

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

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USNRC

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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In the Matter of

TEXAS UTILITIES GENERATING
COMPANY, et al.

(Comanche Peak Steam Electric Station
Station, Units 1 and 2)

Docket Nos. 50-445-DC
and 50-446-DC

CASE'S STATEMENT OF MATERIAL FACTS AS TO WHICH
THERE IS NO GENUINE ISSUE

REGARDING CASE'S FIRST MOTION FOR SUMMARY DISPOSITION
REGARDING CERTAIN ASPECTS OF THE IMPLEMENTATION
OF APPLICANTS' DESIGN AND QA/QC FOR DESIGN

1. The iterative design program which exists at Comanche Peak consists of a design and check program followed by a nine-level review program (Affidavit of CASE Witness Jack Doyle at page 76, item 1; pages 4, 18, 21, and 51). For example:
 - (a) Applicants have another loophole for problems which prove embarrassing and that is to claim that since the particular support has not been final vendor certified any allegation carries no weight. The only time a problem can be laid at the doorstep of Applicants is when the problem can be shown to exist after the nine iterative steps which lead to final vendor certification. (Id., page 18.)
2. The allegations originally stated by CASE Witness Jack Doyle (and supported by documentation) contained 52 node points involving 58 supports and related to the status of Comanche Peak to the last day of Mr. Doyle's employment (Id., at page 76, item 2; pages 3 through 8; and

pages 16-17). For example:

- (a) In his original deposition, CASE Witness Jack Doyle offered documentation on 52 node points which contained 58 separate supports (X, Y, or Z independent supports). In addition to these supports, he has since had the opportunity to examine 10 calculations and drawings from the Cygna Phases 1 and 2 review. Further in relation to Cygna, he has reviewed their findings on 22 main steam supports as outlined in Volume 3 of the Phase 3 segment of the review ("Final Report, Independent Assessment Program of Comanche Peak Steam Electric Station (Phase 3)," Prepared by Cygna Energy Services, July 16, 1984). This represents a total of some 90 supports or so which Mr. Doyle has examined to some extent (not including the cursory review of the Phases 1 and 2 Cygna Report).
(Id., at page 5.)

3. Applicants' attempts to show that no problem exists relative to CPSES generic concerns raised by Mark Walsh and Jack Doyle (the Walsh/Doyle allegations) actually prove the Applicants had no knowledge of the level of problem prior to construction (Id., at page 76, item 3; pages 54, 56, 60, 61, 63, 65, 69, and 70). For example:

- (a) When examining any material supplied by Applicants and NRC Staff, one factor to keep in mind is that the material being supplied is not offered as evidence to do something, but is rather a frantic effort to salvage a 5 billion dollar public menace. Secondly, as has been shown conclusively, the Applicants' ability to produce accurate calculations is not

only questionable, it has been proven to be impossible -- even with 9 levels of review plus the original check. (Id., at page 54.)

- (b) One fact that does come through loud and clear in the analysis (even though it is incomplete) by the Applicants is that the generic stiffness factors were not represented in the installed supports, and in fact, for the 6" line, the actual stiffness varied from 3.6 times the generic value to 1/70 of the generic value, and for that case 75% of the loads increased and were therefore nonconservative. The maximum increase for one support was 200%; 20% of the supports exhibited load changes greater than 25%. And it must be mentioned one more time, these stiffness values did not include the effects of U-bolts, base plates, anchor bolts, gaps, etc. The greatest load increase in terms of actual load was one support, the load of which went from 824 lbs. to 1371 lbs. At one anchor, force and one moment also increased more than 25%. At the other anchor, all moments and two forces increased, and it must be recalled that this was for a system with only one support at 1/70 of the generic stiffness, and as shown above, the possibilities for many systems with one or more soft support (1/70) exists. See W. Paul Chen Affidavit on Open Items Relating to Walsh/Doyle Concerns (under cover letter of 10/14/83), page 24, and Attachment (Applicants' 8/17/83 Additional Pipe Support Generic Stiffness Study).

Recalculation of support loads was also done for support

No. CC-1-107-008-E23R, which was a support that had a generic stiffness of 1/360 of the generic stiffness. The load increase in this particular support was over 600% and resulted in a redesign of the support by CMC 94130, July 29, 1983 (see 10/14/83 Chen Affidavit, pages 25 and 26; see also drawing, CASE Exhibit 669B, Attachment to Deposition/ Testimony of Jack Doyle, item 11TT). (Id. at pages 69-70.)

