UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	Docket Nos. 50-445 and 50-446
TEXAS UTILITIES ELECTRIC COMPANY, ET AL.	)	
	)	(Application for Operating Licenses)
(Comanche Peak Steam Electric Station, Units 1 and 2)	)	

AFFIDAVIT OF JOHN C. FINNERAN, JR. REGARDING A500 TUBE STEEL

I, John C. Finneran, Jr., being first duly sworn, do depose and state as follows: I have previously testified in this proceeding as Pipe Support Engineer for Comanche Peak. As such, I am familiar with Applicants' pipe support design program and the use of A500 tubular steel in the design of linear pipe supports at Comanche Peak. A statement of my educational and professional qualifications was admitted into evidence in this proceeding as Applicants' Exhibit 142B. This affidavit presents information addressing questions raised by the Licensing Board in its Partial Initial Decision regarding material properties for A500 tube steel. I specifically address the Board's interpretation of testimony in this proceeding regarding Applicants' consideration of cyclic loads in pipe support designs and the significance of revised yield values for A500 steel on those designs.

Consideration of Cyclic Stresses

As the Board recognizes in its Decision, Applicants have presented testimony in this proceeding regarding consideration under the ASME Code of cyclic stresses in the design of pipe supports (Decision at 6-7). That testimony was presented in the context of interpreting a specific portion of the ASME Code and does not address the issue the Board raises in its Decision. That testimony simply noted that the ASME Code had stress limits for cyclic stresses which are premised on a twice yield limit to assure that "shakedown" to elastic action will occur under cyclic loadings (Tr. 5893-94). No testimony was given regarding Applicants' method of considering cyclic stresses in pipe supports at Comanche Peak. In this regard, the Board should note that Applicants' pipe support design guidelines have not taken advantage of the Code provision which permits allowable stresses for cyclic loads to be set at approximately twice yield (ASME Code Section 3231.1(a)). Instead, those guidelines establish allowable stresses for these loading combinations at values less than yield. Thus, the small revision to the yield values for A500 tube steel do not give rise to a concern with respect to the consideration of cyclic loads.

Consideration of Revised
Yield Values at Comanche Peak

Even prior to NRC approval of Code Case N-71-10, Applicants recognized that the yield strengths of A500 tubular steel had been slightly decreased by that Code Case from the previously

published values. Applicants also recognized, however, that several factors in their pipe support designs assured that no adverse safety impact would result from their use of the original yield strengths for A500 tube steel. Accordingly, Applicants concluded that it was unnecessary to revise the pipe support designs at Comanche Peak to account for the revised A500 yield values.

In the first instance, at the time Code Case N-71-10 was issued, Applicants recognized that the ASME reviews all Code Cases before issuance to assure that no potential safety concerns are raised by prior practices which may be altered by the new Code Cases. In situations where such concerns may exist, the ASME will either make the Code Case mandatory or notify all parties who may be affected of the potential safety concern. In this instance, the ASME did not make the subject Code Case mandatory and did not issue a notice of a potential safety concern. This assessment was recently confirmed by the ASME in the attached interpretive letter.

In view of this, Applicants were confident that the use of the original yield values for A500 tubular shaped steel presented no safety concern. Applicants did not, however, base this conclusion solely on the ASME review process and determination inherent in the unconditional release of the Code Case. Applicants also recognized that several conservatisms which are not otherwise considered in the design process provide additional margins of safety that more than offset the small reduction in

A500 tube steel yield values occasioned by Code Case N-71-10. First, Applicants knew that design criteria other than the tube steel allowable stress values are the limiting design considerations for pipe supports at Comanche Peak. Thus, by assuring that those criteria are met in the first instance, Applicants were assured that the stresses in the tube steel would be limited to levels well below the allowable stresses. For example, adherence to the 1/16" deflection criteria alone will in most instances limit the stresses imposed on the tube steel to levels well below the allowable stress values. In addition, the stress limits on Hilti (and other anchor) bolts also serve as controlling design considerations, satisfaction of which provides added assurance that stresses in tube steel members are well below allowable stress levels for those members. Given such conservatisms in their design process, Applicants were satisfied at the time the A500 tube steel yield strengths were revised that there is a high level of assurance that stress levels in tube steel members would not exceed even the revised A500 tube steel allowables. Upon receiving the Board's Decision, Applicants undertook an evaluation of a large number of supports which use A500 tube steel to demonstrate the accuracy of their initial judgment on this matter. As discussed below, that evaluation demonstrated that A500 tube steel members in Applicants' pipe supports are generally stressed only small fractions of the revised allowable stress limits.

