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)	'84 SEP -4 A10:12 Docket Nos. 50-445-1 OL and 50-446-1 OL

CASE'S PARTIAL ANSWER TO APPLICANTS' STATEMENT OF MATERIAL FACTS AS TO WHICH THERE IS NO GENUINE ISSUE REGARDING SAFETY FACTORS

in the form of

Affidavit of CASE Witnesses Mark Walsh and Jack Doyle

MESSRS. WALSH AND DOYLE:

Before addressing Applicants' statements in detail, it should be noted that it is our belief that Applicants' Motion for Summary Disposition is a deliberate attempt to mislead the Board. CASE was talking about apples; Applicants in effect have said that they don't want to talk about apples, but they have some oranges they'd like to sell to the Board. CASE should probably move that Applicants' Motion be stricken.

Having said that, however, we also believe that at least a brief Answer is called for to give the Board a small sample of the manner in which Applicants are trying to mislead the Board. Further, we are not ready to allow Applicants' Motion to stand in the record unchallenged, since their statements give the erroneous impression that it doesn't really matter if things are wrong here and there, since they supposedly have this large margin of safety on the order of 46.

1. Applicants state:

"Seismic loading is the design determining force for virtually all piping supports of concern at CPSES. Affidavit of J. C. Finneran, R. C. Iotti and R. D. Wheaton Regarding Safety Factors ('Affidavit') at 3."

In regards to Applicants' statement, first of all, there is no indication that R. D. Wheaton or R. C. Iotti are really familiar with pipe supports at Comanche Peak; for instance, it is not shown on their resumes that they have ever designed a pipe support at Comanche Peak /1/.

In addition, we do not agree with Applicants' statement. As was shown in CASE's response to Applicants' Motion for Summary Disposition Regarding the Effects of Gaps on Structural Behavior Under Seismic Loading Conditions, the support configurations are unique to Comanche Peak (i.e., Richmond Insert/A307 bolt/tube steel connection). Applicants cannot make a valid comparison based on past histories of other plants where this unique support configuration is not used.

The Applicants are neglecting to consider the consequences of normal operation at Comanche Peak in their discussion of safety factors (as discussed at the bottom of page 3 of Applicants' Affidavit). When one neglects the normal operating loads and stresses, one cannot be assured that the structural system will be operating in a predictable manner for a dynamic event.

/1/ We also note that Mr. Wheaton's resume includes, under "Selected Publications" on page 3, two publications in June 1934 and one in 1985 which apparently have not yet been commented on by his peers.

In addition, we note that not included in Mr. Wheaton's resume is (from all appearances) that he helped prepare Reference 4 (see the discussion under answer 4, item (2), later in this Answer).

See also Pages 1 and 2 of Affidavit.

2. Applicants state:

"A conservatively quantified margin of safety associated with some factors affecting seismic design is on the order of 46 (Id. at Table 2, p. 43) and consists of the following items:

"a. Seismic Hazard Evaluation - 2.4 (Id. at 9-10)

"b. Composite Ground Motion - 1.5 (Id. at 10-11)

"c. Synthetic Time-History - 1.2 (Id. at 11-12)

"d. Site-Structure Interaction Analysis - 1.5 (Id. at 18-21)

"e. Damping - 1.38 (Id. at 22-25)

"f. Uncoupled Analysis - 1.1 (Id. at 25-26)

"g. Envelope Support Excitation Approach - 1.1 (Id. at 27-28)

"h. Broadened Floor Response Spectra - 1.1 (Id. 28-29)

"i. Orthogonal Input Motions - 1.1 (Id. at 29-30)

"j. Modal Combintion Rules - 1-2 (Id. at 30-32)

"k. Material Overstrength - 1.8 (Id. at 35-36)

"l. Static Reserve Strength (Code Margin) - 1.43 to 10.41 (assume 1.43 for calculation) (Id. at 36)

"m. Dynamic Reserve Strength - 1.5 (Id at 37)"

We disagree with this statement, which is very misleading. The Applicants (beginning on page 2, last paragraph and continuing onto page 3 of the Affidavit), attempt to explain how a safety factor is born. As will be shown in the following, the factors listed above are not applicable to the design of pipe supports at Comanche Peak, since they are related to Seismic B load factors and not capacity factors as required in the working stress design, which CASE referenced in their Proposed Findings. (See CASE's Proposed Findings of Fact and

Conclusions of Law (Walsh/Doyle Allegations), pages I - 6 through I - 10.) In none of their discussions do they discuss the real world which is controlled and accepted by recognized codes, standards, and NRC Regulations to which Applicants are committed.

In CASE's Proposed Findings, CASE argued that the factor of safety against the allowable stress was being eroded. The loads that produced the stresses were not argued by CASE in its Proposed Findings except when it was totally neglected. There were many points which CASE simply did not get into, regarding which we accepted Applicants' word. For instance: CASE did not argue that the temperature within the containment should be 600 degrees F. during a LOCA (which might be argued due to the temperature of the main steam line) instead of the 280 degrees F. which Applicants use. CASE did not argue that the response spectra method was unconservative. CASE did not argue that the required damping factors which the Applicants are committed to use was too liberal.

What CASE has argued in the past is that the safety factor has been eroded due to the following (just to name a few):

(1) Section properties not properly considered;

(2) Oversize holes and gaps not considered;

(3) Self-weight excitation of supports not being considered;

(4) Not considering the consequences of wall-to-wall and floor-to-ceiling supports;

(5) Not considering friction loads;

(6) The restraining effects from trunnions not being considered;

(7) Lack of consideration of local stresses;

(8) Unstable supports;

(9) Applicants' misuse of Code cases, as with Code Case N-71-10 in regards to A500 steel; etc.

If the Applicants are so confident that they have a factor of safety equal to or greater than 46, why don't they decrease their load by 46 times and move on? Then instead of using a load factor of 1.7, they could have used a load factor of 1 + 1/46 = 1.02. The reason is that it is not realistic and the Applicants know it. Further, there is no indication that the NRC Staff has approved Applicants' premise.