- (c) In no case are the effects of friction on these U-bolts mentioned in the analysis by Applicants, which would increase the effects of interaction. Therefore, even this analysis is non-conservative. (Id. at page 65.)
- (d) The supports with increases selected above only included those with loads that increased 20% or more or where the increase was 10% and lateral loads were indicated that had not existed previously. As may be noted, nine supports suffered significant increase, and additionally, at least one support absolutely failed (quite possibly three, since heavy-duty U-bolts are generally not used when a PUS type U-bolt would only be loaded to approximately 1/3 of its capacity for the old loads issued 1/17/83).

It should be noted that these significant increases and the failure and potential failures were not mentioned in Applicants' affidavits. (Id. at page 63.)

- (e) The fact is that Comanche Peak has failed to consider two-way loading, which is not in compliance with the technical specification or the manufacturer's specification for

interacting loads.

The effects of constraint on a mode not considered in the pipe stress introduce a nonconservatism in the output of loads used in the design of all supports in the system. (Id. at pages 60 and 61.)

(f) The design activity can be carried out in a correct manner only if the design criteria is established in advance of the design, not when the criteria is established after construction. (Id. at page 56.)

4. Applicants' final vendor certified review program was developed to insure that the contents of the design and analysis would be error-free (Id., at page 76, item 4; pages 48-52). For example:

(a) On numerous occasions, we have heard the Applicants and NRC Staff deny the validity of allegations based on the argument that the support being questioned was not final vendor certified and therefore not open to critique.

On an equal number of occasions we have heard the Applicants and NRC Staff state with equal persuasiveness that the errors would all be caught in the final vendor review.

Beyond this, in testimony we listened to Applicants' Witnesses Messrs. Finneran, Vega, Krishnan, and others extol the virtues of a review system based on 9 levels of checking that was so tight that even time couldn't slip by (see Tr. 7140-7200, especially 7189 and 7192).

But now the time has come to silence these oracles of levity because their flawless system is based on the dreams of "somewhat knowledgeable" or incompetent individuals. (Id. at page 48.)

5. Phases 1 and 2 of the review by Cygna Energy Services failed to note at least 6 major engineering fundamental errors which existed on 9 of the pipe support calculations reviewed by CASE (Id., at page 76, item 5; pages 21 and 49). For example:

- (a) In the case of Cygna Energy Services, for Phase 1 of their review, the diligence of their gathering of raw data was somewhat less than desired, as was pointed out in the February 1984 hearings and discussed in the material which appears following page 21, line 14. (Id. at page 21.)

6. Cygna Energy Services failed to note that one support of the 9 mentioned above suffered a structural failure on the modification incorporated to insure stability (Id., at page 76, item 6; pages 23 and 36). For example:

- (a) For support No. SI-1-325-002-S32R (CASE Exhibit 928), the clip angle (item 15) which was installed to assure stability, fails. While Cygna failed to mention this initially, when compelled to supply an answer, they finally stated that they were aware of this problem.

From the above, the value of the Vendor Certified Drawing (VCD) program appears to offer little hope of correcting any problem and may in fact be introducing

new problems. (Id. at page 23.)

7. In the Phase 3 review by Cygna Energy Services (main steam supports), 77.5 per cent of the main steam support calculations contained gross calculational errors (Id., at page 76, item 7; pages 37 through 51). For example:

(a) Of the 31 supports in question, 24 have gross errors which escaped detection through 9 levels of review prior to final vendor certification. This represents a 77.5 per cent error rate, which is fatal for any discipline and a health and safety concern of monumental proportions. (Id. at page 51.)

(b) As for the problems discussed in Mr. Doyle's previous answer on the 22 main steam supports reviewed as Phase 3 of the Cygna Report, Mr. Doyle offered the following summary. Of the 22 supports reviewed by Cygna, which are all Class 2 supports, 18 contained gross errors, a portion of which are included at pages 37 through 48 and summarized at pages 49 through 51 of Mr. Doyle's affidavit attached. (Id. at page 49.)

(c) While these 36 calculational errors are not the total number of errors found in these 22 supports, it is indicative of the extent of the QA/QC breakdown. (Id. at page 51.)

8. In the Phase 3 review by Cygna Energy Services, one support had such gross calculational errors that the support failed and was redesigned (Id., at page 77, item 8; page 41). For example:

- (a) PS-078, Item 1, pages 1 of 10 and 2 of 10,
PS-078, Item 2, page 2 of 10:

Item 1: "Input data calculations for STRUDL model shown on sheet 1 to 8 Design Input calculation (dated 6/21/83) not checked. Moment of inertia and section modulus for members 5 and 6 and 8 to 11 were not calculated correctly.

