APR 18 1983

Docket Nos.: 50-445/446

MEMORANDUM FOR: The Atomic Safety & Licensing Board for:
Comanche Peak Steam Electric Station, Units 1 and 2

FROM: Thomas M. Novak, Assistant Director
for Licensing
Division of Licensing

SUBJECT: INFORMATION FROM CONSTRUCTION APPRAISAL TEAM (CAT) INSPECTION OF COMANCHE PEAK, UNITS 1 AND 2 (BN 83-29B)

By Board Notice BN 83-29 dated March 2, 1983, we informed you of our preliminary findings of a Construction Appraisal Team (CAT) inspection at Comanche Peak, Units 1 and 2.

By a letter dated April 11, 1983 the staff transmitted Construction Appraisal Inspection Report 50-445/83-18, 50-446/83-12 to the Texas Utilities Generating Company (TUGCO) for its review to determine whether the report contained information which should be withheld from public disclosure under the provisions of 10 CFR 2.790(a). In accordance with NRC procedures, TUGCO was allowed 10 days to make that determination. In a meeting with the staff on Wednesday afternoon, April 13, 1983 TUGCO advised the staff that it had determined that the report contained no information which needed to be withheld and TUGCO agreed to its immediate release to the public. Copies of the letter and its enclosures were made available at the meeting to attending members of the public.

The enclosed letter, its appendices and inspection report contain the detailed findings of the CAT inspection at Comanche Peak and the TUGCO corporate office over the periods January 24 - February 4, 1983 and February 14 - March 3, 1983. The letter and its enclosures are forwarded for your information.

/s/

Thomas M. Novak, Assistant Director
for Licensing
Division of Licensing

Enclosure:
Ltr to R. J. Gary (TUGCO from
R. C. DeYoung (NRE:OIE) dtd
4/11/83 w/encls.

cc: The Atomic Safety & Licensing
Appeal Board

Contact:
S. B. Burwell, ONRR
ext.: 27563

concurred by telephone SBB

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Comanche Peak Units 1&2
Docket Nos. 50-445/446

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APR 18 1983

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

APR 11 1983

Docket Nos. 50-445
and 50-446

Texas Utilities Generating Company
ATTN: Mr. R. J. Gary, Executive Vice President
and General Manager
2001 Bryan Tower
Dallas, Texas 75201

Gentlemen:

SUBJECT: Construction Appraisal Inspection 50-445/83-18, 50-446/83-12

This refers to the construction appraisal inspection conducted by the Office of Inspection and Enforcement (IE) on January 24 - February 4, 1983 and February 14 - March 3, 1983, at the Comanche Peak Steam Electric Station and your Dallas corporate office. The Construction Appraisal Team (CAT) was composed of members of IE and a number of consultants. The inspection covered construction activities authorized by NRC Construction Permit CPPR-126/127.

This inspection is the second 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 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 the inspection and of conclusions reached by this Office. Except for the area of the heating, ventilation and air conditioning (HVAC) system, deficiencies noted in installed hardware did not indicate pervasive failures to meet construction installation requirements. In the HVAC system, a breakdown in work and quality control was identified. NRC Region IV has discussed this matter with you and it is our understanding that this matter received immediate action by you and your contractors to evaluate and correct these conditions. NRC Region IV will continue to pursue this issue with you. Prompt management attention to the resolution of other detailed deficiencies identified during the inspection is needed.

In contrast to the HVAC system, the NRC CAT inspectors found few deficiencies in its inspection of safety system piping. ASME Code radiographs for this piping and samples inspected in this area showed evidence of good workmanship.

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

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 IV 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 NRC Region IV Office.

Sincerely,

James H. Sniezek for

Richard C. DeYoung, Director
Office of Inspection and Enforcement

Enclosures:
1. Appendix A - Executive Summary
2. Appendix B - Potential Enforcement Findings
3. Inspection Report 50-445/83-18, 50-446/83-12

APPENDIX A

EXECUTIVE SUMMARY

An announced Construction Appraisal Team (CAT) inspection was performed at the Comanche Peak Steam Electric Station during the period January 24 - February 4, 1983 and February 14 - March 3, 1983.

OVERALL CONCLUSIONS

It is the position of the Construction Appraisal Team that the results of this inspection indicate several construction program weaknesses. NRC Region IV has been made aware of these weaknesses and is pursuing them with licensee management. The licensee is initiating corrective action and/or continuing his effort to resolve the identified concerns. Prompt management attention to other deficiencies identified during the inspection is needed. In addition, the NRC CAT team found few deficiencies in its inspection of safety system piping and ASME Code radiography for this piping. Inspection of samples in this area showed evidence of good workmanship.

The identified construction program weaknesses are as follows:

1. Results of the inspection indicated a breakdown in fabrication, installation, and inspection in the heating, ventilation, and air conditioning (HVAC) systems.

2. A number of examples were identified of failure to meet criteria for separation of safety-related cables from mechanical structures and piping, and separation of redundant trains of safety systems. This was due in part to the licensee decision to not inspect installations for required separation until installation is essentially complete. The NRC CAT inspectors are concerned whether; (1) the inspections can be effectively conducted after installation, and (2) whether adequate correction actions can be accomplished after installation is completed. Correction of cable separation deficiencies at a later date could require repeating portions of system testing. (Note: This matter is being pursued with the licensee by Region IV, IE and NRR through site review and evaluation.)

3. The licensee's quality assurance program did not ensure that certain hanger, support, electrical and mechanical equipment was installed to the latest design documents, and commensurately that an appropriate inspection was conducted to the latest design documents.

4. Findings also indicate a number of instances where nonconforming conditions were identified; however, various methods (e.g., punchlists, inspection reports, verbal, and other informal methods) were used to address and resolve these nonconformances. These methods do not comply with requirements to identify nonconforming conditions and provide corrective actions to prevent recurrence.

5. The licensee's Quality Assurance audit program should have been more effective in detecting and obtaining correction of deficiencies in

safety-related work; such as those in the HVAC system, mechanical equipment, and electrical components.

In summary, the identified weaknesses require increased dedication by management at all levels to assure completed installations meet design requirements and that inspection documentation reflects that the completed installations have been adequately inspected to the latest design document.

AREAS INSPECTED AND RESULTS

Electrical and Instrumentation Construction: Multiple instances of deviations from requirements were observed relative to electrical and electrical/mechanical separation criteria. The review of procedures and records associated with electrical inspection activities indicated inadequate procedures to assure reinspection of modified, previously accepted Class 1E components.

Mechanical Construction: Deviations from design requirements were observed in QC accepted pipe supports/restraints, and HVAC installations. The existing program for pipe support/restraints does not appear adequate to properly verify that final as-built hardware meets the final design requirements. QC inspections of the HVAC system support dimensional features were not performed and duct/accessory inspection activity controls were not defined in procedures. These deficiencies were reflected in the as-built conditions which did not conform to design requirements.

Piping installation conditions appeared adequate and extensive problems with mechanical equipment were not evident.

Welding/Nondestructive Examination: The welding and NDE appears to be in accordance with requirements except for the HVAC area. The HVAC welding activities reveal significant deficiencies. Problems were identified with undersized welds in structural supports, inadequately trained inspection personnel, improperly qualified welding procedures, and inadequate welding documentation. The review of radiographic film of approximately 80 field welds, the review of NDE procedures, and the interview of NDE personnel, including demonstration of NDE technique, indicates an adequate NDE program for safety system piping in accordance with requirements.

Civil and Structural Construction: Documentation reviewed in this area showed that in general, work was performed in accordance with site procedural requirements and the licensee's commitments.

Procurement, Storage, and Material Traceability: Procurement, on-site storage in warehouses, and material traceability were found to be acceptable. Samples of storage in outside lay-down areas and in-place storage of safety-related equipment revealed that some equipment was not protected as required.

QC Inspector Effectiveness: Sixty-three quality control inspectors were interviewed. Instances of harrassment or intimidation were either properly resolved by TUGCO or were referred to NRC Region IV to be included in an ongoing investigation. Interviews and certification reviews revealed that some inspectors have been certified without the required combination of education and experience specified by ANSI N45.2.6, 1978. Interviews and document reviews revealed that individuals not certified as Level II were evaluating the validity and acceptability of final inspections contrary to the requirements of ANSI N45.2.6 as committed in the FSAR.

Quality Assurance: The licensee's quality assurance program should have been more effective in monitoring and controlling safety-related activities, as exemplified by NRC CAT identified deficiencies in the HVAC and electrical separation areas.

Design Change Controls and Corrective Action Systems: In the area of certain hangers, supports, electrical and mechanical equipment, the licensee's program during construction has lacked adequate controls to ensure information transmitted from the design organization was provided to the quality control organization for use in performing timely QC inspections. This fact contributed to the licensee's inability to have an adequate program in-place at the time of this inspection to ensure that field installations were constructed to the latest design document and that an appropriate quality inspection was completed. In addition, the large number (approximately 70,000 CMCs and 15,000 DCAs) of design change documents contributed to the difficulty in determining whether the "final" installation was in accordance with the "final" design.

There were instances where nonconformances were identified, but various methods (some informal) were used to address and resolve these nonconformances rather than the method specified by site procedures. Evidence of appropriate corrective action and technical justification could not be determined in some cases.

APPENDIX B

POTENTIAL ENFORCEMENT FINDINGS

As a result of the Construction Appraisal Team (CAT) inspection of January 24 - February 4, 1983 and February 14 - March 3, 1983, the following items have been referred to NRC Region IV as potential enforcement findings (Section references are to the detailed portion of the Inspection Report).

Electrical and Instrumentation Construction

1. Contrary to 10 CFR 50, Appendix B, Criterion X and FSAR Section 17.1.10, certain inspection activities were not executed to verify installation conformance with procedures including cable spacing in trays, cable bend radii, cable fill, cable supports and tray installation hardware (Sections II.B.1.a, b, d, and II.B.4.b(1)).

2. Contrary to 10 CFR 50, Appendix B, Criterion XVI and FSAR Section 17.1.16, the established inspection program did not provide adequate controls to assure that deviations from electrical and electrical/mechanical separation criteria as defined in the FSAR were promptly identified and corrected (Sections II.B.1.f, II.B.4.a, and II.B.4.b(2)).

3. Contrary to 10 CFR 50, Appendix B, Criterion V, FSAR Section 17.1.5, and IEEE Standard 450, procedures to implement inspection activities relative to certain aspects of battery maintenance have not been developed or implemented (Section II.B.3.c.).

Mechanical Construction

1. Contrary to 10 CFR 50, Appendix B, Criterion V, FSAR Section 17.1.5, and QI-QAP-11.1-28, certain QC accepted ASME pipe supports/restraints are not installed in accordance with the design document to which the pipe supports/restraints were inspected (Section III.B.2).

2. Contrary to 10 CFR 50, Appendix B, Criteria X and XVII, and FSAR Sections 17.1.10 and 17.1.17, an inspection program has not been established to verify and document installation conformance to drawing requirements in regard to pipe supports/restraints and mechanical equipment installations (Section III.B.2 and 3).

3. Contrary to 10 CFR 50, Appendix B, Criteria V and X, and FSAR Sections 17.1.5 and 17.1.10, installed and QC accepted heating ventilation and air conditioning (HVAC) duct, supports and equipment do not conform to design requirements. In addition, inspection procedures have not been established or executed to verify conformance of HVAC supports to design drawings (Section III.B.4).

Welding and Nondestructive Examination

Contrary to 10 CFR 50, Appendix B, Criterion IX and FSAR Section 17.1.9, certain special processes relative to the HVAC system were not adequately controlled, including improperly qualified procedures; improperly qualified inspectors; improper certification of NDE personnel (Section IV.B.3).

Civil and Structural Construction

Contrary to 10 CFR 50, Appendix B, Criterion V and FSAR Section 15.1.5, civil construction test procedures were inadequate to ensure that mixer uniformity tests as required by the ASME-ACI-359 Code were performed at the prescribed frequency (Section V.B.2).

Procurement, Storage and Material Traceability

Contrary to 10 CFR 50, Appendix B, Criterion XIII, FSAR Section 17.1.13, CP-QAP-8.1, Rev. 5, CP-CPM-8.1, Rev. 1, and MCP-10, Rev. 7, storage of certain safety-related equipment in outside lay-down areas and installed in the plant was not properly controlled (Section VI.B.2).

Quality Control Inspector Effectiveness

1. Contrary to 10 CFR 50, Appendix B, Criterion II and FSAR Section 3.8, individuals were certified to levels of capability without the requisite experience described in Regulatory Guide 1.58 (Section VII.B.2.a.(2)).

2. Contrary to 10 CFR 50, Appendix B, Criterion X and FSAR Section 3.8, inspection records were prepared and accepted by L-I inspectors as the "inspector of record" rather than the required L-II "inspector of record" required by ANSI N45.2.6 (Section VII.B.2.b(1)).

Quality Assurance

1. Contrary to 10 CFR 50, Appendix B, Criterion XVIII and FSAR Section 17.1.18, QA audits have not been conducted at a frequency or at sufficient depth to identify and correct significant problems in various areas of construction; i.e., HVAC and electrical separation (Section VIII.B.2.b.(5)(c)).

2. Contrary to 10 CFR 50, Appendix B, Criterion XVI and FSAR Section 17.1.16, audit findings related to maintenance instructions identified in 1979, 1981 and 1982 were not resolved in a timely manner (Section VIII.B.2.b.(5)(c)).

3. Contrary to 10 CFR 50, Appendix B, Criterion VI and FSAR Section 17.1.6, drawings with out-of-date revisions and drawings with damaged or unreadable title blocks were present in construction work areas (Section VIII.B.2.e.).

Design Change Controls and Corrective Action Systems

1. Contrary to 10 CFR 50, Appendix B, Criterion V and FSAR Section 17.1.5, procedures were not adequate to assure design changes were properly transmitted to the Quality Control organization such that an appropriate inspection could be performed (Sections IX.B.4, 1.b and IX.B.1.c).

2. Contrary to 10 CFR 50, Appendix B, Criteria II and XV, and FSAR Sections 17.1.2 and 17.1.15, nonconforming conditions identified relative to some safety-related hardware installations are not being properly documented, evaluated, and dispositioned through the Corrective Action Program. (Section III.B.8, IV.B.2 and IX.B.2)).

UNITED STATES NUCLEAR REGULATORY COMMISSSION
OFFICE OF INSPECTION AND ENFORCEMENT

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

Report No.: 50-445/83-18, 50-446/83-12

Docket Nos.: 50-445, 50-446

Licensee: Texas Utilities Generating Company
2001 Bryan Tower
Dallas, Texas 75201

Facility Name: Comanche Peak Steam Electric Station Units 1 and 2

Inspection At: Comanche Peak Steam Electric Station, Glen Rose, Texas and Texas Utilities Generating Company, Dallas, Texas

Inspection Conducted: January 24 - February 4, 1983 and February 14 - March 3, 1983

Inspectors: for A. B. Beach, Sr. Reactor Construction Engineer (Team Leader) — 4/8/83 Date Signed

P. I. Keshishian, Sr. Reactor Construction Engineer — 4/8/83 Date Signed

G. C. Gower, Sr. Reactor Construction Engineer — 4-8-83 Date Signed

for W. A. Hanson, Inspection Specialist — 4/8/83 Date Signed

N. B. Le, Reactor Construction Engineer — 4-8-83 Date Signed

for H. W. Phillips, Reactor Construction Engineer — 4/8/83 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 — 4/8/83 Date Signed

TABLE OF CONTENTS

I. INSPECTION SCOPE AND OBJECTIVES

The objective of this inspection was to evaluate the adequacy of construction at the Comanche Peak Steam Electric Station (CPSES). This objective was accomplished through review of the construction program, the quality assurance program, and the design change 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 licensee 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 on a routine basis.

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 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
- Procurement, Storage and Material Traceability
- QC Inspector Effectiveness
- Quality Assurance
- Design Change Controls and Corrective Action Systems

II. ELECTRICAL AND INSTRUMENTATION CONSTRUCTION

A. OBJECTIVE

The objective of the assessment in this area was to determine whether safety-related electrical and instrumentation components were being installed and inspected in accordance with approved engineering designs, regulatory requirements, and the applicant's FSAR commitments. 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 and the inspected activities.

B. DISCUSSION

1. Electrical Cable Installation

The NRC Construction Appraisal Team (CAT) inspectors selected a sample of installed electrical cable runs that had been inspected by Quality Control (QC) inspectors. The sample included power, control and instrument cables. For each of these cables, physical inspection of cable was made to ascertain compliance with applicable design and installation criteria relative to size, type, location/routing, bend radius, protection, separation, identification, physical loading and supports.

The following power cables, totaling approximately 1,800 feet, were selected from different systems, electrical trains, physical locations and sizes.

Cable No.	Type	From	To
E0100161B	1/c 750 MCM W-108	EPSWEB01-02	EPMCEB07-06
EG100387A	1/c 750 MCM W-208	EPSWEB04-07	EPMCEB04-01
E0100410	3/c 6 AWG W-120	EPMCEB01-09	TBXCSAPBA01
EG100037	1/c 4/o AWG W-206	EPSWEA02-11	CP1CTAPCS04
AG100385	4/o TRIPLEX W-812	EPSWEB04-09	Penetration E11

The following instrument cables totaling approximately 1,000 feet were selected and inspected to confirm the previously stated installation attributes.

Cable No.	Type	From	To
E0135235	1 SHD TW Pair 16 AWG W-165	Cont Spy Pmp 02	BOP Inst PNL 01
EG 135262	W-270	Elec Penetration E-14	Term Box for 1LT4781

A sampling of approximately 1,200 feet of installed electrical control cable was selected from various areas of the plant. The inspection was performed by examination of cable segments within selected cable tray sections installed in the Safeguards, Auxiliary, Control and Containment buildings. It should be noted that this method of sampling did not confirm the specific routing of cables.

A detailed explanation of this matter is covered in the following paragraphs under Cable Identification. The NRC CAT inspectors observed approximately 500 feet of in-process cable pull activities. This figure represents three control cable pulls, routed in various areas of the plant. These were cable numbers E0021928 N/M, E0117573 and E0221888.

The observed in-process cable pull activities were performed in accordance with procedural requirements.

a. Cable Spacing in Tray

The design basis specifies that ampacities for cable installed in trays require derating based on their installed configuration. Gibbs & Hill Specification 2323-ES-100, Rev. 2, Section 4.2.1.4, states in part, "Power cables run in cable tray shall have maintained cable spacing where so indicated in the cable and raceway schedule and cable pull cards. Maintained spacing between cables (edge to edge) shall be a minimum of one quarter of the diameter of the largest cable".

Texas Utilities Generating Company (TUGCO) procedure QI-QP-11.3-26.6, Section 3.1.4, states in part, " a minimum separation of one quarter of the cable diameter shall be maintained between siderail of cable tray and adjacent cable". The NRC CAT inspectors noted the following cable trays contained improperly spaced medium voltage power cables:

Tray No.

T12GABF27
T12OABB30
T12GABP71
T11GEA323
T12OABB10
T12OSBD06
T12GABF14
T11GSAB06

b. Cable Bend Radius

Gibbs & Hill specification 2323-ES-100, Rev. 2, Section 4.2.2.3, states, "Cables shall be trained so that the minimum bending radius for pertinent plant cable training is not exceeded".

TUGCO Procedure QI-QP-11.3-26.6, Revision 16, Section 3.1.1, states in part, "The QC inspector shall determine the minimum bend radius" for the cable being installed or removed, and shall include minimum bend radius inspection during the surveillance.

