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

December 16, 1983

MEMORANDUM FOR: R. C. Knop, Chief, Projects Branch 1
W. S. Little, Chief, Engineering Branch 2

FROM: C. H. Weil, Investigation and Allegation Coordinator

SUBJECT: CURRENT ALLEGATIONS AT PERRY

On November 29, 1983, you requested that I interview several allegers involving the Perry Nuclear Power Plant. Enclosed for your information/action are three memoranda concerning those interviews.

Charles H. Weil
Investigation and
Allegation Coordinator

Enclosures: As stated

cc w/enclosures:
G. W. Roy
E. T. Pawlik

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INTERVIEW MEMORANDUM

(ATS: R111-83-A-0121)

On November 30, 1983, Phillip Hendrickson telephoned the NRC Resident Inspector's Office at Perry and spoke with Charles H. Weil, R111 Investigation and Allegation Coordinator.

Hendrickson stated he had previously contacted Max Gildner, the NRC Senior Resident Inspector - Perry, about concerns he had with the L. K. Comstock Company (Reference Gildner's memo to R111 files). Hendrickson stated he was calling to provide Gildner with his forwarding address. Hendrickson advised he was leaving immediately and would not be available for a personal interview. Hendrickson provided his forwarding address as

effective December 5, 1983. Since Hendrickson was not available for a personal interview he was requested to briefly state his concerns with Comstock.

Hendrickson advised he had been employed by Comstock (the electrical contactor at the Perry site) from September 27, 1983 until October 10, 1983. Hendrickson further advised he had been in-training as a Level 2 Quality Control Inspector (Welding) at the time of his termination for being "unable to adapt to L. K. Comstock's program." Hendrickson stated he was not certified as an inspector prior to his termination. Hendrickson advised he has worked in the Nuclear Industry in excess of seven years.

Hendrickson stated he was intimidated by Comstock management while he was in training. Hendrickson recounted an incident in which the Comstock Corporate Quality Assurance Manager, Robert Marino, stated in a training class "if I tell you an item is black and white, and you say it is orange, then it is black and white." Marino was pointing at an item on the table when he made the statement.

Hendrickson stated that during another training class he asked a question about material certifications and received an answer which he did not consider to be satisfactory. After the class he went to Clarence Hart (the Comstock Assistant Quality Control Manager) and told Hart he had a problem with the way the class was conducted. Hart took Hendrickson to Dick Bower's office (Bower is the Comstock Quality Control Manager) and restated the problem to Bower. Hendrickson also told Bower that he wanted to speak to the NRC. Hendrickson stated that he was fired within 15 minutes of speaking with Bower and the reason for his termination was his inability to adjust to the Comstock program.

Hendrickson stated he did not feel that Comstock allowed its inspectors the freedom to make interpretations. Hendrickson stated he felt Comstock applied "dominating pressure to inspectors in training." Hendrickson further stated that he believed two Comstock inspectors were either lazy or unqualified, but Hendrickson would not elaborate.

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Enclosure 2

Hendrickson advised he has spoken to both Tom Devine of GAP and the Department of Labor about his employment termination.

Charles H. Weil
Investigation and
Allegation Coordinator

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

NOV 07 1983

Docket Nos. 50-440
50-441

The Cleveland Electric Illuminating Company
ATTN: Mr. Murray R. Edelman
Vice President
Nuclear Group
P.O. Box 5000
Cleveland, OH 44101

Gentlemen:

SUBJECT: Construction Appraisal Team Inspection 50-440/83-31, 50-441/83-30

This refers to the Construction Appraisal Inspection by the Office of Inspection and Enforcement (IE) on August 22-September 2 and September 12-23, 1983, at the Perry Nuclear Power Plant Units 1 and 2. The Construction Appraisal Team (CAT) was composed of members of IE, Region III, and a number of consultants. The inspection covered construction activities authorized by NRC Construction Permits CPPR-148 and CPPR-149.

This inspection is the fourth of a series of construction appraisal inspections being planned by the Office of Inspection and Enforcement. The results of these inspections will be used to evaluate implementation of 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 of detailed inspection of selected hardware subsequent to Quality Control inspections, a comprehensive review of selected portions of your Quality Assurance Program, examination of procedures and records, observation of work activities and interviews with management and other personnel.

Appendix A to this letter is an Executive Summary of the results of this inspection and of conclusions reached by this office. The NRC Construction Appraisal Team noted no pervasive failure to meet construction requirements in the samples of installed hardware inspected by the team. However, management attention is needed for the resolution of the detailed deficiencies identified during the inspection.

NOV 07 1983

The NRC CAT inspectors identified a number of typical construction type deficiencies which had been previously identified by the applicant's project organization. They also perceived a quality conscious attitude throughout this project organization. It was noted that timely management attention was being given to findings identified by both the NRC CAT and the project organization.

It is also our understanding that you plan to review welding of small bore piping manufactured by Pullman Power Products at the Williamsport, Pennsylvania facility as a result of problems identified during this inspection and by Georgia Power Company at their Vogtle facility.

Appendix B to this letter contains a list of potential enforcement actions based on the NRC CAT inspector observations. These have been referred to the NRC Region III office for review and necessary actions.

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 unless you notify this office, by telephone, within 10 days of the date of this letter and submit written application to withhold information contained herein within 30 days of the date of this letter. Such applications must be consistent with the requirements of 10 CFR 2.790(b)(1).

No reply to this letter is required at this time. NRC Region III will address the potential enforcement findings at a later date and any required response will be addressed at that time.

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

Sincerely,

Richard C. DeYoung, Director
Office of Inspection and Enforcement

Enclosures:
1. Appendix A - Executive Summary
2. Appendix B - Potential Enforcement Findings
3. Inspection Report 50-440/83-31, 50-441/83-30

UNITED STATES NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT

DIVISION OF QUALITY ASSURANCE, SAFEGUARDS, AND INSPECTION PROGRAMS
REACTOR CONSTRUCTION PROGRAMS BRANCH

Report No.: 50-440/83-31, 50-441/83-30

Docket Nos.: 50-440, 50-441

Applicant: Cleveland Electric Illuminating Company
Post Office Box 5000
Cleveland, Ohio 44101

Facility Name: Perry Nuclear Power Plant, Units 1 and 2

Inspection At: Perry Nuclear Power Plant, Units 1 and 2, Perry, Ohio

Inspection Conducted: August 22-September 2, 1983 and
September 12-23, 1983

Inspectors: A. B. Beach, Sr. Reactor Construction Engineer (Team Leader) — 10/27/83 Date Signed

G. B. Georgiev, Sr. Reactor Construction Engineer — 10/27/83 Date Signed

for R. A. Rohrbacher, Sr. Reactor Construction Engineer — 10/27/83 Date Signed

for W. A. Hanson, Inspection Specialist — 10/27/83 Date Signed

D. B. Osborne, Reactor Construction Engineer — 10/27/83 Date Signed

H. W. Phillips, Reactor Construction Engineer — 10/27/83 Date Signed

H. J. Wong, Reactor Construction Engineer — 10/27/83 Date Signed

for T. E. Vandel, Reactor Inspector (Region III) — 10/27/83 Date Signed

Consultants: R. M. Compton, D. C. Ford, E. Y. Martindale, and F. A. Pimentel

Approved By: R. F. Heishman, Chief
Reactor Construction Programs Branch — 10/27/83 Date Signed

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I. INSPECTION SCOPE AND OBJECTIVES

The objective of this inspection was to evaluate the adequacy of construction at the Perry Nuclear Power Plant Units 1 and 2. This objective was accomplished through review of the construction program and selected portions of the quality assurance program, with emphasis on the installed hardware in the field.

Within the areas examined, the inspection consisted of a detailed examination of selected hardware subsequent to applicant quality control inspections, a selective examination of procedures and representative records, and observation of in-process work. Interviews were conducted with designated site managers, quality control inspection personnel and craft personnel.

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

- Is the hardware installed in accordance with the approved design?
- Do individuals with assigned responsibilities in a specific area understand their designated responsibilities?
- Are quality verifications performed during the construction process with applicable hold points and are quality verifications conducted to adequate inspection acceptance criteria?
- Do personnel involved with Quality Assurance/Quality Control have the organizational freedom to perform their tasks without harassment or intimidation?
- Are management controls established and implemented to adequately control activities in the subject area?

The areas in which a selected sampling inspection was conducted include:

- Electrical and Instrumentation Construction
- Mechanical Construction
- Welding and Nondestructive Examination
- Civil and Structural Construction
- Material Traceability, Storage, and Maintenance
- QC Inspector Effectiveness
- Quality Assurance

II. ELECTRICAL AND INSTRUMENTATION CONSTRUCTION

A. Objective

The primary objective of the appraisal of electrical and instrumentation construction was to determine whether safety-related components and systems were installed in accordance with regulatory requirements, SAR commitments and approved 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 specific areas. These included electrical cable, raceways, electrical equipment and instrumentation components. Additionally, a review was made of a selected number of documents associated with design change control and nonconformance reports.

1. Electrical Raceway Installation

a. Inspection Scope

The NRC CAT inspectors selected eight conduit runs, with a total length of about 750 feet, from various plant areas for detailed inspection. These runs were inspected for conformance to requirements relative to routing/location, separation, bend radii, supports, support spacing, identification and attachments. An additional 200 feet of conduit, associated fittings and supports were inspected for general workmanship, separation and identification.

Thirteen runs of installed cable tray, with an aggregate length of about 1000 feet, were inspected relative to support location, separation, mounting, protection and physical loading. Samples were selected from plant areas which included the control complex, radwaste, reactor and intermediate buildings.

Twenty raceway supports were examined in detail for such items as location, material, anchor spacing, weld quality and installed configuration.

b. Inspection Findings

(1) Cable Tray Separation

Relative to separation of cable tray, the PNPP FSAR Section 8.3.1.4.1.4 states in part "... cable trays of different divisions have a minimum horizontal separation of three feet when there is no physical barrier between trays. Where horizontal separation of three feet is unattainable, the trays will be separated by fire resistant materials... In cases where trays

must be stacked one above another, a minimum separation of five feet is maintained. Where vertical separation cannot be maintained, the trays will be separated by fire resistant materials."

Specific acceptance criteria for divisional separation between cable trays and conduits are detailed on Gilbert Associates, Inc. (GAI) Drawing D-214-004 Rev. K.

During inspection of the selected cable tray sample, the NRC CAT inspectors observed the following tray segments (listed below) which did not maintain the required separation between divisions. The cable tray segments in the left column do not meet the required separation relative to the tray segments listed in the right column.

Division B 269	Division A 156
Division A 603	Non-Div. 2327 Non-Div. 1260
Division A 656	Non-Div. 1260
Division A 655	CDT. 1R33C-1040X CDT. 1R33T-27X CDT. 1R33R-407X Non-Div. 425
Division A 665	CDT. 1E22H-201C
Division A 152	CDT. 1E22H-201C CDT. 1E22H-204C
Division A 663	Non-Div. 1538 Non-Div. 1575 Non-Div. 3593 Non-Div. 083
Division A 150	Non-Div. 3593 Non-Div. 083
Division B 274	CDT. 1R33C-3133C
Division B 273	CDT. 1R33C-3133C Non-Div. 1649 Non-Div. 2238
Division B 272	CDT. 1R33C-2977C CDT. 1R33R-1029C
Division B 1319	Non-Div. 595
Division B 271	CDT. 1R33-2975C
Division A 601	CDT. 1R33C-2811D CDT. 1R33C-315D

Division A 1680	CDT. 1017R-144C
Division B 1326	CDT. 1C71-136C CDT. 1R33R-3020C CDT. 1R33R-917C CDT. 1R33C-2921C CDT. 1R33C-3022C
Division A 153	CDT 2B42C-24B CDT. 1B33C-3508B CDT. 2R61A-1165B
Division A 3008	Non-Div. 4555
Division B 269	Division A 141
Division A 127	CDT. 1R33C-3301B
Division A 1657	CDT. 1R33C-3033
Division B 1846	CDT. 1R38C-3147C CDT. 1R33F-142C

The NRC CAT inspectors reviewed the inspection records for these installations. The records were in the form of an inspection checklist issued as part of L. K. Comstock (LKC) Procedure 4.3.1, "Cable Tray and Conduit Installation". Section 3.4 of this procedure details the requirements for quality control inspection of cable tray and conduit installations. With regard to separation, Section 3.4.4.11 states... "verify installed cable tray and channel tray have not violated the separation criteria." In reviewing the records of this inspection activity, the NRC CAT inspectors noted that line item 11, separation criteria acceptable, had been initialed by the QC inspector. This indicates an acceptable installation when in fact the installed configuration of the cable tray does not meet the specified separation criteria.

The NRC CAT inspectors discussed this matter with representatives of the quality organizations of both the applicant and the electrical contractor. The results of these discussions indicated that the initialed acceptance of the subject raceway installations was intended to be contingent upon the installation of approved barriers at some later date. The NRC CAT inspectors observed that, although barriers were shown on the design drawings, there were no procedures available for installation of these barriers. Additionally, at the time of the CAT inspection, material to be used for barrier applications had not been specified.

As a result of these observations, the licensee issued Action Request (AR) 692 which details steps to be taken to correct these discrepancies. The AR included:

- the stamping of all existing Form 17 and Form 82 (Cable Tray and Conduit Inspection) Checklists with the words "barrier installation not verified"
- the revision of Procedure 4.3.1 to define the term "separation criteria"
- the revision of Procedure 4.3.1 to procedurally address the use of this stamp.

Further attention will be required by the applicant and electrical contractor to assure that inspection records accurately reflect the actual hardware installation and that work/inspection procedures are developed to control activities associated with barrier installation and inspection.

(2) Drywell Raceway Installation

During inspection of raceway installation within the drywell, NRC CAT inspectors noted that construction activities were being accomplished using sketches. A review of the program which establishes use of these sketches indicated that initially the installation of raceway in the drywell area was in accordance with Gilbert-approved 500 Series drawings. However, as construction coordination problems in this area increased, a variance to use sketches was requested via Field Variance Authorization (FVA) 4331-33-899. This FVA was approved on 8/19/82. Subsequently, a review by the Site Quality organization indicated that the use of an FVA to establish this program was not in accordance with established procedures. Engineering Change Notice (ECN) 1327-33-2422 was then initiated to provide the appropriate incorporation of the Reactor Building As-Built Drawing Program into Electrical Construction Specification 33-4549-00.

The NRC CAT inspectors examined several sketches from areas including the electrical contractor's QC file and the field stick files. These sketches detailed conduit and conduit support installations. Many sketches included specification variances. Some variances were individually initialed, others were circled, still others were apparently approved by initialing the sketch in the lower right hand corner. The sketches themselves did not appear to be consistently approved. Some sketches reviewed included sign-offs in the approval block by electrical, structural, and civil engineers, others received only an initial and date outside of the approval block. The NRC CAT inspectors reviewed the program for issue and control of these sketches and concluded that there was no formal, procedural control of this activity. Discussions with the applicant and representatives from the Conduit Detail Group indicated that these documents are controlled by the Conduit Detail Group and are not controlled or handled by the Contractor's Document Control Section. Sketches are issued to the field and to QC directly by the Conduit Detail Group. The Conduit Detail Group is a rather unique part of the

PNPP project organization in the Nuclear Construction Engineering Section. The detailers in the group work for the electrical contractor (LKC), but the group technically reports to the architect-engineer (GAI).

The NRC CAT inspectors asked about the control of revised or superseded sketches without the use of a procedure. The applicant was unclear as to whether revised or superseded sketches in the field were retrieved or destroyed by the foreman.

Inspection of raceway installed in accordance with this program is not accomplished until the "as-built" information from these sketches is incorporated and approved on a Gilbert 500 Series drawing. The exception to this is the inspection for placement of Hilti bolts and welding of supports. These activities are performed as an in-process inspection. Inspection records reviewed for this activity did not indicate the sketch revision number. The NRC CAT inspectors were unable to discern to which revision of a sketch these in-process inspections were performed. Based upon these observations, the program for installation of raceway in the drywell area appears to require additional procedural controls. (As a result of the NRC CAT review in this area, the applicant has proposed changes to LKC Procedure 4.3.1, "Cable Tray and Conduit Installation", and to Procedure 4.2.2, "Field Engineering Changes", to clarify responsibility and control of raceway sketches.)

(3) Raceway Separation

In the Unit 1 Auxiliary Building, the minimum separation distance between redundant division conduit and pull boxes (PB) was not met relative to conduit 1R33C4239B, PB-1-346 and PB-1-2925. [LKC documented this condition on Nonconformance Report (NR) 2288.]

(4) Conduit Support

The water-tight flexible portion of conduit 1P45H3B-3 in the Emergency Service Water Pump House was supported by a piece of tie-wire that was cutting into the outer covering. (LKC initiated NR 2292 to document this condition.)

(5) Conduit Identification

Conduit identification was readily visible, properly located and appropriately used where necessary.

c. Conclusions

(1) The separation status of numerous installed and inspected cable trays was not accurately recorded on QC inspection records. These records indicated "separation criteria acceptable" when, in fact, this was not the case.

(2) Some drywell installation and inspection activities were being accomplished without formal, procedural controls for the sketches being used.

(3) Although a few minor deficiencies were noted, no major problems were identified relative to the installed raceways.

2. Electrical Cable Installation

a. Inspection Scope

The NRC CAT inspectors selected a sample of installed electrical cable runs that had been previously accepted by site quality control inspectors. The sample included high voltage, power, control and instrument cables. For each of these cable runs, physical inspection was made to ascertain compliance with applicable design and installation criteria relative to size, type, location/routing, bend radii, protection, separation, identification, physical loading and supports.

Additionally, the NRC CAT inspectors selected 56 cable ends (306 terminated conductors). These were inspected relative to the applicable design and installation documents for items such as termination location, correct size and quantity of conductors and correct identification of cables and wires.

The following high voltage and power cables, totaling approximately 1,100 feet, were selected from different systems, electrical trains, locations and sizes:

Cable No.	Type
1R23F-7A	3 1/c 500 MCM
1R23F-18B	3 1/c 500 MCM
1E12F-26A	3/c No. 12
1E12F-20B	3/c No. 12

The following control cables, totaling approximately 600 feet, were selected from different systems electrical trains, locations and sizes:

Cable No.	Type
1E12C-68B	1 3/c No. 14
1E12C-100B	1 7/c No. 14
1E42D-37B	1 3/c No. 14
1E12C-238A	1 9/c No. 14
1E32C-82A	1 9/c No. 14

The following instrument cables, totaling approximately 600 feet, were selected from different systems, electrical trains, locations and sizes:

Cable No.	Type
1C51R-780D	COAX
1C51R-782D	COAX
1E12R-29A	1-4/STP-20
1R61A-587C	1-STP-16

The NRC CAT inspectors also observed installation/pulling activities associated with cable 1E22H201C. This is a 3/c 500 MCM cable to HPCS pump motor 1E22-C001. Observations were made to determine compliance with installation requirements, such as protection during handling and pulling, use of cable lubricant, conduit condition prior to pulling, use of a tension monitoring device and size and proficiency of pulling crew.

b. Inspection Findings

(1) Routing

The LKC QA/QC Procedure 4.3.3, "Cable Pulling Procedure," Section 3.1.3, states "The cable size, type, and routing is as shown on the pull slip or as modified by an approved RCIM (Routing Change Modification). Obvious routing errors shall be brought to the attention of the Project Organization by the Comstock Cable Engineer. Routing of cable may be revised in the field by the Project Organization. The authorized Engineer shall sign and date all revisions to the original cable pull slip as well as the work and QC copies in the field. QC shall have in his possession an approved RCIM (document this RCIM on applicable form 105A) stating revision to routing prior to final acceptance of cable pull."

During inspection of the selected cable sample, the NRC CAT inspectors observed the following cables with installed routings that did not match those indicated on the pull slip, and for which an RCIM had not been initiated:

- Cable 1R23F-7A was pulled from tray 128A through tray 688A into equipment 1R23-S010. However, the pull slip does not indicate vertical tray 688A as part of the routing.

- Cable 1R42D-37B is pulled to equipment 1R23-S011. However, the pull slip indicates the routing of this cable to equipment 1R23-S012 instead of 1R23-S011.

(As a result of these observations, the applicant has initiated NR P033-2132 to rework and reinspect these discrepancies and to revise procedures 4.3.6 and 4.3.17 for clarification to prevent recurrence. Also, NR OQC 302 was initiated to document the discrepancy on circuit 1R2D-37B.)

Although several discrepancies were identified in this area, only one instance was the result of poor construction/inspection practices. A review of design information associated with the remaining cables disclosed that routing discrepancies were a result of errors in the pull slips. Although these errors should have been identified by site QC personnel, there were only a small number of discrepancies noted by the NRC CAT inspectors in this area.

(2) Separation

The PNPP FSAR Section 8.3.1.4.1.1 states in part ... "electrical equipment and wiring for Class 1E electrical systems are segregated into separate independent divisions... such that no single credible event is capable of disabling sufficient equipment to prevent reactor shutdown, ... division separation requirements apply to equipment and wiring systems concerned."

Separation of redundant divisions in general plant areas is discussed in paragraph 1 of this section. For the purpose of clarification, separation, as referred to in this section, deals only with cable and wiring installed in the Power Generation Control Complex (PGCC) ductways and panels.

LK Procedure 4.3.30, "PGCC Control Room Work/Inspection Procedure", Section 3.3.1 states in part... "All cable routing in the PGCC area will be accomplished using Cable Pulling Procedure 4.3.3."

LKC Procedure 4.3.3, Section 3.2.28.1, states in part, "pulled through circuits will be routed as shown on wire list and drawing to maintain the required separation within the duct work. Separation shall be maintained both externally and in-panel."

Section 3.2.2.8.2 states... "QC shall inspect 100% of all pull through circuits in Control Room only. Safety related circuits shall be pulled in safety related raceways only."

Section 3.2.28.7 states... "divisional cables shall be separated from cables of other divisions by six inches or metallic conduit or barriers or as directed by Project Organization."

During the inspection of cable installations in the PGCC ductway of the Unit 2 Control Room, the NRC CAT inspectors observed that many cable separation violations existed. Cables of one division were installed in physical contact with those of another division.

Discussions with the applicant, LKC and General Electric (GE) indicated that approved barriers would be installed at a later date to correct this condition. LKC representatives initiated an NR to document this situation. Items indicated on this report had been transferred to a master deficiency list by the applicant.

The NRC CAT inspectors further reviewed installations in this area and concluded that installation of barriers had yet to be accomplished. It was estimated that there are as many as 400 locations in which barriers will be required. Concurrently, the installation of pull through circuits has progressed to the point of 60-70 percent completion.

Examination of several potential barrier locations indicated that the installed configuration of cable may significantly impair the installation of barriers. Additionally, the NRC CAT inspectors found no formal procedures for installation and inspection of barriers.

Work currently being performed in Unit 1 ductways is accomplished in accordance with a GE Field Design Deviation Request (FDDR). During the inspection of this area, the NRC CAT inspector observed the in-process installation of a separation barrier (duct cover) in Unit 1. The NRC CAT inspectors noted that there were no QC personnel present during this activity and further discussions with the applicant and LKC personnel disclosed that QC had not been notified of this installation activity. (LKC NR 2368 was initiated to document this condition.)

The NRC CAT inspectors concluded that the appropriate procedural controls have not been established to assure that previously inspected cables will not be damaged by the installation of barriers, and that all required barriers will be installed. As a result of this inspection, the applicant has initiated AR 720 which makes the following recommendations:

- LKC QC to ensure that coverage is provided for the established hold point on the installation of PGCC duct covers for the balance of Unit 1.
- No bulk installation of duct covers to proceed in Unit 2 without an approved installation/inspection procedure.
- Initiate an NR to document the indeterminate status of the cables in the ductways.

- Provide both craft and QC training pertaining to the above mentioned requirements.

(3) Terminations

LKC Procedure 4.3.6 sets forth the criteria for cable terminations. Contrary to this procedure, the NRC CAT inspectors observed that the lug on the red conductor at terminal point T3 of cable #1E12F-53B exhibited a 1/4" gap between conductor insulation and lug. (NR LKC 2313 was initiated to rework this connection.)