"Members 5 & 6

"Iy should be 359.95, but 681.51 used in STRUDL input Sy should be 71.99, but 136.3 was used in design.

"Members 8 to 11

"Iy should be 642.73, but 1213.1 was used in design. Sy should be 107.12, but 2.7.18 (sic) was used in design.

"Reanalyses of the frame was required in order to obtain the correct forces & moment for designs. Per TUGCO's calculation dated June 8, 1984, the frame is re-analyzed with beam (Item 22) boxed with 3/4" plates. The modified support is acceptable (Reference Cygna communications report, dated May 24, 1984, Question 41). See Observation PS-01."

(Id. at page 41.)

9. When 77.5 per cent of the calculations for one area and 67 per cent of the calculations in another have gross errors, the accuracy of the remaining plant systems is suspect (Id., at page 77, item 9; pages 3 and 4). For example:

- (a) The majority of the points and allegations are based only on several hundred of the more than 40,000 pipe supports which are installed at Comanche Peak. (Id. at page 3.)
- (b) Now when one is discussing a sample of components which may be comprised of a few tens of thousands of elements (welds, nuts, bolts, plates, structural members,

hardware, etc.) compared to 20 million elements, it cannot be called a large sample. But when this small sample indicates a complete failure to control fundamentals, then it is indeed fair to state that the safety of the complete facility is at best indeterminate if not dangerous. (Id. at page 4.)

10. When 31 per cent of the original supports alleged to have serious faults are rebuilt and 6-1/2 per cent of the 31 reviewed (by Cygna and later by CASE) had to be rebuilt, the safety of the plant is indeterminate (Id., at page 77, item 10; pages 7, 8, and 14 through 17). For example:

(a) The facts are that history and Applicants' activities have proved beyond doubt that of the original 58 supports mentioned in CASE Exhibit 669B, a large percentage have been subjected to major rework to bring them up to par as required by the law, the codes, basic fundamentals, and common sense. (Id. at page 7.)

11. There is no doubt that the independent review process is neither independent nor reliable (Id., at page 77, item 11; pages 21, 29 through 53). For example:

(a) Mr. Doyle restated his position on the credibility of Cygna as an independent reviewer. No person or organization can be effectively independent in a review process if they are allowed to evaluate their own findings in a process which is paid for by the reviewed organization . . . (Id. at page 21.)

- (b) Cygna Energy Services, hired as a consultant by the Applicants for an independent assessment program, was challenged on their uncontesting acceptance of this method of clamping. They spent over two months in analyzing the problem using the most sophisticated and accurate means currently available.

The results were that the stresses in the U-bolt and the pipe under 5 foot pounds of torque exceeded the allowables of the materials and with higher torques would exceed the yield of the materials (at 80 foot lbs., in fact, in one analysis the pipe stress was 80,000 lbs. per square inch). (Id at page 29.)

- (c) Cygna Energy Services, which was responsible for the review of systems at Comanche Peak, either deceived the Board or totally lacked knowledge of several important factors relative to pertinent code sections which, while not adhered to at Comanche Peak, are required for even the most insignificant facility. See Tr. 12,369, where Ms. Williams states that they never considered MSS SP-69, and Tr. 12,371-12,372, where Ms. Williams states that she does not know about the MSS organization. . .

Beyond this, while Applicants, NRC Staff, and Applicants' agents continually refer to industry practice as the caviat for not performing analysis or accepting procedures on the basis of judgement, Ms. Williams admitted that the industry practice being

referred to was the nuclear industry (see Tr. 12,367). Further, Ms. Williams relied on an office survey to determine industry practice (see Tr. 12,954).

In reference to the problem involved with cinched-up U-bolts, Ms. Williams stated that Cygna had been considering torque for some time, that they were trying to address all of Mr. Doyle's questions, and realized that the undertaking was far larger than could be answered in that time period . . . (Tr. 12,406/8-12).

On this subject, after lengthy research, Cygna's Dr. Bjorkman stated that further study was required (Tr. 13,002). (Id. at pages 30 and 31.)