The NRC CAT inspectors noted electrical cables that were installed with less than allowable minimum bend radius in the following locations:

Cable No. or Type	Location
E0120532	Battery Charger No. BC1ED1
EG102592	Battery Charger No. BC1ED2.2
(B) Train Type W-216	T12GCBF82
E0102534	T12OCBD31, T12030560
1/c Type W-206	T11GEAB37, C11G05112

c. Cable Tray Fill

The Comanche Peak Station (CPSES) FSAR, Section 8.3.3.1, states in part, "Cable tray fill criteria generally limit the summation of the cross-sectional areas of control cables and power cables to a maximum of 40 and 30 percent, respectively, of the useable cross section of the tray. However, these percentages may be exceeded provided the following conditions are satisfied:

(1) Cables do not extend above the side rails of the cable tray.

(2) For power cable the thermal rating of the cable is not exceeded.

(3) Cable tray support design is adequate..."

During the inspection of installed electrical cable, the NRC CAT inspectors identified cables that extended above the side rails of Cable Tray Nos. T12GSBG22 and T13GACD14.

d. Cable Supports

Gibbs & Hill Specification 2323-ES-100, page 4-5, paragraph (b.) states in part, "Where supports for cables in vertical cable tray and conduit are not shown on the drawings, top-of-riser supports... and additional supports if required for long vertical risers shall be provided by the contractor to meet the following requirements:

(1) Supports shall be Kellem's mesh grips or engineer approved equal...

(2) One cable support shall be provided at the top of vertical raceway or as close to the top as practical. A support shall be provided for each additional interval as specified in the following table: ..."

The NRC CAT inspectors identified several runs of 750 mcm 6.9 kV SHLD cable installed in vertical riser Tray No. T11GSAB01 and T11GSAB45 of over 100 feet, without specified supports.

e. Cable Identification

The CPSES FSAR requires that all Class 1E cables be identified by a nine alphanumeric character tag.

Gibbs & Hill Specification 2323-ES-100 further requires that identification tags be placed at the termination point of the cable; for example, in an equipment housing or at a terminal box. During the inspection of the selected sample of Class 1E control cables, it became evident that without a more liberal use of identification tags, it would be extremely difficult to trace the physical routing of the samples selected. This was due to the quantity of cable installed in the tray, which in some cases completely buried the selected cables for extended distances.

It was decided by the NRC CAT inspectors that the control cable sample would be made by an examination of cable installed in selected tray segments from various areas of the plant. While this method of sampling could not confirm the total routing of control cables, it did provide adequate assurance that other quality attributes of cable installation had been met.

Discussions with the contractors electrical QC group revealed that further difficulties with cable identification are encountered when installed class 1E control cables sustain insulation damage. The repair procedure requires that the cable to be repaired or replaced must be identified. To accomplish this, the QC inspector may often attempt to trace the cable to its termination point by the "hand-over-hand" method. Where this is not possible, extensive evaluation of raceway schedules are made through the process of elimination to determine which of the cables contained in that tray are of the type, size and reel footage as the one which is damaged. This process has been found to be time-consuming and not always accurate. An example was given of one damaged cable which was identified and pulled out, only to find that it was not the cable it was thought to be. Although current cable identification methods are in conformance with applicant commitments, the practice of placing identification tags only at cable ends has hindered the installation and inspection effort.

f. Electrical Separation

The CPSES FSAR, Section 8.3.1.4, states in part, "The minimum separation distance between redundant Class 1E equipment and circuits internal to the main control boards is maintained at six inches..."

During the inspection of cable terminations within control boards, the NRC CAT inspectors identified multiple instances where the six inch separation between redundant train wiring had not been maintained. Some of these appeared to have been caused by improper training of cables within the panel, others were a result of the location of the terminal point on a device and its proximity to a device of the redundant train.

The electrical QC organization has documented many of these conditions by use of the Nonconformance Report (NCR)or as a punchlist item. However, there appear to be instances which have not been addressed and/or corrected.

Gibbs & Hill Specification 2323-ES-100, Section 4.2.2.3, states in part, "In the event that the above separation distances are not maintained, barriers shall be installed between redundant Class 1E wiring. For main control boards, Service Air Company stainless steel flexible conduit type SS63 shall be used as a barrier."

The NRC CAT inspectors observed two installed barriers whose configuration provided inadequate protection between redundant wiring as well as barriers installed in the main control boards of a type other than Service Air Company stainless steel flexible conduit type SS63 as required.

2. Electrical Cable Termination

An inspection of a selected sample of electrical cable end terminations was performed to determine compliance with the applicable requirements. Inspection attributes included verification of proper lug material and size, proper mounting hardware, accurate location and identification of terminal blocks and points, proper crimp and crimping tool, verification of the calibration status of tool and instruments used, and proper terminating of cable conductors. The NRC CAT inspectors inspected cable end terminations on the following cables.

Cable No.	Type	Location
EG112182	7/c	CP1-ECPRTC-05
EG016018	9/c	CP1-ECPRTC-05
EG127647	8/c	CP1-ECPRTC-05
E0109846	9/c	CP1-ECPRCR-03
E0112867	12/c	CP1-ECPRCR-03
E0109811	2/c	CP1-ECPRCR-03
E0110070	12/c	CP1-ECPRPR-03
E0139235	12/c	CP1-ECPRTC-01
A0118460	2/c	CP1-ECPRTC-01
A0123795	9/c	CP1-ECPRTC-01
EG113353	12/c	CPX-ECPRCB-01
EG113355	12/c	CPX-ECPRCB-01
EG1130904	2/c	CPX-ECPRCB-01
E0113348	12/c	CPX-ECPRCB-01
A0016325	2/c	CPX-ECPRCB-01
E0113331	12/c	CPX-ECPRCB-01
E0138882	3/c	CPX-ECPRCB-01
EG113361	7/c	CP1-EPMCEB-02

EG113367	7/c	CP1-EPMCEB-02
EG113368	2/c	CP1-EPMCEB-02
EG113288	2/c	CP1-EPMCEB-02
EG100474	3/c	CP1-EPMCEB-02
E0113364	7/c	CP1-EPMCEB-01
E0113365	2/c	CP1-EPMCEB-01
E0113366	2/c	CP1-EPMCEB-01
E0113285	2/c	CP1-EPMCEB-01
E0100414	3/c	CP1-EPMCEB-01
E0115077	7/c	CP1-EPMCEB-09
E0113274	2/c	CP1-EPMCEB-09
E0113542	2/c	CP1-EPMCEB-09
E0113865	2/c	CP1-EPMCEB-09
E0100890	3/c	CP1-EPMCEB-09
E0125664	3/c	CP1-EPMCEB-09
EG100701	3/c	CP1-EPMCEB-08
EG109259	2/c	CP1-EPMCEB-08
E0106198	2/c	CP1-EPMCEB-07
E0109253A	7/c	CP1-EPMCEB-07
E0132388	2/c	1PT-2327

The NRC CAT inspectors also observed the in-process termination of four Nuclear Instrument System (NIS) Triax connectors. These were completed in various channels of the Reactor Protection System (RPS) system as follows:

Cable No.	Channel
EY140790	IV
EB140711	III
ER140509	I
EY140794	IV

Two instances of improperly terminated conductors were noted in the following locations, and were subsequently documented by QC personnel on an NCR:

Cable No.	Location
A0123795	CP1-ECPRTC-01 TB4-94, 96
(Terminal lugs are not properly tightened)	
E013331	CPX-ECPRCB-01
(Insulation damage to green conductor at terminal point S6)	

3. Electrical Equipment Installation

A sample of thirty-five pieces of installed electrical equipment were inspected. Samples were selected from both Unit 1 and 2, based on system function and safety classification. Components selected included the following:

a. Motors

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

Motor Identification

Component Cooling Water Pump Motor No. CP1-CCAPCC-01M
RHR Pump Motor No. TBX-RHAPRH-01M
RHR Pump Motor No. TBX-RHAPRH-02M
Safety Injection Pump Motor No. TBX-SIAPSI-02M

During the inspection of these items, it was noted by the NRC CAT inspectors that in several instances the motor or pump had not been grounded. Discussions with the electrical QC group revealed that grounding was not regarded as a part of Class 1E equipment at CPSES and therefore does not receive QC inspection.

The NRC CAT inspectors concluded that the installation activities relative to the above electrical equipment were performed in accordance with procedural requirements. Grounding for motor or pump casings, which is required for personnel safety and protection, had not been performed in several instances.

Reinspection of electrical equipment is discussed in paragraph 8 of this section.

b. Penetrations

The following installed containment penetration assemblies were inspected:

Number	Elevation, Feet
1E49	810
1E14	870
1E46	843
2E33	856

The location, type, mounting and identification were compared with the installation drawings. QC records associated with inspection of these items were also reviewed. Activities observed and documentation reviewed indicated work performed in this area was in accordance with requirements.

c. Motor Control Centers

The following 480 V motor control centers (MCCs) in the Auxiliary and Safeguards buildings were compared to installation drawings relative to location, mounting and identification:

MCC Identification

No. 1EB3-2, CP1-EPMCEB-05
No. 1EB4-2 CP1-EPMCEB-06
No. 2EB1-1 CP1-EPMCEB-01

The installations reviewed indicated work was performed in accordance with requirements.

d. Switchgear

The following 6.9KV switchgear was inspected and compared to installation drawings relative to location, mounting, and identification.

Switchgear Identification

No. 1EA1, CP1-EPSWEA-0
No. 1EA2, CP1-EPSWEA-02
No. 2EA1, CP2-EPSWEA-01
No. 2EA2, CP2-EPSWEA-02

Installation activities relative to these switchgear were performed in accordance with requirements.

e. Station Batteries

The Unit 1 125V vital battery rooms were inspected, including the installed batteries, battery racks and associated equipment. The location, mounting, and environmental control for installation No. BT-1ED1, CPI-EPBTED-01 and No. BT-1ED2, CPI-EPSBTED-02 were compared with applicable requirements and QC inspection records.

During the inspection of these items, the NRC CAT inspectors identifed that there was a considerable amount of activity in the battery rooms. This was due to preparation for relocation of the vital battery cells so that rework of the seismic battery racks could be accomplished. The inspectors observed that although the batteries were charged and in a state of operation, there were no signs posted to prohibit smoking or open flames. Additionally, concrete chipping activities in the wall above the batteries had left deposits of concrete on the cells themselves. Discussions with the electrical QC group revealed that the 125V batteries had been under the control of TUGCO since 1979, and had been moved twice since initial installation. During these moves, responsibility for inspection of attributes associated with handling, mounting, protection, and re-energization was given to a contractors QC group.

The NRC CAT inspectors observed the activities associated with relocation of the vital battery cells. During this activity, two cell casings were damaged and removed from service.

A review of records associated with maintenance of the vital batteries was made to assure that all attributes of the maintenance program had been accomplished and documented. Items such as cleanliness, cell voltages, specific gravity and electrolyte level had been inspected and documented on a regular basis. However, the NRC CAT inspectors observed that the CPSES FSAR, in Section 8.3.2.1, under "Testing and Inspection," states in part, "Periodic inspection and testing of DC systems are performed to monitor the condition of the equipment to ensure reliable operation... All maintenance and testing procedures and criteria for replacement are in accordance with IEEE 450-1975, and Reg. Guide 1.129. IEEE Standard 450-1975, Section 3.3.3 requires a yearly check and record of:

(1) Cell Condition (Detailed Visual Inspection)
(2) Cell-to-Cell and Terminal Detail Connection Resistance
(3) Integrity of the Battery Racks

The NRC CAT inspectors found that the procedure used to perform surveillance of these station batteries (No. ELM-701, Rev. 0) did not implement the requirements for yearly inspection of cell-to-cell detailed terminal resistance, nor was there documented evidence that these attributes had been inspected or verified.

Discussions with the TUGCO Electrical Maintenance Group revealed that the Electrical Maintenance Procedure No. ELM-715 was in the process of being issued to control activities associated with inspection of cell-to-cell detail terminal resistance performed to date.

f. 125 Volt DC System

Equipment associated with the operation of the 125V DC System was inspected to verify compliance with applicable specifications and drawings. The NRC CAT inspectors selected the following sample of equipment.

Identification No.		Equipment
BC-1ED1-1,	CP1-EPBCED-01	Battery Charger
BC-1ED3-1,	CP1-EPBCED-05*	Battery Charger
BC-1ED2-1,	CP1-EPBCED-02	Battery Charger
BC-1ED4-1,	CP1-EPBCED-06*	Battery Charger
1VIEC-1,	CP1-ECIVEC-01	Static Inverter
1VIEC-2,	CP1-ECIVEC-02	Static Inverter
59/1ED1		Overvoltage Relay
59/1ED2		Overvoltage Relay
27DC/1ED1		Undervoltage Relay
27DC/1ED2		Undervoltage Relay
64/1ED1		Ground Protection Relay
64/1ED2		Ground Protection Relay

*These items were originally Unit 2 equipment transferred by Permanent Equipment Transfer (P.E.T.) to Unit 1

Installation activities reviewed indicated work was performed in accordance with requirements.

g. Emergency Diesel Generator

The electrical aspects of the Unit 1 emergency diesel generator (A and B), including control cabinet wiring, were inspected for location, mounting, separation, protection and identification.

These reviewed aspects indicated work was performed in accordance with installation requirements.

h. Motor Operated Valves

A sample of four motor operated valves (MOVs) was selected and inspected for items such as location, mounting, grounding, protection, and proper wiring. The MOVs selected were:

MOV Identification

No. 1HV4776/28537
No. 10611/650
No. 1HV558/BF270925
No. 1HV4709/16142

Inspection of work performed in this area indicated the work was performed in accordance with requirements.

4. Electrical Conduit and Cable Tray Installation

a. Electrical Conduit

The NRC CAT inspectors observed 86 runs of installed electrical conduit, associated pull boxes, fittings, and the associated conduit supports. Total footage of these conduit runs was approximately 1,800 feet. The inspection revealed several discrepancies in the area of electrical conduit installation, including many instances where covers to junction/pull boxes, and condulets were not installed as required.

Discrepancies in the identification numbers between installed conduits and the QC inspection reports in the QA vault were discovered. Further discussion of this matter is found in paragraph 7 of this section under Procedure. Additionally, work performed may not have been inspected to the appropriate design document; specifically, conduit support installations. Further discussion of this matter is found in paragraph 8 of this section under Inspection Procedures.

Relative to NIS conduit installation, the required separation from fluorescent light fixtures was not maintained. The CPSES

FSAR, Section 8.3.1.4, states in part, "all nuclear instrumentation system (NIS) cables are routed in conduit according to their channel assignment... Also, a minimum clear air separation of two feet is maintained from conduit to electrical noise sources such as power and rod control cables."

TUGCO Procedure QI-QP-11.3-29.1, Rev. 8, Section 3.1.2, states, in part, "...a minimum separation of 2'-0" must be maintained between NIS conduit systems and fluorescent lighting fixtures and lighting system conduits except for conduits crossing at an angle of more than 15 degrees. The NRC CAT inspectors identified the following installed Class 1E NIS conduits which do not maintain the required separation from fluorescent light fixtures. These were as follows:

<u>Conduit No.</u>
C16B10045
C16Y10039
JBIA-915Y
C16Y10041

b. <u>Electrical Cable Tray</u>

Eight runs of installed cable tray, comprising 134 tray segments with an aggregate length of about 1,600 feet, were inspected relative to support location, separation, protection and physical loading. Samples were selected from the Reactor, Auxiliary, Control and Safeguards buildings. A random inspection of an additional 500 feet of cable tray was also completed.

(1) <u>Cable Tray Attachments</u>

The NRC CAT inspectors observed several instances where cable tray segments were not bolted together or properly attached to associated seismic supports.

These instances were identified during the inspection of the following cable trays:

<u>Cable Tray No.</u>
T13GRCL08
T13GRCL09
T13GCF019
T13GCF020
T13GACE94

(2) <u>Cable Tray Separation</u>

The NRC CAT inspectors identified instances of cable tray separation that did not meet the CPSES FSAR commitments. These instances reflect a conditions that exist in other areas of the plant.

Examples of deviations from requirements were identified in the areas of redundant train separation, internal control panel wiring separation and electrical mechanical separation.

The NRC CAT inspectors noted that actions taken to correct separation deficiencies have yet to be implemented. It is understood that the use of cable tray covers and other acceptable fire barriers will alleviate a number of these problems; however, there appear to be instances, particularly in the category of electrical mechanical separation, which may not be correctable without a significant amount of rework to installed components.

The CPSES FSAR, Section 8.3.1.4, states in part, "The cable and raceway separation criteria are based on preservation of independence of redundant systems... Cables of redundant Class 1E circuits are run in separate cable trays, conduits, ducts and penetrations."

"The raceways of one train are separated from those of the other train by locating them in separate structures or on opposite sides of large rooms or spaces. Where this is not possible, separation is maintained as described below, or by providing barriers. The Class 1E cables are routed such that any single failure in one train system does not cause a failure in another train system."

The CPSES FSAR, Section 8.3.1.4, continues: "In plant areas which are free from potential hazards such as missiles, external fires, and pipe whip, the minimum separation between redundant cable trays is three feet between trays separated horizontally and five feet between tray separated vertically."

The NRC CAT inspectors identified the following installed Class 1E cable tray segments which did not maintain the required separation between redundant trains:

Train "A"		Train "B"
T130ACG51	From	T13GACZ79
T130ACG54	From	T13GACZ71
T130ACG63	From	T13GCF008
T120ABB23	From	T23GACD85
T120ABA42	From	T23GACD85

Gibbs & Hill Specification 2323-ES-100, Rev. 2, Section 4.3.2 states, "... cable tray shall not be placed within 6 inches of Class I or II piping or component welds unless otherwise approved by the owners field representative (additional allowance shall be made for pipe insulation). The separation for non-safety related and Class III piping and cable tray is to be a minimum of 1 inch from the outside of the pipe or insulation."

TUGCO Procedure QI-QP-11.3-29.1, Rev. 8, Section 3.1.7, states in part, "Raceway and supports shall not be located within (6) inches of Class I or Class II piping welds or component welds..." Also, "Cable tray shall be separated from piping or piping insulation by a minimum of (1) inch."

The NRC CAT inspectors identified the following installed Class 1E cable tray segments which did not maintain required separation from piping or pipe insulation.

Cable Tray No.

T13GACE79
T13GACZ92
T13OSCC77
T13OSCC78
T13OSCC79
T13OSCC74
T13GACE79

The NRC CAT inspectors discussed the above findings with the applicant's lead electrical engineer, and learned that the applicant is aware of the problems. The applicant is anticipating to perform rework where possible, if not, other measures will be evaluated.

NOTE: NRC Region IV, IE and NRR personnel are meeting with the licensee at the site during the week of April 4, 1983, to further evaluate these and other electrical/mechanical separation conditions.

(3) Cable Tray Identification

The CPSES FSAR, Section 8.3.1.3, requires that electrical raceway systems be physically identified by a nine alpha-numeric character tag number and color code system, which is to identify whether or not the given raceway contains safety related cables.

The NRC CAT inspector examined the selected sample of Class IE cable tray and conduit to verify that identification tags and color coding were present, and properly applied, relative to location, materials, and conformance with design drawings. All hardware inspected to these attributes satisfied the identification requirements.

5. Instrumentation

The NRC CAT inspectors selected a sample of instrumentation components which monitor process variables comprising the Reactor Protection System (RPS), Component Cooling System (CCS), and the Engineered Safety Features Actuation System (ESFAS).

