

ATTACHMENT 4

CALCULATION WCG-1-867
BURIED ERCW AND HPFP PIPING/SETTLEMENT EVALUATION

9204070334 920401
PDR ADOCK 05000390
A PDR

TVA 10697 (DNE-6-86)

TITLE BURIED ERCW & HPFP PIPING/SETTLEMENT EVALUATION		PLANT/UNIT WBNP/UNIT 1 & 2	
PREPARING ORGANIZATION NE-EBASCO	KEY NOUNS (Consult RIMS DESCRIPTORS LIST) BURIED PIPE, ERCW, HPFP, YARD		
BRANCH/PROJECT IDENTIFIERS WCG-1-867	Each time these calculations are issued, preparers must ensure that the original (RO) RIMS accession number is filled in. Rev (for RIMS' use) (1) RIMS accession number		
	RO	910607F0039	B18 910429 258
APPLICABLE DESIGN DOCUMENT(S) WB-DC-40-31.5	R_		
	R_		
SAR SECTION(S) 3.7.3.12	UNID SYSTEM(S) 026,067	R_	
Revision 0	R1	R2	R3
ECN No. (or indicate Not Applicable) N/A c/p 4/27/91			
Prepared <i>Chris Parter</i>			
Checked <i>Gwen Chen</i>			
Reviewed <i>Gwen Chen</i>			
Approved <i>J. Stans 1</i>			
Date 4/29/91			
Use form TVA 10534 if more space required.	List all pages added by this revision.		
	List all pages deleted by this revision.		
	List all pages changed by this revision.		

Safety-related? Yes No

Statement of Problem
THE BURIED SAFETY-RELATED ERCW & HPFP PIPING SHOWN ON MECHANICAL DWG. SERIES 17W302 IS QUALIFIED FOR SOIL SETTLEMENT PER DESIGN CRITERIA WB-DC-40-31.5, "ANALYSIS OF SAFETY RELATED BURIED PIPING SYSTEMS".

ORIGINAL

Abstract

These calculations contain an unverified assumption(s) that must be verified later. Yes No

THIS CALCULATION DOCUMENTS THE ANALYSIS AND QUALIFICATION OF THE BURIED ERCW AND HPFP SAFETY-RELATED PIPING. SOIL SETTLEMENT ANALYSIS AND QUALIFICATION HAS BEEN PERFORMED PER THE REQUIREMENTS OF DESIGN CRITERIA WB-DC-40-31.5, "ANALYSIS OF SAFETY RELATED BURIED PIPING SYSTEMS", REV 3. ALL BURIED ERCW AND HPFP SAFETY RELATED PIPING IS ACCEPTABLE PER CRITERIA

LEGIBILITY EVALUATED and ACCEPTED for issue.

J. Stans 4/29/91
 Signature Date

58 PA 10/24/91 CEB

Microfilm and store calculations in RIMS Service Center. **DEBBIE KILLGORE**

Microfilm and return calculations to: **CALC. LIBRARY**

Microfilm and destroy.
WBNP TRAILER NCE7
 Address: **WBN N-QA-BLOC**



CALC ID WCG-1-867

REVISION LOG

Title: BURIED ERCW & HPFP RPING/SETTLEMENT EVALUATION

Revision No.	DESCRIPTION OF REVISION	Date Approved									
R 0	<p>ORIGINAL ISSUE</p> <table border="0"> <tr> <td>NAME (PRINT)</td> <td>SIGNATURE</td> <td>INITIAL</td> </tr> <tr> <td>CHRIS PAINTER</td> <td><i>Chris Painter</i></td> <td><i>CP</i></td> </tr> <tr> <td>I-WEN CHEN</td> <td><i>Iwen Chen</i></td> <td><i>IE</i></td> </tr> </table>	NAME (PRINT)	SIGNATURE	INITIAL	CHRIS PAINTER	<i>Chris Painter</i>	<i>CP</i>	I-WEN CHEN	<i>Iwen Chen</i>	<i>IE</i>	4/29/91
NAME (PRINT)	SIGNATURE	INITIAL									
CHRIS PAINTER	<i>Chris Painter</i>	<i>CP</i>									
I-WEN CHEN	<i>Iwen Chen</i>	<i>IE</i>									

CALCULATION DESIGN VERIFICATION (INDEPENDENT REVIEW) FORM

WCG-1-867
Calculation No.