In general, the terminal blocks and lugs were of the specified material, terminal lugs exhibited evidence of proper crimp tool usage, conductors were free from jacket/insulation damage, conductors were terminated as shown on applicable wiring diagrams and conductors did not violate bend radii criteria.

c. Conclusions

With the exception of problems identified relative to separation of cables and installation of duct covers in the PGCC ductways, the installation of the cable inspected is in accordance with design and installation documents. In general, cables, terminations and associated items exhibited proper configuration and good workmanship. Inspection records reflected the current status of the installed components.

3. Electrical Equipment Installation

a. Inspection Scope

Over twenty pieces of installed electrical equipment and associated items were inspected. Samples were selected based on system function and safety classification. Additional equipment samples are included in paragraph 4 of this section.

The following specific electrical components were inspected:

(1) Motors

The installation of two motors and associated hardware was inspected for such items as location, anchoring, grounding, identification and protection. The motors were the Emergency Service Water Pump Motor 1P45-C001B and the Emergency Closed Cooling Pump Motor 1P42-C001A.

(2) Electrical Penetration Assemblies

The following containment penetration assemblies were inspected: 1R22-S011, 1R22-5026 and 1R22-S004. The location, type, mounting and identification were compared with the installation drawings.

(3) Circuit Breakers

The following Class 1E circuit breakers were examined to determine compliance with the design and installation documents for size, type, mounting, system interface, and maintenance:

RHR Pump "A" Feeder Breaker EH-1110

HPCS Pump Feeder Breaker EH-1303

Emergency Service Water Pump "A" Feeder Breaker EH-1106

Diesel Generator Breakers EH-1201 and EH-1101

RPS Electrical Protection Assembly Breakers 1C71-S003 and 1C71-S003A

The use of circuit breakers with integral under voltage trip attachments at the PNPP was investigated.

(4) Switchgear and Motor Control Centers

The following switchgear and motor control centers were inspected: Emergency Service Water MCC 1R24-S030 and MCC EF1E2; and 4.16 KV Switchgear 1R22-S006 and 1R22-S007.

The installations were compared with installation requirements relative to location and mounting (welds, concrete anchors and bolting). Installation inspection records for the above equipment also were reviewed.

(5) Station Batteries and Racks

The 125V battery rooms were inspected including the installed batteries, battery racks and associated equipment. The location, mounting, maintenance and environmental control for installation of both Unit 1 and Unit 2 batteries were compared with applicable requirements and QC records.

b. Inspection Findings

(1) Motors

The NRC CAT inspectors observed that the installed configuration of these motors was in accordance with design drawings and that installation activities were performed in accordance with procedural requirements.

(2) Electrical Penetration Assemblies

Activities observed and documentation reviewed indicated that the work performed was in accordance to requirements.

One item which was identified related to the certification of material used in the penetration sleeves. This matter had been previously addressed by the applicant in a 10 CFR 50.55(e) report.

(3) Circuit Breakers

The circuit breakers inspected were installed in accordance with design drawings and installation procedures.

An on-site review and discussions with the applicant indicated that no circuit breakers with integral undervoltage trip attachments, such as the W DB or GE AK-2 types, are planned for use in safety-related applications. Additionally, the applicant has requested the NSSS and the AE to confirm that breakers of the above type have not been specified or supplied for the Perry Nuclear Power Plant (PNPP).

(4) Switchgear and Motor Control Centers

During the inspection of switchgear 1R22-S006, the NRC CAT inspectors noted cabinet connection bolts of indeterminate material had been used in cubicles EFH-1204 and EFH-1209. This matter is discussed in Section VI.

(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 indicate no smoking or open flames.

The inspection of the 125V battery racks disclosed that indeterminate bolt material was used on the Unit 1 Division 1 and Unit 2 Division 2 battery racks. This matter is discussed in Section VI.

c. Conclusions

Except for bolting material discrepancies relative to battery racks and switchgear cabinet connections, the electrical equipment inspected was installed in accordance with applicable requirements.

4. Systems Installation

a. Inspection Scope

In addition to the inspection of randomly selected plant components, the NRC CAT inspectors designated two plant systems for inspection of electrical and instrumentation system integrity - the residual heat removal and the reactor protection systems.

Within these systems, electrical and instrument components, cables, associated raceway, signal lines, and supports were inspected relative to the applicable design documents and construction drawings. The following samples were selected:

RHR System

RHR Pump Motors 1E12-C002B and 1E12-C002C
RHR Pump Motor Thermocouples
1E12-N486, 1E12-N485, 1E12-N488 and 1E12-N489
Power Feed to 1E12-C002B (Cable 1E12H-2B)
Power Feed to 1E12-C002C (Cable 1E12H-3B)
Motor Operated Valve 1E12-F004B
MOV Control Cables 1E12F-12B and 1E12C-40B
RHR Pump B Breaker EH-1208 and Pump C Breaker EH-1212

RPS System

RPS Power Distribution Panels 1C71-001 and 1C71-P002
RPS Motor Generator Set 1C71-S001B

b. Findings and Conclusions

During the inspection of these systems, the NRC CAT inspectors observed that not all of the instrument components for these systems have been installed. Additionally, several of the tubing runs inspected, which appear to be essentially completed, have yet to receive QC inspection.

The installation of electrical and instrument components inspected in the RHR and RPS systems was in accordance with the applicable requirements. Components reviewed were installed in accordance with the latest construction drawings and exhibited good workmanship. Documentation reviewed, including inspection and test records, indicated acceptable installations and reflected the current installed configuration.

5. Instrumentation

a. Scope

Six instrument panels and five instrument racks, including associated instrument components and related items, were selected for inspection from various areas of the plant. The sample included about 60 safety-related instrument components within such systems as reactor protection, engineered safety features, residual heat removal, high pressure core spray, some components in the main steam line radiation monitor and reactor vessel instrumentation sub-systems. The racks and panels were inspected for compliance with installation requirements, including location, protection, mounting/anchoring and separation of redundant components and panels. Additionally, about 1000 feet of instrument tubing was inspected against installation requirements relative to location/

routing, supports, support location, identification and protection. The majority of the tubing runs inspected were from the process connections to the sensors/transmitters installed on the above racks and panels. Associated tubing penetration assemblies were also inspected. The type, range, accuracy, material, and similar attributes of 30 of the above installed instrument components were compared with their specification requirements. Instrument panels, and associated instruments, inspected in detail included: H22-P001, H22-P004, H22-P005, P22-P018, H22-P026 and H22-P027 in Unit 1.

b. Inspection Findings

Numerous installed components (mostly Rosemount transmitters) have failed required qualification tests. The applicant is aware of this situation and has tagged the components that require replacement, and some components have already been removed.

A compression fitting was installed in a completed welded-joint tubing run near valve 1E12F053OA and related to panel P22-P018. This run was modified by the addition of a compression fitting tee by Johnson Controls, Inc. (JCI), the instrument contractor, at the request of the Nuclear Test Section (NTS) of the PNPP project organization. It was not clear to the NRC CAT inspectors that this modification was appropriately recorded, scheduled for rework and subsequent re-inspection. Additionally, the installed tubing clamps were removed from this tubing and not properly controlled. About 20 feet was left unsupported and unprotected. (Procedures pertaining to modifications requested by NTS and performed by JCI are to be revised to correct this type of problem.)

In several locations, safety-related instrument tubing was, at best, marginally protected from damage from adjacent construction activities and from inadvertant damage which may occur during plant operation. It was observed that some non-safety-related instrument tubing was more suitably protected from damage than some safety-related tubing.

A choker used for rigging to relocate instrument panel 1H22-026 was attached to internal panel members and across a section of tubing rather than attached to the panel frame. (An NR is to be initiated to document this condition.)

Although much of the safety-related instrument tubing has been installed in Unit 1, the tubing is not color-coded as specified. The applicant indicated that color-coded tape will be applied after tubing hydro tests.

c. Conclusions

Although some minor discrepancies were noted, no items of major safety significance were identified. In general, the racks, panels, components, tubing and associated items inspected were installed in accordance with applicable requirements - or appropriately tagged and/or recorded as nonconforming.

6. Design Change Control and Nonconformance Reports

a. Inspection Scope

The design change program and related procedures used at the Perry site were reviewed. In regard to electrical and instrumentation installation activities, 70 LKC ECNs and 50 LKC FVAs were reviewed; 35 JCI ECNs and 25 JCI FVAs were reviewed; and 10 GE Field Design Instructions and 10 GE Field Design Deviation Requests were reviewed.

The NRC CAT inspectors also reviewed a sample of NRs issued by the electrical and instrumentation contractors. These reports were reviewed for items such as content, completeness, timeliness of review, proper approval, technical justification, and document processing. Approximately 45 NRs initiated by the electrical contractor and 20 NRs initiated by the instrumentation contractor were examined. Additionally, several reports initiated by GE and the PNPP Project Quality Organization were reviewed.

b. Inspection Findings

GAI approves design and engineering changes either at their home office in Reading, PA. or by the GAI assistant project manager at the Perry site. Processing and control of these changes are in accordance with GAI Interface Procedure, Appendix N. GAI initiates ECNs, indicates whether the change is specification or drawing-related and transmits the ECN package to the project Nuclear Construction Engineering Section (NCES). ECNs can also be written to accomplish construction work under the direction of the Nuclear Test Section (NTS). This work is to be controlled by the Corporate Nuclear Quality Assurance Program.

For drawing-related ECNs only, GAI may issue the ECN to the affected contractor prior to transmittal to the project NCES, but only for minor modifications to electrical conduit routings, conduit and tray supports, cable terminations and piping supports including instrument piping supports.

For minor changes only, FVAs may be used. They are generally used for drawing changes, but may be used for specification changes if no design change is involved. FVAs can be initiated by either the applicant or the AE (GAI), but FVAs require GAI approval.

In accordance with site procedures, contractors utilize a nonconforming reporting system to document discrepancies which render the quality of an item indeterminate or unacceptable. Of the nonconforming reports reviewed, it was noted that they had been initiated, reviewed and processed in accordance with the applicable procedures.

c. Conclusions

The general program and procedures established to control design and engineering changes were, in general, considered adequate. However, two problems were identified that indirectly relate to design change controls. One problem, as discussed in paragraph 1 of this section, pertains to the lack of formal, procedural controls of sketches used for conduit installation activities. The other problem relates to the weakness in the control of changes under the direction of NTS - as mentioned in paragraph 5 of this section.

Nonconformance reports reviewed were initiated, reviewed and processed in accordance with the applicable procedures.

III. MECHANICAL CONSTRUCTION

A. Objective

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

B. Discussion

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

1. Piping

a. Inspection Scope

Ten piping isometric drawings were selected and the installed piping inspected for conformance to design and procedural requirements. The installed piping was examined for pipe identification (via ASME Code Data Plates), proper configuration, valve identification, valve and valve operator orientation, bolted flange makeup, interference and support/restraint location (partial). As a result of a problem identified during the inspection with valve/valve operator orientation, an additional 10 valves were selected to verify conformance of their orientation to that shown on the isometrics. Approximately eight flanged joints were inspected for proper gasket and bolting material and proper makeup. See Table III-1 for a listing of the piping inspection samples and observations.

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

Pullman Power Products Procedure IX-3, Rev 4/5/83, "Fabrication and Field Installation Specifications for Nuclear Power Plant Components, Piping Systems and Appurtenances ASME-Section III"

Pullman Procedure IX-5, Rev 1/31/83, "Torquing of Flanged Joints in Piping Systems"

Pullman Procedure VI-5, Rev 8/12/82, "Control of Process Sheets and Weld Rod Stores Requisitions"

Pullman Procedure X-4, Rev 6/8/81, "Final Inspection (Field)"

Applicable piping isometric drawings

b. Inspection Findings

In general, the piping runs inspected were found to conform to requirements for the attributes verified. However, one bolted valve and two valve operators were not oriented as shown on the isometric drawings. As a result of these observations the NRC CAT inspectors selected 10 additional valves for inspection of proper orientation (See Table III-1). Three of these valves and one of the valve operators were oriented in conflict with the isometric drawing. It should be noted that three of the seven valves oriented in conflict with the isometric drawings had been "as-built certified."

Even though some of the valve installations had been "as-built", Pullman, the responsible contractor, does not inspect piping for configuration, valve orientation, flow arrows, and other similar attributes until the final turnover walkdown inspection per their Procedure X-4. Also, none of the valves in question had been inspected for joint makeup per Procedure IX-5. However, joint makeup process sheets do not specify or require verification of proper orientation. The NRC CAT inspectors do not consider the current schedule of piping/equipment configuration (construction acceptance) inspection to be timely, nor prudent from a potential rework/repair standpoint. In addition, the NRC CAT inspectors do not consider the Pullman final walkdown procedure, Procedure X-4, to be specific with regard to the detailed inspections required, the applicable inspection/acceptance criteria and the methods of dispositioning unsatisfactory conditions; i.e., punchlists, deficiency reports, or nonconformances.

c. Conclusions

(1) With the exception of valve and valve operator orientation, no major hardware deficiencies were identified in the piping runs inspected.

(2) Valves and valve operators are being improperly installed by the crafts and the "as-built" program has failed to identify the discrepancies.

(3) The construction acceptance inspections for certain piping features are not being performed in a timely manner and the final piping turnover walkdown procedure lacks specificity regarding responsibilities, inspection/acceptance criteria and discrepancy processing.

2. Pipe Supports/Restraints

a. Inspection Scope

Twenty-eight QC accepted safety-related supports/restraints were selected for inspection which provided a variety of types, sizes, systems and locations. These supports/restraints were inspected for configuration, identification, location, fastener/expansion anchor

- The Phase II checklist for restraint 1E12-H748 was signed, dated and on file but none of the checklist items had been marked as to whether the items were acceptable, unacceptable or not applicable.

- The welding process sheets for supports 1P42-H1043, 1P45-H360, 1E12-H178 and 1C11-H516 (four of 12 examined during the observation of in-process welding activities) did not indicate the latest Pullman issue number of the installation drawing; some as many as five issues behind. However, each work package did contain a copy of the latest issued drawing.

- Three supports/restraints (1B21-H006, 1E12-H010 and 1E12-H614) were found to have potential clearance problems with other structures. There were no seismic clearance violation (SCV) stickers in these areas indicating prior identification by the SCV inspection group. Even though overall "area" inspection effort by the SCV group may at some point identify these clearance problems, the NRC CAT inspectors consider that clearance criteria should be clearly specified for hardware installation and that each contractor should verify proper clearance for their hardware prior to and during acceptance inspections. This will provide greater assurance that all clearance problems will be identified and resolved and minimize rework/reanalysis efforts. See Section V of this report for more details on the SCV inspection group activities.

During this review, controls that Pullman exercises to maintain required traceability of supports/restaints were evaluated. This is discussed in detail in Section VI.

Several Pullman QC inspectors and field engineers and CEI QC Surveillance personnel were informally observed and interviewed in the field by the NRC CAT inspectors. These personnel appeared to be knowledgeable of their responsibilities and of the requirements of the activities they were performing.

c. Conclusions

(1) No extensive or gross structural integrity problems were identified on installed supports/restraints.

(2) Some ASME Section NF (safety related) and Class 4 supports/restraints that had been QC accepted were found by the NRC CAT inspectors to be nonconforming with design drawing and procedural requirements.

3. As-Built Program (Pullman)

a. Inspection Scope

The NRC CAT inspectors reviewed approximately 10 redlined drawings from the as-built field files. Also reviewed were the as-built procedures and program activities of Pullman field engineering, drafting and QC personnel, as well as the CEI Nuclear Construction Engineering Section.

Three of the piping runs and eight of the pipe supports/restraints inspected as detailed in Sections III.B.1 and III.B.2 had been "as-built certified" by Pullman Power Products.

b. Inspection Findings

Discrepancies between installed hardware and drawings were noted on six out of 11 "certified as-built" drawings included in the NRC CAT piping and pipe support/restraint samples. See Tables III-1 and III-3 for listings of identified discrepancies.

The review of "as-built" documentation and program activities indicated several additional deficiencies and weaknesses. For restraint 1P11-H059, the field redlining was performed and the certified "as-built" issued against ECN 12198-45-890 Rev. A, but ECN 12198-45-890 Rev. C was the current revision listed on the Pullman issued installation drawing. Procedure X-24, "Procedure for As-Building Piping Systems and Components," is not being followed in that QC is not involved in all walkdown inspections, walkdown teams are not signing and dating redlined drawings in all cases (1P45-H529, 1P45-H485) and the field engineering group is not determining conformance of hardware to erection tolerances. It should be noted that Pullman personnel were aware that this procedure was not being followed, but had not taken corrective action.

The NRC CAT inspectors consider that Procedure X-24 needs to more clearly define who determines when redlined dimensions are out of tolerance and, if so, what specific action is to be taken. The Pullman drafting group has issued at least four "as-builts" (1P45-H590, 1P45-1176, 1E12-H2002, 1P45-H1277) and has numerous others in the final stage of preparation that had been identified informally to Pullman QC as having conditions requiring determination of acceptability (conflicts between redlined information and the latest design drawing) but, for which no response had been given. Procedure X-24 is also unclear and is inconsistently being applied regarding the determination of elevation, location and concrete expansion anchor diameter and length for supports/restraints.

A review of the CEI program to review "as-builts" as detailed in Site Project Administration Procedure 0303, Rev. 1, "As-Built Drawings" indicated a thorough engineering review. In fact, this review has been resulting in rejection of a high percentage of Pullman "as-built" drawing submittals since April 1983. From April

installation, clearances, member size and damage. In addition, approximately 50 unidentified safety- related supports/restraints were observed in the field for obvious deficiencies such as loose or missing fasteners, improper clearances or angularity, damage and improper concrete expansion anchor spacing.

The NRC CAT inspectors also selected and inspected eight Class 4 supports/restraints. These supports/restraints are installed on fire protection systems or, although not installed on safety-related piping, have a safety function due to their proximity to safety-related items. They are designed to seismic Category I requirements and must not fail during seismic/accident conditions. See Table III-2 for all of the pipe supports/restraints inspection samples.

Acceptance criteria for the field inspections are contained in the following documents:

Pullman Procedure VII-2, Rev 12/2/82, "Material Control"

Pullman Procedure VIII-1, Rev 9/8/82, "Procedure for Identification of Materials, Parts and Components"

Pullman Procedure IX-6, Rev 7/21/83, "Installation and Inspection of Pipe Supports"

Gilbert Drawing, 4549-5-322-002, Rev C, "Pipe Support Dimensions and Tolerances"

Gilbert Drawing, 4549-5-322-004 Rev C, "Pipe Support Erection Standards"

Power Piping standard drawings and catalogues

Applicable support/restraint detail drawings

ITT Grinnel Special Installation Instructions (GE Supports/Restraints)

b. Inspection Findings

General Electric Company (GE) is responsible for the installation and inspection of approximately 154 Unit 1 safety-related supports/restraints for two systems, Reactor Recirculation and Main Steam (MS), in accordance with Cleveland Electric Illuminating (CEI) Specification 38. As none of these ITT Grinnel Fabricated supports/restraints were in a final, QC accepted condition, only one support was inspected in the field for proper configuration. No problems were identified. The NRC CAT inspectors reviewed in detail the partially completed travelers governing the installation of GE supports 1 B33-H355A and 1 B33-H301A. No problems were identified. The final assembly and adjustment travelers were still in preparation.

Pullman Power Products (PPP) is responsible for the installation and inspection of the remainder of the safety related and balance of plant pipe supports/restraints. Gilbert Associates, Inc. provides the detailed support/restraint design drawings which are redrawn by the hardware fabricator, Power Piping. Pullman adds field weld numbers and any applicable change documents such as Engineering Change Notices (ECN's) or Field Variance Authorizations (FVA's) and issues the drawing to the field for installation.

Pullman performs QC inspection of safety related supports/restraints in three phases as follows:

Phase I - Verification of primary attachment to the building structure.

Phase II - Verification of installation details of completely installed assembly.

Phase III - Verification of final settings, clearances, tight fasteners, completeness and freedom from damage just prior to system turnover.

Of the approximately 13,200 large bore and 4,600 small bore safety related supports/restraints in Unit I and common areas, approximately 2,900 had been Phase II inspected at the time of the NRC CAT inspection. Class 4 (nonsafety-seismic) support/restraints are also QC inspected for proper installation. Inspections are documented on detailed checklists.

Discrepancies identified on QC accepted supports/restraints by the NRC CAT inspectors are listed in Table III-3. In summary, three out of 28 safety related supports/restraints, six adjacent supports/restraints and two of eight Class 4 supports/restraints were found not to conform to design requirements. In addition, one Class 4 installation had been QC accepted with an inadequate weld size and wide flange shape size specified on the drawing (1P11-H098).

The following miscellaneous discrepancies were also identified during the NRC CAT inspection activities:

- Restraint 1E32-H100 had been disconnected from the pipe, but had a Phase II tag attached contrary to the requirements of Procedure IX-6. It was later determined that no Phase II inspection checklist existed for this restraint.

- The travel stop had been removed from spring hanger 1P42-H225 prior to the Phase III inspection.

- Clamp bolt threads were not staked on support 1G36-H062. This item would have been verified again during the Phase III inspection.

through July, 1017 of 4164 support/restraint "as-builts" (24%) and 645 of 1667 piping "as-builts" (39%) had been rejected by CEI. Most of the submitted "as-builts" have been of non-safety related hardware. However, the same people and process are used for safety related work. CEI QC involvement in the "as-built" effort appears to be limited and CEI's program has not effectively identified and rectified significant deficiencies in the Pullman "as-built" program.

The NRC CAT inspectors reviewed the Gilbert Associates, Inc. site procedure "General Procedure for IE Bulletin 79-14", Rev. 3, detailing actions to meet the requirements of IE Bulletin 79-14, "Seismic Analyses for As-Built Safety-Related Piping Systems". Related program activities were discussed with the Gilbert Site IEB 79-14 Coordinator. This review revealed that the 79-14 program is essentially a separate Gilbert executed program, involving walkdown redlining of piping and valve data verification. However, as Pullman support/restraint "as-builts" are utilized as input to the 79-14 evaluation, inaccuracy in Pullman's program may affect the safety system analysis.

c. Conclusion

The review of procedures and the "as-built" program implementation reflected by hardware and documentation deficiencies, indicate a number of discrepancies and weaknesses in the Pullman "as-built" program. Pullman and CEI have not taken prompt action to correct previously identified deficiencies in the "as-built" program.

4. Concrete Expansion Anchors for Pipe Supports

a. Inspection Scope

Twenty eight pipe supports/restraints containing 108 concrete anchors were inspected for proper torque. Table III-4 provides a listing of supports and torqueing results. The supports were installed in eight different safety related systems and contained anchors ranging in size from 5/8" to 1-1/4"diameter . Additional examinations performed by the NRC CAT inspectors included verification of the proper length marking on the anchor, installation of washers, proper engagement of nut, and measurement of the length of anchor extending from the concrete (only for those anchors that appeared excessive). The Pullman Power Procedure IX-6 "Installation and Inspection of Pipe Supports" dated 7/21/83 was reviewed as part of this activity.

b. Inspection Findings

(1) Torqueing

The vast majority of nuts exhibited no rotation when the minimum specified torque (per ECN 10493-44-1641 Rev. C) was applied. The maximum rotation was 3/16 of a turn for one nut.

(2) Nut Engagement

All anchors were at least flush with the top of the nut per the procedural requirements.

(3) Anchor Embedment

To verify proper anchor embedment, the anchors that had 2 inches or more of standout from the concrete were noted and the embedment for these anchors was calculated and compared to drawing requirements. A total of five anchors on four supports equaled or exceeded 2" of standout. Four of the five (three supports) had less than the specified minimum embedment, ranging from 1/4 to 1/2 inch. See Table III-5 for a comparison of data on these anchors.

(4) Miscellaneous Discrepancies

One anchor on support (1G41-H253) did not contain a marking. An ultrasonic examination (UT) performed on both anchors on this support verified that they were the specified length of 10 inches.

On support 1G36-H1024, there were no washers installed on the 2 anchor bolts as required. Nonconformance Report (NR).CQC 2880 was issued for this condition.

c. Conclusions

(1) The Field Process Sheet for the concrete expansion anchors do not contain a signoff for verifying bolt diameter. The bolt identification marking relates to length only. Although not a hardware problem for the sample selected, it is conceivable that without this verification, improper torques could be applied in addition to installing improper sized bolts.