Utilizing the Applicants' philosophy and realizing a load factor of 1.02, what the Applicants are in essence saying is that they do not need to consider seismic or dynamic events because there is only a 2% increase in load due to seismic or dynamic events. The factor of safety of 46 is assuming a Utopia where nothing goes wrong and everything has been done correctly. (For instance, Utopia would include the following: no cinched-down U-bolts, all friction connections rather than having bearing connections, stable supports, etc.) This is unrealistic and is far from the situation at Comanche Peak.

Applicants are not discussing factors of safety for design -- they are actually discussing factors of safety for loads. See Applicants' Affidavit at page 3, where they state:

"If the one category just mentioned (including code margins raised by CASE) is termed 'capacity' safety factors, then the other two categories may be called 'design input definition' and 'method of analyses' caused safety factors."

CASE has discussed apples -- but the Applicants are discussing oranges.

As stated before, the Applicants are only considering the seismic or dynamic factors of safety. Two accidents that did not involve seismic or dynamic events that are recalled very quickly are TMI and the Kansas City walkway collapse. The TMI accident was an accident under normal operating conditions and no dynamic events were involved, as was the case with the pipe support in CASE Exhibit 669B, 11XX. The Kansas City accident involved a structural shape in the form of tube steel, where a threaded rod punctured through the bearing surface, and this was done because of a field change. It will be noted that all these changes were either done verbally or by memo. This is still being litigated. (See Attachment A hereto, from Engineering News Record.)

3. Applicants state:

"Additional design margins of safety which exist and add an additional level of margin, but were not quantified and set forth in 4 above, include the following:

"a. Enveloping of SSI Results (Id. at 21-22)

"b. Inelastic Deamplification (Id. at 32-34)

"c. Oversized Members (Id. at 37-38)

"d. Redundancy (Id. at 4-5)"

See answer 2 preceding. In addition, throughout their Affidavit,

Applicants refer to most of the 44 References listed in Attachment 3 to their Affidavit. CASE has now received all but one of the items (No. 37) referenced in Attachment 3. However, we have not had time to thoroughly review the 44 referenced documents /2/.

MR. WALSH:

One of the most striking aspects of those References in Attachment 3 which I have had time to quickly scan is what Applicants are not telling the Board is stated in those documents. For example, it is obvious that those References are relying upon certain very important criteria having been met before the other assumptions can even begin to be adequately evaluated:

(1) ". . . Rigorous nonlinear dyanmic analysis methods are valuable tools in seismic analysis and design when combined with engineering judgement, careful detailing, and quality construction workmanship. . .

(Reference 31 (referenced on page 38 of Applicants' Affidavit: "Non-Linear Structural Dynamic Analysis Procedures for Category I Structures," prepared for USNRC by URS/John Blume and Associates, San Francisco, CA, July 1978.)

(2) I have briefly scanned portions of Reference 4. This draft report (American Society of Civil Engineers, "Uncertainty and Conservatism in the Seismic Analysis and Design of Nuclear Facilities," ASCE Dynamic Analysis Committee, Working Group Report, 1983 (Draft)), which Applicants' Witness Mr. Wheaton

/2/ Applicants supplied CASE with only one copy of each of these 44 documents, and Mr. Doyle has not seen any of these documents.

apparently helped prepare, was referenced in Applicants' Affidavit on pages 6 and 10. (This was one of the more recent References which was included in Applicants' list.)

It states, in part:

"In addition to the parameters discussed in this report, three other considerations that affect the failure/survival characteristics of structures and subsystems are design and construction errors, aging, and construction practices. Design and construction errors are particularly troublesome. They introduce additional uncertainty as to the capacity of a constructed facility. It is improper to accept errors as the status quo, to uniformly increase the uncertainty assigned to the analysis parameters, or to compensate for errors through inflated safety factors or margins. The proper solution is to practice good quality assurance/control techniques to eliminate or effectively minimize the possibility for errors." (Page 1-8, emphases added.)

(3) Another important document referenced by Applicants (page 24 of Affidavit) is Reference 16, NUREG/CR-0098, September 1977, "Development of Criteria for Seismic Review of Selected Nuclear Power Plants," by N. M. Newmark and W. J. Hall. This is one of the more important documents referenced by Applicants because, although it does not have the force of NRC regulations or carry as much weight as Regulatory Guides, it does indicate that the NRC itself has taken a detailed look at this specific matter. It therefore is entitled to that amount of weight by the Board. It states, in part:

"In order to survive the dynamic motions, the element must be strong enough as well as ductile enough to resist the forces and deformations imposed on it. The required strength and ductility are functions of stiffness or flexibility, among other things. In assessing seismic effects it should be remembered that the seismic actions generally are in addition to those already existing, i.e., arising from dead load, live load, thermal effects, etc." (Page 3 of Report, emphasis added.)

"The process of earthquake resistant review and design requires selection of earthquake hazards as well as estimates of structural strengths, either implicitly or explicitly, as an integral part of the review procedure. Unless these determinations are made in a consistent manner, the final design may be either grossly uneconomical or dangerously unsafe." (Page 5, emphases added.)

"Obviously appropriate damping values also must be chosen for use in evaluating the seismic adequacy of the systems under study." (Page 28, emphasis added.)

"Items which do not lend themselves readily to analytical consideration may have an important effect on the response of structures and facilities to earthquake motions and must be considered in the design. Among these items are such matters as the details and material properties of the elements and components, and the inspection and control of quality in the construction procedure. The details of connections of the structure to its support or foundations, as well as of the various elements or items within the structure or component, are of major importance. Failures often occur at connections and joints because of inadequacy of these to carry the forces to which they are subjected under dynamic conditions. Inadequacies in properties of material can often be encountered, leading to brittle fracture where sufficient energy cannot be absorbed, engouth though energy absorption may have been counted on in the design and may be available under static loading conditions. . .

