RELEASE AUTHORIZATION

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WHC Information Release Administration Specialist:

V. L. Birkland
V.L. Birkland

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7. Abstract The existing Condensate Tank (TK-C-100) in the 242-A Evaporator building is not anchored to the floor slab. This tank is a Safety Class 3 sitting in a Safety Class 2 building. The tank needed to be evaluated to withstand the seismic loads. Anchor bolts have been designed to hold the tank during the seismic event.		

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242 -A EVAPORATOR
CONDENSATE TANK (TK-C-100)
TIE DOWN EVALUATION

November 1994

Prepared by 11-15-94
T. S. Hundal, Principal Engineer
Structural Integrity Assessment
Date

Checked by 11-17-94
B. J. Niemi, Engineer
Structural Integrity Assessment
Date

Approved by 12-2-94
K. V. Scott, Manager
Structural Integrity Assessment
Date

WESTINGHOUSE HANFORD COMPANY
Hanford Operation and Engineering Contractor
for the US Department of Energy

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DESIGN CALCULATION

Rev. 0

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(1) Drawing H-2-40704 (2) Doc. No. _____ (3) Page _____ of _____
(4) Building 242-A (5) Rev. _____ (6) Job No. _____
(7) Subject CONDENSATE TANK - HOLD DOWN ANCHORS
(8) Originator J Stundel Date 11-15-94
(9) Checker Bo Turri Date 11-17-94

(10)

PROBLEM STATEMENT

THE EXISTING CONDENSATE TANK (TK-C-100) IS NOT ANCHORED TO THE FLOOR SLAB. THIS TANK IS SAFETY CLASS-3 (SC-3) SITTING IN A SAFETY CLASS-2 (SC-2) BUILDING. DESIGN APPROPRIATE ANCHOR SYSTEM TO WITHSTAND SEISMIC LOADS.

DESIGN BASIS

SEE REFERENCES

ASSUMPTIONS

IT IS ASSUMED THAT THE TANK IS PRE-QUALIFIED TO WITHSTAND SEISMIC LOADS

CONCLUSIONS AND RECOMMENDATIONS

PROVIDE ANCHOR BOLTS AS SHOWN ON PAGE 10.

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 (9) Checker Bg. Ruoff Date 11-17-94

(10)

REFERENCES

1. WHC-SD-GN-DGS-30006, REV. 1, GUIDELINES for ASSESSING THE SEISMIC ADEQUACY OF SAFETY CLASS 3 & 4 EQUIPMENT AT THE HANFORD SITE.
2. HPS-SDC 4.1, REV. 11, STANDARD ARCH-CIVIL DESIGN CRITERIA - DESIGN LOADS FOR FACILITIES.
3. TM-5-809-10, TRI-SERVICE MANUAL, FEB. 1982
4. API STD. 650, WELDED STEEL TANKS FOR OIL STORAGE REV. 1 FEB. 1984
5. DRAWINGS:
  - H-2-40704
  - H-2-69357
  - H-2-69336
  - H-2-69277
  - H-2-69278 SH. 1 & 2
  - H-2-69343

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 (9) Checker BG. Pierce Date 11-17-94

(10)

WT. OF TANK & CONTENTS

WALL THICKNESS = $5/16"$

TANK WT.

$$\text{SKIRT WT.} = (3'-8\frac{1}{2}") (\pi \times 14) (\frac{5}{16}) (\frac{1}{12}) \times 490$$

$$= 2081 \#$$

$$\text{TANK WALL} = 14 (\pi \times 14) (\frac{5}{16}) (\frac{1}{12}) \times 490$$

$$= 7,857 \#$$

$$\text{TOP HEAD} = (2\pi r h) \times (\frac{5}{16}) (\frac{1}{12}) \times 490$$

$$= 2\pi \times 168 \times \frac{1}{2} \times 22.5 \times (\frac{1}{12}) (12.76)$$

$$= 2105 \#$$

$$\text{BOT. HEAD} = 2105 \#$$

$$\text{WT. OF WATER} = 15' \times \pi \times 14^2 \times (\frac{1}{4}) (62.4)$$

$$= 144,086 \#$$

$$= 145,000 \#$$

TOTALS

$$\text{EMPTY TANK WT.} = 2081 + 7857 + 2(2105)$$

$$= 14148$$

$$= 15000 \#$$

$$\text{TOTAL WT.} = 145 + 15$$

$$= 160 \text{ K}$$

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HYDRODYNAMIC EFFECT

a) TOTAL HORIZONTAL RIGID BODY FORCE (REF. 3)

$$V_{RB} = ZIKCS(W_r + W_w + W_I)$$

$$W_r = \text{Wt. of Roof} = 2.1 \text{ K}$$

$$W_w = 7.9 + 2.1 = 10 \text{ K}$$

$$W_I = \text{EFF. IMPULSIVE WT.} \\ = .82 \times 145 \text{ K} = 119 \text{ K}$$