(2) With the exceptions of missing washers and the anchor embedment on three hangers no hardware problem was identified. The applicant should provide justification that expansion anchor embedments are adequate and are being properly inspected.

5. Mechanical Equipment FSAR Comparisons

a. Inspection Scope

A sample of mechanical equipment was reviewed to determine that purchase specification requirements conform with FSAR commitments and whether installed hardware conforms with supplier documentation, purchase specification requirements and FSAR commitments. To accomplish this task, equipment from the RCIC and RHR systems were chosen because of preponderance of operational data given in the FSAR for these systems. Nine components were reviewed including an RHR pump, an RCIC pump, an RCIC turbine, and several RCIC valves. Table III-6

provides a listing of the inspected equipment along with the operational parameters reviewed. Table III-7 provides a listing of documentation reviewed.

b. Inspection Findings

A summary of discrepancies is provided in Table III-8. Of the five discrepancies noted, three require revision to the FSAR. The other two require follow-up action by CEI to assure that acceptable material is installed. It should be noted that CEI had previously uncovered the problem or problems of a similar nature for the discrepancies identified by the NRC CAT inspectors. The more significant discrepancies are discussed below.

(1) RCIC Isolation Valve (F063) Not Meeting FSAR Requirements

The NRC CAT inspector discovered that a discrepancy (non-conservative) exists between the purchased RCIC Isolation Valve (F063) and the FSAR commitment (see Table III-8). In 1979, Gilbert suggested changing this valve from being normally open to normally closed (along with other modifications) so as to reduce the energy release from a rupture in the 4" RCIC steam supply line. Because of the logic change, less stringent requirements for the valve from that shown in the FSAR were apparently possible. The NRC CAT inspector did not verify the adequacy of these requirements since these requirements will be reflected in a FSAR revision and will receive appropriate review at that time.

CEI was aware of problems between the FSAR and system design descriptions prior to the NRC CAT review as evidenced by their 1982 audit of Gilbert which identified two discrepancies between system design and FSAR commitments. Action Requests (ARs) were issued requiring complete FSAR review by Gilbert against system design descriptions. As a result of the NRC CAT inspection, the applicant has commited to include procurement specification requirements in the FSAR review. Additional programs include a CEI FSAR Verification Program and a future audit of GE's procurement program. Procedures have not yet been developed for the CEI FSAR Verification Program, so that its adequacy cannot be determined.

A Gilbert Procedure entitled Technical Document Revision (#QAP 3.1) dated 2/14/83, requires that the procurement document be reviewed to verify that the design criteria are consistent with SAR commitments. There is no evidence that this procedure was followed or if another program/procedure was applicable to the valves and pumps in question. The NRC CAT inspectors do not consider FSAR verification after all equipment is in place to be either prudent or timely from a potential equipment replacement standpoint or from a re-analysis standpoint.

(2) Incorrect Actuator Model # on RCIC Suction Valve (F031):

This discrepancy was initially identified by CEI in the summer of 1982 after the valves and actuators had been installed in the field. In addition to identifying valve F031, CEI identified over 100 valves containing actuator models which differed from the design. The identification of these valves by CEI was part of an inventory program (no procedure identified) for ordering spare parts. A formal procedure existed which, if followed, should have identified the problem prior to the arrival of valves and actuators on site. Section C.1.K of Gilbert's Manufacturing Surveillance Plan 043, Rev. 0 dated 2/6/78 requires final inspection of 50% of each type of valve for the correct specified motor operator (actuator). With over 100 valves not in compliance with the design, there was an obvious breakdown in this procedure. Gilbert has contacted the valve manufacturers (Borg Warner and Contromatics) to assure that the installed actuators are suitable for the specified conditions. The NRC CAT inspectors observed no documented evidence that the valve manufacturers had responded.

c. Conclusions

(1) The depth and importance of the FSAR verification effort should be emphasized, since there is an obvious conflict between purchased equipment and what the designer intended as reflected in the FSAR. These efforts should be adequately administered so that the equipment in the field satisfies the FSAR commitments. Furthermore, effective programs should be in place to verify that equipment currently being purchased satisfy FSAR requirements.

(2) While the discrepancies involving over 100 valves containing actuator models which differed from design were identified by CEI, the identification was part of an inventory pr gram for spare parts. The Gilbert manufacturing surveillance procedure that should have been followed to identify discrepancies of this type was apparently not followed and corrective action to prevent re-occurrence was not initiated.

6. Heating, Ventilating and Air Conditioning (HVAC)

a. Inspection Scope

HVAC systems installation work is essentially complete in Unit 1 and common areas. The contractor for HVAC is the Robert Irsay, Co. (RICO) who fabricates, installs, inspects and leak tests systems in accordance with Gilbert design drawings and specifications. System M40 and portions of M15, M36 and M30 have been turned over to CEI.

The NRC CAT inspectors selected samples of 10 supports/restraints, 15 pieces of equipment and 22 duct segments for field verification of conformance to design and procedural requirements. Duct joint makeup

was examined on numerous other unidentified duct segments during other NRC CAT inspection activities. Features verified were configuration, member size, identification, weld size, fastener/expansion anchor installation, duct gasketing and bolting. See Table III-9 for a listing of inspected items.

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

The Robert Irasy Company (RICO) Quality Assurance Manual

RICO Procedure QCP-6-4/707, Rev 2, "Installation Inspection of Safety Related Drilled in Concrete Expansion Anchors"

RICO Procedure QCP-11-5/707, Rev 4, "Inspection of Seismic Supports"

RICO Procedure QCP-11-6/ 07, Rev 2, "HVAC System Walkdown Inspection"

RICO Seismic Duct Brochure

RICO Drawings D-937-901, 902, 903, 905, 906, 907, 908, and 909, "Duct Support Standard Connections" and D-937-920, "Attachment Schedule"

Applicable construction drawings and fab tickets

b. Inspection Findings

Two of the 10 supports/restraints inspected had significantly undersized member to building structure attachment welds. Three adjacent supports also were observed to have undersized attachment welds and similar findings by the NRC CAT welding inspectors are detailed in Section IV. RICO QC stated that they believed these inadequate welds could be traced to inspections performed by one individual who was on site from May 1979 through June 1980 and who is no longer employed on-site. A reinspection of the suspect supports and a sampling of supports inspected and accepted by the previously employed inspector and others was performed by RICO QC. Preliminary results of this reinspection indicated that, although deficiencies were noted in the work of several additional inspectors, the largest percentage and most technically significant problems were identified on supports inspected by the one inspector. In fact, RICO quality management had been aware that the work done by this individual was suspect and the site lead QC Technician had stated this in an internal memorandum on June 8, 1982 to the RICO QA manager. The memorandum also stated that a complete reinspection of the work performed and inspected by this individual was proceeding. However, there does not appear to be any documentation to consolidate the work scope of this individual nor has all his work been completely reinspected some 15 months later. A RICO review of nonconformance reports (NRs) issued between May 1982 and May 1983 revealed at least 39 NRs directly attributable to

this individual's work and 7 additional NRs that may be attributable to him. This amounted to approximately 27% of all NR's issued during that period. The conditions reported included missing and undersized welds, improper configuration and inadequate documentation. Many required rework or repair. In general, the NRs identified the unsatisfactory work as done by craftmen and inspectors no longer on site. All [illegible] are reviewed by RICO and CEI management and CEI quality engineers perform a trend analysis on NRs. However, neither organizations' programs identified this significant and recurring problem as needing timely and formal corrective action or evaluation for reportability. It should be noted that the current inspection program, although not per procedure as described below, would probably have identified the deficiencies present in currently accepted work.

Related to the above issue, and possibly indicative of a general weakness in procedural matters, were a number of relatively minor but related problems identified during the NRC CAT review of in-process turnover documentation packages. RICO procedure QCP-11-6/707 specifies a three phase sequenced walkdown inspection of a duct system; pre-leak test, post leak test and a "final" inspection. RICO QC is performing the "final" inspection prior to the pre-leak test inspection. Due to the known problems with earlier inspections, RICO QC is now performing a detailed inspection of supports/restraints during the "final" walkdown. While this is a correct action to take, it is not required or defined by site procedures. In addition, RICO QC does not have a specified or executed means to void out existing QC inspection documentation when rework is required to QC accepted hardware. Also, in the review of the "final" walkdown deficiency punchlist for systems 0M15 and 1M36, a number of instances were discovered where conditions were being identified and closed on the punchlist that should have been identified on nonconformances. Examples include missing welds on supports DS-0G-2001-and 2002, improper washers installed on supports DS-0G-4025 and DS-IB-3126 and undercut welds on support DS-IB-4059. Finally, the responsibilities and processes for developing "as-built" drawings are not clearly defined by site procedures.

Minor discrepancies were noted during the inspection of supports/restraints, equipment and duct runs and are summarized in Table III-10.

c. Conclusions

(1) With the exception of undersized attachment welds, HVAC hardware material, configuration, location and installation appeared to generally conform to design documents.

(2) The work performed by certain craftsmen and/or inspectors appears to have been deficient, especially as identified with undersized structural attachment welds.

(3) The quality assurance programs of both RICO and CEI failed to properly and promptly identify, evaluate, correct and document potentially significant and recurring deficiencies in installed HVAC hardware.

(4) Additional attention is needed to ensure that RICO site procedures are adequate and work as specified in these procedures is correctly performed.

7. Design Change Control and Nonconformance Reports

a. Inspection Scope

Seventy NRs were reviewed in the mechanical area for technical adequacy and to determine if the NRs were properly closed in accordance with the approved disposition. Twelve hanger supports were selected when work was in-process to determine if design changes were properly controlled.

b. Inspection Findings

Nonconformance reports reviewed were dispositioned adequately. With one exception, reports reviewed indicate proper closeout. Nonconformance Report CQA 136 dated 1/30/80 was improperly closed out in that the action required for close out [i.e., the listing of components and supports requiring the use of Code Case N-242 must be identified in the Safety Analysis Report (SAR)] was not accomplished. The NR required as part of its disposition that an FSAR change be submitted. However, the NR was inappropriately closed and no FSAR change was submitted. This NR involved the acceptance of a large number of safety-related pipe spools.

Relative to design changes, traveler packages in the field were reviewed to revisions on both the applicable drawing and process sheets. This information was compared to the current information regard the latest design for each of the subject hangers. No problems were identified.

c. Conclusions

Because of improper close out of CQA-126, the requirements under NRC Regulatory Guide 1.85, Revision 16 could not be satisfied. This Regulatory Guide requires that components and supports that are accepted by the use of Code Case N-242 be identified in the SAR. Similar examples of improper closeout of nonconformance reports are discussed in Section VIII under Corrective Action Systems.

Design changes reviewed indicated that they were processed in accordance with the applicant's program requirements.

TABLE III - 1

PIPING INSPECTION SAMPLES AND OBSERVATIONS

System	Isometric	ASME Class	Pipe Diameter	Observations (AR/NR Issued)
RHR	1E12-24	1 & 2	12" & 18"	
RHR	1E12-38	2	12" & 18"	
RHR	1E12-47*	2	8"	
RCIC	1E51-7	2	8"	
RCIC	1E51-1	2	12"	
FPC&C	0G41-9*	3	10"	Valve F557B rotated 90 degrees (NR PPP-4005)
FPC&C	0G41-27	3	10"	
ECC	0P42-31*	3	10"	Valve operator F445 rotated 180 degrees (NR PPP-4005)
ECC	0P42-32	3	10"	
ECC	0P42-34	3	10"	Valve operator F260 rotated 90 degrees

Additional Valves Selected for Orientation

Valve	Isometric	Observation
F140	0P43-29	
F787	0P43-29	
F551	0G41-39	
F280	0G41-39	
F285	0G41-39	
F060	0P50-15	Valve rotated 86 degrees
F780	0P43-28*	Handwheel rotated 180 degrees
F150	0P50-5	Valve rotated 90 degrees
F060	0P50-8	Valve rotated 86 degrees
F785	0P43-19	

*"As-built certified"

TABLE III - 2

PIPE SUPPORTS/RESTRAINTS INSPECTION SAMPLES

Support/Restraint	Type	Class	Size	Location
1B21-H006	Snubber	3	14"	Reactor
1P42-H113	U-bolt	3	10"	Control
1P42-H139	Strut	3	10"	Control
1B21-H117	Snubber	3	10"	Reactor
1P42-H148	Box/Lug	3	12"	Control
1P45-H167	Spring	3	20"	Auxiliary
1G41-H247	Box	3	12"	Intermediate
1G41-H354	U-bolt	3	10"	Intermediate
1P45-H447	Box	3	8"	Diesel
*1E22-H024	Snubber	2	16"	Auxiliary
1E12-H2109	Box	2	2"	Auxiliary
1E12-H138	Spring	2	18"	Auxiliary
1G41-H362	Box	3	10"	Intermediate
1P45-H147	Strut/Box	3	16"	Auxiliary
1B21-H223	Box/Lug	3	2"	Reactor
1C11-H032	Box/Strut/Lug	2	8"	Reactor
1G36-H045	Strut	3	4"	Reactor
1G36-H065	Spring	3	8"	Reactor
1B21-H414	Box	3	12"	Reactor
*1E12-H1061	Box	2	1½"	Auxiliary
*1E12-H1041	Box	2	1½"	Auxiliary
*1E12-1062	Strap	2	3/4"	Auxiliary
1E12-H748	Box	1	12"	Reactor
1E21-H014	Spring	1	12"	Reactor
1E12-H010	Snubber	1	12"	Reactor
1E12-H037	Restraint	1	6"	Auxiliary
1M51-H022	U-bolt	2	4"	Reactor
**1B33-H352A	Spring	1	16"	Reactor
*1P11-H059	Strut/Lug	4	8"	Reactor
1P54-H017	Box	4	4"	Reactor
*1P11-H098	Strut	4	12"	Auxiliary
1P11-H078	Strut	4	12"	Auxiliary
1P54-H199	Strut	4	6"	Intermediate
*1P11-H065	Snubber	4	8"	Reactor
1P54-H1011	Strap	4	1½"	Auxiliary
*1P11-H056	Box	4	8"	Reactor

*"as-built certified"

**General Electric installation

TABLE III - 3

PIPE SUPPORT/RESTRAINT INSPECTION OBSERVATIONS

Support/Restraint	Observation (AR/NR/DR Issued)
Safety Related Sample	
1B21-H006	1/8" clearance to drywell liner (SCV-2544)
1G41-H354	No clearance between pipe and U-bolt (NR PPP-4135)
*1E22-H024	Load pin spacers 1/8" thick vs. 1/16" on drawing Attachment plates switched in position "As-Built" (A.B.) pin to pin dimension in error (NR CQC-2865)
1E12-H138	Loose U-bolt nuts
*1E12-H1062	2 attached hangers not shown on A.B.
1E12-H748	Phase II checklist on file incompletely filled out
1E21-H014	Contact point on drawing has ¼" gap (NR P044-2164)
1E12-H010	½" clearance to decking
Adjacent Safety Related	
1G36-H1045	Wrong size U-bolt and non-safety material installed (NR CQC-2877)
1G36-H1046	Threads on U-bolt had been extended by crafts (NR CQC-2878)
1G36-H062	Phase III tagged, clamp bolts not staked
1P42-H225	Travel stops removed (NR PPP-4034)
1P45-H055	No washers over slotted holes (Procedure IX-6, Rev. 8/10/82, Para. 8.4.6). Clips for sliding connections welded-not shown on drawing (NR PPP-4114)
1P45-H058	No washers over slotted holes (Procedure IX-6, Rev. 8/10/82, Para. 8.4.6). Clips for sliding connections welded-not shown on drawing (NR PPP-4114)

TABLE III - 3 (Continued)

Support/Restraint	Observation (AR/NR/DR Issued)
1P45-H452	No washers over slotted holes (Procedure IX-6, Rev. 8/10/82, Para. 8.4.6). Clips for sliding connections welded-not shown on drawing (NR PPP-4114)
1P45-H458	No washers over slotted holes (Procedure IX-6, Rev. 8/10/82, Para. 8.4.6). Clips for sliding connections welded-not shown on drawing (NR PPP-4114)
1E22-H100	Support disassembled, Phase II tag attached, no Phase II checklist on file (AR 704)
Class 4 Sample	
*1P11-H058	Clip angles installed 2½"x2½"x3/8", drawing specifies 3"x3"x3/8" Strut angularity exceeds erection tolerances DCC issued drawing without latest ECN Revision As-built walkdown and drafting performed to superceded ECN Rev (DR 2391)
*1P11-H098	Drawing specifies 1/16" attachment fillet weld and shape that is not manufactured. Baseplate is 1" thick vs. 3/4" on drawing (DR 2394)
1P11-H078	Pipe attachment location off by 4-3/4" (DR 2392)
1G36-H1024	No washers between nut and baseplate (NR CQC 2880)

*"as-built certified"

TABLE III-4

CONCRETE EXPANSION ANCHOR SAMPLES AND OBSERVATIONS

Support/Restraint No.	Observations (1)
1G36-H1024	One nut rotated 1/8 turn
1G36-H1045	One nut rotated 1/8 turn
1G36-H048	One nut rotated 1/8 turn
1G33-H043	
1P57-H1060	
1P57-H1052	
1G41-H253	One nut rotated 1/8 turn
1G41-H414	
1G41-H362	Two nuts rotated 1/16 turn
1E21-H080	Three nuts rotated 1/16 turn Two anchors with 3 3/4 inch standout
1E21-H030	One nut rotated 3/16 turn One anchor with 2 1/2 inch standout
1E21-H081	Two nuts rotated 1/16 turn
1E21-H1013	
1E21-H053	
1E21-H021	
1E12-H2001	
1E21-H1010	
1E12-H2002	
1E21-H026	One nut rotated 1/16 turn, One nut rotated 1/8 turn
1E32-H163	One anchor with 2 inch standout
1E32-H225	
1E32-H152	
1E12-H1059	
1G36-H036	
1P42-H1164	One anchor with 2 inch standout.
2P42-H043	One nut rotated 1/8 turn
2P42-H057	
1P42-H1219	

NOTE:

(1) Observations were made after the minimum specified torques (per ECN 10493-44-1641 Rec. C) was applied to the nuts.

TABLE III-5 - EMBEDMENT OF CONCRETE EXPANSION ANCHORS

Support/Restraint No.	Marking on Bolt	Minimum Length (in.)	Measurement (Top of Bolt to Concrete) (in.)	Computed Embedment (in.)	Required Embedment (in.)
1E21-H080	T	12	3 3/4 (2 bolts)	8 1/4	8 1/2
1E21-H030	R	10	2 1/2	7 1/2	8
1E32-H163	0	8 1/2	2	6 1/2	6 7/8
1P42-H1164	0	8 1/2	2	6 1/2	5 1/2

TABLE III-6

MECHANICAL EQUIPMENT FSAR COMPARISONS

MPL No.	Equipment	Serial #/(Actuator Model) Documentation	Field Observation	Operational Parameters Item	Specs.	FSAR
E51-C001	RCIC Pump	15210030	15210030	Total Pump Discharge	725gpm	725gpm
				Water Temp. Range	40°F to 140°F	40°F to 140°F
				NPSH	21 Ft. min.	21 Ft. min.
				Developed Head	2980 Ft.[1] 610 Ft.[2]	2980 Ft.[1] 610 Ft.[2]
				BHP, Not to Exceed	825 HP[3] 150 HP[4]	825 HP[3] 150 HP[4]
				Design Pressure	1525 psig	1525 psig
				Design Temperature	40° to 140°F	40° to 140°F

NOTES:

[1] At 1192 psia reactor pressure
[2] At 165 psia reactor pressure
[3] At 2980 feet developed head
[4] At 610 feet developed head

TABLE III-6

MECHANICAL EQUIPMENT FSAR COMPARISONS - Cont.

MPL No.	Equipment	Serial #/(Actuator Model) Documentation	Serial #/(Actuator Model) Field Observation	Operational Parameters Item	Specs.	FSAR
E51-C002	RCIC Turbine	F-38176-A	38176-A	Steam Inlet Pressure	1150 psia, min.[5] 150 min.[6]	1150 psia, min.[5] 150 min.[6]
				Turbine Exhaust Pressure	25 psia, max.[5] 25 psia, max.[6]	25 psia, max.[5] 25 psia, max.[6]
				Design Inlet Pressure	1250 psig[7]	1250 psig[7]
				Design Exhaust Pressure	165 psig[7]	165 psig[7]
E51-F045	RCIC Steam Supply Valve	60810 (SMB-0-25)	60810 (SMB-0-25)	Max. Opening and/or Closing Time	15 sec.	15 sec.
				Differential Pressure	1400 psi	1400 psi

Notes:

[5] H.P. Condition
[6] L.P. Condition
[7] At Saturated Temperature

TABLE III-6

MECHANICAL EQUIPMENT FSAR COMPARISONS - Cont.

MPL No.	Equipment	Serial #/(Actuator Model) Documentation	Serial #/(Actuator Model) Field Observation	Operational Parameters Item	Specs.	FSAR
E51-F063	RCIC Steam Supply Isolation Valve	72965 (SMB-1-60)	72965 (SMB-1-60)	Max. opening and/or closing time	20 sec.	10 sec.
				Differntial Pressure	741 psi	1177 psi
E51-F064	RCIC Steam Supply Isolation Valve	43512	43512	Max. opening and/or closing time	10 sec.	10 sec.
				Differential Pressure	1177 psi	1177 psi
E51-F017	RCIC Pump Suction Relief Valve	1	1	Relief Setting , low	75 psig 14 gpm[8]	75 psig 14 gpm[8]

Notes:

[8] At 10 percent Accumulation

TABLE III-6

MECHANICAL EQUIPMENT FSAR COMPARISONS - Cont.