- (d) Cygna Energy Services, when challenged on accepting this design concept (see CASE Exhibit 928, expanded and renumbered version of CASE Exhibit 891, bound in at Tr. 9825), spent several months in analysis by the finite element method. The results of their analysis showed that the stresses in the box frame (welds not analyzed) were, and this does not include internal pressure or moments of the pipe, at about 70 per cent of the material allowable which was assumed to be 3 Sm . . . (Id. at page 34.)
- (e) Of the 9 support calculations reviewed, the following is apparent: 6 of the 9 calculations, or 67%, were truncated and/or incorrectly done and one of the supports had to be reworked since a structural failure was apparent (see clip angle to hold U-bolt, CASE

Exhibit 928; see also Ms. Williams where she agrees that the clip angle fails, see Tr. 12,699-12,706). Finally all of the above points were established by Mr. Doyle, not Cygna. (Id. at page 36.)

- (f) It should be noted that the June 18, 1984 (item 46(a)) letter justifies a problem; it does not alter the fact that the problem was missed by the complex vendor review system. (Id. at page 39.)
- (g) Mr. Doyle had in this regard only one general statement on the notes in Volume 1 of the Phase 3 Report, and in this regard he addressed only Note 16 because the points would be similar for all of the excuses offered by the Applicants.

The box frame was analyzed by Cygna's Dr. Bjorkman for the May 1984 hearings, and he found the procedures which he used to be close to reality. For that matter, the fine tuning required pertained to minor points which may be noted in what Dr. Bjorkman said (Tr. 12882/5-8):

"So in this particular problem, I don't think the level of refinement is great. It's to incorporate additional loads in the problem, the right allowables, check welds, et cetera."

The highly sophisticated finite element procedure used by Dr. Bjorkman indicated overstress conditions (see Dr. Bjorkman at Tr. 12,710-12,712). The Applicants have decided to discard the more accurate finite approach in favor of hand calculations with overlapping

assumptions. Having chosen this process, Applicants proceed to manipulate the numbers to show a favorable answer. One of the manipulations used by Applicants in calculation SI-1-325-002-S32R (see especially pages 1 and 2) is to average on a straight line assumption which is inaccurate in Applicants' favor. Having assumed an incorrect average temperature for the box frame, Applicants assume (again incorrectly) that the average at that point is constant around a square so that the average temperature at the corners of the square frame are the same as the average at a point on the tube opposite the contact point with the pipe.

By their gyrations, Applicants reduced the loads found by finite methods to 1/2 of their values and thereby manage to make the support appear to be what might be termed "somewhat acceptable". But looking at equation 11, page 8, the stress level is about .9; therefore, any increase would fail the pipe. At this point, Mr. Doyle did not become involved with the erroneous use of the equation shown on pages 5 and 6, because the principal error involves the average temperature manipulations, shown above, which cannot be manipulated on a computer. (Id. at pages 52 and 53.)

12. The NRC Staff has failed in its assigned mission to insure the health and safety of the public (Id., at page 77, item 12; pages 5 through 7, 14 through 19). For example:

- (a) To start with, the Nuclear Regulatory Commission (NRC) investigation of the original allegations was remiss in its objectivity, to say the least (see also discussion in CASE's 8/22/83 Proposed Findings of Fact and Conclusions of Law (Walsh/Doyle Allegations), pages XXVII - 35 through -39). (Id. at page 5.)
- (b) The Staff . . . arrived at two general conclusions: (Id. at pages 5 and 6):
- (1) All of the allegations were without merit with the exception of a part of one allegation as related to bending of Richmond insert bolts (A-307 threaded rod); and
 - (2) The Applicants were aware of any point of an allegation which they could not talk away before Mark Walsh of Jack Doyle outlined the problem (stability, for example).
- (c) Another area of proof that the initial allegations contained in CASE Exhibit 669 (Deposition/Testimony of CASE Witness Jack Doyle, admitted into evidence at Tr. 3630) were accurate, involves the repair to supports to bring them into compliance with the fundamentals of engineering and therefore the laws and the codes. (Id. at pages 15 and 16.)
- (d) Of the original supports contained in Jack Doyle's August 1982 allegations, eighteen have been revised

(and more than likely many more have also). This represents 31% of the sample. One could add the two supports at CASE Exhibit 669B, items 2D and 2E, CT-1-137-701-S22R and CT-1-137-702-S22R, which were changed shortly before the hearings and were therefore never an issue. (Id. at page 18.)

(e) Mr. Doyle states that he believes that this original segment of the allegations standing alone . . . is sufficient to prove two points: (Id. at page 19.)

