UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

CASE'S ANSWER TO APPLICANTS' STATEMENT OF MATERIAL FACTS AS TO WHICH THERE IS NO GENUINE ISSUE REGARDING CONSIDERATION OF LOCAL DISPLACEMENTS AND STRESSES

in the form of

AFFIDAVIT OF CASE WITNESS JACK DOYLE

I. Zero Clearance Box Frames

1. Applicants state:

"In the absence of quantitative code guidance, Applicants employed a conservative methodology for selecting allowables for assessing the localized pipe stresses. These allowables are approximately 60% of the allowables which normally would be applied, i.e., three times Sm. (Finneran Affidavit at 4.)"

I disagree with Applicants' statements.

The Applicants have defended the box frame concept for supporting pipes since the time of my deposition in August 1982 /1/, at which time I pointed out two problems with this concept:

/1/ See CASE Exhibits 669 and 669A, Deposition/Testimony of Jack Doyle, and CASE Exhibit 669B, Attachment to Deposition/Testimony of Jack Doyle.

(1) It restrained thermal growth of the pipe; and

(2) It represented an unstable structure. During the September 1982 hearings, with the aid of models I demonstrated the instability factor. Beyond this, by the use of simplifying equations, I showed that the forces exerted on the box frame were on the order of 28,000 lbs. or 14 tons.

The Applicants and their agents, and in fact, the NRC Staff, have steadfastly stated that this configuration presented no problems. They are not quite sure why this is so, but we must commend them on their persistence if not their technical competence. I state this because each time they offer an absolute proof showing the ability of the system to withstand the forces exerted by the pipe, they either get shot down or blow off their own foot. But rather than backing off, they merely come forward with yet another absolute proof.

A few examples of this proof-of-the-month effort are as follows:

(1) There is no thermal problem because the frame does not actually have a zero inch gap /2/. The NRC Special Inspection Team (SIT) was quite proud that the Applicants had informed them of this avenue of escape. Beyond this, Applicants had physically measured a number of box beams and announced that they had found that gaps in fact had existed. However, CASE pointed out that this condition ensured instability.

/2/ See NRC Staff Special Inspection Team (SIT) Report, at page 34.

(2) Applicants' agent, Cygna Energy Services, proceeded to prove that there was no problem with these box frames by utilizing the most sophisticated method of analysis (finite element); however, their efforts only proved that there were serious problems with this clamping system /3/. Beyond this, although Cygna was less than satified with some of the results of finite element analyses that they had accomplished, they conceded that the excessive forces indicated by the modelling for box beams in this finite model were likely to be more accurate than some of the others /4/.

However, undaunted by these failures, Applicants have now unveiled their latest final absolute proof. But hold your plaudits, for what we have here is yet another example of the deceit and/or stupidity of those "somewhat knowledgeable" engineers for which Applicants have achieved legendary status in their own time.

For this final absolute beyond-the-shadow-of-a-doubt proof, Applicants offer Attachments A, B, C, and D to their Motion for Summary Disposition, which are so flawed as to be rendered useless. For example:

Referring to Attachment A:

(1) At page 1 of calculation SI-1-325-002-S32R, Applicants state: "If air film insulation effect is considered, actual tube temperature will be much higher. Thus, this approach is very conservative."

/3/ See Tr. 12,710-12,712, 12,724-12,725.

/4/ See Tr. 13,086.

I would have thought that even Applicants' somewhat knowledgeable engineers would not attempt to reverse the laws of thermal transport, for the fact is if the air film is considered, the box beam temperatures would be much lower, not much higher as stated by Applicants. The pipe wall temperature at the interface between the outer wall of the pipe and the surface of the air film would be higher, but not the tube interface, since there is an additional layer (air film) between the pipe and the box frame.

(2) The above point is relatively minor when compared to the fatal error which appears on page 2 at (2) of the calculation.

While it is a fact that due to contact between the pipe and the box beam thermal transfer will occur, it is not true that the full length of the tubes making up the box beam will experience the same temperature gradients as was calculated for the tube width resulting from line contact. Any temperature from Applicants' procedure would exist only at a point directly opposite the line of contact.

(3) Because of the temperature gradient between the inner and outer surface of the box frame, the box frame will not expand 0.01359 inches as assumed by Applicants but will in fact expand in an indeterminate manner to a far less degree. Additionally, as a result of the differential expansion of

the two surfaces of the tubes making up the box beam, there will be new internal thermal stresses generated which were not considered by Applicants.

