ATTACHMENT 2

CONDITION REPORT ENGINEERING EVALUATION NO. 96-12151-27

	0PGP04-ZA-0002	Rev. 2
	Condition Report Engineering Evaluation Program	Z31.02
Form 1	Condition Report Engineering Evaluation Form	

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1. Identify the appropriate CR Category

☐ Engineering Action ☒ Engineering Report ☐ Engineering Change ☐ Unclassified

2. Reason for change:

☐ Enhancement ☐ Administrative ☐ Nonconformance

3. NCR Disposition:

☐ Use-As-Is ☐ Repair ☐ Rework ☐ Invalidate ☐ Reject (NF&A Only)

4. Change Type:

☐ Major MOD ☐ Non-Design Change

☐ Minor MOD ☐ Procedure Change

☐ Minor Change ☐ Temporary MOD

☐ Paper Change ☐ Other

Action/Task/Sub-Task/No.	Owner	Dept	Description
96-12151-27	Q. Huynh	DED	Generic Letter 96-06: Engineering evaluation of the potential thermal over-pressure in the RH, SI, PS, WL and ED lines

5. Disposition / Evaluation:

(See attached)

Sam Kannan / [signature] 6/4/97 — Inter-Discipline Review / Date

R. P. Kersey / RPKersey 6/4/97 — Reviewed by / Date

6. Quoc Huynh / Quoc K. Huynh 6/3/97 — Prepared by / Date

7. K. D. House / [signature] 6/4/97 — Supervisor / Date

POTENTIAL THERMAL OVERPRESSURE IN THE RH, SI, PS, WL AND ED LINES

1.0 PURPOSE

The purpose of this report is to evaluate the effects of thermal overpressure on the structural integrity of the following 10 containment penetration piping sections identified in CREE 96-12151-6 in response to Generic Letter 96-06:

- 8"-RH-1204-KB2: Refueling Cavity Drain Line to RWST Containment Penetration M-55
- 8"-RH-1304-KB2: Refueling Cavity Drain Line to RWST Containment Penetration M-76
- 3/4"-SI-1321-BB2: SIS Test Line Containment Penetration M-68
- 1"-PS-1005-BB2: Pressurizer Vapor Sampling Line Containment Penetration M-85
- 1"-PS-1016-BB2: Pressurizer Liquid Sampling Line Containment Penetration M-85
- 1"-PS-1002-BB2: RCS Hot Leg Sampling Line Containment Penetration M-85
- 1"-PS-1003-UB2: RHR Loop Sampling Line Containment Penetration M-86
- 1"-PS-1004-UB2: SI Accumulator Sampling Line Containment Penetration M-29
- 3"-WL-1009-RB2: RCDT Discharge Line to LWPS Containment Penetration M-56
- 2"-ED-1124-SB2: Containment Normal Sump Discharge Containment Penetration M-72

The concern is that elevated containment temperature following a DBA will heat the fluid trapped between the containment isolation valves and could create pressures high enough to affect containment integrity via bypass leakage.

Note: A layer of 1" insulation has been installed on Line No. 3"-WL-1009-RB2 (RCDT Discharge Line to LWPS Containment Penetration). Refer to CREE 96-12151-19 and CR 97-1064 for further details.

2.0 SUMMARY OF RESULTS

The calculation results indicate that the affected piping and penetrations are capable of withstanding the potential peak pressures and still be within the ASME Code allowable limits for Faulted Conditions. Therefore, the containment structural integrity is not affected. **Engineering determined that the associated piping and penetrations will remain operable in the event of a design basis accident.**

3.0 ANALYSES

3.1 Methodology

Group 1: Containment penetrations with inherent overpressure protection

Containment penetration with air-operated globe valves provide inherent overpressure protection when at least one isolation valve is positioned so that trapped fluid applies pressure under the valve plug, and the valve spring is designed to allow the valve to open below the maximum allowable pressure of the piping and valves. The following lines meet the Group 1 criteria:

- 3/4"-SI-1321-BB2: SIS Test Line Containment Penetration
- 1"-PS-1005-BB2: Pressurizer Vapor Sampling Line Containment Penetration
- 1"-PS-1002-BB2: RCS Hot Leg Sampling Line Containment Penetration
- 1"-PS-1003-UB2: RHR Loop Sampling Line Containment Penetration
- 1"-PS-1004-UB2: SI Accumulator Sampling Line Containment Penetration
- 2"-ED-1124-SB2: Containment Normal Sump Discharge Line Containment Penetration

For this group, the maximum pressure required to unseat the valve plug will be calculated (see Attachment A). This pressure or the accident heat-up pressure is then compared against the allowable pressure to which the piping, valves, and penetrations can conservatively withstand without exceeding ASME Code limits.

Group 2: Containment penetrations which do not have inherent overpressure protection

Penetrations with gate or globe valves with trapped fluid pressure above the valve plug do not have inherent overpressure protection. These lines are identified as follows:

- 8"-RH-1204-KB2: Refueling Cavity Drain Line to RWST Containment Penetration
- 8"-RH-1304-KB2: Refueling Cavity Drain Line to RWST Containment Penetration
- 1"-PS-1016-BB2: Pressurizer Liquid Sampling Line Containment Penetration
- 3"-WL-1009-RB2: RCDT Discharge Line to LWPS Contaiment Penetration

For this group, the accident peak pressure due to thermal expansion is calculated by NF&A for each case. This pressure is then compared against the allowable pressure to which the piping, valves, and penetrations can conservatively withstand without exceeding ASME Code limits (see Attachment A).

For both groups, pipe stresses were computed (see Attachment B) to demonstrate that ASME Code allowable stress limits are still met.

3.2 Acceptance Criteria

To ensure the integrity of the containment pressure boundary, the applicable ASME Code allowable limits are followed. UFSAR Tables 3.9-6A and 3.9-7A specify the following limits for piping and valves:

3.2.1 Piping Criteria

UFSAR Table 3.9-7A refers to Code Case 1606-1 (N-53) of the ASME III Code (1974 Edition and addenda through Winter 1975), Subsection NC-3611.2 which specifies the following:

a. For Service Level D pressure limit, NC-3611.2 states " When Level D Limits apply, the peak pressure P_{max}, alone shall not exceed 2.0 times the pressure P, calculated in accordance with Eq. (4), NC-3641.1."

Eq. (4) is given as follows: $\mathbf{P = 2\,S(t_m - A) / [D_o - 2y(t_m - A)]}$

Where:

- P = Calculated maximum allowable internal pressure, psi
- S = Max. allow. stress (psi) in material caused by internal press. at design temp.
- t_m = minimum required wall thickness (in.)
- D_o = Pipe outside diameter (in.)
- y = 0.4, except that for pipe with a D_o/t ratio less than 6, $y = d / (d + D_o)$
- A = Additional thickness to compensate for threading, corrosion, etc.

Therefore, the maximum allowable internal pressure at Faulted Condition (Level D) is: $\mathbf{P_{max} \leq 2\,P}$

b. For stress limits, NC-3611.2 states " The sum of stresses due to internal pressure, live and dead load, and those due to occasional loads... shall not exceed 2.4 times the allowable stress, S_h. This requirement is satisfied by meeting Eq. (9), NC-3652.2, using a stress limit of 2.4 S_h"

Eq. (9) is given as follows: $P_{max} D_o / 4 t_n + 0.75 i (M_A + M_B / Z) \leq 2.4 S_h$

Where:

P_{max} = Peak pressure, psi
M_A = Resultant moment loading on cross section due to weight and other sustained loads, in.-lb
M_B = Resultant moment loading on cross section due to occasional loads, in.-lb
Z = Section modulus of pipe, $in.^3$
S_h = Material allowable stress at design temperature, psi
i = Stress intensification factor
t_n = nominal pipe wall thickness, in.