(1) The Applicants at best have suffered a massive breakdown in their QA/QC program, if such a program ever existed for the engineering discipline;

(2) The NRC Staff has failed in their mission to protect the health and safety of the public and has in effect become dependent on the Applicants to justify the Staff's position as the industry regulator.

13. The QA/QC program at Comanche Peak has not only failed, it is non-existent (Id. at page 77, item 13; entire affidavit, especially pages 3, 8 through 10, 21, 23, 36 through 48, 49, 52, 54, 57, 74, 78 and 79). For example:

(a) As relates to the instability problem, Applicants stated that they had been aware of this since March 1981 . . . they offer three memos as proof of this fact . . . (Id. at page 8).

The third memo, dated 4/2/82 (Attachment A-3 to Finneran Affidavit) was an answer to the previous request for information, and was authored by Ron Wisniewski (ITT Grinnell home office) to Gus Abele. This document not only does not concur with the conclusions of Gus Abele but suggests the problem be discussed with Mr. Ed Eramian. Mr. Doyle states that this document was, as far as he is aware, the last discussion on the subject of instability at Comanche Peak until he revived the problem in about March of 1982. (Id. at page 9.)

It is now understood by CASE and Mr. Doyle that additional follow-up information requested by CASE does not exist (Id. at pages 9 and 10).

- (b) Among the basic problems which eluded Cygna, one of the more critical problems involves the use of incorrect formulas for analysis. The fact that supports may later be correctly analyzed and fall within design limits is of no value as an argument for tolerating such incompetence, since the fact that it occurred and passed through as many as 10 checks (the original check plus 9 levels for vendor certification) proves that incompetence was rampant. As a result of this observation, no engineered element of Comanche Peak can be considered safe until each element is rechecked by

truly independent assessors. (Id. at page 21; see also pages 78 and 79.)

- (c) . . . of 9 vendor certified equations which Mr. Doyle reviewed, 6 were incorrectly done and one item completely failed. (Id. at page 23.)
- (d) The following one example (of many detailed in Mr. Doyle's Affidavit) will point out the real depth of failure as relates to the Applicants' 9-level final vendor certification program . . . from Volume 3 of the Phase 3 Cygna Report (Id., at pages 36 and 45; see also pages 36 through 48):

PS-086, Item 3, page 1 of 9, and
PS-086, Item 11, page 5 of 9:

Item 3: "The load used in the calculation was 20194 lbs. The load reported in the analysis AB-1-02, Rev. 1 was 20305 lbs., a difference of 111 lbs. This difference is negligible because the support allows a 10% deviation in loads. See Observation PI-00-06."

In reference to the final vendor certification review, see Tr. 7153, where Applicants' witness Mr. Vega states that Step 7 of the iteration compares loads and modifies them if required.

- (e) Mr. Doyle states that for the nine supports he reviewed for Phase 1 of the Cygna Report, which were all vendor certified, one had a fatal structural failure and required modifications, three were analyzed by procedures which are not

applicable to the structures in question and one other contained incomplete analysis; the final support contained a deceptive equation to avoid the provisions of the code. In other words, 2/3 of this sample were not in accordance with 10 CFR Part 50, Appendix B, Criterion III requirements . . .

(Id. at page 49).

- (f) Of the 89 supports reviewed . . . a total of 30 have been rebuilt to prevent their collapse, and this represents 34 per cent of the sample -- obviously a fatal level of failure and a threat to the public health and safety. (Id. at page 52.)
- (g) In short, Applicants' QA/QC program for engineering at Comanche Peak not only has suffered, but currently is suffering, from a complete collapse, thus allowing for fundamental engineering errors to be incorporated into Comanche Peak on such a massive scale that the health and safety of the public are at risk. (Id. at page 3.)
- (h) Applicants and their agents, when confronted with a critique of the construction resulting from designs by somewhat knowledgeable engineers, rather than offering the documentation which led to the construction, persist in coming up with all types of methodologies to justify a fait accompli.

What is occurring at Comanche Peak undoubtedly will have an adverse impact on the health and safety of the public. (Id. at page 54.)

