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

January 8, 1985

Docket Nos. 50-445/446

Mr. M. D. Spence, President
Texas Utilities Generating Company
400 North Olive Street
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Dallas, Texas 75201

Dear Mr. Spence:

Subject: Comanche Peak Review

On July 9, 1984, the Comanche Peak Technical Review Team (TRT) began an intensive onsite effort to complete a portion of the reviews necessary for the NRC staff to reach its decision regarding the licensing of Comanche Peak Unit 1. The onsite effort covered a number of areas, including the review of allegations of improper construction practices at the facility.

On September 18, 1984, the NRC met with you and other Texas Utilities Electric Company representatives to provide you with a request for additional information in the electrical and instrumentation, civil and structural, and test program areas having potential safety implications. On November 29, 1984, we reported to you on the status of our technical review in the protective coatings area and requested additional information in the mechanical, and miscellaneous areas. TRT reviews of construction QA/QC allegations and technical issues have progressed to the point where we can now provide you with the status of our efforts in the construction QA/QC area and a request for a program plan specifically addressing our concerns. Further background information regarding these allegations and technical issues will be published in Supplements to the Comanche Peak Safety Evaluation Report (SSER), which will document the TRT's detailed assessment of the significance of all issues examined.

The TRT effort constitutes one element in the process of the agency's review of the Comanche Peak license application. The QA review group on the TRT was comprised of about 20 individuals having a total of over 300 years experience in nuclear engineering, QA, and related fields. This group spent several months at the Comanche Peak site examining the construction QA program in depth.

The TRT findings are provided in the enclosure to this letter. We have not proposed specific TUEC corrective actions as we have in previous reports from the TRT. We request that you evaluate the TRT findings and consider the implications of these findings on construction quality at Comanche Peak. We request that you submit to the NRC, in writing, a program and schedule for completing a detailed and thorough assessment of the QA issues presented in the enclosure to this letter.

Your programmatic plan and the plans for its implementation will be reviewed and evaluated by the staff before NRC considers the issuance of an operating license for Comanche Peak Unit 1. The TRT considers the construction QA/QC findings to be generic to both Units 1 and 2 and your program plan and schedule should address both units. This program plan shall: (1) address the root cause of each finding and its generic implications on safety-related systems, programs, or areas, (2) address the collective significance of these deficiencies, and (3) propose an action plan from TUEC that will ensure that such problems do not occur in the future. Your actions should consider the use of management personnel with a fresh perspective to evaluate the TRT's findings and implement your corrective actions. Finally, you should consider the use of an independent consultant to provide oversight to your program.

The findings of TRT with respect to QA/QC allegations, along with the TRT's assessments of your response to this letter, will be provided to the Senior Management Panel on Contention 5 established by the Executive Director on December 24, 1984. The Senior Management Panel will determine an overall NRC staff position on Contention 5 based on an integrated review of a number of sources of information concerning QA/QC at Comanche Peak in addition to the TRT findings, including information from the CAT team, the SRT team, OI, Region IV and the Hearing Board.

The TRT's overall evaluation of the technical issues and allegations is nearing completion. As we finalize information received in conversations with allegers, and further assess the implications of our findings we will inform you of additional concerns, as they arise. In the mean time, your examination of the potential safety implications of the TRT findings should include, but not be limited to the areas or activities selected by the TRT.

In order to fully discuss these concerns with you we are scheduling a meeting for January 17, 1985 which will be held in our office in Bethesda, Maryland. This meeting will provide an opportunity to ask questions regarding these concerns prior to formulating your program plan. Additional meetings will be held at NRC request as your program plan is formulated.

This request is submitted to you in keeping with the NRC practice of promptly notifying applicants of outstanding information needs that could potentially affect the safe operation of their plant. Future requests for information of this nature will be made, if necessary, as TRT technical reviews continue.

Sincerely,

Darrell G. Eisenhut, Director
Division of Licensing
Office of Nuclear Reactor Regulation

Enclosure: As stated

cc w/enclosure:
See next page

COMANCHE PEAK

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Enclosure

Technical Review Team Findings Resulting From
Quality Assurance/Quality Control Allegations

In evaluating the QA/QC program at CPSES, the Technical Review Team (TRT) completed the following: (1) interviewed Texas Utilities Electric Company (TUEC) and Brown & Root (B&R) personnel and allegers, (2) reviewed quality assurance records, selected affidavits, transcripts and depositions, and NRC Regional and Office of Investigations reports, and (3) physically inspected hardware to evaluate the safety significance of quality assurance/quality control (QA/QC) allegations at Comanche Peak Steam Electric Station (CPSES).

1 QUALITY ASSURANCE PROGRAM

The TRT found that although the TUEC QA program documentation met NRC requirements, the weaknesses of its implementation in several areas demonstrate that TUEC lacked the commitment to aggressively implement an effective QA/QC program in several areas:

A. TUEC failed to periodically assess the overall effectiveness of the site QA program in that there have been no regular reviews of program adequacy by senior management. Further, TUEC did not assess the effectiveness of its QC inspection program.

B. During the peak site construction period of 1981-2, TUEC employed only four auditors, all of whom had questionable qualifications in technical disciplines. Although charged with overview of all site construction and associated vendors, these Dallas based auditors provided only limited QA surveillance of construction activities.

C. Repetitive NCRs were issued that identified the need to retrain construction personnel in the requirements and contents of QA procedures. One corrective action request (CAR) dealing with inadequate construction training and records remained open for one year. The identical problem was identified in a subsequent CAR, which still had not been closed at the time of the TRT's onsite review.

D. The TRT found many examples of incomplete and inadequate workmanship and ineffective QC inspection in TUEC's evaluation of the as-built program. (See Section 4 for a detailed discussion.)

E. Some craft workers newly assigned as QC inspectors were in a position to inspect their own work and records. Site management did not view this lack of separation between production and inspection roles as a potential conflict-of-interest.

F. There were potential weaknesses in the TUEC 10 CFR 50.55(e) deficiency-reporting system. Applicable procedures did not identify what types of deficiencies constituted significant breakdowns in the QA program, nor how they should be evaluated for reportability to the NRC. Evaluation guidelines for reporting hardware deficiencies lacked clarity and definitive instructions and the threshold for reporting deficiencies was too high. Specific past and present construction deficiencies that were not reported by TUEC are listed in Sections 4, 5 and 11 of this enclosure.

