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August 23, 1984
84042.015

Mr. J. B. George
Project General Manager
Texas Utilities Generating Company
Comanche Peak Steam Electric Station
Highway FM 201
Glen Rose, Texas 76043

Subject: U-Bolt Cinching Testing/Analysis Program - Phase 3 Open Item
Comanche Peak Steam Electric Station
Independent Assessment Program - Phase 3
Job No. 84042

References:
(1) Applicants' Motion for Summary Disposition of CASE's Allegations Regarding Cinching Down of U-Bolts
(2) Applicants' Statement of Material Facts as to Which There is No Genuine Issue Regarding Consideration of Cinching U-Bolts
(3) Affidavit of Robert C. Iotti and J. C. Finneran, Jr. Regarding Cinching Down of U-Bolts
(4) "Comanche Peak Steam Electric Station U-Bolt Finite Element Analysis," Westinghouse Electric Corporation, June 12, 1984
(5) "Comanche Peak Steam Electric Station U-Bolt Support/Pipe Test Report," EQ&T-EQT-860, Rev. 0, Westinghouse Electric Corporation

Dear Mr. George:

Cygna has reviewed the above-referenced documents as committed to in the Phase 3 Final Report. Attachment A contains our comments and questions. Cygna cannot complete an assessment of the pipe supports which employ cinched U-bolts until the responses to the questions contained in Attachment A are received.

If your staff would prefer to discuss these questions in more detail please notify us.

Very truly yours,

John C Umuchallo for

N. H. Williams
Project Manager

dmm
Enclosure
cc: Mr. D. Wade (TUGCO)
Ms. J. Van Amerongen (EBASCO/TUGCO)
Mr. R. Ballard (G&H)
Mr. S. Treby (USNRC)
Mr. S. Burwell (USNRC)
Mrs. J. Ellis (CASE)

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ATTACHMENT A

1. Please provide a detailed numerical breakdown of how the stresses in Tables H, I, N and O of the Affidavit (reference 3) were obtained.

2. On page 70 of the Affidavit (reference 3) TUGCO states that preload is non-cyclic and therefore need not be included in a fatigue evaluation. However, during the life of the plant it is reasonable to assume that a cinched U-bolt will, for some reason, be uncinched and retorqued. Therefore, Cygna believes that preload should be considered a cyclic load for both primary plus secondary and fatigue evaluations.

3. In the Affidavit (reference 3), page 28, TUGCO lists 4^k as the maximum OBE load for a 10-inch pipe. In Table 1, the maximum OBE snubber load is 6.7^k for a 10" pipe, with an emergency load of 8.6^k. Since TUGCO has only tested the U-bolts up to 4^k, how does this justify that the support will remain stable under dynamic loads up to 8.6^k with a 50 ft.-lb. of U-bolt preload? A similar discrepancy exists for the 4" pipe. How can the U-bolt be qualified for stability at a load greater than that at which it was tested?

4. In choosing the temperatures for the Westinghouse analysis and test, TUGCO has used 250°F as the maximum for the 10" pipe. Please provide system operating data which justifies 250°F as the maximum expected operating temperature.

5. In the Westinghouse analysis report (reference 4), pages 37 and 38, there are significant differences in the magnitude and sign of the stresses generated by test (reference 5) and analysis. Westinghouse discusses possible reasons for the differences, but does not attempt to numerically correlate these qualitative discussions. Since the analysis results are used to qualify the stresses in the pipe, Cygna is concerned that inadequate correlation between the testing results and the analytical output may affect the conclusions. Were any further analyses performed to confirm the validity of the reasoning or assess the sensitivity of results? If not, please provide additional justification for these apparent discrepancies.

6. In reference 3 TUGCO establishes minimum preloads using the Westinghouse analytical results. As TUGCO has stated, A-36 material can undergo relaxation if it is stressed above 1/2 yield. Please provide assurance that the preload remaining after initially preloading the U-bolt to the TUGCO established minimum is sufficient to preclude slippage during a seismic event after the pipe has been heated and cooled and the support loaded and unloaded.