RO
Revision

Method of design verification (independent review) used (check method used):

- 1. Design Review
- 2. Alternate Calculation
- 3. Qualification Test

Justification (explain below):

Method 1: In the design review method, justify the technical adequacy of the calculation and explain how the adequacy was verified (calculation is similar to another, based on accepted handbook methods, appropriate sensitivity studies included for confidence, etc.).

Method 2: In the alternate calculation method, identify the pages where the alternate calculation has been included in the calculation package and explain why this method is adequate.

Method 3: In the qualification test method, identify the QA documented source(s) where testing adequately demonstrates the adequacy of this calculation and explain.

THE CALCULATION WAS PERFORMED USING ACCEPTABLE
HANDBOOK FORMULAS (i.e. REF. 10). THIS CALCULATION
IS ACCEPTABLE AND REASONABLE.

Juan Chen
Design Verifier
(Independent Reviewer)

4/27/91
Date

EBASCO SERVICES INCORPORATED

BY Chris P. Smith DATE 4/27/91 SHEET iii
 CHKO. BY Andrew Cohen DATE 4/27/91
 CLIENT: TENNESSEE VALLEY AUTHORITY
 PROJECT: WATTS BAR NUCLEAR PLANT - UNIT 1 & 2
 SUBJECT: BURIED ERW & HFP PIPING/SETTLEMENT EVALUATION
 CALCULATION IDENTIFIER: WCG-1-867

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EBASCO SERVICES INCORPORATED

BY Chi Paut DATE 4/27/91 SHEET 1 OF
CHKD. BY Z. Chen DATE 4/27/91
CLIENT: TENNESSEE VALLEY AUTHORITY
PROJECT: WATTS BAR NUCLEAR PLANT - UNIT 1 & 2
SUBJECT: BURIED ERCW & HPFP PIPING/SETTLEMENT EVALUATION
CALCULATION IDENTIFIER: WCG-1-867

1.0 PURPOSE

The purpose of this calculation is:

- (1) to perform soil settlement analysis of buried ERCW and HPFP safety-related buried piping.
- (2) perform qualification check of analysis results per Design Criteria WB-DC-40-31.7.

2.0 SCOPE

The scope of this analysis and qualification includes the safety-related buried ERCW and HPFP piping shown on mechanical drawing series 17W302, "Essential Raw Cooling Water, Control Air & HPFP Piping" (Ref. 7). The analysis and qualification includes soil settlement evaluation of the buried ERCW and HPFP safety-related piping.

3.0 INTRODUCTION

The buried ERCW and HPFP safety-related piping is evaluated for soil settlement per the requirements of Design Criteria WB-DC-40-31.5 (Ref. 6). Beam formulas from reference 10 were incorporated into hand calculations for moment and resultant stress.

The general layout of the analyzed piping is shown on mechanical drawing series 17W302, "Essential Raw Cooling Water, Control Air & HPFP Piping" (Ref 7). The settlement data was obtained from CEB calculation, "Evaluation of Potential Settlement" (Ref. 5), and reviewed for maximum differential settlement. Overburden, moments and stresses were then determined. The pipe stresses were qualified per the requirements of Design Criteria WB-DC-40-31.7 (Ref. 3).

All piping is qualified per ASME Code Equation 10A. The qualification is presented in Section 4.0.

Conclusions are presented in Section 5.0, References are given in Section 6.0.

BY Ch. Part DATE 4/27/91
 CHKD. BY J. Chao DATE 4/27/91
 CLIENT TVA
 PROJECT WBND 1 & 2
 SUBJECT WCG-1-867

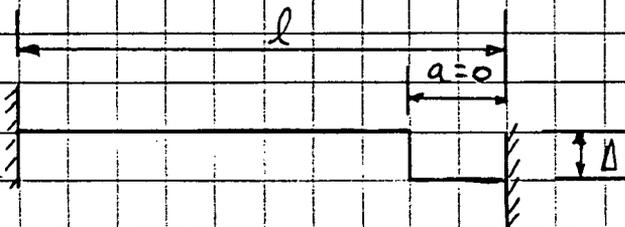
SHEET 2 OF _____
 DEPT. _____
 NO. _____