G. The TUEC exit interview system for departing employees appeared to be neither well structured nor effective, as evidenced by the lack of employee confidence, limited implementation, failure to document explanations and rationale, and failure to complete corrective actions and to determine root causes.

H. The B&R corrective action system was generally ineffective and was bypassed by the B&R QA Manager, as exemplified in the following instances:

1. There were no definitive instructions to describe the types of problems that required corrective action. Minimal procedural instructions resulted in corrective action decisions frequently being left to the judgement of the QA Manager.

2. Since June 1983, B&R had issued no Corrective Action Requests (CARs), and was substituting memos and letters of concern for this function. This shortcut had become a regular method of operation and appeared to bypass the CAR system.

I. The TUEC corrective action system was poorly structured and ineffective in that:

1. Controlling procedures were brief and general.

2. There was no translation of FSAR requirements on trending and no details on how trend analyses were to be accomplished.

3. Quarterly reports were not issued in a timely manner.

4. The method of categorizing problems by building did not assure meaningful trend analysis.

5. A 1984 CAR report identified three items requiring action; however, none had been taken.

6. CAR 029 was used as a vehicle for a specific disposition rather than for generic action, as intended by the CAR system.

2 QUALITY CONTROL INSPECTION

The TRT evaluated the CPSES QC program to determine if it was functionally effective and if the QC system and organization effectively ensured consistent quality of design, procedures, processes and product at the plant. The results of this review showed the following problems.

A. Based on the TRT review of about 200 fuel pool travelers, TUEC was unable to maintain an effective and controlled QC program for fuel pool liner fabrication, installation, and inspection. Typical fuel pool traveler irregularities were:

1. There was apparently a routine practice during construction of the fuel pool that allowed craft personnel to complete a portion of the inspection report forms prior to the actual inspection. Craft personnel entered the word "SAT," dated the entry, and left blank only the space for the QC inspector's signature. It appeared that the craft personnel were judging the inspection results prior to inspections.

2. The date accompanying the signature for visual examination of an inside weld was changed to a date that appeared to precede the examination.

3. Entries by the same inspector for two different inspections did not appear to match in that one entry appeared to be written by another person.

4. The procedure number for a dye penetrant inspection was changed by an inspector different from the one who conducted the inspection.

5. The date for a dye penetrant inspection was changed by an inspector other than the one who performed the inspection.

6. Fuel pool travelers were found with missing QC signoffs for fitup and cleaniness. No proof could be found that some of the required weld fitup and cleanliness inspections were ever performed.

7. The TRT review disclosed the following irregularities with traveler entries in addition to those listed above:

   (a) Date changes after the fact
   (b) Signoffs for functions out of sequence
   (c) Corrections after the fact
   (d) Changes to first party inspector date signoffs
   (e) Missing signatures

B. There were examples of limited corrective action, including vendor-supplied pipe whip restraints that had received inadequate source inspections. Twelve NCRs were issued involving weld defects on these restraints. TUEC corrective action included paint removal from only a sample of the welds and 21 restraints were selected for reanalysis; however, the TRT found no basis or criteria for paint removal or how the worst case restraints were identified.

The reviews of allegations in the Civil and Structural, Coatings, Electrical, Test Programs, and Piping and Mechanical areas also indicate QC inspection deficiencies, as provided in our letters of September 18, and November 29, 1984.

3 T-SHIRT INCIDENT

The T-shirt incident has previously been explored in many forums, including hearings before the Atomic Safety and Licensing Board. The TRT has examined this matter, but will not now describe all of the associated issues. Importantly, however, the TRT believes that TUEC management failed to adequately investigate the incident to determine its root cause, but reacted as though the QC inspectors involved were guilty of disruptive behavior. Of particular concern to the TRT is the strong perception that TUEC QA management may have acquiesced to pressures and complaints from construction personnel and may have failed to adequately support their QC workforce.

4 INSPECTIONS OF AS-BUILT PIPE AND ELECTRICAL RACEWAY SUPPORTS

The TRT conducted a series of inspections encompassing as-built safety-related pipe support and electrical raceway support installations. These inspections were of completed systems or components that had been previously inspected and accepted by TUEC QC as meeting the respective construction and installation requirements.

A. Pipe Support Inspections

Tables 1 and 2 are indicative of the scope of the TRT pipe support as-built inspection effort. Of the 42 pipe supports inspected, 37 were randomly selected, while 5 originated from an alleger's list. Forty-six deficiencies were identified in the supports inspected. Following are examples of the deficiencies identified and the applicable criteria. TUEC's final QC inspections of this sample ranged from December 1982 to October 1984.

1. Component Support Welds:

(a) Applicable criteria

ASME Section III, NF Subsection and subarticles NF-4424 and NF-5360 set forth rules for examining welds.

B&R QI-QAP-11.1-28 Revision 25, Paragraph 3.5.5.1 delineates criteria for the examination of welds, including inspection parameters for acceptable weld sizes.

The TRT found supports exhibiting welds that did not appear to be in accordance with the above-referenced codes and procedures.

(b) Examples of deficient welds

(1) Support No. AF-1-001-001-S33R. Discrepancies included porosity; insufficient weld leg; incomplete welds and insufficient fill. This support was removed, scrapped, and completely rebuilt subsequent to the TRT inspection.

Table 1 Pipe supports in unit 1

Supports Inspected by TRT As-Built group	*42
Class 1 supports inspected	4
Class 2 supports inspected	14
Class 3 supports inspected	24
Hangers with problems	26
Total problems identified	46
Procedure adequacy problems	5
Hardware-related problems	16
As-built drawing related problems	8
Component identification problems	2
Weld-related problems	10
QC record problems	1
Material identification problems	4
Welds inspected without paint by TRT	305
Welds inspected with paint by TRT	89
Total welds inspected by TRT	394
Welds needing weld repair	10
% of welds inspected	2.5%
Supports needing welding repair	6
% of supports inspected	14%

Bldg	System	No. of Supports Inspected
Containment	Safety Injection (SI)	1
Containment	Reactor Coolant (RC)	6
Containment	Residual Heat Removal (RHR)	2
Fuel Handling	Component Cooling (CC)	11
Safeguards	Residual Heat Removal (RHR)	1
Safeguards	Containment Spray (CT)	8
Safeguards	Demineralized Water (DD)	1
Safeguards	Auxiliary Feedwater (AF)	8
Auxiliary	Chemical Volume & Control (CS)	1
Safeguards	Main Steam (MS)	2
Safeguards	Chilled Water (CH)	1

*All 42 pipe supports inspected by the TRT had been previously accepted by site QC.

