UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	
TEXAS UTILITIES GENERATING COMPANY, et al.	Docket Nos. 50-445-1 and 50-446-1
(Comanche Peak Steam Electric Station Station, Units 1 and 2)	

CASE'S ANSWER TO APPLICANTS' STATEMENT OF MATERIAL FACTS AS TO WHICH THERE IS NO GENUINE ISSUE REGARDING STABILITY OF PIPE SUPPORTS

in the form of

AFFIDAVIT OF CASE WITNESSES MARK WALSH AND JACK DOYLE

MESSRS. WALSH AND DOYLE:

It should be noted, first of all, that instability of supports was discussed extensively in CASE's 8/22/83 Proposed Findings of Fact and Conclusions of Law (Walsh/Doyle Allegations), Section III (see also Section IV on cinched-up U-bolts). We will not repeat everything which was stated therein, but urge that the Board review those Sections prior to reading the following.

MR. WALSH:

1. Applicants state:

"Instability of a particular pipe support, when viewed in isolation from the piping system, is of little or no significance. The relevant consideration is whether the entire piping system and associated supports are stable when considered as a single system. (Finneran Affidavit at 5-7.)"

First, it should be noted that, as has happened before with Applicants' Motions for Summary Disposition, the statements in Applicants' Statement of Material Facts do not correspond to the statements in the back-up Affidavit of Mr. Finneran (who is the sole sponsor of the Affidavit). (This is true in other instances throughout the Motion under discussion, but I will not address each and every one of them.) But I believe that we must treat the Statement of Material Facts as the Applicants' position; i.e., that there is little or no significance to instability of a single pipe support, and I am addressing Applicants' Motion accordingly.

I do not agree with Applicants' first Statement of Material Facts. The ASME Code requires that each support be stable (see ASME Section NF, Appendix XVII, Section XVII-2221(a), which is quoted on page 2 of Applicants' Affidavit).

The philosophy presented by the Applicants is mind-boggling. If an unstable support is of "little or no significance," then those supports are in essence not supporting the pipe and a pipe stress analysis would have to qualify the new stresses within the pipe and the additional loads now transmitted to the adjacent supports. The Applicants have not demonstrated that the unstable supports, when removed from all piping systems, would allow the piping systems to perform their function in a predictable manner. Any analysis now provided by the Applicants to verify the adequacy of the piping system is irrelevant, because when one has two groups working (i.e., the pipe stress analysis group and the pipe support group), the procedure is

that the pipe stress analyst will locate supports in such a manner as to minimize the number of supports and still keep the pipe stresses within allowables. The pipe support design group takes the location dictated by the pipe stress analysis and provides a support in the indicated direction. The pipe support designer is not made aware of what the stresses are in the pipe; therefore it is of the utmost importance for all the supports to perform their intended function. If, by chance, a support is not needed and is excluded from the rerun of the pipe stress analysis, then that support could be permanently removed. But to avoid all these reanalyses, it is standard industry practice for all pipe supports to withstand the intended loads and be stable for those loads. That is a basic assumption when performing such analyses.

Applicants' position appears to be that when a support is in effect missing due to instability, it is of little or no significance. (This is contrary to testimony of NRC Staff Witness Tapia, Tr. 8867/12-8868/2, that instability of even a single support could have an influence.) This is a very important concept, because in CASE's previous Answers to other Motions for Summary Disposition, we have discussed supports which are being overstressed for some reason, and these have been problems which are significant and generic (to Comanche Peak). The Applicants' present attitude toward these unstable supports (missing supports) is that they don't care. This attitude calls into question the true extent of their concern about all the other problems discussed in our other Answers to Motions for Summary Disposition, as well as <u>other problems which may not have been identified by CASE but which may exist in other areas throughout the plant</u>.

Also, Applicants do not explicitly address the overall stability of the piping systems together with their supports in design guidelines, as stated by the NRC Special Inspection Team (SIT) at page 28 of the SIT Report (NRC Staff Exhibit 207):

> "It is not general industry practice to explicitly address the overall stability of piping systems together with their supports in design guidelines. Rather, it is standard industry design practice to address only the structural integrity of supports in design guidelines. The Applicant's practice corresponds to this industry practice. Thus, no explicit design guidelines address overall stability. . . " (Emphasis added.)

During the May 1983 hearings, NRC Staff Witness Dr. Chen testified regarding the "disease" of instability, as he referred to it. The problem of stability is discussed in the Affidavit of CASE Witness Jack Doyle, attached to CASE's 10/6/84 First Motion for Summary Disposition Regarding Certain Aspects of the Implementation of Applicants' Design and QA/QC for Design (page 7, line 10, through page 15, line 23; page 51, line 25, through page 52, line 9; for example). I will not quote Mr. Doyle's entire sections on instability, but we adopt them and incorporate them herein by reference. Briefly, Dr. Chen dismissed the problem of instability, apparently because he did not find several unstable supports in a row. But, as discussed in Mr. Doyle's Affidavit (at page 14, line 5, through page 15, line 10), there were actually five unstable supports in a row which have now been documented by CASE. (And there is no reason to assume that CASE has been able to document all cases which actually exist.)

The Applicants agree that there were three in a row on main steam line MS-1-001, and four in a row on main steam line MS-1-003. It is my

understanding from CASE President Juanita Ellis that on October 4, 1984, in response to a request by Mrs. Ellis, Applicants' counsel William Horin provided by telephone the following list of 13 unstable supports which Applicants maintain are the only unstable supports which had a U-bolt with a gap on the main steam line:

MS-1-001-003-S72R
MS-1-001-004-S72R
MS-1-001-005-S72R

MS-1-002-003-S72R
MS-1-002-005-S72R
MS-1-002-006-S72R

MS-1-003-003-S72R
MS-1-003-004-S72R
MS-1-003-005-S72R
MS-1-003-006-S72R

MS-1-004-003-S72R
MS-1-004-005-S72R
MS-1-004-006-S72R

Considering that there are three principal directions for a support (i.e., vertical, and two horizontal directions), one can see, regarding the four unstable supports on main steam line MS-1-003, that there were must have been at least two supports going in the same direction which were unstable.

MR. DOYLE:

Q: Is there anything you would like to add or discuss regarding Applicants' Statement 1?

A: Yes, there is. At page 6 of Applicants' Affidavit, Mr. Finneran states:

> "Mr. Doyle also agrees that the important criterion by which stability should be assessed is system stability. Mr. Doyle

testified as follows in September, 1982, with respect to a particular support which he observed in performing the STRUDL analyses and which he believed to be unstable (CASE Exhibit 669 at 210):

> "'I wouldn't have done this. I would have used a clamp because, even though the structure below is apparently unstable, it takes so little to make it stable that a support horizontally up and downstream is sufficient because the pipe won't see that much force to keep it stable.'

"Indeed, Mr. Doyle was referring to 'a clamp strut situation' similar to that described above (see Figure 2), when he stated that a suport up ro downstream could easily provide added stability (see CASE Proposed Findings at III-9)."

I am getting tired of being cited as approving something which is not the case. To put this problem to bed once and for all, let me state the following:

(1) I never condoned in any way the use of U-bolts as a replacement or alternate for clamps (shell type) (see CASE Exhibt 669B, items 11YY and 11ZZ).

(2) I have always stated that if U-bolts are cinched up, the stresses would fail the mechanism (stresses over manufacturer's allowable) (see CASE Exhibit 669B, item 11ZZ).

(3) I have always maintained that insufficient cinching would lead to lift-off problems when mechanical loads were applied (see Tr. 12,353-12,354).

(4) I have always maintained that the use of U-bolts as clamps on coverd lines with temperatures of 120 degrees F. to 450 degrees F. was not recommended (see MSS SP-69, 2.0 and Table 1).

(5) As relates to instability problems for U-bolt double-pinned columns or, for that matter box frames, is not recommended for support of pipes from below (see MSS SP-69, 6.2 and 6.3).

(6) I have always expressed a concern with the local stress problems on pipes with cinched-up U-bolts (see CASE Exhibit 669B, items 11YY and 11ZZ).

Since I have always objected to the use of U-bolts as clamps, how can I be cited as approving (even indirectly) the use of this unique deviation from standard practice.

MR. WALSH:

2. Applicants state:

"The stability of piping systems is not explicitly addressed in piping analyses. However, it is not necessary to do so because through the normal design process the piping designers achieve a system which will stay within specified deflection limits and, thus, will be incapable of the instabilities at issue here. (Finneran Affidavit at 7.)"

I agree with Applicants' first sentence (see discussion under answer 1 preceding).

Regarding the second sentence, I totally disagree. Applicants' premise is taken from page 7 of Applicants' Affidavit and is illogical, irrational, and undocumented. To demonstrate this fact, consider the following: Applicants' Witness Finneran is relying on the "normal design process" and "specified deflection limits." Applicants' "normal design process" created the problem with unstable supports and there was no mechanism within the Applicants' system to identify, to correct, or to avoid unstable supports in the future, as will be demonstrated later. "Specified deflection limits" on which Mr. Finneran is relying are immaterial, since the supports will deflect out of the way of the pipe if they are unstable. The piping designers are incapable of identifying an unstable support (see Applicants' Witness Krishnan at Tr. 4917, where he conceded that unstable supports could have been input into the stress run as being stable, as pointed out in CASE's 8/22/83 Proposed Findings of Fact and Conclusion of Law (Walsh/Doyle Allegations), at page III - 2). Further (as discussed on page III - 1 of CASE's Proposed Findings), Mr. Krishnan, Applicants' Site Stress Analysis Group Supervisor, lacked any concept of what constitutes

instability (and there is no indication that he has taken steps to make himself more knowledgeable in this regard); he stated that he is not an expert on hanger design and pipe hanger supports, and that he was not giving expert testimony in that regard.

3. Applicants state:

"The support designer is responsible for assuring the stability of each pipe support as part of the piping and support system, and may rely on the presence of the pipe to (sic) a stabilizing effect. This responsibility is delineated in ASME Code Section NF, Appendix XVII, Section XVII-2221(a), to which all support design organizations are committed. (Finneran Affidavit at 8.)"

I will not address the legal requirements regarding Applicants' statements. But regardless of who is responsible, the important point here is that there were unstable supports constructed which were in violation of the ASME Code to which Applicants are committed. And the Applicants did not discourage field engineers from continuing to create these unstable supports or ITT Grinnell from doing so. (See also discussion in answer 15 following.)

4. Applicants state:

"Applicants promptly identified and acted to correct potential instabilities of pipe supports at Comanche Peak in the normal course of the design process. Potential instability of box frame supports with single struts or snubbers (which resulted from modifications made in the field) were intitially identified by ITT engineers on site in May 1981 (prior to Mr. Doyle or Mr. Walsh working at Comanche Peak), at which time a hold was placed on approval of further designs of this type of support. There is no evidence that Mr. Doyle or Mr. Walsh raised the question of stability of these supports with their supervisors or other of Applicants' personnel who were in a position to act on their concern. (Finneran Affidavit at 9-11, 29.)"

MR. WALSH:

I disagree with the first sentence. The Applicants have provided inter-office correspondence by ITT Grinnell (Attachments A-1, A-2 and A-3 to Applicants' Affidavit).

Attachment A-1 is interoffice correspondence from Gus Abele; this is the bi-weekly report for Comanche Peak which provided the status of the work being done by ITT Grinnell field engineers. On page 2, item 6, the potential problem of instability of box structures is discussed, and it states that: "Technical Services will hold all supports using box structures as pipe attachments until written procedure or approval from Providence is received." (Emphasis added.) There was no documentation provided by Applicants that such written procedure or approval from Providence was ever received.

This appears to be Grinnell's method of promptly identifying and correcting design deficiencies. This same correspondence is also used for such relatively insigifnicant items as requesting pencils (bottom of page 2). There appears to be no special significance attached to the identified design deficiencies as opposed to the ordering of pencils, for example. Further, there appears to be no way which identified design deficiencies would have been trended from such a memorandum, so that the recurrence of the problems would have been avoided.

The second memorandum (Attachment A-2) on which the Applicants rely to prove that they promptly identifed this "disease" of

instability was to the Manager RD&E, Robert Mulcahey, from Gus Abele, ITT Grinnell Lead Site Engineer. This memorandum (which was some five months after the first memorandum) is a request for information for ITT Grinnell field engineers to have some concrete guidelines for determining the stability of box frames. There is no indication in either of the two memoranda that Applicants had identified that there was also a problem with instability in regards to supports with U-bolts.

The third memorandum (Attachment A-3 to Applicants' Affidavit), to Gus Abele from Don Wisniewski, was dated 4/2/82, almost six months after the second memorandum and almost one year after the problem was first identified. This answer from ITT Grinnell in regards to concrete guidelines for stability states that a "general answer cannot be generated" for a variety of reasons. It is obvious from this memorandum that the design organization (ITT Grinnell) did not even understand what the problem was or the extent of the problem -- almost a year after the problem was identified. There is no indication that any of the instability problems had been corrected or could be corrected. Further, there is no indication that anyone had identified that there was a problem with instability when utilizing a U-bolt (as on the main steam line, for example). This is not prompt identification and correction of the problem.

MR. DOYLE:

Q: Mr. Doyle, do you agree with Applicants' first sentence?

A: I do not. I discussed this in my Affidavit attached to CASE's 10/6/84 First Motion for Summary Disposition Regarding Certain Aspects of the Implementation of Applicants' Design and QA/QC for Design (at page 8, line 15, through page 10, line 13), and I will not repeat it here, but incorporate it herein by reference.

MESSRS. WALSH AND DOYLE:

In summary, Applicants' statement that they "promptly identified and acted to correct potential instabilities" is misleading, since the Applicants have not provided any documentation to show that they had corrected the problems of instability to box frames or that they had even identified another problem with instability on supports utilizing U-bolts.

MR. WALSH:

Regarding Applicants' second sentence, the Applicants admit that ITT Grinnell engineers identified potential instability of box frame supports with single struts or snubbers, but as discussed above, no corrective action was implemented, apparently in part because ITT Grinnell's home office did not understand the problem. In addition, Gus Abele (the same engineer who wrote the first two memoranda) discussed the potential instability using double struts (Attachment A-2, page 2). (See answer 9 following.)

Also, there is another important aspect discussed in Applicants' Affidavit but not included in their Statement of Material Facts. At

page 10 of his Affidavit, Mr. Finneran states:

> "The potential instability was identified by ITT engineers on site in May 1981 (see memorandum CPG #36, dated May 22, 1981 (Attachment A-1)). As can be seen from page 2 of this memorandum, 1) the two supports referenced as examples (CC-1-159-010-S43R and CC-1-028-039-S33R) are the same supports listed by Mr. Doyle in CASE Exhibit 669B (Items 4g and 4h, 4o and 4p), and 2) the supports were identified as potentially unstable no later than May 22, 1981. Mr. Walsh began work at Comanche Peak on June 15, 1981. Mr. Walsh began work at Comanche Peak on June 15, 1981. Mr. Doyle began work on August 17, 1981. Neither of these individuals could have had any part in the identification of suports as potentially unstable."

Apparently Applicants did not realize that, by his statements quoted above, Mr. Finneran has proved one of our main points. Applicants have now admitted that this problem (even on the same two supports) was identified sixteen months before it was again identified, this time by Mr. Doyle in his August 1982 deposition, that they didn't do anything to correct the problem when it was first identified, and that it wasn't until after I testified in July 1982 and after Mr. Doyle's August 1982 deposition that Applicants finally were forced, because of these operating license hearings, into doing something about this problem -- while at the same time offering this as some sort of proof that "Applicants discovered this problem themselves and promptly acted to address it." Mr. Finneran's own statements, in the same paragraph, prove the contrary.

MR. DOYLE:

Q: Mr. Doyle, do you agree with the third sentence of Applicants' Statement 4, or with the statements made by Mr. Finneran at page 11 of his Affidavit, where he states:

"In fact, only Mr. Doyle alleges that he spoke to anyone regarding his concern. Specifically, he alleges that he had discussed this matter with Mr. Kerlin. However, as Applicants indicated in their Motion for Reconsideration of the Board's Memorandum and Order (at 20-21), Mr. Kerlin was a co-worker of Mr. Doyle's and had no supervisory responsibilities. Thus, Mr. Doyle took no action to bring his concern to any one whom he could have reasonably expected to take any action."

A: I certainly do not. I testified during my August 1982 deposition (CASE Exhibit 669A, Doyle Deposition/Testimony, accepted into evidence at Tr. 3630, pages 21-23), regarding my unsuccessful attempt to explain instability to Mr. Kerlin. I stated at that time regarding Mr. Kerlin's job:

"Q: Was a part of Terry Curlin's (sic) job to work with the pipe stress and pipe support people, the people who did this analysis; was he part of the interface with others, as far as you know?

"A: What I know is that he had something to do with -- between the nuclear engineer, I can't think of his name -- between him and NPSI and Grinnell on supports. I also know he was getting numbers from the Pipe Stress Group because he was running through them. What his exact function is, I can't answer."

While it is true that I did not necessarily mention specifically who I talked to about the instability problem other than Terry Kerlin, from my deposition (CASE Exhibit 669 and 669A, Deposition/Testimony of CASE Witness Jack Doyle, admitted at Tr. 3630), it is obvious that I talked to everyone I thought was interested or might be willing to do something about it relative to a vast number of problems. And among the number, instability (although it is unclear from my deposition) was discussed with Mark Walsh (who was, for some time, leader of my group), Gary Krishnan (Mark Walsh's immediate supervisor), and co-workers Pam Stanford and Jerry Petty, and others. The discussion of problems on

many occasions will be noted as follows, from my deposition (CASE Exhibit 669):

pages 14, lines 3-6, U-bolts and LOCA problems were discussed;

page 24, lines 7-12, LOCA was again a topic; and

page 25, lines 5-7, U-bolts were again brought up, as was the case at page 30, lines 12-15.

As far as general discussions, when questioned by Applicants' Witness Scheppele (at page 299, lines 22-23), I stated that I felt it was serious and that's why I kept passing the information on. I repeated myself again at page 300 (lines 4 and 5), when Mr. Scheppele inquired as to whether I had ever told anybody that I had a specific concern for the design of this facility; I stated that "I certainly did, many times while I was there." At an earlier point, contrary to the openness for discussion with management that Applicants now try to convey, Mr. Scheppele kept insisting that I worked within a box (see pages 258-262). At pages 261, line 25, through 262, line 2, Mr. Scheppele also stated that it was not my responsibility to change configurations of supports.

And beyond this, Applicants' admission that one of their people had presented the instability problem in May of 1981 and received no response until April of 1982 (at which point they sloughed the man off to another individual for further discussion which was not documented) is indicative of the lack of interest Applicants took in any complaints which were brought forward.

The most significant point relative to instability reporting is the fact that Applicants, by their own admission, received communication from ITT Grinnell personnel on site that an instability problem existed. Over a year later, I complained of the same problem on the same supports. Apparently nothing had occurred in the interim. In April of 1982, a year after he had reported it, Applicants passed this same ITT Grinnell employee off to discuss the problem with someone else (that discussion is not documented). So what would have been the advantage of me (or Mr. Walsh) reporting the problem even if we had gone to Mr. Spence himself? Nobody was interested anyway. As stated in my deposition, I quit (or was fired, I'm not sure which) basically because of lack of interest by management at Comanche Peak in the problems that existed (my deposition, CASE Exhibit 669, at page 13, line 25, through page 15, line 1, and page 298, lines 2-13).

MR. WALSH:

Q: Mr. Walsh, do you agree with the third sentence of Applicants' statement 4, where they state:

> "There is no evidence that Mr. Doyle or Mr. Walsh raised the question of stability of these supports with their supervisors or other of Applicants' personnel who were in a position to act on their concern. (Finneran Affidavit at 9-11, 29.)"

. . . or with the statements made by Mr. Finneran at page 11 of his Affidavit, where he states:

> "In fact, only Mr. Doyle alleges that he spoke to anyone regarding his concern. . . Mr. Walsh has not alleged that he spoke to anyone, let alone a supervisor, regarding instability."

A: I disagree with Applicants' statements. There is "evidence in the record that Mr. Doyle or Mr. Walsh raised the question of stability of these supports with their supervisors or other of Applicants' personnel who were in a position to act on their concern," as discussed by Mr. Doyle in the preceding.

To the best of my recollection, Dave Rencher and Terry Kerlin appeared to supervise the Technical Services Design Review Group (TSDRG), including NPSI and ITT Grinnell engineers; Dave Rencher was listed as "Supervisor, Technical Support Design Review . . . Contract employee, managed and supervised by licensee" in the SIT Report (NRC Staff Exhibit 207, page 8 of Appendix). And it appears from documents obtained since I testified in July 1982 that these TSDRG engineers were performing vendor certification of pipe supports. The organizational structure which involved Terry Kerlin and Dave Rencher appeared to be as follows: The ITT Grinnell and NPSI engineers did the calculations for supports that were given to them from Dave Rencher and Terry Kerlin. Any changes to pipe supports or memoranda in regards to those supports were through the office of Dave Rencher and Terry Kerlin. The latest as-built loads went to Dave Rencher and Terry Kerlin, so that the ITT Grinnell and NPSI engineers could evaluate the supports for the new loads.

I generally recall the day when Terry Kerlin and Jack Doyle had their discussion and Jack Doyle tried to explain to Terry Kerlin about instability. I was not directly involved in the discussion but I

overheard parts of it. I don't remember all of the conversation, but I do recall that Jack Doyle pointed out the problem of instability to Mr. Kerlin. Although the Applicants may claim that Mr. Kerlin "was a co-worker of Mr. Doyle's and had no supervisory responsibilities," Mr. Kerlin, in his position, certainly appeared to be in a supervisory position.

It should be noted that the Licensing Board, in its 2/8/84 MEMORANDUM AND ORDER (Reconsideration Concerning Quality Assurance for Design), at page 15, item 2, stated:

> "Applicant relies on extra-record materials to rebut the Board's finding that Mr. Kerlin had some supervisory responsibility. Although Applicant has not yet presented evidence on this point, we are confident that it will do so in order to establish its point."

This is correct, and there was never any need for me to discuss this matter, because Mr. Doyle's testimony was unrebutted in the record anyway. And the Applicants have still failed to provide evidence to rebut the Board's original finding. The only "evidence" which Applicants have provided is Mr. Finneran's statement in his Affidavit (at page 11):

> "However, as Applicants indicated in their Motion for Reconsideration of the Board's Memorandum and Order (at 20-21), Mr. Kerlin was a co-worker of Mr. Doyle's and had no supervisory responsibilities." (Emphasis in the original.)

There is no indication that Mr. Finneran did any independent research regarding this matter or that he is relying on anything other than the extra-record and unsupported statements in Applicants' Motion for Reconsideration. And there is no documentation to support any of

Applicants' statements in this regard; this includes the CMC which Mr. Finneran stated had been written in March 1981 to improve stability (Tr. 4893/12-4895/3).

And regarding Mr. Finneran's amazing statement that "Mr. Walsh has not alleged that he spoke to anyone, let alone a supervisor, regarding instability," during my unrefuted cross-examination testimony in July of 1982, I stated (Tr. 3107/19-22):

> "What happened was the engineer from Grinnell, I went over and informed him that it was unstable, and he told me that it was his responsibility." (Emphases added.)
>
> "Consequently, we sent it back that way."

It should be pointed out that this entire question as to whether or not Mr. Doyle or I had reported our concerns to anyone onsite is a relatively unimportant matter when compared to the many serious design and design QA/QC deficiencies at the plant. It was Applicants who have made this into a big issue, and who have again by their own actions proved (among other things) that they didn't listen when the problem was first brought up, or when it was brought up by Mr. Doyle and me, or apparently even when I testified in July of 1982 in front of many of Applicants' witnesses and representatives (including, I believe but am not positive) Mr. Finneran himself.

5. Applicants state:

> "Applicants reviewed all supports in Unit 1 and common areas and identified 12 frames that fall in the category of box frames with single struts or snubbers. There are about 17,000-18,000 safety-related supports in Unit 1 and common areas at Comanche Peak.

(Finneran Affidavit at 12-13.) Modifications made to these supports (all initiated prior to February 23, 1983) will prevent rotation of the frame around the pipe and thus remove the mechanism through which the potential rigid body instability could occur."