OFS NO. _____

4.0 CALCULATIONS

THE POTENTIAL SETTLEMENT AT EACH BORING HOLE ALONG THE ERCW AND HPPF BURIED PIPING CAN BE FOUND IN CEB CALCULATION "EVALUATION OF POTENTIAL SETTLEMENT" (REF 5)

TWO EVALUATIONS MUST BE MADE. THE FIRST EVALUATION CONSIDERS THE BURIED PIPING AWAY FROM BUILDING CONNECTIONS. IN THIS SITUATION THE PIPING SETTLES WITH AND REMAINS SUPPORTED BY THE SOIL, THEREFORE, PIPE STRESS ONLY OCCURS AT CHANGES OF SLOPE IN PIPING AFTER SETTLEMENT. CONSERVATIVELY ASSUME THE SLOPE OF THE PIPE IS ZERO AT ADJACENT BORING LOCATIONS. THIS IS REPRESENTED BY THE FOLLOWING BEAM DIAGRAM.



SINCE THE BORING HOLES ARE APPROXIMATELY 100 FEET APART,
 $l = 1200$ IN
 , WITH MINIMUM NOMINAL WALL THICKNESS,

AN ANALYSIS IS DONE FOR ALL PIPE SIZES AWAY FROM THE BUILDING CONNECTIONS. EACH ANALYSIS CONSIDERS THE MAXIMUM DIFFERENTIAL SETTLEMENT AWAY FROM THE BUILDING CONNECTIONS. EACH ANALYSIS ALSO CONSIDERS THE MAXIMUM STRESS CONCENTRATION FOR THAT SIZE PIPE (REF 9, SECTIONS 8.0 AND 9.0). THE MINIMUM ALLOWABLE STRESS FOR CARBON STEEL PIPE SHALL BE USED.

BY Chi Park DATE 4/27/91

SHEET 3 OF _____

CHKD. BY I. Chen DATE 4/27/91

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DEPT. NO. _____

CLIENT TVA

PROJECT WBNP 1 & 2

SUBJECT WCG-1-867

4.0 CALCULATIONS (CONT.)

THEREFORE;

$$D = 3.3 \text{ IN}$$

$$E = 27.9 \times 10^6 \text{ PSI, ALL PIPING IS CARBON STEEL.}$$

$$S_c = 15000 \text{ PSI}$$

$$M_{MAX} = 6 E I \Delta / l^2 \quad (\text{REF 10, PAGE 106})$$

$$36" \phi \text{ PIPE, } D = 36.0, t = .375 \text{ IN, } r_m = 17.8125 \text{ IN}$$

$$I = 6664 \text{ IN}^4$$

$$Z = \pi r_m^2 t = 373.8 \text{ IN}^3, l = 1200 \text{ INCH}$$

$$i_{MAX} = 5.64 \quad (36" \phi \text{ ELBOW, } t = .375 \text{ IN})$$

$$\sigma = i M / Z = i 6 E I \Delta / l^2 Z = 38573 \text{ PSI}$$

$$30" \phi \text{ PIPE, } D = 30.0 \text{ IN, } t = .375 \text{ IN, } r_m = 14.8125 \text{ IN}$$

$$I = 3823 \text{ IN}^4$$

$$Z = \pi r_m^2 t = 258.5 \text{ IN}^3, l = 1200 \text{ INCH}$$

$$i_{MAX} = 4.98 \quad (30" \phi \text{ ELBOW, } t = .375 \text{ IN})$$

$$\sigma = i M / Z = i 6 E I \Delta / l^2 Z = 28254 \text{ PSI}$$

$$12" \phi \text{ PIPE, } D = 12.75 \text{ IN, } t = .375 \text{ IN, } r_m = 6.1875 \text{ IN}$$