Table 2 Pipe supports in unit 1*

Problem Category	Hanger No.	No. of Problems	Type
1. No locking device for threaded fasteners	RC-1-901-702-C82S CS-1-085-003-A42K	2	Hardware problem
2. Min. edge distance (on base plate) violated	CC-X-039-006-F43R	1	Hardware prob.
3. Baseplate hole-location dimensions out of tolerance	CC-X-039-007-F43R CC-1-126-010-F33R CC-1-126-011-F33R CC-1-126-012-F33R	4	As-Built prob.
4. Spherical bearing/washer gap excessive	CC-1-126-015-F43R RC-1-052-016-C41K RC-1-052-020-C41K MS-1-416-001-S33R	4	Hardware prob.
5. Spherical bearing contamination	SI-1-090-006-C41K MS-1-416-002-S33R	2	Hardware prob.
6. Snubber adapter plate-insufficient thread engagement	MS-1-416-002-S33R SI-1-090-006-C41K CT-1-013-012-S32K	3	Proced. prob.
7. Insufficient threaded eng'mt, threaded rod (sight holes)	RC-1-901-702-C82S	1	Hardware prob.
8. Snubber/Strut load pin locking device broken or missing	AF-1-001-014-S33R	1	Hardware prob.
9. Load side of pipe clamp halves not parallel	AF-1-001-001-S33R AF-1-001-014-S33R	2	Proced. prob.
10. Pipe clearances w/support out of tolerance	CC-1-126-013-F33R AF-1-001-702-S33R	2	Hardware prob.
11. Pipe clamp locknut loose	AF-1-035-011-S33R	1	Hardware prob.

*All 42 pipe supports inspected by TRT had been previously accepted by site QC.

Table 2 (Continued) Pipe supports in unit 1*

Problem Category	Hanger No.	No. of Problems	Type
12. Snubber/Sway strut misalignment	CC-1-126-014-F43R RC-1-052-020-C41R	2	Hardware problem
13. Snubber cold set dimension does not match drawing	CS-1-085-003-A42k	1	As-Built prob.
14. Snubber orientation does not match drawing	CT-1-005-004-S22K CT-1-013-010-S22K	2	As-Built prob.
15. Component type/model no. installed does not match drawing	SI-1-090-006-C41K RC-1-052-020-C41R	2	Compon. ID prob.
16. No identification for support materials, parts, and components	CT-1-013-014-S32R CC-1-126-012-F33R CC-X-039-005-F43R AF-1-035-011-S33R	4	Matl. identific. prob.
17. BRP column line dimension does not match BRHL Dimension	Support not affected	1	As-Built prob.
18. Weld porosity excessive	AF-1-001-001-S33R	1	Weld-related prob.
19. Weld undercut excessive	AF-1-001-702-S33R	1	Weld-related prob.
20. Weld length undersized	AF-1-001-001-S33R	1	Weld-related prob.
21. Weld leg or effective throat undersized	AF-1-001-001-S33R RH-1-006-012-C42R CC-X-039-007-F43R	3	Weld-related prob.
22. Weld called out on drawing does not exist in field	CC-1-126-013-F33R	1	Weld-related prob.
23. Welds added in field are not reflected on drawing	AF-1-001-702-S33R numerous welds	1	Weld-related prob.
24. Excessive grinding resulting in min. thickness violations (weld clean-up)	AF-1-037-002-S33R CT-1-013-014-S32R	2	Weld-related prob.
25. No QC Buy-off on weld data card	CC-1-126-013-F33R	1	QC record problem
		46	Total problems identified by TRT

*All 42 pipe supports inspected by TRT had been previously accepted by site QC.

(2) Support No. AF-1-001-702-S33R. Exhibited extraneous welding that was not documented on the as-built drawing. One of the required welds was undercut beyond the limits of acceptance (this weld was subsequently repaired).

(3) Support No. CC-1-126-013-F33R. Support drawing required a 1/4" fillet weld to connect item 5 to item 6. This weld was omitted in the field.

(4) Support No. CC-X-039-007-F43R. A required 5/16" all-around fillet weld had an approximately 1/16" undersize weld leg for the length across the top flat of the tube steel.

(5) Support No. RH-1-006-012-C42R. An all-around 1/4" fillet weld connecting item 5 to item 7 was undersized by 1/32" to 1/16" across the top.

(6) Support No. AF-1-037-002-S33R. This support exhibited a 1/16" to 3/32" reduction in plate thickness and weld size due to excessive grinding of the weld at the base plate. Base material thickness of the support plate was reduced beyond the limits of acceptance in three locations.

(7) Support No. CT-1-013-014-S32R. Excessive overgrinding of welds resulted in notching of the sway strut rear brackets. This condition was repaired subsequent to the TRT inspection.

2. Locking Device for Threaded Fasteners:

(a) Applicable criteria

Subarticle NF-4725 states in part that all threaded fasteners, except high-strength bolts, shall be provided with locking devices to prevent loosening during service.

ASME Sect. III, Div. 1, Interpretation No. III-1-83-49R provides that the user should satisfy himself that any other device than those described in NF-4725 is capable of acting as a locking device under all service conditions.

Brown & Root Procedure QI-QAP-11.1-28, Attachment 2, Operation 7, Inspection Attribute h., requires that all exposed threads be free of extraneous material.

CPSES/FSAR, Paragraph 17.1.2 states that the design verification procedure assure that drawings, specifications, procedures, and instructions meet stipulations of related codes and standards.