3.2.2 Valve Criteria

a. For pressure limit for the faulted condition, UFSAR Table 3.9-6A specifies $P_{max} \leq 1.5\ P$

If the pressure limits are met, the stress limits below are considered to be satisfied.

b. For stress limits, UFSAR Table 3.9-6A specifies the following faulted limits:

$$\sigma_m \leq 2.0\ S$$
$$(\sigma_m \text{ or } \sigma_L) + \sigma_b \leq 2.4\ S$$

Where:

σ_m = General membrane stress
σ_L = Local membrane stress
σ_b = Bending stress
S = Allowable stress value in accordance with ASME III Code

3.3 Assumptions

1. No pressure relief due to valve leakage is assumed in this evaluation.

2. Review of the valve drawings (Ref. 3, 15, 34 & 38) reveals that trapped water is isolated to one side of the valve, between the valve nozzle and valve disc. This portion of the valve body geometry is similar to a pipe (i.e. cylindrical shape). Therefore, to simplify the computation, Equation 4 in Section 3.2.1 above is assumed to be also applicable for valves when calculating the maximum allowable pressure (**P**).

3. For pipe thickness (**t_m**), no manufacturing tolerances are considered. The norminal pipe thickness combined with the lowest allowable stress (S) taken from the Appendix I of 1974 ASME III Code are used in calculating the maximum allowable pipe pressure. Review of the Certified Material Test Reports (CMTRs) for the RH lines reveals that the lowest yield strength value of the installed pipe is approximately 35% higher than the minimum yield strength value required by the ASME Code. Therefore, any variations in the actual pipe thickness due to manufacturing tolerances will be offset by the favorable mechanical material properties of the installed pipe if the higher stress values from CMTRs were used.

4. The corrosion allowance (A) is assumed to be zero since the installed piping materials are of corrosion resistant type (austenitic stainless steel) and compatible with the system fluid. All pipe joints are welded and no threaded joints are installed on the pressure side of the piping (Ref. 13).

5. Since the affected piping penetrations are located on elevation 30'of the Radioactive Pipe Chase Room of the Reactor Containment Building where there are significant numbers of hot pipe such as CVCS Letdown lines located in the same room, the initial fluid temperature in some piping penetrations such as RH and WL piping is assumed to be as high as **75 °F**. This is based on the normal room temperature of the Radioactive Pipe Chase before the LOCA. The room temperature was calculated based on a conservative air entering temperature of 66 °F plus a temperature rise of 9 °F. The temperature rise was conservatively calculated based on only 50% of piping heat load of 23,611 btu (Ref. Calc.# MC-5763, Rev. 2) and a supply air flow rate of 1,250 scfm (Ref. P&ID# 5V149V00016#1/#2, Rev. 10/Rev.10) as follows: ΔT = 23,611 btu / (2 X 1.08 X 1,250 scfm) = 8.75 °F, use ΔT = 9°F.

6. The RH line is used to drain water in the Reactor Cavity back to the Refueling Water Storage Tank after each refueling outage. Upon completing the draining evolution, the in-board containment isolation valve is manually closed before the out-board valve, thus the pressure in the penetration during full power operation is equal to the static head difference between the RWST and the penetration. The static head is calculated to be approximately 6 psig. Conservatively, the initial fluid pressure in the RH piping is therefore assumed to be **20 psig**. No valve seat leakage into the penetration is assumed because the containment isolation valves are gate valve type. This is conservative because any seat leakage into the penetration will be leaked out through the same valve.

3.4 Calculation Results Summary

The table below summarizes the calculated peak pressures vs. the allowable pressures to which the piping, valves, and penetrations could b[illegible]ndled without exceeding ASME Code limits. See Attachments A and B for detailed calculations.

Line ID	Calculated Peak Pressure, psig	ASME Allowable Pressure, psig
	Group 1	
3/4"-SI-1321-BB2	11,714	13,614
1"-PS-1005-BB2	12,352	12,534
1"-PS-1002-BB2	12,352	12,534
1"-PS-1003-UB2	6,034	6,911
1"-PS-1004-UB2	6,437	6,911
2"-ED-1124-SB2	437	3,225
	Group 2	
8"-RH-1204-KB2	2,111*	2,416
8"-RH-1304-KB2	2,092*	2,416
1"-PS-1015-BB2	6,935*	12,534
3"-WL-1009-RB2	2,690*	3,359

* Pressures calculated by NF&A (Ref. 41)

A brief summary of the results from Attachments A and B is provided below:

- The internal pressures in the RH, PS and WL piping penetrations (Group 2) following a DBA are within the ASME Code allowable limits.

- All air-operated valves (AOVs) on the SI, PS and ED piping penetrations (Group 1) are capable of unseating themself within the ASME Code allowable pressures, thereby fulfilling the over-pressure relief function if required. In addition, based on the peak pressure calculated by NF&A for a similar size penetration (Line No. 1"-PS-1016-BB2, Ref. 41), the internal pressures of some 1" piping penetrations following a DBA are still within the ASME Code allowable limits and the pressure may never reach the maximum pressure required to unseat the valve plug. Therefore, the function of the AOV to act as a relief valve may not be required and the ASME Code allowable pressure limits are still met. Engineering actions are being formulated (see below) to support this conclusion.

4.0 CONCLUSION

The calculation results indicate that the affected piping and penetrations were found to be capable of withstanding the potential peak pressures and still be within the ASME Code allowable limits for Faulted Conditions. Therefore, the containment structural integrity is not affected. Engineering determined that the associated piping and penetrations will remain operable in the event of a design basis accident.

5.0 ACTIONS

- To determine the number of air-operated valves (AOVs) to be credited for containment penetration over-pressure relief, further calculations will be performed to confirm that the heat-up pressures following a DBA will not exceed the maximum pressures required to unseat the valve plug of the Group 1 AOVs or

- For the AOVs where bench-set pressures are to be credited for containment penetration over-pressure protection, issue a DCP against the Scaling Sheets of the affected AOVs to maintain configuration control of the bench-set pressures.

These actions are tracked under CAP Action No. 96-12151-35.