$$I = 279.3 \text{ IN}^4$$

$$Z = 45.1 \text{ IN}^3, l = 1200 \text{ INCH}$$

$$i_{MAX} = 2.86 \quad (12" \phi \text{ ELBOW, } t = .375 \text{ IN})$$

$$\sigma = i M / Z = i 6 E I \Delta / l^2 Z = 6795 \text{ PSI}$$

BY Ch. Part DATE 4/27/91SHEET 4 OF _____CHKD. BY I. Chen DATE 4/27/91

OFS NO. _____ DEPT. NO. _____

CLIENT TVAPROJECT WBND 1 & 2SUBJECT WCG-1-867

4.0 CALCULATIONS (CONT.)

ASME CODE EQUATION 10A

$$\sigma_{\text{SETTLEMENT}} \leq 3.0 S_c = 3.0 (15000) = 45000 \text{ PSI}$$

$$36" \phi \quad 38573 \text{ PSI} \leq 45000 \text{ PSI}$$

$$30" \phi \quad 28254 \text{ PSI} \leq 45000 \text{ PSI}$$

$$12" \phi \quad 6795 \text{ PSI} \leq 45000 \text{ PSI}$$

THE SECOND EVALUATION CONSIDERS THE PIPING CONNECTED TO BUILDINGS. THIS ANALYSIS CONSERVATIVELY CONSIDERS BUILDING SETTLEMENTS ARE ZERO INCHES. A REVIEW OF THE POTENTIAL SETTLEMENTS ADJACENT TO THE BUILDINGS (REF 5) REVEALS THE MAXIMUM SETTLEMENT IS ADJACENT TO THE INTAKE PUMPING STATION AND IS EQUAL TO 4.8 INCHES.

THEREFORE, THE ANALYSIS CONSIDERS

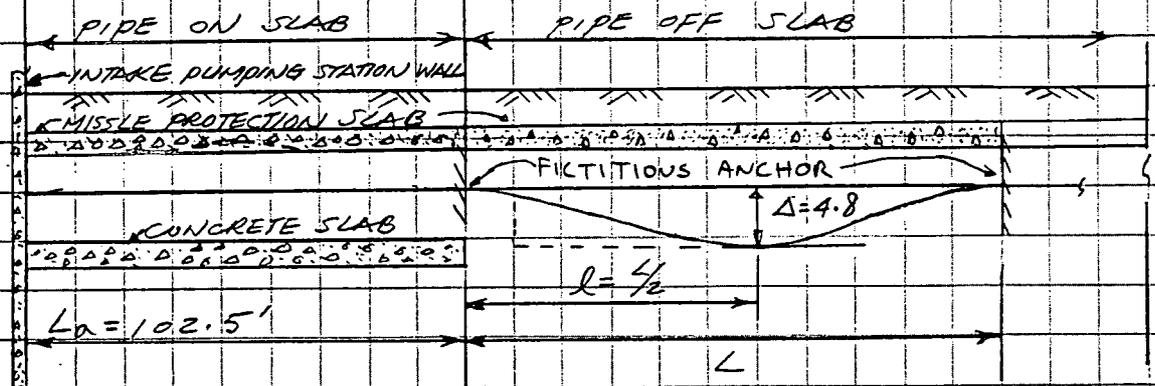
$$D = 4.8 \text{ IN} - 0.0 \text{ IN} = 4.8$$

24" ϕ PIPE AND 12" ϕ PIPE

$k = 1.0$ (NO STRESS CONCENTRATIONS IN REGION INFLUENCED BY THIS SETTLEMENT)

BY Chi Park DATE 4/27/91SHEET 5 OF _____CHKD. BY T. Chen DATE 4-27-91

OFS NO. _____ DEPT. NO. _____

CLIENT TVACALL ID WCG-1-867PROJECT WBND - UNIT 1 & 2SUBJECT BURIED ERCW & HDPE PIPING / SETTLEMENT EVALUATION4.0 CALCULATIONS (CONT'D)EVALUATION FOR THE PIPE OFF IPS SLAB

BASED ON THE DATA OF THE BORING (SEE REF. 5) THE SETTLEMENT OF 4.8" IS LOCATED AT BORING SS-49A WHICH IS THE FIRST BORING FROM THE END OF CONCRETE SLAB. THIS SETTLEMENT OF 4.8" POSSIBLY EXISTS RIGHT AFTER THE END OF THE SLAB AND STAY SOME DISTANCE.

THE CONSERVATIVE APPROACH TO EVALUATE THE PIPE OFF THE SLAB SUBJECTED TO THE DEFLECTION DUE TO THIS SETTLEMENT IS TO CONSIDER AS FOLLOWS

(1) FICTITIOUS ANCHOR IS CONSIDERED AT THE END OF THE SLAB.