MPL No.	Equipment	Serial #/(Actuator Model) Documentation	Serial #/(Actuator Model) Field Observation	Operational Parameters Item	Specs.	FSAR
E51-F022	RCIC Pump Test Return Valve	60809	60809	Max. differential pressure capable of throttling control	1400 psi	1400 psi
				Closure against differential pressure of	-	75 psi
E51-F031	RCIC Pump Suction Valve, Suppression Pool	61522 (SMB-000-5)	61522 (SMB-00-10)	Opening and closing against differential pressure of	75 psi	75 psi
E12-C002	RHR Pump	741 1410	741-S-1410	Head Capacity Curve	Same as FSAR	See FSAR Fig. 5.4-15
				NPSH Requirement Curve	Same as FSAR	See FSAR Fig. 5.4-15
				Brake HP	750 HP @8000 gpm	250 HP @8000 gpm

TABLE III-7

DOCUMENTATION REVIEW FOR MECHANICAL EQUIPMENT

Equipment	Certification Report Number	Purchase Order	Applicable Specification
RCIC Pump	Bingham-Willamette certification dated 4-10-78	205-AG-534 Rev. 8	21A9443AW Rev. 1
RCIC Turbine	PQC C772	205-A6-745 Rev. 1	21A9526AE Rev. 1
RCIC Steam Supply Valve (F045)	5618-18-39	P-1364-K	521.02 B/M RNN 261
RCIC Steam Supply Isolation Valve (F053)	5466-82-10	P-1364-K	521.02 B/M RNU 209
RCIC Steam Supply Isolation Valve (F064)	5618-80-11	P-1364-K	521.02 B/M RNU 206
RCIC Pump Suction Relief Valve (F017)	9128-80-19	P-1257-K	523-4549 B/M RNQ-200
RCIC Pump Test Return Valve (F022)	5618-18-39	P-1364-K	521.02 B/M RNN 261
RCIC Pump Suction Valve, Suppression Pool (F031)	--	P-1364-K	521.02 B/M RNN 260
RHR Pump	PQC R 239	205 A6 070 Rev. 9	21A9514AE Rev. 3

TABLE III-8

SUMMARY OF DISCREPANCIES

Equipment	Discrepancy	CEI Action
1. RCIC Turbine (C002)	Serial # on PQC certification disagrees with # in field.	Request GE confirmation that serial # in field conforms to Purchase Order (1)
2. RCIC Isolation Valve (F063)	Valve does not meet FSAR opening and/or closing requirement of 10 sec. and differential pressure of 1177 psi.	Will revise FSAR to conform to purchase specifications
3. RCIC Test Return Valve (F022)	Purchase specification does not mention closure against 75 psid.	Will revise FSAR to exclude 75 psid closure requirement.
4. RCIC Suction Valve (F031)	Actuator Model Number in field is not the same as specification requirement.	Identified this valve previously along with approximately 100 others as having the wrong activator model numbers (2)
5. RHR Pump (C002)	Brake HP in FSAR is approximately 1/3 of that shown in specifications.	Will revise FSAR to reflect the specified value (3)

Notes:

1 Letter, CEI to GE, PY-CEI/GEN 168 QA, dated 9/21/83
2 Letter, CEI to Gilbert, PY-CEI/GAI-5305, dated 7/29/82
3 PNPP FSAR Change Request C/R # 51

TABLE III - 9

HVAC INSPECTION SAMPLES

Supports/Restraints:

DS-IB-7032	DS-0G-2022
DS-IB-7072	DS-CC-1008
DS-CC-1040	DS-CC-1007
DS-IB-7062	DS-IB-3130
DS-0G-2001	DS-CC-6162

Equipment:

Fire dampers	FDCC-721, FDCC-756 and FDIB-308
Fans	1M15C001A, 2M15C001A, 2M15C001B, 0M40C001B, 0M40C002C
Plenums	2M15D001A, 1M15D001A, 2M150001B, 0M40C002B, 0M40D001C
Flow dampers	1M15F070A and 1M25F130A

Duct Segments:

QM15-739	Pieces 51-68 and 76-79
QM15-722	Pieces 67-70

TABLE III - 10

HVAC INSPECTION OBSERVATIONS

ITEM	OBSERVATION (AR/NR/DR/FQ ISSUED)
Support DS-0G-2001	Support to building structure attachment weld undersized (1/4" vs 3/8")
Support DS-IB-3130	Support to building structure attachment weld undersized (1/4" vs 3/8")
Support DS-IB-3099	Support to building structure attachment weld undersized (1/4" vs 3/8")
Support DS-IB-3129	Support to building structure attachment weld undersized (1/4" vs 3/8")
Support DS-IB-3072	Support to building structure attachment weld undersized (1/4" vs 3/8")
Support DS-IB-7072	Two duct to support welds missing (NCR RICO-501)
Support DS-0G-2022	"Y" dimen. specified as 2", actual = ¼-½"
Plenum 0M15-D001A	One foundation nut less than full engagement (approx. 1 thread) (FQ 31769)*
Fan 0M40-C002B	Three foundation nuts less than full engagement (approx. 1 thread) (FQ 31769)*

*As a result of this finding RICO is reinspecting all previously installed seismically mounted HVAC equipment for full thread engagement of foundation fasteners.

APPENDIX A

EXECUTIVE SUMMARY

An announced Construction Appraisal Team (CAT) inspection was performed at the Perry Nuclear Power plant site during the period August 22-September 2 and September 12-23, 1983.

OVERALL CONCLUSIONS

The Construction Appraisal Team concludes that the results of this inspection indicate several construction program weaknesses. NRC Region III has been made aware of these weaknesses and is pursuing them with applicant management. The applicant is initiating corrective action and/or continuing efforts to resolve the identified concerns. An indication that prompt management attention is being given to the identified deficiencies is that nonconformance reports or other corrective action requests were immediately initiated by the applicant upon identification of the deficiency. These are discussed in the details section of the report. However, management attention is needed where some lack of resolution adequacy and timeliness were noted.

The NRC CAT inspectors noted that many of the typical problems experienced at other facilities were experienced by the Perry Nuclear Power Plant (PNPP) project. However, an agressive attitude in the identification of problems was demonstrated through the applicant's project organization, and was further reflected by the amount of applicant's management involvement at the PNPP site.

The identified construction program weaknesses are as follows:

(1) The current practice of installing concrete expansion anchor bolts in the drywell wall is a concern to the NRC CAT inspectors. The number of intended anchor bolt installations and the real potential for cracking of the drywell wall as a result of normal, transient, and accident loadings lead the NRC CAT to question the ability of the drywell to maintain the specified leaktightness throughout its service lifetime. The preoperational and periodic drywell bypass leakage tests are seen to be crucial tests to assess and monitor drywell bypass leakage from all sources.

(2) A number of examples were identified where the QC inspection program and the "as-built" verification program for piping and pipe supports/restraints did not ensure that installed items conformed to design requirements. While many installations have progressed through the contractor's verification programs, the applicants verification program is in the early stages.

(3) The welder qualification program for two contractors needs attention to ensure welder qualifications are properly performed. Better controls to ensure welder identification should also be utilized. The NRC CAT found few hardware deficiencies in the welding area, and in general, the in-process and completed welds reviewed exhibited good workmanship. The one exception was in the small bore piping area as discussed in the details section of this report.

(4) A number of examples were found where corrective actions related to contractor identified problems were not taken in a timely manner and where nonconformances were closed out prior to completing all of the required corrective actions. Examples where timely corrective actions were not taken include undersized welds on HVAC supports, "as-built" program deficiencies, improper valve actuator installations, and reverifications for required material traceability. Examples of improperly closed-out nonconformances include problems involving training for concrete placement crews and a failure to submit a required FSAR amendment.

AREAS INSPECTED AND RESULTS

Electrical and Instrumentation Construction: In general, the installation of electrical and instrumentation components inspected was in accordance with design documents and exhibited good workmanship. However, several program deficiencies were identified.

Two problems were identified relative to electrical separation. One problem involved documentation for Class 1E raceway installations that indicated separation criteria to be satisfied when in fact a number of raceway installations examined did not conform to requirements. The other problem involved the lack of adequate procedural controls to assure that the duct covers (barriers) for the Power Generation Control Complex (PGCC) received the appropriate quality inspections.

The NRC CAT also identified a problem where sketches were used to install conduit and conduit supports in the Unit 1 containment drywell area without appropriate document controls such as issuance, revision, retrieval and approval.

Mechanical Construction: HVAC and piping runs were found to be constructed in accordance with the applicable requirements. However, a number of examples were identified by the NRC CAT which indicate that some piping and pipe support/restraint deficiencies have not been identified during QC construction acceptance inspections or during the "as-built" verification program. A weakness in procedural adequacy and adherence was observed in these areas. The HVAC inspection and "as-built" verification programs exhibited similar deficiencies and procedural weaknesses.

In addition, two issues were identified regarding the lack of adequate corrective actions taken by the applicant to identified deficiencies. One issue involved HVAC support welding deficiencies which were not properly or promptly addressed. The condition included missing and undersized welds, improper configurations and inadequate documentation. The other issue involved the lack of action where known conflicts existed between installed pumps and valves and the design criteria specified in the FSAR or in the purchase specifications. For example, a number of valves containing actuator models which differed from the original design were identified by CEI, but no corrective actions had been initiated at the time of this inspection.

Welding and Nondestructive Examination: In general, welding and nondestructive examination (NDE) reviewed by the NRC CAT exhibited work performed in accordance with requirements. However, several deficiencies were identified. These included improper visual welding inspection of fillet welds made under the rules of the AWS D1.1 Structural Welding Code; improper reinforcement on

weld-o-lets required by Section III of the ASME Boiler and Pressure Vessel Code; and inadequate procedural controls of heat inputs for the welding of stainless steel socket welds.

The welder qualification program for two contractors was found to be deficient in that film quality of radiographs used for welder qualifications did not satisfy ASME Code requirements. Additional controls should be applied to the welder qualification program to further ensure proper welder identification during qualification.

Civil and Structural Construction: Current concreting activities and erected structural steel appear adequate. Past records of concrete placement, soils backfill operations, and structural steel installations show conformance to specification requirements. However, problems were found in the dispositioning of some seismic clearance violations identified by the applicant's inspection program. Examples of a lack of proper engineering consideration were also identified. There is concern regarding drywell leaktightness due to the current practice of installing numerous (8,000-10,000) expansion anchor bolts through the drywell liner plate.

Material Traceability, Storage and Maintenance: In general, the project material traceability, storage and maintenance programs were found to be acceptable. However, some deficiencies were found in the areas of fastener traceability and material control of some small components, in-plant storage of safety-related equipment and the control of maintenance in the central warehouses.

QC Inspector Effectiveness: Interviews were held with inspectors randomly selected from the applicant's organization and from contractors on the construction site. There were no instances of intimidation or threats reported. In one instance, issues were raised that could have an effect on the contractor QC inspector effectiveness. This instance was referred to the NRC Region III Office for resolution.

Quality Assurance: Selected portions of the QA audit program reviewed indicated an adequate QA program was in-place to monitor construction activities by both the applicant and his contractors. Audit personnel were found to be qualified in accordance with the applicant's commitments. Nonconformances were sometimes closed before the disposition was completed and two contractors were not taking proper corrective action with regard to nonconforming conditions as required by the corrective action program. Overall, the applicant's project organization was found to be aggressive in identifying and resolving construction problems.

IV. WELDING AND NONDESTRUCTIVE EXAMINATION (NDE)

A. Objective

The objective of the appraisal of welding and NDE was to determine if work in progress and Quality Control (QC) accepted work related to welding and NDE activities are controlled and performed in accordance with design and NRC requirements, SAR commitments, and applicable codes and specifications.

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

B. Discussion

To accomplish the above objectives, welds and welding activities for piping, pipe supports/restraints, structural steel installations, pipe whip restraints, heating, ventilation and air conditioning (HVAC) installations, electrical supports and instrumentation and control tubing were inspected. NDE examination activities were appraised through review of radiographs of piping welds and observation of NDE field activities, review of NDE personnel qualifications, and interviews with NDE personnel. This inspection activity involved the following contractors: General Electric (NSSS), Pullman Power Products (piping and supports), Newport News Industrial (containment liner), Johnson Controls (instrumentation and controls), L. K. Comstock (electrical), Pittsburgh Bridge and Iron (structural steel), and Robert Irsay (HVAC).

1. General Electric Company (GE)

a. Inspection Scope

The NRC CAT welding inspection activities relating to the GE contracts were in the areas of piping systems welds, support/restraint welds, welding procedures, welder's qualification, and in-process welding. NDE procedures, personnel qualifications, and the review of radiographic film for shop and field fabricated welds were also included in this inspection.

(1) Welding Activities

The NRC CAT inspections of piping systems consisted of walkdowns of the main steam (B21) and the reactor recirculation (B33) systems. Approximately 700 feet of pipe involving approximately 50 ASME Class 1, 2, and 3 welds were inspected (see Table IV-1). Both field and shop welds were inspected to determine if attributes such as mismatch, weld surface contour and appearance and weld reinforcement were in accordance with the ASME Code requirements. It should be noted that many of the surfaces for the inspected welds had previously been blended for in-service inspection.

Specification 21A2005, for shop fabrication, Specification 21A2005AD for solution heat treatment of shop welds, and Specification CEI527 for cladding the internal diameter of field welds were reviewed to determine if GE welding activities are being performed in accordance with the guidance provided in the NRC Regulatory Guide 1.31 (Rev. 3) "Control of Ferrite Content in Stainless Steel Weld Metal," and NRC Regulatory Guide 1.44 (May 1973) "Control of the Use of Sensitized Stainless Steel".

The NRC CAT also inspected welds on 10 ASME NF Class 1 pipe supports. These welds were inspected for weld size, length, contour and appearance in accordance with the requirements of the ASME Code (see Table IV-2 for a listing of the supports/restraints inspected).

Ten welders were observed while performing in-process welding of piping and support/restraint welds. The supporting documentation for the inspected welds such as filler material withdrawal and process travelers were also reviewed for adequacy.

In addition, the qualification records of twenty-five welders were reviewed. These welders were qualified by either bend tests or by radiography in accordance with Specification GEP-N-004, which was reviewed to the requirements in the latest edition of ASME Section IX. Radiographic film and records of personnel qualified by the radiographic option were also reviewed (see Table IV-3 for a listing of the welder qualifications reviewed).

(2) Nondestructive Examination Activities

The NRC CAT inspection of NDE activities for GE contracts included the review of radiographic film for shop and field fabricated pipe welds, witnessing of in-process field NDE inspections and the review of NDE procedures and personnel qualifications.

A total of 10 shop welds involving 136 film were reviewed for film quality, weld quality and compliance with GE's specifications and ASME Sections III and V. These welds were fabricated by ITT Grinnel for GE. Additionally, 15 welds which were fabricated by GE and radiographically inspected by Magnaflux Corporation were also reviewed. These welds involved 106 film.

The NRC CAT inspectors reviewed the personnel qualification records for 12 NDE technicians and witnessed in-process inspection activities performed by four Magnaflux NDE personnel. Five pieces of NDE equipment were inspected for calibration and compliance with governing specifications and standards.

b. Inspection Findings

(1) Welding Activities

No problems were identified in the area of welding procedures and in-process welding. Inspected shop and field fabricated welds met the quality standards of the ASME Code.

However, the review of welder qualifications revealed that radiographic film quality does not comply with the film quality requirements of ASME Section IX and GE's welder qualification Procedure GEP-N-004. As a result of this finding, Action Requests (ARs) 714, 715, 716, 717, and 721 were prepared by the CEI (Cleveland Electric Illuminating) project organization.

(2) Nondestructive Examination Activities

No problems were identified in the area of nondestructive examination.

c. Conclusions

With the exception of the findings previously discussed, all inspected welding and NDE activities were found to conform to the requirements of the applicable Code and the CEI SAR commitments.

2. Pullman Power Products (PPP)

a. Inspection Scope

The NRC CAT welding inspection activities relating to PPP contracts were in the areas of piping system welds, support/restraint welds, welding procedures, welder qualifications, and in-process welding. NDE procedures and the review of radiographic film for shop and field fabricated welds were also included in this inspection.

(1) Welding Activity

Approximately 8,000 feet of both field and shop fabricated ASME Class 1, 2, and 3 piping was inspected. A total of 1250 welds were visually inspected to determine if attributes such as mismatch, weld surface contour and appearance were in accordance with ASME Section III requirements. It should be noted that many of the piping welds had previously been blended for in-service inspections (see Table IV-1 for a listing of piping inspected).

The NRC CAT also inspected welds on 56 ASME Section III, Sub-section NF Class 1, 2, and 3 supports/ restraints. These welds were inspected for size, length, contour and appearance in accordance with the requirements of the ASME Code (see Table IV-2 for a listing of the supports/restraints inspected).

Twenty PPP welders were observed while performing in-process welding of piping and supports/restraints. The supporting documentation for the inspected welds such as filler material, withdrawal slips and process travelers were also reviewed for adequacy.

In addition, the qualification records of 22 welders were reviewed (see Table IV-3). Welders were qualified by either bend tests or by radiographic inspection of the test sample in accordance with specification II-8, "Welder Performance Qualifications," which was reviewed for compliance with the latest edition of ASME Section IX requirements. Radiographic film and records of personnel qualified by the radiographic option were also reviewed.

(2) Nondestructive Examination Activities

The NRC CAT inspection of NDE activities for PPP contracts included the review of radiographic film for shop and field fabricated piping welds, witnessing of in-process field NDE inspections and the review of NDE procedures.

A total of 67 shop welds, fabricated by PPP (Williamsport, Pa.), involving 746 film were reviewed for film quality, weld quality, and compliance to PPP specification and ASME Sections III and V requirements (see Table IV-4 for a listing of shop welds reviewed).

A total of 91 field-fabricated welds involving 686 film were reviewed (see Table IV-4 for listing of field welds reviewed). Seventeen in-process NDE field inspections involving nine PPP NDE personnel were observed and the radiographic film for three welder qualifications were also reviewed for adequacy.

b. Inspection Findings

(1) Welding Activities

No problems were identified in the areas of welding procedures and in-process welding. Inspected piping and support/restraints welds were found to be in compliance with the quality standards of the ASME Code.

However, problems related to piping installation were noted in the areas of branch piping weld joints. NX-4244 of ASME Section III requires that a fillet size of certain minimum dimensions be met for corner welded nozzles and branch piping connections. PPP fabrication and inspection procedures do not specify these ASME Section III requirements regarding a minimum specified fillet size for branch connections. Field inspection of piping runs revealed that several branch connections had sizes less than those required by the ASME Code.

As a result of this finding, CEI issued Nonconformance Reports (NR) 2916 and 2917 respectively.

Another procedural problem regarding the welding of stainless steel socket welds for the control rod drive (CC11) system was also identified. Socket welds for the control rod drive system required additional welding to the pipe side of the socket weld as a result of an engineering design evaluation. The weld size on the pipe side was increased to 2 times the weld size on the socket or fitting side of the weld. Thus, for 1½ inch socket welds, the weld length on the pipe side is approximately 3/4 inch. Field inspection of actual socket welding revealed that the piping is subject to higher welding heat inputs due to the increased weld size on the pipe side. Welding Procedure WPS-29, which was used to weld the subject welds, is qualified in accordance with ASME Section IX of the Code. It covers materials from 1/16 to 8 inches thick with an amperage range of 50 to 175 amps. The amperage range of WPS-29 appears to be too broad to control heat inputs to the relatively small mass of socket weld as compared to an 8 inch thick weldment. In-process field welds observed by the NRC CAT inspectors were cherry red because of this excessive heat input permitted by welding procedure WPS-29. Sectioned samples of socket welds, welded using Procedure WPS-29, were examined by the NRC CAT inspectors. Samples of normal (1:1 weld legs) socket welds and socket welds exhibiting weld leg size of 2:1 (pipe leg 2 times leg of fitting) were compared. Inspection of the internal surfaces of the sectioned specimens revealed a heavy metal discoloration on the internal surfaces of the socket welds with the 2:1 leg ratio. This heavy metal discoloration indicates that excessive heat inputs were used during the welding of this specimen. Thus, an amperage range to ensure control of heat input to the socket welds should be considered for incorporation into WPS-29.

The reviewed welder qualification records established that the welders were qualified in accordance with the requirements of Section IX of the ASME Code either by bend test of radiography. The radiographs for two welders were found to be deficient with respect to the film quality requirements of PPP Procedure IX-R1-5 and ASME Section IX of the Code.

The overall welder qualification program was reviewed by the NRC CAT and was found to conform to the requirements of the ASME Code and existing regulatory requirements. However, the program was also reviewed in order to assess the adequacy of existing safeguards needed to preclude the possible use of stand-ins for welder qualification tests. This problem was recently addressed in IE Information Notice 83-61 "Alleged Use of Stand-Ins for Welder Qualification Tests". As a result of the review, the following deficiencies were identified.

- A lack of controls to insure that new hires are properly identified.

- A lack of positive welder identification on weld test samples and test coupons for qualification (new hires and regular employees taking qualification tests).

(2) Non-Destructive Examination Activities

No problems were identified in the area of NDE procedures, personnel qualification and in-process NDE.

However, during the review of radiographs for PPP shop welds, three of 67 PPP shop welds were rejected by the NRC CAT inspectors for weld quality problems. The three welds were identified as 1M11-GMS-ITB, 1N27-G-FW-129JT, and 1-N27-G-FW-143HB. Noncon-NR 2362 was prepared as a result of these findings. Two welds were rejected for violation of minimum wall thickness. Minimum wall violations were confirmed by ultrasonic examination of these welds and NR TAS-0057 was prepared as a result of this finding.

The review of reader sheets for PPP shop radiographic film indicated that the sheets have not been signed by the PPP radiographers. The names on the reader sheets were either printed or initialed. AR 724 was prepared as a result of this problem.

Problems concerning shop welds fabricated by PPP at Williamsport have been found to exist at other nuclear facilities. The NRC CAT inspected a number of completed shop welds fabricated at PPP during the inspection at Perry. Most of these were large bore piping welds and had been blended for in-service inspection. Several deficiencies including lack of compliance for weld quality and minimum wall violations were found in small bore piping welds. However, the sample size for welds in small bore piping was small in relation to the total number of piping welds reviewed (see Table IV-4). The NRC CAT understands that the applicant plans to review small bore shop welded piping from PPP at Williamsport to ensure similar deficiencies do not exist at Perry.

During the review of radiographs for PPP field welds, three of the 91 welds were also suspected of not meeting the minimum wall thickness requirements. These welds were identified as O-111-9, welds 02, 03 and 04. The welds were buried underground and the wall thickness could not be verified by ultrasonic examination. These welds are now under investigation and the use of radiographic step wedge thickness versus film density method is being considered as a alternative method of evaluation. NRs TAS-058, TAS-059, and TAS-060 were prepared for these welds.

The radiograph for weld O-P11-9, FW01 was rejected by the NRC CAT inspector for failure to display the 4T hole in the penetrameter for the subject weld. NR TAS-062 was prepared for this condition. Another radiograph was rejected for lack of fusion and NR PPP-4021 was prepared as a result of this finding.

c. Conclusions

With the exception of the findings previously discussed, all inspected welding and NDE activities were found to comply with the requirements of the ASME Code and the CEI FSAR commitments.

3. Newport News Industrial (NNICO)

a. Inspection Scope

(1) Welding Activities

The NRC CAT welding inspection activities relating to NNICO included inspection of field welding (both ASME and AWS D1.1), in-process welding, welding procedures and welder qualifications. NDE procedures, personnel qualifications, and the review of radiographic film for the containment liner welds were also included in this inspection.

A total of four welding attachments to the liner plate were witnessed and the complete documentation involving eleven welds was reviewed in order to ascertain that the welding was performed in accordance with the requirements of the ASME code, specifications and drawings.

The qualification records for six welders and the welder qualification procedures were also reviewed for adequacy.

(2) Nondestructive Examination Activities

Radiographic film for approximately 98 feet of the liner plate was reviewed by the NRC CAT (see Table IV-4 for a listing of the liner plate welds reviewed).

b. Inspection Findings

Welding/Nondestructive Examination Activities

No concerns were identified in the area of inspected welding and NDE activities.

c. Conclusions

No problems were identified in the areas of inspected NNICO welding and NDE activities.

4. Johnson Controls, Inc. (JCI)

a. Inspection Scope

A total of 225 welds were inspected for compliance with the requirements of the ASME Boiler and Pressure Vessel Code. Welding procedures and the qualification test records for 25 welders were

reviewed. In addition, NDE procedures and personnel qualification records were also reviewed. Four NDE inspectors were observed and evaluated for their abilities to use the ASME Code and to follow the Johnson Control (JCI) NDE procedures.

b. Inspection Findings

No concerns were identified in the areas of inspected welding and NDE activities.

c. Conclusions

No problems were identified in the areas of inspected JCI welding and NDE activities.

5. Pittsburgh Bridge and Iron (PBI)

a. Inspection Scope

A total of 340 welds were visually inspected for compliance with the requirements of AWS D1.1 Structural Welding Code. Welding procedures, welder qualification records, NDE procedures and NDE personnel qualifications were reviewed. In addition, a sample of NDE inspectors were observed and evaluated for their abilities to use the AWS D1.1 Code and follow the PBI NDE procedures.

b. Inspection Findings

(1) Eight of the sampled 340 welds were found to be undersized, having excessive concavity or unacceptable contours and were deficient with respect to the acceptance criteria stated in the AWS D1.1 Code. As a result of this finding, the project organization issued nonconformance report (NR) PBI 981 and the welds will be repaired and reinspected as required by the AWS D1.1 Code.

(2) Active welding procedures were found to be in accordance with the requirements of AWS D1.1 Code.

Procedure GR-2, Revision 0 was found to be deficient with respect to the AWS D1.1 Code because it included ASTM A569 material which is not listed in Table 4.1.1 of the Code. Since this material is not listed in Table 4.1.1, the procedure can not be used as a prequalified procedure. PBI indicated that procedure GR-2 was never used in production welding and it will be removed from the approved procedures list.

(3) The welder qualification records for welders were found to be in compliance with the requirements of the AWS D1.1 Code. Welders were qualified by bend testing except for one welder whose test plate was qualified by radiography.

The review of the qualification radiograph revealed that the radiograph was not acceptable with respect to the film quality requirements of the AWS D1.1 Code. PBI re-radiographed the original test plate and the second radiograph was found to be acceptable. In addition, 20 additional welds which have been made by this welder were visually inspected. All inspected welds were found to be of excellent quality indicating that the work was completed by a qualified craftsman.

c. Conclusions

With the exception of the findings previously discussed, inspected welding and NDE activities were found to comply with the requirements of the AWS D1.1 Structural Welding Code.