6.0 REFERENCES

1. UFSAR Tables 3.9-6A and 3.9-7A, Stress Criteria for ASME III Code Class 2 and 3

2. P&ID Nos. 5R169F20000#1/#2, Rev. 19/Rev. 18, Residual Heat Removal System

3. Drawing 0220(1)-00097-AWN and 0220(2)-00098-AWN, Valve Nos. RH-0063B&C/0064B&C

4. Drawing 4036/8036-01073-EEG, Penetration Nos. M-55 and M-76

5. Isometric Nos. 2M369PRH259 Sht. 2, Rev. 4 and 2C369PRH459 Sht. 2, Rev. 9 and Sht. 5, Rev. 7

6. ASME III 1974 Edition, Appendix I, Table I-7.0, Allowable Stress Value, S, for Class 2 Components

7. Code Data Package for Penetration Nos. M-55 and M-76

8. Vendor Data Package for Valve Nos. RH-0063B&C/0064B&C

9. P&ID Nos. 5N129F05016#1/#2, Rev. 11/ Rev. 12, Safety Injection System

10. Drawing 0220(1)-00119-DWN and 0220(2)-00120-DWN, Valve Nos. FV-3970/3971

11. Drawing 4036/8036-01085-EEG, Penetration Nos. M-29, M-68 and M-80

12. Isometric Nos. 5M369PSI272 Sht. A01, Rev. 6, and 5C361/2PSI472 Sht. A05, Rev. 1/Rev. 2

13. Specification for Criteria for Piping Design, 5L019PS004, Rev. 19

14. Vendor Data Package for Penetration Nos. M-29,M-68 and M-80

15. Drawing 4032/8032-01076-CKT for Valve Nos. PS-0004,-0008,-0011,and -0015

16. P&ID Nos. 5Z329Z00045#1/#2, Rev. 17/Rev. 18, Primary Sampling System

17. P&ID Nos. 5Z549Z47501#1/#2, Rev. 9/Rev. 9, Post Accident Sampling System

18. Isometric 2C369PPS485 Sht. A01, Rev. 8,
5M369PPS285 Sht. A01, Rev. 4
5M369PAP287 Sht. A01, Rev. 6

19. Drawing 4036/8036-00101-CEG, Penetration Nos. M-85 and M-86

20. Drawing 4407/8407-00019-BRZ, Valve Nos. FV-4450, 4451, 4454, 4455, and 2455

21. Assembly Drawing 4407/8407-00009-ARZ, Valve Nos. FV-4450, 4451, 4454, 4455, and 2455

22. Vendor Data Package for Valve Nos. FV-4450, 4451, 4454, 4455, and 2455

23. Drawing 4407/8407-00018-BRZ, Valve Nos. FV-2453, 2454, 4823, and 4824

24. Assembly Drawing 4407/8407-00013-ARZ, Valve Nos. FV-2453, 2454, 4823, and 4824

25. Vendor Data Package Valve Nos. FV-2453, 2454, 4823, and 4824

26. Drawing 4026-01145-CWV, Valve No. FV-4461

27. Vendor Data Package for Valve No. FV-4461

28. Drawing 4026-01147-DWV, Valve No. FV-4466

29. Vendor Data Package Valve No. FV-4466

30. Drawing 4409-00177-CVT, Valve No. FV-4451B

31. Vendor Data Package for Valve No. FV-4451B

32. Drawing 4026-01146-DWV, Valve No. FV-4452 and -4456

33. Vendor Data Package for Valve No. FV-4452 and -4456

34. Drawing 4032/8032-00016-CKT, Valve No. PS-0001

35. Vendor Data Package for Valve No. PS-0001

36. P&ID Nos. 5Q069F05030#1/#2, Rev. 14/Rev. 13, Radioactive Vent and Drain System

37. Isometric 5C369PED426 Sht. 5, Rev. 5
    5M369PED226 Sht. A29, Rev. 2
    5M361PED226 Sht. 32, Rev. 0

38. Drawing No. 4038-01149-CAD and 8038-01123-CAD, Valve No. MOV-0064

39. Drawing No. 4026/8026-01144-FWV, Valve No. FV-7800

40. Drawing Nos. 6373-00023-DNY and 6373-00024-ENY, Valve No. ED-0056

41. Pipe Heat-up/Pressurization Analysis Results, CC:Mail from J.M. Wigginton dated 4/29/97 (attached)

42. Drawing 4050/8050-01001-ETG for Valve Nos. FV-4450A,-4451A,-4454A, and -4455A

43. Assembly Dwg No. 4050/8050-00007-CTG for Valve Nos. FV-4450A,-4451A,-4454A, and -4455A

44. Vendor Data Package for Valve Nos. FV-4450A,-4451A,-4454A, and -4455A

45. WKM Engineering Standard 4026/8026-01128-AWN

46. Drawing 4036/8036-01065-BEG for Penetration No. M-72

47. Drawing 4038-01135-AAD/8038-0110?-AAD for Valve No. MOV-0312

48. Drawing 4026-01143-DWV for Valve No. FV-4913

49. Drawing 4036/8036-01078-DEG for Penetration No. M-56

50. P&ID Nos. 5R309F05022#1/#2, Rev. 15/Rev. 16, Liquid Waste Processing System

51. Isometric 5M369PWL277 Sht. 4, Rev. 5 and 5C369PWL477 Sht. 1, Rev. 5

ATTACHMENT A

PIPING PRESSURE CALCULATION

CALCULATION SHEETS

1. SI Line 3/4"-SI-1321-BB2:

Material Data Table

	Wall Thk. t, in.	ASME Material	Allowable Stress, S_h, psi at 300°F	References
Pipe 3/4" Sch.160s	0.219	SA312 TP304L	15,300	13,6
Penetration M68 (1")	0.250	SA376 TP316	18,400	11,6
Valves FV-3970 & 3971	0.219	SA182 F316	18,400	10,6

a. Calculate the maximum pressure required to unseat the valve plug

This line consists of two 3/4" AMETEK air-operated globe valves which at least one valve is positioned so that trapped fluid applies pressure under the valve plug, and the valve spring is designed to allow the valve to open below the maximum allowable pressure of the piping and valves.

Valve Plug cross-section area A_p = 3.1416 $(.672)^2$ /4 = 0.35 in^2. (Ref. 10)
Diaphragm area: A_d = 100 in^2. (Ref.10)
Airset pressure range to unseat the plug: P_D = 33 to 41 psig (Ref. 10)
use P_D = 41 psig (Note: actual airset value is 33 psig, Ref. Scaling Sheets A1(2)SI-FV-3971)
Maximum fluid pressure required to unseat the valve plug: P_p = (41)(100)/0.35= **11,714** psig

b. Calculate the Code maximum allowable pressure for 3/4"pipe and valve

$$P = 2\,S(t_m - A) / [D_o - 2y(t_m - A)]$$

Where:

S	= 15,300 psi
t_m	= 0.219"
D_o	= 1.05" for pipe. Same value is assumed for valve.
y	= 0.612/(1.05+0.612) = 0.37

Therefore,

P = 2 (15,300)(0.219)/[1.05 - 2(0.37)(0.219)] = 7,547 psig for pipe
P = 2 (18,400)(0.219)/[1.05 - 2(0.37)(0.219)] = 9,076 psig for valves

For piping at Faulted condition: P_{max} = 2 P = 2(7,547) = **15,094 psig**
For valves at Faulted condition: P_{max} = 1.5 P = 1.5(9,076) = **13,614 psig**

c. Calculate the Code maximum allowable pressure for 1" penetration

S	= 18,400 psi
t_m	= 0.25"
D_o	= 1.315"
y	= 0.815/(1.315+0.815) = 0.38

P = 2 (18,400)(0.25)/[1.315 - 2(0.38)(0.25)] = 8,178 psig

For penetration at Faulted condition: P_{max} = 2 P = 2(8,178) = **16,356 psig**

Conclusion: Since the Code allowable pressure (13,614 psig) is higher than the maximum pressure required to unseat the valve (11,714 psig), the existing piping and penetration design is acceptable.

2. PS Line 1"-PS-1005-BB2:

Material Data Table

	Wall Thk, t, in.	ASME Material	Allowable Stress, S_h,psi at 150°F	References
Pipe 1" Sch.160s	0.250	SA312 TP304L	15,700	13,6
Penetration M85	0.250	SA312 TP316L	15,700	19,6
Valve FV-4450	0.750	SA479 F316L	15,700	22,6
Valve FV-4450A	0.428	SA182 F316L	15,700	44,6
Valve FV-4452	0.250	SA182 F316	18,800	33,6
Valve PS-0015	0.250	SA182 F316	18,800	15,6

a. Calculate the maximum pressure required to unseat the valve plug

This line consists of a 1" WKM air-operated globe valve FV-4452 which is positioned so that trapped fluid applies pressure under the valve plug, and the valve spring is designed to allow the valve to open below the maximum allowable pressure of the piping and valves.