   Or, stated differently, preload reductions occurred during the vibration testing and seismic simulation. Given the variability in the bolt torque/preload relationship, is it not possible for these reductions to lower the preload below the level required for stability?

ATTACHMENT A

7. Prior to the latest revision (rev. 24) of QI-QAP-11.1-28, there were no installation tolerances on strut angularity. Cygna has also found no design requirements for strut angularity, other than the 5° each vendor typically uses. Discussions with TUGCO personnel on site indicate that a 5° installation tolerance was used prior to the tolerance now shown in revision 24 of QI-QAP-11.1-28. Thus, the following is possible:

   (a) Due to the thermal movement, a designer may find the angularity is 5° east from the vertical. This is acceptable and noted as such in the vendor certification.

   (b) Brown and Root personnel install the strut with an initial angularity of 5° east. Since this is within manufacturer's guidelines, QC accepts the deviation. No note is needed on the drawing.

   (c) Thus, the total angle under thermal loading would be 10°, not the 5° TUGCO used in testing.

   Does TUGCO have justification that this is not the case for any of the 360 supports using U-bolts?

8. In the vibration simulation test was the strut offset 3.5° in each of two orthogonal directions (triaxial test) or only offset 3.5° in one direction (parallel to the floor)? Why was 3.5° used instead of the allowable tolerance of 5°?

9. In response to the question on page 61 of the Affidavit (reference 3) you have stated that conservative values were chosen for mechanical piping stresses in comparison to stresses randomly selected by Gibbs & Hill. Please justify the Gibbs & Hill sample size.

10. Justify the use of a 1500 lbs. amplitude of load in the normal vibration simulation test.

11. The results of the seismic loading simulation test appear incomplete and inadequate. Please explain how a sinusoidal input is used to simulate a seismic test.

12. The following torque versus preload data was taken from the U-Bolt Support/Pipe Test Report.

Pipe	Torque (ft. lbs.)	Preload (lbs.)	Page
10" Sch 80 carbon	100	8057	8
10" Sch 40 stainless	100	5444	8
"	100	4509	53
"	100	3606	66
"	100	6100	46

ATTACHMENT A

Has this apparent scatter in preload versus torque data been adequately accounted for in the torquing levels prescribed in Table P of the Affidavit (reference 3)? If so, how?

13. Due to painting, the torque required to obtain a given preload will be higher than that obtained during the tested (unpainted threads) condition. How will be this be accounted for in the torque inspection program?

14. The friction test at the final preload was performed three times for each of the four pipes. Figures 9 through 12 appear to be the results of only one of three tests. Please furnish the results from the other two tests.

15. For each friction test U-bolt preload was measured at each bolt torque increment. Please give the bolt torque versus preload data from these tests so that the variability in the relationship can be more reliably determined.

16. Please discuss the increase in preload with time exhibited in figure 26 of reference 5. Was this due to a lack of temperature compensating strain gages?

17. On page 80 of the U-bolt Test Report, the left side of the fourth equation should be divided by 2. This error, however, does not appear to affect the value of the coefficient of friction calculated in the fifth equation.

18. For 10" schedule 40 stainless pipe, the minimum preload defined for stability occurs with a bolt torque of 46 ft.-lbs. (U-Bolt Finite Element Analysis, page 7 and Affidavit, page 47). The recommended torque value (Affidavit page 74) is 50 ft.-lbs. Please justify the apparent low safety factor against instability.

    On page 37 of the Affidavit (reference 3) it states that "the minimum torque conservatively estimated to be for stability is about 25 ft.-lbs. . . ." Why are the U-bolts on 4" piping being inspected for 25 ft.-lbs. of torque (Table P) when this is the torque value required for stability? Please justify the use of an apparent 1.0 safety factor against U-bolt stability.

    Please explain why the minimum preload for a 10" schedule 40 stainless pipe (2.54 kips at 46 ft.-lbs.) should be so different from that of a 10" schedule 80 carbon pipe (0.83 kips at 11 ft.-lbs.).

19. Are cinched U-bolts used on other pipe sizes or pipe schedules not included within the testing/analysis program? If so, how are these results to be applied to other pipe sizes and schedules?