7/15/83

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of

APPLICATION OF TEXAS UTILITIES GENERATING COMPANY, ET AL. FOR AN OPERATING LICENSE FOR COMANCHE PEAK STEAM ELECTRIC STATION UNITS #1 AND #2 (CPSES)

Docket Nos. 50-445
and 50-446

MOTION FOR RECONSIDERATION
OF BOARD'S 7/6/83 MEMORANDUM AND ORDER
(Thermal Stress in Pipe Supports)

On July 6, 1983, the Atomic Safety and Licensing Board entered its MEMORANDUM AND ORDER (Thermal Stress in Pipe Supports). In its Order (page 11), the Board indicated that "the legal interpretation contained in the accompanying memorandum are the opinion of the Board and are ordinarily subject to a motion for reconsideration only if it is filed within ten days of service of this decision" and that "The deadline for filing of motions for reconsideration may be exceeded only if a party demonstrates good cause." CASE received the Board's Order on Friday, 7/8/83; we are filing this instant pleading pursuant to the Board's ten-day time limitation for Motions for Reconsideration.

There has been extensive discussion and pleadings filed in regards to this issue by the parties in these proceedings. We will not reiterate most of this information in this pleading, but incorporate herein by reference the following pleadings: CASE's 4/20/83 Brief Regarding Consideration of LOCA in Design Criteria for Pipe Supports; CASE's 5/3/83 Answer to: (1) NRC Staff's Response to Board Question Regarding LOCA-Induced Thermal Expansion

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in Linear Pipe Supports; and (2) Applicants' Brief Regarding Consideration of Thermal Stresses in Design of Pipe Supports; and CASE's 5/9/83 Response to Board's Request for Discussion of Interrelationship of ASME Appendix XVII, 2271.3, to Rest of ASME Code. See also transcript pages 5866-6013, 6173-6269, and 7540-7631, in particular.

There has been so much information contained in Briefs, testimony, legal arguments, and discussions during these proceedings regarding this matter that CASE has some difficulty knowing exactly how to proceed with this Motion for Reconsideration of the Board's 7/6/83 Memorandum and Order (Thermal Stress in Pipe Supports).

Perhaps we should begin by stating that we are in basic disagreement with the Board's statement of the issue involved as being "Thermal Stress in Pipe Supports." CASE has discussed in previous pleadings and arguments the fact that what we are concerned with is not thermal stress but what we believe is more correctly termed "thermal expansion stresses resulting from the constraint of free-end displacement due to a loss-of-coolant accident (LOCA)."

Next, we will consider what is not contained in the Board Order -- a discussion regarding Appendix XVII.

One vitally important portion of the ASME Code was not discussed in the Board's Order: Appendix XVII. There is no disagreement among the parties that Appendix XVII does apply in the design of linear-type pipe supports at Comanche Peak. Appendix XVII is also discussed and included in NRC Regulatory Guide 1.124 (CASE Exhibit 743).

Under XVII-1100 INTRODUCTION (CASE Exhibit 767), it is stated:

"XVII-1110 SCOPE

"The Articles of this Appendix provide rules for the design of linear type supports by either linear elastic analysis (XVII-2000) or plastic (limit) analysis (XVII-4000). Linear elastic analytical procedures are also provided (XVII-3000) for the design of members and connections which will be subjected to high cycle fatigue conditions in service." (Emphases added.)

Under XVII-2270 SIMPLE AND CONTINUOUS SPANS AND PROVISION FOR EXPANSION (CASE Exhibit 707), it is stated:

"XVII-2271 Design Requirements For Spans

". . . XVII-2271.3 Provision for Expansion. Adequate provision shall be made for expansion and contraction appropriate to the function of the support structure."

Applicants have argued (Applicants' 5/11/83 Supplemental Reply Brief Regarding Pipe Support Design, page 4, B) that:

". . . this section concerns the consideration of the forces and stresses induced in supports as a result of the expansion and contraction of the supported system, as appropriate to the function of the support. With respect to pipe supports, this provision applies to the expansion and contraction of the piping system as that system is exposed to cycles of hot and cold contained fluid. Further, this provision requires that to account for the expected expansion and contraction of the system, particular types of supports should be used, e.g., sliding supports, spring hangers, etc., as appropriate. This provision does not, however, require that supports be designed for expansion of the support itself under LOCA conditions." (Emphases in the original.)

There is nothing in Appendix XVII to support Applicants' conclusions. Clearly, the wording and intent of XVII-2271.3 when taken in context applies to the design of the support structure itself, not the piping system as Applicants would have the Board believe. There is no wording within Appendix XVII to indicate that it applies to the piping system, and more specifically, Section XVII-2270 addresses "SIMPLE AND CONTINUOUS SPANS AND PROVISION FOR EXPANSION" and under the sections listed, only beams, girders and trusses are discussed, not the piping systems.

