctable Items
ECN - Engineering Change Notice
FCN - Field Change Notice
FCR - Field Change Request
GQ - General Quality
HECo - Hatfield Electric Co.
Hunter - Hunter Corp.
HVAC - Heating, Ventilating and Air Conditioning
IE - Office of Inspection and Enforcement (NRC)
IEEE - Institute of Electrical and Electronic Engineers
IPCEA - Insulated Power Cable Engineers Association
IRR - Interface Review Report
LP - Liquid Penetrant Inspection
LOCA - Loss-of-Coolant Accident
MIC - Midway Industrial Company
MOV - Motor Operated Valve
NCR - Nonconformance Report
NDE - Nondestructive Examination
NISCo - Nuclear Installation Service Co.
NPS - Nuclear Power Service, Inc.
NRR - Office of Nuclear Reactor Regulation (NRC)
NRC - U. S. Nuclear Regulatory Commission
NSSS - Nuclear Steam System Supplier
OAD - Operations Analysis Department
PAP - Powers-Azco-Pope
PCD - Project Construction Department
PDM - Pittsburgh Des Moines Corp.
PI-BB - Project Instruction - Byron/Braidwood
PSAR - Preliminary Safety Evaluation Report
PSI - Preservice Inspection
PTL - Pittsburgh Testing Laboratories
QA - Quality Assurance

QAM - Quality Assurance Manual
QC - Quality Control
QCSSR - Quality Control Structural Steel Review
QP - Quality Procedure
QR - Quality Requirement
RG - Regulatory Guide (NRC)
RSM - Reliable Sheet Metal Works, Inc.
SAR - Safety Analysis Report
SIP - Site Implementation Procedure
S&L - Sargent and Lundy Engineers
SWI - Site Work Instruction
UT - Ultrasonic Inspection
V - Volt
VT - Visual Inspection
W - Westinghouse Electric Corp.