Valve plug unbalanced cross-section area A_p = 0.306 in^2. (Ref. 45)
Diaphragm area: A_d = 140 in^2. (Ref. 45)
Airset pressure range to unseat the plug: P_D = 24 to 30 psig (Ref. 45)
Use P_D = 27 psig (Note: actual airset value is 24 psig, Ref. Scaling Sheets C1(2)PS-FV-4452)
Maximum fluid pressure required to unseat the valve plug: P_p = (27)(140)/0.306 = **12,352 psig**

b. Calculate the Code maximum allowable pressure for pipe, penetration and valves

$$P = 2\,S(t_m - A) / [D_o - 2y(t_m - A)]$$

Where:

S = 15,700 psi
t_m = 0.250"
D_o = 1.315" for pipe and penetration. Same value is assumed for valves
y = 0.815/(0.815+1.315) = 0.38

Therefore,

P = 2 (15,700)(0.250)/[1.315 - 2(0.38)(0.250)] = 6,978 psig for pipe and penetration
P = 2 (18,800)(0.250)/[1.315 - 2(0.38)(0.250)] = 8,356 psig for valves

For piping and penetration at Faulted condition: P_{max} = 2 P = 2(6,978) = **13,956 psig**

For valves at Faulted condition: P_{max} = 1.5 P = 1.5(8,356) = **12,534 psig**

<u>Conclusion:</u> Since the Code allowable pressure (12,534 psig) is higher than the maximum pressure required to unseat the valve (12,352 psig), the existing piping and penetration design is acceptable. Based on the results of the existing heat-up pressure analysis for a similar line at the same penetration (1"-PS-1016-BB2, Sch. 160 (Ref. 41), the heat-up pressure resulting from a design basis accident for this line is estimated to be approximately 6,935 psig. Therefore, there is significant margin fr... the Code allowable limits and the relief capability of the AOV may not be necessary. Further heat-up pressure calculation is required to confirm the conclusion.

3. <u>PS Line 1"-PS-1002-BB2:</u>

Material Data Table

	<u>Wall Thk. t, in.</u>	<u>ASME Material</u>	<u>Allowable Stress, S_h, psi at 150 °F</u>	<u>References</u>
Pipe 1" Sch.160s	0.250	SA312 TP304L	15,700	13,6
Penetration M85	0.250	SA312 TP316L	15,700	19,6
Valve FV-4454	0.750	SA479 F316L	15,700	22,6
Valve FV-4455	0.750	SA479 F316L	15,700	22,6
Valve FV-4454A	0.428	SA182 F316L	15,700	44,6
Valve FV-4455A	0.428	SA182 F316L	15,700	44,6
Valve PS-0011	0.250	SA182 F316	18,800	15,6
Valve FV-4456	0.312	SA182 F316	18,800	33,6
Valve FV-2455	0.750	SA479 F316L	15,700	22,6

a. Calculate the maximum pressure required to unseat the valve plug

This line consists of a 1" WKM air-operated globe valve FV-4456 which is positioned so that trapped fluid applies pressure under the valve plug, and the valve spring is designed to allow the valve to open below the maximum allowable pressure of the piping and valves.

Valve plug unbalanced cross-section area A_p = 0.306 in^2. (Ref. 45)
Diaphragm area: A_d = 140 in^2. (Ref. 45)
Airset pressure range to unseat the plug: P_D = 24 to 30 psig (Ref. 45)
Use P_D = 27 psig (Note: actual airset value is 24 psig, Ref. Scaling Sheets B1(2)PS-FV-4456)
Maximum fluid pressure required to unseat the valve plug: P_p = (27)(140)/0.306 = **12,352 psig**

b. Calculate the Code maximum allowable pressure for pipe, penetration and valves

$$P = 2\,S(t_m - A)/[D_o - 2y(t_m - A)]$$

Where:

S = 15,700 psi
t_m = 0.250"
D_o = 1.315" for pipe and penetration. Same value is assumed for valves
y = 0.815/(0.815+1.315) = 0.38

Therefore,

P = 2 (15,700)(0.250)/[1.315 - 2(0.38)(0.250)] = 6,978 psig for pipe and penetration
P = 2 (18,800)(0.250)/[1.315 - 2(0.38)(0.250)] = 8,356 psig for valves

For piping and penetration at Faulted condition: $P_{max} = 2P = 2(6,978) =$ **13,956 psig**

For valves at Faulted condition: $P_{max} = 1.5P = 1.5(8,356) =$ **12,534 psig**

<u>Conclusion:</u> Since the Code allowable pressure (12,534 psig) is higher than the maximum pressure required to unseat the valve (12,352 psig), the existing piping and penetration design is acceptable. Based on the results of the existing heat-up pressure analysis for a similar line at the same penetration (1"-PS-1016-BB2, Sch. 160 (Ref. 41), the heat-up pressure resulting from a design basis accident for this line is estimated to be approximately 6,935 psig. Therefore, there is significant margin from the Code allowable limits and the relief capability of the AOV may not be necessary. Further heat-up pressure calculation is required to confirm the conclusion.

4. <u>PS Line 1"-PS-1003-UB2:</u>

Material Data Table

	<u>Wall Thk, t, in.</u>	<u>ASME Material</u>	<u>Allowable Stress,</u> S_h, psi at 150 °F	<u>References</u>
Pipe 1" Sch. 40s	0.133	SA312 TP304L	15,700	13,6
Penetration M86	0.250	SA312 TP316L	15,700	19,6
Valve FV-4823	0.220	SA182 F316L	15,700	25,6
Valve FV-4461	0.250	SA182 F316	18,800	27,6
Valve PS-0008	0.250	SA182 F316	18,800	15,6
Valve FV-2454	0.220	SA182 F316L	15,700	25,6

a. Calculate the maximum pressure required to unseat the valve

This line consists of a 1" WKM air-operated globe valve FV-4461 which is positioned so that trapped fluid applies pressure under the valve plug, and the valve spring is designed to allow the valve to open below the maximum allowable pressure of the piping and valves.

Valve plug unbalanced cross-section area $A_p = 0.087$ in^2. (Ref. 45)
Diaphragm area: $A_d = 35$ in^2. (Ref. 45)
Airset pressure range to unseat the plug: $P_D = 10$ to 34 psig (Ref. 45)
Use $P_D = 15$ psig (Note: actual airset value is 10 psig, Ref. Scaling Sheets C1(2)PS-FV-4461)
Maximum fluid pressure required to unseat the valve plug: $P_p = (15)(35)/0.087 =$ **6,034 psig**

b. Calculate the Code maximum allowable pressure for pipe, penetration and valves

$$P = 2S(t_m - A)/[D_o - 2y(t_m - A)]$$

Where:

$S = 15,700$ psi
$t_m = 0.133"$
$D_o = 1.315"$ for pipe and penetration. Same value is assumed for valves
$y = 0.4$
$A = 0$

Therefore,

P = 2 (15,700)(0.133)/[1.315 - 2(0.4)(0.133)] = 3,455 psig for pipe and penetration
P = 2 (15,700)(0.220)/[1.315 - 2(0.4)(0.220)] = 6,065 psig for valves

For piping and penetration at Faulted condition: P_{max} = 2 P =2(3,455) = **6,911 psig**

For valves at Faulted condition: P_{max} = 1.5 P =1.5(6,065) = **9,097 psig**

Conclusion: Since the Code allowable pressure (6,911 psig) is higher than the maximum pressure required to unseat the valve (6,034 psig), the existing piping and penetration design is acceptable.