(4) The fact is that the thermal gradient is not linear as indicated by Applicants. See CASE Exhibit 669B, Attachment to Deposition/Testimony of Jack Doyle, graphs generated through tests by ITT Grinnell, items 13E through 13J. This would result in actual box frame stresses that are somewhat higher than assumed by Applicants' considering direct bending only as a result of thermal constraint.

(5) Another point associated with Applicants' attempt to supplant logic wih che appearance of logic may also be found on page 2 (2). Young's Modulus is stated to be: 6.387 times 10 to the -6, whereas the AISC states at 6-11 that Young's Modulus is approximately (6.1 + .0019 times the temperature) times 10 to the -6, or 6.486 times 10 to the -6, and this would be the value used in the analysis of a warehouse, not the lesser value used by the Applicants.

Collectively, these deviations from engineering fundamentals listed above become frightening when one finds that the wide band of reliability which existed prior to the inclusion of thermal expansion effects has been dangerously erroded. For example, Applicants at page 8 of 11 indicate that the stress levels for equation 11 are: 39169 divided by 44000 = about 90%. However, the reality is that when

properly analyzed, the pipe fails to meet the codes.

When considering this single problem, one must be aware that there are other contributors to this problem which have not been addressed. For example, the mass of supports supported by the pipe, the stiffness effects, etc., all could result in higher mechanical loads, and are being independently addressed elsewhere.

This manicuring of standard procedures will always occur when somewhat knowledgeable engineers are allowed to justify multiple problems on a point-by-point basis with each justification being offered independent of all other concurrent problems. If the principle of uncoupling of problems were acceptable procedure, it would have been accepted years ago as a means of reducing the cost of all types of construction.

I have come to the conclusion, after almost two years of shooting at moving targets thrown up by the Applicants, their agents, and in fact the NRC Staff, that the American system of jurisprudence is not the proper forum for determining the reliability of nuclear power plants. Should the Board accept the procedures utilized by Applicants to justify construction which was initiated by somewhat knowledgeable engineers based on their judgement in lieu of technical expertise, then the Board must be prepared for the consequences. Acceptance of these concepts offered by the Applicants will establish precedent legalizing the approach of constructing facilities without attention to fundamentals and codes and then at a later time justifying this fait accompli. And this will apply on a national basis, not strictly to Comanche Peak.

I didn't waste my time dissecting all of the material accompaying Applicants' Motion for Summary Disposition on this subject, since I believe that the points made on Attachment A are sufficient to show the methodology that Applicants have used throughout these hearings. Beyond this, it is appalling that for almost two years it has been Mark Walsh and I that have rooted out the fallacies of Applicants' offerings, while the NRC Staff not only have failed to perform their mission to protect the public health and safety, but have in fact been joint participants in these devious games played by Applicants.

2. Applicants state:

"There are 51 zero clearance box frame supports at Comanche Peak. (Finneran Affidavit at 4.)"

See answer 1 preceding.

3. Applicants state:

"Only one zero clearance box frame is located on a piping run with a maximum water cemperature greater than 200 degrees F. This is support SI-325-002-S32R. The maximum temperature of the pipe in this case is 350 degrees F. (Finneran Affidavit at 4.)"

See answer 1 preceding.

4. Applicants state:

"Even when including the local stress induced in the frame from the thermal expansion of the pipe with other loads, all stresses in the frame on support SI-325-002-S32R are less than Code allowables. The

loads and stresses in this support would be greater than those encountered in the other supports of this type because of the higher temperature of this pipe and the fact that the pipe is stainless steel (resulting in greater pipe expansion), and the greater thickness of the pipe (affording less flexibility and, thus, imparting greater loads). (Finneran Affidavit at 4-5.)"

See answer 1 preceding.

5. Applicants state:

"All stresses in the pipe are also less than the conservative allowables Applicants employ for assessing localized pipe stresses. (Finneran Affidavit at 5.)"

See answer 1 preceding.

6. Applicants state:

"Cygna also peformed an analysis (finite element) of the frame on this support. Their analysis demonstrated that the stresses in both the pipe and the box frame remained well below allowables even when both thermal and mechanical loads were combined. (Finneran Affidavit at 5-6.)"

See answer 1. preceding.

7. Applicants state:

"Applicants conservatively calculated the loads between the frame and the pipe for the support cited by CASE in its Proposed Findings (page IV-17) on this topic. That analysis demonstrates that the resulting force between the pipe and the frame will be 454 lbs. CASE had estimated, using a very simplified calculational technique (CASE Proposed Findings at IV-17), that the laod created between the pipe and the box frame was 27,280 lbs. (Finneran Affidavit at 6.)"

See answer 1. preceding.

