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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

OFFICE OF SECRETARY BRANCH

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In Matter of	)	
	)	Docket No. 50-445 and 50-446
TEXAS UTILITIES ELECTRIC COMPANY, et al.	)	
	)	(Application for Operating Licenses)
(Comanche Peak Steam Electric Station, Units 1 and 2)	)	

APPLICANTS' MOTION FOR SUMMARY DISPOSITION REGARDING DESIGN OF RICHMOND INSERTS AND THEIR APPLICATION TO SUPPORT DESIGN

Pursuant to 10 C.F.R. § 2.749, Texas Utilities Electric Company, et al. ("Applicants") hereby move the Atomic Safety and Licensing Board for summary disposition of the Citizens Association for Sound Energy's ("CASE") allegations regarding the design of Richmond inserts and their application to support design. As demonstrated in the accompanying Affidavit of John C. Finneran, Robert C. Iotti and R. Peter Deubler Regarding Design of Richmond Inserts and Their Application to Support Design ("Affidavit") (Attachment 1) and Statement of Material Facts (Attachment 2), there is no genuine issue of fact to be heard regarding this issue. Applicants urge the Board to so find, to conclude that Applicants are entitled to a favorable decision as a matter of law, and to dismiss this issue from the proceeding.

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I. BACKGROUND

In August 1982, intervenor CASE deposed Mr. Jack Doyle, a former employee of Applicants, with respect to certain allegations Mr. Doyle had regarding the design of pipe supports at Comanche Peak. Mr. Doyle's deposition was subsequently admitted into the record in this proceeding as his testimony (CASE Exhibit 669; Tr. 3631). One issue raised by Mr. Doyle concerned the adequacy of design practice regarding Richmond inserts. All parties presented testimony on this issue, e.g., CASE Exhibits 659 at 1-2, 4 and 659H at 3; Applicants' Exhibit 142D at Attachment C; and NRC Staff Exhibits 207 at 17-22, and 208 at 7.

Following litigation of the pipe support design allegations, each of the parties submitted proposed findings addressing, inter alia, allegations regarding Richmond inserts. (See Applicants' Proposed Findings of Fact Concerning Pipe Support Design Questions (August 5, 1983) at 28-40; NRC Staff Proposed Findings of Fact (August 30, 1983) at 36-46; CASE's Proposed Findings of Fact and Conclusions of Law (August 22, 1983), Section VIII; and Applicants' Reply to CASE's Proposed Findings of Fact and Conclusions of Law (September 6, 1983) at 28-30.)

In its Memorandum and Order of December 28, 1983, at 60-66, concerning design issues, the Board stated that the record was not adequate to provide reasonable assurance of adequate design practice regarding Richmond inserts. By Memorandum and Order of February 8, 1984, at 30-31, the Board reaffirmed its earlier decision.

This motion addresses CASE's concerns regarding Richmond inserts, as set forth in its Proposed Findings of Fact at Section VIII. In responding to these concerns, Applicants respond to the Board's December 28, 1983 and February 8, 1984 Orders, and provide the information which they committed to generate as part of Applicants' Plan to Respond to Memorandum and Order (Quality Assurance for Design) ("Applicants' Plan"), items 10 and 11 (February 3, 1984).

II. APPLICANTS' MOTION FOR SUMMARY DISPOSITION

A. General

Applicants have previously discussed the legal requirements applicable to motions for summary disposition in their "Motion for Summary Disposition of Certain CASE Allegations Regarding AWS and ASME Code Provisions Related to Welding," filed April 15, 1984 (at 5-8), incorporated herein by reference.

B. CASE's Allegations Regarding Richmond Inserts Should be Summarily Dismissed

In Section VIII of its Proposed Findings, CASE makes allegations regarding Applicants use of Richmond inserts that may be categorized into six basic areas, viz., (1) the factor of safety used for Richmond inserts, (2) testing of Richmond inserts, (3) ability to resist axial torsion, (4) methods used to analyze connections, (5) bending moments in the bolts, and (6) sharing of shear loads.

In responding to these concerns, Applicants committed to the following analytical and testing program (see Applicants' Plan at items 10 and 11):[1]

> "(10) Provide evidence of the capability of Richmond inserts to accept the maximum loads to which they will be subjected in tension, shear, and combined tension and shear, with ample margins of safety. This evidence will be generated by a combination of tests and analyses.
>
> (11) Provide evidence of the tension in the bolt employed by Richmond inserts and the correct load distribution in the concrete, washer, tube steel, and bolt occurring when a torque is applied to the tube steel. This evidence will be generated through the performance of finite element analyses."

The results of this analytical and testing program and associated evaluations are set forth in the attached Affidavit. As set forth more fully below, none of CASE's six concerns raise an issue that reflects a breakdown in Applicants' Quality Assurance ("QA") Program or a safety concern in the plant. Accordingly, no genuine issue of material fact exists with respect to these allegations, and the Board should find that the Applicants are entitled to judgment as a matter of law.