Regarding the first two sentences, it is not surprising to me that Applicants could only find 12 frames out of the 17,000-18,000 safety-related supports in Unit 1 and common areas at Comanche Peak. The reason I am not surprised is based on the memorandum which is Attachment A-3 to Applicants' Affidavit. It appears that the Applicants could not respond to Gus Abele's request for guidelines for stability, as shown in Attachment A-3 and as stated earlier. As will be shown in answer 6, there is at least one more unstable box frame with single struts which Applicants have not identified as unstable.

In regards to Applicants' third and last sentence, I have two points to make. The Applicants claim that they initiated modifications to the 12 unstable supports with box frames prior to February 23, 1983. The Applicants have shown no proof or documentation that this is true. It is my understanding that this was to be Applicants' last oppotunity to prove their case and that it is the Applicants who must provide sufficient evidence and documentation to prove their point -- not always CASE who must request and provide documentation to the Board. The burden of proof should be on the Applicants -- not CASE or Mr. Doyle or me. It was because of this lack of proof or documentation by Applicants that I am now having to answer (and have answered in the past) Applicants' Motions for Summary Disposition. If the documentation does exist, the Applicants should have provided it with their Motion for Summary Disposition. CASE and I are at an inconvenience in answering these motions which the Applicants are

utilizing to attempt to show that they have a proper design/design QA/QC program because many times we have had to request documents before we have really had time to thoroughly review the Applicants' Motions to begin with. So we've just had to do the best we can with the documents we did ask for and receive.

The Applicants have not demonstrated that the modifications which they have made to these 12 supports will, in fact, prevent rotation of the frame around the pipe and thus remove the mechanism through which the potential rigid body instability could occur.

6. Applicants state:

"CASE incorrectly asserted that NCRs should have been issued against these supports. This potential deficiency was identified as part of the normal design review process. Applicants do not use NCRs to document deficiencies identified in that process. In addition, irrespective of this fact, the Component Modification Cards (CMCs) that were written which created the potential instability do not constitute an official design change until they have been reviewed and approved by the responsible design organization. In this instance, the potential instability was identified prior to approval of the CMCs, and in fact as part of the review cycle. Thus, the question of whether further documentation of this potential deficiency should have been issued is not relevant. (Finneran Affidavit at 14.)"

When Applicants state that "CASE incorrectly asserted that NCRs should have been issued against these supports," it is apparent from Applicants' testimony in the September 1982 hearings, as compared to the Affidavit of Mr. Finneran attached to Applicants' Motion for Summary Disposition, that Applicants are still committed to the same erroneous postion they initially took -- although the Board clearly

stated in its 12/28/83 Memorandum and Order (Quality Assurance for Design) that Applicants (and NRC Staff's) premise was incorrect and in violation of NRC regulations (Order at page 2-7, 20-30, and 69-71, for example).

Also, until Applicants changed their FSAR (Applicants' Exhibit 3) on July 11, 1983, they were in noncompliance with their own FSAR in this regard. (See Attachments A and B hereto: FSAR page 17.1-39, May 31, 1979; and FSAR pages 17.1-39, July 11, 1983, respectively. See also Attachments C and D hereto: FSAR page 17.1-40, May 31, 1979; and FSAR page 17.1-41, August 7, 1981, respectively. See also discussion in CASE's 8/22/83 Proposed Findings of Fact and Conclusions of Law (Walsh/Doyle Allegations), pages XXIX - 19 through -23.)

In his Affidavit at page 14, Mr. Finneran states:

> ". . . the Component Modification Cards (CMCs) that were written which created the potential instability do not constitute an official design change until them have been reviewed and approved by the responsible design organization. As I previous testified, all CMCs creating design changes are subject to review by the responsible design organizations. (Tr. 4870-71.)"

In their Motion for Summary Disposition, Applicants do not discuss what method they do utilize to identify and correct design deficiencies or potential design deficiencies. They rule out the use of NCR's and it is obvious that they cannot use CMC's because, as Applicants claim, it was CMC's which were written which created the potential instability. It appears that Applicants' statement that they do not use NCR's to document deficiencies is correct, but it does not go far

enough -- it appears that Applicants do not use anything to document such deficiencies, based on the small amount of "documentation" they have provided.

The Applicants further claim that the potential instability was identified prior to approval of the CMC's. In CASE Exhibit 669B (Attachment to Deposition/Testimony of CASE Witness Jack Doyle, admitted at Tr. 3630), Item 4E represents one of the unstable supports as it existed at Comanche Peak. Item 4E is written on a CMC and it will be noted that it is approved. Applicants may claim that this does not mean that it was approved for design, but G. M. Chamberlain, the latest approver, is from PSE Engineering; therefore, this is (by implication) engineering approval. In addition, in CASE Exhibit 669B, Item 4C, a copy of the CMC, Rev. 13, is shown for this same support. This CMC was approved by Dave Rencher (who is listed in the SIT Report as Supervisor, Technical Support Design Review, contract employee, managed and supervised by licensee). It should be noted that Technical Support Design Review (TSDR) does the vendor certification.

Although the reason that the support in CASE Exhibit 669B, Items 4C and 4E, is unstable may have been discussed elsewhere, I will quickly reiterate the reason. Without a sufficient clamping force, this box frame will rotate about the axis of the pipe and will slide down the axis of the pipe. The Applicants do not have an established procedure that would be adequate for engineering to verify that a proper clamping force exists. In addition, as will be discussed in

answer 9 herein, it is highly probable that a gap exists between the pipe and the frame.

Attachment E, Attachment F1, and Exhibits F1 and F2, attached hereto, are part of the "insignificant" material which Applicants were to provide to the Staff on instability (CASE is using the same designation for Attachment F1 and Exhibits F1 and F2 which Applicants had already assigned to them, since this fell in line with our Attachment numbering sequence). This support is also shown in CASE Exhibit 669B, Item 11JJ through 11NN. During the 8/23/84 meeting onsite between the NRC Staff and Applicants, Applicants promised to provide this material to the Staff by 8/30/84, but it was not provided to the Staff until 9/24/84, and CASE received it on 9/25/84. Support CC-1-028-034-S33R (which is described in CASE Exhibit 669B, items 4C and 4E), has a similar configuration as that shown in Exhibits F-1 and F-2 for supports CT-1-008-007-S22K and CT-1-008-008-S22K. These last two supports presently exist at Comanche Peak, as discussed in Attachment E hereto at page 1 of Answer F(a), and Exhibit F1, respectively, wherein Applicants attempt to explain why they (erroneously) believe that the support is stable.

One difference between Exhibits F-1 and F-2 and CASE Exhibit 669B, items 4C and 4E, is that the Applicants' Exhibits have lugs welded only to the pipe, whereas items 4C and 4E do not have the lugs welded to the pipe. In CASE Exhibit 669B, items 4C and 4E, the pipe is running horizontally, and is being supported vertically from below and has one horizontal direction of restraint; in Exhibits F-1 and F-2, the pipe is vertical and has horizontal restraints in the East/West and North/South

directions. In Exhibits F-1 and F-2, the Applicants support the deadload of the supports by welding lugs to the pipe. As will be shown below, these lugs do not improve the stability of these supports. Therefore, both Exhibits F-1 and F-2 and CASE Exhibit 669B, items 4C and 4E, are similar in that they are box frames which have a strut or snubber and are intended to provide support for the pipe.

In Applicants' Attachment F-1 from ITT Grinnell, Grinnell attempts to qualify these existing supports. In Grinnell's response regarding the stability of these supports, they attempt to show that the supports are stable. On pages 2, 3, and the top of page 4, Grinnell determines displacements and rotations to come up with the additional load (which is meaningless) for the support configuration. As stated in their reply on page 4, they consider the increase in stress due to a kick load. Since the previous stresses were below the allowables, Grinnell erroneously assumes that "sufficient design margins exist to account for worst case considerations."

Grinnell apparently has no concept, to this date, of what constitutes a support's being stable or unstable, since they are still considering the stresses within the member, and not the rigid body rotation which is exhibited in this type of support. The numbers provided on pages 2, 3, and 4 of Attachment F-1 are irrelevant, illogical, and immaterial, since they do not address the stability problem as a rigid body. These supports are unstable because if a load is in the North/South direction and is minutely offcenter from the

North/South directional support, and has a load in the East/West direction minutely offcenter from the East/West direction, and if both loads would tend to put compression in the supporting snubbers, this frame will rotate out of the way, and this will be as if there is no support at this location.

Grinnell's error in the calculation also did not consider the dynamic effects and the reason a postiive clamping force is required. When the Applicants tested the cinched-down U-bolt with a preload on the U-bolt, they discovered that the support assembly will rotate about the pipe when dynamically loaded. These frames under discussion (single struts or snubbers on box frames) have no positive clamping force and are therefore unstable.

The Applicants provided CASE, on discovery, drawings for some unstable supports. The drawings included the drawing that made the support unstable and the drawing that made it stable. Attachments G and H hereto include the drawings which made the supports unstable. And in both cases, these are on CMC's and both are from engineering (CPPE, which is Comanche Peak Project Engineering). As a matter of fact, in Attachment G, which is for Support CC-1-048-007-A33R, Rev. 1, the originator was G. Abele (Lead Site Engineer, according to Attachment A-2 to Applicants' Affidavit, and according to the SIT Report, NRC Staff Exhibit 207, page 8 of Appendix, Supervisor, Sit Engineering, contract employee, managed and supervised by licensee), who was the one who wrote Attachments A-1, and A-2, and who was the addressee in Attachment A-3, to Applicants' Affidavit. It would appear that the approval as shown on the CMC's would also be from an engineer or from engineering. This assumption is supported by the testimony of

Mr. Finneran in the September 1982 hearings at Tr. 5184/1-6:

"BY WITNESS FINNERAN:

"A. The pipe support field engineer interfaces directly with the craft. When interference or a problem is encountered, he will resolve the problem, document the resolution on a CMC, and forward the CMC to the proper design organization for review and approval." (Emphases added.)

It was during the testimony as to how the problem with unstable pipe supports came about in the first place that Mr. Finneran made his now-famous statement that the problem was caused by field engineers who were not responsible for the design of the support (Tr. 4955-4962), and that these were "somewhat knowledgeable" engineers (Tr. 4962-4965, emphasis added). Then NRC Senior Resident Inspector - Construction Robert Taylor testified, regarding deficiencies in design, that the source of these design deficiencies is "a somewhat inexperienced engineering staff." (Tr. 6403/4-6404/3, emphasis added.) He further confirmed that these somewhat inexperienced engineers are still involved in design work at Comanche Peak (Tr. 6406/1-11). (See discussion at page III - 4 of CASE's 8/22/83 Proposed Findings of Fact and Conclusions of Law (Walsh/Doyle Allegations). I do not want to belabor the point here, but want to call the Board's attention especially to the single-spaced transcript citations in the middle of the page regarding the credibility of Mr. Finneran's testimony.)

In summary, the Applicants have not shown that they have a program which will comply with the requirements of 10 CFR Part 50, Appendix B, Criteria II, XV and XVI. "Somewhat knowledgeable" engineers (including

supervisory personnel) apparently created the unstable supports. "Somewhat knowledgeable" engineers (including supervisory personnel) apparently approved the unstable supports. "Somewhat knowledgeable" engineers (including supervisory personnel) apparently are part of the original design organizations or vendor certification process. The Applicants have not demonstrated whether or how they have, or plan to, educate these individuals to avoid this problem in the future.

7. Applicants state:

"With respect (sic) the question of the stability of the main steam supports, ongoing discussions were in progress in September 1982 as to whether there was a need for corrective action on this type of support. These discussions revolved around the impact of various effects on the supports' stability. Because the design practice for U-bolts used as clamps on single strut supports is to have the U-bolts cinched down (as is done with a clamp) there was no need to impose any restrictions on design practices pending ultimate resolution of these questions. Applicants decided in late 1982 to modify these supports to improve their stability because the modifications were relatively simple and readily accomplished. (Finneran Affidavit at 15-18.)"

To begin with, Applicants did not provide any documentation with their Motion for Summary Disposition to support their allegation that they were having the "ongoing discussions" in September 1982 as to whether there was a need for corrective action on possible instability of the main steam supports. It should be noted that Mr. Finneran does not provide any transcript citation to support his statement that there had been such "ongoing discussions" -- because he did not state that during his testimony in the September 1982 hearings when he discussed this matter. In fact, from his testimony during the September

hearings, it appears that Mr. Finneran was relying only on thermal expansion of the pipe to make the support stable; Mr. Finneran concluded that he felt the support might be unstable with the loads shown without this thermal expansion (Tr. 4943). In addition, it should be noted that Mr. Finneran does not provide any citation to the SIT Report to support his statement that there had been such "ongoing discussions" -- because there is none to cite.

It appears to me that the only "ongoing discussions" were the testimony and cross-examination of Mr. Finneran (and other Applicants' witnesses). There has certainly been no discussion in the transcript, or statements in the SIT Report, or documentation supplied by Applicants to support the idea that they had any such "ongoing discussions" or had even identified the problem prior to Mr. Doyle's deposition on August 19 and 20, 1982. And there is nothing to prove that Applicants would have ever dealt with this problem or attempted to correct the problem if it had not been brought out by Mr. Doyle in these hearings and under the eye of the Licensing Board.

In the third sentence of Applicants' alleged Material Facts, the Applicants are referring to U-bolts which are cinched down. This is irrelevant to the unstable main steam supports because they had a 1/8" gap and were not cincned down. But to clarify the record, the Applicants, even in September of 1982, could not rely upon any clamping force due to the cincned down U-bolts because the craft were not requested or required to pretorque these bolts. This is demonstrated

in the SIT Report (NRC Staff Exhibit 207) on page 32, under the discussion of item g. Use of U-Bolts in Pipe Support Design, where it states (emphasis added):

> "Regarding the preloading stresses in item 3(a) of Mr. Doyle's concern, the Special Inspection Team determined that the Brown & Root Design Change Notice (DCN) Number 1, dated 10/8/82, to Construction Procedure No. 35-1195-CPM 9.10 Rev. 8 provides additional requirements to paragraph 3.3.2, 'Threaded Items,' for U-bolts. It states:
>
> > "'When U-bolts are specified on the design document as not having any clearances, the U-bolt shall be snug tight so that the U-bolt cannot be moved by hand....
> >
> > "'Snug tight is defined as the tightness attained by a few impacts on an impact wrench or the full effort of a man using an ordinary spud wrench.'"

Another reason they could not rely upon a frictional clamping force as is used for a clamp is because a U-bolt is not a clamp; a U-bolt does not go all the way around the pipe as would a clamp. This was recognized by the SIT Team at page 33 of the SIT Report:

> "Further, the U-bolt is normally provided with a 1/16 inch diametrical gap on the pipe to facilitate its installation. Even after cinching down, there is not full circumferential contact between the U-bolt and the pipe." (Emphasis added.)

In addition, as has been pointed out by CASE Witness Jack Doyle (see CASE's Answer to Applicants' Statement of Material Facts As To Which There Is No Genuine Issue Regarding Consideration of Cinching Down of U-Bolts in the form of Affidavit of Case Witness Jack Doyle, at page 4):

> "The Applicants have proved by random sampling that there is no effective torque rate for the plant." (Emphasis added.)

As discussed in the preceding, Applicants did not have procedures to support Applicants' third alleged Material Fact (referencing Mr. Finneran's Affidavit at page 16) of the design practice being to have the U-bolts cinched down. But whether or not there had been such procedures, I do not agree with Applicants statement that "there was no need to impose any restrictions on design practices pending ultimate resolution of these questions." Applicants have boxed themselves into a corner. After the stability problem with these supports was identified by Mr. Doyle, they decided to go along and cinch up the U-bolts, without any consideration of the consequences and without proper analyses to support their improper fix. At that time, according to their own FSAR commitments, they should have written an NCR, placed a hold tag on all affected supports, and made the proper analyses of this design change (which would have indicated that this was an improper fix) -- and they should have done all this before they actually went into the field and cinched down any U-bolts to improve stability. What Applicants did is clearly improper and contrary to their own FSAR commitments, ANSI N45.2.11, and NRC regulations (specifically 10 CFR Part 50, Appendix B, Criteria III, XV, XVI, for example).

On pages 16 and 17 of his Affidavit, Mr. Finneran discusses the specific questions and observations which allegedly were under review in September of 1982. On page 17, under item 1, Mr. Finneran states that "during the compressive load cycle for this support, the crosspiece cannot slide around the pipe" because "sufficient friction

force will be developed to resist the sliding." But when the Applicants performed a vibration test on U-bolts under a cyclic loading condition, they determined that "insufficient assembly preload will permit the assembly to rotate about the pipe and also walk axially along the pipe axis in either direction with respect to the location of the strut." (See Applicants' Motion for Summary Disposition Regarding Cinched-Down U-Bolts, Affidavit of Robert C. Iotti and John C. Finneran, Jr. Regarding Cinching Down of U-Bolts, at page 27.)

These supports which are on the main steam line contained a 1/8" gap between the pipe and the U-bolt. Obviously, these were not cinched down and the U-bolts did not have a preload. Therefore, based on the Applicants' testing, these assemblies would rotate about the pipe and walk axially down the pipe and are therefore unstable (i.e., unable to take the load in the intended direction).

The comments made by Mr. Finneran in item 2 on page 17 are also without merit due to the testing performed for cinched down U-bolts. I believe that Mr. Finneran should have informed the Board in his Affidavit that the U-bolts would not have acted in the intended direction. He did not do this, although there is a clear contradiction in his statements in the two Affidavits.

As the NRC Special Inspection Team has reported to this Board in the SIT Report, as stated before above, the Applicants had no pretorque requirements for U-bolts prior to 10/8/82 (which occurred after Mr. Doyle's testimony had been given in the September hearings). In

addition, the SIT reported that a 1/16" diametrical gap is normally provided to facilitate installation. The Applicants have 380 supports which consist of the same configuration under discussion for the main steam supports (i.e., U-bolt and strut or snubber) which had no pretorque requirements prior to October 1982 which the Applicants considered stable. These supports are now being modified by increasing the U-bolt preload (i.e., cinching the U-bolt down). Without this cinched down U-bolt to a minimum pretorque requirement, all these supports would be unstable, as the Applicants have demonstrated by their own tests.

It should be noted that the preceding statements regarding testing are based on the assumption that Applicants' tests were correct and were correctly done. However, I do not agree that this was the case, and I refer the Board to CASE's Answer to Applicants' Statement of Material Facts As To Which There Is No Genuine Issue Regarding Consideration of Cinching Down of U-Bolts in the form of Affidavit of Case Witness Jack Doyle for further details in this regard.

Regarding Applicants' last sentence in Statement 7, it would appear that the Applicants were (and are) reluctant to admit that these supports were unstable. The Applicants apparently would like to have the Board believe that the only reason that they corrected this problem is to "improve their stability" and because the cinching up of a U-bolt was "relatively simple and readily accomplished." They did not admit that the reason they decided to cinch up the U-bolts was because the support was unstable.

On page 18 of Mr. Finneran's Affidavit, he states that the cinching up of the U-bolts was to "improve their stability." He could not then, and cannot now, quantify the degree of stability then or the amount of stability achieved by cinching up the U-bolt based on the new Brown & Root procedure for torquing of the U-bolt which was discussed in the preceding.

Further, the NRC Staff's understanding (and the Board's and other parties' understanding because of the testimony in the proceedings) was that Applicants were going to assure that each and every unstable support was made stable, as indicated in testimony by NRC Staff Witness Dr. Chen (Tr. 6719/7-6720/11, emphases added):

> "JUDGE McCOLLOM: Now, the Applicant is said to be committed to looking at these unstable supports as a system, to see if they are indeed stable; is that correct?
>
> "WITNESS CHEN: Their actions, I think, will ensure that. In fact, what they are doing is they are looking at each pipe support now, and making sure that in and of themselves they will be stable --
>
> "JUDGE McCOLLOM: Each individual pipe support?
>
> "WITNESS CHEN: The box type, yes, nonrigid box type supports. Those are the only ones outstanding that I'm aware of for this problem.
>
> "With regard to the U-bolts, there was no rotation, and hence no loss of function, if you wish, that kind of support. The box frame kind of supports, though, could have this problem, and they are committed now to remedying those.
>
> "That action, I think, will be sufficient to ensure that the entire piping system will be stable.
>
> "JUDGE McCOLLOM: Will all individual pipe supports also be stable?

"WITNESS CHEN: That is correct.

"JUDGE McCOLLOM: And was the iterative procedure that the Applicant was using, would it have caught these even if we had not been notified of this, if you wish, by Mr. Doyle?

"WITNESS CHEN: Yes, I believe so.

"JUDGE McCOLLOM: You now believe that there is in place a system to remove all these instabilities?

"WITNESS CHEN: Yes, that is correct."

Certainly it was the Board's understanding that Applicants were going to assure that each and every unstable support was made stable, as reiterated by Judge Bloch in the October 1983 hearings (Tr. 8880/17-20):

". . . at the last hearing I thought we understood the Applicants had undertaken to eliminate any instability that might exist in an individual support -- not only system basis, but on an individual support. . . "

There is another important aspect of this of which the Board should be aware regarding the lack of documentation supplied by Applicants with their Motion for Summary Disposition.

NRC Staff Witness Dr. Chen testified at Tr. 6720/18-6721/14:

"JUDGE McCOLLOM: There was some earlier testimony from Mr. Taylor about his reason for believing that the iterative process would pick up all the problems.

"Dr. Chen, as I remember, Mr. Taylor was particularly impressed by the quality of the people who would be participating in the last review.

"What are the factors that led you to believe that -- do you believe all of these mistakes would be picked up, or just that this group would do a very good job of it?

"WITNESS CHEN: I believe that all -- most of them would be picked up.

"JUDGE BLOCH: As a scientist and engineer, you have difficulty in even getting the word 'all' out of your mouth, don't you?

"WITNESS CHEN: That is correct.

"Based on two things, if I may. Our review of the hundred vendor certified supports did not indicate that there were any problems there. And secondly, I have seen, I believe, Notes coming back from Gibbs & Hill to the designer saying that there are unstable supports which need to be fixed." (Emphasis added.)

The notes to which Dr. Chen referred were not attached to Applicants' Motion for Summary Disposition. In fact, there is no documentation which has been provided by Applicants where they actually admit that there definitely, positively, really are supports which are unstable. If such documentation actually exists (as indicated by Dr. Chen), Applicants should have provided it.

8. Applicants state:

"Applicants identified 15 of these types of supports in Unit 1 and common areas. Thirteen of these supports are mainsteam supports. Three of the mainsteam supports were actually modified during initial installation in such a way that the potential instability was removed. These modifications occurred prior to September, 1982. The remaining ten mainsteam supports were modified between January, 1983 and June, 1983. The two non-mainsteam supports were modified in October and December, 1982. The modifications consisted of snugging the U-bolts or adding supplementary structural steel that would prevent the rotation of the U-bolt clamp assembly. (Finneran Affidavit at 18.)"

As Applicants have stated, they only identified 15 supports in Unit 1 and common areas; they did not mention how many supports in Unit 2 were identified or even that they had looked at Unit 2.

Regarding Applicants' first and second sentences, they are assuming that only those supports which indicated a gap between the U-

bolt and the pipe were unstable. As mentioned in answer 7 preceding, all of the supports utilizing a U-bolt were unstable because of a 1/16" diametrical gap which was used to facilitate construction. Therefore, the Applicants' identification process was in error.

Regarding Applicants' third and fourth sentences, there is no documentation attached to Applicants' Motion to support these statements. In addition, Mr. Finneran, in his Affidavit, does not cite any transcript reference where he stated this during his September 1982 testimony (and it would be assumed, he would have done so), nor does he cite any reference in the SIT Report which so indicates. It appears that, at the time he testified in September 1982, these supports had not been identified by Applicants as being unstable, and that if they were modified so that the potential instability was removed, it was by accident.

If these modifications that occurred prior to September 1982 were by removing the 1/8" gap between the U-bolt and the pipe which is needed for radial expansion of the pipe, I would assume that the construction was not in compliance with the drawing or that the field engineers were making modifications to the support and not considering the effects of cinching down a U-bolt.