Instrument components were reviewed to determine if installations were accomplished in accordance with design drawings, applicable codes and specifications. Items such as location, mounting, identification and protection were compared with installation drawings for the following components:

Pressure Transmitter	Flow Transmitters
1 PT-544	1 FT-2464 A
1 PT-2138	1 FT-2466 B
1 PT-535	1 FT-2463 A
1 PT-534	1 FT-424
1 PT-4252	1 FT-426
	1 FT-2465B
	1 FT-414

Pressure Switch	Flow Indicating Switch
1 PS-4519	1 FIS-4650

Level Indicating Switch

1 LIS-4754

The NRC CAT inspectors observed approximately 700 feet of installed instrument tubing, supports, and associated hardware. Tubing was examined to verify such items as, proper material, slope, mounting, separation, and color coding. The inspectors also examined inspection records associated with the installation of tubing and tubing supports.

During the inspection of instrument tubing, the NRC CAT inspectors noted that in several locations, tubing runs had sustained minor damage; specifically, dents, flattening, and disfigured installation. It was determined that this damage was due to construction activities which had occurred after QC inspection of the tubing. Damaged areas were recorded by the contractors QC and reported on an NCR.

Other observed activities and reviewed documentation indicated work performed in this area satisfied the appropriate requirements.

6. Calibration

The NRC CAT inspectors performed an examination of the on-site Brown & Root (B&R) Calibration Facility. Included in this examination was a review of procedures and documentation associated with calibration activities, an inspection of the calibration facility to insure compliance with the environmental conditions specified, and the inspection of a selected sample of calibrated tools and components.

The NRC CAT inspector selected the following sample of reference standards, measuring and test equipment, and certified tools. These were inspected to verify properly documented calibration status, proper storage conditions, current and approved calibration reports on file, and traceability of items associated with the samples history file.

Reference Standards

No. RS-216	Digital Multimeter
No. RS-086	Photographic Step Tablet
No. RS-020	Outside Micrometer
No. RS-094	"Go-No-Go" Gauge
No. RS-067	Decade Resistor

Measuring and Test Equipment

No. M&TE 1432	Dynamometer
No. M&TE 1132	Micrometer Depth Gauge
No. M&TE 1553	Megger Test Set
No. M&TE 0156	Vernier Calipers
No. M&TE 1270	Soil & Aggregate Sieve
No. M&TE 1961	Oxygen Analyzer
No. M&TE 2409	Dry Filit Thickness Gauge
No. M&TE 2388	Current Transformer
No. M&TE 1829	Battery Megger Tester
No. M&TE 1995	Ultrasonic Thickness Gauge

Certified Tools

No. CT-1365	Crimping Tool
No. CT-0608	Torque Wrench
No. CT-1606	Crimping Tool

Items reviewed satisfied applicable requirements. This subject is also discussed in Section VIII of this report.

7. Procedures

The NRC CAT inspectors examined approved TUGCO documents to verify that instructions, procedures, and drawings used to accomplish electrical activities affecting quality contain the appropriate inspection and/or acceptance criteria.

Electrical QC inspections are being performed in accordance with the TUGCO Electrical Inspection Manual. During the review of these documents procedural inadequacies were identified in the following areas:

The inspectors observed examples of electrical conduit installations whose identification numbers did not match those indicated on the QC inspection reports in the vault. Discussions with Electrical QC personnel revealed that some conduits are installed with a unit identification number. These conduits are inspected and documented in accordance with the applicable QC procedure. Subsequent to the inspection, the identification number may be changed in accordance with EI-EP-1 (E-1) and Item 13(c) of 2323-E1-1700, which state that, "The third character denoting plant number 0, 1, or 2 is generated by the computer from the first cable routed through the conduit."

These identification changes are incorporated on Field Structural Engineering (FSE) drawings and sent to the field for construction use. However, the FSE drawings are not controlled by the Document Control Center (DCC) nor are they used by QC for inspection. As a result of this, the QC inspection records may not indicate the true identification number of the installed conduit; further, there are no procedural requirements which address reinspection of these items.

A list of over 100 conduits affected by similar changes were reviewed by the NRC CAT inspectors. These items were found during random inspections performed by the QC group. In some instances, the list indicated changes not only in the unit designator, but in voltage level and redundant train designations as well. Inspection procedures which do not address reinspection of modified, previously accepted components does not appear adequate.

8. Inspection Records

The NRC CAT inspectors reviewed records generated for inspections that were performed relative to cable tray, conduit, electrical cable installation, cable termination, electrical equipment installation, seismic supports, instrument tubing, and instrument installation.

Assessment was performed in this area to determine whether inspection records have been properly prepared, maintained, and contained documented evidence of inspection completion and results. Electrical and instrumentation inspection records were stored in the QA records vault, and were identifiable and retrievable.

Inspection records were completed in accordance with the applicable quality control procedures. The records identified the QC inspector, the type of observation by procedural reference, acceptability, and reference to documents pertaining to identified deficiencies.

The NRC CAT inspectors questioned the adequacy of documentation associated with reinspection of previously accepted items. In the case of some electrical equipment records, the reinspection signatures for equipment that was relocated per Design Change Authorization (DCA) were not found in the equipment records package, but were on a traveler initiated by the civil/structural group. Additionally, attributes verified by the original inspection report were not specifically addressed in this subsequent documentation. The NRC CAT inspectors were unable to determine, from the records available, the extent of the reinspection which was performed. Similar conditions were observed in the review of records associated with inspection of electrical conduit and cable tray supports, many of which have been modified by component modification changes (CMCs) with multiple revisions, and whose inspection records indicate inspection dates which do not reflect the dates of the latest revision of the CMC (this matter is discussed in detail in Section IX of this report).

Additionally, there were examples of documentation of conditions which deviate from requirements by use of systems other than the NCR system. Examples include the use of Request For Information Clarification (RFICs) to document deviations from requirements relative to electrical separation. The engineering response to the RFIC was, in effect, a disposition of the problem, and in some instances was used to initiate field rework. The use of the RFIC in this manner is considered contrary to QA program requirements.

Also, the NRC CAT inspectors found that punchlists were used to document deficiencies. Some of these deficiencies were considered to be nonconforming conditions by the NRC CAT inspectors.

Following the review of inspection records. the NRC CAT inspectors related the following concerns to the B&R QC supervision:

- That some records do not show the extent nor do they adequately reflect the reinspection activities for previously accepted items.

- That the method of documenting deviations from requirements relative to electrical separation, and the method of identifying and dispositioning discrepancies through the exclusive use of punchlists were not in accordance with QA procedural requirements.

III. MECHANICAL CONSTRUCTION

A. Objectives

The objective of the assessment of mechanical construction was to determine if installed and QC accepted safety-related mechanical items conformed to engineering design, regulatory requirements and licensee commitments. Additional objectives were to determine whether procedures, instructions, and drawings used to accomplish construction activities were adequate and whether quality-related records accurately reflected the completed work and the completed activities.

B. Discussion

The specific areas of mechanical construction that were evaluated were piping, pipe supports/restraints, mechanical equipment, and heating, ventilating and air conditioning (HVAC) equipment. To accomplish the objectives stated above, the following activities were performed in each of these areas:

- A detailed field inspection of a sampling of QC accepted hardware.
- A review of procedures and documentation.
- Discussion with responsible QC and Engineering personnel to determine overall knowledge of site procedures, inspection and acceptance criteria, and to identify problems with procedures, design/field engineering/QC interfaces, inspector qualification, and QC independence.

1. Piping

A sample of piping runs was selected to include different systems, building locations, configurations, and sizes. The following lines, totaling approximately 600 feet, were selected for inspection:

System	Drawings	Size, Diameter
Containment Spray	BRP-CT-1-SB-027, Rev 3	2"
Auxiliary Feedwater	BRP-AF-1-SB-006, Rev 11 BRHL-AF-1-SB-006, Rev 2	8" & 10"
Containment Spray	BRP-CT-1-SB-028, Rev 3	2"
Residual Heat Removal	BRP-RH-1-RB-003, Rev. 5 BRHL-RH-1-RB-003, Rev 2	3"
Residual Heat Removal	BRP-RH-1-RB-001, Rev 13 BRHL-RH-1-RB-001, Rev 2	12"
Auxiliary Feedwater	BRP-AF-1-SB-025, Rev 11 BRHL-AF-1-SB-025, Rev 2	4"

System	Drawings	Size, Diameter
Chemical & Volume Control	BRP-CS-1-RB-028, Rev 7 BRHL-CS-1-RB-028, Rev 0	2"
Safety Injection	BRP-SI-1-AB-002, Rev 5 BRHL-SI-1-AB-002, Rev 0	4"

The above runs were inspected in the field for proper configuration, identification of valves, surface condition, valve orientation, bolted flange connections, interferences and support/restraint location, and function. The following documents provided the basic acceptance criteria for the inspections:

- QI-QAP-11.1-26, Rev 9, "ASME Pipe Fabrication and Installation Inspections"
- QI-QAP-11.1-31, Rev 5, "Installation Inspection of Mechanical Joints"
- Applicable piping isometric drawings (BRPs) and hanger location isometric drawings (BRHLs)

Pipe Supports/Restraints are installed and inspected to detail drawings. The NRC CAT inspectors utilized the BRHL isometric to verify support/restraint function and location as a check that the piping was installed and supported/restrained as analyzed by the designers. Not all supports/restraints had been installed at the time of inspection. The piping configuration, valve identification, support/restraint location and function, and flanged joint makeup appeared to conform to procedural drawing requirements.

The Comanche Peak Steam Electric Station (CPSES) program addressing IE Bulletin 79-14 (79-14), "Seismic Analysis for As-Built Safety-Related Piping Systems", was reviewed. Procedures governing these activities are as follows:

- CP-EI-4.5-1, Rev 8, "General Program for As-Built Piping Verification"
- CP-QP-11.13, Rev 5, "As-Built Verification"
- QI-QP-11.13-1, Rev 8, "As-Built Piping Verification Instructions"

The 79-14 program is basically part of a continuing as-built/piping analysis iteration process. The as-built survey package for stress problem 1-017 (a portion of the Safety Injection System) was examined and the as-built survey deficiency punchlist computer printout for problems 1-003, 1-006, 1-007, 1-010A, 1-010C, 1-019B, 1-021 and 1-028 were reviewed. Program details were discussed with the Texas Utilities Services, Inc. (TUSI) Technical Services Supervisor (responsible for engineering aspects) and the TUSI QA Specialist Supervisor and As-Built Coordinator (responsible for field inspections).

As a result of this "As-Built" review, the NRC CAT inspectors identified concerns as to the exclusive use of punchlists to document discrepancies between detail drawings and as-built hardware (versus a documented/controlled method of identifying, correcting and preventing recurrence of deficiencies). The above procedures do not involve the nonconformance procedure or otherwise involve the quality assurance program in addressing discrepant conditions on QC accepted piping and supports/restraints. Specific examples of this concern are detailed in the support/restraint section of this report. The related program requirements are discussed in this report in Section IX.B.2 "Corrective Action Systems."

2. Pipe Supports/Restraints

ASME pipe support/restraints are fabricated, installed, and QC inspected to detailed drawings prepared by ITT Grinnel, Nuclear Power Services Industries (NPSI), or TUSI Pipe Support Engineering (PSE) and applicable Component Modification Cards (CMCs). Small bore (less than 2½" dia.) Class 2, 3 & 5 supports/restraints may be shown on typical drawings or on "engineered" detailed drawings. Supports may be "final" inspected several times based on subsequent changes to original design; because of the issuance of revised design drawings, and primarily by the issuance of CMCs by PSE (field engineering).

When engineering considers that the "final as-built" stress analysis has been performed and there is a high probability that further changes to the support will not be required, a Vendor Certified Drawing (VCD) for large bore supports and a Design Review Drawing (DRD) for small bore supports is issued. These drawings incorporate any "information only" type CMCs and any modifications necessitated by load changes. QC then inspects the supports for those features revised by the VCD/DRD and for obvious missing parts.

The following sample of 24 installed and QC accepted pipe supports/restraints were selected for inspection to provide a variety of types, sizes, systems and locations:

Support/Restraint No.	Location	Size	Class	Type
RC-1-015-708-C41R	Cont.	2"	1	Strut
CC-2-AB-023-002-3	Aux.	2"	3	Strut
SI-1-SB-23B-006-2	Safeguards	1½"	2	Box
SI-1-068-706-C42R	Cont.	2"	2	Box
RH-1-004-007-S32R	Safeguards	12"	2	Strut
CS-1-357-001-S22R	Safeguards	6"	2	Strut
SI-2-031-425-Y32R	Yard	12"	2	Box
CS-2-063-413-S42R	Safeguards	8"	2	Strut
RC-2-121-401-S52R	Safeguards	3"	2	Strut
CS-2-012-403-C42R	Cont.	3"	2	Strut
CC-1-136-706-E63R	Electr.	3"	3	Strut
SI-1-037-005-S32A	Safeguard	8"	2	Anchor
FW-1-017-702-C52K	Cont.	18"	2	Snubber
CC-1-116-037-F43A	Fuel	12"	3	Anchor
CT-1-002-008-S32R	Safeguards	16"	2	Strut
CC-1-116-006-F33R	Fuel	12"	3	Strut
RH-1-003-002-S42R	Safeguards	12"	2	Strut
CS-1-063-008-S22R	Safeguards	8"	2	Box
SI-1-031-046-Y32S	Yard	12"	2	Spring
RH-1-001-001-C41S	Cont.	12"	1	Spring
SI-1-092-008-C41K	Cont.	6"	1	Snubber
CS-1-001-016-C42K	Cont.	3"	2	Snubber
CS-1-055-010-S42S	Safeguards	4"	2	Spring
RC-1-075-026-C61R	Cont.	4"	1	Strut

Some of these supports had VCDs issued, some did not. The above supports were inspected against their detail drawings and CMCs for configuration, identification, location, fastener/anchor bolt installation, clearances, member size, and damage/protection. In addition, approximately 200 additional supports were observed in the field for obvious deficiencies such as loose or missing fasteners, improper clearances or angularity, damage and improper expansion anchor spacing.

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

- Detail support/restraint drawings and applicable CMCs
- Typical drawings including small bore General Notes drawing CP-AA-001
- QI-QAP-11.1-28, Rev. 16, "Fabrication, Installation Inspections of ASME Component Supports, Class 1, 2, and 3"
- QI-QAP-11.1-28A, Rev. 0, "Installation Inspection of ASME Class 1, 2 and 3 Snubbers"
- QI-QP-11.2-3, Rev. 11, "Torquing and Spacing of Concrete Anchor Bolts"

The following discrepancies were identified on the supports/restraints inspected:

- U-bolt configuration not per drawings:

  CS-1-063-028-S32R AF-1-059-001-S33R
  H-RC-1-RB-039-015-2 H-CS-1-RB-017-001-2
  H-RC-1-RB-038-004-2

- Lug to restraint clearance excessive:

  DD-2-019-007-F33R (11/32" vs 3/32")

- Dimension not per drawing:

  RC-1-075-026-C61R (2' 4 3/4" vs 2' 10 1/2")

- Richmond insert anchor bolt threads not as required:

  CS-1-001-016-C42K

- Snubber load pin missing:

  FW-1-017-702-C52K

- Void in concrete near concrete expansion anchor:

  SW-1-102-716-Y33R

- Loose strut locknuts:

  SW-1-003-002-A33R SI-1-044-026-S32R

- Missing/broken cotter pins:

  14 supports

- Class 3 hanger mismarked as Class 2:

  H-GH-X-AB-0042-003

Numerous other instances of loose locknuts, U-bolts, and missing or broken cotter pins were observed on Class 5 supports/restraints that were under the TUGCO QA/QC program. Contributing to the problems identified with U-bolt installations are confusing drawings which show U-bolts with 1/16 inch clearance required, but also with double nuts on the outside of the retaining plate. Clear acceptance criteria is needed prior to inspections being performed.

The NRC CAT inspectors witnessed the QC inspection of fifteen small bore supports and six large bore supports to the VCD per procedure CP-QAP-12.1. Twelve of the small bore supports were satisfactory. Three were unsatisfactory due to drafting/design errors, primarily due to incorrectly incorporated CMCs into the VCD. Three of the large bore supports were unsatisfactory with an improperly welded bracket, two undersized welds, a missing high strength pin and an improper clamp spacer.

Discussions with the Supervisory Authorized Nuclear Inspector (ANI) indicated that there were deficiencies with the accepted hangers and difficulties in determining the specific activities performed during the fabrication/installation phases. The ANI office has recently been receiving completed ASME support/restraint packages for review and acceptance for the ASME Code Data Report. Of the initial packages of QC accepted VCD supports/restraints that were inspected in the field by the ANI, approximately 10% (13 of approximately 130) have been returned to B&R QC due to undersized or otherwise unacceptable welds. The ANI was inspecting these installations for basic configuration and welding details only. Of approximately 665 vendor certified, QC inspected supports forwarded to the ANI on or before February 23, 1983, approximately 100 had been returned for deficiency corrections.

The NRC CAT inspectors reviewed the deficiency punchlists generated by QC during the VCD inspection. Six punchlist items for hangers were selected (biased sample) to verify that nonconforming conditions were being properly identified and action to prevent recurrence was being taken. Two of these items, an improperly installed U-bolt (CS-1-063-046-S22K) and expansion anchor spacing not per drawing (FW-1-098-C08-C62S), are considered by the NRC CAT inspectors to be nonconforming conditions, but were not documented by QC on NCRs. Subsequent to the NRC CAT inspector requesting an evaluation of these items by QC, NCRs were issued. Three more items concerning undersized, missing, or discrepant welds (CC-X-032-700-A43R, CC-1-161-004-S53R, CC-1-131-013-S43R) had been documented on NCRs. However, review of the documentation packages and applicable revisions to the support/restraint drawings and CMCs indicated that none of these welds had been changed by drawings or CMCs since the "final" QC inspection acceptance of these supports. The fact that the supports were accepted originally by QC with deficient welds or that unauthorized/uncontrolled work had been performed on these supports was not indicated on the NCRs. ASME NCR forms do not provide for any evaluation or signoff for action necessary to prevent recurrence. Nonconforming conditions noted during the VCD program are apparently not being properly documented or identified to effect action to prevent recurrence.

During the review of the 79-14 "as-built" program discussed in Section B.1 above, the NRC CAT inspectors selected eight items from the walkdown survey to determine if discrepancies on QC accepted supports/restraints were being properly dispositioned. At least three items (MS-1-003-003-C72S, SI-039-019-S22R and SW-1-026-003-J03R) showed apparent nonconforming conditions for which no changes had been specified (on drawings or CMCs) since QC acceptance of the support/restraint. In addition, the as-built survey team had identified at one point in time 33 QC accepted supports that had been disassembled or completely removed without authorization. These conditions were not documented in any system that would provide long term corrective action, but were referred to the construction organization via memo. It is recognized that the as-built survey team may not be using the latest CMC issued against the supports they are inspecting, which may make the determination of a nonconforming condition difficult. However, it appears that nonconforming conditions noted during this program are not being properly identified, documented or evaluated to effect action to prevent recurrence.