10 CFR 50.55(e)(1) directs that the holder of the construction permit shall notify the NRC regarding each deficiency found in design and construction which, if not corrected, could adversely affect the safety of operations at any time throughout the expected lifetime of the plant.

There appeared to be a difference in locking devices on threaded fasteners for similar pipe support hardware made by two separate vendors. Whereas in some cases Nuclear Power Service Incorporated (NPSI) specified only one nut and no locking device, ITT-Grinnell required two nuts in those same applications. If the design of NPSI models indeed should be found to need the locknuts or their equivalent, there could be hundreds of pipe supports installed without adequate locking devices.

The TRT found examples in Unit 1 where deficiencies existed so that TUEC was in potential violation of the codes, procedures, guidelines, and commitments concerning locking devices for threaded fasteners. In spite of the requirements pursuant to 10 CFR 50.55(e)(1), TUEC did not report to the NRC the omission of thread-locking devices in the Unit 1 nuclear safety systems and did not attempt corrective action until May 1984, when TUEC tested previously applied paint for thread-lock capability. That test was inconclusive, since it did not establish that the paint, an epoxy process, would reliably perform as an effective locking device under all service conditions and throughout the expected lifetime of the plant. Further, TUEC could not identify to the TRT which paint was the subject of testing.

TUEC had a potentially inadequate quality assurance specification No. 2323-AS-31, which did not cover inspection of painted threaded fasteners. The paint was applied to ASME code-controlled, NF hardware per specification 2323-AS-30 (non-Q) which required no inspection. This issue appears to be generic for Unit 1.

The TRT notes that TUEC did not initiate an NCR identifying the widespread problem of missing locknuts; only a Request for Information was generated, which TUEC could not locate for the TRT. An NCR, required by procedure, would have brought the problem and its ramifications to management attention and would have provided a vehicle for controlled, organized, and approved engineering disposition.

(b) Examples of deficient locking devices.

Pipe support RC-1-901-702-C82S had a load bolt at a beam attachment which did not exhibit an approved locking device. (The bolt material type was SA-307 grade A.) Additionally, pipe support CS-1-085-003-A42K had no approved locking device on the "special clamp" bolts, even though the design drawing for this clamp showed each bolt with a nut and a locknut.

3. <u>Minimum Edge Distance for Bolts</u>:

(a) Applicable criteria

<u>QI-QAP 11.1-28 Revision 19, Paragraph 6.1</u> required that bolt holes in structural members shall not be closer than 1-1/2 times the bolt diameter from the edge of the member to the center of the bolt hole.

ASME Sect. III Div. 1, Subsection NA, Appendix XVII, Table XVII-2462-1(b)-1, gives specifically allowed minimum edge distances for bolt holes (reamed, punched or drilled) at sheared or rolled edges of plates, shapes, or bars.

(b) Example of minimum edge distance violation

The baseplate for pipe support CC-X-039-006-F43R, located in the component cooling system, Room 249A, Fuel Handling Building, violated minimum edge distance criteria for bolt holes.

4. Base Plate Hole-Location Dimensions:

(a) Applicable criterion

QI-QAP-11.1-28, Revision 19, Attachment 4, Paragraph 2, under fabrication tolerances, limits a "hole centerline location to ±1/4" or as shown on the design drawing."

(b) Examples of hole-location dimension problems

The TRT found the horizontal member of Support CC-1-126-010-F33R was 3 inches lower at its centerline relative to the upper bolt-hole centerline than shown on the vendor-certified drawing. The as-built drawing had not been revised to reflect the actual installed condition in the plant. This support was located in the component cooling system, Room 247A, in the Fuel Handling Building. Other supports with similar hole-location violations found in the inspections were: CC-X-039-007-F43R, CC-1-126-011-F33R, and CC-1-126-012-F33R.

5. Spherical Bearing Gap:

(a) Applicable criterion

Brown & Root Procedure, QI-QAP 11.1-28, Revision 25 paragraph 3.7.3.1 states that "a sufficient number of spacers shall be used to prevent the spherical bearings from becoming dislodged," and "in no case shall the resulting gap be more than the thickness of one vendor-supplied spacer."

(b) Examples of spherical bearing gap deficiencies

An excessive free gap existed between spherical bearing and washers on the sway strut assembly of support CC-1-126-015-F43R. Other supports with similar bearing gap anomalies found in TRT's inspections were: RC-1-052-016-C41K, RC-1-052-020-C41K, and MS-1-416-001-S33R. The frequency of this type of procedure violation in the TRT's limited inspection suggests that this problem is generic for Unit 1.

6. Spherical Bearing Contamination:

(a) Applicable criterion

QI-QAP-11.1-28 Revision 22, Paragraph 6.3.1 Note 2 states in part that "bearing internal and external surfaces shall be free of rust and foreign material, and bearing shall move freely within the housing."

(b) Examples of spherical bearing contamination

The TRT found paint contamination in the bearings of both snubber assemblies on component support SI-1-090-006-C41K that severely obstructed the bearing cavities and limited their movement. This Class 1 component support is located in the Containment Building of the Unit 1 safety injection system. A similar condition exists on support MS-1-416-002-S33R.

7. Snubber Adapter Plate Bolting - Lack of Full Thread Engagement:

(a) Applicable criteria

QI-QAP-11.1-28, Revision 22, Paragraph 6.1, states that "all bolts, studs, or threaded rods shall have full thread engagement in the nut."

ASME Sect. III, Div. 1, Subsection NF, Subarticle NF 4711 states that "the threads of all bolts or studs shall be engaged for the full length of thread in the nut."

QI-QAP-11.1-28, Revision 25, Attachment 29 permits less than full thread engagement in threaded plates. This allowance for less than full thread engagement is a potential violation of the ASME Code Sect. III, NF-4711; no code case was invoked to set aside this procedure. The requirement of NF-4711 that "the threads of all bolts or studs shall be engaged for the full length of thread in the nut" also implies that there be a full length of a threaded hole in plates, shapes, or bars where the required threaded hole length is the same as the bolt diameter. Further, there is no evidence that partial thread engagement at the snubber adapter plate connection has been given consideration in the design procedures for linear-type supports, nor does it appear that sufficient design margins have been introduced to allow for less than full-threaded connection. The TRT did not check "as-built" analyses to determine whether any such variations from the design norm had been considered in the "as-built" stress calculations.