"The review must include examination of details of construction, fastening, and actual material properties to be sure that the resistance available is adequate to meet the deamnds of the upgrded design requirements." (Page 38, emphases added.)

Obviously CASE's concerns about Applicants' inflated safety factors are in strong controversy and go to the very heart of CASE's Answer to this Motion for Summary Disposition, since safety factors will be eroded by design and construction errors, poor construction practices, ignoring consideration of items which should be properly

considered, lack of consistency, use of improper values, intimidation of QC inspectors, inadequate QA/QC techniques and effectiveness, etc., etc.

Applicants have done the very things which Reference 4 -- the ASCE Report which Applicants themselves referenced and which it appears one of their witnesses helped prepare -- warns against, and Applicants are now attempting to convince the Board that safety factors exist which are in actuality inflated.

Throughout Applicants' Affidavit, there are numerous references to "current nuclear industry practice," "current engineering practice," "current practice," and "industry practice." (Pages 6, 8, 9, 10, 22, 24, 28, 30, and 42, for example.) And on pages 5 and 6 of Applicants' Affidavit, it is stated:

> "The performance of structures and components during past earthquakes indicates that the average facility has a seismic capacity well in excess of its design value. This is true even in those cases, such as petro-chemical plants, where only minimal attention was originally paid to seismic issues. In the case of nuclear power plants, seismic reserve margins would be even greater than for the average facility. (Reference 1 through 4). In short, current nuclear industry practice leads to both a significant overestimate of seismic forces and an underestimation of seismic capacity. The result is a seismic reserve margin, or added safety factor, that far exceeds original design targets." (Emphasis added.)

And on page 9 of their Affidavit, Applicants state:

> "Time intervals of such a magnitude are approaching a geologic time scale and are probably physically unrealistic for engineering purposes. Nonetheless, current nuclear industry practice results in a seismic ground motion that is 'at least a factor of 2.4' times the design objective (Reference 4) (underline included in reference)." (Additional emphasis added.)

In briefly scanning the same Reference 4 (the 1983 ASCE Report) discussed in the preceding on page 7, I found the following statements:

> "Currently in the nuclear industry, probabilistic risk assessments (PRAs) are being conducted to quantify the probability of various adverse consequences which could occur in the event of a serious accident. . . " (Page 1-4, emphasis added.)

It should be noted that this current nuclear industry practice recently the untempered reliance by the nuclear industry on probabilitic risk assessments (PRA's) -- which is included in current nuclear industry practice -- has come under fire. In a March 11, 1983, Memo from M. Bender, NRC Advisory Committee on Reactor Safeguards (ACRS), Washington, to D. Okrent and ACRS Members /4/, there was a discussion regarding the examination of accident precursors, and the following statements were made regarding probabilistic risk assessments (PRA's):

> "Most of the effort has been directed to the implications of accident precursors in probabilistic risk assessment. The results of the Oak Ridge-SAI work and the INPO review of the Oak Ridge effort show clearly why PRAs are not good measures of safety adequacy. So much subjective judgment is involved in the probability evaluation that the results cannot be trusted for absolute risk measurement. . . " (Emphases added.)

Another example of what Applicants are not telling the Board is that virtually all of the referenced documents (at least all which I had time to quickly scan) had one thing in common -- uncertainty. This uncertainty raises strong questions about statements such as the following one from page 5 of Applicants' Affidavit:

/4/ See Attachment 8 hereto.

". . . one study (Reference 36) has shown that, not only is there a large seismic reserve margin in the average piping system, but that it is virtually impossible to actually fail a pipe through seismic excitation . . . "

However, this 1983 report /5/ also discusses some of the uncertainties involved:

". . . based on the data regarding the controlling failure mode of fatigue, it may be difficult to establish generic reserve margin factors applicable to all piping systems. Also, local ductility demands vary considerably from system to system for complex piping configurations, leading to difficulties in defining generic reserve margin factors based on allowable system ductilities. . . " (Page 6-2.)

". . . the precise failure levels and modes have not yet been established, primarily due to a lack of available experimental data. Therefore, the most important challenge in the follow-on work is to identify precise failure modes and corresponding failure load levels for piping system and components. Once these are established, the development and justification of modifications to the ASME Code criteria will be relatively straightforward." (Page 7-1, emphasis added.)

Additional random selections from the References include the following clear indicators of uncertainties about which Applicants have conveniently forgotten to inform the Board:

(1) ". . . it is difficult to predict the outcome of an innovative program that is still in progress . . . .

". . . the innovative nature of the Site Specific Spectra Program and the need for continued review and maturation of the program. . . .

". . . follow up work and sensitivity studies are continuing . . . . "

/5/ Reference 36: "Conceptual Task to Develop Revised Dynamic Code Criteria for Piping," R. Broman, et. al., Impell Corporation Report, Prepared for Electric Power Research Institute under Project RP-1543, 1983.

(Reference 5, referenced on page 9 of Applicants' Affidavit: From 6/23/80 cover memorandum from Robert E. Jackson, Chief, Geosciences Branch, Division of Engineering, NRC, Washington, to D. Crutchfield, Acting Chief, Systematic Evaluation Program Branch, attached to Applicants' Reference 5, U. S. Nuclear Regulatoy Commission, "Initial Review and Recommendations for Site Specific Spectra at SEP Sites.")

(2) ". . . The Pressure Vessel Research Committe, through our Steering Committee and Technical Committee on Piping Systems, are developing an overall position impacting on the design and support of piping systems under dynamic loads with emphasis on seismic. . . " (Emphasis added.)

(Reference 22, unable to find reference in Applicants' Affidavit unless I overlooked it: 6/9/83 cover letter from L. J. Chockie, Chairman, Pressure Vessel Research Committee of the Welding Research Council, to W. R. Mikesell, Pressure Vessel Committee, American Society of Mechanical Engineers, attached to Reference 22, PVRC, "Proposed Provisions to ASME Appendix N and Reg. Guide 1.122" Task Group Report on Spectra Development, 1983.)