The inspection of Class 5, seismic supports was a part of the TUGCO QA/QC program as delineated in procedure QI-QP-11.16-1, Rev. 14, "Installation Inspections of NNS Seismic Category II Supports for Class V Piping". Paragraph 3.16.3 of this procedure permits documentation of discrepancies found during inspections either on Inspection Reports (IRs) or Nonconformance Reports as directed by the QA/QC Civil Mechanical Supervisor. The QA/QC Civil Mechanical Supervisor has issued a memorandum directing QC supervisors that discrepancies are to be documented on IRs only. This procedure and memorandum have thus overridden the nonconforming conditions and corrective action requirements of procedure CP-QP-16.0, "Nonconformances" and the TUGCO QA manual. Although IRs related to base metal defects are input to the "trend analysis" and corrective action system, other types of unsatisfactory IRs (location, angularity, member size, orientation, etc.), which may represent nonconforming conditions are not. Therefore, this action is another case where nonconforming conditions are not identified such that root causes and actions to prevent recurrence can be determined and appropriately dispositioned.

A review of procedures governing safety-related pipe supports/restraints indicated that there are procedures covering many aspects of the program (fabrication, inspection, VCD walkdowns, pre-hydro walkdowns, pre-turnover walkdowns) and that some are quite comprehensive and provide detailed information and acceptance criteria. However, the procedures related to inspection of supports are somewhat confusing and unclear as to the specific attributes requiring inspection. For example, the written instructions/checklist for VCD inspections require a verification of support "configuration". The intent of this item was not clear. The interpretations by QA/QC management, QC supervisors, and QC inspectors offered during discussions with

NRC CAT members varied from a detailed inspection of many attributes to a verification that in fact a snubber is installed when a snubber is indicated as required. Walkdown procedures also do not provide sufficient specific inspection attributes and checklist/markup controls for identification and correction of the large number of loose and missing cotter pins and fasteners.

A review of the documentation packages for the 24 supports/restraints listed previously was performed. The packages are difficult to follow due to the large number of changes involved with an average of over five CMCs per support and as many as 16 on one support. Previous inspections are not voided. It was observed that from a total of 55 inspection reports, covering approximately 410 total attributes, there was only one indication of an unsatisfactory IR and only one NCR was written. For non-ASME supports, QC rejects 20 percent of the supports submitted for final inspection in addition to requiring immediate correction of minor hardware items (loose bolts, etc.). The near perfect record in the ASME program indicates that problems are being turned back to construction for resolution (through immediate correction or issuance of CMCs). This practice when conducted for all types of deficiencies circumvents the Corrective Action Program to identify and prevent recurrence of significant deficiencies.

Review of 14 of these packages indicated the following discrepancies that reinforce this concern. Although the Multiple Weld Data Card (MWDC) has a CMC log block, in numerous instances the log indicates CMC revisions and entry dates much later than the QC inspection signoff dates (some entries over one year after inspection). As the coversheet Inspection Report does not list CMC revisions, it is not possible in most cases to identify which CMC (design document) was used to perform the inspection. Further, the "QC Checklist for Snubber Installation" does not specify the drawing or CMC revision. In 10 of the 14 packages, CMC revisions were issued after the date that construction signed off on the MWDC that the installation was complete, and on or shortly before the date of the QC inspection. Most of these CMC revisions were not "information only" or clarification, but pertained to important design features such as dimensions, material changes, baseplate configuration, etc. In one instance, three CMC revisions were issued between construction completion and QC inspection. In one case, the IR was signed off indicating inspection completed the day before the MWDC with the detailed checklist items was signed. In one instance, the center-to-center dimension on a snubber was changed on a CMC revision to "meet as-built conditions", but had been QC inspected satisfactorily twice before.

The following statements summarize the assessment of pipe support/restraint activities:

a. Numerous cases of QC accepted installed hardware not conforming to drawings and CMCs were identified by the NRC CAT inspectors, ANI, and B&R QC during VCD inspections, and by TUSI "as-built" personnel.

b. These conditions indicate poor inspection work, unclear/erroneous drafting, and/or unauthorized, uncontrolled alteration of completed work.

c. Numerous instances exist where nonconforming conditions have not been properly identified to provide the input to the QA Corrective Action Program for determining root causes and preventing recurrence.

d. From discussions with site personnel and the obviously large number of CMCs, it appears original design drawings were used only as guides to construction, and the actual design/analysis was performed after construction and inspection. This may have resulted from the many changes required due to relocated piping, interferences, and the CMC program itself.

e. The acceptability of the installed hardware to meet design requirements based on a series of partial inspections (versus a final complete inspection after work is completed) is questionable based on the following points:

   - Numbers of "design" changes (CMCs)
   - Somewhat unspecific inspection procedures
   - Amount of ongoing construction activities and the apparent lack of discipline regarding construction personnel tampering with QC accepted hardware.
   - Drafting and design discrepancies noted in initial drawings, CMCs and VCDs.
   - The number of discrepancies noted on supports previously accepted by QC.
   - Inspection documentation not indicating the "design" document (drawing and/or CMC) revision that was used for the inspection.

In conclusion, although extensive major technical problems were not identified in the pipe support/restraint hardware, prompt action is required to address the above program concerns. Specifically, attention must be focussed in the areas of the nonconformance/corrective action program, comprehensive final inspections and inspection documentation in order to provide confidence in the acceptability of installed pipe supports/restraints.

3. Mechanical Equipment

The following sample of installed and QC accepted mechanical equipment was selected and inspected for proper location, identification, foundation/support configuration and condition, in-place storage conditions and damage.

TBX-GHATGD-01, Waste Gas Decay Tank
TBX-GHATGD-07, Waste Gas Decay Tank
TBX-GHATGD-10, Waste Gas Decay Tank
TPX-TRAHLC-01, Letdown Chiller Heat Exchanger
CP1-DDAPRM-01, Reactor Makeup Water Pump
CP2-DDAPRM-01, Reactor Makeup Water Pump
CPX-DDAPRM-01, Reactor Makeup Water Pump
CPX-CSATBA-01, Boric Acid Tank
CPX-CSATBA-02, Boric Acid Tank
CPX-BRATRH-01, Boric Acid Tank
TCX-CSAHLD-01, Letdown Heat Exchanger
TBX-TRAHMH-01, Moderating Heat Exchanger

Acceptance criteria for the field inspections were taken from vendor drawings and technical manuals, and site structural/foundation drawings.

The Operations Travelers detailing the installation and acceptance of Reactor Makeup Water Tank-01, Moderating Heat Exchanger-01, Boric Acid Tank-01, and Letdown Heat Exchanger-01 were examined.

No problems were identified relative to the location, identification, in-place storage, or damage to mechanical equipment. All foundation nuts were installed and appeared tight. However, the makeup of the foundation bolt/nut assemblies was inconsistent, and in some cases, the conformance with vendor requirements was in question. For the tanks and heat exchangers inspected, some bolts had single nuts, some had double nuts, and some had a mixture of single and double configurations. Vendor and site foundation drawings indicated single nuts. The Operations Travelers and site structural bolting procedures do not require or address double nutting. The Westinghouse technical manual for the above heat exchangers specifies that the nuts on the slotted end of these units be backed off slightly to allow movement during thermal expansion. Most of the bolts on the sliding ends of all of the heat exchangers inspected were double nutted and appeared to be drawn down tight. The sliding end of the Letdown Chiller Heat Exchanger appeared to have had grout between the support bracket and the foundation pad. The Operations Travelers did not address the technical manual requirement; they stated only that the units were to be installed in accordance with applicable drawings.

4. Heating Ventilation and Air Conditioning (HVAC)

HVAC systems on Unit 1 and Common are essentially 100% complete and turned over to TUGCO. Many portions are operating. Unit 2 installations are approximately 80% complete.

In general, HVAC duct and equipment supports are fabricated and installed by the Bahnson Service Co. (BSC) in accordance with typical drawings and procedure DFP-TUSI-003. BSC QC inspects expansion anchor installation and the fitup and welding of duct supports. After installation, the support as-built configuration is sketched by draftsmen. This unsigned, unreviewed sketch is sent offsite to Corporate Consulting and Development Co. (CCL) for seismic analysis. If analysis indicates that modifications are required, the supports are modified, QC inspected for new expansion anchors and welds, and the draftsmen prepare a final and formal "as-built" drawing. This drawing is checked, and approved and then reviewed by BSC Site Quality Assurance. This "as-built" is resubmitted to CCL for final review and analysis. Because the typical drawings provide no axial bracing, most duct supports are modified. Nowhere in this process does BSC QC inspect the supports for proper location, proper configuration or member size and length. No QA/QC verification or audit of the drafting department's as-built efforts is performed.

Eight duct supports and one fan support were inspected in the field for proper location, configuration and conformance to drawing, design and procedural requirements. Five of these nine supports did not conform to the configuration and dimensions shown on the as-built sketches or drawings. Following is a list of the supports inspected and the discrepancies noted:

Support	Discrepancy
*A-CB-854-1N-4K	None
A-CB-854-2N-1AK	None
A-CB-854-2N-C5	3 dimens. (discrepancies of 3½", 2 3/8", 4½" from design)
A-CB-854-4-2N-C12	None
A-SG1-852-1J-1C-01	1 dimen. (6½" variance)
SG1-852-1J-2B	1 member size smaller than shown (3x3x3/8 vs 4x4x½)

*Duct supports with "final" as-built drawings have the "A" prefix, the remaining three had only the field sketch used for initial seismic analysis at the time of this inspection.

Support	Discrepancy
CB-807-2N-A	1 dimen. (1")
CB-807-2N-B	None
SKRFC-791402 (Fan Support)	2 dimens. (2 3/8", 2 3/8") and Hilti location spacing (2 missing, 2 in error)

Ducting is inspected for proper installation during the system turnover walkdown. No checklists are used and acceptance documentation for as many as 38 segments were observed on one general Inspection Report. BSC personnel stated that deficiencies noted during the walkdown were noted on a punchlist, corrected and reinspected. However, these punchlists are not a controlled or a retained document, and QC reinspection and closeout are not addressed by site procedures. BSC personnel could not provide an example of a completed/closed out punchlist.

Turnover package 3601, in the final stages of completion, was examined in the BSC office. This package contained 35 Inspection Reports, accepting 495 duct segments, which were all signed by one QC inspector on one day. The inspection activities to verify proper makeup of 495 joints and approximately 200 support locations would take several weeks and require controls over the process to assure that all required inspections are performed. BSC procedures do not provide instructions to QC personnel on how to document/control the in-process walkdown activities and BSC personnel could provide no evidence that the individual inspections included in this package were recorded on log books, marked up drawings, or similar control mechanisms.

The following duct segments and in-line equipment were inspected in the field for conformance to drawing and procedural requirements:

CRKE-1, EMD-7, Segments 6 through 12
Fan CPX-VAFNID-01
Fan CP1-VAFNID-07
Fan CP1-VAFNID-10
Damper CPX-VADPMV-05
Isolation Valve CP2-VAD-PBC-08

Approximately 25 duct segments adjacent to the supports inspected were also examined.

Five of eight joints in the CRKE-1, EMD-7 line had one or more loose bolts. Numerous other joints observed during the support inspection also had loose or missing fasteners and missing lockwashers (for example: four loose bolts on the joint adjacent to support A-SG1-852-1J-1C-01). The flange bolts for containment isolation damper CP2-VADPBC-08 and a similar damper on Unit 1 did not properly fit the holes and were not fully installed. On damper CPX-VADPMV-05, the gasket on one side was partially missing and the other side had no gasket at all, bolts were loose and lockwashers were missing. The bolting requirement of BSC procedure DEP-TUSI-008 that requires additional corner bolting on duct accessories was not met on the damper on the discharge side of Fan CPI-VAFNID-07.

The BSC program to inspect and document the installation of HILTI concrete expansion anchors, however, appears to have been thorough and effective.

In summary, the number and variety of discrepancies noted by the NRC CAT inspectors between installed hardware conditions and drawing/procedure requirements indicates that the QC inspection requirements and controls have not been sufficiently detailed in procedures, nor has the QC inspector performance in the field been adequate to assure that HVAC systems are installed as required. There was an apparent failure of the BSC Corporate, Brown and Root and TUGCO QA organizations to identify and correct the observed program deficiencies during their audit/surveillance activities.

IV. WELDING, NONDESTRUCTIVE EXAMINATION

A. Objective

Determine by direct observation and independent evaluation of work performance, work in progress, and completed work, whether field welding activities associated with piping, hangers/supports, steel structures, and heating, ventilation and air conditioning (HVAC) systems, are controlled and performed in accordance with NRC requirements, SAR commitments, and applicable codes and specifications.

In addition, determine by direct observation and review of records that welders and nondestructive examination (NDE) personnel are adequately trained and qualified in accordance with established performance standards and applicable code requirements.

B. Discussion

1. Pipe Supports/Hangers

Twenty-seven pipe supports were selected for inspection of welding. All of the hanger welds had been previously quality control (QC) inspected and accepted by Brown & Root (B&R). A listing of the hangers follows:

Type	Pipe Size, in.	Unit No.	System*	ASME Class	Hanger No.
Box	1.5	1	SI	2	SI-1-SB-23B-006-2
Strut	6.0	1	CVC	2**	CS-1-357-001-S22R
Box	12.0	2	SI	2	SI-2-031-425-Y32R
Strut	8.0	2	CS	2	CS-2-063-413-S42R
Strut	3.0	2	RC	2	RC-2-121-401-S52R
Anchor	8.0	1	SI	2	SI-1-037-005-S32A
Strut	16.0	1	CS	2	CT-1-002-008-S32R
Strut	12.0	1	CC	2	CC-1-116-006-F32R
Box	8.0	1	CVC	1	CS-1-063-008-S22R
Spring	12.0	1	SI	2	SI-1-031-046-Y32S
Strut	12.0	1	RH	2	RH-1-004-007-S32R
Strut	12.0	1	SI	2	SI-1-031-024-Y32R
Strut	8.0	1	CVC	2	CS-1-063-037-A42R
Box	3.0	1	CC	3	CC-1-136-706-E63R
Strut	2.0	2	CC	2	CC-2-AB-023-002-3
Strut	3.0	2	RH	2	CS-2-012-403-C42R
Strut	12.0	1	CC	3***	CC-1-116-037-F43A
Snubber	18.0	1	FW	2	FW-1-017-702-C52K
Snubber	3.0	1	CV	2	CS-1-001-016-C42K
Snubber	6.0	1	SI	1	SI-1-092-008-C41K
Spring	12.0	1	RH	1	RH-1-001-001-C41S

Type	Pipe Size, in.	Unit No.	System*	ASME Class	Hanger No.
Spring	4.0	1	RC	1	RC-1-075-026-C61R
Spring	4.0	1	CV	2	CS-1-055-010-S42S
Strut	18.0	1	FW	1	FW-1-017-001-S62K
Strut	2.0	1	RC	1	RC-1-015-708-C41R
Strut	12.0	1	RH	2	RH-1-003-002-S42R
Box	1.0	1	CVC	2	CS-1-SB-059-003-2

*SI= safety injection; CVC = chemical and volume control; CS = containment spray; RC = reactor coolant; RHR = residual heat removal; FW = feedwater

**Undersize Weld

***Overlap, Improper Contour

The majority of hangers inspected utilized fillet welds for joining hanger components and details.

Two of 27 hangers exhibited unacceptable welds. Hanger CS-1-357-001-S22R exhibited one undersize fillet weld. The weld was 1/16-in. to 1/8-in. under the specified requirement. Hanger CC-1-116-037-F43A exhibited overlap and improper weld contour. Thirteen of 27 hangers had been inspected to vendor certified drawings (VCD).

The welds, for the most part, exhibited good workmanship. Some of the hangers inspected were painted and NRC CAT inspection of these hangers was mainly for weld size.

2. Safety Related Supports/Hangers for Electrical Conduit and Instrumentation

a. Electrical Conduit Supports/Hangers

These conduit supports/hangers are fabricated on-site both in the shop and in the field. The following conduit supports/hangers were being fabricated in the on-site shop. The NRC CAT inspection was performed on the subject hangers before the hangers were painted.

C03G09160-1	C12G06431-26	C04G21038-1
C03G09160-2	C12G10452-3	C12G21174-2
C03G09160-3	C12G10652-4	C23H10674-6
C12021194-4	C12G10455-23	

All welds on the above supports/hangers were visually inspected by the NRC CAT inspectors for acceptance to QI-QP-11.10-4 which invoke AWS D1.1, "Structural Welding Code." The NRC CAT inspectors examined the on-site shop facilities, and reviewed fabrication procedures, inspection records, and in-process activities relating to material identification, marking, cutting, cleaning, and welding.

The NRC CAT inspectors observed the arc-stud welding process being requalified. Requalification was performed for 1/4-in., 3/8-in., and 1/2-in. studs. Two studs for each of the indicated sizes were welded for requalification. Welding was performed in accordance with AWS D1.1. The welded studs passed the bend test in accordance with AWS D1.1, and therefore the welding process was judged acceptable.

The NRC CAT inspectors examined field installed and QC accepted supports/hangers. The inspected hangers were constructed for the most part of 6-in. x 6-in. square tubing. The supports/hangers were relatively complex as evidenced by the numerous secondary supports attached to the primary structure. The subject supports/hangers inspected (listed below) were partially fabricated in on-site shops and completed during field installation:

C03G18046-7	C22K06857-1	C12K15116-1
C03G18046-8	C22K06902-1	C02Q30179-1
C03G18046-9	C12Q12705-6	C02Q30179-2
C03G18046-10	C12Q12705-7	SH-IN-CHM-5b
C12K06108-2	C12Q12705-11	SH-IN-CHM-5c
C13G13999-2	C12Q15077-7	SH-IN-CHM-5e
C03G18046-11	C11Q04797-1	SH-IN-CHM-5f
		SH-IN-CHM-5g

The identified hanger/support welds that were inspected (both shop fabricated and field installed) were visually acceptable. Review of the shop activities revealed that the work was being conducted with proper controls and the quality of the workmanship appeared consistent with good industry practice.

b. Instrumentation Hangers/Supports

The majority of instrumentation and control (I&C) non-ASME (safety-related) hangers are fabricated in shops on-site. B&R field construction installs them by bolting or welding the hanger assembly to building structures. Both field and shop inspections were being performed by the licensee.

The NRC CAT inspectors observed shop fabrication of six hangers at various stages of manufacturing. In-process activities reviewed were material traceability and identification marking, application, cutting and cleaning of materials, welding, filler material control, and hanger identification markings.

Review of documentation for the shop fabricated hangers included review of material records, engineering drawings for configuration, inspection records for welding, material verification, visual inspection of welds, inspection report number, and verification of surface preparation for painting. Documentation indicated inspections were performed according to QC document QI-QP-11.8-2.

Ten field installed and QC accepted hangers were also reviewed by the NRC CAT inspectors. The inspected hangers are identified by the following numbers:

S-1467	S-2729
S-1806	S-2723
S-2244	S-2724
S-2250	S-2726
S-2292	S-2762

The identified field installed hangers were inspected for visual weld acceptance in accordance with AWS D1.1. and no deficiencies were identified.