What is in question is whether any calculations had been made to address this particular thread engagement condition for each size snubber being used in the plant.

(b) Examples of lack of full thread engagement

Snubber (shock arrester) adapter-plate bolt threads were insufficiently engaged in all four threaded holes of component support MS-1-416-002-S33R. The worst condition was 0.095" short, or more than 25% less than full thread engagement. Similar lack of full thread engagement deficiencies was found on NF supports SI-1-090-006-C41K and CT-1-013-012-S32K.

8. Threaded Rod Thread Engagement:

(a) Applicable criterion

QI-QAP-11.1-28, Revision 21, Paragraph 6.3.2.a. directs that "QC shall verify thread engagement if site [sight] holes are present in the strut body."

(b) Example of rod thread engagement deficiency

Sight holes were present in the strut body to verify threaded rod engagement. The rod was not visible through the sight hole for support RC-1-901-702-C82S.

9. Snubber/Sway Strut Load Pin Locking Device:

(a) Applicable criterion

QI-QAP-11.1-28, Revision 22, Paragraph 6.3.1.1.b states that "the size of the cotter pins, when used, should be the maximum size the hole will accommodate and shall be fully opened."

(b) Example of locking device deficiency

Sway strut No. AF-1-001-014-S33R had a broken cotter pin.

10. Load Side of Pipe Clamp Halves Not Parallel:

(a) Applicable criterion

QI-QAP-11.1-28, Rev. 25, Sec. 3.7.3.1 states that "pipe clamp halves, in relation to attaching eyerod end, shall be parallel."

(b) Examples of halves not parallel

Clamp halves for pipe supports AF-1-001-001-S33R and AF-1-001-014-S33R were not parallel.

11. Pipe Clearances Outside of Allowable Tolerance:

(a) Applicable criterion

QI-QAP-11.1-28, Revision 19, Attachment 4, item 3.b states "where the design shows 0" on one side and 1/16" on the other, 0" must be maintained while 1/16" ± 1/32" is required on the other side."

(b) Examples of pipe clearance violations

Pipe support CC-1-126-013-F33R exhibited no clearance on top or bottom, while the hanger drawing called out 0" on the bottom and 1/16" on top. A similar problem existed for pipe support AF-1-001-702-S33R.

12. Pipe Clamp Locknut Loose:

(a) Applicable criterion

QI-QAP-11.1-28 Revision 21, Sect. 6.1 states that "unless otherwise shown on the drawing, fasteners will be tightened securely."

(b) Example of loose locknut

A pipe clamp locknut for pipe support AF-1-035-011-S33R was found loose (less than finger-tight).

13. Snubber/Sway Strut Misalignment:

(a) Applicable criterion

QI-QAP-11.1-28, Revision 18, Sect. 6.3.1.d states that "maximum sway strut misalignment shall not exceed 5° for ITT-Grinell and NPSI from the centerline of the sway strut."

(b) Examples of misalignment

Pipe support CC-1-126-014-F43R exhibited angularity that exceeded this requirement. A similar problem existed with pipe support RC-1-052-020-C41R.

14. Snubber Cold Set (AC) Dimension Did Not Match Drawing:

(a) Applicable criterion

QI-QAP-11.1-28, Revision 24, Sec. 3.8.3.5.b states that "deviation of more than ± 1/8" from the specified cold setting (AC dimension shown on the design drawing) is not permitted, unless authorized by a design change."

(b) Example of incorrect AC dimension

Pipe support CS-1-085-003-A42K deviated by approximately 1" from the cold set dimension shown on the design drawing.

15. Support Configuration Did Not Match Drawing:

(a) Applicable criterion

- QI-QAP-11.1-28, Revision 24, Attachment 2, Operation 3 lists the following inspection attribute: "support configuration complies with the design drawing."

(b) Examples of configuration problems

Pipe support snubber CT-1-005-004-S22K was installed end-to-end opposite from the orientation shown on the drawing. A similar problem existed with pipe support CT-1-013-010-S22K, where dimensional discrepancies existed on the support drawing that detailed the orientation of the snubber.

16. Component Type/Model No. Installed Did Not Match Drawing:

(a) Applicable criterion

QI-QAP-11.1-28, Revision 24, Sect. 3.2.1.1 states that "vendor-supplied NPT stamped component supports shall bear marking (i.e., name plate) traceable to the design drawing."

(b) Examples of component identification problems.

Model numbers of installed snubbers for pipe support SI-1-090-006-C41K did not match the model number on the design drawing. A similar problem existed with pipe support RC-1-052-020-C41R.

17. Weld Data Card Missing QC Initials For Welds:

(a) Applicable criterion

QI-QAP-11.1-28, Rev. 25, Paragraph 3.5.3 Welder and Welding Material Verification states that "The QCI shall verify that the welder is qualified to make the weld utilizing the welder qualification matrix (attachment 16, typical), that the use of the WPS (Attachment 17, typical), and the type of filler material listed on the WFML [weld filler material log] are the same as those listed on the weld data card (WDC), and the welder's symbol has been recorded on the WFML."

(b) Example of deficient weld data card

Support number CC-1-126-013-F33R had some welds performed with no QC inspector initials or signature on the corresponding blocks of the weld data card for that support inspection package.

18. Identification of Materials and Parts:

(a) Applicable criteria

10 CFR 50 Appendix B, Criterion VIII states that "measures shall assure that identification of the item is maintained by heat number, part number, serial number or other appropriate means either on item or on records traceable to the item, as required throughout fabrication, erection, installation and use of the item."

QI-QAP-11.1-28, Revision 19, Sect. 3.1.2 states that "at installation inspection, the QC inspector shall verify the hanger number, the material type, grade and heat number ... using the information provided on the Material Identification Log."

(b) Examples of material identification deficiencies

- A replacement part (sway strut eyerod) for pipe support CT-1-013-014-S32R had no apparent material identification either on the hardware or in the documentation package for the support. The Material Identification Log (MIL) did not list any identification traceable to the origin of the replacement part. A similar problem existed with pipe supports CC-1-126-012-F33R, CC-X-039-005-F43R, and AF-1-035-011-S33R.

