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August 30, 1990

the southern electric system

W. G. Hairston, III
Senior Vice President
Nuclear Operations

ELV-01956
0515

Docket Nos. 50-424
50-425

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D. C. 20555

Gentlemen:

VOGTLE ELECTRIC GENERATING PLANT
SETTLEMENT MONITORING PROGRAM ADDITIONAL INFORMATION

A March 19, 1990 letter from Mr. W. G. Hairston, III to the NRC provided responses to the NRC's request of November 21, 1989 for additional information on the VEGP settlement monitoring program. On June 14, 1990, a telephone conference was held with Mr. T. A. Reed and Mr. R. Pichumani during which the NRC also requested the supporting data referenced in GPC's response number 2(b) of the above letter.

Our explanatory notes to this request for additional information on previous response number 2(b) regarding differential settlement of Category 1 buried piping are shown below. Enclosed are three (3) copies of each of the requested documents.

- o DC-1017 Rev. 5, Pipe Stress and Pipe Supports Analysis Criteria

  Applicable portions of this design criteria document have been selected which relate to differential building settlement.

- o Figure 13, Estimated Settlement of Power Block Structures, of DC-1000-C

  This figure is included in design manual change notice (DMCN) number DC-1000C-14, which was initiated to reconcile this figure with other VEGP design documents.

- o Calculation X4CPS-0167, Building Settlement Summary, Unit 1, Rev. 1

- o Calculation X4CPS-0168, Building Settlement Summary, Unit 2, Rev. 1

  A detailed check of this calculation has been performed which resulted in revisions to data previously reported in the March 19, 1990 letter from Mr. W. G. Hairston, III to the NRC as follows:

  Pipe identification number 2-1202-030-6[illegible] for the NSCW tower previously

A001
1/1

reported an allowable differential settlement of 0.95 inches due to a mathematical mistake. The correct value of 1.09 inches provides a greater margin.

Pipe identification number 2-2403-053-2" for the diesel generator building previously reported an allowable differential settlement of 0.53 inches because a value of 0.25 inches was mistakenly used for the calculated differential settlement. The revision of this calculated differential settlement to 0.30 inches increases the allowable differential settlement to a larger value of 0.64 inches.

o Comparison of Differential Settlements

The Unit 1 and Unit 2 data sheets for the comparison of differential settlements are being re-submitted to reflect corrections to the allowable differential settlement values as discussed above in regard to calculation X4CPS-0168. These data sheets have also been revised to correct editorial mistakes which resulted from transposing the data from the design calculations to this table as follows:

The Unit 1 pipe identification number 1-2403-069-2" calculated differential settlement for the diesel fuel oil storage tank has been revised. The value should have been 0.3 inches rather than 0.5 inches.

The Unit 2 pipe identified number 2-2403-066-3" allowable differential settlement for the diesel fuel oil storage tank has been revised. The value should have been 3.19 inches at the buried pipe-to-building interface rather than the 2.66 inches at the tank nozzle.

Should you have additional questions please inquire.

Sincerely,

W. G. Hairston, III

WGH,III/JLL/gm
Enclosures

xc: Georgia Power Company
Mr. C. K. McCoy
Mr. G. Bockhold, Jr.
Mr. R. M. Odom
Mr. P. D. Rushton
NORMS

U. S. Nuclear Regulatory Commission
Mr. S. D. Ebneter, Regional Administrator
Mr. T. A. Reed, Licensing Project Manager, NRR
Mr. B. R. Bonser, Senior Resident Inspector, Vogtle

ENCLOSURE 1

DC-1017
PIPE STRESS AND PIPE SUPPORTS
ANALYSIS CRITERIA

ALVIN W. VOGTLE NUCLEAR PLANT
DESIGN BASES
JOB NO. 9510

VNP DESIGN MANUAL

REV 5 DATE 3-19-86

DESIGN CONTROL NO. DC-1017 TITLE PIPE STRESS AND PIPE SUPPORTS ANALYSIS CRITERIA

PRINCIPAL RESPONSIBILITY BECHTEL - PLANT DESIGN Q LIST ☐ YES ☒ NO

SYSTEM CLASSIFICATION ☒ SAFETY RELATED ☐ SAFETY IMPACT ☐ OTHER

1.0 PRINCIPAL FUNCTION

The function of this document is to provide the stress and loading criteria bases for analysis and design of both nuclear and non-nuclear piping systems and component supports on the Vogtle Plant. The criteria associated with design for the safe shutdown earthquake (SSE) are also discussed.

This criteria is based on applicable ASME and ANSI codes and project licensing requirements which are listed in this document.

In addition, guidelines are included which have been generated by the Pipe Stress and Support Group to define analysis procedures and safety code and licensing requirements.

SAFETY CLASS 0, 1, 2, 3, 4, 6 SEISMIC CATEGORY 1 and 2

RG 1.124, 1.130, 1.20, 1.29, 1.48, 1.61, 1.67, 1.68, 1.84, 1.85, 1.92

GDC 1, 2, 4, 14, 15

SRP 3.7.3, 3.9.1, 3.9.2, 3.9.3

BTP Not Applicable

W CRITERIA NSSS design transients/SIP document 1.2

REFERENCES:

PSAR SECTION 3.7, 3.9

ER SECTION Not Applicable

SYSTEM DRAWINGS Not Applicable

APPROVAL SIGNATURES

EGL (ORIGIN)	EGS (ORIGIN)	CHIEF	LIC. ENG	PE
MECH EGS	ELECT EGS	CIVIL/STRUCTURAL EGS	CSE EGS	
NUC EGS	ARCH EGS	PLANT DESIGN EGS	ASSIST. PE	
ASSIST. PE	ASSIST. PE	PQE		

LEVEL OF APPROVAL 1, 2, 3, 4, 5 DATE OF ORIGIN 1-19-78

INDICATE EGS AND ASSIST. PE APPROVALS MEGS C/SEGS, EEGS, CSEGS, AEGS, NEGS

DATE(S) OF ALL CHANGES 1-24-83 10-13-83 12-6-84 8-9-85 3-19-86

CONCURRENCE

SCSI YES ☐ NO ☐ RESPONSE DATE

QA SIGNATURE 3-19-86 DATE

APPROVAL LEGEND	
1 EGL	6 INDICATED EGS
2 EGS (ORIGIN)	7 INDICATED APE
3 CHIEF	
4 PE	
5 LIC. ENG	8 PQE

PP-172 (9510) 12/76

4. Level D Service Limits

These sets of limits permit gross general deformations with some consequent loss of dimensional stability and damage requiring repair, which may require removal of the component from service.