3. Heating Ventilation, and Air Conditioning (HVAC)

The NRC CAT inspectors performed field inspection of HVAC welds on hangers, ducting accessories such as flow control devices, air dampers, and containment isolation valves. All of the items inspected by the NRC CAT inspectors had been previously accepted by Bahnson QA/QC.

a. HVAC Supports/Hangers

Structural steel hangers supporting ducting runs were visually inspected to determine if welding met the requirements of AWS D1.1. Typically hangers are field fabricated from 4-in. x 4-in. x 1/2-in. structural steel angle iron. Hangers inspected and results are as follows:

No.	Hanger No.	No. of Welds Inspected	No. of Unacceptable Welds
1	CB-807-2N-A	21	11
2	CB-807-2N-B	21	10
3	SGI-852-1J-1S	12	11
4	SGI-852-1J-1C-01	12	3
5	SGI-852-1J-2B	12	10
6	SGI-852-1J-16A	18	6
7	DG-844-2K-1AR	14	8
8	DG-844-2K-1AT	14	5
9	DG-844-2K-1AQ	14	2
10	DG-844-2K-1AR	14	3
11	DG-844-2K-1BD	6	3
12	DG-844-2K-1BC	6	3
13	RB-1A-C1	3	2
14	RB-1A-C2	3	1
	TOTAL	170	78

Thus, a rejection rate of approximately 45% was exhibited for welds on structural steel hangers. The majority of those welds that were unacceptable were rejected because of undersize welds. The size of weld specified on most of the drawings was 1/2-in. These welds usually measured approximately 3/8-in. The rest of the welds were unacceptable because of insufficient length, undercut, and improper weld contour.

Bahnson QA/QC personnel observed and acknowledged most of the above weld deficiencies. It was reported after the NRC CAT inspection that on February 28, 1983 the licensee's audit of the installed HVAC system confirmed the deficiencies and a 10 CFR 50.55(e) report was filed by the licensee.

b. Containment Isolation Damper

The Unit 1 HVAC containment isolation damper connection flange detailed on Bahnson sketch, ISO-001, shows a 48 in. circular flange made from 2-in. X 3-in. X ¼-in. angle iron. Inspection of this flange in the field revealed that it is actually fabricated from two pieces of flat stock joined by fillet welding to form a right angle flange. This is contrary to the sketch. The drawing is also in error in that it fails to specify a fillet weld joining the two pieces of material. Furthermore, the fillet weld upon inspection was found to be unacceptable in a number of areas.

Because of limited access to the full circumference of the weld, only a 180-degree segment was inspected. Approximately 40% of the 180-degree segment of the weld was visually acceptable in accordance with AWS D1.1. The rest of the weld exhibited areas of undersize welding, linear surface indications, arc strikes, undercut, overlap, and in general, a poor level of workmanship.

c. HVAC Welder and Procedure Qualifications

Bahnson procedure QCI-CPSES-009, specifies that welders shall be qualified to ASME Section IX. Gibbs and Hill specification 2323-MS-85 (Bahnson contract requirements) specifies that welding procedures and welders may be qualified in accordance with AWS D1.1 or with ASME Section IX. Actual field fabrication is performed to the requirements of AWS D1.1, Structural Welding Code," and AWS D19.0, "Welding Zinc-Coated Steel".

The NRC CAT inspectors reviewed welding procedure specifications and welder performance qualifications. This review revealed the following discrepancies.

WPS No.	Process	Comments
BSC-12.1	GMAW	AWS D1.1, 5.5.2.3 specifies that the cover gas flow rate be ±25% of the rate qualified; however, WPS BSC-12.1 fails to specify the actual rate used during qualification. AWS D1.1, 5.5.2.3 specifies ±10% for amperage, ±7% for voltage, but BSC-12.1 fails to specify a range; specific values are given for amps and volts, but no tolerance is permitted by WPS BSC-12.1.
BSC-15 BSC-14* BSC-14.1*	GMAW	The weld procedure qualification sheet for BSC-15 specifies unique values for amps volts, travel speed, and gas flow. The WPS BSC-15 specifies 30-40 ft3/hr gas flow, 90-170 amps, 12-25 volts, 5-12 in./min travel. The ranges are outside of the tolerances permitted by AWS D1.1.
BSC-13	GMAW	WPS BSC-13 specifies ranges for amperage, voltage and travel. No weld procedure qualification record was available for WPS BSC-13 that states what values were used during the qualification test.

BSC-20	SMAW	95 amps is indicated on Welding Procedure Qualification Record Sheet for this procedure. WPS BSC-20 specifies a range of 70-160 amp. This range exceeds the ±25% tolerance permitted by AWS D1.1. (71-119).

* Same comments apply to these procedures as for BSC-15

Bahnson specification 2323-MS-85 paragraph 2.14b Welding, (modified by Design Change Authorization 9898) specifies that all welding shall be in accordance with AWS D19.0-72. Paragraph 2.14(a), of specification 2323-MS-85 specifies that welding procedures and welders shall be qualified in accordance with AWS D1.1 Section 5 <u>or</u> ASME Section IX.

All of Bahnson welding procedures have been qualified in accordance with ASME Section IX. Qualification in accordance with ASME Section IX is permitted providing the requirements of Section IX meet or exceed all of the requirements of AWS D1.1. As noted above, weld procedures BSC-13, BSC-14., BSC-14.1, BSC-15, and BSC-20 fail to meet all the requirements of AWS D1.1, and are not qualified procedures. The balance of Bahnson's welding procedures were not reviewed by the NRC CAT inspectors and their status of qualification, was not determined.

d. HVAC Welding Documentation

A review of Bahnson quality control records and procedures reveals a failure to identify what weld procedure was employed for a specific hanger weld. The welding material issue slip, used to control the issue of welding rods, has a space to enter the HVAC system identification. However, as determined by review of welding material issue slips, the space provided for system identification only indicates the plant elevation, building, and reactor unit number. Also, traceability of the welding material utilized and the welders employed on specific welds cannot be determined.

Bahnson field inspection reports, although providing for acceptance of welding, fail to identify the welder, the welding procedure, and the welding materials used.

e. HVAC QC Inspector's Qualification

HVAC QC inspector qualifications, both past and present, were reviewed. Training records, experience, and educational requirements were compared with the requirements of ANSI 45.2.6 and Regulatory Guide 1.58. On the basis of this review, the supporting documentation appears to meet the minimum requirements of ANSI 45.2.6; however, QC training appears to have been based on review of QC procedures. Little evidence was available that reflected technical training of substance.

The QC inspectors informed the NRC CAT inspectors that up to 1 year ago BSC inspectors were not using fillet gauges, or other similar tools for measuring weld sizes. Furthermore, during the NRC review some inspectors exhibited limited knowledge of welding inspection. QC inspector qualification records appear to meet the letter of the ANSI requirement but it was apparent that the QC inspectors lacked proficiency in the inspection of welds.

4. Visual Examination of Piping Welds

Seven piping isometrics were preselected for visual inspection of piping welds. Nine additional piping isometrics were selected at random for visual inspection of welds. All of the piping runs had been inspected and accepted by B&R QC before NRC CAT inspection. The inspected piping runs and other system parameters are as follows:

Piping Sample Plan

Unit No.	System*	Isometric No.	Pipe dia. (in.)	Ft. of Pipe	ASME Class	No. of Valves	Welds
1	CS	CT-1-SB-028	2.0	55	2	2	26
1	CS	CT-1-SB-027	2.0	50	2	2	29
1	SI	SI-1-SB-004	6.0	85	1 & 2	2	12
1	SI	SI-1-AB-002	4.0	130	2	2	12
2	SI	SI-2-AB-001	4.0	85	2	0	12
1	AFW	AF-1-SB-006	10.0	62	2	2	11
1	AFW	AF-1-SB-025	4.0	105	3	2	11
TOTAL WELDS							113

Randomly Selected Piping Runs

Unit No.	System*	Isometric No.	No. of Welds
1	SI	SI-1-RB-037	1
1	SI	SI-1-SB-042	11
1	SI	SI-1-RB-053	1
1	SI	SI-1-RB-052	1
1	SI	SI-1-RB-033	6
1	SI	SI-1-RB-043	7
1	CS	CT-1-RB-017	3
1	CS	CT-1-RB-019	8
1	RHR	RH-1-SB-003	1
TOTAL WELDS			39

*CS = containment spray; SI = safety injection; AFW = auxiliary feedwater; RHR = residual heat removal

The welds inspected (identified by 16 piping isometrics) are ASME III Class 1, 2, and 3 welds. The size of the piping ranged from 2.0 to 24.0 in. in diameter; approximately 1400 ft of piping was involved in the sample. A total of 152 piping welds were visually inspected in accordance with ASME III-74 for undercut, overlap, lack of fusion, surface porosity, and other anomalies related to surface conditions. Both vendor and field fabricated welds were part of the sample.

Three of the 152 welds exhibited undesirable surface conditions: Weld F-11B (reference SI-1-SB-004, safety injection system) exhibited insufficient weld in that the face of the weld was below the adjacent pipe surface. This weld was also improperly located on the isometric drawing (ISO) provided. The ISO for weld F-11B specified that the weld should have been located at a given position from a wall. Actual field location was on the opposite side of the wall, approximately 8-ft from the location shown on the ISO. A nonconformance report (NCR) was prepared by the licensee for both the surface condition of the weld and for mislocation.

One weld identified on ISO RH-1-SB-003, Rev. 9, joins a section of 12.0 in. pipe to a section of 8.0-in. pipe. The transition, reducing elbow was vendor fabricated. The weld joining the 8.0-in. pipe sections exhibits a taper or slope of approximately 4:1. The slope permitted by ASME III is 3:1 maximum. This condition was discussed with B&R QC personnel, and at the end of the NRC CAT inspection, the matter was still under review.

A weld-o-let (vendor installed) identified on ISO CT-1-RB-019, Rev. 1 (adjacent to field weld FW-4) has insufficient weld reinforcement on the weld joining the weld-o-let to the pipe.

The subject weld exhibits less than full weld reinforcement. This condition is readily apparent by noting that portions of the weld preparation on the weld-o-let side are observable.*

A review of quality control procedures and engineering and construction specifications for vendor and field installed weld-o-lets or sock-o-lets reveals a lack of criteria for specifying the required size of weld reinforcement for less than full reinforcement welds. Typically, weld-o-lets can be installed on several sizes or diameters of piping and wall thicknesses. On the basis of the engineering requirements (temperature and pressure) for a given system, the size of the weld reinforcement needs to be specified for those cases where the weld is less than full reinforcement.

5. Review of Radiographs

Radiographs for a total of 81 B&R welds, 88 ft of Chicago Bridge & Iron (CB&I) containment liner plate welds, nine Southwest Welding Co. welds and ten ITT Grinnell welds, involving 1254 film were reviewed for compliance to applicable requirements. All weld radiographs had been previously reviewed and accepted by the licensee or his authorized representative.

One hundred twenty-five additional film were also reviewed in the radiographic interpretation room for the purpose of evaluating three interpreters' ability to follow B&R procedures and their ability to properly interpret radiographic film.

Conditions were disclosed by the NRC CAT inspectors in six welds that require attention and correction (See Table IV-1). These conditions were discussed with the licensee representative. These conditions are summarized below:

a. Brown and Root weld radiographic film #24555-CS-1-RB-30 revealed an indication of insufficient fusion (IF) which was rejected on the original film by the B&R interpreter but was not identified on a subsquent repair shot. This deficiency was identified by the NRC CAT inspector. Brown and Root prepared a nonconformance report (NCR) and the new radiograph that resulted from this NCR confirmed the IF. The new radiograph also revealed that the angle of the repair shot had been taken 180° from the original shot,

*Another undersize weld was found (not part of pipe sample) on a 2-in. diameter sock-o-let on piping located in CC pump room 01. This sock-o-let is welded to a 8-in. line shown on ISO CC-2-AB-016.

thus changing the appearance of the IF on the film and reducing the likehood of its being identified.

b. The NRC CAT inspector review of B&R radiographic film #4162-MS-1-RB-081 revealed an area on the film, that coincided with the pipe weld zone, which was more dense (thinner material) than that part of the film showing the parent material. B&R prepared an NCR and later confirmed a thin wall section by taking an ultrasonic thickness reading. The area was approximately 0.014-in. under minimum wall thickness. This radiograph had been accepted by B&R QC. B&R stated that weld repairs to this area would be made.

c. B&R film #29030-FW-RB-020 revealed an area of IF and aligned enlongated porosity in excess of 1-in. that had been accepted by B&R. An NCR was prepared and new radiographs were taken. The new radiographs revealed the same condition and the weld was rejected. The licensee representative stated this weld will be repaired.

d. B&R film #28669-CC-AB-018 revealed an indication of IF that was not marked by the interpreter (the same interpreter involved in film 29030). This indication was however, identified by another B&R interpreter when a subsequent repair shot was evaluated. The NRC CAT inspector's review of the original film for the subject weld revealed indications of incomplete fusion similiar to the repair weld radiograph. Both film evaulations were made within a short period of time. This deficiency in film interpretation was referred to the licensee representative for followup and corrective action.

e. During the NRC CAT inspectors review of radiography film (20619-CS-1RB-028, 29018-CS-2-AB-091) two welds were observed to have densities that are below minimum in the area of interest or are outside the +30% - 15% for penetrameter requirements in the ASME Code and B&R procedure. As a followup to the above, it was learned that B&R had changed the three-view RT technique to a four-view technique approximately two years ago to correct low-film density problems. B&R is now in the process of reviewing radiographs of welds shot before that time with three-view technique. The NRC CAT inspector was informed by the licenseee that any radiographs found that do not meet code requirements will be re-radiographed.

f. Initial review of approximately 10-ft of radiographic film taken of containment linear weld seams revealed linear indications. Subsequent visual examination of the liner plate, in the area of interest, revealed that the liner plate contained grinding marks adjacent to the weld. On the basis of a correlation of the grinding marks on the liner with marks on the radiographic film, the NRC CAT inspector agrees that the welds are acceptable.

No deficiencies were identified in the review of Southwest Welding and ITT Grinnell sample of radiographs.

6. Review of NDE Procedures, Practices, and Personnel Qualifications

a. Review of Brown and Root NDE Procedures

A total of 19 procedures were reviewed by the NRC CAT inspector.. It was observed that most of the procedures had been revised within the preceeding five months. With the exception of QI-QAP-2.1-1 and QI-QAP-10.2-3, the procedures appear to be adequate and in good order. Comments on these procedures follow:

(1) QI-QAP-2.1-1, Nondestructive Examination Personnel Certification

This procedure does not detail specific requirements for work experience and how the NDE Level III makes his determination for qualification before certification as required by SNT-TC-1A, 1975 edition.

(2) QI-QAP-10.2-3, Radiographic Examination

This paragraph allows the use of Ir 192 on steel as thin as 0.125 without explanation. Review of records disclosed that this procedure requirement was based on a qualification film using two flat pieces of material in the center of the film. This set of conditions is not representative of the geometric conditions that would be encountered on an actual radiograph of piping welds. The qualification film revealed a marginal 4T sensitivity.

b. Certification Records

Records of 68 separate certifications involving 22 persons were reviewed. There was one certified ultrasonic record for a Level II that contained no evidence of experience in angle beam, shear, wave examination. A subsequent interview with this person and a signed document confirm that he had no experience with shear wave techniques. The person stated that this information was made known to the Level III before he was certified. The requirements of ANST-TC-1A were not met in the case of this individual. The NRC CAT inspector was informed by the licensee that this person had not performed any ultrasonic work for B&R.

c. Interviews

Twenty persons were interviewed for determining their understanding of procedures, and their ability to perform the operations for which they were certified. Each person interviewed appeared to have a good attitude toward management and procedures. They all had a current copy of procedures and were very open and willing to discuss their assignments.

d. Work in Progress (Method Demonstration)

Observations of 21 separate nondestructive examinations were performed. Of the 21, nine were radiographic, one ultrasonic, and eleven liquid penetrant. Of the nine demonstrations in radiography, two were field setups, three were for welders' qualification, one for darkroom procedures, and three for in-process film viewing.

(1) Radiography

In all cases, the personnel demonstrated a good understanding of how to use the equipment, and how to perform the nondestructive examinations.

(2) Ultrasonic

One person certified at Level II was asked to conduct a calibration procedure for 3/4-in. plate. The calibration was performed satisfactorily.

(3) Liquid Penetrant

All personnel performed in a satisfactory manner except in their understanding for contamination of the penetrant application by brush. This is not considered a major problem.

e. NDE Equipment Calibration and Material Verification

Over 47 items of equipment and materials were checked for calibration, certification and compliance with established requirements. They included:

8 ultrasonic instruments
4 densitometers
15 cassetts
3 survey instruments
4 density strips
3 Ir192 decay charts

The items reviewed satisfied the specification and procedural requirements.

7. Review of Welder Qualification

From the sample piping runs inspected, welder identification numbers noted on piping welds were selected and the welder performance qualifications records reviewed for compliance to WES-031, "Specification for the Qualification of Welders and Operators".

The welders whose qualifications were reviewed are identified below by their assigned symbols:

AFK	AWJ	AIM
AWD	AUA	BIG
AHX	APL	AHK
AHF	AFO	ARP
AGM	BCO	BGU
ABR		

A review of WES-016, "Schedule of Standard Test Welder Qualification Matrix and Welder Performance Qualification Log" was conducted. WES-016 specifies the various weld tests for qualification and requalification of welders. A review of the welder qualification matrix, listing the cross-matrix of the welding procedures applicable to each welder, was also conducted to ensure that the essential variables for welder qualification in accordance with ASME Section IX, were not violated.

No deficiencies were observed in the welder qualifications reviewed.

8. Review of B&R Welder Qualification Program

B&R has instituted a program whereby the weld engineering unit utilizes welding technicians in the field to oversee and assist welders in the conduct of their work. Additionally, tests for qualification, (both the types of tests administered to newly hired welders and to welders being upgraded) exceed the requirements of ASME Section IX. Furthermore, B&R has implemented a program to qualify welders by radiographic testing rather than mechanical testing per ASME Section IX. Section IX of the ASME Code permits either radiographic or mechanical testing. Radiographic testing normally is more difficult to pass, thus requiring a higher skill level. No discrepancies were observed during the review of this program.

9. Summary - Welding and NDE Activities

Overall, the B&R program for welding, welders qualification, NDE and general training activities appears to be effective and well administered. This observation is supported by visual examinations, observed NDE results and practices, witnessing field welds in process and the general level of workmanship demonstrated.

Findings in the HVAC area with respect to undersize welds, weld inspection practices and lack of adequate documentation indicate serious QA/QC deficiencies for that particular work.

BROWN & ROOT FILM REVIEW

TABLE IV - 1

RT NUMBER	DRAWING NUMBER	CLASS ASME	WELD NUMBER	MINIMUM DENSITY	MAXIMUM DENSITY	MINIMUM PENETRA-METER DENSITY	MAXIMUM PENETRA-METER DENSITY	NUMBER OF FILM	REMARKS
24555	CS-1-RB-30	2	18-1	---	ok	---	---	8	Insufficient fusion rejected on original film, but
24555R	CS-1-RB-30	2	18-1	---	ok	---	---	8	was missed on repair shot. NCR written, subsequent
24555R	CS-1-RB-30	2	18-1	---	ok	---	---	2	RT confirmed finding.
4162	MS-1-RB-018	2	4R2	---	ok	---	---		Low density noted. NCR prepared by B&R. UT verified area to be 0.014 in. under minimum wall. condition had been accepted by licensee.
29030	FW-2-RB-020	1	1A	---	ok	---	---	10	Indication of incomplete fusion and aligned linear porosity not marked. Verified by RT. NCR written by B&R.
28699	CC-2-AB-018	2	4R1	---	ok	---	---	6	Indication of incomplete fusion not marked on 28669. Next repair shot of weld showed same incomplete fusion and was caught by different interpreter. This film (28669) and 29030 was misread by same interpreter.
20619	CS-1RB-028	2	5-1	2.72	---	3.34	---	6	Film density below minimum in area of interest.
29018	CS-2-AB-091	2	1R	1.87	---	---	---	2	Low density.