(3) ". . . Various aspects of this study, including the structures considered, the analysis criteria, the dynamic loadings, and the material properties, are purely hypothetical. These aspects are intended to model Category I conditions, and any resemblance to specific nuclear power plant structures is purely coincidental." (Page 1 of Report.)

"It is always difficult to model reinforced concrete members properly because reinforced concrete is a composite material exhibiting tensile cracking at low stress levels, bond-slip between the concrete and steel reinforcement, aggregate interlock, degrading stiffness, and spalling under cyclic loading. . . Many uncertainties would still remain even if more refined mechanical models were formulated because of variations in material properties. . . Until such capabilities are developed, crack propagation, spread of plasticity, concrete spalling, and crushing cannot be examined properly. . .

"Additional work is needed to catalog experimental data relevant to nuclear power plant structures and to perform further tests to accumulate enough data so that accurate mathematical models encompassing the key parameters may be developed and used. . .

"The response of a structural system after the formation of a collapse mechanism is extremely sensitive to the time variations of inertia forces. . .

". . . it is difficult to specify a confidence level for nonlinear responses of the structures as computed by the rigorous methods. . .

"In the second phase . . . This will require a major software development effort . . .

"In the third phase . . . (t)he problems are twofold. First, no comprehensive constitutive model of concrete under triaxial cyclic loading is currently available. Secondly, the cost of a total three-dimensional analysis may be prohibitative at this point. . .

"Among the three phases discussed above, the first two may yield uncertain results. . . The third phase seems to be the most straightforward . . .

"Various trends indicate that the future course of structural engineering will require more explicit considerations of the nonlinear, inelastic strength and energy capacity of structures. . . Development of such an analysis method would be a considerable undertaking; however, it is clearly needed for a more complete yet practical accounting of the nonlinear strength of structures." etc., etc. (Emphases added.)

(Reference 31, referenced on page 38 and Attachment 2 of Applicants' Affidavit: "Non-Linear Structural Dynamic Analysis Procedures for Category I Structures," prepared for USNRC by URS/John Blume and Associates, San Francisco, CA, July 1978.)

Thus, as demonstrated by a random sampling of Applicants' own referenced documents, the conclusions drawn by Applicants are not based on proven technology or analyses. Further, Applicants' own documents include statements which support and reinforce CASE's positions.

If these seismic design margins (referenced in Applicants' alleged material fact 4) are significant, then the safety factors incorporated

in the codes (i.e., through allowable stress margins, or required load inputs) will have been reduced and Comanche Peak would have utilized them and they would have been included in their FSAR -- but they were not. Since this has not been done, the Applicants' statement is immaterial.

Further, in their Affidavit, Applicants have failed to include the fact that their premise is based on certain additional considerations, and that if these additional considerations are not included, their premise is not valid.

For example, included in some of the recent information received from Cygna was a July 4, 1984 TUGCO Office Memorandum to G. Grace from G. M. Chamberlain (see Attachment C hereto). As stated in that memorandum, the safety factor has been reduced:

> "*In this case a 30% overstress of the bolt does not mean failure but only a reduced factor of safety. . . "

Since there was apparently no NCR, CMC, IR, or other nonconformance documentation on this problem, there is no way of knowing how many other similar instances of a reduced safety factor there have been at Comanche Peak, or how much the combination of those instances have reduced the overall safety factor.

Additionally, the Applicants currently utilize a refined response spectra curve, as shown in the July 4, 1984 TUGCO Office Memorandum to G. Grace from C. Ray (see Attachment D hereto), which states, in part:

> "These loads can be shown in the analysis AB-1-23B Rev. 1 analyzed incorporating refined resonse spectra, refined seismic anchor movement and modified coding of the valve stem in consistence with 1-23A, C, and D.

The Applicants, in their Affidavit at page 33, claim that they have a higher factor of safety due to inelastic deamplification, and they refer to Reference 32 to support that statement. However, according to Reference 32 /6/, the refined response spectra cannot be used when using this technique for deamplification. It is stated on page 6 of that document:

> ". . . elastic spectra, rather than reduced spectra, should be used for seismic input."

4. Applicants state:

"Numerous studies of the effects of seismic events on major structures support the conclusion that seismic design margins are significant. Id. at Attachment 2."

Applicants' state on page 5 of their Affidavit:

> ". . . This is borne out by observations conducted at several plants subjected to severe earthquakes. It is to be noted that these plants were not built with the stringent QA requirements applied to nuclear plants. A summary of these observations is provided in Attachment 1 (sic -- should be Attachment 2)."

It should be noted that throughout their Affidavit, Applicants do not indicate the page numbers from which their statements are taken, nor did they attach copies of any of the pages. This tends to give the erroneous impression that the entire document supports Applicants' position, which is not correct.

/6/ Referred to on page 34 of Applicants' Affidavit: "Seismic Analysis Methods for the Systematic Evaluation Program," UCRL-52528, Lawrence Livermore Laboratory, Livermore, California, July, 1978, by T. A. Nelson.

Attachment 2 to Applicants' Affidavit states: ". . . Several examples of these events are discussed in References 37 through 41." To the best of my knowledge, CASE has not yet received Reference 37; we have received the rest, however.