B. Deficiencies with High Rate of Occurrence

The following pipe support inspections by the TRT were in addition to those already listed in the previous examples. Results of these ancillary inspections are summarized in Table 3.

The TRT identified six specific deficient items which need further evaluation to assess their generic implications. The TRT concern is that these items may have a high rate of occurrence throughout plant safety-related systems. The specific "frequently occurring" items and relevant inspection criteria were as follows:

(1) Strut and snubber load pin spherical bearing clearance with washers was excessive (Ref. QI-QAP-11.1-28, Sec. 3.7.3.1 Rev. 25).

(2) Strut and snubber load pin locking devices (cotter pins or snap lock rings) were damaged or missing (Ref. QI-QAP-11.1-28 Rev. 25, which did not specifically address load pin locking devices).

(3) Pipe clamp halves on load side were not parallel (Ref. QI-QAP-11.1-28, Sec. 3.7.3.1 Rev. 25).

(4) Bolts threaded into tapped holes of snubber adapter plates had less than full thread engagement (a "frequently occurring" deficiency; see related discussions on pipe supports, example 7 "Snubber Adapter Plate Bolting - Lack of Full Thread Engagement" within Part A of this section on as-built inspection).

(5) "Hilti Kwik" bolts (concrete expansion anchors) as installed did not meet minimum effective embedment criteria (Ref QI-QP-11.2-1, Sec. 3.5.1 Rev. 16).

(6) Locking devices for threaded fasteners were missing or of a non-approved type (see item 2 "Locking devices for threaded fasteners" on pipe support deficiencies within Part A of this section on as-built inspection).

Table 3 Summary of additional TRT inspections

Area: Room 77N, El 810'-6"
Unit 1, Safeguards Bldg

	Deficiency	No. of Supports Inspected	No. of Supports Deficient	% Deficient
Item 1.	Excessive Spherical Bearing Clearance	92	5	5.4%
Item 2.	Load Pin Locking Device Missing	92	14	15.2%
Item 3.	Pipe Clamp Halves Not Parallel	40	9	22.5%
Item 4.	Snubber Adapter Plate Bolts With Less Than Full Thread Engagement	19	*13	to be determined

Area: Cable Spread Room 133, El 807'-0"
Unit 1, Auxiliary Bldg

	Deficiency	Bolts Inspected	Number Deficient	% Deficient
Item 5.	Hilti Kwik Bolt Does Not Meet Minimum Embedment**	24	3	12.5%

*Bolts had less than full thread engagement.

**Taking into account the "allowed" slippage of the bolt for a distance of one nut thickness due to torquing (Ref. "Installation of 'Hilti' Drilled-In Bolts" 35-1195-CEI-20, Rev. 3, Para. 3.1.4.1) and the minimum specified embedment, the above Hilti bolts violated the "effective" embedment requirements.

The TRT undertook additional hardware inspections to ascertain the regularity with which these specific items may exist. All accessible pipe supports in Room 77N, at the 810-foot, 6-inch elevation of the Unit 1 Safeguards Building, were inspected for "frequently occurring" deficiencies 1, 2, 3 and 4 listed above. To assess the level of occurrence of "frequently occurring" deficiency 5, electrical support 'Hilti' baseplates located in the Cable Spread Room 133, at the 807-foot elevation of the Unit 1 Auxiliary Building, were inspected. For details on "frequently occurring" deficiency 6, see item A.2, "Locking Device for Threaded Fasteners," of the pipe support deficiencies, described above.

C. Electrical Raceway Support Inspections

The TRT inspected electrical conduit supports and cable tray hangers to the requirements of QI-QP-11.10-1, Inspection of Seismic Electrical Support and Restraint Systems; QI-QP-11.21-1, Requirements of Visual Weld Inspection; and other applicable instructions for conduit support and cable tray hanger inspections. All electrical raceway supports included in TRT inspections had been previously QC accepted. Table 4 summarizes the results of the TRT inspections not previously provided as part of our letter of September 18, 1984.

The TRT found the following discrepancies during its inspection of selected electrical conduit supports and cable tray hangers in Unit 1:

1. Undersize Welds:

(a) Applicable criterion

DCA 3464, Rev. 23, page 3 of 32, note 3 states in part that "welding requirements as shown on various details should be read as the minimum requirement."

(b) Examples of undersize welds

Three of four welds on conduit support C120-21-194-3 (cable spread room) were undersized. The required weld size was 1/4" at all weld joints, while the measured weld size was 7/32" to 5/32" for the full lengths of three out of the four welds.

Similarly, cable tray hanger CTH 5824 (Containment Building) had 12 undersize welds. The all-around welds on the six horizontal beams should be 1/4" in size, according to details L_1 and L_2 on Drawing FSE-00159, sheet 5824, 1 of 2. The measured size of these welds was 3/16" to 5/32" at each connection. Also, support IN-SP-7b exhibited undersize welds measuring 7/32" to 5/32" instead of the required 1/4".

Table 4 Summary of electrical raceway support inspection by the TRT - unit 1

Support welds inspected	59
Supports inspected	5*
Supports with problems	3 (60%)
<u>Types of problems</u>	
Hardware-related, other than welding	6
Unauthorized configuration change	1
Weld-related types of problems (categories)	2
Welds requiring rework	41
Welds made in field but not recorded on drawing	80**
Beam stiffeners added but not recorded on drawing	40
<u>Building/Area</u>	<u>Supports</u>
Cable Spread Room	CTH 12646 C 130-21-250-3 C 120-21-194-3
Auxiliary Building	CTH 6742
Containment	CTH 5824

*All electrical supports inspected by the TRT had been previously inspected and accepted by QC.

**Full visual inspection was not performed by the TRT on these extra welds.

2. Misplaced Welds:

(a) Applicable criterion

QI-QP-11.10-1, Revision 29, Paragraph 3.5.2, Assembly Inspection, includes the requirement to inspect a support for configuration. Paragraph 3.6.2 of the same procedure requires that support welds receive visual inspection and that nonconforming welds be reported.