Another possibility which may be the reason the Applicants are claiming the support is stable is by assuming that the strut or snubber binds up at the base plate, as was discussed during the May 1983 hearings by NRC Staff Witness Dr. Chen (Tr. 6730/15-6734/18), regarding CASE Exhibit 819, pages 2 and 3 (bound in following Tr. 6723). I do

not agree with this assumption, based on two points. As indicated in the cited transcript pages, the binding plates are not symmetrical because there was a 5/8" gap; one of the plates was 5/8" further from the centerline of the strut than was the other plate. In addition, this binding action would induce additional stresses within the strut due to bending which had not been accounted for the in the original design, and struts are not qualified for bending, only for an axial load.

In sentence 5 and the last sentence, Applicants state that the "remaining ten mainsteam supports were modified between January, 1983 and June, 1983" and that the "modifications consisted of snugging the U-bolts or adding supplementary structural steel that would prevent the rotation of the U-bolt clamp assembly." (The supplementary structural steel is also referred to as a "bumper.") Apparently four of these ten relied upon bumpers for stability, as indicated in the Cygna Phase 3 Report, Observation No. PS-02, Sheet 1 of 1:

> "The stability of four Main Steam supports is maintained by providing horizontal 'bumper' frame members to limit the support horizontal movement to approximately 1/8". There was no derivation of design load for these 'bumper' frame members, nor were there any design calculations. The remainder of the support was designed properly."

Under "4.0 Potential Design Impact" (same page), the Cygna Report states:

> "Failure of the 'bumper' frame members may prevent the support from performing its intended function."

And on Attachment A of Observation PS-02, Sheet 1 of 1, "1.0 Probable Cause," Cygna states:

> "Project personnel (reference 3.5) directed designers not to perform calculations for the 'bumper' frames." (Emphasis added.)

See Attachment 1 hereto, which is a main steam support with a bumper frame.

There are several points I want to make regarding this. First, if the U-bolts are cinched up, the bumpers will act as a horizontal restraint, and this was not considered by the Applicants for this fix.

The second comment I would like to make is that because there is a 1/8" gap between the cross-piece member and the bumper, the bumper does not provide a sufficient mechanism for rotational restraint such that the support would be considered stable for the vertical load condition, which it was intended to do. My position was also concurred in by the NRC Staff's Mr. Terao in his discussion with the Applicants during the 8/9/84 meeting with the Applicants and NRC Staff in Bethesda, excerpted from Tr. 6 through 11:

> "MR. TERAO: Well, I think my position is still- my position still, on this restraint is, because of the gap in there, going back to my criteria so to speak on whether or not that clamp is functional, if we can't rely on the clamping function around the pipe then I am not going to allow credit as a seismic restraint even in the vertical direction. But, what I am saying, because your analysis show that you don't even need this restraint for a seismic then I have no problems with you using this restraint for a weight tender. But, I would not approve the restraint for a seismic restraint in the vertical direction.
>
> ". . . It's not clamping. There is no positive clamping force developed between the pipe and the support.
>
> ". . . My problem is still that analytically it is very difficult to show what will happen to that pipe during a seismic event without some type of testing or without some type of nonlinear analysis to conclusively show what will happen.

". . . the problem is that it is not a controlled mechanism for assuring the stability of that,- of the clamp around the pipe."

"MR. IOTTI: . . . We only have two of these?

"MR. FINNERAN: Two that don't have a cinched U bolt."

"MR. TERAO: . . . My disagreement is whether or not you can analytically prove it and whether or not this restraint will then negate your linear analysis that you run in your typing (sic) analysis.

". . . The disagreement is whether or not you can analytically show it and whether or not your analysis is valid. Whether you can rely on your present analysis to show that this restraint is going to conform to that analysis."

One reason this is significant is due to the procedures utilized by the Applicants. The pipe support designer is required by the ASME Code to provide a stable support, as discussed in answer 1 preceding. The designer did not fulfill this obligation, and now the Applicants are attempting to demonstrate that, although the pipe supports are not needed, the piping stresses are still within allowables (as will be shown later, this is an incorrect premise and they are needed). The pipe support designers do not qualify the piping systems; their job is to provide a support in the intended load direction. The Applicants, regarding this particular matter, are looking only at 50' of straight main steam line. If the Applicants had previously known that they did not need any pipe supports for this portion of the main steam line, it is not reasonable to believe that they would have gone to the trouble and expense of installing them to begin with; this is not logical, and it is certainly not sound engineering.

It is also significant because the Applicants have informed the NRC Staff, as well as the Licensing Board, that the stresses within the pipe were below Code allowables. But that pipe stress analysis did not consider the mass participation factors, and as Cygna stated in the resolution of this item (Cygna Phase 3 Report, Observation PS-02, Attachment A, Sheet 1 of 1):

> "Cygna has not reviewed these calculations as yet, since these piping systems will be affected by the results of the Gibbs and Hill mass participation study (see Potential Finding Report PFR-01). Cygna will review the new results for these four lines when they are available."

Of additional significance is the fact that, as indicated in the preceding from Attachment A of Observation PS-02, Sheet 1 of 1, "1.0 Probable Cause," of the Cygna Phase 3 Report: "Project personnel (reference 3.5) directed designers not to perform calculations for the 'bumper' frames." (Emphasis added.) Without these calculations having been performed (as discussed by Mr. Terao of the NRC Staff in the portion quoted earlier), Applicants cannot analytically show whether or not their analysis is valid, and they cannot rely on their present analysis to show that the restraint is going to conform to that analysis.

Applicants' repair for the majority of these supports has been cinching down of the U-bolts. This now creates a problem for the pipe stress analyst, if he realizes that it was cinched down; he needs to know to what amount, so that he can add the additional stresses to the pipe stress already calculated, if he cares to address it. The cinched down U-bolt will increase the stresses within the pipe, which has not been adequately addressed by the Applicants.

It should be noted that Cygna did not consider the erroneous use of bumpers to provide stability to be a problem (much less a Definite Potential Finding Report) and considered this closed (as indicated in the Cygna Phase 3 Report, Observation PS-02, Attachment A, Sheet 1 of 1, under 2.0 Resolution).

As indicated in the preceding, two of these supports were not originally cinched down and two of them were cinched down later, and all four of them relied upon the bumpers to provide stability -- an improper fix. Since the 8/23/84 meeting between the Applicants and the Staff, the Applicants have again modified these four main steam supports. As stated in Attachment E hereto (Applicants' answers to the Staff on stability), page 53, item (f):

> Question: "(f) Describe any proposed modifications to the main steam line supports which have limiting bumpers."
>
> Answer: "These supports, of which there is one per main steam line, will be modified by assuring that the U-bolts are cinched and enlarging the gap between the bumpers and the supoprt proper so that contact with the bumpers cannot take place. This gap enlargement will be accomplished via removal of the bumpers or cutting of a portion of it, whichever can be most expeditiously accomplished."

This now means that the statement in the Cygna Phase 3 Report (Observation No. PS-02, Sheet 1 of 1, as quoted above) that "The stability of four Main Steam supports is maintained by providing horizontal 'bumper' frame members to limit the support horizontal movement to approximately 1/8"" is no longer valid.

Thus, Applicants utilized an improper fix (the use of bumpers) to correct instability -- then turned around and utilized another improper fix (cinching down of the U-bolts) to correct that original improper fix -- all without having performed proper and necessary calculations and analyses in a timely manner as required by NRC regulations and Code and other requirements.

In addition, at the time Applicants wrote their Motion for Summary Disposition, they were not aware that they had made an improper fix in regarding to the use of bumpers. After the Applicants became aware of this improper configuration, they did not inform the Licensing Board and have not changed their Affidavit or their Motion.

It is also my understanding that Applicants have claimed to the Board and parties that this was an "insignificant" change, and that this was part of the information to which Mrs. Ellis called the Board's attention (because Applicants had told the Board that there was nothing significant in the information they would be providing to the Staff as a result of the 8/23/84 onsite meeting between Applicants and NRC Staff). This "insignificant" change amounts to 40% of the supports under discussion being improperly fixed. Four out of the ten supports had to be modified. (This is not to say that their latest fix is proper, and it in fact is also improper.)

In Applicants' next-to-last sentence they state that the "two non-mainsteam supports were modified in October and December, 1982." One

of the two supports which the Applicants claim was modified is Support SB-1-101-001-A55R. There are two significant items which are evident from the documents Applicants provided CASE on discovery (see Attachment H hereto). CASE requested from the Applicants the drawing which made the support unstable and the drawing which corrected the instability. For this support, the instability was created in August of 1982. This was one month after I had testified to the Licensing Board that there was a problem with instability of pipe supports at Comanche Peak. The Applicants claim that the support was modified in October or December, 1982. The drawing which Applicants provided CASE as being the one which corrected the instability is dated 2/22/84 (see Attachment H hereto).

The other support is CC-1-048-007-A33R (see Attachment G hereto), and Applicants also claim that this support was modified in October or December, 1982. This support was made unstable in June of 1980. But the drawing which Applicants provided CASE as being the one which corrected the instability is dated February 10, 1983 (see Attachment G hereto).

It appears that one of three things must have occurred: (1) The statement in Mr. Finneran's sworn affidavit is incorrect; (2) the documents provided to CASE on discovery were incorrect; or (3) Applicants made this fix without documenting the change on their component modification cards or drawings (or whatever other way they might have documented it).

9. Applicants state:

"CASE has raised allegations concerning the stability of two other categories of supports, namely, double strutted frames and single struts or snubbers with snug U-bolts. Applicants' review of the double strutted frames shows that the friction forces associated with these frames are sufficient to prevent the frame from sliding down the pipe and, thus, to maintain stability. Applicants' extensive tests and analyses of the single struts or snubbers with snug U-bolts demonstrate that these supports will function as pipe clamps and prevent rotation of the clamp assembly around the pipe. Thus, this category of supports is also stable. (Finneran Affidavit at 19-21.)"

I disagree with Applicants' statements. Regarding double strutted frames, the Applicants are relying on a friction force and have provided in the their Affidavit an erroneous calculation (page 19 of Affidavit). This calculation and its results are all based on a static loading condition; the actual loadings are dynamic in nature. For example, if one were to drive a car down a gravel road, the car can sit still and the rear end will not move sideways. But as the car begins to move at a higher rate of speed, the rear end of the car will begin to swerve to one side or the other of the crown of the road. A similar situation occurs when driving on snow or ice. As long as the car is sitting still, it will not move sideways. But as it begins to move, the rear end will try to slide off the road. The Applicants' testing regarding the cinched down U-bolts verifies this phenomenum. As the Applicants demonstrated in their cinched down U-bolt testing, under a dynamic load even under preloading on the holding item so that there is a positive clamping force, the support walked down the axis of the pipe. (See Affidavit of CASE Witness Jack Doyle, attached to CASE's

10/8/84 Answer to Applicants' Motion for Summary Disposition Regarding Consideration of Cinching Down of U-Bolts, including especially pages 3, 4, 10 and 11; see also Applicants' Motion for Summary Disposition Regarding Cinched-Down U-Bolts, Affidavit of Robert C. Iotti and John C. Finneran, Jr. Regarding Cinching Down of U-Bolts, at page 27; and see also discussion in answer 7 preceding.)

For these double strutted or snubber support configurations, the instability occurs from the time a dynamic load is applied; the support will slide along the pipe and will not be able to resist the piping load in the intended direction.

The stability of the double strutted snubber supports was also a concern of G. Abele in 1981, as shown in Attachment A-2 to Applicants' Affidavit. On page 2, the bottom drawing is of a double strutted support. This unstable support configuration was a concern to G. Abele in 1981, but the Applicants did not address his concern until September 1982 before the Licensing Board.

In a related matter, the Applicants in the past have relied on no gap between the pipe and the box frame to provide stability (see Tr. 4943/24-4946/7). At this portion of the transcript, the discussion was regarding CASE Exhibit 669B, item 4-O. As shown on that exhibit, there is a zero inch gap between the pipe and box frame. As part of Applicants' answers to the NRC Staff's questions, Applicants provided drawings for double strutted frames. Of particular concern is drawing SW-1-012-009-A33R, as shown in the attached portion from Applicants'

Attachment F-10. This is the same support which was attached to Applicants' Motion for Summary Disposition Regarding Consideration of Friction Forces in the Design of Pipe Supports with Small Thermal Movements, Attachment A. As the Board is aware, this support was not capable of resisting the friction load. This support was already ill due to problems with friction, then the Applicants gave it the disease of instability. In my Affidavit attached to CASE's Answer to Applicants' Motion for Summary Disposition on friction, in regard to the dimension shown on the drawing, I questioned whether a 1/16" gap existed as shown on the drawing (see my Affidavit attached to CASE's Answer, pages 11 and 12). In reply to my questioning of the Applicants' drawing, Mr. Finneran stated in a sworn affidavit:

> "The tube steel is installed with a 1/16" clearance as indicated on the drawing." (Emphasis in the original.)

The drawing to which Mr. Finneran was referring is Rev. 1 of the ITT Grinnell drawing. The current drawing, which indicates a zero inch gap (although Mr. Finneran claims there is actually a 1/16" gap) is Rev. 4 of the Brown & Root drawing.

This discrepancy leads to two significant problems. One of these is that the Licensing Board cannot rely on the sworn affidavit of Mr. Finneran if in fact no gap exists. The other significant problem would be that if a 1/16" gap does exist, the drawings on which the engineers rely are no good. The present drawing indicates a zero inch gap, but there is no way of knowing whether or not this has actually been verified in the field by QC inspection or other properly proceduralized

methods. We still do not know whether or not there actually is a 1/16" gap. This is the only support which the Applicants have implied that they actually went out and checked the actual support configuration in the field, and this did not correspond to the latest revision of the drawing.

The preceding takes on even more significance when considered in conjuction with the following portions of the transcript of the 8/23/84 onsite meeting between the Applicants and the NRC Staff (which would, according to Applicants' counsel, generate no significant changes applicable to Applicants' Motions for Summary Disposition). This discussion concerns the results of the inspection by the NRC Staff's Mr. Fair regarding U-bolts acting as two-way restraints. Excerpted from Tr. 56-61 (emphases added):

> "MR. IPPOLITO: John was in the procss of completing his evaluation, and what he wanted to do is to apparently go look at what were identified as maybe eight or so of the most significant of these U bolts and just confirm that, yes, in fact the plant is built as you have indicated in your design and in your drawing. He sent this morning with your people, and the thermal agra (sic), whatever was over it, was removed in front with John present. John made some measurements. And I would like to have John tell you what he discovered while he was there. Did you see all eight?
>
> "MR. FAIR: Yes.
>
> "MR. IOTTI: John, are these the same eight that we have identified as the --
>
> "MR. FAIR: Yes. . . These are the cases where you use U bolts for one-way restraints with the presumption that they provided no lateral restraints to the piping system. There were the limited number which you identified in the affidavit. The argument in the affidavit, the steps of the argument, went this way: there was a sixteenth of an inch gap designed in these U bolts. You identified eight of them where the total movement exceeded that

one sixteenth of an inch total seismic plus thermal. You did some sample re-analysis, seismic re-analysis, assuming no gap present for two of the U bolts that had the largest total displacement, found no problem with the piping analysis. Tested a couple of sizes of U bolts, determine that they could take substantial lateral deflections, and then concluded that there was no safety concern with these seventy U bolts. I have no problems with your technical arguments that you put forth. The only thing I wanted to do was to go out to the field and take these eight U bolts and confirm the existence and nonexistence of these gaps. As it turns out, when I took the measurements this morning, the sixteenth of an inch gap existed in the direction of restraint and not in the lateral direction. As a matter of fact, six out of the eight supports I checked had lateral gaps less than one sixteenth of an inch, and only two of them had a sixteenth of an inch gap or better in the lateral direction. . .

"MR. IOTTI: I'm not sure I follow. What do you consider directional restraints? Directional restraint is up?

"MR. FAIR: That's correct.

"MR. IOTTI: Can you resummarize it again? You said six out of eight had no gap laterally?

"MR. FAIR: Had lateral gaps less than one sixteenth of an inch, this is total lateral gap on both sides.

"MR. IOTTI: Right. That's the way it's stated here.

"MR. FAIR: There was one that had practially zero gap in the lateral direction.

"MR. IOTTI: That's total?

"MR. FAIR: Total, both sides. Therefore, I was unable to confirm that the sixteenth of an inch gap exists on these U bolts.

. . . I also looked at the drawings as I was reviewing these supports, and the sixteenth of an inch gap that is specified on the drawing is in the direction of the restraint and not the lateral direction.

"MR. IOTTI: Which systems were they on? Do you recall?

"MR. FAIR: Majority of them were component tooling (sic -- should be cooling). . .

"MR. IPPOLITO: I think that's what John said was he had no problems with your analysis, but the plant apparently does not conform to your analysis.

"MR. FAIR: Well, I'm not sure that that's the case. . .

. . . Let me say I have two problems. One problem is that the summary disposition motion with it states that there is a sixteenth of an inch gap, that leads me to the conclusion that the sixteenth of an inch gap was in a lateral direction, and therefore, we were only concerned with eight total supports. We took a sample of the worst two and showed no problem, and I thought it was a pretty good sample. The second is in the basic assumption of ignoring the lateral restraints. Now, if you do have a gap in there and it did exceed the movement, I have no problem with making that assumption. However, if the gap does not exist there, I consider that a bad assumption even if it does not turn out to be a safety problem. I think that was a poor engineering practice. . .

. . . Let me state I only looked at those supports, those eight, which the movements were greater than one-sixteenth."

Regarding the 380 supports with single struts or snubbers with snug U-bolts, see discussion in answer 7 (pages 28, 29, 31, and 32) preceding; see also discussion in CASE's Answer to Applicants' Motion for Summary Disposition Regarding Consideration of Cinching Down of U-Bolts, Affidavit of CASE Witness Jack Doyle. To briefly summarize, these 380 supports were unstable and could not have been verified to be stable because there was no pretorque requirement, and even after torquing there was a 1/16" diametrical gap. These supports which the Applicants have and still consider to be stable, have had their U-bolts all cinched down and reinspected -- still an inappropriate fix.

10. Applicants state:

"Almost all Unit 1 and common pipe supports (17,000-18,000) have been vendor certified to date. A total of 27 supports for all of Unit 1 and common area safety-related supports were potentially unstable. /1/ (Finneran Affidavit at 22.)

"/1/ This figure is consistent with Mr. Finneran's representation to the Board in an affidavit filed June 3, 1983, that only 21 of 13,681 supports certified at that time had been identified as potentially unstable."

The 27 supports referenced by Applicants does not include the box frame supports which were Exhibits F-1 and F-2 attached hereto (see discussion in answer 6 preceding). Further, the Applicants have neglected to consider the number of unstable supports in Unit 2. And they have not considered the 380 supports with cinched down U-bolts or the double-strutted frames, both of which were discussed in answer 9 preceding.

11. Applicants state:

"None of the potentially unstable supports identified by CASE present a safety concern. As explained above, two of the four categories of allegedly unstable supports were, in fact, stable. (Finneran Affidavit at 19-21.) As for the other two categories; the potential instabilities were detected in the normal course of the design process, and appropriate measures were implemented to address the condition. Because these conditions were detected in the normal design process, no concern is raised for the adequacy of that process. (Finneran Affidavit at 9-18.) In addition, even if the mainstream (sic) supports were considered to be unstable and uncapable (sic) of carrying seismic loads, there are no adverse safety implications. (Finneran Affidavit at 27-28.)"

I disagree with Applicants' statements.

With regard to Applicants' second sentence, I do not agree; see answer 9 preceding. In fact, all four categories of supports were unstable.

With regard to Applicants' third and fourth sentences, I do not agree; see answers 4 through 8 preceding. The Applicants are relying

on their "normal design process" to detect these unstable supports. They apparently are including, in the normal design process, allegations made to the Licensing Board which brought these problems to their attention, since their normal design process at Comanche Peak had not identified which supports were unstable, how many supports were unstable, and they had not (in my opinion) corrected any of the unstable supports prior to the testimony of CASE's witnesses in these proceedings.

As discussed in previous answers, Applicants did not take steps to correct the problems of instability promptly. The instability problems at Comanche Peak were not detected in the normal design process, because had the normal design process been working effectively, it would not have allowed the problems of instability to continue unidentified and uncorrected as long as they did. Clearly the "normal design process" as implemented at Comanche Peak and on which Applicants are relying is inadequate. The normal design process which is normal to the industry does not allow field changes by "somewhat knowledgeable" engineers, and does not allow the support to be built and actually existing in the field, and then have the original design organization perform calculations, analyses, and tests after-the-fact to try to make it appear that what exists in the field meets design requirements.

One reason this type of design process is unacceptable is that this puts the engineers to the task of qualifying substandard

configurations. For example, Mr. Finneran is attempting to qualify the double-strutted supports by use of static friction methods. The supports are already in existence in the field, and if the calculations were performed prior to the construction of the supports, the original designer might have detected the instability problem (though whether they would have or not is questionable also).

MESSRS. WALSH AND DOYLE:

Q: Do you agree with Applicants' assertions in the first and last sentences, that none of the potentially unstable supports identified by CASE present a safety concern, and that, even if the mainstream (sic) supports were considered to be unstable and incapable of carrying seismic loads, there are no adverse safety implications?

MR. DOYLE:

A: I certainly do not agree. The facts are that instability problems represent a gross concern for the design of Comanche Peak and are in violation of the codes and laws to which Applicants are committed.

MR. WALSH:

A: I totally disagree with Applicants' statements.

For example, when Applicants omitted the main steam supports from the piping analysis, the supports for the connecting 8" line exceeded allowables (see pages 27-28 of Applicants' Affidavit). The analysis which the Applicants used did not consider mass participation factors as was noted in the Phase 3 Cygna Report, Potential Finding Report PI-

00-05. Cygna's Observation PS-02, Observation Record Review, Attachment A, Sheet 1 of 1 (see discussion in answer 8 preceding), also states:

> ". . . As stated in the TUGCO letter to Cygna dated July 12, 1984, TUGCO has reanalyzed these four systems (AB-1-23A, B, C, D)
>
> > "'...with these supports completely removed from the analysis. This evaluation results in no overstressed piping or supports.'
>
> "Cygna has not reviewed these calculations as yet, since these piping systems will be affected by the results of the Gibbs and Hill mass participation study (see Potential Finding Report PFR-01). Cygna will review the new results for these four lines when they are available.
>
> "Based on the above TUGCO response, and contingent on the favorable outcome of the mass participation study, this observation has no impact on the design and safety of CPSES and is considered closed."

Cygna closed this item because TUGCO's response indicated "no overstressed piping or supports" (emphasis added). It is apparent that Cygna was not given the true effects of the analysis of the main steam system without the supports, and therefore their conclusions are based on false information. The mass participation factors, which were not included in the analysis of the main steam line without supports, will increase the stresses within the pipe and increase the loads on the adjoining supports.

I have not seen the calculations which the Applicants should have provided to support their position that the stresses were within allowables for the containment penetration and moment restraint; but the Applicants have, in the past, have utilized improper design and

calculational methods to qualify supports (as discussed in CASE's Answers to Applicants' Motions for Summary Disposition on AWS/ASME (Design); A500 Steel; damping - OBE/SSE; friction; generic stiffnesses; Richmond inserts; local displacements; and axial restraints). The Board cannot rely on Applicants' answers without supporting documentation (with the opportunity for review by CASE).

12. Applicants state:

"Forces and moments, including static and dynamic loads, provided by the pipe design organizations at the node points of these supports were considered by the pipe support design groups. (Finneran Affidavit at 22-24.)"

This statement was in response to the first two Board questions posed by the Board in its 2/8/84 Memorandum and Order (Reconsideration Concerning Quality Assurance for Design):

(1) "[W]hether the forces and moments indicated by the initial pipe run analysis were met by the pipe design groups at the node points to which these supports were attached."

(2) [W]hether all required static and dynamic forces were considered."