5. PS Line 1"-PS-1004-UB2:

Material Data Table

	Wall Thk, t, in.	ASME Material	Allowable Stress, S_h, psi at 150 °F	References
Pipe 1" Sch. 40s	0.133	SA312 TP304L	15,700	13,6
Penetration M29	0.250	SA376 TP316	18,800	11,6
Valve FV-4824	0.220	SA182 F316L	15,700	25,6
Valve FV-4466	0.250	SA182 F316	18,800	29,6
Valve PS-0001	0.250	SA182 F316	18,800	34,6

a. Calculate the maximum pressure required to unseat the valve plug

This line consists of a 1" WKM air-operated globe valve FV-4466 which is positioned so that trapped fluid applies pressure under the valve plug, and the valve spring is designed to allow the valve to open below the maximum allowable pressure of the piping and valves.

Valve plug unbalanced cross-section area A_p = 0.087 in². (Ref. 45)
Diaphragm area: A_d = 35 in². (Ref. 45)
Airset pressure range to unseat the plug: P_D = 16 to 40 psig (Ref. 45)
Use P_D = 16 psig (Note: actual airset value is 16 psig, Ref. Scaling Sheets B1(2)PS-FV-4466)
Maximum fluid pressure required to unseat the valve plug: P_p = (16)(35)/0.087 = **6,437 psig**

b. Calculate the Code maximum allowable pressure for pipe, penetration and valves

$$P = 2 S(t_m - A)/ [D_o - 2y(t_m - A)]$$

Where:

S	= 15,700 psi
t_m	= 0.133"
D_o	= 1.315" for pipe and penetration. Same value is assumed for valves
y	= 0.4
A	= 0

Therefore,

P = 2 (15,700)(0.133)/[1.315 - 2(0.4)(0.133)] = 3,455 psig for pipe and penetration
P = 2 (15,700)(0.220)/[1.315 - 2(0.4)(0.220)] = 6,065 psig for valves

For piping and penetration at Faulted condition: $P_{max} = 2P = 2(3,455) =$ **6,911 psig**

For valves at Faulted condition: $P_{max} = 1.5P = 1.5(6,065) =$ **9,097 psig**

Conclusion: Since the Code allowable pressure (6,911 psig) is higher than the maximum pressure required to unseat the valve (6,437 psig), the existing piping and penetration design is acceptable.

6. ED Line 2"-ED-1124-SB2:

Material Data Table

	Wall Thk, t, in.	ASME Material	Allowable Stress, S_h, psi at 150°F	References
Pipe 2" Sch.40s	0.154	SA312 TP304L	15,700	13,6
Penetration M72	0.154	SA312 TP304	18,300	46,6
Pipe 3" Sch. 40s	0.216	SA312 TP304L	15,700	13,6
Valve MOV-0064 (3")	0.218	SA351 CF8	16,450	38,6
Valve FV-7800 (3")	0.281	SA351 CF8M	17,000	39,6
Valve ED-0056 (1")	0.190	SA351 CF8M	17,000	40,6
Valve FV-2453 (1")	0.220	SA182 F316L	15,700	25,6

a. Calculate the maximum pressure required to unseat the valve plug

This line consists of a 3" WKM air-operated globe valve FV-7800 which is positioned so that trapped fluid applies pressure under the valve plug, and the valve spring is designed to allow the valve to open below the maximum allowable pressure of the piping and valves.

Valve plug unbalanced cross-section area $A_p = 9.3\ in^2$. (Ref. 45)
Diaphragm area: $A_d = 140\ in^2$. (Ref. 45)
Airset pressure range to unseat the plug: P_D = 11 to 29 psig (Ref. 45)
Use P_D = 29 psig (Note: actual airset pressure is 13.22 psig, Ref. Scaling Sheets A1(2)ED-FV-7800)
Maximum fluid pressure required to unseat the valve plug: $P_p = (29)(140)/9.3 =$ **437 psig**

b. Calculate the Code maximum allowable pressure for 2" pipe and penetration

$$P = 2S(t_m - A)/[D_o - 2y(t_m - A)]$$

Where:

S = 15,700 psi
t_m = 0.154"
D_o = 2 375"
y = 0.4

Therefore,

$P = 2(15,700)(0.154)/[2.375 - 2(0.4)(0.154)] =$ **2,147 psig**

For piping and penetration at Faulted condition: $P_{max} = 2P = 2(2,147) =$ **4,294 psig**

c. Calculate the Code maximum allowable pressure for 3" pipe and valves

S = 15,700 psi
t_m = 0.216"
D_o = 3.50"
y = 0.4

P = 2 (15,700)(0.216)/[3.5 - 2(0.4)(0.216)] = **2,038** psig for pipe

P= 2 (16,400)(0.218)/[3.5 - 2(0.4)(0.218)] = **2,150** psig for valve

For valves at Faulted condition: P_{max} = 1.5 P = 1.5(2,150) = **3,225 psig**

<u>Conclusion:</u> Since the Code allowable pressure (3,225 psig) is higher than the maximum pressure required to unseat the valve (437 psig), the existing piping and penetration design is acceptable.

7. <u>RH Lines 8"-RH-1204-KB2 and 8"-RH-1304-KB2</u>:

Material Data Table

	<u>Wall Thk, t, in.</u>	<u>ASME Material</u>	<u>Allowable Stress, S_h, psi at 150 °F</u>	<u>References</u>
Pipe, 8" sch. 40S	.322	SA312 TP304L	15,700	13,6
Penetration M55 and M76	.322	SA312 TP304	18,300	7,6
Valves RH063B/RH064B	.460	SA182 F316	18,800	3,6
Valves RH063C/RH064C	.460	SA182 F316	18,800	3,6

a. Peak pressure due to thermal expansion: **2,111 psig** (Ref. 41)

b. Calculate the Code maximum allowable pressure for pipe, penetration and valves

$$P = 2S(t_m - A)/[D_o - 2y(t_m - A)]$$

Where:

S = 15,700 psi
t_m = 0.322"
D_o = 8.625" for pipe and penetration. Same value is assumed for valves.
y = 0.4
A = 0 (See note below)

Therefore,

P = 2 (15,700)(0.322)/[8.625 - 2(0.4)(0.322)] = 1,208 psig for piping
P = 2 (18,300)(0.322)/[8.625 - 2(0.4)(0.322)] = 1,408 psig for penetration
P = 2 (18,800)(0.460)/[8.625 - 2(0.4)(0.460)] = 2,095 psig for valves

For piping at Faulted condition: P_{max} = 2 P = 2(1,208) = **2,416** psig.
For penetration at Faulted condition: P_{max} = 2 P = 2(1,408) = 2,816 psig.
For valves at Faulted condition: P_{max} = 1.5 P = 1.5(2,095) = 3,142 psig

Conclusion: Since the Code allowable pressure (2,416 psig) is higher than the peak pressure due to thermal expansion (2,111 psig), the existing piping and penetration design is acceptable.