3.1.2 Loading Combinations for ASME Section III, Division 1, Code Class 1, 2 and 3 Piping Systems and Component Supports

The design loading combinations for ASME Section III, Division 1, Code Class 1, 2, and 3 piping systems, and component supports outside the Westinghouse scope of supply, are provided in Table 2.

3.1.3 Allowable Stress Limits

The allowable stress limits for ASME Section III, Division 1, Code Class 1, 2, and 3 piping systems are provided in Table 3.

The allowable stress limits for ASME Section III, Division 1, Code Class 1, 2, and 3 component supports are provided in Tables 4 and 5.

The stress criteria for the development of ASME Section III, Division 1, Code Class 1, 2, and 3 pump specifications are provided in Table 19.

The stress criteria for the development of ASME Section III, Division 1, Code Class 1, 2, and 3 valve specifications are provided in Table 20.

3.1.4 Stress Limits Due to Inelastic Deformation

In the event that the proposed stress limits result in inelastic deformation, analyses shall be performed in accordance with ASME Section III, Division 1 Code, Article NB-3000. BN-TOP-2 applies to the design where inelastic pipe whip is to be controlled.

3.1.5 Building Settlement

Maximum anticipated buildirg settlement values for each building are provided in Table 6. Relative displacement values can be determined from the maximum values in the table. Maximum anticipated differential settlement values between outside area structures and components are provided in Table 7.

Building settlement piping stresses are evaluated independent of plant condition in accordance with the following:

$$\frac{i\, M_{bs}}{Z} \leq 3\, S_c$$

where: M_{bs} = resultant moment due to building settlement
i = stress intensification factor
Z = pipe section modulus
S_c = material stress allowable at ambient temperature

If 75% of the differential settlements used in design actually occurs, a review shall be made to determine the need for any subsequent evaluation.

This review shall consist of one of the following steps:

- Verify the piping installation date versus the date the building settlement data was initiated to eliminate any settlement differential which may have occurred before the piping system was installed and confirm the revised building settlement differential with the Civil Structural group.

- Reanalyze the piping stress calculation using a larger building settlement to verify if the piping system and supports can take a larger settlement differential.

3.1.6 Branch Piping

Table 8 lists branch piping sizes to be included in the run pipe analysis. When the decoupling criteria of Table 8 is satisfied, the effect of the support system of the branch pipe on the run pipe can be assumed to be insignificant. However, stress intensification factors must be applied to the run pipe at each branch intersection point.

3.1.7 Functional Capability

Piping components in essential ASME Class 1, 2, and 3 piping systems designed to Level C or D service limits shall be shown to retain functionability for emergency and faulted plant conditions by meeting the screening criteria found in Reference 7. Non-safety lines which are connected to essential lines and must remain functional shall meet the Reference 7 screening criteria. All lines which must meet Reference 7 screening criteria are defined in calculation No. X6CNA.01.

3.1.8 Local Stresses at Welded Attachments on ASME Class 2/3 and ANSI B31.1 Piping

Local stresses at welded attachments shall be calculated. Local stresses at circular or rectangular attachments may be obtained using WRC Bulletin 107 (Computer Program ME210). Local stresses are combined with general pipe stresses, and the total stress intensities shall be in accordance with NC-3200 and Appendix XIII. Rectangular cross-section and hollow circular cross-section welded attachments may also be evaluated in accordance with Code Cases N-318-2 and N-392, respectively.

3.1.9 Local Stresses at Welded Anchor Straps (Reference 11)

Local stress effects due to welded anchor straps are taken into account by applying stress intensification factors (SIFs) of:

- 2.1 for the bending moment in the direction parallel to the strap legs

7.0 REFERENCES

1. Letter from H. A. Sindt, Westinghouse, to M. Z. Jeric, Bechtel Power Corporation, Subject: Reactor Coolant Loop Model, Letter No. GP 2865, March 16, 1979.

2. Letter from M. Z. Jeric, Bechtel Power Corporation, to D. E. Dutton, Georgia Power Company, Log No. BRE-205, August 12, 1980.

3. LAPD Pipe Support Design Manual, Volumes I-1 (Rev. 0) and I-2 (Rev. 0). See Table 16 for commonly used sections of manual.

4. American Welding Society Structural Welding Code - AWS D1.1-79.

5. AISC "Manual of Steel Construction," 8th Edition.

6. Letter from J. L. Vota to M. Malcom, Log GP 7955 dated July 13, 1984, Revised Reduced RCL Seismic Model.

7. "Functional Capability for Essential Mark II Piping," GE Topical Report, NEDO-21985, September 1978 and memo from D. L. Capito/D. F. Sewell, Bechtel Power Corporation, to M. Maryak, Westinghouse, Subject: Functional Capability, D/t >100, corrected copy, File: X4BP26, Log: BV-11717, July 14, 1988.

8. Letter from J. L. Vota, Westinghouse, to M. Z. Jeric, Bechtel Power Corporation, Subject: Transmittal of SIP Document 1-2 Volumes 1 and 2: NSSS Design Transients, GP-3337, September 18, 1979.

9. Interoffice Memorandum from D. L. Capito to D. Sewell, Bechtel Power Corporation, Subject: PSSG Instruction Memos, File: X4BP26, BB-47846, February 19, 1986.