- (i) . . . at Comanche Peak accuracy is an unknown quantity that is replaced by the simpler unwritten Comanche Peak code: "Defend the bottom line utilizing the doctrine of plausible deniability." (Id. at page 57.)
- (j) In Volume 1 of the Phase 3 Cygna Report (Section 1, page 4) under PI-00-06, the observation is noted that in numerous instances (18 supports) for the main steam inside containment, the support loads used in design did not match the values obtained by examining the computer output. In one case (Support No. MS-1-004-005-C72K), the snubber is overloaded by using the method of analysis historically used by Gibbs & Hill. (Id. at page 74.)
- (k) Mr. Doyle made two statements on this point. First, the gravity of the erroneous use of loads is not reflected in the pipe support review, and second, this is not in keeping with the intent of the final vendor certification program as stated by Applicants' Witness Vega at Tr. 7153 where he states that step 7 of the iteration compares loads and modifies them if required. (Id. at page 74.)

(1) In all, at least four supports are known to have required rework and one required reanalysis after the final design review for vendor certification was completed. This is in addition to the 31 which were redesigned as a result of the original Walsh/Doyle allegations. Mr. Doyle noted that this does not include the U-bolts which were replaced during the reanalysis for U-bolts used as one-way supports but acting as two-way constraints. (Id. at page 74.)

14. Evasion of the truth by Applicants and their agents and the NRC Staff has been rampant in the hearings before the Atomic Safety and Licensing Board (Id., at page 77, item 14; pages 1 through 3, 8 through 10, 14, 15, 18 through 25, 54 through 74.) For example:

(a) . . . it appears that during the May 1983 hearings, the testimony of the NRC Staff was either blind or somewhat less than candid. As an afterthought, the Applicants, by their silence in the matter outlined below, must also be suspect. (Id. at page 14.)

Mr. Walsh asked Dr. Chen whether there might be three or four unstable supports which were adjacent to each other (Tr. 6722-6727). After some discussion, Dr. Chen stated "I believe I saw one piping run where the supports had about three intervening supports" and that was the closest he found them (Tr. 6727-6728). Dr. Chen elaborated on

this and stated that the piping was not in the same direction in both locations, and therefore the instability would not have been additive (Tr. 6728). (Id. at page 14.)

However, the fact is that the main steam lines have five unstable supports in a row, and in fact, the sixth support is unstable since it is double-pin-ended (clamp and strut) but all of the other supports cannot assist in giving the strut on the sixth support stability. But neglecting the sixth support, there are still five unstable supports in a row at the critical main steam isolation valve and pressure relief valves. (Id. at pages 14 and 15.)

- (b) Applicants keep on insisting that there were less than two dozen unstable supports (and they are still reluctant to admit that there are any unstable supports) . . . Applicants' position falls apart since, with only the supports that Mr. Doyle has seen and not including Unit 2, Mr. Doyle listed 11 from his deposition, 20 from the Cygna Report minus 2 duplicates for the main steam, plus 1 from the Phase 1 Cygna Report (CASE Exhibit 928, formerly Exhibit 891, bound in following Tr. 9825) -- all of which equals an absolute minimum of 30

supports known to have been repaired to correct stability problems. (Id. at page 15.)

For example: At items 52 and 49 (of CASE Exhibit 848, admitted at Tr. 8352, stipulations between CASE and NRC Staff), it was basically stipulated that Applicants did not recognize the problem or attempt to deal with it prior to Mr. Doyle's bringing it up, and that they had no mechanism in place to keep the problem from recurring again and again. (Id. at pages 17 and 18; see also pages 8 through 10, and 15.)

- (c) Beyond this, it is apparent that the Applicants have reversed the role of engineering from that of justifying structures to be used in construction to justifying structures which have been designed by somewhat knowledgeable engineers. The NRC Staff has been only too eager to concur in the acceptance of this unique but dangerous deviation from standard engineering fundamentals and sequence. (Id. at pages 19 and 20.)
- (d) Cygna Energy Services' Ms. Williams attempted to justify the engineering judgement used to assume that there is no significant effect due to neglecting the restraint of rotation by referring to the fact that the "pipe stresses go down" and one must balance the two (Tr. 12774).

But Ms. Williams is misleading the Board, since the stress levels in the pipe and the loads on the struts (or stresses) are not equatable but actually are totally independent. For example, if a procedure were used that overloaded building columns but reduced the loading on beams and girders, the building could still collapse due to that overload. So the balancing of loading consideration is without merit. (Id. at page 25.)

(e) A factor not generally considered in these hearings is the intent of the law as relates to engineering for these facilities. By devisive tactics, Applicants would have the Board believe that accuracy is without privilege as long as some Mickey Mouse manipulation of numbers would untimately indicate that a structure would not fall on the floor the first day of operation. Beyond this, Applicants' philosophy is that if the first calculations prove fatal, it is acceptable to try new assumptions and machinations until, by whatever Machiavelian postulates are successful, the problem goes away. (Id. at pages 54 and 55.)