The 13 main steam supports referenced by Applicants did not consider the forces which would induce instability; i.e., a compression force. All field modifications to the remaining 14 unstable supports referenced by Applicants should never have been allowed to become unstable. If the Applicants had followed ANSI N45.2.11 and 10 CFR Part 50, Appendix B, Criterion III, these supports would have been commensurate with the original design and would not have been allowed to become unstable.

In regards to the dynamic forces, the Applicants are still neglecting the dynamic nature when it pertains to the box frames and double-strutted frames, as discussed in answers 6 and 9, respectively.

13. Applicants state:

"The conditions which could cause instability of the supports in question are unlikely to occur. (Finneran Affidavit at 24.)"

I totally disagree with this statement.

This statement was apparently an effort to respond to the Board's third question in its 2/8/84 Memorandum and Order:

(3) "[T]he nature of the instability, including the conditions under which it would exist and the likelihood of those conditions occurring."

As discussed previously herein, Applicants are still refusing to even admit that any stability existed or exists at Comanche Peak. It is apparent that Applicants did not and do not understand the nature of instability, including the conditions under which it would exist (or how to correct it) (see, for example, discussion at page 24, answer 6 preceding). And if they do not understand these basic considerations, they cannot know the likelihood of the conditions occurring.

Obviously, Applicants' statement cannot be true, since such conditions have occurred and in some instances still exist at Comanche Peak that we know about -- and there is no reason to believe that we have been able to identify ALL such instances where the problem currently exists but has not been identified by Applicants, the NRC Staff, or Cygna. (Also see previous answers herein.)

14. Applicants state:

"Gibbs & Hill was provided as-built drawings of each pipe support along with as-built survey information that was marked on the drawings. It was not Gibbs & Hill's responsibility, as piping analyst, to review these supports for stability. (Finneran Affidavit at 25.)"

These statements were apparently in response to the Board's fourth question in its 2/8/84 Memorandum and Order:

(4) "[T]he extent to which Gibbs & Hill was provided with all the information about the performance of the support that they needed for the purpose of doing a revised pipe run analysis and a local pipe stress analysis."

I disagree with Applicants' entire premise. First of all, it appears that this is an effort to remove responsibility from Gibbs & Hill and from Applicants for allowing these unstable supports to develop, go undetected, and go uncorrected. And there was no documentation provided with Applicants' Motion for Summary Disposition to support their statements.

15. Applicants state:

"In that the support designer is required to maintain support stability by the ASME Code, there is no need for separate design guidelines regarding stability. (Finneran Affidavit at 28-29.)"

This appears to be an attempt by Applicants to answer only the first of two Board questions in its 12/28/83 Memorandum and Order (Quality Assurance for Design) at page 21:

"(1) why design guidelines concerning stability were not necessary."

I do not agree with Applicants' statement. It is apparent that, since there was a problem and it was a historical problem at Comanche

Peak, the Code had to be supplemented by Applicants through some kind of guidelines. These guidelines would have brought to the designer's and field engineers' attention that stability of the individual members and the support configurations is a vital requirement and more attention needed to be placed on it. (Both the original designer and the field engineers should have used the same guidelines, since under ANSI N45.2.11 and 10 CFR Part 50, Appendix B, Criterion III, design changes should be commensurate with the original design.)

In addition, guidelines are what G. Abele was requesting in May 1981 and October 1982, not whether the support was stable or not; he apparently had already realized that the supports were obviously unstable and was asking for assistance in the form of guidelines.

It should be noted that Applicants have included important statements in their Affidavit, wherein they attempt to answer additional Board questions, which were not included in their Statement of Material Facts (see pages 26, 27, and 28 including the second of the Board's questions on page 21 of its 2/8/84 Memorandum and Order).

Regarding Board question (5) cited on page 26 of Applicants' Affidavit:

(5) "[T]he reason that these supports were unstable."

. . . Applicants are still refusing to admit that any supports were, and are, in fact unstable. Applicants' response to the Board's question is inadequate. See previous discussions herein regarding our answers to the discussions referenced by Applicants.

Regarding Board question (6):

(6) "[H]ow Applicant identified these instabilities and the process by which it resolved (or is resolving) them, including the paper trail of that process."

. . . Applicants (as stated above) still do not admit that there are any unstable supports. See also previous answers herein, especially answer 6 regarding the paper trail.

Regarding Board question (7):

(7) "[T]he potential safety significance of these deficiencies."

. . . Applicants' answer that the unstable supports were detected through their design review process is a bunch of baloney. It is quite apparent that it was detected after Mr. Doyle and I brought these allegations to the Licensing Board. See previous answers herein, especially answers 7 and 8.

Another important comment is in regard to the main steam supports where Applicants state "Applicants and their design organizations believed that realistically these supports would function in a stable manner." (Emphasis added.) These main steam supports would not be able to support the intended load, as discussed in answer 8 herein, and as admitted by NRC Staff Witness Dr. Chen (Tr. 6725/20-26). It is unfortunate that the Applicants relied only on their "belief," rather than upon calculations, analyses, and/or properly performed testing. It is unfortunate that the Applicants, instead of utilizing proper engineering techniques, were wishing their problems away. I believe that is how Applicants designed the entire plant, i.e., by wishing their problems away and pretending that they do not exist.

At the top of page 27, Applicants make the statement that "by mutual agreement between TUSI and ITT, the supports were modified to improve their stability." This statement proves my point discussed in answer 15 preceding that Applicants' guidelines and procedures for dealing with the problems of instability were (and undoubtedly still are) inadequate and should have been supplemented. Further, from Applicants' discussion at the bottom of page 26 and continued on page 27, it is obvious that -- even now -- Applicants would not have ever addressed this problem and would never have taken any corrective action had the problem of instability not been brought up by Mr. Doyle and me, and had the Licensing Board not been concerned about it.

Regarding the second of the Board's two questions in its 12/28/83 Memorandum and Order (Quality Assurance for Design) at page 21:

"(2) whether design deficiencies are corrected promptly."

. . . it is obvious that the answer must be an emphatic NO. See discussions in previous answers herein.

With regards to Applicants' further statements on pages 27 and 28, see previous answers preceding.

I believe we have already addressed Applicants' statements in our preceding answers. It is my understanding that we are only required to respond to the matters specifically stated in the Statement of Material Facts. If, however, the Board decides to rule based on these statements by Applicants even though they are not included in their

Material Facts, I would like the opportunity to further address any statements to which we have not specifically responded.

ATTACHMENTS:

Attachment A — FSAR Page 17.1-39, May 31, 1979 -- in effect prior to 7/11/83 -- see page 21 of this pleading

Attachment B — FSAR Page 17.1-39, Amendment 41, July 11, 1983 -- see page 21 of this pleading

Attachment C — FSAR Page 17.1-40, May 31, 1979 -- in effect through at least 8/22/83 -- see page 21 of this pleading

Attachment D — FSAR Page 17.1-41, August 7, 1981 -- in effect through at least 8/22/83 -- see page 21 of this pleading

Attachment E — Pages 43-54, F. Stability section of information provided to Staff by Applicants -- see page 23 of this pleading

Attachment F1 — Attachment provided with Attachment E above -- see page 23 of this pleading

Exhibit F1 — Exhibit provided with Attachment E above -- see page 23 of this pleading

Exhibit F2 — Exhibit provided with Attachment E above -- see page 23 of this pleading

Attachment F10 — Support SW-1-012-009-A33R, 2-page drawing, Rev. 4 -- see page 38 of this pleading

Attachment G — Support CC-1-048-007-A33R, 2-page drawing, Rev. 6, ar Component Modification Card (CMC) No. 37607, R. 1, Sheet 1 of 2 -- see page 25 of this pleading

Attachment H — Support SB-1-101-001-A55R, 1-page drawing, Rev. 5, and 1-page Component Modification Card (CMC) No. 77263, Rev. 1 -- see page 25 of this pleading

Attachment I — Support MS-1-004-003-S72R, 3-page drawing, Rev. 4, from Phase 3 Cygna Report, shows a main steam support with a bumper frame -- see page 38 of this pleading

The preceding CASE's Answer to Applicants' Statement of Material Facts As To Which There Is No Genuine Issue was prepared jointly under the personal direction of the undersigned, CASE Witnesses Jack Doyle and Mark Walsh. We can be contacted through CASE President, Mrs. Juanita Ellis, 1426 S. Polk, Dallas, Texas 75224, 214/946-9446.

Our qualifications and background are already a part of the record in these proceedings. (See CASE Exhibit 842, Revision to Resume of Jack Doyle, accepted into evidence at Tr. 7042, and CASE Exhibit 841, Revision to Resume of Mark Walsh, accepted into evidence at Tr. 7278; see also Board's 12/28/83 Memorandum and Order (Quality Assurance for Design), pages 14-16.)

We have read the statements therein, and they are true and correct to the best of our knowledge and belief. We do not consider that Applicants have, in their Motion for Summary Disposition, adequately responded to the issues raised by us; however, we have attempted to comply with the Licensing Board's directive to answer only the specific statements made by Applicants.

Jack Doyle

(Signed) Jack Doyle

Date: Oct 11 1984

STATE OF Massachusetts

COUNTY OF Worcester

On this, the 11th day of October, 1984, personally appeared Jack J. Doyle, known to me to be the person whose name is subscribed to the foregoing instrument, and acknowledged to me that he executed the same for the purposes therein expressed.

Subscribed and sworn before me on the 11th day of October, 1984.

Nancy A. Porter

Notary Public in and for the State of Massachusetts

My Commission Expires:

MY COMMISSION EXPIRES JANUARY 9, 1987

The preceding CASE's Answer to Applicants' Statement of Material Facts As To Which There Is No Genuine Issue was prepared jointly under the personal direction of the undersigned, CASE Witnesses Jack Doyle and Mark Walsh. We can be contacted through CASE President, Mrs. Juanita Ellis, 1426 S. Polk, Dallas, Texas 75224, 214/946-9446.

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Mark Walsh
(Signed) Mark Walsh

STATE OF TEXAS

On this, the 14 day of Oct, 1984, personally appeared Mark Walsh, known to me to be the person whose name is subscribed to the foregoing instrument, and acknowledged to me that he executed the same for the purposes therein expressed.

Subscribed and sworn before me on the 14 day of Oct, 1984.

Samuel W. Nestor
Notary Public in and for the
State of Texas

SAMUEL W. NESTOR
My Commission Expires
1-31-85

My Commission Expires: 1-31-85

A nonconformance report is 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.

All nonconforming items are tagged and segregated as defined in section 17.1.14, "Inspection and Test Status" and Section 17.1.13, "Handling, Storage, and Shipping."

Following identification and dispositioning of nonconformances, specified reviews and approvals are procedurally required for 1) "use as is" and "repair," and 2) "rework."

Upon completion of action required for disposition, repaired or reworked items are reinspected to verify that specified action and requirements are complied with.

A deficiency report is utilized for the identification, documentation, resolution, and re-evaluation of procedural violations/programatic deficiencies which are not directly related to the physical charactristics of an item. Procedures provide measures which, when initiated, assure tnat activities adverse to quality are suspended pending identification, documentation, and resolution. Proposed resolutions are then reviewed and approved, prior to implementation, to assure that specified requirements are complied with. Implemented resolutions are re-evaluated to assure that the resolution has provided compliance with specified requirements.

Procedures require "trending" of nonconformance and deficiency reports to identify trends adverse to quality.

Procedures require the initiation of a corrective action request for significant nonconformances/deficiencies and chronically repetitive nonconformances/deficiencies as defined in Section 17.1.16.

Procedures define the actions necessary to identify, resolve, and closeout deficiencies in characteristics, documentation, or procedures which render the quality of an item unacceptable or indeterminate.

When required by specific procedures/instructions, items identified as unsatisfactory or incomplete and which can be corrected within a reasonable period of time may be identified on an inspection report and/or deficiency report. A nonconformance report is used to document deficiencies unless another method is prescribed by a specific procedure/instruction. 41

Items identified on a nonconformance report are tagged and segregated where practical as defined in section 17.1.14, "Inspection and Test Status" and Section 17.1.13, "Handling, Storage, and Shipping."

Following disposition of nonconformance reports, specified reviews and approvals are procedurally required for 1) "use as is" and "repair," and 2) "rework."

Upon completion of action required for disposition, repaired or reworked items are reinspected to verify that specified action and requirements are complied with.

Procedures require "trending" of deficiencies identified on nonconformance reports, deficiency reports, and inspection reports to identify trends adverse to quality. 41

Procedures require the initiation of a corrective action request for significant or chronically repetitive nonconformances as defined in Section 17.1.16.

17.1.16 CORRECTIVE ACTION

TUGCO/TUSI requires that measures be established to assure that conditions adverse to quality are promptly identified, reported, and corrected. Responsibility for performing corrective action is assigned to contractors, applicable subcontractors, and vendors so that each is alert to those conditions adverse to quality within his own area of activity. In the case of significant conditions adverse to quality, which are reportable to NRC under the provisions of 10 CFR Part 50.55 (e), measures are taken to assure that the cause of the condition is determined and corrective action is implemented to preclude repetition. Corrective action procedures placed in effect require thorough investigation and documentation of significant conditions adverse to quality. The cause and corrective action is reported in writing to the appropriate levels of management and to the purchaser. This corrective action applied is subject to review by TUGCO and the prime contractor responsible for the original purchase specification.

For CPSES, the Quality Assurance Plan requires that procedures and practices be established and documented which provide assurance that conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, defective material and equipment, and nonconformances, are promptly identified, documented, and corrected as soon as practicable, and that appropriate action be taken to correct the cause of the condition. Corrective action documentation and request forms or formal letters are used to document the corrective action-related requests, responses, and follow up. The plan requires that measures be established by the prime contractors to assure that the acceptability of rework or repairs is verified by reinspecting the item as originally inspected and that the reinspection is documented. These measures are verified by review and approval of the prime contractors' QA Program and by the subsequent audit for conformance to the approved program. Significant conditions adverse to quality are identified (such as those which, if they had remained undetected, would

have adversely affected safety-related functions), the cause of the condition is determined, and corrective action is taken to preclude repetition. Such significant conditions, their causes, and the corrective action taken are documented and reported to appropriate levels of management through established communication systems. Corrective action followup and close-out procedures provide that corrective action commitments are implemented in a systematic and timely manner and are effective.

The occurrence and magnitude of deficiencies and nonconformances requiring corrective action are evaluated by the purchaser's inspectors during surveillance and at hold point inspection and witnessing. Additionally, these areas are identified for audit purposes.

The effectiveness of the vendor's corrective action program is assessed during audits by the vendor, the prime contractor, subcontractor, and by TUGCO. Stop work authority is exercised as required.

17.1.17 QUALITY ASSURANCE RECORDS

The TUGCO/TUSI Quality Assurance program establishes procedures and practices to assure that TUGCO/TUSI and its contractors have a quality records system which provides documentary evidence of the performance of activities affecting quality. Procedures assure or shall require:

1. That records that are required to be maintained show evidence of performance of activities affecting quality. Typical records maintained include quality assurance programs and plans, design data and studies, design review reports, specifications, procurement documents, procedures, inspection and test reports, material certifications, personnel certification and test reports, audit reports, reports of nonconformances and corrective actions, as-built drawings, operating logs, calibration records, maintenance data, and failure and incident reports.

F. Stability

a) Provide the drawing for the one support having indexed lugs. Provide a detailed description of the reason why Applicants have determined that the specific indexed lug support cannot behave in an unstable manner.

The drawings that show the details of the index lug support are attached as Exhibit F1 and F2. A discussion as to why this support is considered stable is provided in Attachment F1.

b) Provide drawings for the strutted supports which are multiple frames, which are mentioned on page 19 of the Affidavit.

There are four such supports in Unit 1 and common areas. Drawings for these supports are attached as Exhibit F3, F4, F5 and F6.

c) Perform analyses which demonstrate that the triple strutted, multiple support frames will behave in a manner not incommensurate with the assumptions made in the analysis of the supported piping and the design of the support proper.

The pertinent support drawings for three of these four frames are attached as Exhibits F3, F4 and F5. Two of the frames are suspended from the ceiling at elevation 871'-7" of the auxiliary building with the third strut going laterally to a wall. The other two frames are in the electrical building and are suspended from the ceiling at elevation 871'-5", with the third strut also going to a wall. Only the complex frame is shown (see drawing of support CC-1-144-701-E63R). The fourth

frame is extremely simple and any analytical effort on this frame would be clearly encompassed by the analyses of the first three frames.

To determine that each of these supports would behave under a seismic event in such a way as to not invalidate any of the analyses performed for the piping or supports Applicants have performed bounding analyses for each of the three supports. These analyses assumed the following:

(1) During the earthquake the complete frame would move horizontally as if there were no piping supported within. Furthermore, no credit is taken for the third strut guiding action. This means that the frame moves as a pendulum. This assumption leads to the maximum possible horizontal displacement of the frame. In reality, the interaction of the pipes with the frame, as well as the third strut effect, will limit the horizontal deflection of the frame to a value which is less.

(2) The possible axial movement is less than the "free" movement because of the presence of piping. This movement which occurs from simultaneous horizontal and vertical earthquake is assessed from a force balance where the instantaneous horizontal force created by superposition of maximum motion due to the horizontal earthquake and the horizontal component due to the

vertical earthquake is resisted by the reacting force of the pipe, and the corresponding vertical force is reacted by the pipe and the struts.

(3) The horizontal deflection of the frame results in a vertical (upward) deflection which would not have been considered in the original analysis of the pipe. This vertical deflection can produce additional stresses in the pipes, which can be conservatively computed by assuming that the vertical upward deflection occurs simultaneously with the maximum vertical seismic force computed for the pipes.

(4) The validity of the pipe analysis is assured (other than any additional contribution to pipe stresses from (3) above) if the displacement is within the tolerance limits assumed in the original analysis or sufficiently close to them so that the pipe analyst need not repeat the analysis.

The three frames are modelled as simple pendulums. The maximum horizontal displacement that the frames can have (in the absence of the supported pipes) is determined by computing the lowest frequency at which the frame will respond, which would be that of a simple pendulum, and then determining the corresponding displacement from the tripartite charts provided for the floors of interest. For instance, the responses (displacement, velocity acceleration,) at Elevation 873.5 (the floor from which the frames are suspended) are provided for the SSE as Exhibit F7 'the

worst of the two horizontal earthquakes at the low frequencies are shown). Obviously the presence of pipes will significantly affect the calculated frequency and result in lower displacements.

The calculations and these results are summarized hereinafter for the three multiple support frames.

(i) Frame # 1.

This frame contains supports CC-1-041-710-A63R, CC-1-139-706-A63R, CC-1-138-710-A63R and CC-1-144-707-A63R. All frames except that of CC-1-138-710-A63R have a 1/16" clearance at the top of the 4" pipes. The CC-1-138-710-A63R frame has no clearance, i.e. there is 0" gap on top and bottom.

Modelling this frame as a pendulum of length 3.88 ft., the frequency of the pendulum is computed to be 0.458 Hz. From the tripartite charts the horizontal "free" displacement (free because it assumes that the pipes are not present) is only available for 2% damping and is equal to 7 inches. To compute the free displacement at the very low damping that a pendulum would have, which is here assumed to be 0.5 percent, the displacement at 2% damping is multiplyed by the ratio of displacements at 0.5% and 2% damping at a frequency of 0.25 Hz, which is available from Regulatory Guide 1.60. This ratio is 1.28.

Similarly one can obtain the horizontal force of the pendulum from the product of its mass, which is approximately 400 lbs., and the acceleration at 0.458 Hz, which is 0.14g at 2%

damping, and is converted to the acceleration at 0.5% damping, by multiplication of the acceleration factor at 0.25 Hz obtained from R.G. 1.60 which is 1.4. The horizontal force is then 400 x 0.196g = 78.4 lb.

The maximum "free" displacement would be about 9 inches. such horizontal displacement encompasses a rotation of the pendulum through 10.94° and this rotation would result in a vertical lift of the frame equal to 0.846 inches. This vertical lift is not possible because of the presence of the pipes, even when one assumes that the pipes are moving vertically under the influence of the vertical earthquake component for a distance equal to the 1/16" clearance, plus the vertical seismic motion at the support calculated by the stress analysis, which is small ($< .003$"), plus the vertical motion of the mode shape away from the node point which is assumed to facilitate frame horizontal motion (rotation). The combination of these three vertical motions would only result in about 0.1" vertical pipe deflection. Thus, the angle at which the frame makes initial contact with the pipes (any pipe) as it attempts to rotate is no larger than 3.75°. It is to be noted that to obtain that angle we have assumed that <u>all</u> frames have 1/16" clearance vertically. In reality one of them has no clearance, hence the frame could not swing freely, or in other words the fundamental frequency of the frame would be much higher.

To compute the maximum angle which the frame can rotate, four occurrences have been examined. They are the following:

1. Pipe(s) impart a vertical up force on the support(s) equal to the maximum computed by stress analysis;
2. Pipe(s) impart the same force but downwards;
3. The support(s) impart a vertical force upward (pull) on the pipe(s) equal to the maximum force of the stress analysis; and
4. The support(s) impart a vertical downward force (push) on the pipe(s) of magnitude as above.

Of the four scenarios (1) and (4) are essentially the same, and are bounding.

The angle of rotation that could be achieved by the frame if there were no hinge between the struts and the frame proper is computed by equating the vertical component of the total force (resulting from the vertical earthquake and the rotation of the frame caused by the horizontal earthquake) which is carried by the pipes to their bending resistance. The remainder of the force is carried by the struts.

The bending resistance is determined by modelling the pipes as simply supported beams with a total span length of 25'-6 1/4" loaded 10'-9" from one of the ends. The total vertical stiffness of the four pipes is thus computed to be 1498.4 lb/in.

The angle computed in this fashion is 3.97°. To compute the resulting pipe stresses a single pipe and a shorter span (20') is used. The stress thus computed is 1735 psi, which is acceptable.

Under the assumption made that all frames have 1/16" clearances (which led to the angle of 3.97° to begin with), this rotation angle may not be the maximum that is possible. This is

because the simultaneity of the vertical and horizontal motions can cause the frame to seize on its far bottom edge when the pipe pushes downward and by leverage on this edge move its top in the same direction as the motion of the overall frame. This is permitted by the hinge between the struts and the frame. Next as the pipe pushes up (or the support pulls) the contact can be established at the opposite top edge while the bottom of the frame swings in the same direction of motion as a result of horizontal acceleration.

These alternating pivoting actions can result in a "walking" of the frame along the pipe. The extra horizontal distance travelled in this fashion can be estimated from the following:

a. The distance per cycle is determined by geometrical considerations (a 3" x 3" Tube steel frame supporting 4" pipes with 1/16" vertical clearance) and is equal to 0.18 inches

b. The total distance is the product of the distance per cycle times the number of cycles.

c. The pertinent number of cycles is that of the horizontal cycles which impart the force necessary to move the bottom portion of the frame away from the vertical. The vertical cycles would move the frame closer to vertical as shown in the U-bolt cinching tests when frames aren't allowed to rotate around the pipe. The total number of cycles is 0.458 Hz times the 30 second duration of the earthquake.

Thus, the extra distance is 2.60 inches, which when added to the horizontal distance corresponding to the angle of 3.94° (3.25 inches) gives a total horizontal distance of 5.85 inches, and an overall angle of rotation of 7.16°.

The horizontal distance of 5.85 inches would not invalidate the Gibbs & Hill stress analysis.

The moment and shear stresses which would occur as the frame locks about the pipe through an angle of 1.05° (during the walking) are also acceptable since they are 1544 psi and 430 psi, respectively. Since several conservative assumptions have been made in these bounding analyses, namely (1) gap of 1/16" in a frame where there is none, (2) no frictional resistance opposing axial motion of the frame, (3) motion of the frame computed as if it were a very low frequency frame (pendulum), whereas the pipes will influence its frequency response, and (4) the third strut has been neglected, the horizontal displacement and rotations that could occur during an earthquake will be smaller. Since stresses in the pipes are acceptable and even at the conservatively estimated horizontal distances from the previously analyzed points, Gibbs & Hill states that the stress analyses would not be affected, it is concluded that the support would fulfill the function required by the stress analysts.

(ii) Frame 2

This frame contains supports CC-1-041-711-A63R, CC-1-138-711-A63R, CC-139-707-A63R, and CC-1-144-708-A63R. All frames have a 1/16" clearance vertically.