6. L.K. Comstock (LKC)

a. Inspection Scope

A total of 160 sampled welds were visually inspected in accordance with the requirements of the AWS D1.1 Code.

Welding procedures and the qualification test records for 18 welders were reviewed. In addition, NDE procedures and personnel qualification records were reviewed. Two NDE inspectors were observed and evaluated for their abilities to use the AWS D1.1 Code and to follow the LKC NDE procedures.

b. Inspection Findings

No concerns were identified in the areas of inspected welding and nondestructive examination activities.

c. Conclusions

No problems were identified in the areas of inspected LKC welding and NDE activities.

7. Robert Irsay (RICO)

a. Inspection Scope

Total of 160 welds were inspected comprising a sample of vendor procured welds and field welds completed by RICO. Welding procedures, welder qualification records, NDE procedures and NDE personnel qualifications were reviewed. In addition, two NDE inspectors were observed and evaluated for their abilities to use the AWS D1.1 Code and to follow the RICO NDE procedures.

b. Inspection Findings

(1) During the visual inspection of completed field welds, some of the welds were found to be undersized. As a result of this finding, the project organization issued NRs RICO-488, RICO-489 and RICO-490 and all deficient welds will be required to comply with code and specification requirements.

(2) Vendor supplied multi-blade dampers were found to be tack welded instead of the required 1" stitch weld. As a result of this finding, the CEI project organization issued NR MCC F-40 to address this item.

(3) The welding and NDE procedures reviewed were found to be in conformance with the requirements of the AWS D1.1 Code.

(4) The welder and NDE personnel qualification records reviewed met the requirements of the AWS D1.1 Code.

c. Conclusions

With the exception of the previously discussed findings, inspected welding and NDE activities were found to comply with the requirements of the AWS D1.1 Structural Welding Code.

Table IV-1

PIPING RUNS INSPECTED

System/Name	Class	Size
1B21/Nuclear Boiler System	3	10", 12", 14"
1G33/Reactor Recirculation	1	20", 28"
1C11/Control Rod Drive	2	1¼", 1½", 8"
1E12/Residual Heat Removal	1, 2, 3	3", 4", 6," 10", 12", 18"
1E21/Low Pressure Core Spray	1, 2	2", 12", 14", 24"
1E22/High Pressure Core Spray	1, 2	10", 12", 16", 24"
1E32/ MSIV Leakage Control	2	2½", 3", 4"
1E51/Reactor Core Isolation Cooling	1, 2	2", 4", 6", 10", 12"
1G33/Reactor Water Cleanup	1, 3	4", 6", 12"
1G36/RWCU Filter/Demineralizer	2, 3	4", 6", 8"
1G41/Fuel Pool Cooling and Cleanup	3	8", 10"
1G42/Suppression Pool Drain and Cleanup	3	8", 10"
1G42/Suppression Pool Drain and Cleanup	3	8", 10"
1G61/Liquid Radwaste Sumps	2	2½"
1N27/Feed Water	1	12", 20"
1P11/Condensate Transfer and Storage	2	10", 16"
1P42/Emergency Closed Cooling	3	4", 10", 12"
1P45/Emergency Service Water	3	4", 8", 10", 14"
1P47/Control Complex Chilled Water	3	3", 6", 8", 10"

TABLE IV-2

Pipe Supports/Hangers Inspected

Supports/Restraints No.	Results
H101 B(A)-1	Welds acceptable
H101A(A)-1	"
H101A(B)-1	"
H101D(A)-1	"
H102B-1	"
H306A-1	"
H305A	"
H351B-1	"
H353B-1	"
H101B(B)-1	"
H101D(B)-1	"
H356B-1	"

NOTE: These supports/hangers listed on this page are installed by General Electric

TABLE IV-2

PIPE SUPPORTS/HANGERS INSPECTED - Cont.

Supports/Restraints No.	Results
1B21-H006	Welds Acceptable
1P42-H113	"
1P42-H139	"
1B21-H117	"
1P42-H148	"
1P45-H167	"
1G41-H247	"
1G41-H354	"
1P45-H447	"
1E22-H024	"
1E12-H2109	"
1E12-H138	"
1G41-H362	"
1P45-H147	"
1B21-H223	"
1C11-H032	"
1G36-H045	"
1G36-H065	"
1B21-H414	"
1E12-H1061	"
1E12-H1041	"
1E12-H1062	"
1E12-H748	"
1E21-H014	"
1E12-H010	"
1E12-H037	"
1M51-H022	"
1P42-H345	"
1E12-H2095	"
1G41-H209	"
1P42-H099	"
1P45-H120	"
1P42-H345	Rejected by CEI Phase II inspection
IP42-H139	Under sized fillet welds (2) NRC 2540R11 had been prepared for undersize welds
1E12-H1062	Welds acceptable
1E12-H136	"
1P42-H113	"
1P42-H148	"
1E12-H2109	"
1B21-H117	"
1B21-H006	"

NOTE: The supports/restraints on this page are installed by Pullman Power Products

TABLE IV-2

PIPE SUPPORTS/HANGERS IINSPECTED - Cont.

Support/Hanger No.	Results
1P45-H167	Welds Acceptable
1G41-H247	"
1G41-M354	"
1P45-H447	"
1C11-H614	Reviewed for welding and Design Change Control. Acceptable
1C11-H642	"
1C11-H021	"
1E12-H072	"
1C11-H015	"
1B33-H1068	"
1P42-H1043	"
1E12-H178	"
1P45-H360	"
1C11-H516	"
1B21-H107	"
1P45-H1516	"

NOTE: The supports/restraints listed on this page are installed by Pullman Power Products

TABLE IV-3

WELDER QUALIFICATIONS

General Electric

Welder I.D.	Method of Testing/ Comments
GEP-005	RT
GEP-071	Bends
GEP-072	"
GEP-082	"
GEP-084	"
GEP-104	"
GEP-105	"
GEP-113	RT
GEP-118	"
GEP-121	Bends
GEP-132	RT
GEP-140	"
GEP-160	"
GEP-175	RT & Bends
GEP-177	RT (1)
GEP-187	RT (1)
GEP-199	RT
GEP-210	Bends
GEP-217	Bends
GEP-271	RT (1)
GEP-274	"
GEP-279	"
GEP-288	RT
GEP-290	RT (1)
GEP-297	RT

Pullman Power Products

Welder I.D.	Method of Testing/ Comments
RX	Bends
FZ	RT & Bends
AJV	Bends
X2	"
AGK	"
ATC	"
ARA	"
JT	"
ADE	"
ATH	"
ATM	"

TABLE IV-3

WELDER QUALIFICATIONS - Cont.

Pullman Power Products - Cont.

Welder I.D.	Method of Testing/ Comments
ARC	"
ALN	"
E2	"
ABJ	"
ADF	"
AUH	"
ATP	"
AJK	"
AP	RT & Bends
ARD	"
AC4	RT (1)
AMQ	RT (1)

Newport News Industrial

Welder I.D.	Method of Testing/ Comments
018-4144	RT
018-488	"
441-1745	"
441-4469	"
065	"
024	"

Others

FBI/Kelly Steel - A total of 57 welder qualification records were reviewed. 56 welders were qualified by bend test and one by radiography.

Johnson Controls - A total of 25 welder qualifications were reviewed. All welders were qualified by bend testing.

L. K. Comstock - A total of 18 welders were reviewed. All welders were qualified by bend testing.

Robert Irsay Co. - A total of 17 weldres were reviewed. All welders were qualified by bend testing.

NOTE (1): The radiographic film quality was unacceptable per ASME Code.

TABLE IV-4

RADIOGRAPHIC FILM REVIEW

General Electric (Shop Welds)	Weld I.D.
KER-1701-250	St. Seam
702-E-82-9G010	[illegible]-LSWOL
1-B21-MS-LOOPC	Weld 8012A
1-B21-MS-LOOPC	Weld 0038D
1-B21-MS-LOOPB	Weld 0090
1-B21-MS-LOOP	Weld 4B
1-B21-MS-LOOPD	Weld 602
1-B21-4A-FRT-F-CL	Weld 6A
1-B21-4A-FFB	Weld 4A
1-B21-7D-MS-FCL	Weld 4A
1-B21-A3-F-TRA	Weld 6A
1-B21-A1-1PC-1-3A	Weld 3A
1-B21-D2	
1-B21-7CT1B21	Weld 031
1-B21-4CT1B21	Weld 026
1-B33-RRA19LOOPA	
1-B33-RR10-A-1	
1-B33-RR-002	Weld A-10
2-E32-GMSIV-63AB	Weld A
2-E32-GMSIV-63AB	Weld B
2-E32-GMSIV-63AB	Weld C
2-E32-GMSIV-51AB	Weld A
2-E32-GMSIV-51AB	Weld B
2-E32-GMSIV-51AB	Weld C
2-E32-GMSIV-52AB	Weld A
General Electric (Field Welds)	FRT(B33-1-34)
"	FGL-10
"	FRT(B33-1-38)
"	FGL-10
"	RCC-1-RCB33-RR
"	RCCA12G33-1-A12
"	RCCB33-1-A

TABLE IV-4

RADIOGRAPHIC FILM REVIEW - Cont.

Pullman Power Products Shop Welds (67)	Weld I.D.
**2E12-GRH-91AB	Weld B
1N27-GFW-129ST	Weld C
*1N27-GFW-129ST	Weld E
1E12-GRH-216HB	Weld A
1E12-GRH-216AB	Weld C
*1N27-GFW-143HB	Weld A
**2E21-GHR-91AB	Weld E
2E12-GHR-91AB	Weld D
2E12-GHR-91AB	Weld C
2E12-GHR-91AB	Weld A
1E22-GHPC-8AB	Weld B
1N27-GFW-140HB	Weld B
1E51-GRCIC-33AB	Weld F
1N27-GFW-129ST	Weld A
1N27-GFW-129ST	Weld B
1N27-GFW-136ST	Weld B
1N11-GMS-1TB	Weld A
*INH-GMS-1TB	Weld B
2E-32GMSIV-37AB	Weld G
2E-32GMSIV-52AB	Weld A
2E-32GMSIV-56AB	Weld B
2E-32GMSIV-56AB	Weld C
2E-32GMSIV-56AB	Weld D
2E-32GMSIV-56AB	Weld E
2E-32GMSIV-56AB	Weld G
2-E12-G-RH-220AB	Weld J
2-E12-G-RH-220AB	Weld D
2-E12-GRH-4-AB	Weld E
2-E12-GRH-4-AB	Weld B
2-ER-GRH-19-AB	Weld G
1-E12-GMSIV-10RAB	Weld N
1-E12-GMSIV-10RAB	Weld H
1-E12-GMSIV-10RAB	Weld A
1-E12-GMSIV-10RAB	Weld A
1-E12-GMSIV-2AB	Weld A
2-E12-GGRH-4AB	Weld C
2-E12-GRH-220AB	Weld C
2-E12-GRH-7AD	Weld A
1-G-3BGRWC-20-RB	Weld A
1-E21-GLPG-7-AB	Weld A
1E21-GLPC-2-AB	Weld C
1E12-RCIC-12-AB	Weld A
1E21-GLPC-8-AB	Weld A
1E21-GLPC-11-AB	Weld B
2E12-GRH-7-AB	Weld B
1E51-GRCIC-30-AB	Weld C
1E31-GRCIC-11-AB	Weld B

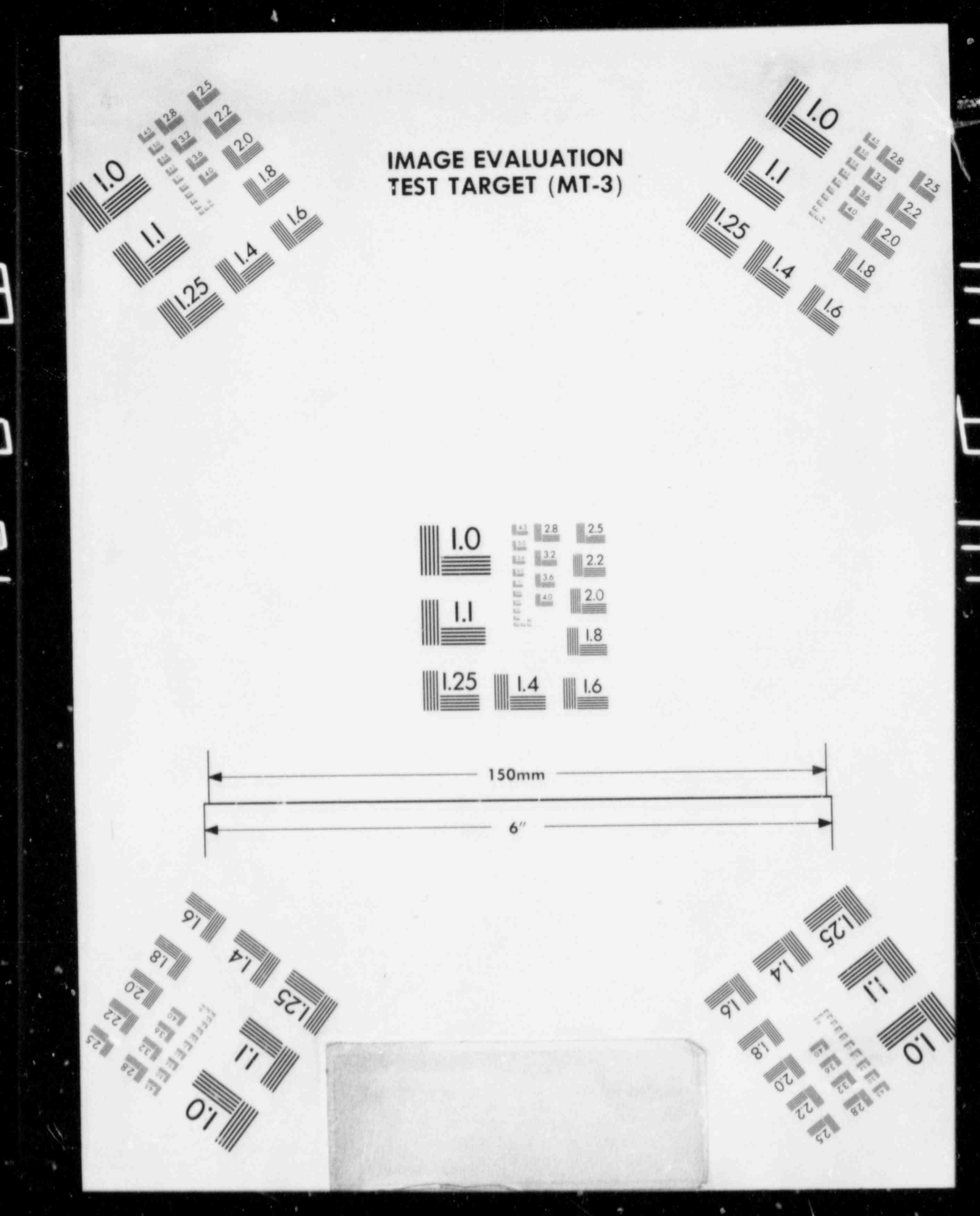
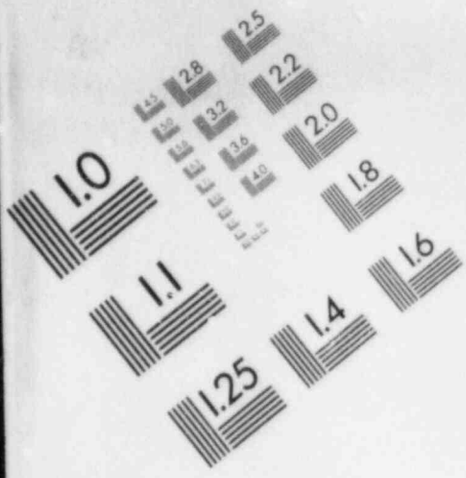
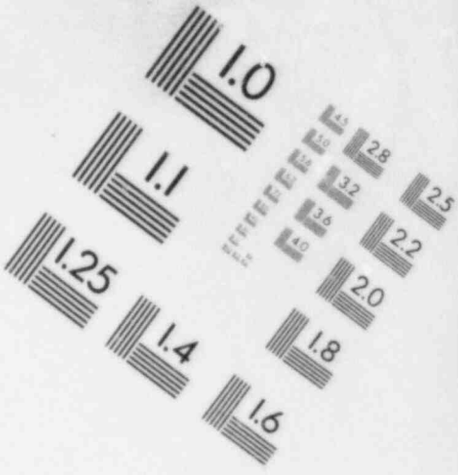
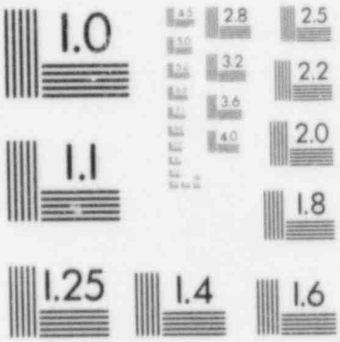


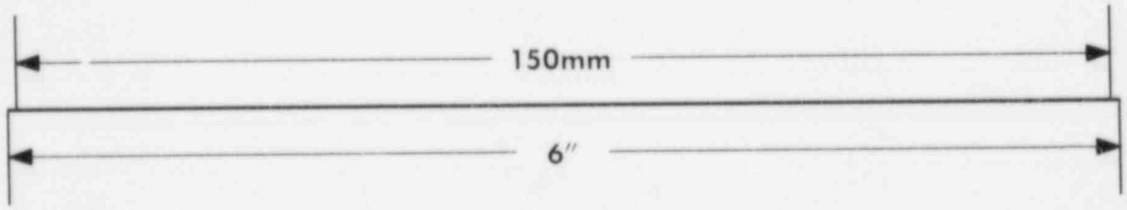
IMAGE EVALUATION
TEST TARGET (MT-3)
1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
150mm
6"

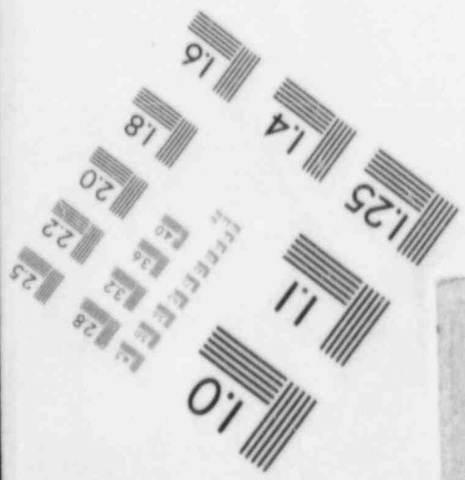
IMAGE EVALUATION TEST TARGET (MT-3)











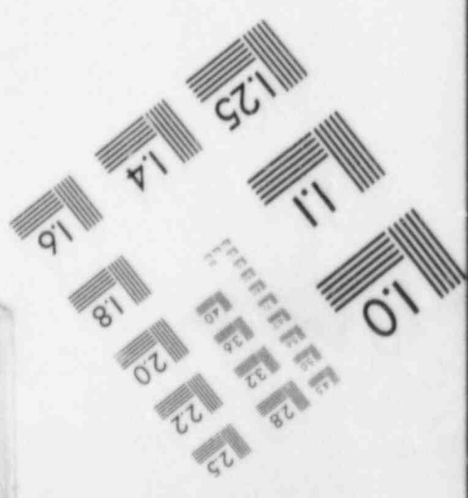


IMAGE EVALUATION
TEST TARGET (MT-3)

150mm

6″

TABLE IV-4

RADIOGRAPHIC FILM REVIEW - Cont.

Pullman Power Products Field Welds (91)	Weld I.D.
1-G33-GRWCU-20-AB	Weld A
1-E12-33-1510460	Weld 01
1-E51-2	Weld 46
1-E22-2	Weld 05
1-E22-2	Weld 09
1-E22-5	Weld 02
1-E22-5	Weld 01
1-E22-5	Weld 04
1-E22-5	Weld 31
1-N27-1	Weld 09
1-E22-4	Weld 08
1-N27-1	Weld 15
1-E12-11	Weld 20
Cont WNI-90	15' Vert weld
1-G-23-5	Weld 02
1-G-23-6	Weld 04
1-E-51-2	Weld 09
1-E-51-2	Weld 01
1-E-51-2	Weld 40
1-G-33-5	Weld 32
1-G-33-5	Weld 03
1-G-33-3	Weld 01
1-E-12-34	Weld 02
1-E-51-8	Weld 01
1-E-51-8	Weld 02
1-N-27-2	Weld 01
2-E-12-G-RH-220-AB	
1-E-12-11	Weld 20
1-E-12-17	Weld 10
1-E-12-22	Weld 03
1-E-12-22	Weld 05
1-E-12-22	Weld 06
1-E-12-22	Weld 07
1-E-12-22	Weld 08
1-E-12-22	Weld 10
1-E-12-31	Weld 05
1-E-12-35	Weld 01
1-E-12-36	Weld 12
1-E-12-31	Weld 06
1-E-12-12	Weld 05
1-E-12-14	Weld 01
0-P11-9	Weld 02**
0-P11-9	Weld 01***
0-P11-8	Weld 01
1-C41-510	Weld 44
0-Paa-9	Weld 03**
0-P11-9	Weld 04**
0-P11-10	Weld 01

TABLE IV-4

RADIOGRAPHIC FILM REVIEW - Cont.

Pullman Power Products Field Welds (91) - Cont.	Weld I.D.
0-P11-10	Weld 02
1-E12-20	Weld 03
1-E12-30	Weld 20
1-E12-20	Weld 03
1-E12-23	Weld 01
1-C41-4	Weld 02
1-C41-4	Weld 08
1-E12-2	Weld 10
1-E12-4	Weld 03
1-E12-5	Weld 12
1-E12-5	Weld 13
1-E12-11	Weld 03
1-E12-12	Weld 03
1-E12-15	Weld 02
1-E12-15	Weld 03
1-F12-17	Weld 01
1-E12-32	Weld 15
1-E12-33	Weld 07
1-E12-33	Weld 08
1-E12-45	Weld 05
1-E12-48	Weld 05
1-E32-7	Weld 04
1-E51-3	Weld 08
1-E51-3	Weld 01
1-E51-5	Weld 04
1-E51-6	Weld 06
1-E51-7	Weld 03
1-E51-7	Weld 03
1-E51-1	Weld 01
1-E51-1	Weld 02
1-E51-2	Weld 60
1-E21-2	Weld 03
1-E21-2	Weld 117
1-E21-3	Weld 04
1-E21-3	Weld 06
1-E12-14	Weld 09
1-E12-17	Weld 08
1-E12-20	Weld 01
1-E12-23	Weld 02
1-E12-27	Weld 09
1-E12-24	Weld 21
1-E12-27	Weld 08
1-E12-24	Weld 05
1-E12-28	Weld 03

TABLE IV-4

RADIOGRAPHIC FILM REVIEW - Cont.