10. Letter from O. Batum, Georgia Power Company, to F. B. Marsh, Bechtel Power Corporation, Subject: Use of ASME Later Edition and Addenda for Small Bore Piping, File: X7BC17, Log: SB-6177, April 16, 1986.

11. Letter from O. Batum, Georgia Power Company, to F. B. Marsh, Bechtel Power Corporation, Subject: Stress Intensification Factors of Welded Anchor Straps, File: X4BA04, Log: SB-6189, May 13, 1986.

12. Letter from J. L. Vota, Westinghouse, to F. B. Marsh, Bechtel Power Corporation, Subject: Overlapping Criteria for Piping Analysis, File: Vendor Package No. 25516, Log: GP-10429, January 29, 1986.

13. Memorandum from B. Pusheck/D. Sewell, Bechtel Power Corporation, to A. Ayoob/M. Beer, V-SAMU, Subject: Overlapping Methodology, File: X4BP26, Log: PFE-10242, February 7, 1986.

14. Letter from F. B. Marsh, Bechtel Western Power Corporation, to O. Batum, Georgia Power Company, Subject: Welded Attachments within Five Piping Diameters of Break Locations, Log No. BS-6618 July 30, 1986, File X7BC47.

15. Letter from J. A. Bailey, Georgia Power Company, to B. J. Youngblood, Nuclear Regulatory Commission, Subject: SER Open Item 15: Arbitrary Intermediate Pipe Breaks, Log No. GN-1090, File: X7BC35, September 30, 1986.

16. Memorandum from D. Capito/D. Van Buskirk, Bechtel Western Power Corporation, to D. Houghton, Bechtel Western Power Corporation, Subject: Building Settlement and Seismic Anchor Movements, Log: BB-49276, File: X4BP26, May 6, 1986.

17. Memorandum from D. L. Houghton, Bechtel Western Power Corporation, to D. Capito, Bechtel Western Power Corporation, Subject: Building Settlements and Seismic Anchor Motion, Log: BB-49445, File: X4BP26, X2BA08, X2BR01, May 13, 1986.

18. Memorandum from D. L. Houghton, Bechtel Western Po[illegible] Corporation, to D. Capito, Bechtel Western P[illegible] corpo[illegible]ion, Subject: Design Differential Settlement fo[illegible] Feedwater Line at Control/Containment Interface, Log: BB-50878, File: X2BA08, X4BP26, August 27, 1986.

19. Memorandum from D. Capito/D. Van Buskirk, Bechtel Western Power Corporation, to D. Houghton, Bechtel Western Power Corporation, Subject: Building Settlement Data for M[illegible]in Steam Lines, Log: BB-50675, File: X4BP26, August 15, 1986.

20. Memorandum from D. L. Houghton, Bechtel Western Power Corporation, to D[illegible] Capito, Bechtel Western Power Corporation, Subject: Seismic Separation Finalization Program - Tower 1A vs. Valve House 1A, Log: 51667, File: X4BP26, X2BE08, October 9, 1986.

21. Memorandum from D. L. Houghton, Bechtel Western Power Corporation, to D. Capito, Bechtel Western Power Corporation, Subject. Differential Movements for Valvehouse/Splash Ring/Tower, Log: BB-51621, File: X2BA08, October 15, 1986.

22. Memorandum from D. L. Houghton, Bechtel Western Power Corporation, to D. Capito, Bechtel Western Power Corporation, Subject: NSCW System, Revise Building Settlement and Seismic Anchor Movement, Log: BB-48087, File: X2BA08, X4BP26, March 3, 1986.

23. Memorandum from D. Capito, Bechtel Western Power Corporation, to D. Houghton, Bechtel Western Power Corporation, Subject: Differential Settlement, Log: BB-50948, File: X4BP01, X4BP26, X2BA08, September 8, 1986.

24. BP-TOP-1, Seismic Analysis of Piping Systems, Revision 3, January 1976.

25. Letter from J. L. Vota, Westinghouse, to F. B. Marsh, Bechtel Western Power Corporation, Subject: FSAR Change to Allow Use of Equivalent Static Load Coefficient, Log: GP-11349, File: X7N03.7, August 27, 1986.

26. Memorandum from D. L. Houghton, Bechtel Western Power Corporation, to D. Capito, Bechtel Western Power Corporation, Subject: Seismic Anchor Movements and Building Settlement Movements Between Diesel Generator Building and Buried Piping, Log: BB-52415, File: X4BP26, X2BE08, X2BR01, December 5, 1986.

27. Memorandum from D. L. Houghton, Bechtel Western Power Corporation, to D. Capito, Bechtel Western Power Corporation, Subject: SAM and Building Settlement at Interface of Auxiliary Building to Tunnel, Log: BB-52526, File: X4BP26, X2BR01, X2BA08, December 15, 1986.

28. Memorandum from D. L. Houghton, Bechtel Western Power Corporation, to D. Capito, Bechtel Western Power Corporation, Subject: SAM and Settlement for Diesel Fuel Oil Storage Tank Pumphouse, Log BB-52527, File: X2BR01, X2BA08, December 16, 1986.

29. Memorandum from D. L. Houghton, Bechtel Western Power Corporation, to D. Capito, Bechtel Western Power Corporation, Subject: Differential Settlement at Transfer Building/Auxiliary Building Interface, Log: BB-50876, File: X2BA08, August 21, 1986.

30. Safety Evaluation Report, Vogtle Electric Generating Plant, Units 1 and 2, Docket Nos. 50-424 and 50-425, NUREG-1137, Supplement No. 4, December 1986, Paragraph 3.9.2.2.

31. Safety Evaluation Report, Vogtle Electric Generating Plant, Units 1 and 2, Docket Nos. 50-424 and 50-425, NUREG-1137, Supplement No. 5, January 1987, Paragraph 3.9.2.2.

32. Memorandum from D. Thorne, Bechtel Western Power Corporation, to D. Capito/D. Vanbuskirk, Subject: Differential Settlement for Mainsteam Lines at Unit 2 Control/Containment, Log: BB-53719, File: X2BA08, X4BP26, June 8, 1987.