In addition to the above, Applicants derived further assurance that stresses in tube steel members will not approach even the revised allowables for A500 tube steel from the fact that Applicants' pipe support design organizations use very conservative design philosophies. For example, Applicants support designers frequently apply more conservative allowable load levels than are required. In this regard, Applicants apply level B stress allowables in assessing the more severe level C loads. Further, each pipe support design organization, as a general practice, employs stronger tube steel sections than necessary in order to provide a contingency for possible changes in support loads and stresses as a result of support modifications or piping reanalysis. This fact is evidenced by Applicants' evaluation of tube steel stresses, as discussed in the sample below. Thus, the stresses imposed on the tube steel members in Applicants' pipe support designs are often <u>much</u> less than stress limits imposed by ASME criteria and NRC regulations.

Further, Applicants' experience with test data (which we receive with each shipment of steel) was that the actual yield strengths are generally substantially greater than the published values. This test data is provided to Applicants by fabricators of steel materials who perform material tests for various properties, including yield strengths, on each production run of material. Applicants were confident, therefore, that the reductions in A500 tube steel yield strengths presented no concern for the ultimate safety of pipe support designs at

Comanche Peak. To demonstrate for the Board the accuracy of our judgment on this matter, Applicants have examined the actual yield strengths for A500 tube steel in a sample of pipe supports and conservatively assessed the worst case supports. As discussed below, this evaluation clearly confirms that Applicants' original judgment on this matter was correct.

Evaluation of Impact of Revised A500 Tube Steel Yield Values

To assess the impact of the revised A500 tube steel yield values on actual pipe support designs at Comanche Peak, and to confirm Applicants' previous judgment that no safety concern exists with respect to those revised values, Applicants sampled a large number of supports for evaluation using the revised yield values. This analysis demonstrates that all stresses in tube steel support members remain below even the reduced allowable stresses and that, in fact, the stresses in the vast majority of supports remained significantly below those allowables.

To generate the sample of supports for this analysis, Applicants first developed alphabetical listings of all Unit 1 and common area ASME supports for each support design organization (NPSI, ITT-Grinnell and PSE). Applicants then selected every hundredth support (PSE selected every 90th) from the list. If the selected support did not utilize A500 tube steel, the next support on the list which did was chosen. The resulting selection of 182 supports contained an excellent mix of buildings, systems, classes and types of supports. Each selected

support was then reviewed to determine the effect of substituting the reduced allowable stresses for the A500 tube steel based on the yield strengths published in Code Case N-71-10. Applicants then tabulated the percentage of the revised allowable stress seen by the most stressed tube steel member of each support. The results of this tabulation are, as follows:

Number Supports	Percentage of Reduced Allowable Stress for Highest Stressed Tube Steel Member
82	0-10
52	10.01-20
22	20.01-30
9	30.01-40
8	40.01-50
3	50.01-60
4	60.01-70
1	70.01-80
0	80.01-90
1	91
182 (Total)	

Analysis of the above sample demonstrates that for over 95% of the sampled supports the tube steel members seeing the maximum stress is stressed <u>less than 50%</u> of the <u>reduced</u> A500 allowable. In fact, the average percentage of the allowable stress seen by all such members is 16.4%.