Pullman Power Products Field Welds	Weld I.D.
1E31-GRCIC-11-AB	Weld A
2E12-GRH-9-AB	Weld G
1E12-GRH-19-AB	Weld F
1E32-G-MSIV-10R-AB	Weld M
1E32-G-MSIV-10R-AB	Weld L
1E32-G-MSIV-10R-AB	Weld G
1E32-G-MSIV-10R-AB	Weld E
1E32-G-MSIV-10R-AB	Weld J
1E32-G-MSIV-10R-AB	Weld B
1G32-G-MSIV-10R-AB	Weld C
1E32-G-MSIV-10R-AB	Weld D
2E12-G-RH-4-AB	Weld A
2E12-G-RH-4-AB	Weld D
2E12-G-RH-4-AB	Weld F
2E12-G-RH-220-AB	Weld C-R1
2E12-G-RH-220-AB	Weld C-R2
2E12-G-RH-220-AB	Weld E
2E12-G-RH-220-AB	Weld E-R1
1-G-33GRWCU-20-AB	Weld B
1-G-33GRW-CU-20-RB	Weld C
1-G-33GRWCU-20-RB	Weld D

* Welds rejected by NRC CAT for lack of compliance for weld quality
** Rejected by NRC CAT for minimum wall violation
*** Rejected for failure to display 4T hole of the penetrameter

Containment Liner Review

Newport News Industrial (NNICO)

INNO-2 (177-179) Horizontal Seam
INNI-90 Verticle Seam
Approximately 98 Ft. Film for containment liner plate reviewed

TABLE IV-5

IN-PROCESS NDE INSPECTIONS

Contractor	NDE Method	Item Inspected	Results
G.E.	R.T.	Piping Welds	Acceptable, Witnessed 4 R.T. Technique/setups
PPP	P.T.	Piping Welds	Acceptable, Witnessed 1 P.T. Exam
	R.T.	Piping Welds	Acceptable, Witnessed 3 R.T. Exams
JCI	P.T.	Piping Welds	Acceptable, Witnessed 6 P.T. Exams
	V.T.	Piping Welds	Acceptable, Witnessed 6 visual exams
LKC	V.T.	Structural Welds	Acceptable, Witnessed 2 visual exams
	P.T.	Structural Welds	Acceptable, Witnessed 2 P.T. Exams
RICO	V. T.	Structural Welds	Acceptable, Witnessed 2 visual exams
	P. T.	Structural Welds	Acceptable, Witnessed 2 visual exams
PBI	V.T.	Structural Welds	Acceptable, Witnessed 7 V.T. Exams
	M.T.	Structural Welds	Acceptable, Witnessed 7 M.T. Exams
	P.T.	Structural Welds	Acceptable, Witnessed 3 P.T. Exams
	U. T.	Structural Welds	Acceptable, Witnessed 1 U.T. exam

V. CIVIL AND STRUCTURAL CONSTRUCTION

A. Objective

Determine by independent evaluation of work in progress, completed work, and by review of documentation whether work, inspection, and test activities relative to the civil engineering area were accomplished in accordance with project specifications and procedures. These objectives were met through evaluation of the Seismic Clearance Program, concrete expansion anchor bolts, concrete placement, in-situ concrete and reinforcing steel placement quality, concrete and soils records, containment vessel steel, structural steel installation activities and design changes and nonconformance reports in these areas.

B. Discussion

1. Seismic Clearance Program

a. Inspection Scope

The applicant's Seismic Clearance Program provides for the identification and review of those instances in which seismic clearance criteria have been violated. The criteria, established by the architect engineer, Gilbert Associates, Inc. (GAI), cover safety-related components (i.e., piping and supports, HVAC ductwork and supports, and electrical conduits and cable trays) and also non-safety-related components which in a seismic event could affect safety-related components. The seismic clearance inspections are to be performed in accordance with Construction Quality Assurance Instruction 21-1007, Rev. 1, dated 7/5/83, "Seismic Clearance Inspection." The review of the violations of seismic clearance criteria is described in the site Procedures Manual, Volume 4, 4-0500, "GAI Interfaces," dated 9/30/82. The regulatory requirements are specified in paragraphs C.2 and C.4 of Regulatory Guide 1.29, Rev. 3, dated 9/78, "Seismic Design Classification."

A sample of 26 hardware installations in the field was reviewed to determine the workmanship quality. The hardware reviewed were those which had been identified as violating the seismic clearance criteria and had been resolved by GAI engineering with or without repair work being required. This review was performed to verify whether the quality of workmanship was adequate for those components for which GAI had performed analyses.

From the 26 hardware installations reviewed, an evaluation was also performed of seven engineering calculations done by GAI which had accepted the hardware installations. The engineering calculations were evaluated to verify the technical adequacy of the dispositions of the seismic clearance violations.

b. Inspection Findings

For the 26 Seismic Category I, nonsafety-related hardware installations (see Table V-1), the general quality of workmanship (i.e., weld appearance, nut tightness, structural integrity assessment, and support spans) was reviewed. The review also included the inspection of supports and components in the vicinity of the seismic clearance violation (those conditions which could affect the engineering analyses). Seven supports were inspected in detail for conformance to the design drawings. The findings are detailed in Table V-1.

The significant hardware installation problems identified by the NRC CAT were: 1) excessive lateral movement of fire protection piping among safety-related cable trays; 2) instances of missing or poor welds; 3) one support spring can out of alignment; and 4) excessive piping spans with a minimal number of supports. For the sample of hardware installations inspected by the NRC CAT, except for the fire protection piping among cable trays, the hardware deficiencies appear to be isolated cases and were not of a condition which would jeopardize structural integrity; however, the deficiencies were of a nature that could affect engineering analyses in other more critical applications.

Seven GAI engineering calculations were reviewed by the NRC CAT. This review included: use of current seismic floor response spectra, proper analytical techniques, proper analysis assumptions, and proper evaluation of the calculation results. The calculation review findings are summarized in Table V-1. Twenty-two floor response spectra curves, used as input into the calculations, were verified to be the current response spectra. However, it was identified that the curves were not being formally distributed to those on-site design groups using these curves. Two significant issues were identified:

(1) The lateral movement of fire protection piping among safety-related cable trays was not considered by the GAI engineers. In addition, the impacting of the fire protection piping with the cable trays was considered in the engineer's judgment to be "insignificant". In the actual hardware installation, the only lateral restraint is at the branch connection at the main header piping, allowing the fire protection piping to move laterally, impacting cable trays or adjacent conduit.

(2) Generally, the calculations were found to be performed in a manner not well controlled. Examples are: a bolt capacity not properly evaluated for adequacy, use of differing factors of safety for the same component without guidance as to which factor of safety should be used and under which circumstances, differing allowable capacities for threaded rod, assumptions for field hardware not verified, calculation references made incorrectly, use of the wrong size bolt (larger than actual) in a calculation, and generic calculations which analyzed similar seismic clearance violations were not based on the most limiting hardware installation parameters. Although, in the calculations reviewed, no cases were identified in which the lack of detailed design

control caused a significant analysis error, the errors should not have been made nor passed through the checking process without the errors being identified. It appeared that without formal design/analysis guidance each GAI engineer used analysis techniques and methods of their own choosing. This led to some analysis inconsistencies.

In the review of an added support (CC-574-FD-4) required to satisfy seismic clearance violations (SCVs), the NRC CAT identified undersized welds and weld splatter (SCV #187). Final inspection of the added support had not been performed; however, the violation had been already closed by GAI. It was determined that 29 SCVs had been dispositioned by GAI engineering as "accept-as-is" when, in fact, the violation could only be closed if additional work was performed (installation of supports or removal of temporary lines). The use of "accept-as-is" vice "repair" dispositions by GAI caused the closure of these violations prior to completion of the necessary repair work.

This practice may preclude the repair work from being properly tracked (using a work package) and properly inspected. These early closures of violations are contrary to the implementation of Appendix Y (Section 2:03) to GAI Interface Procedure, Volume 4, 4-0500, dated 9/30/82, "Interfaces." As a result of the NRC CAT finding in this area, Action Request (AR) #706, dated 9/12/83, was issued to identify and reopen those SCV's erroneously dispositioned "accept-as-is." This AR was closed on 9/22/83.

c. Conclusions

(1) The GAI engineering resolution for cases of fire protection piping among cable trays (SCV 2442, 2460, 2492) was improper in that lateral movement was not considered. There has been inadequate attention to those analyses which relied mainly on engineering judgment.

(2) Generally, GAI engineering calculations have been performed in an inconsistent manner, and not well controlled. In the sample of calculations reviewed the inconsistencies and errors were not of a magnitude to invalidate the conclusions reached. However, this is indicative of a lack of attention to detail by the engineer and checker.

(3) Cases of deficient installation workmanship were identified which could be significant under other more critical situations.

(4) Seismic clearance violations were identified which had been closed prior to the completion of the necessary repair work. Improper dispositions by GAI engineering had caused closure prior to verification that the nonconforming conditions were fully resolved.

2. Concrete Expansion Anchor Bolts (Hilti Bolts)

a. Inspection Scope

The qualification test report and installation specifications were reviewed for the predominant type of concrete expansion anchor bolt used at Perry (Hilti Kwik-Bolt). The inspection and installation procedures for the Hilti bolts were also reviewed for two contractors (Pullman Power Products and L. K. Comstock).

It was identified by the NRC CAT that concrete expansion anchor bolts (Hilti Kwik-Bolts) are being installed in the drywell wall through the drywell liner plate and into the concrete behind the liner plate. The 5/8" and 3/4" diameter anchor bolts are being used primarily to support instrumentation and control lines, electrical conduits, and pipe supports. Based on discussions with the applicant, the total number of anchor bolts anticipated to be installed in the drywell walls are 6000-8000 per unit. Approximately 2000 were installed as of the time of this inspection.

b. Inspection Findings

On-site qualification tests for Hilti Kwik-Bolts were performed and the results are summarized in GAI Report No. 2304, "Perry Nuclear Power Plant: Report on Evaluation of Hilti Kwik-Bolt Qualification Tests," dated 5/11/81. The report summarized the qualification tests performed from November 1978 through November 1980. The current installation specifications and installation procedures for Pullman Power Products and L. K. Comstock were compared by the NRC CAT with the qualification report and found to be in agreement. The following was noted in the review of the qualification report:

(1) Torque-tension relationships were established based on the qualification testing. In all cases, except for 1/2" diameter Hilti bolts, the specified inspection torque provides a preload at least equal to the allowable load. The installation torques are higher than the inspection torques. The use of 1/2" diameter Hilti bolts was discontinued in November 1980.

(2) The 1/2" diameter Hilti bolt testing showed capacities less than the value required by GAI specifications (8% low). However, the GAI design practice had been to double anchor bolt loads in order to account for base plate flexibility. For the standard 4-anchor bolt base plate, doubling the bolt load is generally overly conservative and the slight reduction in the capacity of 1/2" diameter anchor bolts can be offset by the doubling of the bolt loads. Additionally, there had been only a small number of 1/2" diameter anchor bolts installed prior to their discontinuation. A random sample of approximately five small bore pipe support designs were reviewed and verified by the NRC CAT that the anchor bolt loads were in fact doubled and proper anchor bolt allowable loads used.

(3) The ultimate capacities used by GAI for Hilti bolts are based on Hilti catalog recommendations. The qualification testing was done to confirm that the Hilti recommended anchor bolt capacities were being achieved in actual site concrete.

(4) The use of 1" diameter Hilti bolts has been discontinued due to the poor test results of four 1" diameter anchor bolts in a closely spaced pattern. The 1/2" diameter Hilti bolts showed similar poor results in a closely spaced pattern. The problem of anchor bolts in closely spaced patterns has been reported previously by the licensee in a 10 CFR 50.55(e) report.

The issue of Hilti bolts being installed through the drywell liner plate is of concern to the NRC CAT due to the number of anchor bolts being installed (6000-8000) and that the drywell must meet bypass leakage limits. The method of Hilti bolt installation is to drill holes through the liner plate and into the concrete behind to a depth approximately 7", install the Hilti bolt, place HVAC metal air duct sealer tape material (similar in consistency to putty) in the annular space between the Hilti bolt and the drywell liner plate with a small amount of overfill, install the attachment, and then torque the Hilti bolt. The attempt is made to restore in part the leak tightness of the liner plate that was lost when the Hilti bolt was installed through the drywell liner.

The leak tightness of the drywell is questioned by the NRC CAT based on the following discussion:

(1) The Hilti bolts, especially with the large number being installed, could contribute to crack initiation or propagation in seismic or dynamic loading conditions leading to unacceptable through wall cracking.

(2) The General Electric (GE) topical report on drywell cracking, NEDO-10977, "Drywell Integrity Study: Investigation of Potential Cracking for BWR/6 Mark III Containment," dated August 1973, notes in Section 2.2 that the results of the study do not include any construction defects (such as construction joints, honey-combing, or rock pockets) or local effects of stress concentrations caused by penetration or associated embedments. This GE topical report was presented as evidence that the drywell liner was in fact not required to minimize bypass leakage. However, embedments, such as Hilti bolts, in the drywell wall were not addressed in the GE study and in addition, the NRC has not formally accepted the GE topical report.

Investigation of other facilities using the Mark III containment design, shows that River Bend has a steel drywell liner but does not install concrete expansion bolts through the drywell liner plate. The Grand Gulf FSAR, Section 3.8, specifically indicates that the drywell concrete is the pressure retaining structural element and in fact does not utilize a drywell liner. However, the FSAR does present an analysis and evaluation for drywell concrete cracking.

(3) Drywell bypass leakage will be tested during the pre-operational phase at the full drywell design pressure and periodically at a reduced pressure of three psi differential. The allowable leakage limits for the full pressure test is 0.168 square feet of leakage area. This limit is equivalent to approximately 1.2% of the space between the 8000 Hilti bolts and the drywell liner plate contributing to the bypass leakage not even considering other bypass leakage paths. The periodic test at reduced pressure may not detect excessive bypass leakage for the full 40 year life of the plant.

(4) Concrete cracking is a common phenomenon resulting primarily from volumetric changes (drying shrinkage, creep under load, and thermal stresses) and the loading conditions. Cracking is recognized by the American Concrete Institute (ACI) in ACI 207.2R-73 and the ACI Committee 224 Report, "Control of Cracking in Concrete Structures" wherein it is realized that with the use of large, closely spaced bars and minimum cover requirements, it will likely require smaller maximum aggregate sizes and wetter mixes for placement ease. Subsequent volume changes and cracking may therefore increase rather than decrease. It is also recognized that cracks of the magnitude of 0.009 inches will allow some leakage (water being referred to, but applicable to air). The ACI Committee 224 report recommends a limit on the allowable crack width for water retaining structures of 0.004 inches. Leak tightness can in most instances only be achieved if specific measures are taken beforehand.

(5) Several (15 to 20) small areas of voiding behind the drywell liner plate have been identified thus far during the Hilti bolt installation process and documented on nonconformance reports (NRs). These voids have occurred in almost all cases just below the liner plate horizontal stiffener. The voiding indicates the difficulty in achieving complete fill and consolidation in congested areas inside the drywell wall, increasing the potential for through wall leakage.

In addition, two NRs from Pullman Power Products (PPP) concerning Hilti bolts in the drywell wall (NR PPPF-3842 and PPPF-3500) were reviewed. One NR was found to be improperly dispositioned by GAI and the other NR had bypassed the established trending program for tracking NRs. NR PPPF-3500 described a problem with an oversized hole for a Hilti bolt. The proposed disposition was to grout the hole and redrill it. GAI engineering agreed with the proposed disposition. However, it is not standard industry practice to allow grouting and redrilling of holes for expansion anchor bolts. The NRC CAT concern is whether the grout will actually bond tightly to the concrete to transfer the loads into the concrete without the pulling out of the grout portion in the hole. This is an instance of an improper engineering disposition.

Project and GAI civil engineering personnel had been informally monitoring NRs which described problems in achieving torque for Hilti bolts in the drywell wall. Their interest is due to the fact that the inability to achieve torque could be indicative of voiding or honey-

combing of the concrete behind the drywell liner plate. It was identified by the NRC CAT that NR PPPF-3842 had not been brought to the attention of site and GAI personnel working in this area. The repair was to grout the holes and redrill them as discussed previously.

As evidenced by these two NRs, it appears that Pullman Power Products and internally within GAI, personnel are not properly distributing to the appropriate project and GAI engineering personnel information concerning problems with Hilti bolts and, in particular, Hilti bolts in the drywell wall. Engineering review by personnel knowledgeable in the area of Hilti bolts and Hilti bolts through the drywell liner would most likely have properly identified these two NRs as requiring additional attention.

c. Conclusions

The above findings indicate that:

(1) Hilti Kwik-Bolts have been properly qualified in accordance with specifications and procedures for their use at Perry. In addition their installation and inspection by contractors has been controlled by the use of specification and procedure changes.

(2) The NRC CAT is concerned that under normal, transient, and accident loading conditions whether the drywell wall can maintain its leak tight integrity over its service lifetime of 40 years considering the large number of expansion anchors currently being installed. The preoperational drywell bypass leakage test is important in that it will be the first test for drywell leak tightness. This issue is under additional NRC review.

(3) From the review of two NRs, it appears that one contractor (Pullman) and internally within GAI, personnel have not communicated to ensure that problems with Hilti bolts are properly dispositioned and brought to the attention of project and GAI personnel working in this area.

3. Concrete Placement

a. Inspection Scope

The concrete placement activities for two areas were witnessed by the NRC CAT. The areas were: three Diesel-Generator Building construction blockouts (Pour Nos. DGO-W01-638, DGO-W02-635, DGO-W03-638) and the Unit 2 Shield Building Dome (Pour No. RB2-D8C-754). These placements were made by Dick Corporation during the NRC CAT inspection. The activities witnessed included: pre-placement cleanliness, rebar and embed plate placement, batch plant activities, in-process testing, and concrete placement and consolidation. These activities were reviewed for conformance to specifications, regulatory requirements and commitments. The review of applicable specifications and procedures included:

- Dick Specifications:
  - SP-19-4549-00, Rev. V, (4/12/78), Construction of Shield Building Walls and Domes for Reactor Buildings 1 and 2
  - SP-201-4549-00, Rev. 6, (6/12/78) Attachment Specification - Placement of Structural Concrete
  - SP-202-4549-00, Rev. 5, (4/5/78), Attachment Specification- Placing of Reinforcing Steel for Safety Class Structures
- Dick Quality Control and Work Procedures:
  - FQC-10.1, Rev. 7, 2/3/82 - Concrete Control General
  - FQC-10.2, Rev. 7, 12/1/80 - Preplacement, Placement, and Post-Placement of Concrete
  - FQC-10.3, Rev. 2, 11/8/76 - Reinforcing Control
  - CWP-10.1, Rev. 1, 2/23/77 - Pumping Concrete
  - CWP-10.2, Rev. 3, 12/1/77 - Placement of Concrete
- U.S. Testing Company Quality Control Procedure:
  - QCP-3, Rev. 11, 1/19/82 - Quality Control Procedures for Sampling and Testing of Concrete

b. Inspection Findings

The placement areas were reviewed prior to the actual placement of concrete, during placing activities, and during in-process testing. The following observations were made:

(1) Reinforcing and embedded plates were of the specified size and grade, properly located, and secured in accordance with the design drawings, including Engineering Change Notices and Field Variance Authorizations. Lap splices were verified to be staggered and of the specified lap length.

(2) Concrete cover distances were maintained.

(3) Forms were free of standing water and debris and were adequately secured.

(4) Construction joint surfaces were prepared, where required, by bush hammering to expose the coarse aggregate. A Field Question (No. 31237) was initiated on the Shield Building Dome placement to determine whether the vertical construction joint with a keyway required bush hammering. GAI engineering responded that joint preparation was only required on the horizontal construction joint.

(5) Wall thicknesses were maintained.

(6) Batch plant operations were observed and batch tickets reviewed against the mix design-daily mix adjustment sheets. Batch plant operations were continuously under QC surveillance.

(7) The concrete placement crews were observed during placement operations and the number of crew members was sufficient to control the placement operation. Concrete placement in the forms minimized segregation of the concrete. There was no excessive movement of concrete by vibration. One vibrator head could not be removed from the forms (Pour DGO-WO2-635) and it was necessary to cut the vibrator cable and leave the head embedded in the wall. Dick NR 215 was written for this condition. GAI engineering accepted this condition and the NR is now closed.

(8) Concrete in-process testing was performed by U.S. Testing at the concrete pump discharge or truck discharge as appropriate for the placement. The concrete was tested for slump, air content, temperature, and unit weight and concrete cylinders taken in accordance with the frequency specified in the construction specifications. The concrete in the first truck for placement DGO-WO1-638 was tested and found to have an excessive slump (5 3/4" vs. 5"). Procedures were followed for additional field testing when the concrete was found to be out of specification requirements. Since approximately three cubic yards of the high slump concrete had already been placed, Dick NR 214 was issued and accepted based on acceptable cylinder strength tests at 28 days (minimum tested strength - 6155 psi vs. minimum required strength - 3000 psi). The NR is now closed.

(9) Post-placement inspection of the pours was performed by the applicant and areas were identified in placement DGO-WO2 and DGO-WO3 of superficial honeycombing. These areas were documented in Dick NR 216. As part of the NR and attached to the NR were the Perry Review Board comments on 9/8/83 which stated, "Training of crafts to be documented and attached to this NR prior to closeout." However, the closeout date of Dick NR 216 is 9/14/83, whereas the training documentation indicates that training was not given until 9/21/83 (one week after the NR was formally closed). AR 716 was initiated to identify the cause of the discrepancy and the steps to prevent recurrence. This is an example of the closure of an NR prior to completion of all the required actions (see Section VIII).

c. Conclusions

The placement activities witnessed indicate that generally concreting is being performed in accordance with procedures and specifications. The problems which occurred during the placement process were properly identified, addressed by procedures, and the procedures were followed, except in one case concerning improper closure of a nonconformance report prior to completion of the required actions.

4. In-Situ Quality of Concrete and Reinforcing Steel Placement

a. Inspection Scope

Four construction access blockouts were reviewed by the NRC CAT for proper reinforcing steel placement, cadweld quality and concrete quality. The blockouts are listed in Table V-2.

In addition, approximately 30 cadwelds were reviewed in the Unit 1 and 2 Reactor Building annulus areas. These cadwelds were being installed as part of the reactor building containment fix and included both cadwelds done in-place and those done above and then put into the annulus area. The cadwelding was done by Dick.

b. Inspection Findings

In the four blockout areas reviewed by the NRC CAT, reinforcing steel placement was found to be in accordance with the design drawings, including applicable Engineering Change Notices and Field Variance Authorizations. Dowels into the blockout areas were the specified length. Reinforcing steel bar size and grade were as specified and lap splices the required length. Cadwelding in the blockout areas and the Unit 1 and 2 annulus areas was found to have evidence of proper centering of the cadweld sleeve, no excessive voiding, no burn through of the sleeve, no slag at the tap hole, and proper identification. Concrete quality was good with no areas of honeycombing and good bonding with the reinforcing steel.

It was noted that at some of the construction access blockouts, reinforcing dowels had been accidentally bent probably by items being passed through the opening. In one case, the bent reinforcing dowels had been previously identified in an NR; however, in another case of bent rebar no NR had been initiated. CQC NR 2871 was issued concerning the bent rebar during the NRC CAT inspection and remains open pending closing of the access opening at a later date.

c. Conclusions

From the construction blockouts and annulus areas reviewed, it appears that reinforcing steel was placed in accordance with the design drawings, cadwelds were made properly, and concrete quality appears acceptable.

5. Concrete and Soils Placement Records

a. Inspection Scope

The records associated with concrete and soils placements were reviewed for conformance to construction specifications and regulatory requirements. The documentation reviewed included records of inspection, in-process testing, material certification, surveillance testing, and cadwelder qualification, performance, and surveillance testing. The records covered 28 concrete placements (see Table V-3). The review of the 28 concrete placement records included: all four

contractors in safety-related concreting (National Engineering and Contracting Company, Great Lakes Construction Company, Blount Brothers Corporation, and Dick), a sample of 26 Receipt of Material Inspection Reports (RMIRs) with their associated material certification records (CMTRs or Certificates of Compliance), in-process testing of concrete and aggregate, curing records, and concrete cylinder strength testing. In addition, the annual records for in-process testing of cement, aggregate, and admixtures were selectively reviewed primarily for the years 1976 through 1979. Three Class A backfill inspection records and one excavation inspection record were reviewed for conformance to the specifications and requirements. The records were reviewed for three cadwelders employed by Dick for qualification and production testing.

b. Inspection Findings

The concrete and soils records were found to generally meet the construction specification requirements, except in three instances. The records were reviewed for proper frequency of testing or surveillance, satisfaction of acceptance criteria, proper materials used, material properly certified, and qualification of material and cadwelders.

The following are the three instances in which discrepancies were identified.

(1) In the review of monthly in-process testing of aggregates, the NRC CAT identified one instance in which the August 1976 aggregate sample was actually drawn out on September 7, 1976. In fact, the September 1976 sample was also drawn on September 7, 1976. Apparently, the aggregate sample for August 1976 was not taken. However, material drawn on September cannot be substituted for a sample which should have been drawn the previous month. As a result of this finding, NR P014-2186 was initiated.

Additional investigation by the applicant of all the aggregate sampling records revealed only three additional instances of this occurrence. In two instances, there was only a one day discrepancy and in the other case, there was a delay of only three days. The last occurrence was in June 1979, with the others occurring in February, April, and August of 1976. The concreting program was initiated in 1976 in which the initial startup of the activity could have contributed to this condition. NR P014-2186 has been closed.