In their discussion of References 37 through 41, there are certain things which the Applicants failed to state. For example:

Reference 38 (El Centro Steam Plant, discussed on pages 1 and 2 of Attachment 2 to Applicants' Affidavit):

It was concluded that highly damped soil springs reasonably reflect the forces induced on the building (page xvi). Comanche Peak does not have the same characteristics of sub-surface as the El Centro plant, and therefore a comparison is not truly appropriate, and any comparison would be unconservative. In addition, this report concludes that only nuclear power plant equipment similar to that in Unit 4 and anchored as well should perform equally well in a similar earthquake. (Page xvi). Since Comanche Peak has been known for its unique design (i.e., cinched-up U-bolts to provide stability, Richmond insert/tube steel idea, as well as others), this is another reason not to compare Comanche Peak with this report, and to do so would be unconservative. One further note is that damage was done to the piping system during this earthquake (page 1); that is, the cooling water piping line was damaged, the water treatment line and the hydrogen cooling water line were damaged (page 9). In addition, many mechanical equipment supports were damaged; for example, air-actuated valve operators, heat

exchangers, and horizontal tanks. The feedwater supports were replaced with new designs due to plastic deformations. (Page 10.) Unit 4 was out of service for two hours, so that plant personnel could inspect the damage. Unit 3 was restored to service within 15 minutes after the main shock. Only by expedient plugging of leaks was Unit 3 kept in service. Although Unit 4 was back in service within two hours, it was taken out of service within three hours to make the repairs. (Page 1.) One must remember that this was not a nuclear power plant and all the repairs could be made without any risk due to radioactivity.

Reference 39 (discussed on pages 2 and 3 of Attachment 2 to Applicants' Affidavit):

This is a very brief report by Westinghouse regarding the Diablo Canyon plant which is based on the information about the El Centro plant (which is discussed in detail in Reference 38).

Reference 40 (discussed on page 3 of Attachment 2 to Applicants' Affidaivt):

This report states that in the mill buildings, designed for about 0.15g with x-bracing, there was a substantial amount of failed x-bracing, usually at the bolted connections, and there was also some bending and stretching of some anchor bolts. The plant had toppled bins and conveyors, twisted crane rails, cracked walls, cracked valves, displaced pipelines and supports, broken steam and water mains, dislodged equipment, etc. The reason for these damaged plant items was inadequate seismic considerations. As pointed out in the report, comparisons were difficult. This plant was out of normal operation for

6 days. (Page D35.2.) It must be remembered that this was not a nuclear power plant where radioactivity could have jeopardized the repairs and the public health and safety.

Reference 41.

Unless I have overlooked it, this does not appear to be addressed at all in Attachment 2 to Applicants' Affidavit. This was a very short paper presented in 1980 on "Seismic Performance of Piping in Past Earthquakes." It briefly discusses several earthquakes, which (from a brief scanning) appear to have ranged from a 60 MW to 600 MW plant. None of the plants were nuclear power plants.

There is another, even more disturbing, aspect of this to which we would like to call the Board's attention. In their statement on page 5 of their Affidavit (discussed in the preceding), Applicants refer to the "stringent QA requirements applied to nuclear plants" as though those requirements were actually being met at Comanche Peak. As the Board is aware, this is one of the areas of contention in these proceedings, and we challenge this implication.

5. Applicants state:

"Loads from sources other than a seismic event (i.e., static and other dynamic loads) are generally well known, and in many instances the impacts of such loads are tested, e.g., hydrostatic tests, hot functional tests, and operational tests. See e.g., Chapter XIV of the FSAR for a list of tests that have been and will be conducted. Id. at 3-4."

I strongly disagree with Applicants' representations. See discussion on pages 16, 17, and 18 of CASE's 8/29/84 Partial Answer to Applicants' Statement of Material Facts As To Which There Is No Genuine Issue Regarding Applicants' Use of Generic Stiffnesses Instead of Actual Stiffnesses in Piping Analysis. See also CASE's 10/13/83 (1) Motion to Add A New Contention, (2) Motion for Discovery, and (3) Offer of Proof.

6. Applicants state:

"Many safety margins which apply to seismic design apply equally well to static and other dynamic loads. Id."

As shown in the documents referenced in answer 5 above, the factor of safety or the Applicants' ability to predict the behavior of a piping system for a hydrostatic and hot functional test is less than what normally would be desired. Equally important is the poor showing of the predictability of the Hot Functional Test (HFT), and the Applicants are rerunning some of the tests. The Staff will not be able to tell the Applicants to perform a seismic test, which is one test which the Applicants cannot and will not perform -- yet it is the sole basis for Applicants' Motion for Summary Disposition, if one were to accept the Applicants' statement /7/.

Were Applicants able to convince the Board and the NRC Staff that it is permissible to ignore all other design loadings (because of

/7/ Affidavit at page 3: "In that seismic loading is the design determining force for virtually all piping supports, the principal issue here, this affidavit will focus on the safety margin which stems from consideration of seismic design."

Applicants' fallacious premise), it would also allow them to be able to ignore the numerous problems encountered in the hydrostatic and hot functional tests; and retesting would not even be necessary.

See also pages 14 and 14a of CASE's 8/29/84 Partial Answer to Applicants' Statement of Material Facts As to Which There Is No Genuine Issue Regarding Applicants' Use of Generic Stiffnesses Instead of Actual Stiffnesses in Piping Analysis.

MESSRS. WALSH AND DOYLE:

7. Applicants state:

"The minimum safety factor conservatively quantified for dynamic loads other than those resulting from a seismic event is on the order of 5.0 (Id. at 41) and includes the specific factors noted in item 2e, f, i, j, k, l and m, above. Id. This safety factor does not include margins inherent in the computation of dynamic loads. Id."

See answer 2 preceding.

8. Applicants state:

"The minimum safety factor conservatively quantified for static loads is 1.68 (Id. at 41) and includes the specific factors noted in items 2k and l, above. Id."

See answer 2 preceding.

MR. WALSH:

Also, neither of us has had time even to scan the transcript of the 8/6/84 Applicants/NRC Staff/CASE telephone conference call (Mr. Doyle was

not on that call), the transcripts of the 8/8/84 and 8/9/84 Bethesda meetings between the NRC Staff and the Applicants, (all of which were just received by CASE on 8/22/84), and of course, the transcript of the meeting held at Comanche Peak 8/23/84 between the NRC Staff and the Applicants. Also, it is my understanding that there will be some changes (at least one substantive) to some of Applicants' Affidavits regarding some of the Motions for Summary Disposition and that by 8/30/84 the Applicants are to provide the Staff with several documents relating to the Motions for Summary Disposition (which obviously I also need to adequately answer Applicants' Motions).