The analyses for this frame make the same assumptions as for the prior frame. Results are somewhat different because of the differences in geometry. The "free" frame frequency is 0.53 Hz (this stems from a pendulum length of 2.94'), which results in a maximum "free" horizontal displacement of 7.17" and a "free" angle of rotation of 11.49°. Again, the presence of pipes prevent this angle and displacement from being achieved.

The resistance of the pipes, computed as before, result in a rotation angle of 4.4° which would be the maximum if no "walking" motion occurred along the pipe because of the clearance in the frame and the hinges between the struts and the frame. This clearance and the hinge permit a motion of 0.15" to occur per cycle (the horizontal motion of 0.15" differs from the 0.18" motion obtained for the previous problem because the frames are composed of 4" x 4" tube steel instead of 3" x 3" tube steel). Thus, a total horizontal motion of 5.08" resulting in an angle of 7.19° could be achieved. For this support, however, this will not happen. Because of the location of the supports, the vertical stiffness of the pipes in this case is considerably higher than in the previous case. For this case the pipes have been modelled as simply supported beams 11'9" in length loaded 1'-0" from the end. The vertical stiffness is this 5.73×10^4 lb/in. With this stiffness, the vertical resistance of the pipes alone is sufficient to arrest all further horizontal motion at an angle of 6.38° which corresponds to a horizontal distance of 3.95 inches.

Pipe stresses are acceptable and the variation in horizontal location of the support does not affect previous stress analyses. Hence, it is concluded that this frame behaves as required by the stress analyst.

(iii) Frame #3.

This frame contains supports CC-1-144-701-E63R, CC-2-144-702-E63R and CC-2-139-701-E63R. All have 1/16" clearance vertically with the pipes. The analyses of this frame are in all respects equal to those conducted for frame 1. For purposes of computing pipe stiffness the pipes have been modelled as simply supported beams 20'-3 1/2" long, while to compute stresses the span lengths reduce to 16'-3 1/4". The "free" frequency, horizontal displacement, vertical displacement rotation, and force are 0.442 Hz, 8.85 inches, 0.79 inches, 10.2^{o} and 25 lbs, respectively.

The maximum rotation permitted by the pipes excluding "walking" of the frame is 3.75^{o}, and when "walking" is included, that rotation is increased to 6^{o}. The total horizontal distance is 5.26 inches. Conclusions for this frame are the same as for the previous two frames.

Calculations that show how the values given above have been obtained are attached as Exhibit F8.

(d) Provide drawing package for the piping segment containing support CC-1-234-017-C53R.

The drawing package requested is enclosed as Exhibit F9.

(e) Provide drawings for each rigid frame support on double struts or snubbers. Provide a description of why the zero gap between the frame and the pipe assures the stable behavior of the supports.

The explanation as to why these supports are considered stable is provided in Attachment F1. The drawings of these supports are enclosed as Exhibit F10.

(f) Describe any proposed modifications to the main steam line supports which have limiting bumpers.

These supports, of which there is one per main steam line, will be modified by assuring that the U-bolts are cinched and enlarging the gap between the bumpers and the support proper so that contact with the bumpers cannot take place. This gap enlargement will be accomplished via removal of the bumpers or cutting of a portion of it, whichever can be most expeditiously accomplished.

(g) Describe any support which does not fall into any other categories described in the Affidavit, but which may be susceptable to "instability" as defined during the meeting of 8/23 at the CPSES site.

Applicants had already identified some mainsteam supports which were trapeze type supports carrying vertical load which have a U-bolt pipe attachment that has a clearance. Although Applicants had judged these supports to be stable, the decision has been made to snug these U-bolts up during the U-bolt torquing

program which Applicants committed to in their Affidavit on cinched U-bolts. This would eliminate any concern for stability under the current definition.

Attachment F1

ITT Grinnell Corporation
Executive Offices
260 West Exchange Street
Providence, Rhode Island 02901
(401) 831-7000

Pipe Hanger Division

September 14, 1984

Texas Utilities Services, Inc.
P.O. Box 1002
Glen Rose, Texas 76043

Attn: J.C. Finneran

Subject: Texas Utilities Gen. Co.
Comanche Peak Stm. Elec. Sta.
Units 1 & 2
P.O. No. CP-0046-A
ICN - 2104

Gentlemen:

As a result of your meeting on August 23, 1984 at the CPSES site with the NRC we wish to provide the following information relative to the stability concerns.

For clearity first let us reitterate the definition of stability as it pertains to pipe supports.

The lengthly definition is the following:

Improper functionability ("instability") is the ability of the support to move to an unqualified position in the absence of positive controls. Unqualified position is any position which violates the assumptions made in the piping analyses, and alternatively is a position which by reason of unquantifiable uncertainities becomes unanalyzable. Positive controls denote appurentances by which the support is prevented from undesired motion by intentional design of the appurentances as well as physical limitations in recognition of which the support designer need not design appurentances to prevent motion since the geometrical configuration itself assures the support cannot move in an undesired manner.

To: J. C. Finneran - TUSI

A. The supports to which the NRC refers are CT-1-008-007-S22K and CT-1-008-008-S22K (see Att. A).

For subject support to behave in an unstable manner, it must move to an unqualifiable position. Let's assume, for sake of argument, that maximum thermal and seismic displacements and rotations occur simultaneously causing the support to become out of plumb to its maximum possible position. This condition will then be analyzed to determine if it is, or could lead to, an unqualifiable position. Fully unrestrained, maximum displacements and rotations are as follows (data provided by Gibbs & Hill).

X = +.239"	RX = -.0035 rad
Y = +.2504"	RY = -.0012 rad
Z = -.336"	RZ = -.0045 rad

Note:
X, Z, & RY due to maximum thermal, only
Y, RX, & RZ due to maximum thermal, SSE, and seismic anchor motion (sum absolutes).

First, a check is made to determine if the cumulative effect of vertical displacement and horizontal rotations could cause contact with the ceiling. The following calculation, verifies that the support frame cannot impact the ceiling.

An examination of a plan view of the support indicates that the southeast corner of the frame will displace in an upward direction due to the directions of rotations above. Maximum vertical displacement may be calculated by:

$$Y = .2504 + (.0035)(12.5) + (.0045)(11.375) \Rightarrow$$

$$Y = 0.345" \leq 1.0"$$

A check is also made to see if the top of item 4 (which is only 1/2" from ceiling) could possibly impact the ceiling. Conservatively assume that RX = +.0035 rad., rather than minus thus,

$$Y = .2504 + (.0035)(20.8125) + (.0045)(2.75) \Rightarrow$$

$$Y = 0.336" \leq 0.5"$$

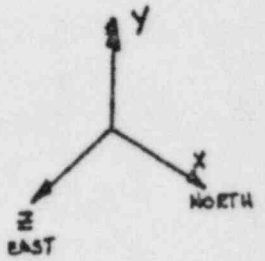
In conclusion the support frame cannot impact the ceiling.

To: J. C. Finneran - TUSI

The following calculations are now made to find the maximum out of plumb configuration that the support can assume.

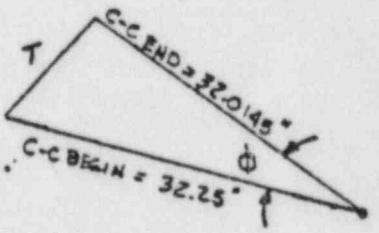
I) CT-1-008-007-S22K, displacement calculated at southern rear bracket...

$X = +0.239"$
$Y = +.2504" + (.0045)(14.25) \Rightarrow \quad Y = +0.315"$
$Z = -.336 - (.0012)(14.25) \Rightarrow \quad Z = -0.353"$



Installed condition, C-C begin = 32.25"
C-C end = $[(30.25 - .239)^2 + (.315)^2 + (.353)^2]^{1/2}$
C-C end = 32.0145"

$T = [(.239)^2 + (.315)^2 + (.353)^2]^{1/2} \Rightarrow \quad 0.530"$



By the law of cosines,

$$\cos \phi = \frac{(30.0145)^2 = (32.23)^2 - (.530)^2}{2(30.0145)(32.25)}$$

$\phi = 0.847^\circ$ (Maximum Misalignment)

II) CT-1-008-008-S22K, displacement calculated at eastern rear bracket...

$X = +.239 + (.0012)(20.8125) \Rightarrow \quad X = +.264"$
$Y = +.2504 + (.0035)(20.8125) \Rightarrow \quad Y = +.323"$
$Z = -.336"$

Installed condition, C-C begin = 21.8125"

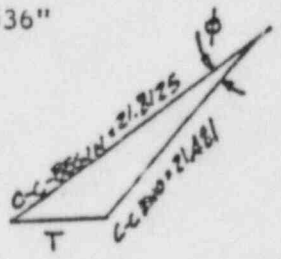
C-C end = $[(21.8125 - .338)^2 + (.264)^2 + (.323)^2]^{1/2} \Rightarrow$
C-C end = 21.481"

$T = [(.264)^2 + (.323)^2 + (.336)^2]^{1/2} = \quad T = .536"$

By the law of cosines,

$$\cos \phi = \frac{(21.8125)^2 + (21.481)^2 - (.536)^2}{2(21.8125)(21.481)}$$

$\phi = 1.988^\circ$ (Maximum Misalignment)



To: J. C. Finneran - TUSI

For CT-1-008-007-S22K, this value is 0.847°, for CT-1-008-008-S22K it is 1.988°. Assuming a 2° skew on CT-1-008-008-S22K, an additional 248# of force could be introduced into the piping/support system. The Y-component of this force must be taken up by the frame and pipe; the horizontal component will be shared with CT-1-008-008-S22K.

For conservatism, assume a 5% increase in stresses for both supports due to the "kick load". Review of the support calculations show the three maximum stressed areas to be reviewed:

Steel (item 10)....75.7%
Weld at baseplate....69.3%
Hiltis (by FUB)....51.0%

Hence, as expected sufficient design margins exist to account for worst case considerations.

Gibbs and Hill has informed us that pipe stress at the support location based on unrefined response spectra are as follows:

Eqn. 8: = 678 psi < 15,000 psi
Eqn. 9(Upset): = 2779 psi
Eqn. 9(Emerg): = 3683 psi < 18,000 psi
Eqn. 10: = 1553 psi < 21,000 psi
Eqn. 11: = 2233 psi < 36,000 psi

Additionally, consideration has been given to the local stresses induced by the lugs. These stresses are negligable.

In conclusion, based on a thorough review of all factors, adequate positive controls exist to assure that the support cannot move to an unqualifiable position, and therefore is considered stable for all loading conditions.

B. The mechanism for improper functionability (instability) for rigid frame supports with double struts is an out of plumb alignment of the frame down the axis of the pipe. For this to happen, the frame must "walk" down the axis of the pipe a sufficient amount such that the support assumes an unqualifiable position.

To: J. C. Finneran - TUSI

With zero gap existing on the frames, the frame cannot displace axially relative to the pipe unless two events occur simultaneously:

(1) The frame slides down the pipe (since the pipe is assumed to have sufficient axial restraint), and
(2) The pipe displaces towards the building structure in the restrained direction an appropriate distance to accomodate all of the pendulum action of the struts.

For event (1) to occur, a sufficient axial force must exist in the frame to overcome the friction between the pipe and frame. Any actual force applied to the frame thru the struts will also exert a rotation or binding force to the frame which significantly decreases any tendancy for it to slide down the pipe

In order for event (1) to occur event (2) must also occur because the struts are a fixed length and must swing the frame on an arc. If the pipe could displace in this manor, it will exert a restoring force on the frame (due to the restraining effect of other supports up and down stream), which would add to the fictional effect of the pipe to the frame.

This information we hope will clear up any concerns the NRC staff may have on this issue.

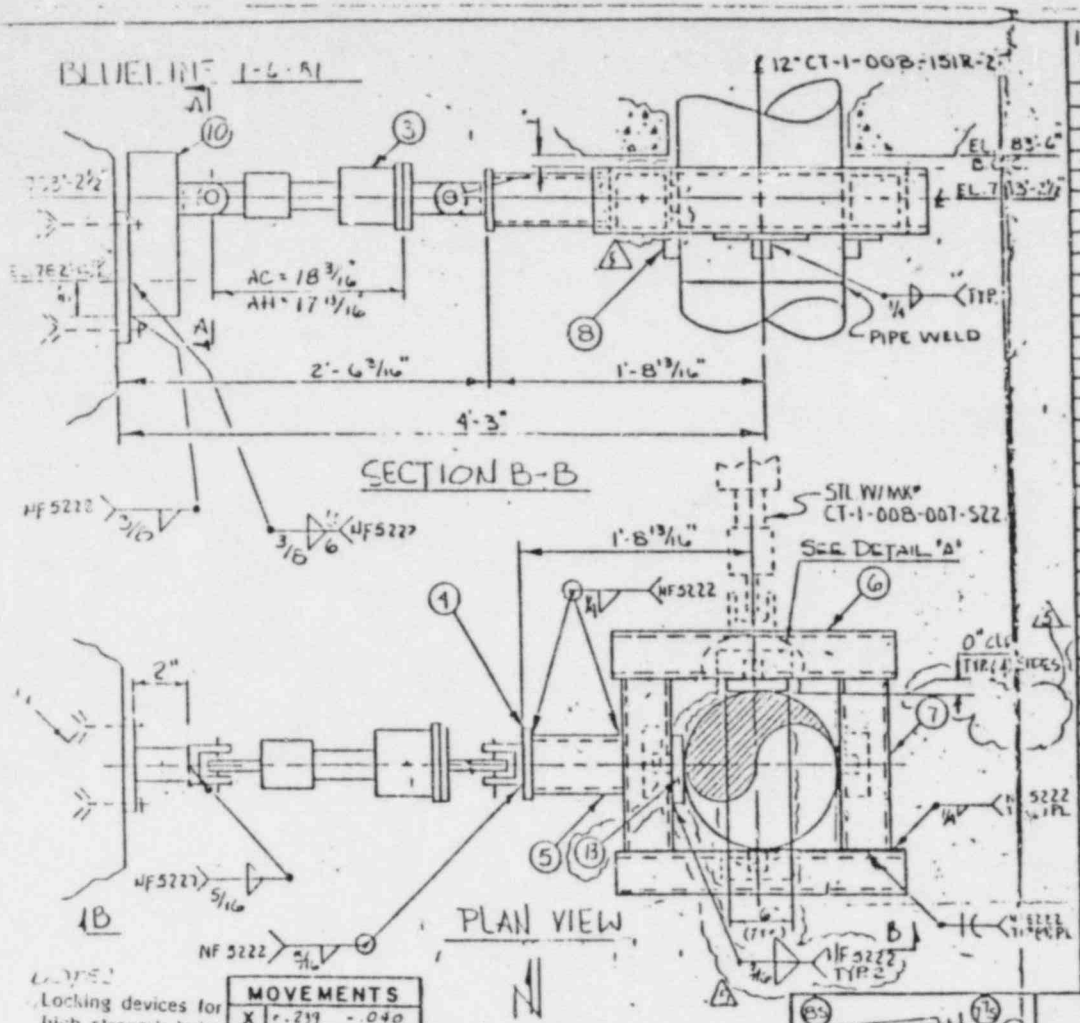
If we can be of any further assistance please do not hesitate to call on us.

Very truly yours,

ITT GRINNELL CORP.

D. E. POWERS
Engineering

DEP/ng
cc: B. Hill - ITT Fld. Rep.
K. Thornton - B&R
D.C. Frankum - B&R
J.W. Hare - Prov.
R. Meitzen - Houston
S. Perreault - Prov.
2084c



ITEM NO.	MATERIALS & OPERATIONS	QUAN	SHIP
	SEISMIC MECHANICAL SHOCK SUPPRESSOR CONSISTING OF:	QTY	
1	4-7" Hilti Kwik-Concrete-Anchors (1144)	4	
2	3/4" THRD Carbon Steel (SA-513-OR 65 ps GR 36) Plate 60 KSI-F-Nut	1	
3	SNAF-10-BA MECH. SNUBBER	1	
4	R 5 1/2" x 1/2" x 5 1/2" (SA-36)	1	
5	T S 4x4x1/2" x 0'-5 3/8" LG (A-500 GR B)	1	
6	T S 5x5x1/2" x 2'-1" LG (A-500 GR B)	2	
7	T S 5"x5"x1/2" x 1'-0 7/8" LG (A-500 GR B)	2	
8	FB 1 1/2" x 1 1/4" x 1 1/2" (SA-240 TYPE 304)	4	
9	C S B 1 1/2"x4", 7" LG. (SA-36/SA-515 GR 65) PER DETAIL "B"	4	
	SEISMIC ASSEMBLY SKETCH AND ENGINEERING BUNDLE AND TAG	1	
	MARK # CT-1-008-008-S22K	1	
	Apply Carbo-Zinc #11 to above mat'l except th'ds which shall be treated with a rust prevantative		
	NO MATL BY GRINNELL		
10	2" C S B. 4" x 12" (SA36) FIELD CUT TO SUIT	1	
11	1"x12" SUPER HILTI KWIK BOLT (10 1/2" LG) (SS)	4	
12	1" C S D PIPE CLAMP (SA-36/SA-515 GR 65)	1	
13	3/8" MAX C S B 2"x6" (SA-36)	2	

FOR OFFICE AND ENGINEERING USE ONLY

VENDOR CERTIFIED
DRAWING REV. NO. 5
BY [illegible] DATE 7-12-84

REV	DATE	DWN	CHK	APP	DESCRIPTION
3	7-12-84	CB	[illegible]	[illegible]	REV. VENDOR CERT.
4	8-31-84	[illegible]	[illegible]	[illegible]	REV. VENDOR CERT.
5	11-19-84	[illegible]	[illegible]	[illegible]	REV VENDOR CERT, REF CHG 99819 R.O

FOR MATERIALS AND OPERATIONS SEE SKETCH NO. _____ SHEET ____ OF ____

MOVEMENTS		
X	+.239	-.040
Y	+.077	-.017
Z	+.054	-.336

Locking devices for high strength bolts are not required per DCA 7607

BRHL Iso CT-1-SB-016 R2
I.P.D. Iso. CT-1-SB-116 R.5
Data Point 116Ω/FROB" AB-1-031 R.0
Pipe Mat'l. SA-312 TP 304
Insul. — Bldg. SB

NORM OPER DISPL.	
DX	+.239
DY	+.018
DZ	-.336

Brown & Root, Inc.

REF. DRAWING NUMBERS
PIPE: M-CX-07 R.13 ELECT: E-CX-01 R.6
STEEL: S1-0600 R.17 H.V.A.C.: M-CC508 R.5

CONDITIONS	Fx	Fy	Fz	Mx	My	Mz
DESIGN						
NORMAL & UPSET			-5135			
EMERGENCY			7107			
FAULTED						

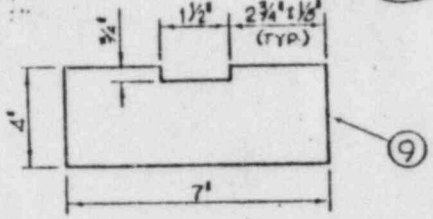
REV	DATE	DWN	CHK	APP	DESCRIPTION
A	5-6-81	JW	[illegible]	[illegible]	ISSUE FOR CONST. F/U 1-2
1	1-6-82	[illegible]	[illegible]	[illegible]	REVISED AS NOTED. REF. FIELD MODIFIED HANGER SECTION
2	7-26-84	CB	FC	CB	VENDOR CERTIFICATION. REF DCA 7607 (MK #)

CUSTOMER Texas Utilities Service, Inc.
ORDER OR CONT. NO. CP-0040
JOB NAME Comanche Peak Unit 1 & 2
MARK NO CT-1-008-008-S22K
SKETCH NO
SHEET 1 OF 2 REV. 5

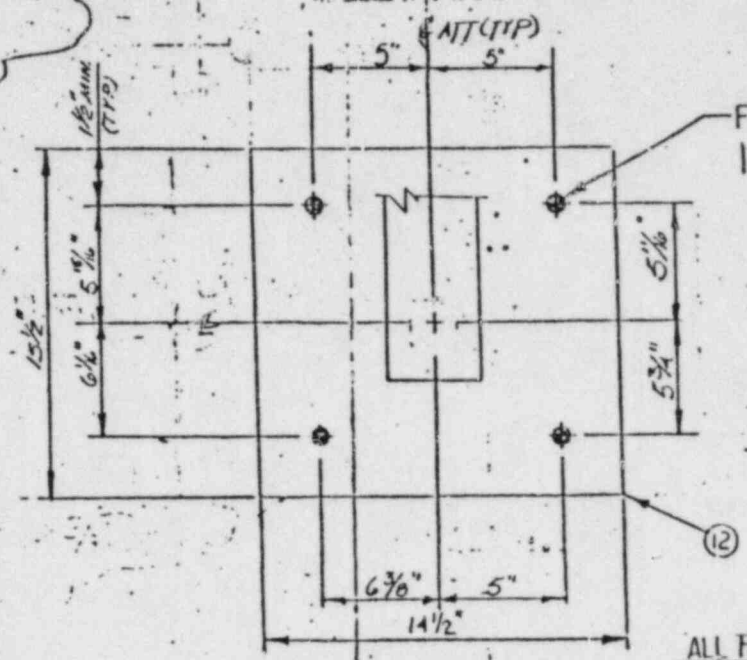
Exhibit F1

B/L OF LINE: 1-6-81

VENDOR CERTIFIED
DRAWING REV. NO. 5
BY: BH DATE: 7-12-84

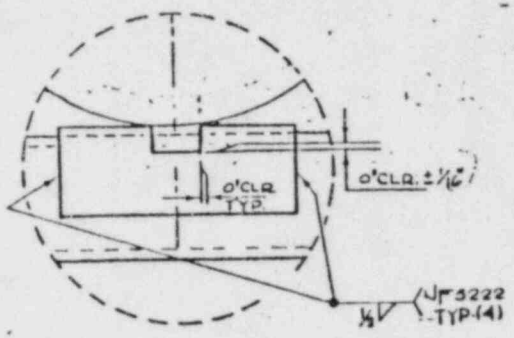


DETAIL "B"



ALL R DIMENSIONS ± 1/4" UNO.

SECTION A-A



DETAIL 'A'
(TYP 4)

FOR CONSTRUCTION AND ENGINEERING USE ONLY

REV	DATE	DWN	CHK	APP	DESCRIPTION
4	1-6-84	EH			REV. VENDOR CERT.
3	7-13-84	EH			REV VENDOR CERT. REF CMC 9981980

REV	DATE	DWN	CHK	APP	DESCRIPTION
1	1-6-81				ISSUED FOR CONST. REF FIELD
2	2-24-81				MODIFIED HANGER SKETCH FITT R-1 DELETED NOTES 1-3 & REV. NOS 1-2
3	3-22-84				VENDOR CERTIFICATION. REF: CMC 3114787 REV: VENDOR CERT.