1. Factors of Safety Used for Richmond Inserts and Tests

This issue raises the concern that Applicants had employed a safety factor of 2 for Richmond inserts instead of the manufacturer's recommended value of 3. (See the Staff's Proposed Findings of Fact and Conclusions of Law (August 30, 1984) at 37-39 adopted in the Board's December 28, 1983 Memorandum and Order

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1 In addition, Applicants have addressed CASE's tangential concern that Applicants failed to consider the A-307 bolt in their calculations submitted as Applicants' Exhibit 142D. Affidavit at 43-46.

at 60-62). The two key aspects of this concern are (1) the appropriateness of Applicants' use of a safety factor which could be viewed as lower than that recommended by the manufacturer, and (2) the lack of certain test data regarding Richmond inserts. Affidavit at 3.

Based on testing, the manufacturer of the Richmond inserts specified the ultimate loads associated with the various sized inserts. Id. at 4. In addition, the manufacturer selected a factor of safety and back-calculated the corresponding allowable loads, i.e., the ultimate load divided by the safety factor is equal to the allowable load. Id. It should be noted that this factor of safety and corresponding recommended allowable loads specified by the manufacturer applies only to the Richmond insert itself and not to the threaded rod (sometimes used interchangeably with bolt) which may be procured separately. Id. Allowables for the threaded rod are those set forth in appropriate Codes, e.g., for A-36 threaded rod the allowed load in shear is 17.7 kips. Id.

In its design calculations, Applicants used higher allowable loads for the inserts than specified by the manufacturer. Id. Accordingly, if the ultimate loads listed by the manufacturer were applicable to Applicants' use of the inserts, it could be viewed that Applicants had reduced the factor of safety recommended by the manufacturer. Id. However, this is not the case. Taking into consideration relevant factors (e.g., the differences between the conditions of the tests from which the Richmond insert manufacturer obtained its recommended ultimate loads and the conditions known by Applicants to exist in the actual applications of the Richmond inserts at CPSES), the ultimate loads for the inserts used at CPSES are much higher than those specified by the manufacturer, and the actual safety margin for Richmond inserts in CPSES is essentially equivalent to that recommended by the manufacturer. Id. at 4-11.

Two sets of tests have been conducted that verify Applicants' position. Id. at 11-17. First, at the request of the NRC Staff, shear tests were conducted at CPSES on 1-1/2 inch Richmond inserts in March 1983. Id. at 11. The results of these tests demonstrate that the performance capabilities of the Richmond inserts in shear exceed the design allowables by a ratio in excess of 3.3 to 1. Id. at 12. Because the tests were terminated before failure, the actual ratio is higher, and the results are conservative. Id.[2]

In addition, a second series of tests were conducted in March and April 1984. Id. at 13. These tests were performed to determine the load-carrying characteristics of 1 and 1-1/2 inch Richmond inserts (inserts of concern here) when subjected to tension only, shear only and combined shear and tension loadings. Id. The test results confirm the judgment of Applicants that the actual factors of safety for the Richmond inserts used at CPSES

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2 It should be noted that the test results for the specimens with and without 1 inch washers installed were comparable, indicating that the presence of the washer has little effect on the performance of the threaded connection/bolt or the Richmond insert. Id. If any bending stress is introduced in the bolt as a result of the 1 inch thick washer, the test results show that it is not significant. Id. at 12-13.

are in excess of 3.0 for shear, tension and combined shear-tension loadings. Id. at 13-14.

In sum, from the foregoing, Applicants conclude that the margins of safety for Richmond inserts for loading in shear, tension and combined shear-tension for the conditions at CPSES are in excess of a factor of 3.0.[3]

2. Ability to Resist Axial Torsion

This issue refers to a concern by CASE regarding the ability of the Richmond assembly (including the threaded rod) to resist "axial" torsion. The Board concurred with CASE's view that the Applicants' manner of computing the tension force in the bolt of the Richmond insert assembly, resulting from torsion in the tube steel, was incorrect. Id. at 18.

In computing the torsion force in the bolt of a Richmond insert, Applicants used formula T = Fd; where T = torsion applied to the steel tube, F = tension in the bolt, and d = the distance from the bolt to the force acting on the washer. Id. The Board believed that Applicants were using an incorrect calculation to determine the distance "d," i.e., 2/3 of the one half of the width of the washer. See December 28, 1983 Memorandum and Order at 62-66. Affidavit at 19.

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3 As to CASE's concern that the concrete used in the tests has more rebar than that found at CPSES, Applicants have conducted a review of a representative sample of test reports of concrete used at CPSES to assure that such concrete is essentially the same as that used in the tests. Id. at 16-17. In addition, Applicants have reviewed NCRs regarding concrete at CPSES to provide additional assurance that the concrete used in these tests was representative of that used at CPSES. Id. at 17. In short, with regard to concrete, the test conditions are representative of, and even more conservative than, the conditions at CPSES. Id.