V. CIVIL AND STRUCTURAL CONSTRUCTION

A. OBJECTIVE

Determine by review of documentation and by independent evaluation of completed work, whether work, inspection, and test activities relative to the civil engineering area were accomplished in accordance with project specifications and procedures.

The specific areas evaluated included concrete placement, concrete testing, soil inspection, protective coating, containment liner, and structural steel installation activities.

B. DISCUSSION

1. Concrete Placement

This area of inspection was initiated by a review of the procedures delineated in the project concrete specification and the "Civil Inspection Manual." As there was little or no work being performed in this area, the evaluation of the concrete placement program was limited to a document review of completed work activities.

Five concrete placement record packages were reviewed. The placements reviewed were as follows:

PLACEMENT	DATE
201-8805-01	9/18/79
201-4885-018	7/18/80
002-E778-052	5/06/80
201-4823-008	9/21/79
105-9865-002	9/15/80

The NRC CAT inspector attempted to correlate all related documentation reviewed to the above concrete placement records. This related documentation included the following inspection and test records:

Cadweld Inspection Records

Cadweld Sleeve Inspection Records

Cadweld Splicer Qualifications

Cadweld Splice Testing Reports

Reinforcing Steel Inspection Reports

Miscellaneous Steel/Embedment Inspection Reports

Concrete Inspection Records

Curing Inspection Reports

In-Process Test Records

Additionally, records involving associated grout and pressure grout placement, were reviewed. Five "Compressive Strength of Cores" and five "Defective Concrete Placement" records were reviewed and compared to the applicable Nonconformance Report (NCR).

In general, the records reviewed reflected that concrete placement activities were performed in accordance with the site procedural requirements and the licensee's FSAR commitments.

2. Concrete Testing

A review of the procedures included in the "Civil Testing Laboratory Manual" was performed. The evaluation of the concrete testing program was limited to a review of completed testing activity documents.

Samples of various civil testing laboratory inspection records were selected. These samples included:

Mix Design Data (Two Mixes)

Compressive Strength Tests

Selected Aggregate Tests

Selected Water Tests

Related Nonconformance Reports

Additionally, certifications for cement, air entrainment, aggregate, and epoxy grout were reviewed. Reinforcing steel and miscellaneous steel certifications were similiarly reviewed.

During the review of these various test reports, it was discovered that no mix uniformity tests had been performed to the commitments contained in Section 3.8.1.6 of the FSAR. Paragraph 5 of this section, "Construction of Concrete" requires that concrete construction, including mixing, be in accordance with CC-4200 of ASME-ACI-359. Section CC-4223.2 of this document, "Operation of Mixers" states, "The range of mixing capacities and corresponding mixing times for all mixers shall be determined by the performance of mixer uniformity tests as specified in ASTM C94, "Specification of Ready-Mixed Concrete". Table CC-5200-1 defines the testing frequency for these required tests. The licensee could provide no evidence that these tests had been performed. Thus, tests to verify proper operation of the concrete mixers were not performed during concrete construction.

3. Soil Inspection

Ten soil inspection test records were reviewed and found to have been performed in accordance with site procedural requirements. It was noted that a number of these tests required several retests, but acceptance criteria and test performance were noted to be in accordance with program requirements.

4. Protective Coating

Three protective coating application inspection records and the associated adhesion tests were reviewed. One in-process protective coating application was observed.

During this portion of the review, NCR C-650 was reviewed relevant to protective coating applications. This NCR documented deficiencies relevant to a safety-related concrete placement. The latest revision of the NCR required the application of protective coatings over the concrete repairs, but deleted the requirements for the applicable adhesion test. Licensee representatives indicated this area would be reviewed under an inspection "back-fit" program for protective coating application. However, since this program had not been initiated at the time of this inspection, licensee representatives assured the NRC CAT inspector that this matter would receive appropriate review.

5. Containment Liner Installation

Procedures for the installation of the containment liner are defined by the "Chicago Bridge and Iron (CB&I) Handbook"; specifically, Book 2, Section IIIa and Section IIIb (Contract 74-2427/28U). Three separate traveler packages were reviewed to these procedures.

Samples were also selected from the following files:

Vendor Material Certifications

Visual Inspection Reports

LPT Examination Reports

MPT Examination Reports

UT Examination Reports

*Radiographic Inspection Reports

*Actual radiographs were reviewed and are documented in the Welding/NDE section, Section IV of this report.

The "CBI Nonconformance Control List", and the reference to the applicable repair checklists were compared. "CBI Request for Acceptance of Nonconformity as a Deviation" was also reviewed.

The records reviewed reflected that the containment liner installation activities were performed in accordance with the site procedural requirements.

6. Structural Steel Installation

Procedures delineated in the "Non-ASME Mechanical Inspection Manual" related to structural steel installation activities were reviewed. Four structural and miscellaneous steel installation inspection records were reviewed.

One portion of an installation was observed in the field. Application of traceability, where applicable, was noted. Documentation reviewed included a selected sample of:

Receiving Inspection Reports

Material Requisition Requests

Applicable Certified Mill Test Reports

Applicable Certificates of Compliance

Fabrication Traveler Summaries

Applicable Design Changes and Nonconformances

Documentation reviewed and the activity observed reflected that structural related activities were performed to the site procedural requirements and the licensee's commitments.

VI. PROCUREMENT, STORAGE AND MATERIAL TRACEABILITY

A. Objective

The objective of this portion of the inspection was to examine on-site procurement, receipt, storage, maintenance and traceability of safety-related equipment and material to determine the adequacy of the licensee's program relative to these activities.

B. Discussion

The approach used to perform this part of the inspection was to tour the site and observe construction activities in progress. Various site personnel were interviewed and samples from different disciplines at various stages of work were selected. Delivered equipment and material at locations in storage or installed in the plant were also inspected. Applicable documentation relative to these activities was also reviewed.

Organizational charts and procedures were reviewed and discussed with site personnel. Offices and other site facilities were toured and examined, including temporary offices, warehouses, outside lay-down areas, and the plant areas of Units 1 and 2.

A selection of 71 samples was made for procurement and storage consideration from mechanical; electrical; civil/structural; instrumentation and control; heating, ventilation and air conditioning (HVAC); welding and miscellaneous categories. In addition, 73 samples were selected specifically for material traceability, including 58 weld joints, each involving two materials to be welded with one or more weld filler materials.

The following describe the results of inspection in the areas listed.

1. Procurement and Receiving

A total of 71 purchase order files for safety-related equipment and material were examined. A detailed inspection was made of 35 samples. Referenced engineering specifications, quality requirements, submittals, approved-vendor status, revisions, and other aspects were reviewed.

Quality Control (QC) authorizations to ship from vendors' plants and on-site QC receiving inspection documentation were examined. The receipt of required material certifications was examined.

Records reviewed reflect that procurement and receiving activities were performed in accordance with procedural requirements. It was noted that the computerized system implemented at the site provided adequate control of vendor submittals and engineering approval of test reports and data.

2. Storage and Maintenance

a. Storage Facilities - General

Warehouses and lay-down areas for Class A, B, C, D and E storage levels were examined. The Class A storage space requiring temperature and humidity control was found to be within control limits. Discussions with warehouse personnel revealed back-up provisions to maintain control in event of a site power outage.

Weld rod storage areas in Warehouse A and ovens in Field Weld Rod Room #2 were examined and found to be maintained within required temperature limits.

Storage facilities observed and records reviewed reflected that the identified storage facilities comply with site procedural requirements.

However, a lack of control over two unmarked areas apparently used as scrap yards was discovered. These areas and contents therein were as follows:

(1) Numerous piping, valves and other items were identified on the ground in a fenced area with the gate removed on the East side of the Pipe Shop. No signs identifying this area were observed.

(2) Numerous cables, motors and other items were found on the ground in an area with no enclosure on the North side of the Electrical Lay-down Area. No signs identifying this area were observed.

The observed lack of control of these two areas does not meet NRC or site procedural requirements for the control of equipment and material.

b. Storage in Warehouse Buildings

The storage of equipment and material in storage bins and lay-down areas within warehouse buildings was examined.

Activities observed and records reviewed reflected that storage activities in warehouse buildings were performed in accordance with site procedural requirements.

c. Storage in Outside Lay-Down Areas

The storage of equipment and material in outside lay-down areas was examined.

Corrosion, dust and dirt were noted on a number of safety-related items due to the lack of covers and/or protective coatings. For example, 128 ITT-Grinnel hanger struts and approximately 400

NPSI hanger struts, with associated bolts and nuts, were noted in outside lay-down areas north of Warehouse A. Nuts, bolts and bearing pins were noted to be very rusty. Bearings were noted to be corroded and dirty. Specific samples inspected were:

(1) The nut and threaded portion of the strut was corroded relative to ITT-Grinnel Hanger Strut, Serial No. E3473, ID No. E-TZ-040, Class 2. Bearing pins and retainer rings were corroded. Bearings were dry and corroded.

(2) The bolts, the nuts and the bearing pin for NPSI-Hanger Strut, CP-0046A, ID No. SI 2045418542R, Class 2 were corroded. The bearing was dry, corroded, and covered with dust.

(3) Corrosion was noted on outside of the Joseph Oat Corp. Automatic Nuclear Strainer, CP-0029A, Serial No. 2308D, 1977, Zurn Tag No. CP2-SWSRAU-02, Zurn Serial No. 6250. Corrosion was also noted on similar equipment stored in a nearby location.

These examples indicate a failure of the licensee to satisfy the FSAR commitments and to properly follow site procedural requirements for protection of material and equipment in storage.

d. <u>In-Place Storage of Equipment</u>

The storage of equipment in place in the CPSES plant was inspected. Corrosion was noted, and some wood, metal and paper trash were noted adjacent to safety-related equipment. Specific examples noted were:

(1) The Motor Operated Valve, Serial No. 43554, Tag No. GGC302BGMC, Safeguards Bldg.-2, Elevation 790 ft. was observed to be without a protective cover. The drive mechanism was noted to be dry.

(2) The Auxiliary Feedwater Pump and Motor, Pump CP2-AFAPMD-02, and Motor CP2-AFAPMD-02, were not covered. Corrosion was noted on the base and wood, metal and paper trash were noted on and around the base.

(3) The intake filter of the Component Cooling Water Pump Motors CPA-CCAPCC-01M, and CPI-CCAPCC-02M were clogged with foreign materials and debris, thus restricting the air flow to the motor.

(4) Construction materials were present on the Residual Heat Removal (RHR) Pump Motors, TBX-RHAPRH-01M and TBX-RHAPRH-02M. Oil was observed to be dripping from the inside of one RHR motor casing.

The examples of improper storage of installed equipment mentioned above represent the licensee's failure to satisfy the site storage requirements.

e. Maintenance

The activities to control and perform maintenance by the millwrights for mechanical equipment, and by the electricians for electrical equipment were reviewed. A centralized card record system is used by each group. Generic maintenance schedules are applied where applicable, and additional instructions are obtained from the appropriate discipline engineer when needed. For each piece of equipment requiring maintenance, a card listing the maintenance work and schedule is used. A QC representative verifies the work and signs after each maintenance activity has been completed on the equipment. A number of maintenance record cards were reviewed, and no deviations were noted.

The informal manner (often by telephone) of identifying equipment requiring maintenance, particularly special maintenance to comply with vendors' instructions, was questioned by the NRC CAT inspector. The actual maintenance work and schedule are specified by discipline engineers for use by the crafts, but there was concern that required maintenance may be omitted from items in storage at the plant without a more formal system of control. Similar concerns identified by the licensee relative to maintenance requirements and scheduling of maintenance are discussed in the Quality Assurance section (Section VIII) of this report. All maintenance records reviewed indicated maintenance was performed to the requirements in accordance with the specified schedule.

In addition, a lack of adequate maintenance procedures to protect safety-related equipment from corrosion and/or other damage after installation and before turnover to TUGCO for operation was identified. During a tour of the plant, extensive corrosion was noted on the tube support/spacer plates of a Unit-1 Containment Spray Heat Exhanger that had the outer shell removed for an internal modification. Discussions revealed that the licensee was aware of the corrosion condition. There had been a time delay between the installation of the heat exchanger and the turnover to TUGCO. Thus, the Nitrogen blanket required prior to piping installation hookup had been deleted at the time of piping hookup, and no protection against internal corrosion had been applied after piping hookup. This problem led to an examination of the two heat exchangers for Unit 2 by the NRC CAT inspector.

The Unit 2 Containment Spray Heat Exchangers Purchase Order (P.O.) CP-0050, Joseph Oat & Sons, Inc. vendor storage and installation instructions were reviewed. It was noted that a Nitrogen blanket on the shell side (safety-related Class 3) was specified at 10 psig, to be checked monthly, for moisture prevention. No instructions were provided for protection after installation hookup to piping. Site maintenance cards maintained by the millwrights called for checking the Nitrogen blanket weekly, but no instructions were provided for protection after installation hookup. Maintenance cards for the two Unit 2 heat exchangers revealed the following:

(1) For heat exchanger CP2-CTAHCS-02, site maintenance of Nitrogen blanket was deleted 4/6/80 at installation when opened for piping installation hookup. Thus, this heat exchanger has not been under a nitrogen purge or any other protection for over 2½ years.

(2) For heat exchanger CP2-CTAHCS-01, site maintenance of Nitrogen blanket was deleted 11/5/81 when opened for piping installation hookup. Thus, this heat exchanger has not been under Nitrogen blanket or any other protection for over 1 year.

Licensee personnel are aware of this problem and are investigating corrective actions to remove any corrosion and prevent future corrosion as the heat exchangers are tested and placed in operation by adding a rust preventive to the liquid involved, and possibly applying a chemical cleaning process. Consultations with chemical engineering personnel of Dow Chemical Company and Westinghouse (the NSSS vendor) are in progress to resolve this problem. The licensee stated that a solution is anticpated after the forthcoming Hot-Functional Test on Unit 1 has been completed, and the internal corrosion condition of the Unit 1 heat exchangers is better defined.

3. Traceability

Significant effort was devoted to discussions and examinations of samples and records pertaining to traceability of in-place material back to engineering drawings and specifications and to procurement sources and heat numbers. Generally, it was noted that the licensee has placed a high degree of emphasis on traceability. A total of 73 samples were examined for traceability, including:

58 Safety-related piping weld joints, each involving two materials and one to three weld filler materials
1 Class 1, safety-related structural weld joint
4 Lots of materials for safety-related hangers
1 Lot of HVAC structural support material
2 Lots of HVAC duct material
3 Multi-lot samples of weld filler material
1 Lot of safety-related fastening devices
3 Lots of miscellaneous shim stock, and hanger strut hardware

Specific results of the inspection regarding the traceability area are as follows:

a. Safety-Related Piping Weld Joints

A total of 58 piping weld joints were selected for traceability. Of these, 42 were selected by observation of completed work in the plant, and the balance included welds identified by other CAT team members in the applicable sections of this report.

During early examination of 27 sample weld joints in the plant, 4 heat numbers could not be found on the pipe, but records were found to be complete. Further examination of the joints in the plant resulted in locating the 4 heat numbers that were not readily located. Discussions with licensee personnel revealed that QA reviewed spool pieces at the fit-up stage and checked all materials for correctness and traceability to heat numbers prior to welding, and again after welding before QC signatures were applied to the records.

Also, during the examination of records for sample weld joints, record discrepancies were noted for two weld joints. A review of the welds and records involved revealed that design changes had been made, and that, while the actual welds were correct, the documentation had not been accurately changed. The two record discrepancies were corrected by a Component Modification Card (CMC) change, Serial No. 87228, initiated 2/1/83, and a Manufacturing Record Sheet (MRS) change, Serial No. MI-612, dated 2/22/83.

Sample results of traceability examinations of weld joints are as follows:

(1) Weld No.: W-21-1 (shop weld - pipe to valve)
Welder: BYL
System: Service Water
Drawing: SW1AB14, Spool 7Q3
Class: 3
Pipe: Heat No. N5894
Valve: Heat No. AJ330
Weld Rods: Heat Nos. 746100 and 762550

(2) Weld No.: W-8-1 (shop weld - pipe to pipe)
Welder: AMA
System: Chemical Volume Control
Drawing: CS1AB003, Spool 3Q2
Class: 2
Pipe: Heat No. 713876
Pipe: Heat No. 28970
Weld Rods: Heat Nos. 4282R308L and 463638

(3) Weld No.: FW-1A (field weld - pipe to weld-o-let)
Welder: ABT
System: Containment Spray
Drawing: CT1SB023, Spool 1Q2
Class: 2
Pipe: Heat No. 280385
Weld-o-let: Heat No. 320J Weld
Rods: 463638 and 546506

(4) Weld No.: W-1 (shop weld - pipe to flange)
Welder: AGZ
System: Safety Injection
Drawing: SI15B11, Spool 1Q2
Class: 2
Pipe: Heat No. BWL16M
Flange: Heat No S4J2L
Weld Rod: Heat No. C3220E

(5) Weld No.: W4-1A (shop weld - pipe to pipe)
Welder: AXP, ATX
System: Chemical Volume Control
Drawing: CS1AB005, Spool 12Q2
Class: 2
Pipe: Heat No. 51891
Pipe: Heat No. M-2253
Weld Rods: Heat Nos. 4282R and 463638

(6) Weld No.: FW-16B (pipe to 45° elbow)
Welder: BCJ, ATZ
System: Safety Injection
Drawing: SI1SB004, Spool 10Q2
Class: 2
Pipe: Heat No. 28970
45° Elbow: Heat No. U4LLH4
Weld Rods: Heat Nos. 463552, 463638, 546506

(7) Weld No.: FW-12A (pipe to pipe)
Welder: AGR
System: Safety Injection
Drawing: SI1SB004, Spool 4Q2
Class: 2
Pipe: Heat No. M0635
Pipe: Heat No. M0623
Weld Rods: Heat Nos. Consumable insert 4282R308L and rod 463638

(8) Weld No.: FW-18A (pipe to valve)
Welder: BCJ, AGR
System: Safety Injection
Drawing: SI1SB004, Spool 6Q2
Class: 2
Pipe: Heat No. M0623
Valve: Heat No. (S/N) 85740038
Weld Rods: Heat Nos. Consumable insert E3047T316 and rod 746100

(9) Weld No.: FW-10 (field weld - pipe to 45° elbow)
Welder: AGN
System: Containment Spray
Drawing: CT1SB023, Spool 7Q2
Class: 2
Pipe: Heat No. M0624 45°
Elbow: Heat No. U4KCH
Weld Rod: Heat No. C3220E

(10) Weld No.: FW-7A (field weld - pipe to 45° elbow)
Welder: AFN, ABT
System: Containment Spray
Drawing: CT1SB023, Spool 8Q2
Class: 2
Pipe: Heat No. M0624
45° Elbow: Heat No. U4LLH4
Weld Rods: Consumable insert 2526T308 and rod 463730

NOTE: Certifications verifying heat numbers for these samples were in the central files.

b. Class 1 Structural Weld Joint

One weld on a large structural support furnished by Westinghouse and fabricated by Teledyne Brown Engineering was examined for traceability, with satisfactory results as follows:

Weld: Mounting Plate to Shim Plate (no number assigned)
Welders: BOA, BKX, CEA, BXU
Item: Whip Restraint for Safety Injection System
Drawing: EIV-0527-0508-2, Loop-3
Class: ASME III, Class 1
Plate: Heat No. E1B0514, Mtl. ASTM-A588
Plate (Shim): Heat No. 1G0200, Mtl. ASTM-SA-36
Weld Rods: Heat Nos. 431L24S, 52592, L22580 and 421P5132
Certs: Chemical and physical certifications for plate materials and weld rods were in the records file.

c. HVAC Structural Support Material

One lot of angle iron purchased under Purchase Order No. TUSI-1148 for Bahnson Service Company (HVAC contractor) was examined for traceability, with the following satisfactory results:

Item: 140 pieces of galvanized angle iron 4"x4"x½"x20'
Spec.: Mtl. ASTM A-36; Galvanizing ASTM-A-123-78
Heat No.: 425340
Color Code applied by Bahnson: Red-Orange
Certs: Physical, chemical and galvanizing certifications were in records file.

d. HVAC Duct Material

Two lots of metal sheets purchased under Purchase Order No. TUSI-0776 for Bahnson Service Company (HVAC contractor) were examined for traceability, with the following satisfactory results:

(1) Item: 149 pieces of galvanized sheet metal 48"x120"x10 GA
Spec: ASTM A-526, G-90 coating
Heat No.: 500H3480
Color Code applied by Bahnson: Caution Yellow
Certs: Physical, chemical and coating certifications were in records file.