II. Anchors

8. Applicants state:

"Applicants performed a conservative analysis of the anchor supports referenced in Section 14 of CASE Exhibit 669B for which CASE claimed the radial thermal expansion of the pipe should have been calculated. Inclusion of the thermal expansion effects of the pipe with other loads in the assessment of the anchors led to no overstressed conditions. (Finneran Affidavit at 8.)"

See answer 1 preceding.

9. Applicants state:

"Cygna analyzed a similar support for these same effects in their response to Doyle Question 15 (see Testimony of Nancy H. Williams, Board April 1984 Ex. 1 at 33.) These results demonstrate that all stresses in the frame and baseplate were far below the allowables used by Cygna. (Finneran Affidavit at 7-8.)"

See answer 1 preceding.

III. Tube Steel Walls

10. Applicants state:

"Applicants' practice regarding the assessment of local stresses in tube steel walls is for each support design organization to assess the effects on a case-by-case basis, when deemed appropriate by the engineer. The NRC Staff reviewed Applicants' practices in this regard and had no concern regarding the adequacy of Applicants' approach. The Staff reviewed a random sample of 100 vendor certified supports selected by the Staff and found Applicants had considered these local effects. (Finneran Affidavit at 9.)"

See answer 1 preceding.

11. Applicants state:

"CASE performed no calculations to substantiate its assertions on this issue. Rather, CASE premises its position on certain factors it believed indicated that analyses should be performed. First, CASE incorrectly implies that the minimum width ratio of tube steel to tube steel connections that Applicants used (until September of 1982) was 0.8. Next, with respect to CASE's assessment of the local stresses in the support referenced in its Proposed Findings, CASE claims that the tube to tube ratio was less than .4. The connection ratio is actually .5625. Finally, the actual stress for this connection is 2261 psi, or 57% of the applicable allowable. Thus, contrary to CASE's assertion the design of this connection is clearly adequate. (Finneran Affidavit at 10-11.)"

See answer 1 preceding.

12. Applicants state:

"Applicants selected several worst case supports from CASE Exhibit 669B with tube steel connection ratios less than 1.0., and included three additional supports claimed by CASE to have been inadequately designed with respect to local effects of welded attachments to tube steel, for detailed local failure analysis. In all cases the local stresses were less than allowables. (Finneran Affidavit at 11-12.)"

See answer 1 preceding.

IV. Local Deflections and Deformations

13. Applicants state:

"Applicants' practice regarding consideration of local deflections and deformations is standard industry practice which is premised on sound engineering principles that result in adequate support designs. Applicants' practice is to consider the deflections of the structural portions of each support in calculating deflections for comparison to the 1/16" deflection guideline. (Finneran Affidavit at 13.)"

See answer 1 preceding.

14. Applicants state:

"To assess these effects, Applicants selected the 15 supports from CASE Exhibit 669B which present worst case conditions, and a support used by CASE in the cross-examination of the Staff on this subject. Applicants' analyses demonstrate that even when local and component effects are accounted for in deflection calculations, their deflection criterion is still satisfied in the vast majority of cases. In those cases where the deflection does exceed 1/16" (and none greatly exceeded the criterion), the support stiffnesses remained in the acceptable range. Thus, although these local effects may result in potential deflections slightly greater than 1/16" there is no safety significance to this fact. (Finneran Affidavit at 13-16)."

See answer 1 preceding.

15. Applicants state:

"CASE incorrectly alleges that Applicants' support designs will have 'large deformations' and, thus, Applicants have not satisfied the guidance contained in the Regulatory Guide 1.124. However, Applicants' practice regarding Class 1 supports (to which the Regulatory Guide applies) is to perform complete stiffness calculations, including consideration of local effects. (Finneran Affidavit at 16.)"

See answer 1 preceding.

16. Applicants state:

"Irrespective of the support classification, the discussion in Regulatory Guide 1.124 regarding large deformations is related to the use of plastic analysis methods. With respect to support design using elastic analysis, as Applicants use, Regulatory Guide 1.124 recognizes that deformations will, in fact, be small. (Finneran Affidavit at 17.)"

See answer 1 preceding.

I have read the foregoing affidavit, which was prepared under my personal direction, and it is true and correct to the best of my knowledge and belief.

(Signed) Jack Doyle

Date: Aug 24 1984

STATE OF Massachusetts

COUNTY OF Hampden

On this, the 25th day of August, 1984, personally appeared JACK 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 25th day of August, 1984.

Notary Public in and for the
State of Massachusetts

My Commission Expires: MY COMMISSION EXPIRES JANUARY 9, 1987