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March 14, 1984
84042.06

50-445/446

Mrs. Juanita Ellis, President
Citizens Association for Sound Energy
1426 South Polk
Dallas, Texas 75224

Subject: Comanche Peak Steam Electric Station Independent Assessment Program - Response to CASE Questions

Reference: (1) Brief Summary of Generic Problems from CASE Witness Jack Doyle, 2/22/84.

(2) Brief Summary of Cross-examination Questions from CASE Witness Mark Walsh, 2/22/84.

Dear Mrs. Ellis:

Enclosed please find our responses to reference (1) items 2 and 8.

Further responses will be forthcoming.

Very truly yours,

N. H. Williams

Nancy H. Williams
Project Manager

NHW:eam
Enclosures: Attachment A, Partial Responses to CASE Questions

cc: See attachment

B001
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1.0 CASE Question

Local effects on tube walls:

- o Punching shear
- o Effect on welds
- o Resultant effect due to wall flexibility on moment at tube weld

2.0 Cygna Interpretation

When tube sections are employed in the design of pipe supports, how were the following local effects considered:

a. Punching shear?

b. Effect on welds?

c. Resultant effect due to wall flexibility on moment at tube weld?

3.0 Response

Consider pipe support RH-1-062-002-S22R (CASE Exhibit 897). It is designed using a tube section, TS 4" x 6" x 1/2", welded to a baseplate at one end and to a strut clevis at the other end. Punching shear and welding stresses are discussed below:

a. Punching shear stresses are within allowable for all supports reviewed by Cygna. This is evidenced by the punching shear check provided in Enclosure D2-1.

Adequacy can also be determined by inspection through a simple comparison betwen the weldment shear stress and the punching shear stress in the flange, as illustrated below:

Based on force equilibrium,

$$t_c = (F_x * .707 * t_w)/(.4 * F_y)$$

where t_c = tube wall thickness, inches

F_s = allowable weld shear stress, ksi (use 18 ksi)

t_w = fillet weld leg size, inches

F_y = allowable tube shear stress, ksi (use 31 ksi)

substituting,

$$t_c = (18 * .707 * t_w)/(.4 * 31) = 1.0\ t_w$$

Therefore, if the fillet weld leg is equal to the tube thickness, punchout shear stresses will be satisfactory. For support RH-1-064-S22R, the tube thickness (1/2") is twice the attached fillet weld (1/4").

b. Each welded connection in support RH-1-064-011-S22R is discussed below:

<u>Tube to-Baseplate</u>

This connection is a standard beam-to-column detail, as evidenced by the AISC Manual, Part 4. Furthermore, the flare-bevel weld detail has been properly evaluated and sized by the designer.

<u>Tube-to-Clevis</u>

Attaching the strut clevis to the tube flange introduces no adverse effects into the connecting fillet weld.

c. Flexibility of the tube flange produces no significant additional loads on the weld due to diaphragm action. This welded connection compares favorably with certain standard weldments shown in Blodgett's <u>Design of Welded Structures</u> (see Enclosures D2-1 and D2-2). The connections shown in these enclosures are more "flexible" than the tube-to-clevis detail in support RH-1-064-S22R, and are not evaluated for added weld stresses due to diaphragm action.

ENCLOSURE D2-1

Punching shear check for Support No. RH-1-062-002-S22R.

Reference: American Welding Society (AWS), D1.1, Section 10.5.

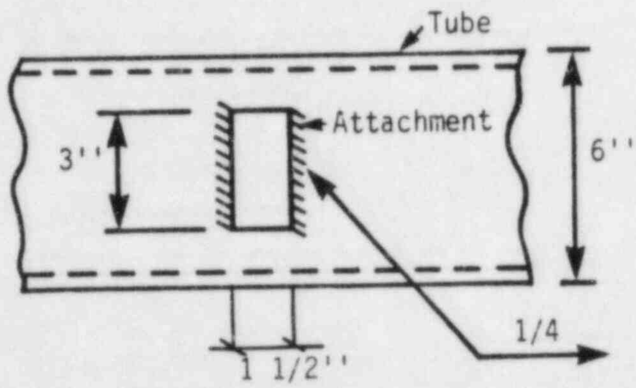

FIGURE D2-1

Applied axial load = 5092 lbs.