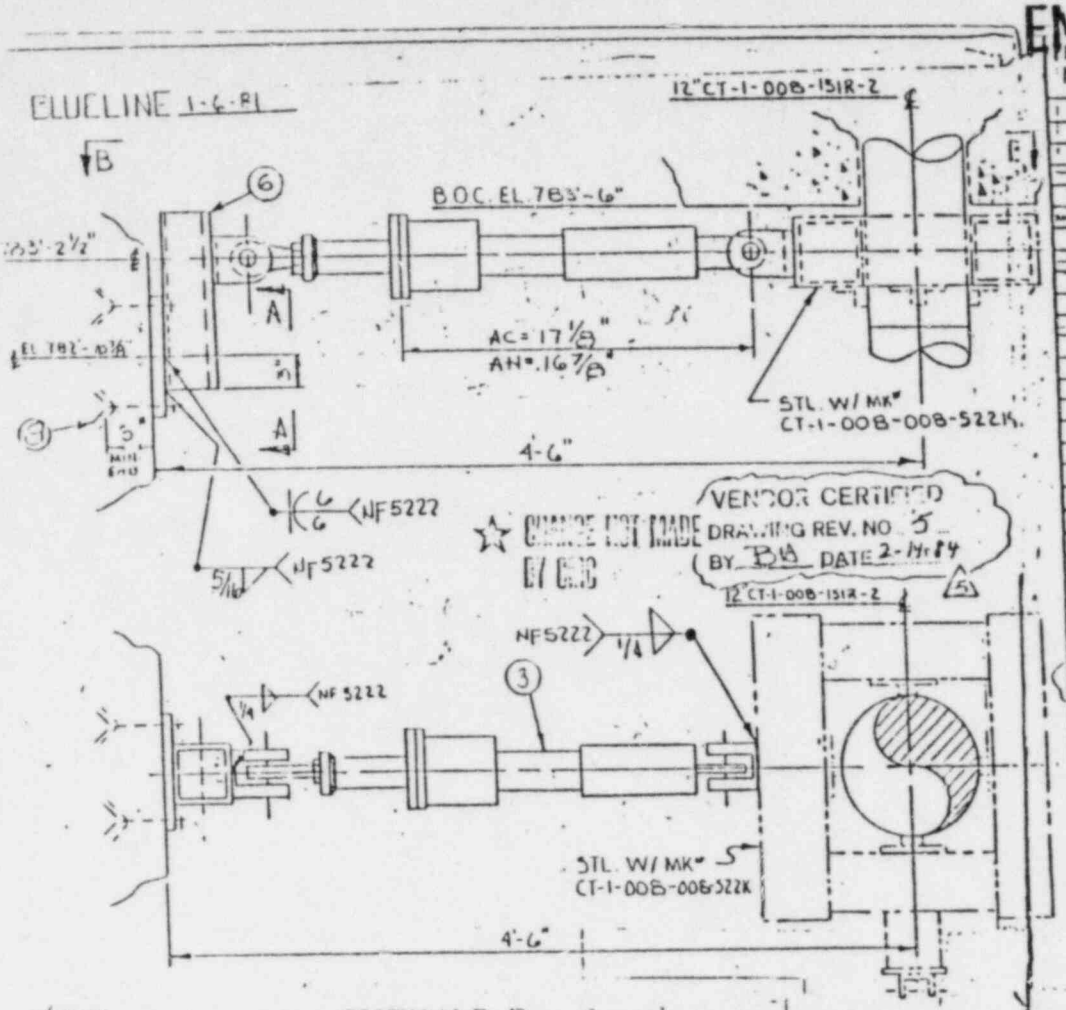
THIRD PARTY INSPECTION: YES ☒ NO ☐
CODE CLASS: ASME - III - 2

Brown & Root, Inc.

REF. DRAWING NUMBERS
PIPE: ELECT:
STEEL: H.V.A.C.:

CUSTOMER Texas Utilities Service
ORDER OR CONT. NO. CT-0310
JOB NAME
MARK NO. CT-1-008-008-S22K
SKETCH NO.
SHEET 2 OF 2

FOR OFFICE AND ENGINEERING USE ONLY



ITEM NO.	MATERIALS & OPERATIONS	QUAN	SHIP		PBS	L	CSS PRIM	SEC	AISC
1	SEISMIC MECHANICAL SHOCK SUPPRESSOR CONSISTING OF:	ONE							
1	1/2" x 5 1/2" Hilti Kwik Concrete Anchors (11191)	2					x		
2	3/4"-12" Carbon Steel (SA-515 OR 65 or SA-36) Plate, 1'-0" Long, TW-21#	1			x				
2	#3, 5" Stroke, Fig. 307 Mechanical Shock Suppressor, W-1'-3 15/16" Cold Setting-2 11/16", Hot Setting-2 5/16", 12 3/4" O.D. Pipe, Carbon Steel, Load-45#2#	1					x		
3	SMA-3-BA MFG'D SNUBBER	1					x		
	SEISMIC ASSEMBLY SKETCH AND ENGINEERING BUNDLE AND TAG MARK # CT-1-008-007-S22K	1 1							
6	L 3 4"x4"x 1/4"x 12" LG. (A500GR.B) FIELD CUT TO SUIT Apply Carbo-Zinc #11 to above Cat 1 except th'ds which shall be treated with a rust preventative	1							
	No Mfr. By G RUNNELS								
7	1" CSR PIP SECTION A-1 (SA 515 Gr 65/SA 36)	1							
8	1" x 12" SUPER HILTI KWIK BOLT	4							

REV	DATE	DWN	CHK	APP	DESCRIPTION
3	2-2-84	BJ			REV. VENDOR CERT.
4	2-7-84	VM			REV. VENDOR CERT.
5	2-14-84				REVD VENDOR CERT.

Approved By: C.E.C.
Date: 4-24-79

FOR MATERIALS AND OPERATIONS SEE SKETCH NO. ____ SHEET ____ OF ____

NOTES:
1) Locking devices for high strength bolts are not required per DCA 7602.

BRHL Iso. CT-1-SB-116 R.2
I.P.D. Iso. CT-1-SB-16 R.5
Data Point 1160 / PROB AB 1-031 R.0
Pipe Mat'l. SA-312 TP 304
Insul. 0" Bldg. 5
Group B, D Fig, V-N1 A

T/O" 1802

MOVEMENT		
X	+0.239	-0.040
Y	+0.032	-0.017
Z	+0.054	-0.334

NORM OPER MVT
DX = +0.239
DY = +0.018
DZ = -0.334

SEE BPHL FOR HGR LOCATION

LOCATION PLAN

THIRD PARTY INSPECTION YES ☒ NO ☐
CODE CLASS: ASME-III-2

Brown & Root, Inc.

REF. DRAWING NUMBERS
PIPE: M-0607 REV 15 ELECT: E1-0600-01 R6
STEEL: S1-0600 REV 17 H.V.A.C.: M-0650 R.5

CONDITIONS	Fx	Fy	Fz	Mx	My	Mz
DESIGN						
NORMAL & UPSET	-2735					
EMERGENCY	-3059					
FAULTED						

REV	DATE	DWN	CHK	APP	DESCRIPTION
A	6-6-79	JW			ISSUE FOR CONSTRUCTION
1	7-6-81				REVISED AS NOTED. REF. FIELD WORK DIRECTIVE SKETCH LIFT R.I. DELETED NOTES 1-3 (REV. NO. 1 ADDED SHEET 2)
2	12-3-81				INCREASE CLEARANCE FROM 5222 TO 6.5, ADD PLOTTING, REVISION

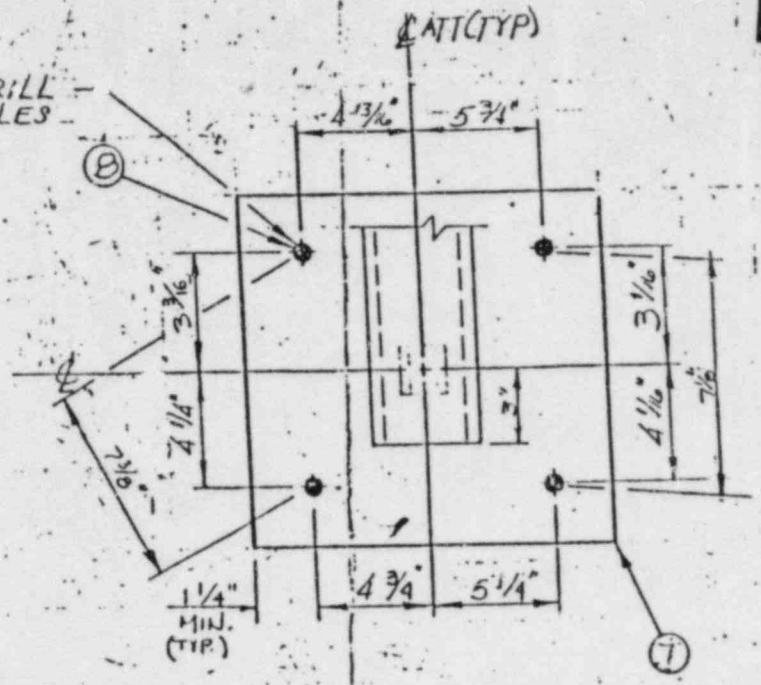
CUSTOMER Texas Utilities Service, Inc.
ORDER OR CONT. NO. CP-0046
JOB NAME Comanche Peak 1 & 2
MARK NO. CT-1-008-007-S22K
SKETCH NO. 2
SHEET 1 OF 2 REV.

Exhibit F2

BLUE LINE 1-6-81

VENDOR CERTIFIED DRAWING 5 BY [illegible] DATE 2-14-84

FOR OFFICE AND ENGINEERING USE ONLY



SECTION A-A

CPSES 88-1105 CENTRAL FILE COPY TU ELECTRIC CONSTRUCTION CENTER

REV	DATE	DR	CHK	APP	DESCRIPTION
4	2-7-84	VM	[illegible]	[illegible]	REV. VENDOR CERT.
5	2-14-84	[illegible]	[illegible]	[illegible]	REV. VENDOR CERT.

Brown & Root, Inc.

REF. DRAWING NUMBERS

PIPE: ELECT:

STEEL: H.V.A.C.:

REV	DATE	DWN	CHK	APP	DESCRIPTION
1	1-6-81	[illegible]	[illegible]	NA	ISSUED FOR CONST. REF FIELD
2	1-29-81	[illegible]	[illegible]	[illegible]	MODIFIED HANGER SKETCH 1 ITR 2.1 DELETED NOTES 1-3 & ENG NO 1
3	2-2-81	[illegible]	[illegible]	[illegible]	VENDOR CERTIFICATION PER EMC 81122 R-1, DCA 7107 (NI-4), SIN 6700
4	2-7-84	[illegible]	[illegible]	[illegible]	REV. VENDOR CERT.

THIRD PARTY INSPECTION ☐ YES ☒ NO

CODE CLASS: ASME-III-2

T/O = 1802

CUSTOMER Texas Utilities Services

ORDER OR CONT. NO. CP-0016

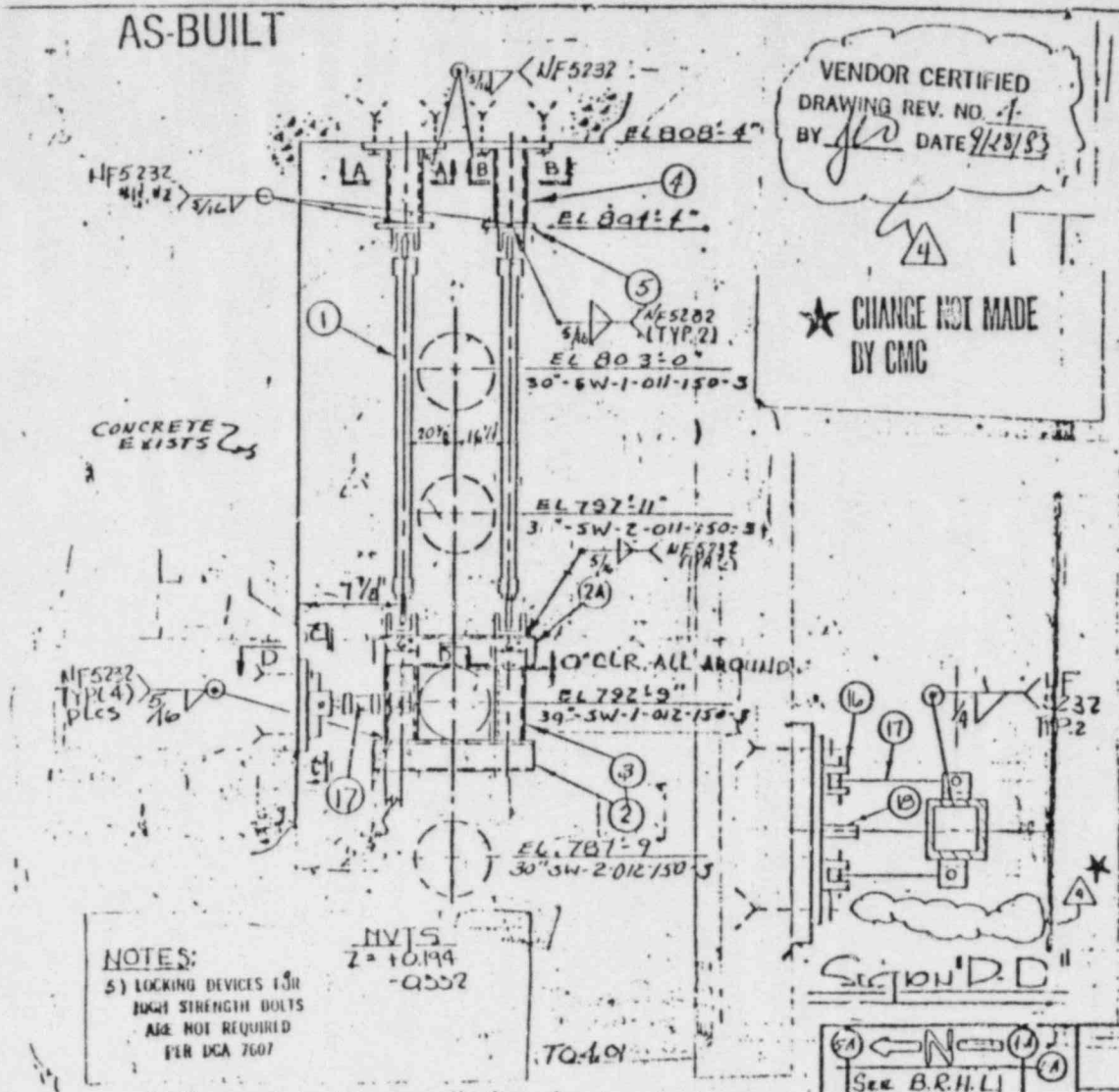
JOB NAME

MARK NO. CT-1-008-007-522K

SKETCH NO.

SHEET 2 OF 2 REV 5

AS-BUILT



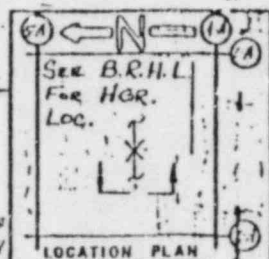
VENDOR CERTIFIED
DRAWING REV. NO. 4
BY JLC DATE 9/28/83

★ CHANGE NOT MADE BY CMC

NOTES:
5) LOCKING DEVICES FOR HIGH STRENGTH BOLTS ARE NOT REQUIRED PER DCA 7607

P&ID Iso. SW-1-AB-02-REV. 5-1
I.P.D. Iso. SW-1-AB-02 REV. 11
Data Point 510 /1208 FAB-1 COW-REV.1
Pipe Mat'l SA312 T CLASS1 GR.TP.69
Insul. _____ Bldg. AUX

WJ No.	Weld Procedure	Exam. Procedure
	1-01-1-13	I-SF-1562 NR-2



THIRD PARTY INSPECTION YES
CODE CLASS: ASME III - 3

ITEM NO.	MATERIALS & OPERATIONS	QUAN	SHIP.
	SEISMIC SWAY STRUT ASSEMBLY CONSISTING OF:	ONE	
	MATERIAL EXISTS IN FIELD		
1	SRS-20-BA SWAY STRUT	2	
2	6"x6"x1/2" T.S. (A500 GR.B) 3'-7" Long.	1	
2A	TS 6"x6"x1/2"x2'-11"LG. (A500 GR.B)	1	
3	4"x6"x3/8" T.S. (A500 GR.B) 2'-6½" Long, TW=110#	2	
4	6"x6"x1/2" T.S. (A500 GR.B) 3'-10" Long, TW=264#, Shop Center & Weld To Item #5 As Shown)	2	
5	1"x7" Carbon Steel (SA515 GR.65 or SA-36) Plate, 0'-7" Long, TW=28#	2	
6A	1"C.S.P. PER SECTION 'B-B' (SA36/SA515 GR65)	1	
6B	1"C.S.P. PER SECTION 'A-A' (SA36/SA515 GR65)	1	
7	3/4"x10" Hilti Kwik Concrete Anchor, TW=5#	8	
	NEW MATERIAL REQUIRED BY FIELD		
8	1"C.S.P. PER SECTION 'C-C' (SA36/SA515 GR65)	1	
9	1"x9" (1144) Hilti Kwik Concrete Anchors	4	
10	W4x13, (SA-36) 0'-5" Long, TW=5#	1	
11	DWG TOTAL-ACME III NAMEPLATE	1	
12	W 4x13 x 6 1/2" LG. (SA36)	1	
	Apply one coat of Carbo Zinc #11 to above mat'l except th'ds which shall be coated-A out		
16	SRPB-10 REAR BRKT	4	
17	SRF-10-SO SPUT	2	
18	1"C.S.P. x 3"x 15" LG (SA36)	1	
	SEISMIC ASSEMBLY SKETCH AND ENGINEERING BUNDLE AND TAG	1	
	MARK # SW-1-012-009-A33R	1	

CPSES

NO.	DATE	DWN	CHK	APP	DESCRIPTION
4	9-27-83	JP	Q	[illegible]	REVD. AS NOTED. REF. CMC's 39204 E3; 39145 R-H, DCA 7607 (SEE NOTE 5) DEL
3	~	~	~	~	FW#1-10; ADDED SHEET 2, 12
2	~	~	~	~	REVISED AS NOTED PER CMC VENDOR CERTIFICATION. REF. CPPA #22110
1	7-6-83	JC	[illegible]	[illegible]	REV. VENDOR CERTIFICATION

FOR MATERIALS AND OPERATIONS SEE SKETCH NO. SHEET

Brown & Root, Inc.

REF. DRAWING NUMBERS
PIPE: M1-0704-REV.10 ELECT: E1-0700-01-REV.1
STEEL: S-0705-REV.11 HV.A.C: M1-0735-REV.5

NO.	DATE	DWN	APP	DESCRIPTION
0	5/30/83	EES	[illegible]	ISSUE FOR CONST. FW#1-10 B
1	8/11/83	EES	[illegible]	REVISED AS NOTED PER CMC REV.1, ADDED FW#9-10
2	9/19/83	JC	[illegible]	REV AS NOTED, SEE NOTE-4

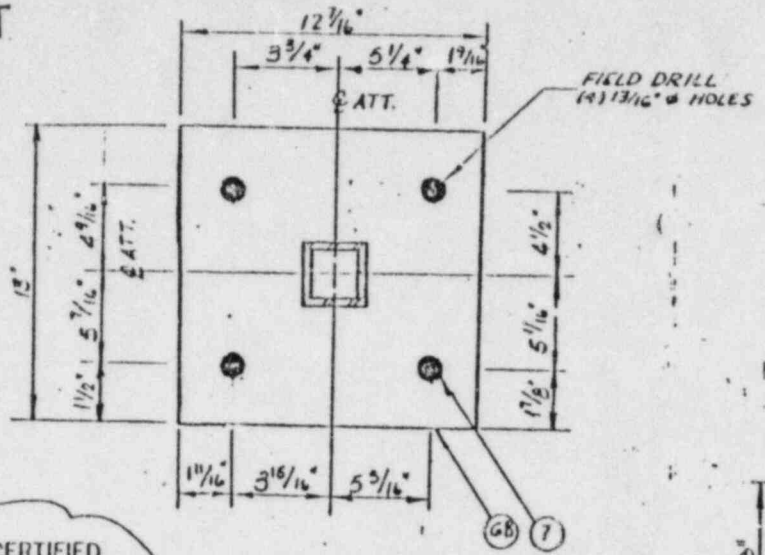
CONDITIONS	Fx	Fy	Fz	Mx	M
DESIGN					
NORMAL & UPSET	E 1152	-9405			
	+1240	+00			
EMERGENCY	E 1218	-11707			
	+1125	+1115			
FAULTED	E 1218	-11707			
	+1405	+1125			

CUSTOMER Texas Utilities Service
ORDER OR CONT. NO. CP-0046
JOB NAME Comanche Peak 1 & 2
MARK NO. SW-1-012-009-A
SKETCH NO.
SHEET 1 OF 2 REV

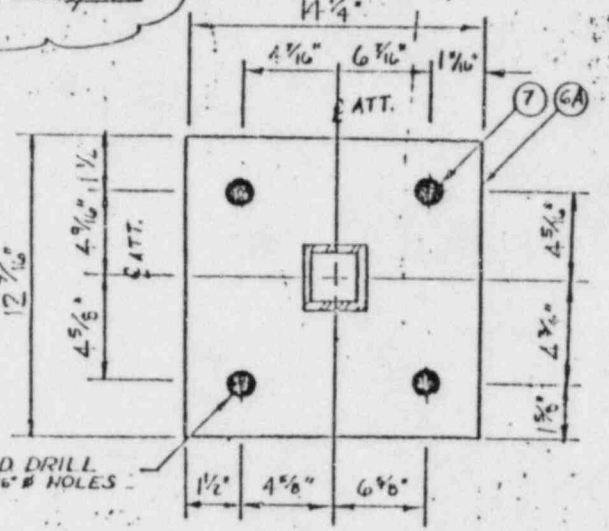
From Applicants' Attachment F10

ENGINEERING COPY
FOR OPERATING USE

S-BUILT



SECTION 'A-A'

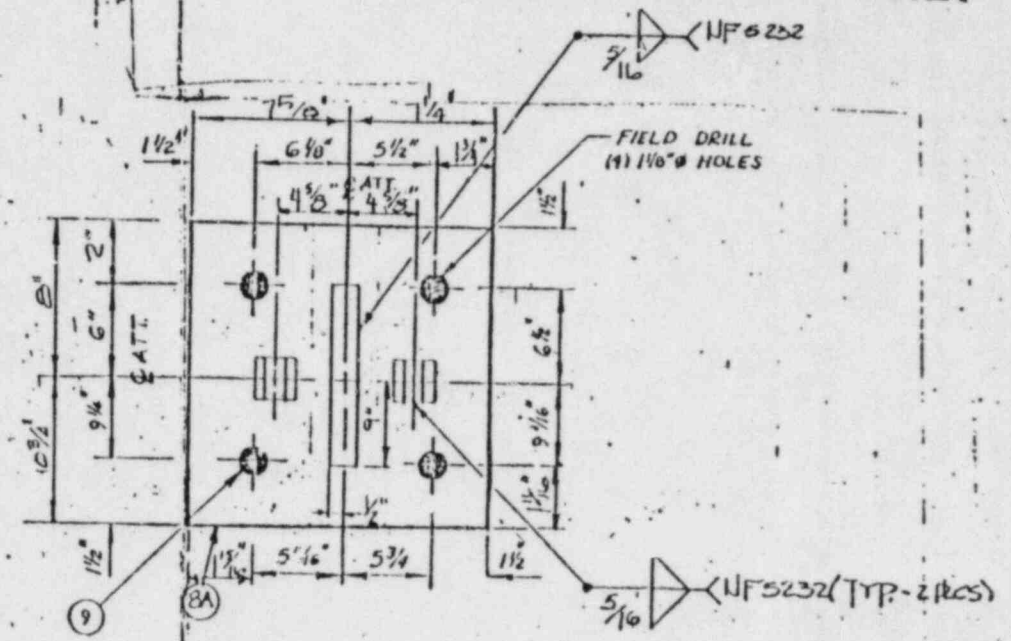


SECTION 'B-B'

4

VENDOR CERTIFIED
DRAWING REV. NO. 4
BY JLD DATE 9/18/83

FOR OFFICE AND ENGINEERING USE ONLY



SECTION C-C

4

Brown & Root, Inc.