(2) THE MODEL OF THE PIPE FIXED AT BOTH ENDS WITH UNIFORMLY DISTRIBUTED OVERBURDEN LOAD IS USED TO OBTAIN THE EFFECTIVE LENGTH IN WHICH THE DEFLECTION AT THE MIDDLE POINT IS 4.8".

(3) THE SECOND MODEL OF THE PIPE FIXED AT BOTH ENDS WITH A HALF OF THE EFFECTIVE LENGTH AND THE DEFLECTION OF 4.8" AT ONE END IS USED TO OBTAIN THE BENDING MOMENT BY WHICH THE PIPE STRESS CAN BE CALCULATED.

BY Chi Park DATE 4/27/91

SHEET 6 OF

CHKD. BY Z Chen DATE 4/27/91

OFS NO. DEPT. NO.

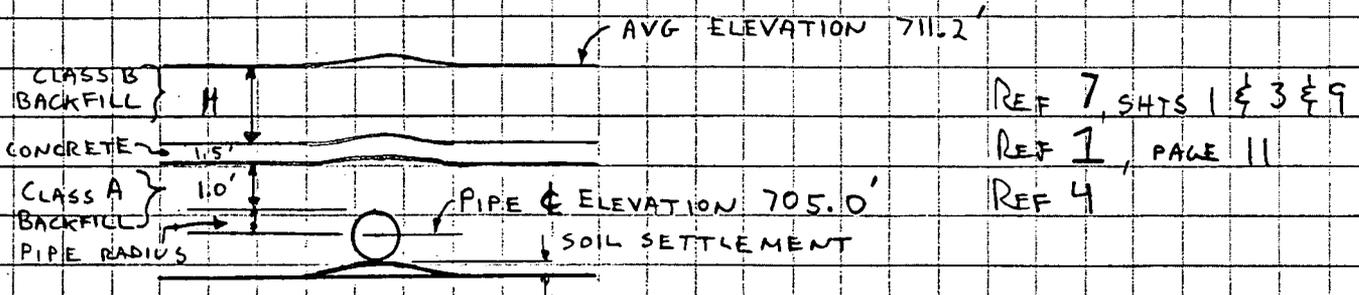
CLIENT TVA

PROJECT WBNP 1 & 2

SUBJECT WCG-1-867

4.0 CALCULATIONS (CONT.)

DETERMINE OVERBURDEN



A COLUMN LOAD IS REPRESENTATIVE OF THE OVERBURDEN FOR ERCW, 24" ϕ PIPE, $r = 12$ INCHES = 1 FOOT
 $H = 711.2 - 705.0 - 1.0 - 1.0 - 1.5 = 2.7$ FEET

DENSITY γ (PCF)	DESCRIPTION	REFERENCE
119.2	CLASS B BACKFILL	REF 1, PAGE 6
150.0	CONCRETE MISSILE SHIELD	REF 2, TABLE 2
113.3	CLASS A BACKFILL	REF 1, PAGE 6

$$W_b = (\sum \gamma_i H_i) (D / 144)$$

$\gamma_i \equiv$ PCF, $H_i \equiv$ FEET
 $D \equiv$ INCH

$$W_b = [(119.2)(2.7) + (150.0)(1.5) + (113.3)(1.0)] (24.0 / 144)$$

$$W_b, ERCW = 110.0 \text{ lbs/LINEAR INCH}$$

FOR HPFP 12" ϕ PIPE, $r = 6.375$ IN = .53 FEET

$$H = 711.2 - 705.0 - .53 - 1.0 - 1.5 = 3.17 \text{ FEET}$$

$$W_b = [(119.2)(3.17) + (150.0)(1.5) + (113.3)(1.0)] (12.75 / 144)$$

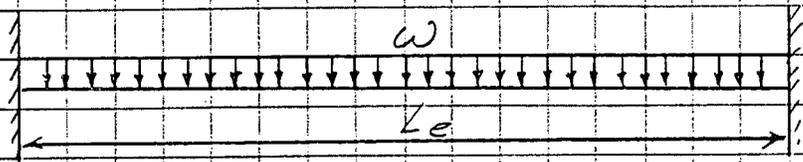
$$W_b, HPFP = 63.4 \text{ lbs/LINEAR INCH}$$