15. The review of three systems at Comanche Peak (residual heat removal, main steam, and component cooling), all of which were final vendor certified, resulted in a calculation error rate of $6 + 18 + 46$ divided by $9 + 66 + 22 =$ 72 per cent.

(An error in this case could be one error or a multiplicity of errors, because only the support was counted as an error regardless of the number of errors.) (Id., at pages 77 and 78, item 15.)

In a cursory review of the component cooling system (see Volumes 2 and 3 of the Phase 3 Cygna Report, PS-001 to PS-066), Mr. Doyle states that he found that 70 per cent of the calculations contained gross engineering errors. (Id. at page 73.)

16. The U-bolt cross-bar/clamp analogy used at Comanche Peak is not standard industry practice. (Id., at page 78, item 16; pages 7, 10, 31, 59, and 60.) For example:

(a) . . . by Applicants' own testimony, all unstable supports which utilized a U-bolt in lieu of clamp were to be cinched up to prevent clamp rotation . . . (Id. at page 7).

(b) The use of U-bolts in this manner is a unique design feature, and is not in compliance with 10 CFR 50.34 (a)(8). In many cases, as may be noted in MSS SP-58 and SP-69 (to which Applicants are committed; Id. at pages 10 through 12), the procedures used at Comanche Peak are not an industry practice. (Id. at page 7.)

(c) . . . both Ms. Williams and Dr. Bjorkman (of Cygna) admitted that they had never seen the cinched-up U-bolt or box frame concept at other nuclear plants

(see Ms. Williams at Tr. 13,027, and Dr. Bjorkman at Tr. 13,028). (Id. at page 31.)

- (d) In relation to the use of U-bolts (much less cinched-up U-bolts), and still on the subject of instability, the Applicants' procedures are in violation of standard industry practice for a garbage processing plant, much less for a nuclear plant, and therefore are in violation of 10 CFR Part 50, Appendix A, Criterion 1 as regards the adequacy section for nonconformance with standard practice. (Id. at page 10.)
- (e) But one thing is certain -- the stress levels in the U-bolt and run pipe are far higher than originally believed by Applicants, who (along with the NRC Staff) assumed that the additional loads due to cinching and thermal constraint were negligible (see Applicants' Dr. Chang, Applicants' Exhibit 142F, page 5, Question and Answer No. 15, where he states that the temperature of the pipe and the U-bolt are the same). (Id. at page 59.)
- (f) . . . the Applicants and the NRC Staff argued vociferously and adamantly that neither cinching of U-bolts nor thermal constraint had any significant effect on the U-bolt or the pipe.

However, as the Cygna finite element program pointed out, the stresses exceeded 3 times the

allowable. Beyond this, the deceptive mathematical manipulations by Applicants still resulted in stresses which were more than merely significant.

(Id. at page 60.)

17. Practices followed by engineering at Comanche Peak are in non-compliance with the law. (Id., at page 78, item 17; pages 13, 17, 19, 24, 25, 35, 36, and 56.) For example:

(a) Comanche Peak practices evade the provisions of 10 CFR 50.34(a), which states that the minimum information to be included in the Applicants' Preliminary Safety Analysis Report (PSAR) was to have included:

"(2) A summary description and discussion of the facility, with special attention to design and operating characteristics, unusual or novel design features, and principal safety considerations." (Emphases added.)

"(8) An identification of those structures, systems, or components . . . which require research and development to confirm the adequacy of their design; and identification and description of the research and development program which will be conducted to resolve any safety questions associated with such structures, systems or components; and a schedule of the research and development program showing that such safety questions will be resolved at or before the latest date stated in the application for completion of construction of the facility." (Emphases added.)

"(9) The technical qualifications of the applicant to engage in the proposed activities in accordance with the regulations in this chapter." (Emphasis added.) (Id. at page 13.)

(b) The Applicants and SIT argue that the problems are the result of "somewhat knowledgeable" engineers, but this would be a violation of the skill provision of 10 CFR Part 50, Appendix B, Criterion II. (Id. at page 17.)

(c) Beyond this, the NRC Staff and the Applicants were well aware of the lack of skill of the Comanche Peak staff when in 1981 they had to commence a redesign of massive proportions, particularly at elevations 790 and 810, because the supports as designed would not fit in the areas assigned (see NRC Staff Witness Taylor at Tr. 6666). (Id. at page 17.)