8. PS Line 1"-PS-1016-BB2:

Material Data Table

	Wall Thk, t, in.	ASME Material	Allowable Stress, S_h, psi at 150°F	References
Pipe 1" Sch.160s	0.250	SA312 TP304L	15,700	13,6
Penetration M85	0.250	SA312 TP316L	15,700	19,6
Valve FV-4451	0.750	SA479 F316L	15,700	22,6
Valve FV-4451A	0.428	SA182 F316L	15,700	44,6
Valve FV-4451B	0.350	SA351 CF3M	17,000	31,6
Valve PS-0004	0.250	SA182 F316	18,800	15,6

a. Peak pressure due to thermal expansion: **6,935 psig** (Ref. 41)

b. Calculate the Code maximum allowable pressure for pipe, penetration and valves

$$P = 2\,S(t_m - A) / [D_o - 2y(t_m - A)]$$

Where:

S = 15,700 psi

t_m = 0.250"

D_o = 1.315" for pipe and penetration. Same value is assumed for valves

y = 0.815/(0.815+1.315) = 0.38

A = 0

Therefore,

P = 2 (15,700)(0.250)/[1.315 - 2(0.38)(0.250)] = 6,978 psig for pipe and penetration

P = 2 (18,800)(0.250)/[1.315 - 2(0.38)(0.250)] = 8,356 psig for valves

For piping and penetration at Faulted condition: P_{max} = 2 P = 2(6,978) = **13,956 psig**

For valves at Faulted condition: P_{max} = 1.5 P = 1.5(8,356) = **12,534 psig**

Conclusion: Since the Code allowable pressure (12,534 psig) is higher than the peak pressure due to thermal expansion (6,935 psig), the existing piping and penetration design is acceptable.

9. WL Line 3"-WL-1009-PB2:

Material Data Table

	Wall Thk. t, in.	ASME Material	Allowable Stress, S_h, psi at 150°F	References
Pipe 3" Sch. 40s	0.216	SA312 TP316L	15,700	13,6
Penetration M56	0.216	SA312 TP316	18,800	49,6
Valve MOV-0312	0.219	SA351 CF8M	17,000	47,6
Valve FV-4913	0.281	SA351 CF8M	17,000	48,6
Valve WL-0636 (1")	0.250	SA182 F316	18,800	15,6

a. Peak pressure due to thermal expansion: **2,690 psig (Ref. 41)**

b. Calculate the Code maximum allowable pressure for 3" pipe, penetration and valves

$$P = 2\,S(t_m - A) / [D_o - 2y(t_m - A)]$$

$S = 15{,}700$ psi
$t_m = 0.216"$
$D_o = 3.50"$
$y = 0.4$

$P = 2\,(15{,}700)(0.216)/[3.5 - 2(0.4)(0.216)] = 2{,}038$ psig for pipe and penetration

$P = 2\,(17{,}000)(0.219)/[3.5 - 2(0.4)(0.219)] = 2{,}239$ psig for valves

For piping and penetration at Faulted condition: $P_{max} = 2\,P = 2(2{,}038) =$ **4,077 psig**

For valves at Faulted condition: $P_{max} = 1.5\,P = 1.5(2{,}239) =$ **3,359 psig**

Conclusion: **Since the Code allowable pressure (3,359 psig) is higher than the peak pressure due to thermal expansion (2,690 psig), the existing piping and penetration design is acceptable.**

ATTACHMENT B

PIPE STRESS CALCULATION

CREE 96-12151-27

STP361 (06/94)	CALC NO. RC0680	SHT	OF
SOUTH TEXAS PROJECT ELECTRIC GENERATING STATION HOUSTON LIGHTING & POWER	REV.	PREPARER/DATE	REVIEWER/DATE
		[signature] 6/3/97	[signature] 6-3-97
GENERAL COMPUTATION SHEET			
SUBJECT SEE COVER SHEET UNIT/S 1&2			

While responding to Generic Letter (GL) 96-06, it was found that penetration M68 on line 3/4" SI-1321-BB2 will experience a faulted pressure of 11,714 psi following a DBA. Therefore, faulted stresses need to be reevaluated and compared against the ASME Section III Code allowables.The portion of piping, inside containment, from valve FV3970 to penetration M68 is analyzed in calc RC0680 (Data Points 205 through 245). The portion outside containment is part of calculation RC1315 and the impact due to penetration overpressurization for this portion is evaluated separately.

The following is the evaluation for portion inside containment for penetration M68.

EVALUATION

Faulted peak pressure per GL 96-06, P = **11,714 psi**
Outside dia of pipe, Do = 1.05"
Wall thickness, t = 0.219"
Longitudinal Pressure stress, S_{lp} = $P_{max}D_O/4t$
= **14,041 psi**
Conservatively using maximum Eqn 9D stresses from the design stress calc, part-C sheet 104 at DP200, for the SSE inertia stress =**10,614 psi**
(conservative, since this already includes original pressure stress)
Total Eqn 9D stress =14,041 + 10,614 = 24,655 psi

Allowable max stress for Eqn 9D = 2.4 S_h = 36,720 psi
(Based on S_h 15300 psi at 300° F)
Note: Per Design Stress calc Unit 1 stresses envelop Unit 2 stresses.

REFERENCE

1. CREE 96-12151-27 for peak pressure
2. Designstress calc RC0680 Revision 3
3. ASME Section III Subsection NA, 1974 Edition

CONCLUSION

Faulted, Level D stresses are within the ASME Section III Class 2 allowables

STP361 (08/ 1)

SOUTH TEXAS PROJECT
ELECTRIC GENERATING STATION
HOUSTON LIGHTING & POWER

GENERAL COMPUTATION SHEET

SUBJECT SEE COVER SHEET UNIT/s 1&2

CALC NO. RC1315	SHT	OF
REV.	PREPARER/DATE	REVIEWER/DATE
	[signature] 6/3/97	[signature] 6-3-97

While responding to **Generic Letter (GL) 96-06**, it was found that penetration M68 on line 3/4" SI-1321-BB2 will experience a faulted pressure of 11,714 psi following a DBA. The elevated containment temperature following a DBA will heat up the trapped fluid between the isloation valves and cause this high pressure. Therefore, faulted stresses need to be reevaluated and compared against the ASME Section III Code allowables. The portion of piping from valve FV3971 to penetration M68 is analyzed in calc RC1315 (Data Points 100 through 165). The portion inside containment is part of calculation RC0680 and the impact due to penetration overpressurization for this portion is evaluated separately. The following is the evaluation for portion inside containment for penetration M68.

EVALUATION

Faulted peak pressure per GL 96-06, P_{peak} =11,714 psi
Outside dia of pipe, Do = 1.05"
Wall thickness, t = 0.219"
Longitudinal Pressure stress, S_{lp} = $P_{peak} D_O/4t$
= 14,041 psi

Conservatively using maximum Eqn 9D stresses from the design stress calc, page 13 at DP155, for the inertia stress 17815 psi (conservative, since this already includes original pressure stress)

Total Eqn 9D stress= 14,041 + 17,815 = 31,856 psi

Allowable max stress for Eqn 9D = 2.4 S_h = 36,720 psi
(Based on S_h 15300 psi at 300 °F)

Note: Per Design Stress calc Unit 1& 2 analyses are common due to similarity of piping configuration.

REFERENCES

1. CREE 96-12151-27 for peak pressure
2. Design stress calculation RC 1315 Revision 3
3. ASME Section III Subsection NA, 1974 Edition

CONCLUSION

Faulted Level D stresses are still within the ASME Section III Class 2 allowables.

CREE 96-12151-27

STP361 (08/94)

SOUTH TEXAS PROJECT
ELECTRIC GENERATING STATION
HOUSTON LIGHTING & POWER

GENERAL COMPUTATION SHEET

SUBJECT SEE COVER SHEET UNIT/S 1&2

CALC NO. RC7492	SHT	OF
REV.	PREPARER/DATE	REVIEWER/DATE
	[signature] 6/2/97	[signature] 6-2-97

While responding to Generic Letter (GL) 96-06, it was found that penetration M85 on line 1" PS-1005-BB2 will experience a faulted pressure of 12,352 psi following a DBA. Therefore, faulted stresses need to be reevaluated and compared against the ASME Section III Code allowables. The portion of piping, inside containment, from valve FV4450A to penetration M85 and valve PS015 to line 1" PS-1005-BB2 are analyzed in calc RC7492 (Data Points 10 through 35 & DP 75 through 20). The portion outside containment is part of calculation RC9017 and the impact due to penetration overpressurization for this portion is evaluated separately.