REF. DRAWING NUMBERS

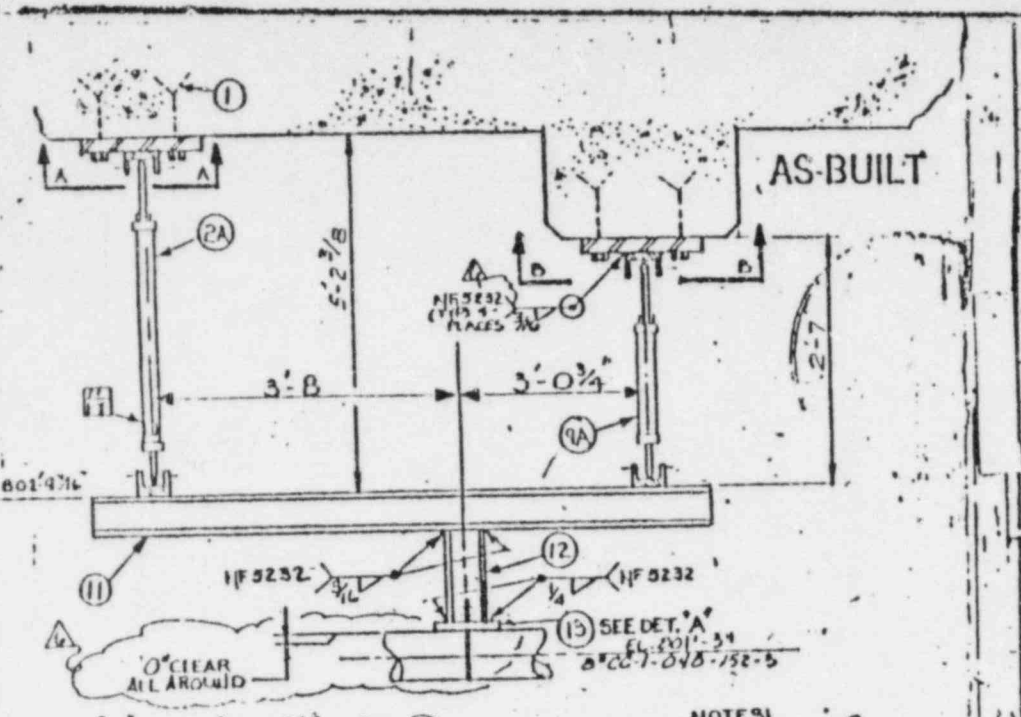
PIPE: ELECT:
STEEL: H.V.A.C.:

REV	DATE	DWN	CHK	APP	DESCRIPTION
4	9-27 83	JAR			ISSUED FOR AS BUILT: REF: CMC 39201 R3, CMC 39145 R-3, DCA 7607 (SEE NOTE 3) DELETED EWR ST. NO. CMC 69796 REV. VENDOR CERTIFICATION. REF. CPPA # 22910.
3	~	~	~	~	
2	~	~	~	~	
1	~	~	~	~	
0	3-23 83				

THIRD PARTY INSPECTION W ☐ CP ☐
CODE CLASS: ASME III-3

T.O., 401

CUSTOMER Texas Utilities Service.
ORDER OR CONT. NO. CP-0046
JOB NAME Comanche Peak 1 & 2
MARK NO. SW-1-012-009-A33R
SKETCH NO.
SHEET 2 OF 12 REV 4

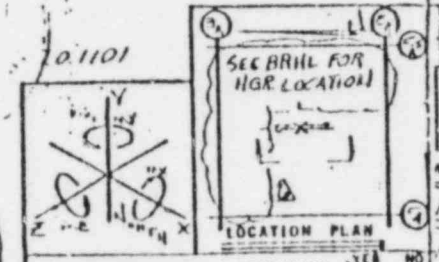


NOTES:

4) BY ISSUE OF REV. 3 OF THIS DRAWING, THE FOLLOWING DOCUMENTS ARE VOIDED: CMC-37607 R.1

NOTES CONT. BELOW

BRHL ISO CC-1-AB-47 R-5
I.P.D. ISO CC-1-AB-47
Data Point A220/AB-1-GIE R-0
Pipe Mat'l SA-106 Gr B
Insul. 1½" Bldg. A



NOTES CONT.:

5) Locking Devices for high strength bolts are not required per DCA 7607

VENDOR CERTIFIED
DRAWING REV. NO. 6
BY [illegible] DATE 4/10/13

THIRD PARTY INSPECTION
CODE CLASS: ASME III-3

ITEM NO.	MATERIALS & OPERATIONS	QUAN	SHIP
	SEISMIC SWAY STRUT ASSEMBLY CONSISTING OF	ONE	
1	[illegible] 1/2" DIA L.C. Kwik-Bolt Concrete Anchors	8	
2A	SHS-OG-BA SWAY STRUT C-C = 1'-10 7/8"	1	
3	PLATE (SA-36) 6" x 1-3/4" Long (W-748)	1	
4	[illegible]	2	
5	[illegible]	1	
6	[illegible]	2	
7	[illegible]	3	
8	[illegible]	1	
9A	SRS-OB-BA SWAY STRUT C-C = 2'-2 1/2"	1	
10	[illegible]	4	
11	W6x15.5 x 7'-8 7/16 Lg. (SA-36)	1	
12	W8x13.5 x D = 7 7/16 Lg. (SA-36)	1	
13	PL 3/8 x 8" x 12" (SA-515 Gr. 65/SA-36)	1	
14	PIPE SHOE	1	
15	[illegible]	2	
16	1/2 C.S. PLATE (SA-515 Gr. 65/SA-36) [illegible]	1	
17	1/2 C.S. PLATE (SA-515 GR. 65/SA-36) (SEE SECTION 4.4)	1	
	Apply one coat of Carbo Zinc #11 to above nut & except those which shall be coated w/a rust preventative.		
	Date: 3-27-13	QUAN	SHIP

REV	DATE	DWN	CHK	APP	DESCRIPTION
1	9/13	[illegible]	[illegible]	[illegible]	REVD AS BUILT, REF: CMC 94337 VENDOR CERTIFICATION, SEE GIII 62520

SEISMIC ASSEMBLY SKETCH AND ENGINEERING BUNDLE AND TAG MARK # CC-1-048-001-A33R

REV	DATE	DWN	CHK	APP	DESCRIPTION
1	7/12	[illegible]	[illegible]	[illegible]	REVD AS NOTED
2	7/12	[illegible]	[illegible]	[illegible]	REV AS NOTED, REF CMC 93328 (DCA 7607 SEE NOTE 3 (AS BUILT))

FOR MATERIALS AND OPERATIONS SEE SKETCH NO. SHEET OF

CONDITIONS	Fx	Fy	Fz	Mx	My	Mz
DESIGN						
NORMAL & UPSET		-289 / 1017				
EMERGENCY		-335 / 1215				
FAULTED						

Brown & Root, Inc.

REF. DRAWING NUMBERS

PIPE: All-Steel Shell ELECT: Elevation
STEEL: S-0711 " HVAC: Miscellaneous

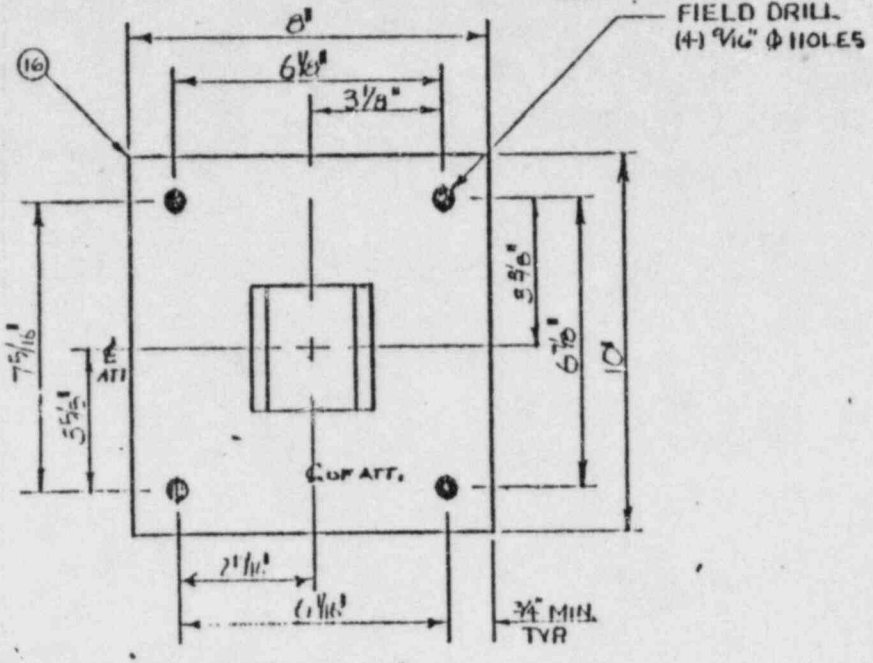
REV	DATE	DWN	CHK	APP	DESCRIPTION
6	4/10/13	[illegible]	[illegible]	[illegible]	ISSUE FOR CONST FIELD WELDS 1:10 ; FULL EXAM.
5	3/11	[illegible]	[illegible]	[illegible]	[illegible]
4	3/11	[illegible]	[illegible]	[illegible]	[illegible]
3	1/13	[illegible]	[illegible]	[illegible]	[illegible]

CUSTOMER Texas Utilities Service, Inc.
ORDER OR CONT. NO. CF-0046
JOB NAME Comanche Peak 1 & 2
MARK NO. CC-1-048-001-A33R
SKETCH NO.
SHEET 1 OF 2 REV. 6

ATTACHMENT G

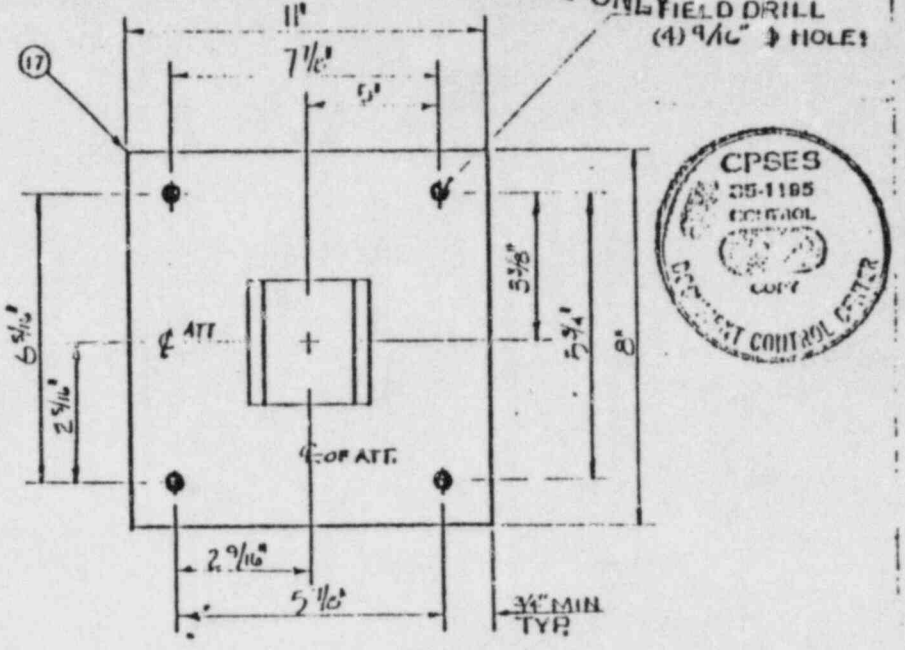
AS-BUILT

VENDOR CERTIFIED
DRAWING REV. NO. 6
BY [illegible] DATE 4/10/85



SECTION A-A

ALL DIMENSIONS ± 1/4" U.N.O.



SECTION B-B

ALL DIMENSIONS ± 1/4" U.N.O.

BROWN & ROOT, INC.
ENGINEERS & CONSTRUCTORS

REF. DRAWING NUMBERS
PIPE:
STEEL:
ELECT:
H.V.A.C.:

REV	DATE	DWN	CHK	APP	DESCRIPTION
6	4/10/85	RG	RH	DW	REV'D AS BUILT, REF: CP-CSE-8517 W/CONF. CERTIFICATION, REF: MIL-8320

T.O. 1101

THIRD PARTY INSPECTION YES NO

CODE CLASS: ASME III-3

REV	DATE	DWN	CHK	APP	DESCRIPTION
4	10/16	RG	RH	MC	ISSUED FOR CONST. REF: FIELD MODIFIED HANGER SKETCH (SEE NOTE 4)
5	2-26	RG	RH	MC	REV. AS NOTED, REF. CMC 13932 R.S.S. & DCA-7607-SEE NT.5 (AS BUILT)

CUSTOMER TEXAS UTILITIES SERVICE, INC.
ORDER OR CONT. NO. CP-0046
JOB NAME COMANCHE PEAK I & 2
MARK NO. CC-1-0418-007-A33R
SKETCH NO.
SHEET 2 OF 2 REV. 6

MANCHE PEAK STEAM
CTRIC STATION (CPSES)

COMPONENT MODIFICATION CARD (CMC)

SHT. 1 OF 2

SERIAL NO. Nº 37607 R.1

) APPLICATION: PIPE SUPP'TS. WELD MOD. ☑ Q ☑ NON-Q ☐ DESIGN CHANGE/DEVIATION ☒

) DWG. NO. BRH.
1-048-007-A33R REV. 1

) LINE NO./COMPONENT NO.

④ REASON FOR CHANGE:
CABLE TRAY SUPPORT

⑦ ORIGINATOR
DAC/G.ABELE
NAME
☑ CPPE
☐ ORIGINAL DESIGNER

) INSTRUCTIONS:

MOVE ☑

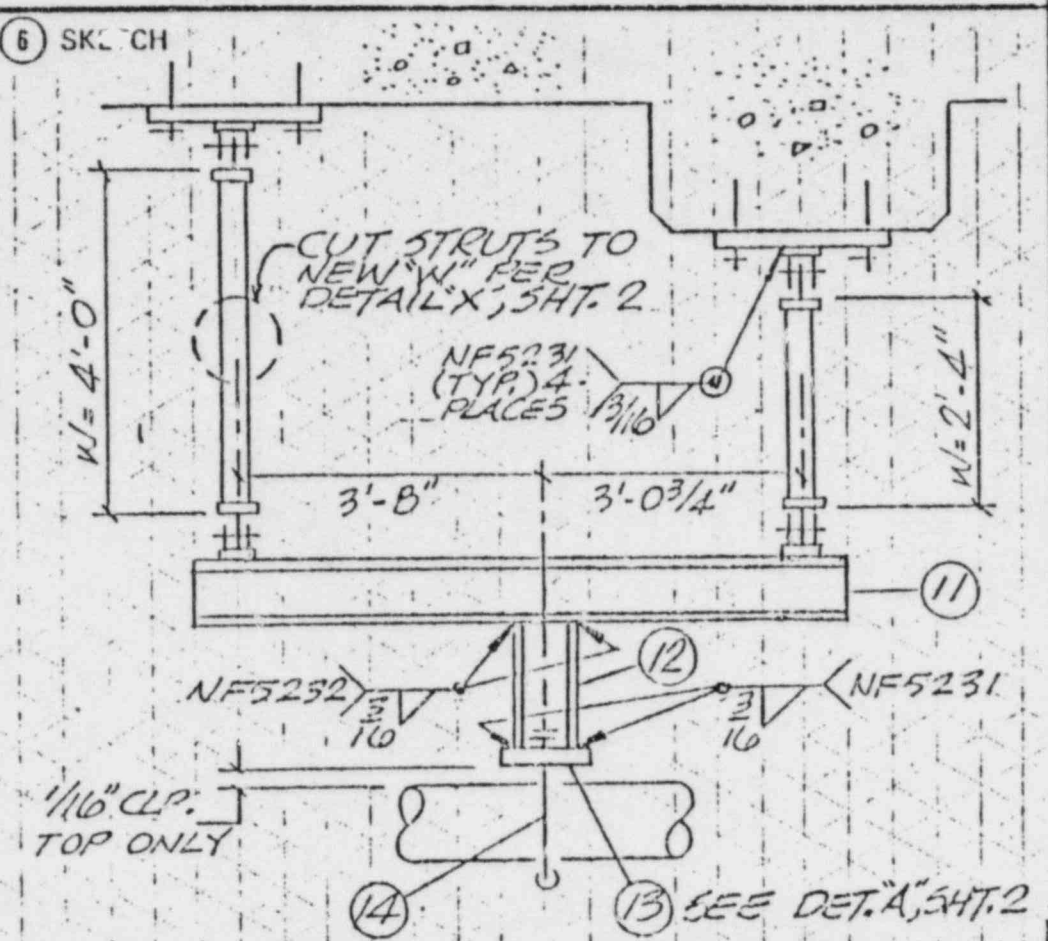
ELETE ITEM #5&7
" #10 3
1

REVISION VOIDS
SUPERSEDES
UMENT SERIAL NO.
#37607 R.0

DD ☑

W6x15.5x7'-8"LG.
A-36
W6x15.5x7 9/16"LG.
A-36
L2 5/8x8x12
515-SR.US/SA-36
PUS-080

⑥ SKETCH



ELEV. LKG. EAST

⑧ APPROVED BY:
D. Custalow 6-27-8C
R13 DATE
1 D. Custalow 7-24-8(
DATE
DATE
DATE
DATE
DATE
DATE

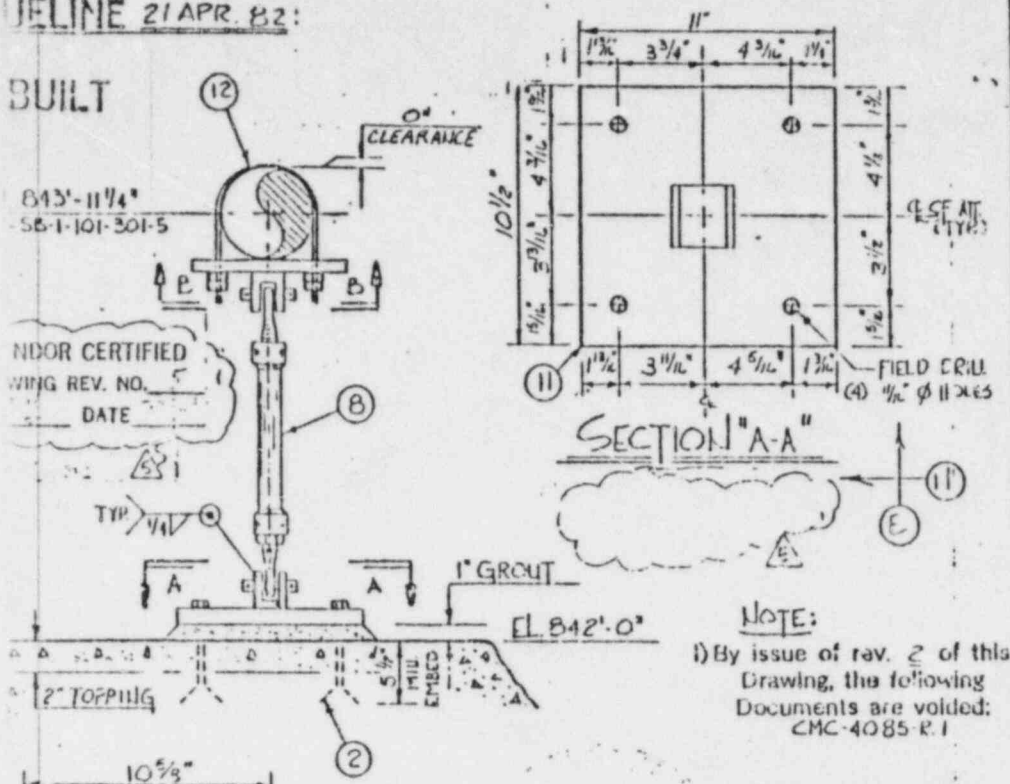
⑨ DISTRIBUTION	DCC CNTL NO.	QT

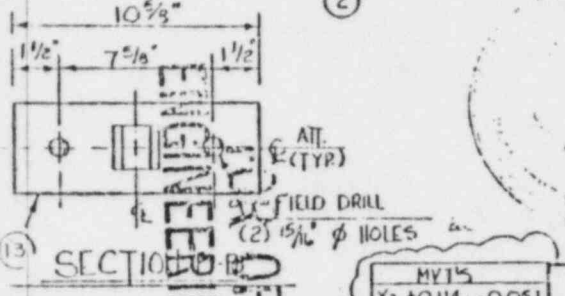
FOR ENGINEERING AND OFFICE USE ONLY

FOR OFFICE AND

...ELINE 21 APR 82:

BUILT





NOTE:

1) By issue of rev. 2 of this Drawing, the following Documents are voided: CMC-4085-R.1

2) LOCKING DEVICES FOR HIGH STRENGTH BOLTS ARE NOT REQUIRED PER DCA 7607

ITEM NO.	MATERIAL & OPERATIONS	QUAN	SHIP		PGS	L	CSS	PRIM.	SEC.	AISC.
2	5/8" x 8½ HILTI-KWIK BOLTS	4								
8	SB3-OM-BA SWAY STRUT	1								
9	[illegible]	1								
10	3/4" G.S.D. PER SECT. A-A (A-36/SA-515 GR 65)	1								
11	3/4" C.S.D. PER SECT. A-A (A-36/SA-515 GR 65)	1								
12	PUH-060 HEAVY U-BOLT w/(4) HEAVY HEX NUTS	1								
	B=6¼", TL=9"									
13	C.S. R 36" THK. PER SECT. B-B (A-36/SA-515 GR 65)	1								

REV	DATE	DWN	CHK	APP	DESCRIPTION
[illegible]	~	~	[illegible]	~	VENDOR CERTIFICATION, REF. CPPA 25574
[illegible]	[illegible]	A	[illegible]	[illegible]	REVD VENDOR CERTIFICATION
[illegible]	[illegible]	SL	[illegible]	[illegible]	REVD VENDOR CERT REF CMC 3600?

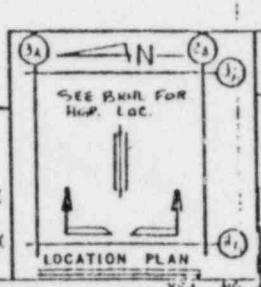
MARK # SB-1-101-001-ASSR
PAINT: CARBO ZINC # 11

ITEM NO.	MATERIAL & OPERATIONS	QUAN	SHIP		PGS	L	CSS	PRIM.	SEC.	AISC.