BY Chi Pant DATE 4/27/91 SHEET 7 OF
 CHKD. BY Z Chen DATE 4/27/91 OFS NO. DEPT. NO.
 CLIENT TVA CALL ID WCG-1-867
 PROJECT WBNP - UNIT 1 & 2
 SUBJECT BURIED ERCW & HPEP PIPING / SETTLEMENT EVALUATION

4.0 CALCULATIONS (CONT'D)

EVALUATION FOR THE PIPE OFF THE SLAB (CONT'D)

CALCULATION FOR THE EFFECTIVE LENGTH (Le)



$$\Delta = \frac{w L_e^4}{384 EI} \quad (\text{PAGE 100 OF ROARK BROOK, 5TH ED.})$$

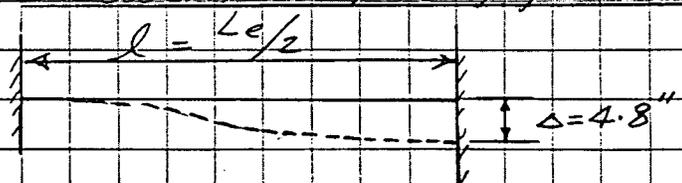
FOR 24" Ø PIPE

OVERBURDEN UNIT WEIGHT $w_o = 110.0 \text{ \#/IN}$
 PIPE & CONTENT UNIT WEIGHT $w_p = (94.62 + 183.8) / 12 = 23.2 \text{ \#/IN}$
 $E = 27.9 \text{ E6 PSI}$, $D_o = 24"$, $t_n = 0.375"$
 $I = 1942.3 \text{ IN}^4$
 $Z = \pi r^2 t_n = 164.39 \text{ IN}^3$
 $w = w_o + w_p = 110.0 + 23.2 = 133.2 \text{ \#/IN}$

$$L_e = \left(\frac{384 EI \Delta}{w} \right)^{1/4} = \left(\frac{384 \times 27.9 \times 10^6 \times 1942.3 \times 4.8}{133.2} \right)^{1/4}$$

$$= 930.57 \text{ IN}$$

CALCULATION FOR PIPE STRESS



$$l = L_e / 2 = 930.57 / 2 = 465.29 \text{ IN}$$

$$M = \frac{6 EI \Delta}{l^2} \quad (\text{PAGE 106 OF ROARK BROOK, 5TH ED.})$$

BY Ch. Fawc DATE 4/27/91

SHEET 8 OF _____

CHKD. BY I. Choo DATE 4/27/91

OFS NO. _____

DEPT. NO. _____

CLIENT TVA CALL ID WCG-1-867

PROJECT WBNP - UNIT 1 & 2

SUBJECT BURIED ERCW & HPFP PIPING / SETTLEMENT EVALUATION

4.0 CALCULATIONS (CONT'D)

EVALUATION FOR THE PIPE OFF THE SLAB (CONT'D)

$$M = \frac{6 \times 27.9 \times 10^6 \times 1942.3 \times 4.8}{(465.29)^2} = 7208843. \text{ IN-LBS}$$

$$\sigma = i \frac{M}{Z} = 1.0 \times \frac{7208843.}{164.39} = 43852. \text{ PSI}$$

EQ. 10A STRESS = 43852. PSI < 3.0 S_c = 45000. PSI

∴ O.K.

FOR 12" Ø PIPE

D_o = 12.75" , t_n = 0.375"

I = 279.3 IN⁴ , Z = π r² t_n = 45.1 IN³

UNIT WEIGHT OF OVERBURDEN

W_o = 63.4 #/IN

W = W_o + W_p = 63.4 + (49.56 + 49.0) / 12 = 71.62 #/IN

$$L_e = \left(\frac{384 E I \Delta}{W} \right)^{1/4} = \left(\frac{384 \times 27.9 \times 10^6 \times 279.3 \times 4.8}{71.62} \right)^{1/4}$$

= 669.2 IN

l = L_e / 2 = 334.6

$$M = \frac{6 E I \Delta}{l^2} = \frac{6 \times 27.9 \times 10^6 \times 279.3 \times 4.8}{(334.6)^2} = 2004545. \text{ IN-LBS}$$

$$\sigma = i \frac{M}{Z} = \frac{1.0 \times 2004545.}{45.1} = 44447. \text{ PSI}$$

EQ. 10A STRESS = 44447. PSI < 3.0 S_c = 45000. PSI

∴ O.K.