$$ZIKCS = (.3)(1.5)(2)(.14) = .13$$

$$V_{RB} = .13(2.1 + 10 + 119) = 17 \text{ K}$$

MOMENT @ BASE OF TANK

$$M_{RB} = ZIKCS(W_r h_r + W_w h_w + W_I h_I)$$

$$h_r = 19.5' \pm$$

$$Z = .30 \text{ (Ref. 1 Table 2.2)}$$

$$I = 1.5$$

$$CS = .14$$

$$K = 2$$

$$\alpha = h/R = 17/7 = 2.43$$

$$W_I/W = .82$$

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$$d_{max} = \left\{ \frac{.75(ZIKCS)}{1 - k_d(ZIKCS)} \right\} R = \left\{ \frac{.75(.06)}{1 - 1.84(.06)} \right\} (7)$$

$$= .35' < h_f - h = 18 - 17 = 1.0' \therefore \text{ok}$$

TOTAL DESIGN FORCES

$$V_T = \sqrt{V_{RB}^2 + V_{SL}^2} = \sqrt{17^2 + (1.7)^2}$$

$$= 17.1 \text{ K}$$

$$M_T = \sqrt{M_{RB}^2 + M_{SL}^2} = \sqrt{(156)^2 + (23.7)^2}$$

$$= 158 \text{ K-ft}$$

RESISTANCE TO OVERTURNING (REF. 4)

WT. OF TANK CONTENTS THAT RESIST OT

$$W_L = 1.25 \text{ GHD}$$

$$= 1.25(1)(17)(14) = 296 \text{ #/ft of SHELL CIRC.}$$

CHECK IF ANCHORS REQ'D

$$W_t = 15/\pi(14) = .34 \text{ #/ft.}$$

$$\frac{M}{D^2(W_t + W_L)} = \frac{158}{14^2(.34 + 296)}$$

$$= 1.27 < 1.5$$

$$\therefore \frac{b + W_L}{W_t + W_L} = 3.3$$

$$b = 3.3(.34 + 296) - 296 = 1.8 \text{ #/ft}$$

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 (9) Checker [Signature] Date 11-17-94

(10)

$$f_a = \frac{b}{12t} = \frac{1.8}{12(.3125)} = .48 \text{ ksi} = 480 \text{ psi}$$

$$\frac{GHD^2}{t^2} = \frac{(1)(17)(14)^2}{(.3125)^2} = 10662 < 10^6$$

$$\begin{aligned} \therefore F_a &= \frac{10^6 t}{2.5D} + 600 \sqrt{GH} \\ &= \frac{10^6 (.3125)}{2.5(14)} + 600 \sqrt{1(17)} \\ &= 8930 + 2470 \\ &= 11400 \text{ psi} > 480 \text{ psi} \\ &\therefore \text{OK} \end{aligned}$$

$$\text{OT MOMENTS} = 158 / \pi(14) = 3.59 \text{ k/Ft.} = M_T$$

$$\text{RESISTING MOMENT, } M_R = 296 \times 7 = 2092 \text{ #/Ft. of CIRCUM.}$$

$$M = M_T - M_R = 3.59 - 2.1 = 1.49 \text{ k/Ft.}$$

$$M = 1.49 (\pi \times 14) = 66 \text{ k-in}$$

ANCHOR BOLTS DESIGN

$$\begin{aligned} \text{ANCHOR BOLT TENSION, } T &= \frac{4M}{ND} - \frac{W}{N} \\ &= \frac{4 \times 66}{8 \times 14.3} - \frac{15}{8} \\ T &= .43 \text{ k/BOLT} \end{aligned}$$

$$\begin{aligned} \text{ASSUME ONLY 4 BOLT RESIST SHEAR} \\ \text{SHEAR/BOLT, } S &= \frac{V_T}{4} = \frac{17.1}{4} = 4.25 \text{ k} \\ (\text{VERY CONS. NO FRICTION CONSIDERED}) \end{aligned}$$

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CONC. $f'_c = 3000$ psi
 SLAB THICKNESS = 20"
 Ref. DWG. H-2-69277
 H-2-69278

ANCHOR BOLTS SIZE & DETAILS

TRY 1" ϕ x 8" HKB-II w/ 4 1/2" MIN. EMB

$$T_A = 1.9^k, S_A = 7.125^k \quad (\text{REF. 1})$$

TABLE 4.5

CHECK UNITY FORMULA

$$T/T_A + S/S_A < 1.0$$

$$.43/1.9 + 4.25/7.125 = .82 < 1.0$$

$\therefore$ OK

USE 8-1" ϕ x 8" HKB-II w/ 4 1/2" MIN. EMB

USE EXIST. HOLES IN THE BASE RING

ALTERNATE ATTACH. W/O WELDING TO BASE RING

IF FOR LACK OF CLEARANCE TO DRILL HOLES IN THE BASE RING, USE FOLLOWING DETAIL.

TRY PL $t \times 6 \times 6$ $M = .43 \times 3 = 1.29^k\text{-in}$

$$t_{REQ'D} = \sqrt{\frac{2M}{9b}} = \sqrt{\frac{2 \times 1.29}{9 \times 6}} = .22"$$

USE PL 1/2" x 6" x 6"

TO INSTALL 1" ϕ HKB

* FABRICATE SHIM PLATE(S)
 w/ 1 1/8" ϕ HOLE & TO FIT
 SNUG BETWEEN BOLT & BASE RING