Since the attachment is not a tube and only welded on the 3" side, the calculation of F_a in the following equation for Acting V_p (AWS Section 10.5.1) will be conservatively high, because the loads shared by the 1-1/2" sides of the tube are being neglected.

$$\text{Acting } V_p = \tau \left(\frac{f_a \sin\theta}{K_a} + \frac{f_b}{K_b}\right)$$

where $f_a = 5092/(3+3)\ t_b = 849/t_b$

$f_b = 0$

$\theta = 90$ degrees

$\tau = t_b/t_c$

$B = b/D$

$K_a = 1.0$

Acting $V_p = 1698$

Basic $V_p = F_y/(0.6\gamma)$ where $\gamma = D/2t_c$

$= 31350/(0.6)(6)$ $= 6/2(1/2) = 6$

$U = (f_a + f_b)/0.6\ F_y$ (see Note 1, Table 10.5.1)

$f_a = 849/t_b = 849/(1/4) = 3395$ psi

(Note: f_a is conservatively calculated using t_b of 1/4", i.e., the weld size).

$U = (3395 + 0)/(.6)(31350) = 0.18$

Since U less than 0.44, $Q_f = 1.0$; and, since beta (0.5) is less than 0.6, $Q_b = 1.0$.

Allowable $V_p = Q_bQ_f$ (Basic V_p)

$= (1)(1)(8708$ psi$) = 8708$ psi

This is considerably greater than the Acting A_p = 1698 psi.

Design margin = 1 = (1698/8708) = .80 = 80%

OK.

Comanche Peak ASLB Hearings
Response to CASE Questions
Question No.: Doyle #8
Exhibit No.: 893

1.0 CASE Question

There is no documentation in calculations to support the conclusion that flare welds are stronger than fillet welds--no calculations; therefore, why did Cygna accept this statement?

- o Flare weld strength depends on radius of flare (depth).

2.0 Cygna Interpretation

Why did Cygna consider flare welds stronger than fillet welds when no calculations were made?

3.0 Response

In the case of a welded beam attachment for SI-1-079-001-S325, flare welds are stronger than a 1/4" fillet weld for two reasons:

1) Minimum effective throat thickness (t_e) is greater

   o For flare weld:

   $$t_e = 5/16\ R = 5/16\ (1\text{-}1/4") = 0.39"$$

   where R = minimum weld groove radius
   = 1-1/2 (1/2") + 1/2" = 1-1/4"

   o For fillet weld:

   $$t_e = 0.707\ (1/4") = 0.18"$$

   since 0.39"   0.18", a flare weld is considerably superior to a 1/4" fillet weld.

2) More weld length

For the welded beam attachment considered, the weld length is 2" along the square side versus 3" along the beveled side. Consequently the installed flare weld along the bevel will give this support 50% more capacity for the same t_e.

Communications Report

CYGNA

Company: CASE	☒ Telecon	☐ Conference Report	
Project: Comanche Peak Steam Electric Station Independent Assessment Program		Job No.	84042
		Date:	March 6, 1984
Subject: ASLB - Clarification of Technical Questions		Time:	3:00 p.m.
		Place:	Cygna - San Francisco
Participants: Juanita Ellis		of	CASE
Nancy H. Williams			Cygna

Item	Comments	Required Action By
	I called Mrs. Ellis to clarify some of the questions transmitted to Cygna on 2/22/84 as follows:	
1.	<u>Reference: Mr. Doyle's Questions, Item 5</u> Please explain what is meant by "the inaccurate conclusions."	
2.	<u>Reference: Mr. Doyle's Questions, Item 5</u> What is meant wide/thin ratio? What is the 1:4:1 ratio?	
3.	<u>Reference: Mr. Walsh's Questions, Item 4</u> Is the reference to PI-02 correct since there is no table on this checklist?	

Signed: N. H. Williams /eam Page 1 of 1

Distribution: See attachment

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Communications Report

CYGNA

Company	CASE	☒ Telecon	☐ Conference Report
Project	Comanche Peak Steam Electric Station Independent Assessment Program	Job No.	84042
		Date	March 7, 1984
Subject	ASLB - Response to questions on 3/6/84 telecon	Time	2:00 p.m.
		Place	Comanche Peak
Participants	Juanita Ellis	of	CASE
	Nancy H. Williams		Cygna

Item	Comments	Required Action By
	I called Mrs. Ellis for CASE's response to the above referenced telephone conversation. She provided the following clarifications: <u>Reference:</u> <u>Mr. Doyle's Question, Item 5</u> Mr. Doyle will be sending some information within the next day which should clarify his question. Mrs. Ellis will express mail this information to Cygna. <u>Reference:</u> <u>Mr. Doyle's Question, Item 9, second sentence</u> The wide/thin ratio is the face width of the weld/effective throat. The 1:4:1 ratio was a typographical error. The correct value is 1.4:1. <u>Reference:</u> <u>Mr. Walsh's Question, Item 4</u> The correct reference should be PI-02-03 rather than PI-02.	

Signed: N. H. Williams /eam Page 1 of 1

Distribution: See attachment

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