FOR MATERIALS AND OPERATIONS SEE SKETCH NO. SHEET OF

MYTS
X: +0.114, -0.051
Y: —
Z: +0.013, -0.005

BRHL Iso. SB-1-AB-[illegible]-R.1
I.P.D. Iso. SB-1-AB-038-R.2
Data Point 31[illegible]
Pipe Mat'l. SA 312 TP-304
Insul. —
T.O. 4401



THIRD PARTY INSPECTION YES ☐ NO ☐
CODE CLASS: B31.1-5

BROWN & ROOT, INC.
ENGINEERS & CONSTRUCTORS

REF. DRAWING NUMBERS
PIPE: MI-0711-R4 ELECT: E1-0701-R4
STEEL: S-0725-R.2 H.V.A.C.: MI-0714-R4

CONDITIONS	Fx	Fy	Fz	Mx	My	Mz
DESIGN	—	[illegible]	—	—	—	—
NORMAL & UPSET	[illegible]	-4196 LBS	—	—	—	—
EMERGENCY	—	[illegible]	—	—	—	—
FAULTED	—	[illegible]	—	—	—	—

REV	DATE	DWN	CHK	APP	DESCRIPTION
[illegible]	[illegible]	TG	[illegible]	[illegible]	ISSUED FOR CONST.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	REVD LOADS, MOD'D U-BOLT
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	REVD PER CMC #4035 R.1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	REV'D & REDRAWN — REF: M.I.'S & SEE NOTE 1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	REVISED PER CMC-7763 R.2 DCA-7607 (IT.2) "AS BUILT"

CUSTOMER Texas Utilities Service, Inc.
ORDER OR CONT. NO. CP-0046
JOB NAME Comanche Peak 1&2
MARK NO. SB-1-101-001-ASSR
SKETCH NO.
SHEET 1 OF 1 REV. 5

ATTACHMENT H

FOR OFFICE ONLY

Unit 2 Sup Rev. 2

ANCHE PEAK STEAM
TRIC STATION (CPSES)

COMPONENT MODIFICATION CARD (CMC)

SERIAL NO. 77263 ⚠1

APPLICATION: PIPE SUPPORT | WELD MOD. [NA] | Q [NA] | NON-Q [✓] | DESIGN CHANGE/DEVIATION: [✓]

DWG NO: SF-1-101-001-A55K REV-2

LINE NO / COMPONENT NO: 6" SF-1-101-301-5

(4) REASON FOR CHANGE: LOADS INCREASED PER NEW ANALYSIS (Ref. 1-MB)

⚠1 SHOW CLR. PROVIDED (AS-BUILT)

(7) ORIGINATOR
Chris S. Wright
NAME
[X] CPPE
[NA] ORIGINAL DESIGNER

INSTRUCTIONS:

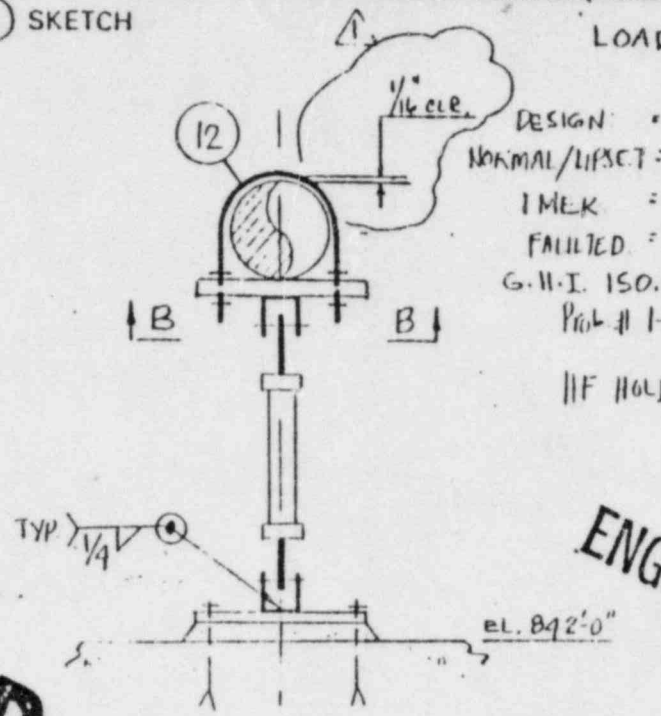
MOVE [✓]

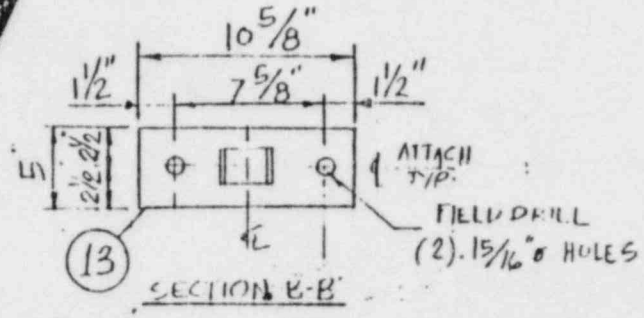
[illegible] ITEM NO. 3 of 10

[✓]

ITEM NO ½ PUR 060
U-BOLT w/ (4) HEAVY
PLATE, B=6¼", TL 4" GUAN (1)
NO ½ 2¼" O.C. H HF
H & (A36/A515 OR 65)
QUAN. (1)

(6) SKETCH





LOADS

	F_Y (#)
DESIGN	3376
NORMAL/UPSET	4156
IMEK	4937
FAULTED	4937

G.H.I. ISO. WI-3239-91 Rev. 0
Prob # 1-1118 (CMTA 18.209)

HF HOLD Per CPPA 21.680

VOID

FOR OFFICE AND ENGINEERING USE ONLY

(8) APPROVED BY
(CSW) J.R. Morgan 8-4-92 DATE
⚠1 BY: [signature] 8-10-92 DATE
DATE
DATE
DATE
DATE
DATE

(9) DISTRIBUTION

	DCC CNTL NO	QTY
TECH SERVICES	INFO	2
SITE DAMAGE STUDY GROUP	INFO	
SYSTEMS PLANNING	INFO	1

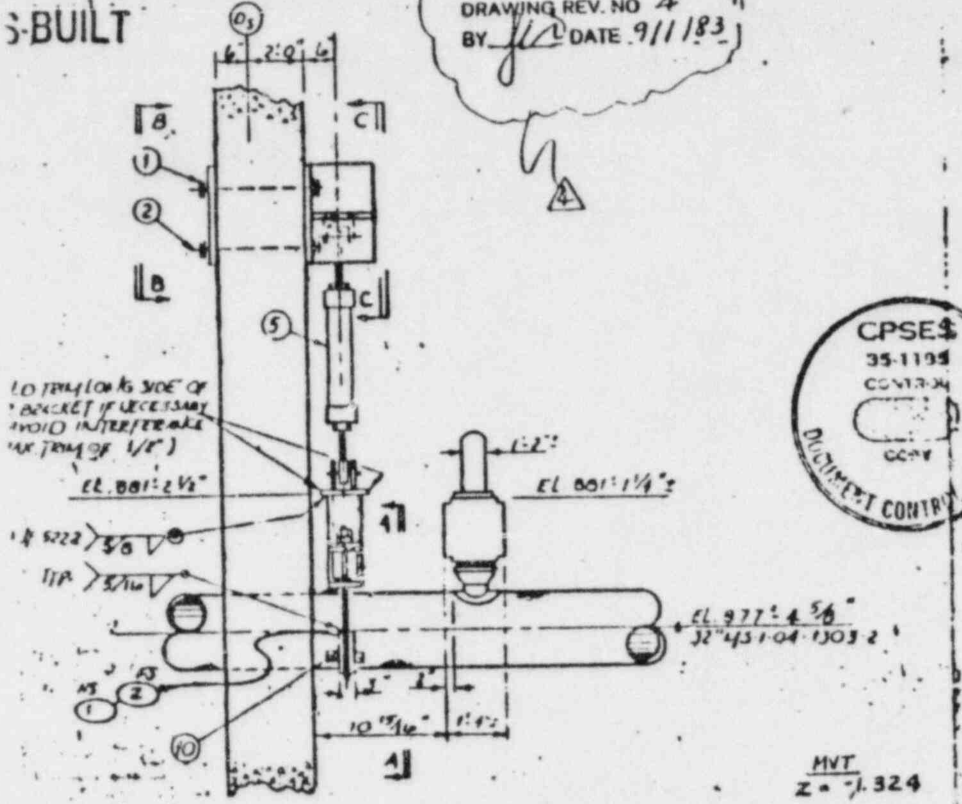
THIS REVISION VOIDS AND SUPERSEDES DOCUMENT SERIAL NO. CMC-77263 Rev 0

AREA MANAGEMENT INFO

UELINE: 5 NOV 81

S-BUILT

VENDOR CERTIFIED
DRAWING REV. NO 4
BY [illegible] DATE 9/1/83



MVT
Z = -1.324

CPSES 35-1195 CONTROL COPY DOCUMENT CONTROL CENTER

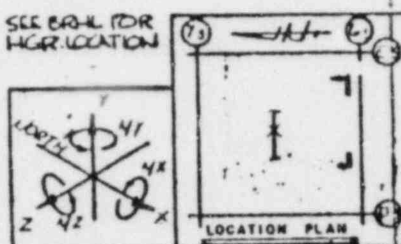
ITEM NO.	MATERIALS & OPERATIONS	QUAN	SHIP		PBS	L	C33	PRIM	SEC	AISC
1	FHN 1 1/2" HEX NUT	16					X			
2	1 1/2" 6UNC, 3'-7" ROUND ROD (SA 193 [illegible]) w/6" THREAD BOTH ENDS	4					X			
3	1 3/4" C.S. PL PER SECTION B-B SA515 GR. [illegible] A36	1			X			X		
4	[illegible]	[illegible]								
5	FIG 211 [illegible] SNUB STRUT [illegible]						X			
6	TS 8"x4"x1/2"x2'-6" LG. A500 GR B	1				X		X		
7	FIG 137 SN, U-BOLT C.S. (SA 36) 1-2 1/2" 3'-2"-10 1/8" [illegible] DEVELOPED LENGTH: 10'-0 1/4" W/ HEX NUTS	1					X			
8	1" C.S. PL PER DETAIL "G" SA 515 GR 65 or SA 36	2			X			X		
9	TS 8"x4"x3/8"x3'-4 1/4" PER DETAIL "B" A500 GR B	1				X		X		
10	1" C.S. PL 3 1/4"x4"-5 5/8" SA515 GR65 / SA 36	1			X			X		
11	[illegible] HEAVY HEX NUT	[illegible]					X			
12	1 1/4" C.S. PL PER SECTION "C-C" SA515 GR65 or A36	1			X			X		
13	ASME III NAME PLATE	1								
14	1" C.S. PL 8 1/4" x 12" LG. SA515 GR 65 or SA 36	4			X			X		
15	C.S. PL 1" x 2 1/2" x 2 1/2" (SA36 / SA515 GR65)	4			X			X		
16	[illegible] ANGLE PER DETAIL [illegible] (SA 36)	[illegible]								
17	[illegible]	[illegible]								
18	1/2" C.S. PL x 5" x 2'-0" LG. SA36	1								
19	1/2" C.S. PL x 5" x 11 [illegible]" LG. SA36	1								
20	TS 1/2" x 4" x 6" LG. A500 GR B	1								
21	TS 1/2" x 4" x 6" LG. A500 GR B									
22	1/2" C.S. PL x 5" x 9" LG. [illegible]									
23	TS 1/2" x 4" x 6" LG. [illegible]									
24	TS 1/2" x 4" x 6" LG. A500 GR B									
25	TS 1/2" x 4" x 8" LG. [illegible]									

FOR OFFICE AND ENGINEERING USE ONLY

REV	DATE	DR.	CHK	APR	DESCRIPTION
3	3/23/83	[illegible]	[illegible]	[illegible]	REV. VENDOR CERTIFICATION REF: CMC-[illegible]
[illegible]	—	—	—	—	SH 3
4	9-1-83	M	[illegible]	W	REV. VENDOR CERT.

FOR MATERIALS AND OPERATIONS SEE SKETCH NO. ____ SHEET ____ OF ____

SEE BRHL FOR HGR. LOCATION



THIRD PARTY INSPECTION
CODE CLASS: ASME III-2

BROWN & ROOT, INC.
ENGINEERS & CONSTRUCTORS

REF. DRAWING NUMBERS
PIPE: [illegible] R 5 ELECT.: [illegible] R 1
STEEL: [illegible] R 3 H.V.A.C.: [illegible] R 6

CONDITIONS	Fx	Fy	Fz	Mx	My	Mz
DESIGN	—	—	—	—	—	—
NORMAL & UPSET	—	-5590	—	—	—	—
EMERGENCY	—	[illegible]	—	—	—	—
FAULTED						

REV	DATE	DWN	CHK	APP	DESCRIPTION
0	[illegible]	[illegible]	[illegible]	[illegible]	ISSUED FOR CONST. REF. F.M. 7S [illegible]
1	4/[illegible]	[illegible]	[illegible]	[illegible]	REVD AS NTD: [illegible] REV, DCA 7607 [illegible] VENDOR CERTIFICATION, [illegible]
2	~	~	~	~	[illegible]
3	3/23/83	[illegible]	[illegible]	[illegible]	[illegible] VENDOR CERT

CUSTOMER Texas Utilities Service, Inc.
ORDER OR CONT. NO. CP 2046
JOB NAME COMANCHE PEAK 1 & 2
MARK NO. MS-1-004-003-S72R
SKETCH NO.
SHEET 1 OF 3. REV. 4

NOTE:
2) Locking devices for high strength bolts are not required per DCA 7607

BRHL 150-MS-1-SB-017 R.0
B.R.P. 150-MS-1-30-17 R 1
DATA POINT 495 [illegible] AB-1 2BD R.0
PIPE MAT'L SA-155 KC70 CL1
INSUL. 2.25" BLDG. SB

0"3401

RECEIVED
FEB 7 1984
CYGNA SAN FRANCISCO

ATTACHMENT I

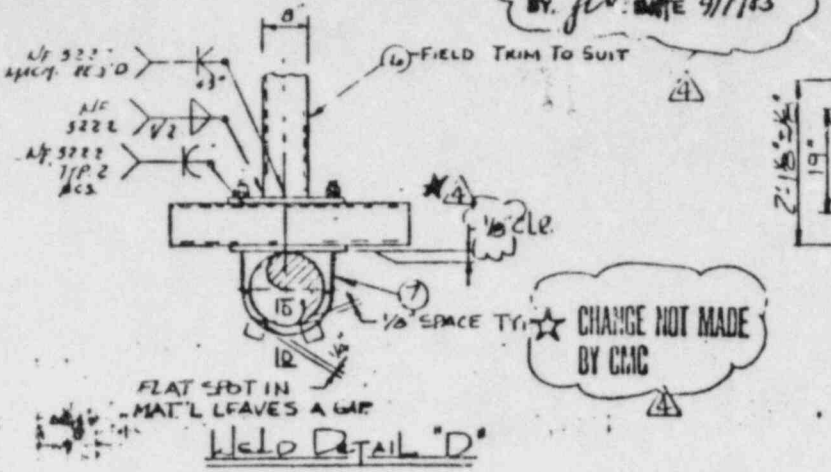
RECEIVED

FEB 7 1984

JELINE: 5 NOV 81 AS-BUILT

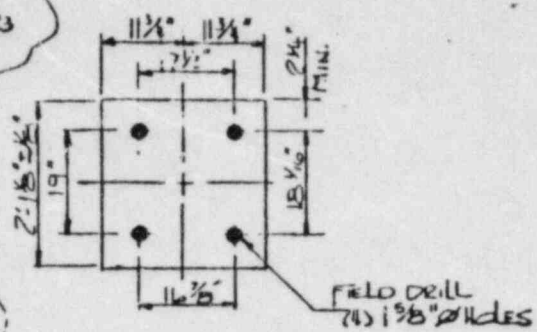
VENDOR CERTIFIED DRAWING REV. NO. 4 BY. JLS DATE 9/1/83

CYGNA - SAN FRANCISCO

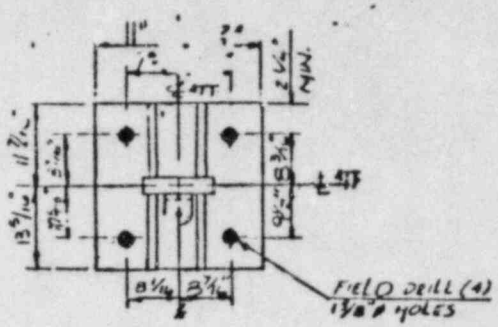


Weld Detail "D"

CHANGE NOT MADE BY CMC



SECTION "B-B"



SECTION "C-C"

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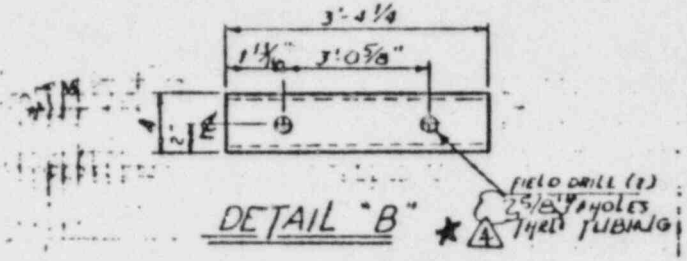
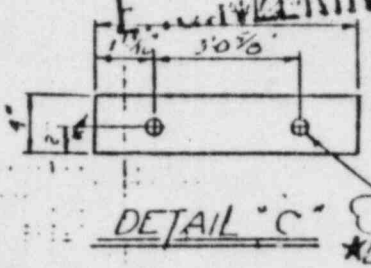
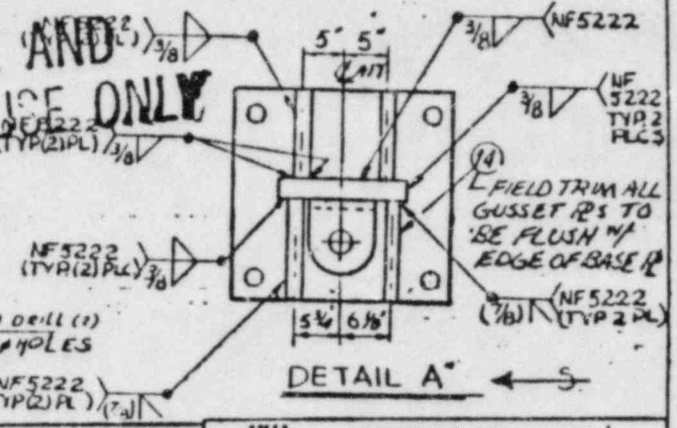


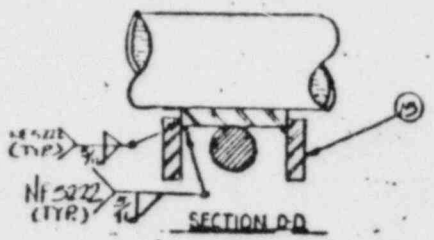
DETAIL "B"



DETAIL "C"



DETAIL "A"



SECTION D-D

REV.	DATE	DR.	CHK.	APP.	DESCRIPTION
3	9/1/83	JLS	[illegible]	[illegible]	REV: VENDOR CERTIFICATION REF: ECC-91871R-1APP
CON'T	–	–	–	–	SAME AS
4	9-1-83	VM	[illegible]	[illegible]	REV VENDOR CERT.

REV.	DATE	DRN.	CHK.	APP.	DESCRIPTION
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CON'T	–	–	–	–	–
1	[illegible]	[illegible]	[illegible]	[illegible]	REV VENDOR CERT.

BROWN & ROOT, INC.
ENGINEERS & CONSTRUCTORS

REF. DRAWING NUMBERS

PIPE: ELECT:

STEEL: H.V.A.C.:

CUSTOMER TEXAS UTILITIES SERVICE, INC

ORDER OR CONT. NO. CP 0046

JOB NAME [illegible]

MARK NO. HS-1-004-003-S72R

SKETCH NO.

SHEET 2 OF 3 REV. 4

THIRD PARTY INSPECTION

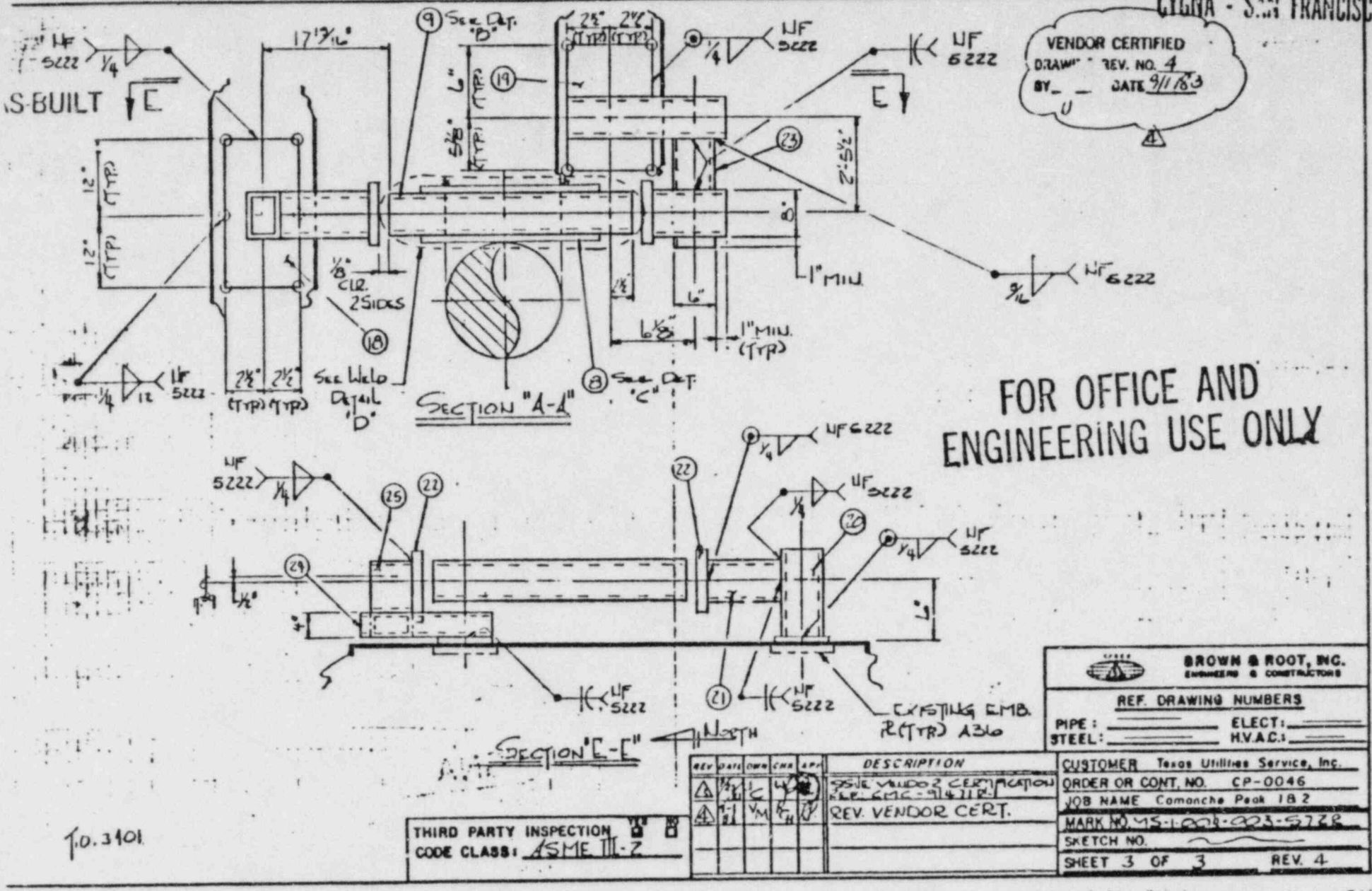
CODE CLASS: ASME III - 2

3401

RECEIVED

FEB 7 1984

CYGNA - SAN FRANCISCO



FOR OFFICE AND ENGINEERING USE ONLY

BROWN & ROOT, INC.
ENGINEERS & CONSTRUCTORS

REF. DRAWING NUMBERS

PIPE: _____ ELECT: _____

STEEL: _____ H.V.A.C.: _____

REV	DATE	DWN	CHK	APP	DESCRIPTION
3	9/12/83	LC	VM	KH	ASME VALIDATION REF. CMC-9143 IR-1
4	9-11-83	VM	KH	JV	REV. VENDOR CERT.

CUSTOMER Texas Utilities Service, Inc.

ORDER OR CONT. NO. CP-0046

JOB NAME Comanche Peak 1&2

MARK NO. MS-1-001-923-S228

SKETCH NO.

SHEET 3 OF 3 REV. 4

THIRD PARTY INSPECTION

CODE CLASS: ASME III-2

T.O. 3401

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	}{	
	}{	
TEXAS UTILITIES ELECTRIC	}{	Docket Nos. 50-445-1
COMPANY, et al.	}{	and 50-446-1
(Comanche Peak Steam Electric	}{	
Station, Units 1 and 2)	}{	

CERTIFICATE OF SERVICE

By my signature below, I hereby certify that true and correct copies of

CASE's Motions and Answer to Applicants' Motion for Summary Disposition Regarding Stability of Pipe Supports

have been sent to the names listed below this 15th day of October, 1984, by: Express Mail where indicated by * and First Class Mail elsewhere.

* Administrative Judge Peter B. Bloch
U. S. Nuclear Regulatory Commission
4350 East/West Highway, 4th Floor
Bethesda, Maryland 20814

* Ms. Ellen Ginsberg, Law Clerk
U. S. Nuclear Regulatory Commission
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Bethesda, Maryland 20814

* Dr. Kenneth A. McCollom, Dean
Division of Engineering,
Architecture and Technology
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Stillwater, Oklahoma 74074

* Dr. Walter H. Jordan
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* Judge Elizabeth B. Johnson
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Office of Executive Legal
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Commission
Maryland National Bank Bldg.
- Room 10105
7735 Old Georgetown Road
Bethesda, Maryland 20814

Chairman, Atomic Safety and Licensing
Board Panel
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Chairman
Atomic Safety and Licensing Appeal
Board Panel
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

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Michael D. Spence, President
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Skyway Tower
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Dallas, Texas 75201

Docketing and Service Section
(3 copies)
Office of the Secretary
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

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Assistant Attorney General
Environmental Protection Division
Supreme Court Building
Austin, Texas 78711

Juanita Ellis

(Mrs.) Juanita Ellis, President
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Dallas, Texas 75224
214/946-9446