(2) Item: 28 pieces of galvanized sheet metal 48"x120"x10 GA
Spec: ASTM A-526, G-90 coating
Heat No.: 516N1509
Color Code applied by Bahnson: Flare Red
Certs: Physical, chemical and coating certifications were in records file.

e. Weld Filler Material

Three purchase orders (POs) for large quantities of weld filler materials were examined for traceability as follows:

(1) PO 20726 to Sandvik, Inc.

Examination of records showed traceability to specifications, QC Receiving Inspection Reports, and certifications for chemical analysis and physical tests for various lots.

(2) PO CPF-1049-S to Murex Welding Products, Agent for Airco Welding Products.

Examination of record showed traceability to specifications, QC Receiving Inspection Reports, and material certifications for chemical analysis and physical tests for various lots.

(3) PO 14920 to Arcos Corporation.

Examination of records showed traceability to specifications, QC Receiving Inspection Reports, and certifications for chemical analysis and physical tests.

f. Safety-Related Fastening Device (Stud)

A sample from the field was randomly selected. Information provided was that the item was a stainless steel stud with notations DF60, 660T and VA.

The sample satisfactory inspection results were as follows:

System: Heating and Ventilating System (VA)
Drawing: VA-X-AB-004C, Rev. 6
P. O.: 30228, Item 20
Item: 7/8"x5" Stainless Steel Stud,
Spec.: ASME SA453, Grade 660
Vendor: Texas Bolt Co. (on approved vendor list)
QC Receiving Inspection Report: RIR 13847
Certifications: Chemical and physical tests in file
Heat (Trace) No.: DF60
Code Class: 2
Material Requisition: MR-154401
Application: To attach flange of piping from Hydrogen Purge Exhaust Filter Package to flange of Heating and Ventilating System.

NOTE: "T" after 660 designates the vendor (Texas Bolt Co.)

g. Miscellaneous

(1) Two purchase orders for safety-related shim stock were examined, with the following satisfactory results:

(a) P.O.: CPF-1648-S, Stainless Steel Shim Stock
Receiving Inspection Report: RIR-19319
Certifications: Received with shipment.

(b) P.O.: CPF-1725-S, Stainless Steel Shim Stock
Receiving Inspection Reports: RIR-18899, RIR-18900 and RIR-19633
Certifications: Received with shipment

(2) Hardware and materials for a sample Hanger Strut were examined. Results are as follows:

NPSI supplied hanger.
DWG. No.: CT-2-001-406-S32R, Rev. 1
Drawing Item No.: 4-Rigid Sway Strut
Hardware and Material Identification Control Numbers (traceable to heat numbers):

Pipe - NP 288	Eye Rod - NH 631
Nut - NR204	Eye Rod - NH 631
Nut - NR 236	Bracket - NF 1287
Hex Nut - NB 280	Pin - NH 846

Activities observed and records reviewed reflected that the traceability activities were performed in accordance with site procedural requirements. Emphasis on the necessity for good traceability was apparent throughout the site organizations.

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 if inspection personnel are qualified, trained and have the organizational freedom to perform their tasks.

B. Discussion

1. Program Requirements

The Quality Control Program is defined and implemented by the Corporate Quality Assurance Manual, and by more detailed Quality Assurance procedures and instructions which are endorsed by management directive. Management and supervisor responsibilities have been described in these procedures.

The Final Safety Analysis Report (FSAR) contains implementing statements for 10 CFR 50 Appendix B and provide commitment statements to regulatory guides including NRC Regulatory Guide 1.58 (ANSI N45.2.6), which define Quality Program requirements.

Quality Assurance procedures were developed to implement these commitments. For example, QAP-2.1 defines the requirements for the training and certification of mechanical inspection personnel.

2. Program Implementation

Implementation of this portion of the program was determined from discussions with Quality Control personnel and their supervisors, from a review of inspector training, from a review of certification procedures and the inspector verification files, and from a review of the sequence of recording and permanently filing the results of inspections.

Interviews were held with 63 inspectors randomly selected from Texas Utilities Generating Company (TUGCO) and contractor organizations performing inspections on site (Brown & Root, Bahnson Services, and Grinnell). These discussion included the inspector's area of assignment, background, training and education, perception of how thoroughly inspectors were trained and prepared to perform inspections, and involvement relative to construction craft interfaces, including the presence of any form of intimidation.

Comments concerning inspector qualifications in the area of nondestructive examination (Section IV) and specific comments concerning electrical (Section II) and mechanical (Section III) inspection procedures are presented in the applicable sections of this report.

a. Inspector Qualification/Certification

(1) Inspectors were required to attend training sessions, perform independent reading of standards relative to their inspection area, and were tested with regard to this training material. Inspectors were required to participate in on-the-job training (OJT) which was verified by a senior inspector designated in writing to verify this training.

Appropriate forms and certificates were on file, in accordance with ANSI N45.2.6 requirements, attesting to the inspector's background, experience, education and training and certifying an inspection capability in particular construction activities.

(2) During the review of the training records and from interviews with supervisors, it was found that some QC inspectors were certified with less experience than required. For example:

a. Three individuals were certified Level II (L-II) as mechanical inspectors having authority to witness pump or component disassembly and reassembly with qualifying experience only in welding and nondestructive examination.

b. One individual was certified L-II as mechanical inspector having authority to witness pump or component disassembly and reassembly using education as a factor in the qualification process when the education was from a non-technical, unrelated college degree.

c. One individual was certified Level I (L-I) electrical inspector after only 3 weeks of electrical inspection experience.

d. Two individuals were certified L-I anchor bolt inspectors with less than 1 month inspection experience.

ANSI N45.2.6 requires a minimum of 6 months experience for L-I when a candidate has a high school diploma or equivalent education, and 3 years experience for L-II when a candidate has a high school diploma or equivalent education.

b. Recording Inspection Results

(1) The Inspection Report (IR) form was the document primarily used to record inspection results. A review was made of the recording, reviewing, and filing of inspection reports with the following results:

a. The FSAR and the TUGCO response to NRR Generic letter 81-01 state that TUGCO is in compliance with Regulatory Guide 1.58, which endorses ANSI N45.2.6, "Qualifications of Inspection, Examination and Testing Personnel for Nuclear Power Plants." ANSI N45.2.6, Section 3 and Table 1 provides the levels of capability for project functions and defines them as:

- L-1 capable of recording inspection, examination, and testing data and implementing inspection, examination, and testing procedure.

- L-11 capable of performing as a L-1 plus;

  Planning inspections ....
  Evaluating the validity and acceptability of inspection .... results
  Reporting inspection, examination .... results
  Supervising equivalent .... personnel
  Qualifying lower level personnel

  The requisite qualification for these capability levels is provided within Section 3 of the standard.

b. The NRC CAT inspectors found during interview and document review that:

- With a few exceptions, as stated above, inspectors were experienced.

- In the areas reviewed, QC inspectors completed and signed IRs. L-11 certified inspectors in the electrical and instrument areas of inspection reviewed the IRs, but did not document their review. In some inspection disciplines, such as mechanical (non ASME) and conduit supports experienced lead inspectors (designated L-1) reviewed the IR before it was sent to file.

  In other inspection disciplines, such as Civil QC, there were no routine reviews performed by an experienced lead inspector. In each of these cases, the reports were not signed by the reviewer.

  Document reviews revealed that inspection instructions and inspection reports were detailed and inclusive. Licensee representatives indicated that the reason for these detailed instructions and reports was that they could be completed by inspectors with no additional reviews by other inspectors or supervisors.

  The intent of ANSI N45.2.6 is that a L-11 be the inspector of record. The practices in place at the site did not ensure that this requirement was satisfied.

c. Inspector Intimidation

During discussions with inspectors it was revealed that in one section of the inspection organization threats and intimidations had been made. This information was transmitted to NRC Region IV since an investigation in this area was currently in progress. An inspector from a different inspection area reported previous threats, which resulted in the craft person making the threats being removed from the project.

Aside from the ongoing investigation, it was revealed that agressive action was taken by management to prevent inspector intimidation.

Inspectors from one section reported that they were informed not to prepare nonconformance reports. This instruction was issued by memorandum and is discussed in Section III and Section IX of this report.

VIII. QUALITY ASSURANCE

A. Objective

The objective of this review was to determine the adequacy of the licensee's Quality Assurance (QA) Program. The program was reviewed to determine if it was appropriately established in instructions and manuals; and if the construction and quality assurance effort was monitored through audits and other management actions. In addition, a sampling review of specific steps taken by the licensee regarding the oversight of contractors, control of measuring and test equipment, document control, and control of QA records was made to determine if specific parts of the program were implemented.

B. Discussion

1. Program Requirements

The QA program is defined by a management endorsed hierarchy of general directives and implemented by procedures at the corporate and site levels to control construction activities. These procedures were implemented to satisfy the licensee's Final Safety Analysis Report (FSAR) commitments.

2. Program Implementation

Implementation of this portion of the program was determined based on reviewing the organizational structure, input from other NRC CAT inspectors, the construction audit program, sampling drawing revisions in the construction work areas, and reviewing the control of measuring and test equipment.

a. Organization

The QA organization includes the site construction quality control organization which is independent from the site construction management. The quality assurance organization reports to the Vice President for Nuclear Operations, whose responsibilities include the construction and operation of the Comanche Peak Steam Electric Station (CPSES). The authority and duties of the positions involved were described in the FSAR and corporate manuals. The audit organization was located at the Corporate Headquarters in Dallas. The QA organization was found to be in accordance with NRC requirements and the description contained in the FSAR. Organizational Charts indicated that a number of staff positions were vacant and had been for an extended period.

b. Audits

The licensee's audit program was reviewed. At least 18 audits out of 60, performed between 1978 and 1983, were selected and reviewed with emphasis on the following major areas: auditor qualifications and certifications; audit planning and scheduling; audit instructions and check sheets; audit reports; audit results and followup; and the overall effectiveness of the audit program.

(1) Auditor Qualifications and Certifications

(a) The licensee qualification and certification program for auditors and lead auditors was established in QA Procedure DG1-QA-2.1 "Qualification of Audit Personnel".

(b) The certification records for ten lead auditors were reviewed. The lead auditors met the TUGCO and ANSI N45.2.23 requirements. The review revealed, however, that auditors not meeting the experience requirements for the lead auditor position had been assigned as "Acting Lead Auditor", but the limits of an acting lead auditor's authority and the guidance provided was not defined.

(2) Audit Planning and Scheduling

(a) Document reviews and interviews revealed that audit plans were developed and a system of check sheets were used as guides to the auditors to ensure that specific points were reviewed. Open audit findings were also reviewed during the audit. It was revealed that the check sheets were developed by the auditor assigned the audit or by the audit group supervisor but were not approved by the QA Services Manager.

Interviews revealed that audit schedules were developed using previous audit findings, schedules, experience, and discussions with construction site supervisors concerning construction problems. There were no trend analyses or construction schedules provided to the QA organization by the site; therefore, these important sources of information were not used in developing the audit schedule. Also, there was no QA procedure to describe the method to be used to develop audit schedules or what management approvals the schedule should receive.

(3) Audit Reports

Audit reports provided a description of the audit scope; identification of auditors; persons contacted; a summary of results and a description of any deficiencies or findings.

(4) Audit Deficiency Reporting and Follow-up

Audit deficiencies were clearly written and required timely response by the management of the audited organization. The completed deficiencies were reviewed by the audit team leader for adequacy. Deficiencies were reviewed in subsequent audits for completeness. Prompt corrective action was not always taken on audit findings (See Paragraph B.2.b.(5) below).

(5) Program Effectiveness

Although the audit program was in place, there were several weaknesses in the program that decreased its effectiveness.

(a) Audit Effort

The audit organization is located at the TUGCO offices in Dallas. All audits are performed from that location. There are eight auditors in the audit section. Although audit teams are sometimes supplemented by personnel from other sections of the QA organization, the eight member audit section is assigned to perform audits of suppliers, subcontractors at the construction site, construction activities and startup. Of the eight auditors in the audit organization, four had technician background and four had a general nontechnical background. None of the auditors assigned to the group had engineering background or experience. Interviews revealed that approximately 1200 man days were spent preparing for, conducting and reporting audits at the site in 1982. A review of the 32 audits performed in 1982 revealed that about 330 man days were spent on site performing these audits. This appears to be a small percentage of the total audit effort considering the level of effort ongoing at the site. Interviews revealed that five additional auditor positions had been authorized for more than one year but the positions were still vacant.

(b) Audit Frequency

Interviews and document reviews revealed that:

- Twelve audits of construction activities were performed in 1981. Of these, six were of engineering and administrative areas such an audits of IE Bulletins, and procurement and six were of construction field activities.

- Thirty-two audits were performed in 1982. Only nine of the audits were of construction field activities, the other 23 audits were performed of engineering activities and other support areas. Of the audits of construction field activities: one audit was performed of mechanical piping activities, one of restraint and snubber installations, two of electrical work, one of civil work, one of instrument and controls, and three of protective coatings application.

The frequency of audits of construction activities has been very low and may have contributed to the problems in the technical disciplines identified in Sections II, III, and IV of this report.

(c) Audit Effectiveness

Areas of the construction activity were audited; however, the audits did not identify major construction program problems, for example:

- Bahnson Services was audited yearly since 1980. The last audit was in April 1982. Although fabrication and installation activities and personnel qualifications were in the scope of the 1982 audit, such NRC CAT identified items as undersized welds, out of tolerance dimensional characteristics, and an inadequate structural welding inspection program were not identified and resolved.
- The electrical area of construction was audited only four times since 1980. The audits did not identify the cable separation issue as discussed in the Electrical Construction Section (Section II) of this report.

Ineffective corrective action has been taken as a result of audit findings; for example:

- Equipment maintenance was audited in August 1979 (audit number (TCP-5)). An audit finding identified that vendor instructions were not being incorporated into ongoing maintenance instructions. The July, 1981 QA audit of startup activities (TUG-5) and the June 1982 Quality Surveillance Summary, QSR-82-023, identified additional problems with ensuring that manufacturers requirements and qualification report requirements had been incorporated into the maintenance program. An October 1982 audit (TUG-14) identified the concern that equipment qualification reports were not reviewed during the process of establishing maintenance requirements. The problem was identified in 1979, and it has not been resolved as evidenced by the 1982 audit. Thus, the effectiveness of the corrective action system for audits is not effective..

The NRC CAT inspector's conclusion is that weaknesses exist in the established audit program. These weaknesses include the scheduling and frequency of audits, the lack of effective construction program monitoring, and in lack of effective resolution of some audit findings.

c. <u>QA Program Interfaces</u>

The NRC CAT inspector reviewed the QA organizations' overview of documents that prescribe actions taken by engineering, construction, and quality assurance personnel. A planned and systematic program is in place with one aspect being procedure review.

Interviews and document reviews revealed that:

(1) The QA/QC manager or a senior representative reviews all inspection procedures.

(2) The QA/QC manager or a senior representative reviews construction control procedures to ensure the proper construction-inspection interface exists.

(3) Engineering control procedures are not reviewed by the QA/QC manager or a representative of the QA organization.

The lack of proper interface with engineering may have contributed to the issues discussed in Sections II, III, and IX of this report. These issues relate to the final engineering design and the final inspection reports not being reflected in the hardware.

d. <u>Construction Monitoring</u>

A program of construction monitoring was established. The program consisted of: monitoring the ASME construction and installation activities performed by Brown and Root (B&R), and surveillance of concrete anchor bolt installations.

The monitoring of ASME construction activities consisted of a systematic review by two individuals of B&Rs compliance to approved instructions, procedures and/or drawings that implement the requirements of the B&R ASME QA manual. The monitoring was scheduled in advance and provided a review, although less formal than audit, of ongoing ASME work activities. The surveillance of anchor bolt installation was performed in accordance with TUGCO procedure CP-QP-11.2 Rev. 4. which indicates that 10 installations should be monitored each shift for each discipline. A review of the monitoring record since September 1982 revealed that not nearly that many installations were monitored. In September 1982, 35 to 40 installations were monitored. From October 1982 through January 1983, 30-40 installations were monitored each month. This is an average of monitoring one installation each day instead of ten each day.

Interviews revealed that, although the installation activity had decreased, inspectors were assigned to inspect completed work and that the surveillance requirements of the procedure were not being met. The anchor bolt monitoring program is not being performed as required by the implementing procedure.

e. Document Control

Document control includes the control of all documents associated with the design and construction program. This includes drawings, procedures, specifications and manuals. Drawing control was selected for review as an indication of the implementation of document control.

Controls had been established to formally log drawing and revision numbers into a card system and subsequently into the computer. Document control group personnel reproduce the drawings and revisions for distribution. Distribution is made to a central pickup area. Each major construction organization has assigned personnel to distribute the drawings from the pickup point to drawing control points and to work areas throughout the site. A master drawing revision list is issued every three months and each organization is required to audit their areas to determine that all drawings are of the correct revision.

The control of drawings was reviewed in the control and distribution centers for the pipe shop, welding engineering and the electric shop. In addition to these office areas, drawing control was reviewed in construction work areas of the auxiliary building, the cable spreading room and the control room.

These reviews revealed that:

(1) The drawings in the control and distribution centers were of the latest revision.

(2) On February 3 and 15, 1983, in construction work areas, out of 70 drawings checked by the NRC CAT inspector, 16 were not of the latest revision.

(3) On February 22, 1983 construction areas were toured by the NRC CAT inspector. It was found that improvements had been made in drawing controls. One drawing to an out-of-date

revision was found during the tour, however there were still drawings in the areas that had damaged or missing title blocks.

Interviews with TUGCO personnel revealed that drawing control had been an ongoing problem that required frequent attention. Based on this sample, document control still is weak.

f. Control of Measuring and Test Equipment

The system of control of measuring and test equipment was reviewed. The review included equipment calibration, issue, and recall.

During a tour of the calibration facility the following areas were reviewed; the use of certified equipment during the calibration process and the relationship of the certified equipment to national standards; the storage and separation of calibrated equipment from equipment out of calibration or defective; and the general condition of the facility.

It was found that the equipment used during calibration was traceable to national standards and that equipment was properly stored. Other comments concerning the facility and some specific instruments checked are contained in the Electrical Construction Section (Section II) of this report.

The methods of control and issue of electrical cable crimping tools in the storage area, and condition of tools in the electrical construction tool issue station was reviewed. The storage area and the control of termination equipment was satisfactory.