Further, the somewhat knowledgeable problem was no secret; everyone knows about it (see: for the NRC Staff: Taylor at Tr. 6403-6405 and 6665; Tapia at Tr. 6669; and for the Applicants: Finneran at Tr. 4955-4965; Reedy at Tr. 7164; and Vega at Tr. 7166). (Id. at page 17.)

(d) The . . . caviat "not vendor certified" cannot stand the test of logic, since using the caviat is itself an admission of non-compliance with 10 CFR Part 50, Appendix B, Criterion VII, as relates to the provision for adequacy of the document prior to release for use. And one must keep in mind that these supports were fabricated, erected, inspected, turned over to the utility, and many were in place long before hydro testing. (Id. at page 19.)

(e) The fact is that regardless of whether or not the support or procedure will ultimately prove acceptable, the installation and acceptance of indeterminate structures in nuclear power plants is a crime under the law. (Id. at page 56.)

- (f) This fact is reflected in the federal laws as codified in the Code of Federal Regulations. See, for example, 10 CFR Part 50, Appendix B, Criterion III . . . In addition to the law, certain codes and standards to which Applicants are committed are required by law; see 29 CFR 1910, the William Steiger Action 1970; see also 10 CFR Part 50, Appendix A, Criterion 1 . . . Among the codes which are applicable to Comanche Peak is ANSI N45.2.11, Applicants' Exhibit 148 . . . (Id. at page 56.)
- (g) Either of the two supports (snubbers or struts), when input as a moment restraining system, will experience substantially higher loads than are evident when the node point is input into the pipe stress model as a single unit acting along the centerline of pipe with the total load later divided equally to the two supports. This is a recognized problem in industries associated with piping systems; see for example, ANSI B31.1, paragraph 121.3.1 (a) and (b). (Id. at page 24.)
- (h) Since the configuration of the supports is such that a de facto moment restraint exists, the manufacturer is required by the ASME code to ensure the integrity of the support. (See ASME Section III, NA-3340.) (Id. at page 25.)
- (i) . . . Cygna's Dr. Bjorkman admitted that engineering judgement to dismiss calculations for box frames was inadequate (see Tr. 12,666 through 12,669). Beyond

this, Dr. Bjorkman stated that this problem should be looked at by the Applicants, including adding in the effects of pressure and pipe bending (see Tr. 12,669).

Cygna's Ms. Williams confirmed that Applicants never looked into this stress problem (see Tr. 12,666), nor were the effects of such problem added to the normal calculated loads for this support (see Tr. 12,666).

This problem indicates a non-conformance with 10 CFR Part 50, Appendix A, Criterion 1, particularly as relates to the generally accepted code section. Additionally, the procedure is not in compliance with 10 CFR 50.34 (a)(8) relative to unique designs. Also, the support fails to consider the industry practice as outlined in MSS SP-69 at 12.2 (depending on thermal expansion is not a positive means of engagement). (Id. at pages 35 and 36.)

18. The preceding analysis of the Cygna review proves beyond doubt that there are major problems involving calculational errors, including the fact that no less than four supports required modification due to errors in the final vendor certified calculation . . . identified by either Cygna or (in the event Cygna missed it) by CASE. Had CASE had access to all of the calculations for Phase 2 of the Cygna Report, it is more than likely that CASE's witnesses would have found more errors and possibly more support failures, as was the case when they reviewed the nine supports from Phase 1. (Id. at page 78; pages 22 through

37.) For example:

- (a) Item 1 (pages 22 and 23 of Doyle Affidavit) shows that of 9 vendor certified equations which CASE Witness Jack Doyle reviewed, 6 were incorrectly done and one item completely failed. (Id. at page 23.)
- (b) In reference to Item 4 (pages 29-33 of Doyle Affidavit), several points were made by Mr. Doyle. Cygna Energy Services, which was responsible for the review of systems at Comanche Peak, either deceived the Board or totally lacked knowledge of several important factors relative to pertinent code sections which, while not adhered to at Comanche Peak, are required for even the most insignificant facility. See Tr. 12,369, where Ms. Williams states that they never considered MSS SI-69, and Tr. 12,371-12,372, where Ms. Williams states that she does not know about the MSS organization. (Id. at page 30.)
- (c) For support No. SI-1-325-002-S32R (CASE Exhibit 928), the clip angle (item 15) which was installed to assure stability, fails. While Cygna failed to mention this initially, when compelled to supply an answer, they finally stated that they were aware of this problem. (Id. at page 23.)