I would have liked to be able to do a more thorough job, and would like to be able to supplement my testimony after I have had a chance to review the referenced transcripts, changed Affidavits, and additional documents.

Attachments:

Attachment A 7/26/84 ENGINEERING NEWS RECORD article, "Hyatt hearing traces design chain" -- see answer 2, page 6

Attachment B 3/11/84 Memo from M. Bender, NRC Advisory Committee on Reactor Safeguards (ACRS), Washington, to D. Okrent and ACRS Members -- see answer 3, page 11

Attachment C 7/4/84 TUGCO Office Memorandum to G. Grace from G. M. Chamberlain, Subject: CC-1-028-024-S33R -- see answer 3, page 15

Attachment D 7/4/84 TUGCO Office Memorandum to G. Grace from C. Ray, Subject: AB-1-238 -- see answer 3, page 15

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.

Mark Walsh

(Signed) Mark Walsh

STATE OF TEXAS

On this, the 27 day of August, 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 27 day of August, 1984.

Samuel W Nestor

Notary Public in and for the
State of Texas

My Commission Expires: _____

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

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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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: Aug 24 1984

STATE OF Massachusetts

COUNTY OF Worcester

On this, the 25th day of August, 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 25th day of August, 1984.

Norma A. Poste

Notary Public in and for the State of Massachusetts

My Commission Expires:

MY COMMISSION EXPIRES JANUARY 9, 1987

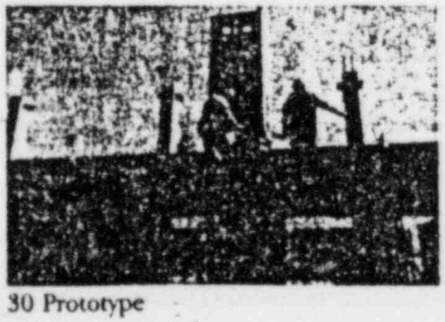
ENR Contents

July 26, 1984, Vol. 213 No. 4

ATTACHMENT A

26 Pragmatism *(Cover)*

12 Precedent



30 Prototype

Next week in ENR: Top International Design Firms

Granite slipping from Pittsburgh tower—

The 13-year-old Pittsburgh National Bank Building may need to have its entire granite skin resecured at a cost of as much as $5 million. Many of the stainless-steel fasteners securing more than 4,000 slabs to the outside of the 30-story building, on one of the city's busiest corners, have loosened. A problem was first noticed last fall. Now, from 25 to 100% of the 800 to 1,600-lb slabs need to be resecured to prevent "a possible catastrophe," says a bank official. The repairs could take as long as 2 years.

Three Mile Island cleanup—

Workers were set to lift the head of General Public Utility's damaged Three Mile Island unit-two reactor this week. The lift is the next major step devised by cleanup manager Bechtel Power Corp., San Francisco, on the road to defueling the reactor in July, 1985. The 156-ton head was to be lifted from the vessel and moved to a shielded storage stand. A hollow metal cylinder was to have been placed on top of the vessel for shielding. The cylinder will be filled with water and covered with a lead and stainless-steel plate. The underlying plenum is set for removal in the spring.

LILCO struggling with bankers for cash—

The Long Island Lighting Company, Mineola, N.Y., struggling to avoid bankruptcy, is trying to [illegible] a consortium of U.S. and European banks to extend the company $200 million in credit using accounts receivable and stored oil as collateral. The utility's long battle to complete its $3.6-billion Shoreham nuclear plant has left it deep in debt. The $200 million could keep LILCO going until the end of 1985 if the New York State Public Service Commission also agrees to a $281-million rate increase.

Contractors' cash flow slows—

After experiencing fewer problems with bill collection throughout most of 1983, contractors' cash flow slowed slightly during the first three months of this year, the latest period for which figures are available from TRW, Inc., Cleveland. Contractors in six of seven categories experienced a drop in the percentage of current accounts receivable during the first quarter, only metal work contractors showing a slight gain. Still, those subs collected only 10.8% of their bills on time, the lowest of all construction categories. Of the others, general contractors reported the highest share of current accounts, 87.6%, and heating and air conditioning companies the lowest, 52.6%.

Iraqi-Saudi pipe link to be bid next month—

Iraq has invited bids on construction of a 400-mile crude-oil pipeline to run from its southern oil fields to Saudi Arabian oil lines. Bids are expected by August 11. Construction is to begin in September. Cost is estimated at $500 million to $1 billion. Basic pipeline design has been completed by Brown & Root, Inc., Houston (ENR 3/29 p. 5). A $2-billion second phase of work will continue through Saudi Arabia.

Pressurized-pipeline studies—

Battelle Memorial Institute's laboratory at Columbus, Ohio, plans a multiclient study of stresses induced in existing pressurized oil and gas pipelines when new roads are built over them. The institute's researchers believe that present design guidelines are overly conservative, leading operators to undertake the unnecessarily costly measures of lowering a pipeline, installing casing or replacing the pipe. The institute is seeking $10,350 in financial backing from interested companies.

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Back issues of ENR are generally available for the previous six months. Semiannual indexes available from the editorial office. ENR is also indexed in the Applied Science & Technology Index, Business Periodicals Index and the Engineering Index.

ENR News
The McGraw-Hill Construction Weekly
July 26, 1984

Hyatt hearing traces design chain

During tense cross-examination last week, the steel fabricator for the Kansas City Hyatt Regency hotel said the connection believed to be responsible for the hotel's walkway collapse was the only steel-to-steel connection in the building that his firm and its subcontractor did not design. He maintained that the critical connection had already been designed by the engineering firm hired to design the hotel's structure.