While Applicants, in general, did not use this calculation to determine the value of "d," Applicants conducted an evaluation of the methodology used in calculating "d" to determine whether it accurately reflected the appropriate load distribution. Id. at 19. As a result of the evaluation, Applicants conclude that while the method used to calculate "d" is valid if the problem were truly two-dimensional, and is generally employed for solving problems of this kind, the distribution of strains within the assembly is a tri-dimensional complex pattern and without further analyses the issue could not be resolved with certainty. Id. at 20-21.

To study this problem further, Applicants performed detailed finite element analyses utilizing the STARDYNE computer program. Id. at 21. The results of the analyses indicated that the methods used by Applicants, as described above, did not precisely model the resulting forces. Id. Further, the formulas used by Applicants resulted in a calculated force that was low for virtually all supports by as much as 18 percent (for six specific 4 x 4 x 1/2 inch tube steel sections, the calculated force was low by a factor of 33%). Id. at 21. However, because of conservatisms in the methodology and process used by Applicants in the initial calculations, the finite element analyses and confirmatory testing reflected that in all cases allowables would not have been exceeded. Id. at 21-24 and Attachment F.

In the process of performing the finite element analyses, Applicants noted that when it was assumed that no clearance existed between the tube steel and the bolt, a shear couple is created which places the bolt in bending. Id. at 24-5. The effect becomes pronounced when the bolt holes are offset to their largest values. Id. at 25. To investigate the possible adverse effects on the connections of this condition, Applicants developed a screening criterion which was based on very conservative assumptions. Id. Testing revealed that the assumptions were exceedingly conservative and contained factors of safety in excess of 10. Id. at 25-8. Based on Applicants' evaluations, only 12 supports exceeded the conservative criterion. Id. at 24-30. Subsequent testing revealed that with regard to the 12 supports, there is no safety concern, and an adequate margin of safety exists. Id. at 28-30.

In sum, from the foregoing Applicants conclude that the Richmond inserts have adequate capacity to withstand the effects of axial torsion with adequate margins of safety and without any adverse impacts.

3. Method Used to Analyze Connection

CASE criticized the method used by Applicants to analyze the connections of the bolts, tube steel and Richmond inserts in that Applicants assumed the release of all moments except the torsional moment (M_x). Id. at 31. While CASE agrees that the moment in the tube about the axis of the bolt (M_y) cannot develop, it contends that the moment (M_z), which would tend to produce a prying action, should either be considered (i.e., "coupled out") whenever the torsional moment (M_x) is considered, or both M_x and M_z should be released. CASE Proposed Findings at VIII-6.

Applicants performed a finite element analysis in response to these concerns. The results of the analysis reflect that Applicants' method of calculation (i.e., the release of all moments except the torsional moment (M_x)) is appropriate, and no increase in bolt tension is experienced. Id. at 32-40.

In addition, a parametric study was used to analyze if any prying action would occur from a bending moment (M_z) produced due to a torsional load. Id. at 33. The results of this study indicate that there is no prying action. Id. at 33-37, n. 12.

Applicants also reanalyzed several support configurations selected at random to test the effect of assuming the release of all moments, as CASE recommended. Id. at 39. The results of this analysis indicate that adequate margins exist even considering fully released moments. Id.

In sum, from the foregoing Applicants conclude that with regard to this issue, the method used to analyze connections is correct and assures adequate margins of safety.

4. Bending Moments

CASE has also expressed concern with allegedly high bending moments caused by shear forces on a bolt that is offset from the concrete surface by the use of a one-inch washer between the concrete and the support steel (see the discussion in Applicants' Proposed Findings at 35-37).

Applicants have utilized a finite element analysis to evaluate the effected supports which are highly loaded in shear. Affidavit at 40. The results of this analysis reflect that such bending moments do not present a safety concern (Id. at 40-42).

These results were reinforced by testing which demonstrated that deflection of the supports at the design loads are very small regardless of whether the load is applied torsionally or as a shear load, and that ample margin against failure exists. Id.

5. Sharing of Shear Load

CASE has also raised a concern with the sharing of a shear load by all the bolts in a particular support. CASE's Proposed Findings at VIII-10. More specifically, CASE alleges that because of the presence of oversized bolt holes, only half or fewer of the bolts would accept the shear, and these would exceed allowable values before the remainder of the bolts could take up the load. Id. at 42.

Since this issue is common to all connections, not just Richmond inserts, Applicants have elected to address it in a separate Affidavit and Motion for Summary Disposition Regarding the Effects of Gaps on Structural Behavior Under Seismic Loading Conditions, filed in this proceeding on May 18, 1984, and, as appropriate, incorporated herein by reference.

III. CONCLUSION

For the foregoing reasons, Applicants request that the Board grant Applicants' motion for summary disposition.

Respectfully submitted,

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