BY Ch. Pante DATE 4/27/91

SHEET 9 OF _____

CHKD. BY I. Chen DATE 4/27/91

OFS NO. _____ DEPT. NO. _____

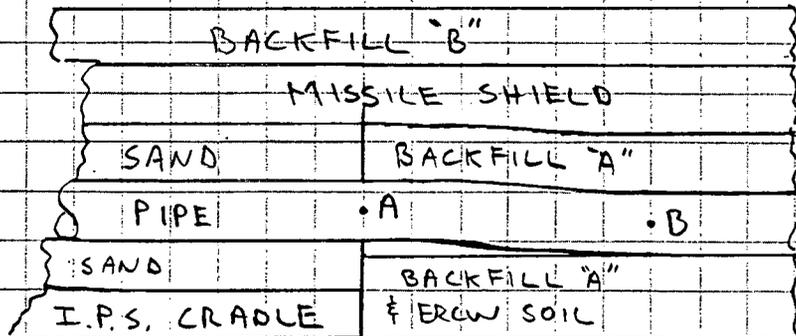
CLIENT TVA

PROJECT WBND 1 & 2

SUBJECT WCG-1-867

4.0 CALCULATIONS (CONT.)

ADDRESS PIPE ON THE CRADLE.



THE PIPING ANALYSIS CONSIDERS FIXED POINTS AT A & B.

IF THE REACTION (TO THE LEFT OF A), CAUSED BY THE MOMENT CALCULATED AT A, IS ENOUGH TO OVERCOME THE OVERBURDEN AND THE PIPE TO THE LEFT OF A LIFTS OFF ITS FOUNDATION, THEN THE END CONDITIONS IN THE ANALYSIS (FIXED-FIXED) WERE CONSERVATIVE.

IN ANY CASE, THE MOMENT CALCULATED AT POINT A IS DISSIPATED AS THE PIPE PROCEEDS TO THE LEFT OF POINT A. SINCE QUALIFICATION OF PIPING IS A FUNCTION OF MOMENT IN THE PIPE AND NOT A DIRECT FUNCTION OF REFLECTION OR ROTATION ABOUT A POINT OF PIPE, THE PIPE ON THE CRADLE MEETS THE REQUIREMENTS OF DESIGN CRITERIA WB-DC-40-31.7, TABLE 4.1-2, EQUATION 10A.

EBASCO SERVICES INCORPORATED

BY chi Pant DATE 4/27/91 SHEET 10 OF
CHKD. BY I. Chen DATE 4/27/91
CLIENT: TENNESSEE VALLEY AUTHORITY
PROJECT: WATTS BAR NUCLEAR PLANT - UNIT 1 & 2
SUBJECT: BURIED ERCW & HPFP PIPING/SETTLEMENT EVALUATION CALCULATION
IDENTIFIER: WCG-1-867

5.0 CONCLUSIONS

The buried safety-related ERCW and HPFP piping is evaluated for soil settlement as required by Design Criteria WB-DC-40-31.5 (Ref 6).

The buried safety-related ERCW and HPFP piping meets the soil settlement criteria as imposed by Design Criteria WB-DC-40-31.7 (Ref 3).

EBASCO SERVICES INCORPORATED

BY Chi Pait DATE 4/27/91 SHEET 11 OF
CHKD. BY J. Chen DATE 4/27/91
CLIENT: TENNESSEE VALLEY AUTHORITY
PROJECT: WATTS BAR NUCLEAR PLANT - UNIT 1 & 2
SUBJECT: BURIED ERCW & HPFP PIPING/SETTLEMENT EVALUATION CALCULATION
IDENTIFIER: WCG-1-867