Further, the items which Applicants state are covered by XVII-2271.3 are in fact covered under NF-3270 SPECIAL COMPONENT STANDARD SUPPORT REQUIREMENTS. NF-3271 General Requirements states:

> "Component standard supports (NF-1214) shall conform to the special requirements of NF-3270.
>
> "NF-3271.1 Types of Component Standard Supports.
>
> "The types of component standard supports considered are those listed in (a) through (e) below:
>
> "(a) Rigid supports consisting of anchors, guides, restraints, rolling or sliding supports, and rod type hangers;
>
> "(b) Constant and variable type support spring hangers;
>
> "(c) Hydraulic snubbers;
>
> "(d) Sway braces and vibration dampeners;
>
> "(e) Integral and nonintegral structural attachments, such as ears, shoes, lugs, rings, clamps, slings, straps, and clevises."

Loads are addressed in NF-3271.2. Provisions for Movement of Supported Component are addressed in NF-3271.3. (See CASE Exhibit 710.)

NF-3271.3 states:

> "Consideration shall be given to the relative motion of the supported piping or other supported component and the component support. When clearances or travel ranges or both are required to accommodate component movements, sufficient design margins shall be introduced to allow for variations due to fabrication and installation. Care shall be taken to ensure that design clearances and travel ranges are based on the maximum range that might occur between two operating conditions and not necessarily on the maximum cold to hot range. All parts of the support shall be fabricated and assembled so that they will not be disengaged by the movement of the supported piping. Supports needed only to provide stability during the Emergency or Faulted Conditions shall be designed and installed so as not to overstress the piping during Normal or Upset Conditions."

Mr. Doyle attempted to also address this matter in the May 16, 1983, hearings, but as sometimes happens, there were interruptions and the discussion went off on a tangent and Mr. Doyle never completed his discussion on this particular point (tr. 5948/4 through 5940/21).

Our point is that the provision for expansion discussed under XVII-2271.3 must refer to something other than the expansion of the piping system as Applicants allege. The logical interpretation of XVII-2271.3 is that it mandates that adequate provision shall be made for expansion and contraction within the support itself.

Contrary to the statements of Applicants and NRC Staff (see NRC Staff's 5/11/83 Response to Board Inquiry Regarding Appendix XVII of the ASME Boiler and Pressure Vessel Code), adequate provision must be made for expansion and contraction appropriate to the function of the support structure, as mandated by XVII-2271.3. The function of the support structure with which CASE is concerned is the ability of the support structure to operate in such a manner so as to prevent or mitigate the consequences of events associated with an emergency or faulted plant condition. Operability of these supports must be assured.

This is consistent with the provisions of NRC Regulatory Guide 1.124 (CASE Exhibit 743), which Applicants and NRC Staff have stated applies to Comanche Peak, and which the Licensing Board discussed on page 7 of its Order. See Regulatory Guide 1.124, B. Discussion, page 1.124-1; 4. Large Deformation, pages 1.124-2 and 1.124-3, and especially 5. Function of Supported System, page 1.124-3.

5. Function of Supported System states, in part:

> "In selecting the level of service limits for different loading combinations, the function of the supported system must be taken into account. To ensure that systems whose normal function is to prevent or mitigate consequences of events associated with an emergency or faulted plant condition (e.g., the function of ECCS during faulted plant conditions) will operate properly regardless of plant condition, the Code level A or B service limits of Subsection NF (which are identical) or other justifiable limits provided by the Code should be used." (Emphasis added.)

One way to assure that the supports in question would fulfill the above requirements is to analyze them including the effects resulting from constraint of free-end displacements, as stated in Reg. Guide 1.124, C. Regulatory Position 5.a. (page 1.124-5). Another way is to follow the provisions of ASME XVII-2271 and allow for expansion and contraction. Regardless of the way chosen to assure that the necessary requirements are met, they must be met -- according to ASME XVII-2271.3 and according to Reg. Guide 1.124.

Another area of concern to CASE (in which CASE is in disagreement with the Board) is the Board's ruling that the so-called "thermal stresses" need not be considered within the support itself. As stated previously, CASE believes this would be more properly termed "thermal expansion stresses created by the constraint of free-end displacement" and that it is therefore covered

under the provisions of XVII-2271.3. Another aspect of this concerns the extent of constraint of free-end displacement. If the forces created by the constraint of free-end displacement of the pipe support itself are strong enough to push whatever is constraining the free-end displacement out of the way (such as the pipe), then the stresses within the support itself would be relieved. However, if the support were restrained on each end so that it could not move when it wanted to under the uniform increase in temperature resulting from a LOCA, the support could buckle or "squash" (as stated by Applicants' witnesses Finneran and Chang, tr. 5255). Clearly, this is not permitted by Reg. Guide 1.124, which states, in part:

> B. Discussion, 1. Design by Linear Elastic Analysis (page 1.124-2):
>
> "b. Allowable Increase of Service Limits. While NF-3231.1(a), XVII-2110(a), and F-1370(a) of Section III all permit the increase of allowable stresses under various loading conditions, XVII-2110(b) limits the increase so that two-thirds of the critical buckling stress for compression and compression flange members is not exceeded, and the increase allowed by NF-3231.1(a) is for stress range. Critical buckling stresses with normal design margins are derived in XVII-2200 of Section III. Since buckling prevents 'shakedown' in the load-bearing member, XVII-2110(b) must be regarded as controlling. . . the increases permitted by NF-3231.1, XVII-2110(a), and F-1370(a) of Section III are not directly applicable to allowable shear stresses and allowable stresses for bolts and bolted connections. The increase permitted by NF-3231.1 and F-1370(a) of Section III for shear stresses or shear stress range should not be more than 1.5 times the level A service limits because of the potential for non-ductile behavior. . ."
>
> C. Regulatory Position, Position 4 (page 1.124-5):
>
> ". . .all increases (i.e., those allowed by NF-3231.1(a), XVII-2110(a), and F-1370(a)) should always be limited by XVII-2110(b) of Section III. The critical buckling strengths defined by XVII-2110(b) of Section III should be calculated using material properties at temperature. This increase of level A or B service limits does not apply to limits for bolted connections. Any increase of limits for shear stresses above 1.5 times the Code level A service limits should be justified. . ."

(See also Regulatory Position 8, page 1.124-6, which refers back to Regulatory Position 5, page 1.124-5, item a. of which refers back to Regulatory Position 4 -- see above.)

As indicated above, supports which must function so that they can prevent or mitigate the consequences of events associated with an emergency or faulted plant condition cannot be allowed to buckle or "squash," any more than bolts can be allowed to shear off.

An additional concern of CASE is the deformation which the Board's ruling would allow to occur. Reg. Guide 1.124 has much to say regarding deformation of pipe supports:

> "Component supports are deformation sensitive because large deformations in them may significantly change the stress distribution in the support system and its supported components." (Emphases added.)
>
> --B. Discussion, last sentence of first paragraph, page 1.124-1

> "4. Large Deformation
>
> "The design of component supports is an integral part of the design of the system and its components. A complete and consistent design is possible only when system/component/component-support interaction is properly considered. When all three are evaluated on an elastic basis, the interaction is usually valid because individual deformations are small. However, if plastic analysis methods are employed in the design process, large deformations that would result in substantially different stress distributions may occur.
>
> "When component supports are designed for loadings associated with the faulted plant conditions, Appendix F of Section III permits the use of plastic analysis methods in certain acceptable combinations for all three elements. These acceptable combinations are selected on the assumption that component supports are more deformation sensitive (i.e., their deformation in general will have a large effect on the stress distribution in the system and its components.) Since large deformations always affect the stress distribution, care should be exercised even if the plastic analysis method is used in the Appendix F-approved methodology combination. This is especially important for identifying buckling or instability problems where the change of geometry should be taken into account to avoid erroneous results."
>
> --pages 1.124-2 and 1.124-3

The buckling ("squashing") or deformation which the Board's ruling would allow to occur has not been addressed by the Applicants or the NRC Staff. There is nothing in the record to support a conclusion that pipe supports which have been allowed to deform will still be able to withstand the same external loads which could be withstood if the supports did not deform. The question of how much of the safety factor may be reduced by this deformation has not been addressed in these proceedings. CASE submits that it must be addressed under the requirements of Reg. Guide 1.124, even if the Board does not change its decision in this regard.

On page 6 of the Board's Order, it is stated that "This sentence (from NB-3213.13) makes it clear that thermal stress is generated because a solid body is prevented from expanding due to a change in temperature." (Emphasis added.) CASE's disagreement with the Board in this regard has to do with the definition of a "solid body." A pipe support configuration generally has a structural member attached to a concrete surface by means of anchor bolts. The structural member and the concrete surface are not bonded or clad together; they are independent of each other; there are air gaps in between them. Therefore, they cannot be considered a solid body.

"Solid" is defined in Webster's Dictionary as: "Not hollow; having its interior filled with matter. Capable of resisting, up to a certain limit, forces tending to deform; rigid; not soft or fluid. Even or unbroken in surface; as a solid panel. Entirely of one metal or containing the minimum of alloy necessary to impart hardness; as solid gold.". . etc. (Emphases in the original.)

Thus, this portion of NB-3213.13 is not helpful when applied to Comanche Peak, since the pipe support configuration at Comanche Peak is not a solid body.