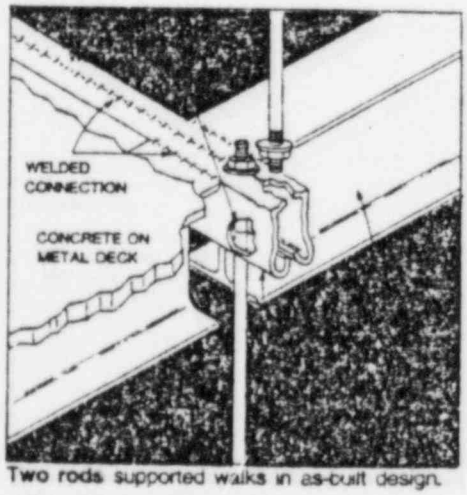
The testimony came at a hearing in St. Louis that could determine the future careers of the structural engineers involved. It started almost exactly three years after two pedestrian bridges crossing the hotel's atrium fell, killing 114 persons and injuring over 200 others.

This "battle of the experts," as one lawyer called it, could set a precedent defining the responsibility implied by a structural engineer's seal. The hearing may also unravel the tangled chain of responsibility for the Hyatt walkway failure.

The petitioner in the case before the Missouri Administrative Hearing Commission is the Missouri Board for Architects, Professional Engineers and Land Surveyors. The board has charged GCE International, Inc., St. Louis; its president, Jack D. Gillum; and vice president Daniel M. Duncan with gross negligence, incompetence and unprofessional conduct (ENR 2/9 p. 14).

Engineer Gillum (seated left) confers with lawyers about hearings to determine fate of his license.

Duncan was GCE's project engineer for hotel.



Two rods supported walks in as-built design.

Gillum was chief engineer for the design of the Hyatt, and Duncan was project engineer. If the charges are upheld by the state administrative law judge, James B. Deutsch, the two engineers could lose their licenses to practice in Missouri, have their licenses temporarily suspended or be reprimanded.

Layer after layer of detailed testimony has unfolded to expose conflicting views of the events surrounding the construction of the walkways. The walkways, directly above one another at the hotel's second and fourth-floor levels, were supported by welded steel box beams. The beams were suspended from the ceiling by 1¼-in. steel rods and were attached to the building structure at either end.

In an investigation of the collapse, the National Bureau of Standards found that a connection design change, in which continuous support rods were replaced with pairs of offset rods, was a critical factor in causing the failure. If the original design had been retained, the connection could have supported the weight of the walkways and the people on them at the time of the collapse, NBS said (ENR 3/4/82 p. 11).

Grilled. William G. Richey, of steel fabricator and erector Havens Steel Co., Kansas City, Mo., was grilled by defense attorneys and the judge himself. Richey admitted that while the Hyatt was in

design. Havens had too much work. The firm sent partly completed shop drawings to a subcontractor, steel detailer WRW Engineering, Kansas City, Mo., for completion. Richey said Havens and WRW detailed more than 100 connections in the hotel atrium, and that for many of them engineers on the detailer's staff calculated loads and sized members. Gillum and Duncan say they never knew of WRW's involvement.

Richey maintained that GCE designed the critical walkway connection. "Are you trying to tell this court that the one and only steel-to-steel connection that was totally designed [by the structural engineer] was the box-beam-to-hanger-rod connection?" asked defense attorney Reeder R. Fox. "If there were others, I'm not aware of it," said Richey.

Richey was also questioned on a crucial phone call that he claims he made to Duncan at GCE to clear up a discrepancy in a structural drawing. In that drawing, one view of the second and fourth-level walkways shows a single, continuous rod supporting both. But a detail on the same drawing indicates that a rod should terminate under both the second and fourth-level walkways, implying a double-rod design.

Richey says, "He indicated to me to make it two rods. I informed WRW what Duncan informed me to do."

Duncan issued a press release on the day of this testimony denying that this conversation ever took place. Defense attorneys, using Havens purchasing documents and "speed memos" as evidence, maintain that the change to two rods was a result of Havens' and WRW's concerns about the contructibility of the one-rod system and the difficulty of buying single rods 46 ft long.

Defense attorney Lawrence B. Grebel presented documents showing that in February, 1979, after Richey claims Duncan had told him to use two rods, Richey was still having discussions with others about splicing rods together to make up the 46-ft length needed in the single-rod design.

The buck stops. A key issue in the case is the responsibility implied by a structural engineer's seal. "According to Missouri statute, ultimate responsibility rests with the structural engineer, no matter what," said Patrick McLarney, attorney for the licensing board. McLarney cited the statute: "Any registered engineer who affixes his signature and personal seal to any such plans . . . shall be personally and professionally responsible therefor."

A plaintiff expert witness, Richard F. Ferguson, a retired engineer who helped write the American Institute of Steel Construction (AISC) specifications for structural steel design, said the engineer of record usually has to delegate his duties because there's too much work. "But he cannot delegate his responsibility. . . . There has to be a point where the buck stops."

The defense maintains, on the other hand, that it is the "custom and practice in the construction industry" for the steel fabricator's engineers to design connections. In that way, fabricator-erectors can choose details that suit the equipment in their shop and the experience of their workers.

Disclaimers. Both sides traded paragraphs of boilerplate language on responsibility found in contract documents. Plaintiff attorneys cited documents mentioning the AISC Code of Standard Practice: "Approval [by the owner and its representatives, the architect and engineer] constitutes the owner's acceptance of all responsibility for the design adequacy of any connections designed by the fabricator."

Defense attorneys, on the other hand, cited general conditions in the specifications such as: "Approval does not relieve the contractor of responsibility for errors or omissions."

Judge Deutsch observed, "There are disclaimers of responsibility that let anybody blame everybody else."

Second chance. Considerable testimony concerned a collapse of part of the Hyatt atrium's roof during construction—an accident in which no one was injured. At this point, McLarney says, GCE had "another chance to catch its mistake" but did not.