(b) Examples of misplaced welds

During inspection of Hanger CTH-6742, the TRT found that two structural welds were made in the wrong direction. The 3/16" shop welds which join MK-10 and MK-11 were made horizontally instead of vertically, as shown on drawing FSE-00159, sheet 6742. QC Inspection Report ME-I-0024909, dated February 16, 1984, accepted all inspectable attributes as satisfactory prior to the TRT inspection.

3. Unauthorized Configuration Changes:

(a) Applicable criterion

QI-QP-11.10-1, Inspection of Seismic Electrical Support and Restraint Systems, paragraph 3.5.2 includes the requirement for inspection of a support for configuration compliance.

(b) Examples of configuration change

The TRT found that cable tray hanger CTH 5824 (Containment Building) had been fabricated to include 40 more stiffeners and 80 more welds than required or shown on drawing FSE-00159, sheet 5824, 2 of 2, Detail L_2. Inspection Report ME-1-0006155 verified final QC inspection and acceptance on January 3, 1984.

Further, cable tray hanger CTH-6742 (Auxiliary Building), Clip, MK-12, should be 6" x 6" x 3/4" angle stock in accordance with FSE-00159, sheet 6742. The actual flange thickness of MK-12 was 3/8".

4. Hilti Anchor Bolt Installation Deficiencies:

(a) Applicable criterion

QI-QP-11.2-1, Concrete Anchor Bolt Installation, provided requirements for proper installation and inspection of Hilti anchor bolts.

(b) Examples of Hilti bolt deficiencies

CTH-6742 (Auxiliary Buildihg) anchor bolt torque was not verified (paragraph 3.5 of the procedure). Hilti bolts were not marked in accordance with attachment 1 of the procedure, nor was the length of these bolts verifiable (paragraph 3.2).

CTH-5824 (Containment Building) base plate bolt holes had violated minimum edge distance--edge distance cannot be less than 1 7/8" (Attachment 2 of the procedure). Actual distance was 1 5/8" to 1 3/8" from the nearest plate edge. This condition affected five of the eight Hilti anchor bolt holes in the base plates for this hanger.

One Hilti bolt was skewed to more than 15 degrees. Maximum allowable skew was 6 degrees without corrective bevel washers (paragraph 3.1.2).

The Hilti bolt torque on this hanger CTH 6741 (Auxiliary Building) was not documented as being verified by QC (paragraph 3.5).

5. Undersize Nuts:

There was inconsistency in the application of nuts for SA-325 bolts in that both standard and heavy hex nuts were used. No stipulation was found which would permit the use of standard (non-heavy) hex nuts. This condition is a potential violation of the Material Specification ASTM A325 (ASTM, Part 4-1974) paragraph 1.5, which provides that "heavy hex structural bolts and heavy hex nuts shall be furnished unless other dimensional requirements are stipulated...." B&R Drawing No. FSE-000159, sheet 5824, 2 of 2, required the use of ASTM A325 bolts for cable tray hanger number CTH-5824.

D. Summary of Pipe Support and Electrical Raceway Support Inspections

The as-built verification effort conducted by the TRT provides evidence of faulty construction by craft personnel, installed hardware that does not match as-built drawings, and ineffective QA and QC inspections. Despite the small size of the TRT's sample, there appears to be a large number of deficiencies. The potential also exists that these deficiencies are not represented correctly in the final stress analysis.

5 DOCUMENT CONTROL

The TRT evaluated the CPSES document control system to determine if it was effective and if it ensured consistent quality of documents for construction practices and records. The results of this review showed the following problems.

A. The TRT found that there was a potential for document control center (DCC) field distribution centers (satellites) to issue deficient document packages to craft personnel. Typical problems identified were: packages were not thoroughly examined; procedures and guidelines were not specific or were not followed; and documents controlling operation of the centers existed in the form of guidelines and charts rather than as controlled procedures.

B. The TRT found that many problems indicative of inadequate drawing control existed at CPSES from September 1981 to April 1984. These problems had been identified prior to the TRT's evaluation by both TUEC and NRC Region IV audits and reviews.

Prior to placing the satellites in operation (a phased effort between February and August 1983), DCC distributed drawings, component modification cards (CMCs), and design change authorizations (DCAs) to file custodians, welding engineering, the pipe fabrication shop, QC, and the hanger task force. Document control through this system proved to be ineffective.

In an attempt to correct identified problems, DCC satellites were created to distribute drawings to field personnel, rather than use the file custodians. However, between August 1983 and April 1984, recurring problems with document control were identified. Examples of the types of document control problems that existed between August 1983 and April 1984 were as follows:

1. Drawings released to the field were not current.

2. Drawing and specification changes were not current.

3. Design documentation packages were incomplete.

4. DCC did not provide the satellites with up-to-date drawings, CMCs, DCAs and document revisions.

5. Drawings hanging from an open rack, which had no checkout control, were available to craft and QC personnel.

6. Design change logs were inaccurate.

7. Design documents were not always properly accounted for in DCC.

8. Current and superseded copies of design documents were filed together.

9. Satellite distribution lists were inaccurate.

10. There were discrepancies between drawings contained in the satellites and those in DCC.

11. Some drawings were missing from the satellite files.

12. Telephone requests for design documents resulted in the issuance of documents that bypassed the controlled distribution system.

In April 1984, top management took a direct interest in recurring document control problems. Their efforts appear to have been successful. For instance, in April 1984 satellites 306 and 307 had error rates of 30% and 10%, respectively; but by July 1984, these error rates had fallen to less than 1% for both satellites. The TRT has found that TUEC document control after July 1984 was adequate; however, the effects of document control inadequacies prior to July 1984 have yet to be fully analyzed by TUEC.

C. Deficiency reporting procedure CP-EP-16.3 appeared to relate only to craft and engineering personnel and was not directed to noncraft and nonengineering personnel who may have had knowledge of reportable items. Procedure CP-EP-16.3 indicated that the applicable manager was responsible for documenting and reporting Deficiency and Disposition Reports (DDRs); but there were no checks or balances to ensure that a manager or a designated substitute would process a DDR.

D. TUEC did not consider the CYGNA audit findings regarding the DCC as appropriate for formal reporting to the NRC pursuant to 10 CFR 50.55(e), as required by procedure CP-EP-16.3, "Control of Reportable Deficiencies."