6.0 REFERENCES

- 1* Calculation N3-BP-001, "Safety Related Buried Piping Wall Deflection Calculation", Rev. 2.
- 2* DS-C1.3.1 "General Design Information - Dead Loads", rev. 0, Dated 2/3/78.
- 3* Design Criteria, WB-DC-40-31.7, "Analysis of Category I and I(L) Piping Systems", Rev. 12.
- 4* WBNP FSAR, including amendment 64.
- 5* CEB Calculation, "Evaluation of Potential Settlement", Rev. 0, Rims No. CEB840816015.
6. Design Criteria, WB-DC-40-31.5, "Analysis of Safety-Related Buried Piping Systems", Rev. 3, Dated 02/28/90, RIMS No. B26900305077.
- 7* Drawing Series 17W302, "Mechanical, Essential Raw Cooling Water, Control Air & HPFP Piping", Sht 1-Rev D, Sht 2 Rev C, Sht 3 Rev H, Sht 4 Rev D, Sht 5 Rev D, Sht 6 Rev F, Sht 7 Rev E, Sht 9 Rev C, Sht 10 Rev D, Sht 11 Rev B.
- 8* Drawing Series 17BM302, Bill of Materials.
- 9* WCG-1-682, Rev 2, "Analysis and Qualification of Buried ERCW Piping", Rims No. B18910426265.
10. Roark and Young, "Formulas for Stress Strain", Fifth Edition.

*NOTE: REFERENCE USED AS DESIGN INPUT

EBASCO SERVICES INCORPORATED

BY Chris Piant DATE 4/27/91

SHEET A1 OF _____

CHKD. BY Ryan Chen DATE 4/27/91

CLIENT: TENNESSEE VALLEY AUTHORITY

PROJECT: WATTS BAR NUCLEAR PLANT - UNIT 1 & 2

SUBJECT: BURIED ERCW & HPFP PIPING/SETTLEMENT EVALUATION

CALCULATION IDENTIFIER: WCG-1-867

ATTACHMENT A - VERIFICATION WORKSHEET

VERIFICATION WORKSHEET
FOR CALCULATIONS

Task No. HR
Document No. WCG-1-867
Revision RO

Title BURIED ERCW & HPFP PIPING/
SETTLEMENT EVALUATION

QUESTIONS TO BE ADDRESSED

1	Were the inputs correctly selected at the correct revision level, and incorporated into the design?
2	Are the assumptions necessary to perform the design activity adequately described and reasonable? Where necessary, are assumptions identified for subsequent reverification after the detailed design activities are completed?
3a	Are the appropriate quality requirements specified?
3b	Are the appropriate quality assurance requirements specified?
4	Are the applicable codes, standards, and regulatory requirements including issue and addenda properly identified, and are their requirements for design met?
5	Have applicable construction and operating experience been considered?
6	Have the design interface requirements been satisfied?
7	Was an appropriate design method used?
8	Is the output reasonable compared to inputs?
9	Are the specified parts, equipment, and processes suitable for the required application? Are all applicable construction specifications referenced on the drawing(s)?
10	Are the specified materials compatible with each other and with the design environmental conditions to which the materials will be exposed?
11	Have adequate maintenance features and requirements been specified?
12	Are accessibility and other design provisions adequate for performing needed maintenance and repair?
13	Has adequate accessibility been provided to perform the inservice inspection expected to be required during the plantlife?
14	Has the design properly considered radiation exposure to the public and plant personnel?
15	Is the acceptance criteria incorporated in the design document sufficient to allow verification that design requirements have been satisfactorily accomplished?
16	Have adequate preoperational and subsequent periodic test requirements been appropriately specified?
17	Are adequate handling, storage, cleaning and shipping requirements specified?
18	Are adequate identification requirements specified?
19	Are requirements for record preparation review, approval, retention, etc., adequately specified?

For Calculations, only questions 1, 2, 4, 6, 7, 8 and 15 are considered applicable.

Independent Verifier I-WEN CHEN / Iwen Chen 4/27/91
Print/Sign Date

ENCLOSURE 2

LIST OF COMMITMENTS
RESPONSE TO NRC INFORMATION REQUEST JANUARY 31, 1992

1. The Worst Case Selection Calculation for HAAUP Embedded Plates will be revised to document consideration of attachment locations and shear in the selection process. This calculation will be completed by June 12, 1992.
2. Calculation CEB 820604002, "Seismic Analysis of Earthfill Contained by Sheetpile Walls at the Intake Pumping Station," will be revised for completeness to document the frequency dependency of acceleration levels and shear stresses. This calculation will be completed by June 12, 1992.