GCE says that it volunteered to inspect steel-to-concrete connections after the collapse, but the owner hired an independent testing service instead.

But the plaintiffs presented a report on a structural design check of atrium steel submitted by Duncan that says, "We then checked the suspended bridges and found them to be satisfactory." The construction manager's notes of a meeting after the atrium collapse also say: "Jack Gillum confirmed that . . . every connection in the atrium, both steel-to-steel and steel-to-concrete, had been reviewed."

The hearing was originally slated to run two weeks, but it now seems that it may be recessed until mid-August and continued then. The judge's decision is not expected until the fall. ■

Disastrous 1981 collapse killed 114 persons and injured over 200 others at afternoon tea dance.

Sabotage to delay opening of pipeline

Apparent sabotage of a 100-mile, natural-gas pipeline in Alaska will cost the owner about $400,000 to repair holes and check for others. But the anticipated fall opening of the newly installed line will only be delayed by 15 to 18 days.

Seven holes were found recently in a 6-mile section of pipeline near Eagle River when water tests showed lost pressure in the lower portion of the pipe. Work crews dug up a section of the ½-in.-thick pipe buried 11 ft beneath a creek that flows into Eagle River and found ⅛-in. to 3/16-in.-dia holes drilled through it. Sabotage is also suspected on a similar line in western Montana (ENR 7/19 p. 16).

Spokesman Daniel Dieckgraeff, of Enstar Natural Gas Co., Anchorage, a sub-

UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D. C. 20555

March 11, 1983

ATTACHMENT B

MEMO FOR: D. Okrent
ACRS Members

FROM: M. Bender MB

SUBJECT: SUGGESTIONS FOR THE LETTER ON ACCIDENT PRECURSOR STUDIES (APS)

As noted in the Reactor Safety Study Review Committee Report, the examination of accident precursors can provide very useful safety information. They can show:

1. where improved maintenance practices are needed (e.g., the Salem circuit breakers),

2. whether there are adequate diagnostic capabilities to indicate impending problems and how to control them,

3. whether plant operating procedures are adequate and effective,

4. deficiencies in engineering design, construction and application of plant systems, controls, and components,

5. the stage at which accident consequences can be controlled most effectively,

6. effects of plant aging on safety,

7. quality deficiencies that may have been overlooked.

8. adequacy of 10 CFR 50 requirements (e.g., single failure criterion)

None of those purposes appear to have been addressed by the APS studies thus far performed. Most of the effort has been directed to the implications of accident precursors in probabilistic risk assessment. The results of the Oak Ridge-SAI work and the INPO review of the Oak Ridge effort show clearly the reason why PRAs are not good measures of safety adequacy. So much subjective judgment is involved in the probability evaluation that the results cannot be trusted for absolute risk measurement. Comparative results based on a consistent judgment basis can, of course, provide useful insights.

The Oak Ridge work was a useful pilot study but did not really identify any new matters needing attention. Its screening method is usable for some types of PRA work but does not really serve the needs of other aforementioned purposes. Other screening criteria should be sought.

Received: 3-11-83

The study effort should include entire chains of events for important precursors. For example, the Browns Ferry fire event should include the frequency of fires initiated at the barrier penetration seals and the TMI-2 event should include contribution of the TMI-demineralizer resin problems to the accident sequence and the system interactions from the instrument air system that initially upset the turbine condenser controls.

Such studies need careful review but little purpose is served by using the original WASH-1400 participants as reviewers. Their objectivity is certain to be challenged. The INPO review was obviously directed to refuting the Oak Ridge study's probability judgments. The lack of a qualified statistician to assist in evaluating the use of statistical data makes the value of these reports questionable. The industry groups such as INPO or individual utility groups are best able to perform the APS work. But the groups should include a good selection of system and equipment specialists as well as statistical and probability analysts.

This activity again points up the problem of using "PRA" type studies as the basis for public safety assessment. In this case it has led to considerable wasted effort to explain numerical values. It did not physically enhance plant safety.

cc:
R. Major, ACRS
R. Fraley, ACRS
M. Libarkin, ACRS
J. C. McKinley, ACRS

Page Revised: 3/14/83

186

TEXAS UTILITIES GENERATING COMPANY

OFFICE MEMORANDUM

July 4, 1984

To G. Grace Glen Rose, Texas

Subject CC-1-028-024-S33R

From the attached STRUDL analysis without the skewed bolt at joint 10, the bolt interaction for joint 12 is the following:

x-Force=96#
y-Force=4747#
z-Force=6471#

$$\left(\frac{4747}{12110}\right)^2 + \left(\frac{6567}{7850}\right)^2 = 0.853 \leq 1 \text{ (ok)}$$

The bolt interaction for joint 14 is the following:

x-Force=214#
y-Force=9740#
z-Force=6362#

$$\left(\frac{9740}{12110}\right)^2 + \left(\frac{6365}{7850}\right)^2 = 1.30^*$$

*In this case a 30% overstress of the bolt does not mean failure but only a reduced factor of safety. In this case it is an absolute worst case condition because we are assuming no forces are being resisted by the canted bolt. In actuality the tremendous ductibility of the A36 rod at joint 10 would resist some of the load and reduce the interaction at joint 14.

Very Truly Yours,

G.M. Chamberlain

GMC/jrf

CYGNA

JOB NO.

DATE LOGGED

LOG NO.

FILE

CROSS REF FILE

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 Partial Answers to Applicants' Motions for Summary Disposition Regarding: Consideration of Local Displacements and Stresses; Differential Displacement of Large-Framed, Wall-to-Wall and Floor-to-Ceiling Pipe Supports; Consideration of Force Distribution in Axial Restraints; Upper Lateral Restraint Beam; Use of Generic Stiffnesses Instead of Actual Stiffnesses in Piping Analysis; and Safety Factors

have been sent to the names listed below this 28th day of August, 1984, by: Express Mail where indicated by * and First Class Mail elsewhere.

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Bethesda, Maryland 20814

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