E. The TRT found that the DCC issued a controlled copy stamp to the QC department to expedite the flow of hanger packages to the Authorized Nuclear Inspector. Methods for this kind of issuance and control of such stamps were not described in TUEC's procedures.

6 TRAINING/QUALIFICATION

The TRT identified numerous weaknesses during its review of the ASME and non-ASME training, certification, and qualification of QC and DCC personnel. TUEC's training and certification program lacked the programmatic controls to ensure that the requirements in 10 CFR 50, Appendix B were achieved and maintained. The items identified by the TRT include those listed below, in addition to the items previously provided in our letter of September 18, 1984.

A. Twenty percent of the training records reviewed contained no verification of education or work experience.

B. The results of Level I certification tests were used for some Level II certifications rather than the results of a Level II test.

C. After failing a certification test, a candidate could take the identical test again.

D. Certifications were not always signed or dated.

E. White-out was used on certification tests.

F. Seven inspectors had questionable qualifications.

G. There was no limit or control on the number of times an examination could be retaken.

H. No guidelines were provided for the use of waivers for on-the-job training.

I. In some cases recertification was accomplished by a simple "yes" from a supervisor.

J. There was no formal orientation training for DCC personnel prior to August 1983.

K. The responsibility for administration of the non-ASME training program was not clearly assigned to a single individual or group.

L. Non-ASME personnel capabilities were loosely defined by levels (I, II, III).

M. There were numerous additional problems in non-ASME certification testing, such as: no requirement for additional training between a failed test and the retest; no time limitation between a failed test and a retest; two different scoring methods to grade a test and a retest; no guidelines on how a test question should be disqualified; no program for periodically establishing new tests except when procedures changed; and no details on how the administration of tests should be monitored.

N. The exemption provision in ANSI N45.2.6, which allowed substitution of previous experience or demonstrated capability, was the <u>normal</u> method for qualifying inspection personnel rather than the <u>exceptional</u> method.

7 VALVE INSTALLATION

The TRT found that installation of certain butt-welded valves in three systems required removal of the valve bonnets and internals prior to welding to protect temperature-sensitive parts. The three systems involved were the spent fuel cooling and cleaning system, the boron recycle system, and the chemical and volume control system. This installation process was poorly controlled in that disassembled parts were piled in uncontrolled areas, resulting in lost, damaged, or interchanged parts. This practice created the potential for interchanging valve bonnets and internal parts having different pressure and temperature ratings.

8 ONSITE FABRICATION

The TRT findings regarding onsite fabrication shop activities indicated that:

A. The scrap and salvage pile in the fabrication (fab) shop laydown yard was not identified and did not have restricted access.

B. Material requisitions prepared in the fab shop did not comply with the applicable procedure.

C. The fab shop foremen were not familiar with procedures that controlled the work under their responsibility.

D. Fabrication and installation procedures did not include information to ensure that B&R-fabricated threads conformed to design specifications or to an applicable standard.

E. Indeterminate bulk materials that accumulated as a result of site cleanup operations were mingled with controlled safety and nonsafety material in the fab shop laydown yard.

F. Site surveillance of material storage was not documented.

G. Work in the fab shop was performed in response to memos and sketches instead of hanger packages, travelers, and controlled drawings.

9 HOUSEKEEPING AND SYSTEM CLEANLINESS

TRT inspections at CPSES indicated that the facility was well maintained. However, two issues were identified that indicate housekeeping and system cleanliness deficiencies.

A. The TRT reviewed the August 6, 1984, draft of flush procedure FP-55-08. The purpose of this procedure was to verify the cleanliness of Unit 1 reactor coolant loops, including the reactor vessel, by means of hand-wiping, visual inspection, and swipe testing. Tests to determine surface chloride and fluoride contamination were performed by TUEC systems test engineers and Westinghouse representatives. The TRT notes, however, that FP-55-08 required only two swipe tests of the reactor vessel--one on the side and one on the bottom. This limited number of swipe tests may not provide adequate assurance that the vessel had been properly cleaned.

B. In rooms 67, 72, and 74 of the Unit 2 Safeguards Building, the TRT observed that not all snubbers were wrapped with protective covering when welding was being done in close proximity to them. This practice was a violation of B&R procedure CP-CPM-14.1, which required protection of installed equipment during welding. This condition was immediately corrected when the TRT reported it to TUEC QA management, and an inspection was performed by TUEC to correct similar conditions in other areas as well.

10 NONCONFORMANCE REPORTS (NCRs)

There were several weaknesses in the NCR and deficiency identification reporting systems. The TRT found that:

A. The TUEC procedure for preparation and processing of NCRs did not contain explicit instructions for handling voided NCRs.

B. NCRs were used as a tracking document to record removal of a part from equipment on a permanent equipment transfer rather than for reporting a nonconforming condition; such usage of the NCR was not defined in procedures.

C. There was an inconsistency between paragraphs 2.1 and 3.2.1 in procedure CP-QP-16.0. Paragraph 2.1 required all site employees to report nonconformances to their supervisor or to the site QA supervisor, while paragraph 3.2.1 required persons other than QA or QC personnel to submit a draft NCR to the Paper Flow Group.

D. The NCR form had no form number or revision date to indicate that the form was being adequately controlled.

E. There were two versions of the TUEC NCR form, one with and one without a space for the Authorized Nuclear Inspection (ANI) review.

F. The NCR form had no space to identify the cause of the nonconformance and the steps taken to prevent its recurrence.

G. The NCR form had no provision for quality assurance review.

H. The TRT found approximately 40 different forms (other than NCRs) for recording deficiencies. Many of these forms and reports were not considered in trending nonconforming conditions.

11 MATERIALS

The as-built review effort by the TRT included a material traceability check on 33 of the same pipe supports that the TRT had field inspected. The material traceability was adequate for those 33 pipe supports, with the exception of four material identification discrepancies, as noted in section 4 on as-built inspections.

In another case, TUEC failed to maintain material traceability for safety-related material and numerous hardware components. This QA breakdown was identified in an ASME Code survey in October 1981 yet was not reported to the NRC in accordance with the requirements of 10 CFR 50.55(e).