(2) The review of selected US Testing records for in-process testing of admixtures for the years 1976 through 1978 showed that in three instances for the infrared spectrophotometric analysis there was no documentation of the evaluation of the analysis results. The graphical analysis was attached to the US Testing report, however, there was no statement of the analysis evaluation. It was noted that other similar test reports did provide an analysis evaluation. As followup to this finding, the licensee identified three additional instances of this occurrence

and US Testing was requested to perform the analysis evaluation. The analyses were found to be acceptable.

It was noted that the US Testing records turned over to the applicant had not yet been accepted. Based on discussions, these records will be reviewed by the applicant for completeness and adequacy prior to acceptance. As evidenced by this finding, a records review for just the existence of the test report will not be sufficient to identify any similar problems in the test reports.

(3) A review of NR QCA-100 (Blount Brothers) identified that the NR was voided although the specification requirements for soils testing was not met. The specification requirements for the dry unit weight (at 85% relative density) is a minimum of 120 pcf. The voided NR identified test results of 119.7, 119.4, and 117.2 pcf. It appears that this NR was voided due to a misinterpretation of the specification requirements. Based on this review, NR CQC-2919 was initiated and GAI has accepted the test results not meeting specifications based on actual in-place density meeting relative density requirements. All other NRs of this contractor were reviewed by the applicant and no additional instances were identified. This NR is now closed.

c. Conclusions

From the concrete and soils placement records reviewed above, it appears that these activities were performed in accordance with the construction specification and regulatory requirements. The three instances in which records did not meet specification requirements can be attributed to the fact that the concrete and soils programs were just beginning at that time and some minor problems can be expected. Additional investigation by the applicant of two instances shows that the problems identified were isolated cases. For the third instance concerning US Testing test reports without analysis evaluations, the NRC CAT finding should be considered prior to the applicant's acceptance of these records.

6. Containment Vessel Shell Steel Installation

a. Inspection Scope

The containment vessel shell steel installation activities performed by Newport News Industrial (NNICO) were reviewed. The shell steel installations included six stiffener ring assemblies and one penetration stiffener area (approximately 25 members) in Units 1 and 2 (see Table V-4). The stiffener installations were inspected against the design drawings for configuration, member size, and weld size and appearance.

b. Inspection Findings

For the shell stiffener steel installations inspected, no problem areas were identified. The configuration and member sizes for all items were found to be in conformance with the design drawings and associated NRs. The welding was of the proper size and length and was visually acceptable.

c. Conclusions

From the above findings, it appears that the containment vessel steel stiffener rings and penetration stiffeners have been installed in accordance with the applicable design drawings.

7. Structural Steel Installation

a. Inspection Scope

The structural steel installation activities of Pittsburgh Bridge and Iron (PBI) Industries were reviewed by the NRC CAT. Installed and QC accepted structural steel was inspected for member size, configuration, conformance of bolted and welded connections to the design drawings, and structural steel bolts were tested using a calibrated torque wrench to determine whether the bolts were properly tightened. The building structures inspected were: Units 1 and 2 Auxiliary Building, Unit 2 Suppression Pool, Unit 2 Reactor Building, Units 1 and 2 Control Complex, and Intermediate Building (see Table V-5).

The structural steel installations reviewed included: 33 members and stiffeners checked for proper size and dimensions, 26 bolted and welded connections, and approximately 260 bolts were tested for minimum installation torque.

b. Inspection Findings

The 33 structural steel members and stiffeners and the 26 bolted and welded connections were found to be in conformance with the design drawings except for one case. High strength bolts were tested to determine whether minimum torque requirements were met. The bolts tested included 3/4", 7/8", and 1" diameter A325 bolts tested to 355, 570, and 850 ft-lbs respectively. The test torques were compared with those values obtained by Skidmore testing and were found to be in general agreement. The Skidmore testing was witnessed by the NRC CAT and specification and procedure requirements were met. The approximately 260 bolts were found to have at least the minimum torque requirement.

The only discrepancy identified by the NRC CAT was undersized clip angles for a column to embed plate connection. The discrepancy is at Elevation 661' of the Control Complex building at column lines CC-6 and 3'-0" north of CC-E (column mark number 715-C3). The installed clip angles were 5"x3"x1/2" (6" long), however, the design drawings specified clip angles 6"x4"x1/2" (6" long). The clip angles

were installed in late 1979. Based on this finding, NR PBI-982 was initiated to investigate the cause for the discrepancy and identify any other similar discrepancies in clip angle size. Based on the additional investigation, the following was identified:

(1) Similar discrepancies exist for five other columns. All six column connections are located in the same structural bay and elevation of the Control Complex.

(2) Additional investigation by the applicant and NRC CAT for proper clip angle size revealed no discrepancies other than those described in (1) above.

(3) Revision A to drawing D-514-301 specified the change in clip angle size from 5"x3"x1/2" to 6"x4"x1/2". The only other work changed in Revision A to the drawing was also for a change in clip angle size and these clip angles were verified in the field to be the proper size.

(4) A review of material shipment documents revealed that an insufficient number of the proper size clip angles were ordered and also a PBI drawing revision had a typographical error in the piece mark number for these clip angles.

(5) Recent changes at that time in job supervisor and inspection personnel may have contributed to the discrepancy not being identified in the installation process.

c. Conclusions

In general, the structural steel installation activities (member size and configuration, connections, and bolt torque) by PBI Industries were found to be in conformance with the design drawings. The discrepancy of undersized clip angles appears to be an isolated instance and not a generic concern based on the additional investigations of work nearby, work done by inspection personnel, and work affected by the same drawing revision.

8. Design Change Control and Nonconformance Reports

a. Inspection Scope

Design change control activities and nonconformance reports in the civil engineering area were reviewed by the NRC CAT. The review consisted of a sampling of nonconformance reports, engineering change notices, and field variance authorizations for the contractors in the civil area (National Mobile Concrete Corporation, U.S. Testing, PBI Industries, Dick, National Engineering and Contracting Company, Great Lakes Construction, NNICO, and Blount Brothers). This includes NRs issued by the Perry project organization. The areas covered concrete, structural steel, containment vessel steel, and soils activities. Approximately 150 nonconformance reports, 10 engineering change notices, and 10 field variance authorizations were reviewed for: proper use of the design change documents, identification of

the issue, proper engineering disposition, QC verification of the disposition, and proper review for changes to the Safety Analysis Repor (SAR). Selected design change records were reviewed against the current design drawings.

b. Inspection Findings

For the design change documents reviewed in the civil engineering area, all were found to be performed in accordance with the program requirements, except three instances previously discussed in Section V.B.2 (PPPF NR 3842), Section V.B.3 (Dick NR 216), and Section V.B.5 (Blount Brothers NR No. QCA-100).

c. Conclusions

From the above findings, it appears that design changes and nonconformance reports in the civil engineering area were generally accomplished in accordance with program and regulatory requirements, except in three instances. These instances are discussed in detail in previous paragraphs and/or in Section VIII.

TABLE V-1: SEISMIC CLEARANCE PROGRAM REVIEW

Seismic Clearance Violation No.	Workmanship Findings	Calculation Review Findings
2442, 2460, 2492	Excessive lateral motion of fire protection piping; in some cases lines actually impact safety-related cable trays.	GAI engineering did not evaluate for lateral motion of fire protection piping.
821	Two supports reviewed against design drawings; one of two pipe supports has missing welds.*	
898	Poor weld on an adjacent support; spring can out of alignment on an adjacent support (not same support as poor weld).	
1877	Only one deadweight support for over 50 feet of floor drain piping.	
1678	Bent beam clamp.	
1681	Poor support welds.	
1551	Poor weld on a support on the piping run in vicinity of SCV #1551.	
187	Undersized welds and weld splatter on repair work.	GAI disposition was "accept-as-is" although additional supports had to be installed.
1182	Acceptable.	Spans used in calculations checked by NRC CAT and found to match those actually in field.

*The applicant had recently identified the missing welds and the condition was documented on Nonconformance Report-PPPF 4066 dated 9/6/83.

TABLE V-1

SEISMIC CLEARANCE PROGRAM REVIEW - Cont.

Seismic Clearance Violation No.	Workmanship Findings	Calculation Review Findings
2542	Acceptable.	Hilti bolt capacity check mistake by GAI.
2519	Acceptable.	Acceptable.
1953, 1965	Acceptable.	Hilti bolt embedment assumed for analyses, but in some cases not verifiable in the field (conservative assumption not used); improper references to another calculation; improper bolt size (larger than physically possible) used in analysis; wrong value used in equation allowable vs. actual.
2181	Acceptable; 4 supports reviewed against design drawings.	
1603	Acceptable; one support reviewed against design drawings.	
1634	Acceptable.	Acceptable; spans used in calculations checked by NRC CAT and found to match those actually in field.
1993	Acceptable.	
1970	Acceptable.	
2471	Acceptable.	
2306	Acceptable.	
2356	Acceptable.	
1630	Acceptable.	

TABLE V-1

SEISMIC CLEARANCE PROGRAM REVIEW - Cont.

Seismic Clearance Violation No.	Workmanship Findings	Calculation Review Findings
2032	Acceptable.	
2053	Acceptable.	
Total of 26 violations reviewed in the field.		Total of 7 GAI calculations reviewed.

TABLE V-2

IN-SITU CONCRETE QUALITY

Location	Pour No.	Contractors	Placement Date	Drawing No.
Aux. #2 Roof Slab	AX2-S04-652	National Engineering	10/09/79	D-462-302, Rev. H D-462-304, Rev. C
Control Complex Wall	CC0-W03-705	Great Lakes Construction Co.	12/07/78	D-414-524, Rev. A
Intermediate Building Walls	IB0-W05-680	National Engineering	08/14/79	D-413-118, Rev. D Walls D-413-182, Rev. A
	IB0-W16-680	National Engineering	07/25/79	D-413-162, Rev. E

TABLE V-3

CONCRETE PLACEMENT RECORDS REVIEW

Contractor	Pour No.	Date of Placement	RMIR* Reviwed
National Engineering and Contracting Co.	Bio-Shield Wall:		
	RB1-HWT1-616	06/09/79	3242, 3243
	RB1-HWT2-616	06/10/79	(see RB1-HWT1-616)
	RB1-HWT5-654	12/07/80	3945, 3946, 3947, 3953
	RB1-HWT6-654	12/13/80	(see RB1-HWT5-654)
	RB2-HWT2-618	06/14/80	3822, 3825, 3826, 3827
	RB2-HWT3-630	12/14/80	(see RB1-HWT5-654)
	Drywell Wall:		
	RB1-W01-616	06/04/79	3219-3224
	RB1-W02-630	07/13/79	
	RB1-W03-645	10/16/79	3508, 3509, 3512
	RB1-W181-641	02/22/80	
	RB2-W01-616	07/30/82	4359, 4361
	RB2-W01-648	02/06/81	
	RB2-W02-648	02/06/81	
	RB2-W03-646	12/04/80	
Great Lakes Construction Co.	Control Complex Basemat:		
	CCO-M27-575	12/15/76	
	CCO-M22, 28, 32-575	01/05/77	
	CCO-M29-568	11/30/76	
	CCO-M31-575	12/15/76	
	Emerg. SW Pump House:		
	EPH-W11-585	10/04/78	2679, 2682
	EPH-W1-585	08/30/78	

* RMIR - Receipt of Material Inspection Report with attached material certification records

TABLE V-3

CONCRETE PLACEMENT RECORDS REVIEW - Cont.

Contractor	Pour No.	Date of Placement	RMIR* Reviwed
Blount Brothers Corp.	Reactor Building Basemat:		
	RB1-M1-574	09/22/76	
	RB1-M4-574	11/01/76	
	RB2-M3-574	11/19/76	1042, 1045, 1046
	RB2-M5-575	11/24/76	
Dick	Shield Building:		
	RB1-W6-677	12/15/77	
	RB1-W6A-677	11/07/78	

* RMIR - Receipt of Material Inspection Report with attached material certification records

TABLE V-4

CONTAINMENT VESSEL SHELL STEEL

Location	Assembly No.	NNICO Drawing No.
Unit 1 - Shell Stiffeners		
Ring No. 4	98-7	249716 Rev. F
	99-46	249716 Rev. F
Ring No. 5	97-1	249717 Rev. D
Ring No. 6	99-9	249717 Rev. D
Unit 2 - Shell Stiffeners	99-17	249716 Rev. F
	94-2	
Unit 1 - Penetration Stiffeners		249923 Rev. F
Elev. 592'-2" to 604'-11"		249924 Rev. D
		249925 Rev. D
Az. 23°-30' to 32°-00'		249926 Rev. D with NR No. P017-758

TABLE V-5
STRUCTURAL STEEL INSTALLATION

NRC CAT Inspection Area	Structure	Drawing No.
Member Size and Connections:	Unit 1 Aux. Bldg.	D-512-023 D-561-011 D-561-084
	Unit 2 Reactor Bldg.	D-561-051 D-512-066
	Unit 1 and 2 Control Complex	D-514-101 D-514-102 D-514-011 D-514-022 D-514-301 D-514-302 D-514-303
	Intermediate Bldg.	D-513-015 D-513-018
Bolt Torquing:	Unit 1 and 2 Control Complex	D-514-021 D-514-022 D-514-101 D-514-201 D-514-202
	Unit 2 Aux. Bldg.	D-562-021
	Unit 2 Reactor Bldg.	D-561-020 D-561-021

VI. MATERIAL TRACEABILITY, STORAGE AND MAINTENANCE

A. Objective

The objective of this portion of the inspection was: to examine material traceability and control, to review storage and maintenance of safety-related equipment and material, and to determine the adequacy of the applicant's program relative to these activities.

B. Discussion

The approach used to perform this part of the inspection was to identify and select samples of installed safety-related material and equipment for examination. Some samples of delivered material and equipment not yet installed, but stored in warehouses or lay-down areas, were included. A total of 178 samples were examined to varying extents.

Applicable procedures for these various activities were reviewed. Table VI-1, "Summary of Samples", indicates the Perry Project contractors contacted and the types of activities and samples examined. Table VI-2, "Sample Breakdown By Contractors", shows the number and type of samples applicable to the selected contractor. Table VI-3, "Weld Filler Material Compliance", contains a list of weld filler material samples.

The following sections describe the results of the inspection in the areas of material traceability, storage, and maintenance.

1. Material Traceability

a. Inspection Scope

A total of 178 samples were examined for traceability to drawings, specifications and procurement records, if applicable. Supplier certification, including required Certified Material Test Reports (CMTR) or Certificates of Compliance (C of C), heat numbers or other required documentation were reviewed. Table VI-2 indicates the types and quantities of samples examined.

b. Inspection Findings

In general, it was noted that the applicant and contractors performing safety-related work had appropriate procedures in place for control of material and for material traceability. The applicant utilizes a computerized Master Parts List (MPL) program to control the identification of equipment and components on a project-wide basis. An overall records management program had been planned and is now being implemented to help control the flow and transfer of documentation from the Construction to the Operation phase. Several deficiencies involving material traceability and material control were noted by the NRC CAT inspectors as follows:

(1) Material Identification Markings on ASME Class 1 Hangers

Lack of material identification markings on parts of ASME Class 1 hangers was noted for Reactor Recirculation (B33) and Main Steam (N11) Systems.

The NRC CAT inspection of material traceability for General Electric (GE) ASME Section NF Class 1 supports/restraints identified problems regarding the lack of visible unique identification marking of support/restraint items, marked materials not traceable to verification documentation and the thoroughness of the GE material traceability reverification program.

A prior audit by the Cleveland Electric Illuminating (CEI) project organization and follow-up activities revealed the lack of visible unique identification marking of support/restraint items, including the lack of visible marking after welding on 14 clevises involving 14 of 34 hangers for these systems. Two nonconformance reports (NRs) [GE-38-0522 and GE 38-0523] were issued requiring reverification and recording of material identification for parts of the hangers. Samples were cut from the 14 clevises for chemical analyses, and the results confirmed the proper material for the clevises. Even though the two NRs were prematurely closed out, the applicant stated that other "reverification work was proceeding" (This early close-out of NRs is discussed further in Section VIII). New reverification drawings were being prepared. The NRC CAT inspection of four hangers, however, resulted in the questioning of the clarity of a marking on one additional clevis, and the lack of the visibility of material identification markings on other parts.

The applicant initiated action for a chemical analysis to be made of a sample of material from the additional clevis, and issued a new NR (GE 38-0708, dated 9/6/83) to require completion of material identification and the recording of material markings for the Main Steam and Reactor Recirculation hangers.

Also, the NRC CAT inspectors noted three clamp studs for hanger H102B-1 marked as D55B, yet this marking was not on the applicable material letter code list. The applicant indicated that this matter had already been identified under the NR activity and had not been fully resolved. A letter dated 9/2/83 from ITT Grinnell (the hanger supplier) confirmed that the material specified was SA-36, which is designated as "A" on the code list. The licensee stated that in resolution to this documentation deficiency, reference would be provided consistent with the ITT Grinnell letter.

The controls that Pullman Power Products (PPP) exercises to maintain material control and traceability of ASME Section NF support/restraint materials were evaluated. This evaluation included a review of procedures, discussions with responsible individuals, verification of records to hardware traceability for four supports (1E21-H014, 1E120-H010, 1E51-H037 and 1E12-H748),

and field observations. The NRC CAT found the overall controls regarding receiving, marking and maintenance of traceability through installation for PPP to be in accordance with requirements. A documentation weakness in the program had been corrected in the latest revision to Pullman Procedure IX-6, "Installation and Inspection of Pipe Supports" by specifically requiring QC verification and recording of material heat or LCN numbers on process sheets at installation.

(2) Weld Filler Material

Twenty-one samples of weld filler material were examined and traceability documentation, including CMTRs and heat numbers, were reviewed. Table VI-3 is a listing of samples reviewed including those examined in detail. However, questions were raised regarding the material data for three of the samples as follows:

(a) Weld Wire ER-70S-2, 1/8" x 36", 1200 lbs., GE Purchase Order No. 380N0803-524, GE Specification GEP-PS-5011 Rev. 7, Heat No. 401L3151. On reviewing the CMTR for this material, it was noted that N/A is marked in the "Stress Relieved" block under "Additional Test Results". This material, if used in applications specifying ASME Code NB-2430 (Weld Metal Tests), must undergo time at post-weld heat treatment for eight hours. The applicant indicated and later confirmed that no applications for this material were involved which required the eight hours of stress relief prior to mechanical testing.

(b) Insert Material, 1/8"x5/32", 5000 ft., E70S-2 or 6, SFA5.18, Pullman Purchase Order No. 7691-575, Heat No. 4644B131. On reviewing the CMTR dated 9/3/83, it was noted that exactly identical impact test results were listed for six sets of test results. Since it is not considered probable that six actual test results would be exactly identical, the accuracy of the CMTR listing of test results was questioned. The applicant proceeded to examine this matter further in an attempt to explain the unusual impact testing values. A welding engineer contacted the testing laboratory involved and was advised that the six test results were actual results, and that written confirmation would follow.

(c) Filler Material (for consumable insert rings), ER 308, Heat No. X43724. This heat of filler material failed to have the required delta ferrite content. GE Specification Z1A2005, Paragraph 4.3.4, "Welding Materials," requires a delta ferrite content of 8% minimum for the 308 filler materials. GE CMTR for Heat No. X43724 indicates a delta ferrite content of 6.5%. This material was utilized for welding of at least three details. The affected details are item G010A-1, G012A-30-1, and G011A-90-1. Although not meeting site specification requirements, the subject filler material does meet the minimum delta ferrite content of 5% specified by NRC Regulatory Guide 1.44, and ASME Section III, Subsection NB. Two NRs were issued to document these conditions (NRs TAS0063 and TAS0064).

(3) Fasteners

Examination of 32 samples of fasteners, both installed in the plant and in contractor's bins revealed several deficient conditions regarding material control as follows:

(a) Bolts in Bin (Comstock Storeroom). A bin and a carton in the bin were both labeled A-325. However, 1/2" x 1 1/2" long bolts in the carton showed a marking B7 and manufacturer's identification on the heads of the bolts. A review of documentation revealed that the carton of bolts were of material SA-193 GrB7 and that a CMTR was filed for these bolts. The bin and carton were incorrectly marked for these bolts.

(b) Bolts for Battery Racks 1R42-S002 and 2R42-S003. The NRC CAT inspectors reviewed the vendor's manual and appropriate design documents for these installations. One document (Flight Dynamics, Inc. Report FDI A-3-82 prepared for Exide Power Systems Division) detailed the seismic analysis of two step "G" size high seismic battery racks. Based upon this report, it was determined that the 125V DC Battery racks for the Perry Nuclear Power Plant (PNPP) had been seismically qualified using SAE Grade 5 and Grade 2 bolting materials. The NRC CAT inspection of the Unit 1 Division 1 battery rack disclosed a total of forty-eight (48) bolts which were of indeterminate material; i.e., the bolts were not marked SAE Grade 2 as specified. The inspection of the Unit 2, Division 2 battery rack indicated a total of seventy-four (74) bolts with the same status.

The NRC CAT inspectors reviewed vendor (Exide) shipping documents and receiving inspection reports to ascertain what material types were supplied. Page 3 of the packing list, dated 6/8/79, indicated that all bolts supplied were SAE Grade 5 or ASTM A-449 or better. Additionally, a vendor surveillance report (Gilbert/Commonwealth Quality Assurance Division Report 9948-80-05, dated 2/29/80) indicated that the vendor had supplied SAE Grade 5 or ASTM A-449 or better bolting materials. Discussions with the installing contractor indicated that the installation had been accomplished using only vendor-supplied materials. Further historical review of the battery rack installation records and discussions with the applicant did not disclose any information that would help to clarify why bolting material other than that specified and supplied was used in the installation of the 125V DC battery racks. As a result of this inspection, the applicant issued NR OQC-307 recommending that all bolts in question be replaced with the SAE Grade 5 material and that the bolts in question be submitted for testing.

(c) Bolts for 4KV Switchgear Cabinet 1R22-S006. The vendor had specified by letter that switchgear interframe bolting would be accomplished with SAE Grade 2 hardware. Bolts installed were not marked SAE Grade 2 as specified.

The NRC CAT inspectors reviewed installation inspection records for the equipment. These records did not indicate deficiencies relative to bolting materials. As a result of this inspection, the applicant initiated NRs OQC-0324 and OQC-0325 to address these problems.

(d) Bolts for Flanged Joints of Diesel Starting Air Line 1R44509. Some studs for flanged joints of the Diesel Starting Air Line had markings, but others had no markings. Four of eight studs at one flange joint were not marked. Some of these joints had missing studs.

(e) Bolts for Class 1E Motor Control Center 2R24-S019. Examination of hardware attaching adjacent cabinets of the Motor Control Center (MCC) revealed that 1/4" round head bolts and nuts were used. It was noted that some of the bolt heads and nuts were not properly seated. Some used flat washers, others did not. The bolts appeared too small for the holes in the cabinets and improper seating resulted. However, examination of other Class 1E cabinets revealed that larger bolts were being used, and as in the one case of cabinet 2H13-P747 1/2" bolts had been installed (to comply with an NR). The applicant issued four NRs on 9/19/83 to initiate action to check and correct this improper fastener condition (NRs OQC-318, OQC-319, OQC-320 and OQC-321).

(f) Fasteners for Standard Component Supports. The NRC CAT inspectors observed in four areas that crafts were not maintaining traceability of small items and threaded components of standard component supports (catalogue items such as struts, clamps, spring cans, snubbers, and other similar types of components). Paragraph 5.2.3 of Pullman Procedure IX-6 requires items to be marked or remain attached as an assembly until the time of installation. The following conditions were observed in different areas of the Auxiliary Building, 620' elevation on September 13 and 14, 1983.

- Pipe clamp for 1E32-H014 with a missing bolt
- A 12" pipe clamp with no bolts, no marks, no tags
- Pipe clamp for 1E12-H526 with a missing bolt
- Snubber clamp with a missing load pin, no tags, or markings with support or LCN numbers
- Spring hanger 1E12-H184 with missing rod, eye-nut, clevis, pin and pipe clamp

c. Conclusions

The overall material control and material traceability program was considered adequate, except for some traceability program deficiencies and for the material control of fasteners and small items. Traceability program problems were identified regarding the thoroughness of application of the traceability program procedures for material identification markings on ASME Class 1 hangers and the thoroughness of the contractor's reverification efforts to satisfy site traceability program requirements for ASME Class I hangers.