33. Memorandum from D. Capito, Bechtel Western Power Corporation, to D. Sewell/M. Beer, Subject: Instruction Memos, Group 3, Memos 10 and 24, Log: BB-54059, File: X4BP26, August 19, 1987.

34 Memorandum from Phil G. Alexander, Southern Company Services, to J. P. Hawley, Subject: VEGP Unit 2 Maximum Seismic Deflection for Small Bore B31.1 Category II Piping in Category I Structures, Log: SB 6412, File: X4BP26, June 17, 1987

35. "Dynamic Testing of Flexibility Supported Fire Protection Systems, Vogtle Unit 2. ANCO Engrs; 2X4X03-5871-1.

36. National Fire Protection Association Code, 1983.

37. Memorandum from D.B. Thorne, Bechtel Western Power Corporation, to D. Capito, Subject: Differential Settlement, Log: BB 53390, File: X2BA08, dated April, 1987.

38. Memorandum from D.B. Thorne, Bechtel Western Power Corporation to D. Capito, Subject: Unit 2 Differential Settlement - Containment/Fuel, Log: BB 53089, File: X2BA08.

39. Memorandum from D. B. Thorne, Bechtel Western Power Corporation to D. Sewell Dated October 26, 1987, Subject: Differential Settlement for Unit 2 Main Steam Lines, File: X4BP26, X2BA08, Log: BB-54449.

40. Memorandum from D. B. Thorne, Bechtel Western Power Corporation to D. Capito Dated October 26, 1987, Subject: Differential Settlement at Aux/Tunnel 2T5B Interface - Line 2301-199-4", File: X2BA08, X4BP26, Log: BB-54433.

41. Memorandum from R. Platoni, Bechtel Western Power Corporation to R. Kies, Dated November 29, 1987, Subject: Differential Settlement at Aux/Transfer Bldg. Interface, File: X2BA08, Log: BB-54636.

42. Memorandum from R. Platoni, Bechtel Western Power Corporation to D. Capito Dated February 22, 1988, Subject: Differential Settlement at Unit-2 Containment/Auxiliary Bldg. Interface, File: X2BA08, X4BP26, Log: BB-55087.

43. Memorandum from R. Platoni, Bechtel Western Power Corporation to D. Capito Dated February 9, 1988, Subject: Differential Settlement at Containment/Auxiliary Bldg. Interface, File: X2BA08, Log: BB-55021.

44. Memorandum from R. Platoni, Bechtel Western Power Corporation to D. Capito Dated February 19, 1988, Subject: Unit-2 Differential Settlement at NSCW Tower/Valvehouse Interface, File: X2BA08, Log: BB-55071.

45. Letter from W. C. Ramsey, Southern Services Company to T. E. Richardson, Bechtel Western Power Company Dated May 5, 1988, Subject: Approval of Later Code Addenda, File: X7BC17, Log: GB-3948.

46. Memorandum from A. P. Ibe, Bechtel Western Power Corporation to P. L. Goodman, April 10, 1978, Subject: Main Steam and Feedwater Piping Seismic Anchors in the Main Steam Tunnels, File: X4BA08, X6AA00.

47. Memorandum from R. S. Platoni, Bechtel Western Power Corporation to D. Sewell, Dated March 16, 1988, Subject: Unit 2 Diesel Fuel Oil Storage Tank Pumphouse vs Adjacent Soil, File: X23BA08, Log: BB-55245.

48. Calc. X4CPS-00118, SIF's for Fillet (Socket) Welds, Revision 1, April 25, 1988.

49. Memorandum from D. D. Niehoff/S. K. Thomas, Bechtel Western Power Corporation to M. E. Maryak/C. W. Gay, Westinghouse, dated July 6, 1988, corrected date July 26, 1988, Subject: Units 1 and 2 Diesel Fuel Oil Storage Tank Pumphouse, File: X2BA08, Log: BV-11699.

50. Memorandum from R. S. Platoni to D. Capito, Bechtel Western Power Corporation, dated May 5, 1988, Subject: DC-1017 Re: Differential Settlement, File: X2BE08, BB-55564.

51. Memorandum from R. Platoni, Bechtel Power Corporation, to D. Capito/R. Kies, dated September 30, 1988, Subject: Differential Settlement at Radwaste Tunnel, File: X2BA08, Log: BB-56492.

52. Memorandum from R. S. Platoni, Bechtel Power Corporation to D. Capito/R. Kies, dated October 26, 1988, Subject: Differential Settlement at Radwaste Tunnel, File: X2BA08, Log: BB57345.

TABLE 6

MAXIMUM ANTICIPATED DIFFERENTIAL SETTLEMENT BETWEEN BUILDINGS

(See Notes Below)

Building Structure	Maximum Anticipated Differential Settlement (inches)
Unit 1 Turbine Building	0.5
Unit 2 Turbine Building	0.4
Auxiliary Building	0.6
Control Building	0.6
Fuel Building	0.2
Unit 1 Containment Building	0.5
Unit 2 Containment Building	0.5

NOTES:

1. As an example the maximum differential between the control building and any adjacent structure (including tunnels) should be taken as 0.6 inch (worst case).

2. Subsequent to support installation the maximum anticipated differential settlement displacements for the main steam lines, where they pass between the containment building and control building, are 0.3 inches and 0.4 inches for Units 1 and 2 respectively. (References 19, 32 & 50)

3. The maximum anticipated differential settlement displacement for the Unit 1 main steam line where it passes between the Auxiliary and Containment buildings, subsequent to pipe support install . is 0.4 inch for the Auxiliary building relative to the Containment and 0.3 inch for the Containment relative to the Auxiliary building (Reference 19).

4. The differential settlement for the Unit 1 feedwater lines passing between the Control building and the Containment building is 0.4 inch (Reference 18).