The following is the evaluation for portion inside containment for penetration M85.

EVALUATION

Faulted peak pressure per GL 96-06, P_{peak}	=12,352 psi
Outside dia of pipe, D_o	= 1.315"
Wall thickness, t	= 0.25"
Longitudinal Pressure stress, S_{lp}	$=P_{peak} D_o/4t$ = 16,243 psi

Conservatively using maximum Eqn 9D stresses from the design stress calc, sheet 23 at DP17, for the SSE inertia stress = 6991 psi (conservative, since this already includes original pressure stress)

Total Eqn 9D stress	=16,243 psi + 6,991 psi
	= 23,234 psi < 37,680 psi
Allowable max stress for Eqn 9D= $2.4S_h$	= 37,680 psi

(Based on S_h 15700 psi at 150° F)
Note: Per Design Stress calc Unit 1& 2 analyses are common due to routing similarity.

REFERENCES

1. CREE 96-12151-27 for peak pressure
2. Design stress cal RC7492 Revision 1
3. ASME Section III Subsection NA, 1974 edition

CONCLUSION

Faulted, Level D stresses are within the ASME Section III Cl 2 allowables

CREE 96-12151-27

STP361 (08/94)	CALC NO. RC9017	SHT	OF
SOUTH TEXAS PROJECT ELECTRIC GENERATING STATION HOUSTON LIGHTING & POWER	REV.	PREPARER/DATE	REVIEWER/DATE
		[signature] 6/2/97	P. [signature] 6-2-97

GENERAL COMPUTATION SHEET

SUBJECT SEE COVER SHEET UNIT/S 1&2

While responding to Generic Letter (GL) 96-06, it was found that penetration M85 on line 1" PS-1005-BB2 will experience a faulted pressure of 12,352 psi. Therefore, faulted stresses need to be reevaluated and compared against the ASME Section III Code allowables. The portion of piping from valve FV4452 to penetration M85 is analyzed in calc RC9017.(Data Points 5 through 45). The portion inside containment is part of calculation RC7492 and the impact due to penetration overpressurization for this portion is evaluated separately.

The following is the evaluation for portion outside containment for penetration M85.

EVALUATION

Faulted peak pressure per GL 96-06, P_{peak} =12,352 psi
Outside dia of pipe, Do = 1.315"
Wall thickness, t = 0.25"
Longitudinal Pressure stress, S_{lp} = $P_{peak} D_O / 4t$
= 16,243 psi
Conservatively using maximum Eqn 9D stresses from the design stress calc, sheet 27 at DP35, for the inertia stress =6905 psi
(conservative, since this already includes original pressure stress)
Total Eqn 9D stress =16,243 + 6905 = 23,148 psi < 37,680 psi
Allowable max stress for Eqn 9D = 2.4 S_h = 37,680 psi
(Based on S_h 15700 psi at 150°F)
Note: Per Design Stress calc Unit 1& 2 analyses are common due to similarity.

REFERENCES

1. CREE 96-12151-27 for peak pressure
2. Design stress cal RC9017 Revision 1
3. ASME Section III Subsection NA, 1974 Edition

CONCLUSION

Faulted, Level D stresses are within the ASME Section III Class 2 allowables

CREE 96-12151-27

STP361 (08/94)	CALC NO. RC7499	SHT	OF
SOUTH TEXAS PROJECT ELECTRIC GENERATING STATION HOUSTON LIGHTING & POWER	REV.	PREPARER/DATE	REVIEWER/DATE
		[signature] 6/2/97	[signature] 6-3-97

GENERAL COMPUTATION SHEET

SUBJECT SEE COVER SHEET UNIT/s 1&2

While responding to **Generic Letter (GL) 96-06**, it was found that penetration **M85** on line 1" PS-1002-BB2 will experience a faulted internal pressure of 12,352 psig following a DBA. The elevaletd containment temperature following a DBA will heat up the trapped fluid between the isolation valves and cause this high pressure. Therefore, faulted stresses need to be reevaluated and compared against the ASME Section III Code allowables. The portion of piping from valve FV4454 , FV4455 , PS0011, FV4454A & FV4455A to the penetration **M85** is analyzed in calculation RC7499 . The portion outside containment is part of calculation RC9030 and the impact evaluation for this portion is performed separately.

The following is the evaluation for portion inside containment for penetration M85.

EVALUATION

Faulted peak pressure per GL 96-06, P_{peak} = **12, 352 psig**
Outside dia of pipe, D_o = **1.315 "**
Wall thickness, t = **0.25"**
Longitudinal pressure stress, s_{lp} = $P_{peak}\ D_o\ /\ 4\ t$
= **16,243 psi**
Conservaitively using the maximum Eqn 9D stress from the design stress calculation, sheet 25, at DP 15 = 10,214 psi
This max stress includes the peak pressure stress used in the design calc. However, for conservatism, this is taken as only SSE inertia stress
Total equation 9D stress = 16,243 + 10,214 = **26,457 psi < 37680 psi**
(where Allowable max stress for Eqn 9D = $2.4S_h$ = 37,680 psi
based on S_h = 15,700 psi at 150 ^{0} F)
Note: Per design stress calculation Unit 1&2 analyses are common due to similarity of piping configuration.

REFERENCES

1. CREE 96-12151-27 for peak pressure
2. Design stress calc RC7499 Revision 1
3. ASME Section III , Subsection NA

CONCLUSION

Faulted Level D stresses are within the ASME Section III Cl 2 Code allowables.

CREE 96-12151-27

STP301 (08/94)	CALC NO. RC9030	SHT	OF
SOUTH TEXAS PROJECT ELECTRIC GENERATING STATION HOUSTON LIGHTING & POWER	REV.	PREPARER/DATE	REVIEWER/DATE
		[signature] 6/2/97	P. [signature] 6-3-97
GENERAL COMPUTATION SHEET			
SUBJECT SEE COVER SHEET UNIT/s 1&2			

While responding to **Generic Letter (GL) 96-06**, it was found that penetration **M85** on line 1" PS-1002-BB2 will experience a faulted internal pressure of 12,352 psig following a DBA. The elevaletd containment temperature following a DBA will heat [illegible] apped fluid between the isolation valves and cause this high pressure. Therefore, fault[illegible] need to be reevaluated and compared against the ASME Section III Code allowa[illegible] on of piping, outside containment, from valve FV4456 & FV2455 to the penetrati[illegible] is [illegible]lyzed in calculation RC9030 (DP 5 through 120 & 50) The portion outside contain[illegible] calculation RC7499 and the impact evaluation for this portion is performed separately.

The following is the evaluation for portion inside containment for pe[illegible]ation M85.

EVALUATION

Faulted peak pressure per GL 96-06, P_{peak} = **12, 352 psig**
Outside dia of pipe, D_o = **1.315"**

Wall thickness, **t** = **0.25"**
Longitudinal pressure stress, s_{lp} = $P_{peak}\ D_o\ /\ 4\ t$
= **16,243 psi**

Conservaitively using the maximum Eqn 9D stress from the design stress calculation, sheet 25, at DP 120 = 14,443 psi
This max stress includes the peak pressure stress used in the design calc. However, for conserva[illegible]m, this is taken as only SSE inertia stress for our evaluation.