Regarding material control, six of the 32 samples of fasteners examined revealed improper control of the application of fasteners. Five conditions of improper control of traceability of small items and threaded components of standard component supports were noted.

2. Storage

a. Inspection Scope

A total of 32 samples were examined for appropriate storage in warehouses, in laydown areas and in the plant. Site storage facilities themselves were also examined.

b. Inspection Findings

Warehouses and outside storage facilities were found to meet requirements. It was noted that the only Class A storage facility, the site Calibration Laboratory, utilized properly calibrated temperature and humidity recording indicators showing conditions within required limits. Weld rod storage, issue stations and holding ovens in various locations on the site were examined and found to be satisfactory.

Several examples of improper storage and protection (from damage and deterioration) of safety-related equipment in the plant and in a lay-down areas were noted. Some protective covers were missing. Some equipment damage from nearby construction activities was noted. Poor housekeeping was noted on or around the equipment. Also, improper marking of safety-related steel was noted in an outdoor lay-down area. The following is a list of samples examined:

(1) Motor Control Operated Valve 1E22-F001
(2) Motor Control Center 1R24-S024
(3) Reactor Core Isolation Cooling Pump 1E51-C001
(4) Emergency Closed Cool Pump/Motor 1P42-C001B
(5) High Pressure Core Spray Pump/Motor 1E22-C001
(6) Safety-related pre-fabricated structural steel parts for Reactor Building No. 1 in the "PBI/Kelly" lay-down area.

Regarding item 6, the procedures reqire labeling of these parts for identification and control after coatings are applied. These parts

were found to be not adequately marked. The metal tag for part 239M2 was corroded and separated from the part. Tags were missing and parts were temporarily marked with a soapstone marker for parts 240M2-L, 240 M2-L, 240 M2-R, and 240 M2-R.

The NRC CAT inspector was informed that a Field Question (F.Q. 31006) was issued 8/19/83 requesting Engineering direction to improve the marking technique and remark steel prior to the onset of adverse weather. Re-identification and re-marking of steel in storage was authorized for the Field Question 8/22/83. The NRC CAT inspector was informed 9/28/83 that re-identification and re-marking, with QC and Engineering assistance, was proceeding initially for Turbine Building steel in storage, and that re-identification and re-marking of coated safety-related Reactor Building items would follow.

c. Conclusions

The storage and related procurement, receipt and warehouse procedures as well as the facilities themselves met regulatory requirements, except for storage of some safety-related material and equipment in the plant. Five of 62 samples inspected for storage were found to be inadequate.

3. Maintenance

a. Inspection Scope

A total of 43 samples of safety-related equipment were examined. Maintenance requirements and history records were reviewed for items stored in warehouses and installed in the plant.

b. Inspection Findings

Manual lists and schedules for equipment received at the central warehouse, and determined by engineering to require maintenance, are maintained by central warehouse personnel. Records are kept of maintenance performed on each item. Items issued to Comstock and Johnson Controls are then controlled by manual lists and maintenance schedules by these two contractors. Other material and equipment requiring maintenance after issuance for installation are listed in the project computerized system for scheduling and control of maintenance. The applicant's computerized system used during Construction will later evolve into the Operations maintenance control system. As items are turned over from Comstock and Johnson Controls, such items will also be included in the Operations maintenance control system. It is planned that the overall Operations maintenance program will utilize the computerized data base, and the system will then be further developed to meet operational maintenance needs. The NRC CAT inspector inquired regarding the omission of computerized control of maintenance in the central warehouse and of maintenance performed by Comstock and Johnson Controls. It was noted that a recent Project Internal Audit of Maintenance identified deficiencies

regarding the control of maintenance in the warehouses, and that this matter is being considered further.

On examining equipment in the plant requiring maintenance control by the applicant and reviewing maintenance records, no unsatisfactory conditions were noted. However, on reviewing procedures and activities pertaining to storage and maintenance, and examining samples and records in central warehouses #1 and #2, some delays in initiating required maintenance provisions were noted.

An initial review of nine items revealed three with periods exceeding 10 days: (1) over five years, (1) over thirty days, and (1) over five months. This requirement is defined in "Nuclear Design and Procurement 3-1301", Rev. 4, dated 8/16/82 which states that "the Responsible Engineer is to forward a copy of the Storage Maintenance Requirements (SMR) form within 10 days of receipt of the Receiving Report".

Specific examples are as follows:

		Received	SMR Date
a.	High Pressure Core Spray Pump Bowl Assy. 2E22-C001	12/01/77	01/25/83
b.	Low Pressure Core Spray Motor E21-C001 (Spare)	04/20/83	05/31/83
c.	Power Supply MR 20078	05/05/82	10/18/82

Further review of records for a total of 43 samples revealed 11 for which the SMR was not issued until later than 10 days. Also, SMRs had never been issued for 18 of the 43 items, some of which may have required maintenance.

c. Conclusions

In general, the overall project program for control of maintenance was found to be adequate, except for the control of maintenance in the central warehouses. Eleven of 43 samples revealed situations where the Responsible Engineer had not issued Storage Maintenance Requirements for safety-related equipments requiring maintenance until later than the time specified by procedure (which is within 10 days after receipt). Three of the samples revealed that receipt of the Storage Maintenance Requirements had not occurred for periods of 30 days to 5 years.

TABLE VI-1 - SUMMARY OF SAMPLES

Contractors	Activities and Samples	No. of Samples*
Pullman	Piping, hangers, weld joints, welding mtl., fasteners	36
GE	NSSS equip., piping, hangers, weld joints, welding mtl., fasteners, shims	26
Comstock	Electrical equip., cables, hangers, weld joints, welding mtl., fasteners	30
Johnson Controls	Instru. & Controls, racks, welding mtl., fasteners, tubing	22
RICO	HVAC equip., control panels, hangers, weld joints, weld mtl., fasteners	16
PBI	Structural mtl., weld mtl., fasterners	23
NNI	Liners, vessels, weld joints, weld mtl., fasteners	22
Dick	Cadweld sleeves	3
	TOTAL	178

*NOTE: Some items served as multi-purpose samples (e.g., for traceability, storage and maintenance).

TABLE VI-2 - SAMPLE BREAKDOWN BY CONTRACTORS

		Pullman	GE	Comstock	JC	RICO	PBI	NNI	Dick	Total*
1.	Equipment	5	8	13	4	5	-	-	-	35
2.	Pipe	4	-	-	3	-	-	-	-	7
3.	Steel (Structural)	2	-	-	3	2	8	-	-	15(L)
4.	Steel Plate/ Sheet	-	-	-	2	1	1	5	-	9(L)
5.	Hangers/ Supports	2	5	2	-	1	-	-	-	10
6.	Weld Filler Material	6	2	3	2	2	3	3	-	21(L)
7.	Weld Joints	12	4	2	2	2	4	11	-	37
8.	Elec. Cables (Reels)	-	-	3	-	-	-	-	-	3(L)
9.	Fasteners	5	5	7	2	3	7	3	-	32
10.	Shims	-	2	-	-	-	-	-	-	2(L)
11.	Cadweld Sleeves	-	-	-	-	-	-	-	3	3(L)
12.	Tubing	-	-	-	4	-	-	-	-	4(L)
	TOTALS	36	26	30	22	16	23	22	3	178

* L = Lots

TABLE VI-3

WELD FILLER MATERIAL COMPLIANCE

Contractor	Material Designation	H.T. No./ Material I.D.	Compliance Comments
GE	ER308R	NG460	Acceptable
GE	ER308L	05845	Acceptable
GE	ER308L	05345	Acceptable
GE	E308L-16	06004	Acceptable
GE	E308-16	95533	Acceptable
GE	ER308	741102	Acceptable
GE	E308-16	740654A	Acceptable
GE	ER308	434788	Acceptable
GE	E308-16	741619	Acceptable
GE	ER308	740014	Acceptable
GE	ER308	75213	Acceptable
GE	ER308	X43724	Less than 8% Ferrite
GE	ER70S-2	401L3151	Acceptable
GE	E70S-2	401K0151	Acceptable
GE	E308L-16	8M13C Mix 22 (trace)	Acceptable
GE	E7018	401J1571	Acceptable
NNI	E308-16	77NNI507	Acceptable
NNI	E308-16	77NNI508	Acceptable
NNI	E309-16	77NNI509	Acceptable
NNI	E70T-G	77NNI549	Acceptable
NNI	ER308L	80NNI097	Acceptable
NNI	E70T-1	81NNI039	Acceptable
NNI	E308L-16	77NNI1525	Acceptable
NNI	E7018	79NNI019	Acceptable
NNI	E7018	81NNI055	Acceptable
NNI	E7018	77NNI589	Acceptable
NNI	E7018	115K (trace)	Acceptable
NNI	E7018	115L (trace)	Acceptable
NNI	ER309L	08544	Acceptable
PPP	E7018	70612	Acceptable
PPP	E308L-16	743927	Acceptable
PPP	ER308L	3548R308L (K shape)	Acceptable
PPP	E70S-2	065312	Acceptable
PPP	E70S-2	4644B131	Identical impact test results
PPP	E7018	4121C1391	Acceptable
JC	ER308L	07665	Acceptable
JC	E7018	422S1961	Acceptable
PBI	E7018	33042	Not checked
PBI	AA7018	422W8351	Not checked
PBI	E709L-16	467267	Not checked
COMSTOCK	E7010-A1	614AF (trace)	Not checked
COMSTOCK	E7018	34-4B2A (trace)	Not checked
COMSTOCK	E7018	2-215C4B (trace)	Not checked
RICO	E7018 (LH)	411T1231	Not checked
RICO	E7018 (LH)	412N?851	Not checked

VII. QUALITY CONTROL INSPECTOR EFFECTIVENESS

A. Objective

The objective of this portion of the inspection was to determine if quality control inspectors function freely in performing their tasks, without intimidation by craft personnel or supervision, and to determine if inspection personnel are qualified, trained and have the organizational freedom to perform their tasks.

B. Discussion

1. Inspection Scope

Implementation of the Quality Control Program was determined from discussion with the Quality Control personnel and their supervisors, reviews of the inspector training and certification procedures, review of the inspector training records, and review of the recording of inspection results.

2. Inspection Findings

a. Inspector Support

Discussions were held with inspectors selected from the applicant and contractor organizations performing work on the construction site. A total of thirty inspectors were selected from the Cleveland Electric Illuminating (CEI) organization and from the eight contractor organizations. The discussion subjects included the inspectors areas of assignment, experience, education, training, and the inspectors knowledge of any form of intimidation by craft or supervisor personnel.

During these discussions, certain issues were raised that could have an effect on inspector effectiveness relative to one contractor's organization. The significance of these points will require investigation beyond the scope of this inspection and has been referred to the NRC Region III Office for further review.

b. Inspector Qualification/Certification

Records were reviewed to determine whether the training and certification files for the inspectors interviewed contained the correct documentation to meet the Applicant's Quality Assurance program commitments.

(1) It was found that inspectors were certified prior to performing inspections. Appropriate forms and documents were on file in accordance with the applicant's commitments to ANSI N45.2.6, "Qualification of Nuclear Power Plant Inspeciton, Examination, and Testing Personnel Requirements". These documents attest to the inspectors experience, education and training.

(2) Training and indoctrination of inspectors was appropriately documented. Training and indoctrination of newly hired inspectors, in some instances, was done in only a few days, which could be questionable. However, of the inspectors reviewed, all had inspection experience at other nuclear construction sites.

3. Conclusions

There was no reported intimidation of inspectors by craft or supervision. However, in one contractor organization, there were issues raised by QC inspectors that require further review. The certification and training of Quality Control inspectors reviewed met ANSI standard requirements.

VIII. QUALITY ASSURANCE

A. Objective

The objective of this review was to determine the adequacy of selected portions of the applicant's Quality Assurance (QA) Program. The program was reviewed to establish that: it was appropriately defined in instructions and manuals; the construction quality assurance effort was monitored through audits and other management actions; on-site contractors work was reviewed and monitored; on-site contractor audits were performed effectively; the applicant or selected site contractors had instituted an effective corrective action system; and instructions and drawings used during the construction process were controlled.

B. Discussion

1. Inspection Scope

Implementation of the Quality Assurance Program was determined by reviewing: the organizational structure; the construction audit program; the corrective action system of the applicant and selected site contractors; and a sampling of design/installation drawings to assess document control (current issue status).

2. Inspection Findings

a. Organization

Quality Assurance functions were performed by CEI and site organizations contracted to perform construction work. The quality assurance function appeared to be performed by an organization having a sufficient degree of authority and freedom.

b. Audits

The project and contractor audit programs were reviewed to the applicant's commitments defined in the CEI QA program.

(1) CEI Program

The CEI audit program is performed to ensure that commitments and responsibilities at the project level are met and to ensure that contractor commitments have been met. The program is implemented by various corporate and project level procedures that fully describe the program.

Audit areas were reviewed for: scheduling; development and use of checklists; reporting; audit finding resolution; and auditor qualification and certification.

Audits from 1981, 1982 and 1983 were selected for review. Eighteen project level audits and forty audits of contractor activities were selected for review. Audits of contractor activi-

ties varied from a complete review of the contractor's program compared to 10 CFR 50, Appendix B, to a review of a specific work activity (for example, cable pulling). Although the number varied from year to year, in the order of 150 audits of contractor activities and 35 audits of project activities were performed each year.

The comments provided below are based on these audit reviews and personnel interviews.

(a) Audit Scheduling

Document reviews and interviews of personnel associated with the audits performed at the project level revealed that a system of annual audit scheduling with quarterly review and updating was used. Audit schedules were systematically developed and periodically reviewed to factor in supplemental audits.

The review of completed contractor audits and the Construction Quality Surveillance (CQS) audit status log revealed that audits were performed on a periodic bases to monitor contractor activities.

(b) Audit Reporting

Audit reports prepared by each part of the CEI organization provided a description of the audit scope; identification of auditors; persons contacted; summary of results; and a description of any deficiencies or findings.

The NRC CAT found that Audit findings were clearly written. The QA program required that the finding be evaluated for adequacy, and described the action taken to prevent recurrence be described.

(c) Audit Program Effectiveness

The combination of audits performed at the project level and the audit and surveillance inspections performed at the contractor level in most cases monitored and controlled construction contractor activities.

One weakness in the program was the length of time taken by some contractors to resolve audit findings. Some contractors, Pullman Power Products and L. K. Comstock for example, allowed audit findings to remain unresolved for nearly a year. Some audit findings were made in 1981 and 1982. CEI action was not effective in resolving this problem. There has been improvement in the time taken to resolve audit findings in 1983. NRC RIII had previously identified this problem and is monitoring it as an unresolved item (NRC Report 50-440/83-12).

(d) Auditor Qualification and Certification

The records and certification reports of 12 Lead Auditors in the CEI audit program were reviewed. Lead auditors were selected from CEI organizations auditing at the project and at the contractor level of activity. The program was established and Lead Auditors were certified to the requirements and applicant's commitments as defined by ANSI N45.2.23, "Qualification of Quality Assurance Program Audit Personnel for Nuclear Power Plants."

(2) Contractor Audit Programs

A sampling of contractor audit programs was made to determine if the contractor programs complied with CEI committments. The programs of Robert Irsay Company, Johnson Controls Inc., L. K. Comstock, Pullman Power Products and Metalweld were reviewed.

Results of the Review

The audit program descriptions for the contractors and the audits reviewed met the requirements of ANSI N45.2.12 "Requirements for Auditing of Quality Assurance Programs for Nuclear Power Plants."

Lead auditors for Johnson Controls, L.K. Comstock, and Pullman Power Products were certified to the ANSI N45.2.23 requirements.

Audit findings, identified by Johnson Controls, were not individually documented for follow-up and resolution as audit findings prior to June 1983. In June 1983 the program was revised to require that Quality Nuclear Findings (QNF) be written to document and track any findings.

Audit findings identified by L.K. Comstock were documented on Audit Finding Reports (AFR). Some AFRs were opened in September 1981 and not closed until April 1983. All of the AFRs reviewed had been closed prior to the NRC CAT inspection.

Metalweld corporate officials performed audits of on-site activities related to 10 CFR 50, Appendix B. Although the auditors were not certified in accordance with ANSI N45.2.23, the audits appeared to be comprehensive in that the observation of work underway and work that had been performed and inspected in the field was included. There was little completed work (hardware inspection) sampling performed by the other contractors as a final check of the installation and inspection process.

c. Corrective Action Systems

The applicant's overall corrective action and nonconformance control program was reviewed. The provisions for the corrective action system are included in the Corporate Nuclear Quality Assurance Program, Section 1600, Revision 4, dated 6/1/83. The policy states that; for conditions adverse to quality, the cause of the conditions

shall be determined and appropriate action taken to preclude repetition, the identification, cause, and actions taken are documented and reported to appropriate levels of management, significant conditions within the intent of 10 CFR 50.55(e) or 10 CFR 21 are reported to appropriate levels of management and to the CEI Nuclear Quality Assurance Department (NQAD).

Three of five contractor programs reviewed satisfied the system's procedural requirements. Two contractors did not comply with the procedural requirements. The program of two other major contractors were not reviewed since NRC Region III had recently reviewed their programs. A potential problem with the corrective action system of one of these contractors is still under review (NRC Report No. 50-440/83-12).

Procedural problems identified are as folows:

(1) Instrumentation Contractor

There was no method identified to adequately identify and follow-up on audit findings; therefore, the corrective action procedure was used.

The procedural requirements for responses and for corrective actions had not been enforced.

The CEI site organization issued AR 693 to Johnson Controls, Inc., the contractor on 8/26/83, requiring that both the Corrective Action and Auditing procedures be changed to resolve this problem.

(2) NSSS Equipment Installation Contractor

Late in 1982 the contractor experienced difficulty with AWS welding, in that the procedure was not being followed, which resulted in cracking or other defects in the completed welds. Twenty-two Nonconformance Reports (NRs) were written regarding AWS welding problems during the first quarter of 1983, however, the contractor, General Electric (GE), did not identify the problem as a corrective action item nor as a reportable significant deficiency either prior to or subsequent to action taken by the CEI site organization.

The site organization issued Corrective Action Request (CAR) #82-28 on 1/6/83 citing the contractor for AWS welding problems. This CAR recommended investigation of all AWS welding and procedures to determine if problems also existed in other areas of contractor work.

It was further observed that this significant deficiency was not reported by the applicant as a 50.55(e) item. A significant deficiency had been reported to the NRC Region III office identified as Pipe Whip Restraint Bracket Welds for B21/B33 systems [CEI Deviation Analysis Report (DAR) 111 dated 12-21-82)]. The

significant deficiency, however, did not describe the full scope of the problem. The above identified welding problem was the cause for the whip restraints unacceptability as well as for other safety component welding problems (i.e., polar crane, fuel handling crane, etc) where the same AWS procedure had been used.

The NRC CAT Inspector learned that the applicant had initiated action to require contractor procedure modifications and, in addition, planned to expand the scope of the significant deficiency report to appropriately address the deficient condition and the extent of impact.

In addition to the overall review of the applicant's corrective action systems, the NRC CAT reviewed approximately 300 NRs as referenced in other sections of this report. NRs reviewed were processed in accordance with procedural requirements. In most cases, nonconformances were being identified and dispositioned as required. However, as described in Sections III (CQA-136), Section V (NR-216 and QCA-100), and Section VI (GE 38-0522 and GE 38-0523) of this report, certain identified nonconformances have been closed prior to completion of the entire scope of work required by the proposed disposition of the NR. This has resulted in some cases of less than adequate action taken to identied deficiencies and does not comply with the applicant's program requirements.

d. Document Control

The system utilized on site for control of issuance of documents, such as instructions, procedures, and drawings, including changes thereto, was reviewed by obtaining a broad base sampling of drawings available to craft and inspection personnel and determining the current status as maintained by the CEI site organization. No instance of obsolete revisions of safety-related drawings was identified in a sampling of drawings as follows:

Electrical Drawings	24 drawings
Piping Iso-drawings	14 drawings
Piping Hanger Drawings	18 drawings
Structural Drawings	32 drawings

3. Conclusions

With few exceptions, both the project and contractor audit programs reviewed were implemented to meet CEI commitments. Generally, the audit and surveillance program performed by CEI has provided an overview that has identified construction problems. However, audit findings identified by CEI and contractor auditors have not always been resolved in a timely manner. In addition, certain key issues identified in sections II, III, and VI of this report were not identified by the applicant's audit and surveillance organizations as well as by the contractor audit program.

The corrective action systems in use by some contractors reviewed were inadequate. However, the CEI site organization has taken action to provide control. In some instances, NRs have been improperly closed prior to completion of the entire scope of work required by the proposed disposition of the NR.

The system for Document Control is being effectively employed by the applicant at the Perry Nuclear Power Plant (PNPP) site.

ATTACHMENT A

A. PERSONS CONTACTED

The following list identifies the applicant's representatives, including coordinators for specific areas, contacted during this inspection:

1. Entrance or Exit Meetings

B. Barkley*
L. Beck
J. Bellack
T. Boss
M. Brown
W. Coleman
R. Davidson*
M. Edelman
J. Eppich
R. Farrell
P. Gibson
L. Hartline*
C. Hunter
R. Jadgehew
K. Kaplan
J. Kerr
J. Kline
M. Kritzer
R. Krotseng
J. Lastovka
G. Leidich
M. Lyster
J. Marjenin*
P. Martin
J. Mehaffey*
G. Parker
K. Pech
E. Riley
E. Shaw
C. Shuster
P. Solanios
F. Stead
E. Sterle
T. Swansiger*
D. Tackas*
S. Tulk
H. Waldron*
H. Walls
B. Walrath

* Attended exit meeting only.

2. Applicant's Coordinators

a. Civil/Structural

M. Kritzer

b. Mechanical

R. Matthys
R. Solt

c. Electrical, Instrumentation and Control

K. Cimorelli
W. Morris

d. Welding and NDE

H. Walls

e. Material Traceability, Storage and Maintenance

M. Franchuk
C. Hubbard

f. QA and QC Inspector Effectiveness

T. Boss

In the course of this inspection, numerous craftsmen, inspectors, engineers, and supervisory personnel who are not specifically listed were also contacted.

B. DOCUMENTS REVIEWED

The documents listed below were reviewed by the inspection team members to the extent necessary to satisfy the inspection of objectives stated in Section I of this report. References to specific procedures are contained with the body of the report.

1. Final Safety Analysis Report
2. Quality Assurance Manuals (CE 1 and Contractors)
3. Quality Assurance Procedures
4. Quality Control Procedures
5. General Electrical Specifications
6. General Concrete Specifications
7. General Mechanical Installation Specifications
8. General Piping Installation Specifications
9. Maintenance Procedures
10. Procurement, Receiving, and Storage Procedures
11. Material Traceability Procedures
12. QA Audit Reports
13. Trend Analysis Reports
14. Procedures for Initiating & Processing Field Changes
15. Procedures for Initiating & Processing Nonconformances
16. Construction Test Procedures
17. Nonconformance Reports (NRs)
18. Field Question Reports
19. Project Engineering Directives
20. As-Built Packages
21. NDE Procedures
22. Personnel Qualification Records
23. Purchase Orders
24. Drawings and Specifications
25. Receiving Reports
26. Documentation Packages
27. Storage Maintenance Requirements

February 24, 1984

FREEDOM OF INFORMATION ACT REQUEST
FOIA-84-142
Rec'd 2-28-84

Mr. J.M. Felton, Director
Division of Rules and Records
Office of Administration
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

FREEDOM OF INFORMATION ACT REQUEST

Dear Mr. Felton:

Pursuant to the Freedom of Information Act, 5 USC 552, as amended, and the provisions of 10 CFR Part 9, the undersigned hereby requests the following:

All minutes, notes, memos, draft reports, final reports, or other documents related to any inspections or investigations concerning allegations made by the following persons relating to the Perry Nuclear Power Plant: Steve Balazs, Phillip Hendrickson, Gene Mathis, Richard Wade.

I agree to accept the charges for the search and production of these documents.

Sincerely,

Susan L. Hiatt

Susan L. Hiatt
OCRE Representative
8275 Munson Rd.
Mentor, OH 44060
(216) 255-3158

8405250353