5. For specific line design differential settlement see Note 9 of Table 7.

TABLE 7

MAXIMUM DIFFERENTIAL BUILDING SETTLEMENT (Sheet 1 of 4)

Item	Description	Differential Settlement (Inches)	Item	Description	Differential Settlement (Inches)
1.	Turbine bldg/main steam tunnel	0.5	22.	Tunnel T13A/buried small piping	0.3
2.	Control bldg/main steam tunnel	0.6	23.	Tunnel T13A/tunnel T12A	0.3
3.	Auxiliary bldg/main steam tunnel	0.6(9)	24.	Tunnel T13A/auxiliary bldg	0.5(6)
4.	Main steam tunnel/buried pipe @ AFW EH	0.5	25.	Elec steam boiler bldg/ elect steam boiler tunnel	0.3
5.	Elect boiler steam line crossover/main steam tunnel	0.5	26.	Tunnel T15A/auxiliary bldg	0.6
6.	Auxiliary bldg/tunnel T16A (Auxiliary FW)	0.6	27.	Tunnel T15A/NSCW valve house train A	0.5
7.	Tunnel T16A&B/main steam tunnel bridge	0.3	28.	Tunnel T15B/auxiliary bldg	0.6(9)
8.	Main steam tunnel bridge/ tunnels T16A&B main steam tunnel & AFWEH)	0.3	29.	Tunnel T15B/NSCW vlave house train B	0.5
9.	Tunnels T16A&B/AFWEH	0.5	30.	Tunnel T12A/NSCW valve house train A	0.5
10.	Control bldg/tunnel T16B	0.6	31.	Tunnel T12B/auxiliary bldg	0.6
11.	AFWEH/buried pipe south of AFWEH	0.5	32.	Tunnel T12B/RWST	0.5
12.	AFWEH/condensate storage tanks area	0.5	33.	Tunnel T12B/buried NSCW transfer lines	0.3(6)
13.	DG bldg/electrical tunnel	0.5	34.	Tunnel T12B/RWST	0.5
14.	DG bldg/buried FO piping	0.3(7)	35.	Tunnel T12B/buried 8" fire protection line	0.3
15.	DG bldg/tunnel T13A	0.5	36.	Tunnel T12B/NSCW valve house train B	0.5
16.	DG bldg/tunnel T13B	0.5	37.	RWSU/RWST degasifier area	0.5
17.	Tunnel T13B/electric boiler steam line crossover	0.5	38.	NSCW valve house train A/ buried piping	0.3(6)
18.	DFOS tank pumphouse/ buried FO Piping	0.5(8)(10)	39.	NSCW valve house train B buried piping	0.5
19.	Tunnel T13B/buried small piping	0.3	40.	NSCW tower train A/ NSCW valve house train A	0.5(3)(9)
20.	Tunnel T13B/elec. steam boiler building	0.5	41.	NSCW tower train B/NSCW valve house train B	0.5(9)
21.	Tunnel T13Belec. steam	0.6(9)	42.	NSCW chemical control bldg/buried piping	0.3

TABLE 7

MAXIMUM DIFFERENTIAL BUILDING SETTLEMENT (Sheet 2 of 4)

Item	Description	Differential Settlement (Inches)	Item	Description	Differential Settlement (Inches)
43.	R/W transfer tunnel/ auxiliary bldg	0.6	53.	Dow polymer storage tank/ R/W solidification bldg	0.5
44.	R/W transfer tunnel/ R/W transfer bldg	0.5	54.	Liquid chillers/buried piping	0.3
45.	R/W transfer tunnel/ R/W solidification bldg	0.5	55.	Dow polymer storage tank/ buried piping	0.3
46.	R/W transfer bldg/ auxiliary bldg	0.6(9)	56. 56A.	Tunnel TT2A/TT2A Tunnel TT2B/TT2B	0.3(1) 0.3(1)
47.	R/W solidification bldg/ buried piping	0.5	57.	Tunnel TT3A/TT3A	0.3(1)
48.	R/W solidification bldg/ health physics bldg	0.5	58.	Tunnel TT3B/TT3B	0.3(1)
			59.	DFOS tanks/DFO pump house	0.3
49.	Health physics bldg/ buried utility piping	0.3	60.	DFO tank train 'A'/DFOS tank train 'B'	0.3
50.	Evaporative cooler/air compressor bldg	0.3	61.(4)	a. NSCW valve house (5)/ splash ring; splash ring/NSCW tower	0.5 0.25
51.	Air compressor bldg/ buried piping	0.3			
52.	Cement silo/R/W solidification bldg	0.5		b. NSCW valve house (5)/ splash ring; splash ring/NSCW tower	0.25 0.5
			62.	DFO Storage Tank Pumphouse Floor Slab/Walls Footers (11)	0.3

NOTES:
1. Seismic gaps occur within structure. See Reference 31 (Documents Applicability to Unit 2 also).
2. All references to Unit 1 are also applicable to Unit 2.
3. The 0.5 inch differential for pipe sleeve clearances assumes valvehouse settles relative to cooling tower - Unit 1 only. (Reference 20).
4. Combination a. and b. both need to be verified for trains A and B.
5. If there are no rigid supports in the NSCW valve house, then settlement shown applies to tunnels TT2A and TT2B (Reference 21).
6. See Reference 22.
7. See Reference 26.
8. The differential settlement for the soil adjacent to the footing inside the pumphouse structure relative to the soil adjacent to the footing outside the structure is 0.25 inch (vertical) (Reference 28).
10. The design differential settlement between diesel fuel oil storage tank pumphouse and adjacent soil is 0.30 inch. (Ref. 47)
11. DFOS/TH Walls and Footers settle with respect to floor slab. Reference 49.