The equipment recall was computerized which allowed prompt notification of craftsmen and inspectors when the tool calibration due date was approached.

The control of measuring and testing equipment appeared satisfactory.

IX. DESIGN CHANGE CONTROLS AND CORRECTIVE ACTION SYSTEMS

A. OBJECTIVE

The purpose of this assessment was to review program implementation with emphasis on actual safety-related hardware installed in the field, as well as records including design change controls and any identified nonconforming conditions related to installed hardware.

Samples were selected in the technical disciplines to check program implementation, as well as to ensure design control, design interface, and design verification procedures satisfy NRC requirements and licensee commitments. Additionally, a sample of records were reviewed to determine how nonconforming conditions were identified, dispositioned, and the extent to which corrective actions were taken.

B. DISCUSSION

1. Design Change Control Program

a. Organization

The organization of the general site engineering, construction, and procurement efforts were defined in procedure CP-EP-3.0, Rev. 5. By this procedure, the Engineering and Construction Manager is responsible for the Comanche Peak Steam Electric Station (CPSES) design, engineering, and procurement. These activities are normally delegated to Gibbs & Hill, Westinghouse, and other contractors/vendors. However, Texas Utilities Services, Inc. (TUSI) has been designated by Texas Utilities Generating Company (TUGCO), the licensee, to retain overall responsibility for these activities and to perform design functions as necessary.

The TUSI Project Engineering Manager is responsible for the general direction of engineering activities. These duties and responsibilities were implemented through the Comanche Peak Project Engineering (CPPE) staff and organizational structure managed by the Comanche Peak Project (CPP) Discipline Engineers. The CPP Discipline Engineers were responsible "to administer an orderly design change program which complements construction and assures design adequacy".

b. Discipline Engineering Reviews

(1) Civil Engineering

Most of the design changes in this area were processed via Design Change Authorization (DCA). Previous design changes processed prior to the current procedural requirements were processed via the Design Change/Design Deviation Authorization (DC/DDA). A total of thirty of both of these types of design changes were reviewed. Ten, initiated as a result of a nonconforming condition, and were reviewed and compared to the associated nonconformance report (NCR). Ten were traced by the NRC CAT inspector to the latest drawing and/or specification. The final ten were initiated based on a licensee field inspection effort. These last ten were compared by the NRC CAT inspector to the drawing and/or specification in effect at the time of the inspection. Design changes reviewed in this area were found to be processed in accordance with procedural requirements.

The NRC CAT inspector noted that some original designs in this area were processed via Component Modification Card (CMC). The CMC, which is a design change document, was processed in accordance with design change control procedure CP-EP-4.6, Rev. 7. However, these CMCs showed no evidence of Gibbs and Hill review, which is necessary to satisfy ANSI N45.2.11 requirements. ANSI N45.2.11, "Quality Assurance Requirements for the Design of Nuclear Power Plants" requires that field changes be justified and subjected to design controls commensurate with the original design. The responsible licensee engineering representative indicated these CMCs would be treated as a field change, and hence, would receive Gibbs & Hill review to satisfy ANSI N45.2.11.

A selected sample of Engineering Evaluation of Spacing Variance Reports (EESV), used in pipe support base plate installations, was reviewed. The expansion anchor bolt installation program was reviewed to the requirements of NRC Bulletin 79-02, Rev. 2, "Anchor Bolt Base Plate Flexibility Analysis." It was found, from the samples reviewed, that the licensee's program satisfies the Bulletin's requirements.

(2) Field Structural Engineering

Most of the engineering effort in the TUSI Field Structural Engineering Group at the time of this inspection involved design of conduit supports. The original design of these supports was performed by Gibbs & Hill to Revision 8 of the 2323-S-910 drawing "package". From this point, the design effort was delegated to the TUSI organization at the site. Installation was coordinated between engineering and construction, with installation performed to the 2323-S-910 "packages". After installation, the support design was then sent to Gibbs & Hill for review to satisfy ANSI N45.2.11 requirements. TUSI personnel prepared no DCAs to the "S-910" drawings, only CMCs where design or design changes were necessary.

Location of conduit supports were determined by the use of criteria established from "Location of Support" (LS) drawings and the requirements of the site Electrical Specification ES-100.

Cable raceway supports were installed to Gibbs & Hill original design drawings. TUSI personnel issued DCAs to the support drawings for generic design changes, such as the addition of a hanger to the raceway configuration. They issued CMCs for design changes affecting an individual support.

The NRC CAT inspector reviewed two structural calculations for cable tray and conduit supports with the responsible licensee's representative. The design input, verification, and output (information provided by the Field Structural Engineering Design Review Log) were reviewed. Stress levels, as defined in FSAR Section 3.8.3.3.3.1 and FSAR Section 3.8.4.3.3.1 were properly incorporated into the support designs reviewed.

The NRC CAT inspector sampled and reviewed sixty CMCs and fifteen DCAs. About thirty of the CMCs and DCAs reviewed had not received the appropriate review and approval by the original designer, Gibbs & Hill as required by ANSI N45.2.11. Installations to the design document had been performed or were in-process, but the design document had not been 'final' reviewed. A review of the Gibbs & Hill "CMC Master Index" (structural) indicated there were on the order of four-to-five thousand of such changes that had been generated but had not yet been "final" reviewed by Gibbs & Hill.

It was determined that proper verification of such changes might ultimately be accomplished. However, the volume of CMCs and DCAs remaining to be reviewed by the original designer, as well as those designs that have as yet to be performed in the structural area, is of concern to the NRC CAT inspector. The concern involves the adequacy of review which will be provided considering the approaching September, 1983 Fuel Load Date.

During this same review of CMCs and DCAs, there was evidence of a problem relevant to what revision of the design document a component or an activity has been inspected. CP-CPM-6.10, Rev. 6, "Inspection Item Removal Notice Form" addresses subsequent inspection following removal of an item, but not for addition of an item to a component. Furthermore, construction and/or engineering rather than quality control determine when an item is to be reinspected or when some type of inspection is required.

The NRC CAT inspector determined that inspections performed and completed were not always to the latest issued design document. For example, supports for twenty cable tray and conduit installations were examined. Of these twenty, twelve were not "final" inspected to the latest issued design document, even though records in the QA vault indicated "final" inspection had been performed. Later CMCs covering design changes existed for all twelve of these installations. In addition, the licensee's QC inspections were performed in six instances to CMCs with earlier revisions than the latest revision issued and in effect <u>at the time the inspection was</u>

performed [Similar conditions were discovered and discussed in the Electrical and Instrumentation Construction Section of the report Section II)].

ANSI N45.2.11, Section 8, states that procedures shall be provided which "assure that the impact of the change is carefully considered, ...and information concerning the change is transmitted to all affected persons and organizations." As a result of the procedures and records reviewed relative to this area, the NRC CAT inspector considers existing procedures have not assured that the information concerning the change is transmitted to the appropriate organization; i.e., the Quality Control organization responsible for the inspection of the cable tray and conduit supports. This was substantiated by records in the QA vault.

(3) Electrical Engineering

a. Program Review

Original design in the electrical area was performed by Gibbs and Hill. Design changes were processed via the DCA in this area.

The NRC CAT inspector reviewed approximately thirty DCAs in the electrical discipline. As was the case in Field Structural Engineering, reviews to be completed by the original designer in accordance with ANSI N45.2.11 are usually only performed after construction or installation has been performed. DCAs reviewed were processed in accordance with CP-EP-4.7, Rev. 7. During this same review, the NRC CAT inspector also noted a problem similar to that in the Field Structural Engineering relevant to what revision of the design document a component or activity has been inspected. As a result, the NRC CAT inspector proceeded with a review of the site "Design Change Verification Group".

b. Design Change Verification Group Review in the Electrical Area

CP-QP-15.4, Rev. 3, "Design Change Verification" provided criteria...(for) review of design and inspection documents to assure incorporation of design changes into the physical plant.

This procedure required that design documents be reviewed by the TUGCO Design Change Verification Group (DCVG) to ascertain whether or not incorporation of the latest design document had taken place, and if further inspection was required the DCVG "shall perform" it.

Also, per procedure, the DCVG was required to select a representative sample of design changes per drawing (thirty percent or three design changes, minimum, whichever is greater) for verification.

A review by the NRC CAT inspector of the "DCA Verification Log" indicated that of some four-hundred eleven design changes verified, fifty-three had not been incorporated into the actual design documents used for QC inspection. Due to the high number of unincorporated changes, licensee representatives indicated that the procedure would be changed from the current thirty percent sample to a one-hundred percent sample.

However, the NRC CAT inspector had other additional concerns with the licensee's program at the time of this assessment. These were as follows:

- With the approaching Fuel Load Date, and the numbers of DCAs to be verified, the thoroughness of the review by DCVG may be jeopardized due to pressures from the construction completion schedule.

- Procedures for the DCVG in some cases required physical verification by inspection of design incorporation. It was unclear as to who was to perform the required inspection, a DCVG individual or a QC inspector. Additionally, licensee representatives could not assure the NRC CAT inspector that the individual who would perform the inspection function would satisfy the applicable qualification requirements as defined in ANSI N45.2.6, "Qualification of Nuclear Power Plant Inspection, Examination, and Testing Personnel" in accordance with the licensee's FSAR commitments.

- Unsatisfactory conditions discovered during the verification process were not documented on an NCR but rather on a "Request for Information of Clarification" (RFIC) form since conditions were considered to be only "potential" nonconformances. As the component or activity may not have received the "final" inspection, the licensee stated: "it was not considered to be a nonconformance."

- Documented deficiencies relative to installation were not documented on the Master Punchlist for "turnover", as the licensee representatives indicated only NCR items were referenced on the master punchlist. These deficiencies were applied to a separate "deficiency" list, and then were tracked by the DCVG.

- It appeared from this review that the DCVG did not include in their review electrical systems "turned over" for test or electrical systems which have been energized. The NRC CAT inspector could determine no basis why these systems should be excluded in the sample for design verification.

The responsible licensee representatives, during the discussion of these inadequacies, commited to revise the program by the addition of a tracking system which would correlate the affected inspection documentation to the latest related design change document. They further reiterated their intent to ensure that all safety-related components and/or activities have been or will be inspected to the latest design document to satisfy NRC requirements.

At the time of this inspection, as no work has been essentially fully completed from the design and construction standpoint for these areas, the NRC CAT inspector cannot determine from a sampling review whether or not the activity or installation was performed to the approved design and that an adequate inspection was performed to this approved design. However, from a sampling review of documentation from the program in-place, including the "final" quality inspections and the latest design documents, the existing design verification program would not satisfy the licensee's FSAR commitments [Further discussion of inspection documentation is in the Electrical Construction section of this report (Section II.B.8)]. Whether or not the licensee's proposed revisions to the program are adequate to accomplish the desired objective in the alloted time span cannot be determined.

(4) Instrumentation Engineering

Instrumentation installation activities and documentation reviewed by the NRC CAT inspector indicated that these installations had received an appropriate inspection to the latest design document. Supports for instrumentation were usually designed in-place. From a review of fifteen design change documents, the numbers of design changes as compared to the installations completed were considerably less than those in other discipline areas reviewed.

However, adequate engineering reviews to the design changes were usually made after installation, similar to the process described relative to other installation activities discussed thus far in the report.

(5) Piping Support Engineering

Two contract pipe design groups (ITT-Grinnel and NPSI), and the site Pipe Support Engineering (PSE) Group, were responsible for the design of large bore pipe supports. These three groups prepare a design for each pipe support. This design is then incorporated into the "Brown and Root Hanger Drawings (BRHLs)", which are the drawings used for installation purposes. If the pipe support installation personnel determine that a support cannot be installed as designed, PSE field engineers are notified and make changes as necessary to produce a design that can be installed.

When the pipe and some of its supports have been installed, the Quality Control program starts its "as-built" inspection, documenting the as-built dimensions of the pipe and installed pipe supports. The drawings for the pipe and pipe supports are revised to reflect the as-built configurations, and are stamped "as-built verified." When a significant portion of the supports on the length of pipe have been "as-built verified," a package is assembled and forwarded for a preliminary stress analysis.

A stress analysis is performed to determine new stresses in the pipe and new loads on pipe supports. If the design requirements are appropriately satisfied, the drawings are then stamped "vendor certified" (VCD).

For small bore piping designs, the pipe support design activity commences when small bore piping is installed and is designed on location. PSE then issues the small bore support drawing. Installation then proceeds, with necessary changes performed as required. After incorporation of these changes, the drawing is "as-built" reviewed and a Design Review Drawing (DRD) is then issued.

Class V hangers are "vendor certified" only when a stress problem becomes evident in the performance of the stress analysis. Otherwise, Class V hangers receive a review equivalent to the original design and incorporation of the latest change to the design.

Design changes made to any of these designs are processed via CMCs. Approximately seventy-five CMCs were reviewed to program requirements by the NRC CAT inspector.

The review of these CMCs and inspection documentation in the ASME area by the NRC CAT inspector also revealed that design changes are apparently initiated as a result of the performance of QC inspection. These changes are then processed to accept the "as-built" configuration, rather than modify the support to actually satisfy the design document in effect at the time of the inspection. These practices do not provide incentives to the crafts to properly construct in strict accordance with the design document.

(a) <u>NRC Bulletin 79-14 Engineering Walkdown</u>

This CPSES program was compared to the requirements addressed in the NRC Bulletin 79-14, "Seismic Analysis for As-Built Safety-Related Piping Systems." CPSES engineering program requirements were also defined in CP-EI-4.5-1, Rev. 8, "General Program for As-Built Piping Verification." Discussions with the responsible licensee engineering personnel indicated that a detailed "as-built" inspection is being performed and is being analyzed in accordance with the engineering requirements of the bulletin.

The responsible engineering representative for the "79-14" program was interviewed, and the actual mechanics of the walkdown were discussed in detail. Basically, the program requirements regarding large bore hangers were discussed. Also, ten selected calculation packages were reviewed relative to this type of pipe support.

Approximately fifty-five percent of the "79-14" verification program was completed for CPSES Unit 1. A very small number of "packages" have completed the required reviews and are considered "final." Thus, it was not possible for the NRC CAT inspector to determine from a sampling review whether or not the activity or installation was performed to the approved "final" design and that an adequate inspection was performed to this approved "final" design.

(b) VCD Program Walkdown by QC Inspectors

From this review, it was difficult for the NRC CAT inspector to determine the thoroughness and adequacy of this walkdown and/or inspection. Interpretations of the procedural requirements by licensee personnel ranged from a detailed inspection of many attributes to a "location-only" walkdown. Additionally, the NRC CAT inspector could not determine when a component was "final" inspected.

The NRC CAT inspector considers that these inspections do not necessarily provide adequate assurance that the elements/components have been installed to requirements. As indicated in the Mechanical Construction Section (Section III.B.2) of this report, numerous examples of hardware accepted by VCD walkdown were found not to comform to design by the NRC CAT inspectors, the ASME Authorized Nuclear Inspector (ANI), and QC during subsequent inspections.

However, the VCD drawing does define a stopping point in the iterative design process, a control not present in the other disciplines reviewed. Licensee representatives again stated their intent to satisfy the necessary NRC requirements, and also expressed confidence in their VCD program.

(6) Piping and Mechanical Engineering

To review the design change control process in this area, approximately fifty DCAs/CMCs were reviewed. Several traveler and installation packages were compared to the program requirements for piping installations. As referenced in this report, few deficiencies in the review of safety system piping and ASME Code radiography for this piping were found by the NRC CAT inspectors within the hardware areas. Few design changes were found relevant to this area.

Several traveler and installation packages were reviewed to the program requirements for mechanical installation.

Similar observations relevant to the processing of design changes and documentation of nonconformances were made. These were discussed in previous paragraphs of this section of the report as to electrical equipment, electrical supports, and pipe hanger/support installations. Discrepancies relevant to inspection procedures are discussed in the Mechanical Construction Section (Section III) of this report.

c. Summary Comments Concerning the Design Change Process

The design change process at CPSES is complex, and at times, cumbersome. The NRC CAT inspector's review of design change processes in the various disciplines revealed a design change program with controls incorporated under a "design-construct-design review" philosophy. This philosophy resulted in a large number of design changes and a repetitive inspection process. (NOTE: There are approximately 70,000 CMCs and 15,000 DCAs that have been issued. This number does not include revisions).

Although this design change process may be difficult, there is nothing in NRC requirements to discourage or prohibit the use of such a system. In general, design change controls at CPSES satisfied the applicant's FSAR commitments and the ANSI standard requirements. However, with this type of system in-place, actual verification of hanger, support, electrical, and mechanical equipment installations to the appropriate design requirements cannot be performed until "work activities" have been completed. Few, if any, installations could be verified as few have been designated as completed under the licensee's context of "completion." Thus, the final adequacy of these controls could not be determined by the NRC CAT inspector.

2. Corrective Action Systems

The CPSES FSAR requires a nonconformance report be "utilized for the identification, documentation, dispositioning, and verification of deficiencies in characteristics, documentation, or procedures which render the quality of an item unacceptable or indeterminate". The FSAR also requires procedures for trending of nonconformance reports to identify trends adverse to quality and for the initiation of corrective action requests for significant and repetitive nonconformances.

CP-EP-16.1, "Processing Nonconformance Reports" and the applicable references were implemented at the site to meet these requirements to satisfy the licensee's FSAR commitments.

A review of approximately one-hundred selected nonconformance reports (NCRs) indicated that identified nonconformaning conditions (documented on NCRs) were dispositioned and processed in accordance with procedural requirements.

As discussed in Sections II, III, and IX of this report, overall findings indicate numerous instances in the electrical and mechanical areas where nonconformances were identified. However, various methods (e.g., punchlists, inspection reports, verbal, and other informal methods) were used to address and resolve these nonconformances, providing no collective evidence of appropriate corrective action and/or justification. Additionally, the NRC CAT inspectors discovered that the Mechanical/Civil QA/QC Supervisor directed his supervisors to document nonconforming conditions on an unsatisfactory Inspection Report (IR) only, contrary to the licensee's FSAR commitments and QA program requirements.

ATTACHMENT A

A. Persons Contacted

The following list identifies by title, the individuals contactd during this inspection.

Corporate Office:

Vice President, Nuclear Operations
Manager of Quality Assurance
Quality Assurance Audits Supervisor
Regulatory Interface, Program Review, and Training Supervisor

Comanche Peak Site:

Vice President, TUSI
Construction Manager, TUSI
Resident Construction Manager, TUSI
Project Construction Manager, B&R
Project Engineer, TUSI
Project Discipline Engineers (4), TUSI
Engineering Unit Supervisors (8), TUSI
Startup Manager, TUGCO
Quality Assurance Supervisor, TUGCO
Quality Assurance/Quality Control Inspection Supervisors (3), TUGCO
Quality Assurance Manager, B&R
Quality Control Inspector Supervisors (3), B&R
Welding Engineering Unit Supervisor, B&R
Procurement and Control Manager, TUSI
Product Control and Warehouse Manager, B&R
Authorized Nuclear Inspector (2)

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

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. The specific procedures in the report are listed by title and revision number, if applicable, when they first appear.

1. Final Safety Analysis Report (FSAR)
2. Quality Assurance Program Policy
3. Quality Assurance Procedures
4. Quality Control Procedures
5. General Construction Specifications
6. Quality Assurance Procedures
7. Engineering Procedures
8. Procurement, Storage, and Material Traceability Procedures
9. Audit Reports
10. Trend Analysis Reports

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