In addition to the above analysis, Applicants have evaluated the impact of using actual, rather than published, yield strengths in pipe support designs. As already mentioned, the actual strength of fabricated steel materials is generally much greater than the published material properties (<u>e.g.</u> yield strengths used for design calculations). To demonstrate the implications of this fact for the pipe support designs at

Comanche Peak which use A500 tube steel, Applicants selected the ten highest stressed support members from the sample of supports discussed above for further analyses. Applicants determined from the certified mill test reports for these support members that the minimum actual yield strength for the A500 tube steel material in these members was 56.3 ksi. To account for the 15% reduction in yield strength assumed by the ASME to result from welding, we reduced the lowest of these actual yield strengths by 15% to 47.8 ksi. This value is 33% above the 36 ksi yield strength tabulated by the ASME for A500 tube steel in Code Case N-71-10, and still greater than the 42 ksi yield strength value originally published. Thus, even the worst case comparison of actual v. published yield strengths for A500 tube steel used in supports at Comanche Peak demonstrates that there is a significant favorable margin between these values. This fact emphasizes the highly conservative nature of Applicants' support designs and confirms Applicants' initial judgment at the time the A500 tube steel yield values were reduced that consideration of actual material properties would more than offset the slight reduction of the yield values published by the ASME.

Finally, I note that the revised yield strengths for A500 tube steel are themselves conservative values selected by the ASME. The ASME recognized that the yield strength of A500 steel in the cold wrought condition may be slightly reduced in the heat

affected zone of weldments. Accordingly, although precise material data was not available, the ASME selected as conservative values for this criterion the yield strengths for A501 and A36 materials. See ASME interpretative letter, November 18, 1983, (Attachment).

John C. Finneran, Jr.
John C. Finneran, Jr.

County of Somervell)
State of Texas)

Subscribed and sworn to before me this 10th day of April, 1984

[signature]
Notary Public

This is a telecopy facsimile. The original will be sent under separate cover.

The American Society of Mechanical Engineers

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November 18, 1983

Texas Utilities Services Inc.
PO Box 1002
Glen Rose, TX 76043

Attn: M. R. McBay

Subject: Section III, Division 1
Code Case N-71-9 & N-71-10
ASTM A-500 Tubular Shapes

Reference: Your letter of October 25, 1983
ASME File # NI 83-101

Gentlemen:

Our understanding of the questions in your inquiry, and our replies are as follows:

Question 1: An Owner has contracted for construction of component supports under the provisions of Case N-71-9. Must component supports constructed from ASTM A-500 tubular shapes under the provisions of Case N-71-9 be redesigned or re-analyzed using the lower yield strength values published in a later revision of the Case (e.g., N-71-10) for the same material?

Reply 1: No, the provisions of later revisions to Code Cases are neither mandatory or retroactive.

Question 2: Why were the yield strength values for A-500 tubular shapes published in Case 1644-3 through N-71-9 reduced in N-71-10?

Reply 2: The Committee recognized that the yield strength of A-500 in the cold wrought condition may be slightly reduced in the heat affected zone of weldments. The revised values, given in N-71-10, for A-500 were those used for A-501 and A-36 material which were selected as conservative values for A-500 tubular shapes in the welded condition. The revised values may be changed at such time when material data for the welded condition, as required by the Code, is presented to the Committee for consideration. The higher

yield strength values published in N-71-9 are adequate because of the many safety factors and design constraints applied to the yield strength in the design of piping supports.

Question 3: If a component support is ordered under a Design Specification which required compliance with an Edition and Addenda of the Code which was issued prior to final approval of Case N-71-10, and the contract date for the support is after the date of Council approval of Case N-71-10, does the Code allow the construction of the support under the provisions of Case N-71-9?

Reply 3: Yes, in accordance with NA/NCA-1140.

* * * * * * *

We note that when, in the opinion of the Committee, a review of current Code provisions indicate a potential safety concern there are established means of notifying organizations and individuals who may be affected. These means include notification through Mechanical Engineering magazine and letters to holders of Certificates of Authorization and jurisdictional and regulatory authorities. These measures were determined not to be necessary in the case of the yield strength values for A-500 tubular shapes in Case 1644-3 through N-71-9.

Yours truly,

Kevin Ennis

Kevin Ennis
BPVC Assistant Secretary
(212) 705-7643

KE/dp

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CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing "Applicants' Response To Partial Initial Decision Regarding A500 Steel" in the above-captioned matter was served upon the following persons by overnight delivery (*), or deposit in the United States mail, first class, postage prepaid, this 11th day of April, 1984, or by hand delivery (**) on the 12th day of April, 1984.

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