TABLE 7

MAXIMUM DIFFERENTIAL BUILDING SETTLEMENT (Sheet 3 of 4)

9. REVISED DESIGN DIFFERENTIAL SETTLEMENT FOR INDIVIDUAL LINES.

LINE OR ISO#	INTERFACE	REVISED DESIGN DIFFERENTIAL SETTLEMENT (IN)	REFERENCE
2RS-1301-007-01	AUX. BLDG/TUNNEL AREA (2T1)	.42	39
2RS-1301-001-01	AUX. BLDG/CONTAINMENT(PEN #162)	0.4	39
2-2301-199-4"	AUX. BLDG/TUNNEL-2T3B	0.8	40
1-1215-171-4"	AUX. BLDG/TRANSFER BLDG.	1.10	41
A-1215-122-4"	AUX. BLDG/TRANSFER BLDG	1.30	41
1-1208-044-1 1/2"	CONTAINMENT/FUEL	0.4	16
2-1208-044-1 1/2"	CONTAINMENT/FUEL	0.4	17
1-1208-046-1 1/2"	CONTAINMENT/FUEL	0.4	38
1-1202-036-10"	AUX. BLDG/TUNNEL 1T3B	0.7	23
1-1202-038-10"	AUX. BLDG/TUNNEL 1T3B	0.7	23
1-1301-008"-38"	AUX. BLDG/M.S.TUNNEL @ SUPPORT (VI-1305-056-H005)	0.3	27
2-1204-063-3"	AUX. BLDG/CONTAINMENT	0.4	37
1-1214-303-4"	AUX. BLDG/R/W TRANSFER BLDG	0.85	29
A-1214-454-4"	AUX. BLDG/R/W TRANSFER BLDG	1.10	29
2-1201-001-8"	AUX. BLDG/CONTAINMENT BLDG	0.4	42
2-1202-192-8"	AUX. BLDG/CONTAINMENT BLDG	0.4	42
2-1202-225-8"	AUX. BLDG/CONTAINMENT BLDG	0.4	42
2-1202-196-8"	AUX. BLDG/CONTAINMENT BLDG	0.4	43
2-1202-195-8"	AUX. BLDG/CONTAINMENT BLDG	0.4	43
2-1202-187-8"	AUX. BLDG/CONTAINMENT BLDG	0.5	43
2-1202-189-8"	AUX. BLDG/CONTAINMENT BLDG	0.5	43
2-1202-222-8"	AUX. BLDG/CONTAINMENT BLDG	0.4	43
2-1202-223-8"	AUX. BLDG/CONTAINMENT BLDG	0.4	43
2-1202-023-6-05	NEON TOWER/VALVEHOUSE	0.4	44
2-1202-031-6-02	NEON TOWER/VALVEHOUSE	0.4	44
2-1202-033-6-05	NEON TOWER/VALVEHOUSE	0.4	44
2-1202-024-6-05	NEON TOWER/VALVEHOUSE	0.4	44
2-1202-006-6-02	NEON TOWER/VALVEHOUSE	0.4	44
2-1202-032-6-05	NEON TOWER/VALVEHOUSE	0.4	44
2-1202-034-6-05	NEON TOWER/VALVEHOUSE	0.4	44

TABLE 7

MAXIMUM DIFFERENTIAL BUILDING SETTLEMENT (Sheet 4 of 4)

9. REVISED DESIGN DIFFERENTIAL SETTLEMENT FOR INDIVIDUAL LINES.

LINE OR ISO8	INTERFACE	REVISED DESIGN DIFFERENTIAL SETTLEMENT (IN)	REFERENCE
2-1229-011-3"	R/W Transfer Tunnel/ Auxiliary Bldg.	0.9	51
2-1229-013-3"	R/W Transfer Tunnel/ Auxiliary Bldg.	1.1	51
2-1407-097-2"	R/W Transfer Tunnel/ Auxiliary Bldg.	0.9	51
1-1224-005-1 1/2	R/W Transfer Tunnel/ Auxiliary Bldg.	0.8	51
1-1229-011-3"	R/W Transfer Tunnel/ Auxiliary Bldg.	1.0	51
1-1229-013-3"	R/W Transfer Tunnel/ Auxiliary Bldg.	1.0	51
A-1591-263-2 1/2"	R/W Transfer Tunnel/ Auxiliary Bldg.	0.8	51
A-1591-264-2 1/2"	R/W Transfer Tunnel/ Auxiliary Bldg.	0.9	51
A-1901-024-2"	R/W Transfer Tunnel/ Auxiliary Bldg.	0.9	51
A-1901-055-2"	R/W Transfer Tunnel/ Auxiliary Bldg.	0.9	51
A-2301-408-4"	R/W Transfer Tunnel/ Auxiliary Bldg.	1.0	51
A-2401-021-1 1/2"	R/W Transfer Tunnel/ Auxiliary Bldg.	1.0	51
A-2420-040-1 1/2"	R/W Transfer Tunnel/ Auxiliary Bldg.	1.0	51
A-2401-021-1 1/2"	R/W Transfer Tunnel/ R/W Transfer Bldg.	0.7	51
A-2420-040-1 1/2"	R/W Transfer Tunnel/ R/W Transfer Bldg.	0.7	51
2-1414-529-1 1/2"	R/W Transfer Tunnel/ R/W Transfer Bldg.	0.7	52

ENCLOSURE 2

DC-1000-C
FIGURE 13
ESTIMATED SETTLEMENT OF POWER BLOCK STRUCTURES

ALVIN W. VOGTLE NUCLEAR PLANT

DESIGN MANUAL CHANGE NOTICE (DMCN)

DMCN NO. DC-1000C-14

DATE 7-5-90

INSERT THIS CHANGE NOTICE FOLLOWING THE COVER PAGE OF THE APPLICABLE DESIGN CRITERIA OR SECTION AND RETAIN UNTIL CHANGE NOTICE IS REPLACED BY A REVISION

DM SECTION OR DC NO. DC-1000C TITLE General Design Criteria (Civil/Structural)

REV. NO. 3

PRINCIPAL RESPONSIBILITY SCS VNP - Civil Group Q LIST: ☒ YES ☐ NO

SYSTEM CLASSIFICATION: ☒ SAFETY RELATED ☐ SAFETY IMPACT ☐ OTHER

CHANGE REQUESTED BY: ☐ CLIENT ☒ ENGINEERING ☐ SUPPLIER/CONTRACTOR

REASON FOR CHANGE To incorporate the final settlement estimates as determined by Project design calc. no. X2CF-S-106, rev. 1.