On page 5 of the Board's Order, there is a discussion of the first sentence of NB-3213.13, which states:

> "Thermal stress is a self-balancing stress produced by a nonuniform distribution of temperature or by differing thermal coefficients of expansion." (Emphasis added.)

Since the temperature increase resulting from a LOCA would be a uniform, rather than a nonuniform distribution of temperature (such as a hot pipe resting on a support), that portion of NB-3213.13 does not apply to the thermal expansion stresses resulting from the constraint of free-end displacement due to a LOCA, with which CASE is concerned.

The Board discussed on page 5 an example of a concrete-steel unit (with a steel pipe attached along the diameter of the inside of a concrete cylinder), in its discussion regarding thermal stress resulting from differential coefficients of expansion. While the Board's example (if it is assumed that the concrete and steel is bonded or clad together) is a valid example of this type of thermal stress, it too is not helpful when applied to Comanche Peak, since there are no pipe supports at Comanche Peak such as the concrete-steel example. (Further, in the Board's example, the insulation of the concrete would probably alleviate the problem to begin with. For instance, CASE has never argued that the thermal stress within the Richmond insert, which is embedded in concrete, was a problem and had to be considered.)

Thus, NB-3213.13 does not resolve the particular concerns which CASE has raised regarding the thermal expansion stresses resulting from the constraint of free-end displacement due to a LOCA.

Although there are other portions of the Board's Order with which CASE does not totally agree, they have been pretty well covered already in Briefs

(which we incorporate herein by reference) or in the transcript of the hearings (see page 2 of this pleading).

There are a few items which should be addressed, however, for clarification of the record. For example, it should be noted that the temperature rise in the containment of "somewhere between 180°F and 210°F resulting from LOCA conditions (Board Order, page 1) is a nonconservative estimate. The design temperature within the containment is listed in the FSAR (Table 6.2.1-1) as 280°F. It should also be noted that a LOCA can occur at start-up, contrary to Mr. Vivirito's statement that the LOCA will occur after the plant has been in operation. Further, in the fourth paragraph on page 1 of CASE Exhibit 659G (Attachment to Mark Walsh testimony, Gibbs & Hill letter of 10/9/81 to TUGCO), it states that the analysis performed was to establish the containment integrity, and consequently the analysis maximized pressure and reduced heat transfer; and, as stated in that paragraph, the analysis is not conservative in regard to the maximum temperature that the containment can experience during a LOCA. (See also CASE Exhibit 659, Mark Walsh 7/28/82 testimony, page 2, second full paragraph; and tr. 3125/14-3128/7 and 3178/25-3179/19.)

With regard to the Board's discussion at pages 10 and 11 on "The Board's Role," CASE still does not believe that the Board can hope to determine what was in the minds of the writers of the ASME Code based on the wording in the Code -- not due to any fault on the Board's part, but because of the manner in which the Code was worded by ASME in the first place. We agree with the Board's assessment at the bottom of page 3 continued at the top of page 4 that "the ASME Code may not be as useful a document as it should be." It

should be noted, however, that in oral argument during the 6/13/83 hearings, CASE stated:

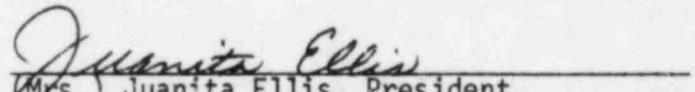
> ". . . this Board has the added responsibility of interpreting the intent of Regulatory Guide 1.124 and other NRC regulations regardless of the interpretation of ASME by Applicants or even by ASME itself, as indicated in 10 CFR Part 50, Appendix A, Criterion 1." (Emphases added.)

Thus, although CASE does not agree with the Board's bottom-line interpretation or with some specific portions of the Board's Order, we do agree with the Board's view that it does have the responsibility to form its own independent conclusions about licensing issues.

CASE'S MOTION

For the reasons stated herein and based on the entire record in this matter, CASE moves that the Licensing Board reconsider its ruling that the so-called "thermal stresses" (which CASE believes are more properly termed "thermal expansion stresses created by the constraint of free-end displacement due to a LOCA") within the pipe support itself need not be considered in the design of pipe supports at Comanche Peak.

Respectfully submitted,



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CERTIFICATE OF SERVICE

By my signature below, I hereby certify that true and correct copies of CASE'S 7/15/83 MOTION FOR RECONSIDERATION OF BOARD'S 7/6/83 MEMORANDUM AND ORDER (Thermal Stress in Pipe Supports)

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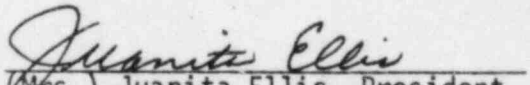

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