DESCRIPTION OF CHANGE Revision to Figure 13. "Estimated Settlement of Power Block Structures", p. G5, to show the latest settlement estimate for the center point of the Fuel Handling Bldg. (changed from 3.4 to 4.0). Figure 13. also revised to show the estimated settlement for the center of the south end of the Unit 1 Diesel Gen. Bldg. (1.4) that was previously not shown.

APPROVAL SIGNATURES - SCS ENGINEERING		DATE
ORIG	C. Martin Greene	7-5-90
INTERDISCIPLINE REVIEW:	RT 7/05/90 (CDM/DATE) WRB 7/5/90 (EDM/DATE) 7-9-90 (MDM/DATE)	
ENG. OVERSIGHT (AS REQUIRED)	N/A	
**SAR CHANGE	FSAR Fig. 2.5.4-8 to be revised per SS-9422 REQUIRED ☒ NOT REQUIRED ☒	7-9-90
*NUC SAFETY ENGR.		7-9-90
*PQAE	L. C. Singleton	7-9-90
PEMV/DESIGNEE		7/10/90

*SIGNATURE REQUIRED ONLY IF SAFETY RELATED OR SAFETY IMPACT **COMPLETED BY NSE

AS IS:

STRUCTURE LOADS FOR SETTLEMENT ANALYSIS			
STRUCTURE	BEARING PRESSURE, KSF		ELEVATION OF APPLIED PRESSURE (FT.)
	GROSS	NET*	
DIESEL GEN BLDG	3.0	2.3	211
TURBINE BLDG	3.6	0.5	186
CONTROL BLDG	4.3	1.3	173
FUEL BLDG	0.1	0.1	173
REACTOR CONT BLDG	8.4	1.0	150.5
FUEL BLDG	0.1	0.1	150
RSCW TOWERS	0.8	0.4	120
AUXILIARY BLDG	10.2	3.3	100.25

*BEARING PRESSURE IN EXCESS OF WEIGHT OF FILL ABOVE FOUNDATION

1. Settlements are based on finished grade elev. 220 ft. and ground water elev. 165 ft.
2. Total settlements include initial settlement of sand backfill, loose sand stratum, and clay bearing stratum and consolidation settlement of clay bearing stratum caused by net structural loads, weight of fill above foundation level of each structure and soil fill weight.
3. Settlements in clay bearing stratum and loose sand stratum due to fill under structures will occur prior to application of loads and are not included in total settlements.
4. Stresses and settlements were computed using "SEPOL" - A computer program developed at Massachusetts Institute of Technology.
5. Soil properties used were as follows:

Clay bearing stratum
Saturated unit weight = 115 pcf
Undrained Young's Modulus = 4,000 - 10,000 KSF
Poisson's Ratio = 0.5
Layer thickness = 70 ft

Compacted backfill
Moist unit weight = 125 pcf
Sat. unit weight = 132 pcf
Undrained Young's Modulus = 1,500 KSF
Poisson's Ratio = 0.4
Layer thickness = 90 ft

Loose sand stratum
Saturated unit weight = 115 pcf
Undrained Young's Modulus = 10,000 - 22,000 KSF
Poisson's Ratio = 0.4
Layer thickness = 1,000 ft

LEGEND
• Point at which settlement was computed
25 Total settlement in inches

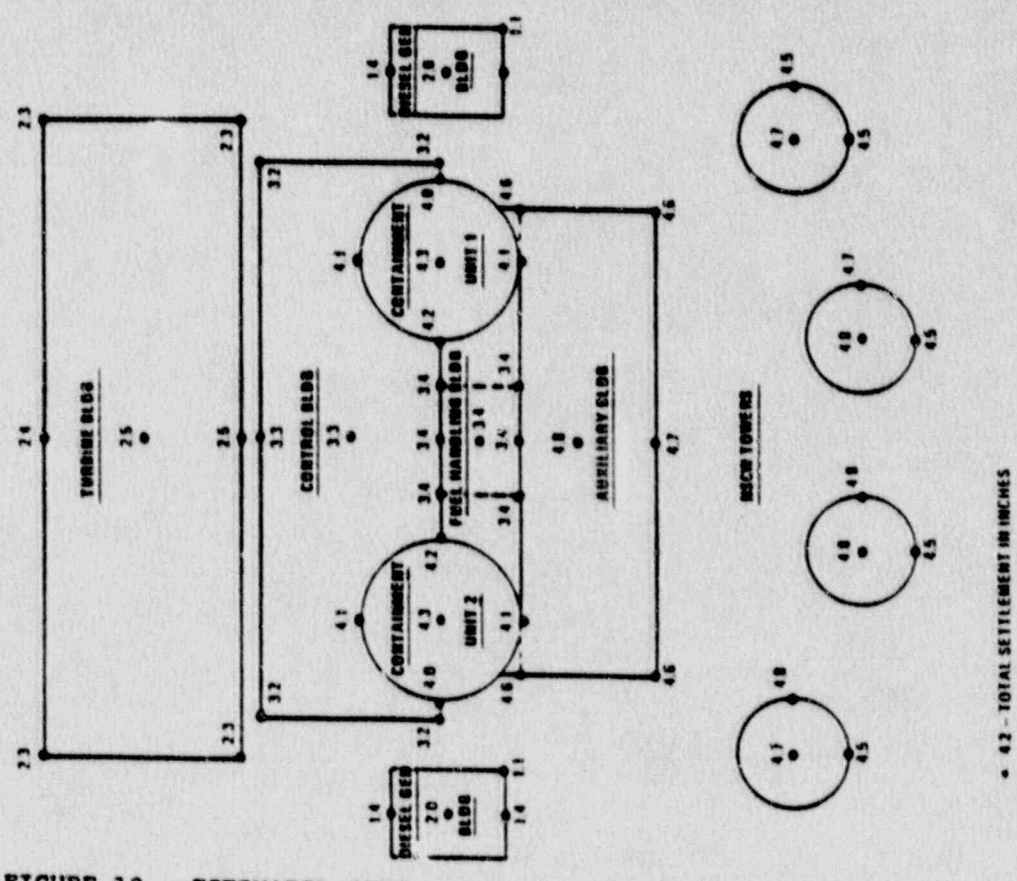

FIGURE 13. ESTIMATED SETTLEMENT OF POWER BLOCK STRUCTURES

PROPOSED CHANGE:

STRUCTURE LOADS FOR SETTLEMENT ANALYSIS			
STRUCTURE	BEARING PRESSURE, KSF		ELEVATION OF APPLIED PRESSURE (FT)
	GROSS	NET*	
DIESEL GEN BLDG	3.2	2.7	211
TURBINE BLDG	3.6	.85	186
CONTROL BLDG	4.3	1.3	173
FUEL BLDG	6.1	0.1	173
REACTOR CONT BLDG	8.4	1.8	152.5
FUEL BLDG	6.1	0.1	154
RSCW TOWERS	6.8	.24	128
AUXILIARY BLDG	10.2	3.3	109.2±

*BEARING PRESSURE IN EXCESS OF WEIGHT OF FILL ABOVE FOUNDATION

1 Settlements are based on finished grade elev. 220 ft and ground water elev. 185 ft

2 Total settlements include elastic settlement of sand backfill, loose sand stratum, and clay bearing stratum and consolidation settlement of clay bearing stratum caused by net structural loads, weight of fill above foundation level of each structure and net fill weight.

3 Settlements in clay bearing stratum and loose sand stratum due to fill under structures will occur prior to application of loads and are not included in total settlements.

4 Stresses and settlements were computed using "SEPOL" - A computer program developed at Massachusetts Institute of Technology

5 Soil properties used were as follows:

	Compacted backfill	Loose sand stratum
Clay bearing stratum	Moist unit weight = 126 pcf	Saturated unit weight = 115 pcf
Sat. unit weight = 115 pcf	Sat. unit weight = 132 pcf	Undrained Young's Modulus = 10,000-22,000 KSF
Sat. unit weight = 110 pcf	Undrained Young's Modulus = 1,500 KSF	Poisson's Ratio = 0.4
Undrained Young's Modulus = 4,000-10,000 KSF	Poisson's Ratio = 0.4	Layer thickness = 1,000 ft
Poisson's Ratio = 0.5	Layer thickness = 30 ft	
Layer thickness = 70 ft		

LEGEND

• Point at which settlement was computed

25 Total settlement in inches

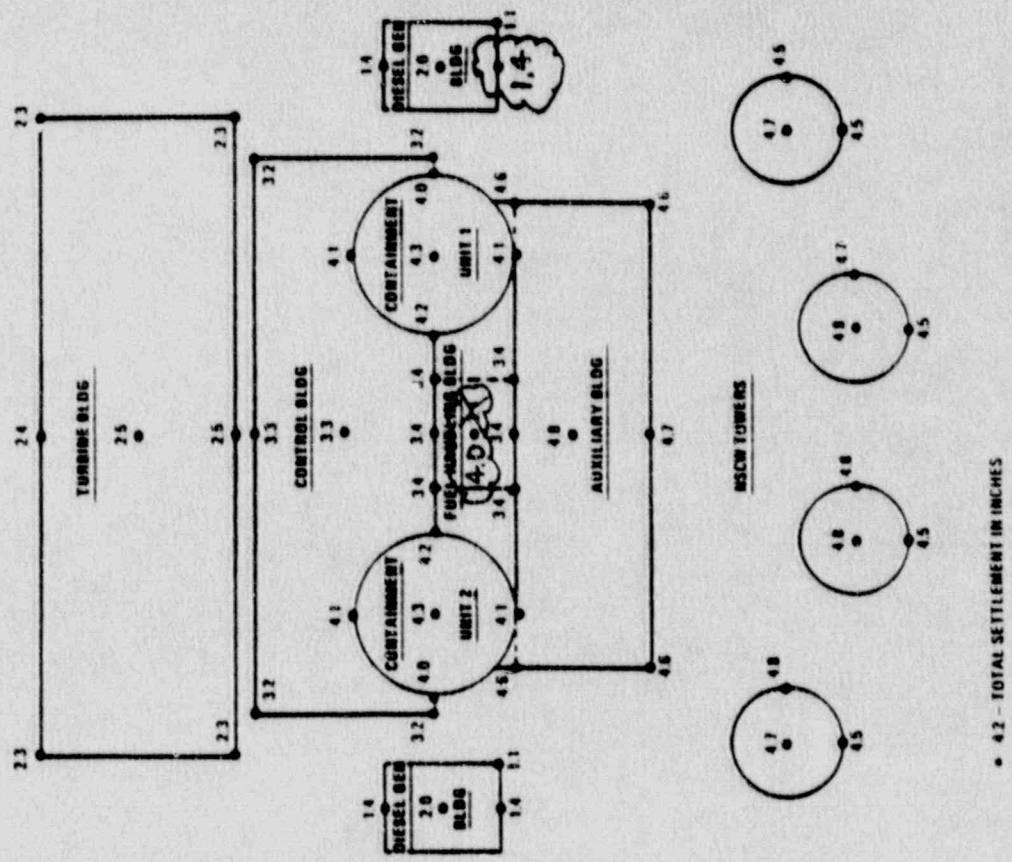

FIGURE 13. ESTIMATED SETTLEMENT OF POWER BLOCK STRUCTURES

ENCLOSURE 3

CALCULATION X4CPS-0167

BUILDING SETTLEMENT SUMMARY, UNIT 1