Total equation 9D stress = 16,243 + 14,443 = **30,686 psi < 37,680 psi**
(where Allowable max stress for Eqn 9D = $2.4S_h$ = 37,680 psi
based on S_h = 15,700 psi at 150 ^{0} F)
Note: Per design stress calculation, Unit 2 Eqn 9D stresses are lower than Unit 1 stresses.

REFERENCES

1. CREE 96-12151-27, for peak pressure
2. Design stress calc RC9030 Revision 1
3. ASME Section III , Subsection NA, 1974 Edition.

CONCLUSION

Faulted Level D stresses are within the ASME Section III Cl 2 Code allowables.

CREE 96-12151-27

STP361 (06/94)	CALC NO. RC7494	SHT	OF
SOUTH TEXAS PROJECT ELECTRIC GENERATING STATION HOUSTON LIGHTING & POWER	REV.	PREPARER/DATE	REVIEWER/DATE
		[signature] 6/2/97	[signature] 6-2-97
GENERAL COMPUTATION SHEET			
SUBJECT: SEE COVER SHEET UNIT/s 1&2			

While responding to **Generic Letter (GL) 96-06,** it was found that penetration **M86** on line 1" PS-1003-UB2 will experience a faulted internal pressure of 6,034 psig following a DBA. The elevaletd containment temperature following a DBA will heat up the trapped fluid between the isolation valves and cause this higher pressure. Therefore, faulted stresses need to be reevaluated and compared against the ASME Section III Code allowables. The portion of piping from valve FV4823 & PS0008 to the penetration **M86**, inside containment, is analyzed in calculation RC7494 (DP 5 through 45). The portion outside containment is part of calculation RC9031and the impact evaluation for this portion is performed separately.

The following is the evaluation for portion inside containment for penetration M86.

EVALUATION

Faulted peak pressure per GL 96-06, P_{peak} =6,034psig

Outside dia of pipe, D_o = 1.315"

Wall thickness, **t** = 0.133"

Longitudinal pressure stress, s_{lp} = $P_{peak}\ D_o\ /\ 4\ t$

= **14,915 psi**

Conservaitively using the maximum Eqn 9D stress from the design stress calculation, sheet 25, at DP 110 = **22,123 psi**

This max stress includes the peak pressure stress used in the design calc. However, for conservatism, this is taken as only SSE inertia stress

Total equation 9D stress = 14,915 + 22123 = **37,038 psi < 37680 psi**

(where allowable max stress for Eqn 9D = $2.4S_h$ = 37,680 psi

based on S_h = 15,700 psi at 150 $^{\circ}$ F)

Note: Per design stress calculation Unit 1&2 analyses are common due to similarity of piping configuration.

REFERENCES

1. CREE 96-12151-27, for peak pressure
2. Design stress calc RC7494 Revision 1
3. ASME Section III , Subsection NA, 1974 Edition

CONCLUSION

Faulted Level D stresses are within the ASME Section III Cl 2 Code allowables.

CREE 96-12151-27

STP361 (08/94)	CALC NO. RC9031	SHT	OF
SOUTH TEXAS PROJECT ELECTRIC GENERATING STATION HOUSTON LIGHTING & POWER	REV.	PREPARER/DATE	REVIEWER/DATE
		[signature] 6/2/97	P. [signature] 6-2-97
GENERAL COMPUTATION SHEET			
SUBJECT SEE COVER SHEET UNIT/s 1&2			

While responding to **Generic Letter (GL) 96-06,** it was found that penetration **M86** on line 1" PS-1003-UB2 will experience a faulted internal pressure of 6,034 psig following a DBA. The elevaletd containment temperature following a DBA will heat up the trapped fluid between the isolation valves and cause this higher pressure. Therefore, faulted stresses need to be reevaluated and compared against the ASME Section III Code allowables. The portion of piping from valve FV2454 & FV4461 to the penetration **M86**, outside containment, is analyzed in calculation RC9031 (DP 5 through 110) The portion inside containment is part of calculation RC7494 and the impact evaluation for this portion is performed separately.

The following is the evaluation for portion outside containment for penetration M86.

EVALUATION

Faulted peak pressure per GL 96-06, P_{peak} = 6,034 psig

Outside dia of pipe, D_o = 1.315"

Wall thickness, **t** = 0.133"

Longitudinal pressure stress, s_{lp} = $P_{peak}\ D_o\ /\ 4\ t$

= **14,915 psi**

Conservaitively using the maximum Eqn 9D stress from the design stress calculation, sheet 27, at DP 45 = **9372 psi**

This max stress includes the peak pressure stress used in the design calc. However, for conservatism, this is taken as only SSE inertia stress

Total equation 9D stress = 9,372 + 14,915 = **24,287 psi < 37680 psi**

(where allowable max stress for Eqn 9D = $2.4S_h$ = 37,680 psi

based on S_h = 15,700 psi at 150 °F)

Note: Per design stress calculation Unit 1&2 analyses are common due to similarity of piping configuration.

REFERENCES

1. CREE 96-12151-27 for peak pressure
2. Design stress calc RC9031 Revision 1
3. ASME Section III , Subsection NA, 1974 Edition

CONCLUSION

Faulted Level D stresses are within the ASME Section III Cl 2 Code allowables.

STP361 (08/94)	CALC NO. RC7490	SHT	OF
SOUTH TEXAS PROJECT ELECTRIC GENERATING STATION HOUSTON LIGHTING & POWER	REV.	PREPARER/DATE	REVIEWER/DATE
		[signature] 6/2/97	[signature] 6-2-97
GENERAL COMPUTATION SHEET			
SUBJECT SEE COVER SHEET UNIT/s 1&2			

While responding to **Generic Letter (GL) 96-06,** it was found that penetration **M29** on line 1" PS-1004-UB2 will experience a faulted internal pressure of 6437 psig following a DBA. The elevaletd containment temperature following a DBA will heat up the trapped fluid between the isolation valves and cause this high pressure. Therefore, faulted stresses need to be reevaluated and compared against the ASME Section III Code allowables. The portion of piping from valve FV4824 & PS0001 to the penetration **M29**, inside containment, is analyzed in calculation RC7490 (DP 5 through 50) The portion outside containment is part of calculation RC9032 and the impact evaluation for this portion is performed separately.

The following is the evaluation for portion inside containment for penetration M29.

EVALUATION

Faulted peak pressure per GL 96-06, P_{peak} = **6,437 psig**

Outside dia of pipe, D_o = **1.315"**

Wall thickness, **t** = **0.133"**

Longitudinal pressure stress, s_{lp} = $P_{peak}\ D_o\ /\ 4\ t$

= **15,911 psi**

Conservaitively using the maximum Eqn 9D stress from the design stress calculation, sheet 25, at DP 75 = **19,283 psi**

This max stress includes the peak pressure stress used in the design calc. However, for conservatism, this is taken as only SSE inertia stress

Total equation 9D stress = 15,911 + 19,283 =**35,194 psi < 37,680 psi**

(where Allowable max stress for Eqn 9D = $2.4S_h$ = 37,680 psi

based on S_h = 15,700 psi at 150 ^{0} F)

Note: Per design stress calculation Unit 1&2 analyses are common due to similarity of piping configuration.

REFERENCES

1. CREE 96-12151-27 for peak pressure
2. Design stress calc RC7490 Revision 1
3. ASME Section III , Subsection NA

CONCLUSION

Faulted Level D stresses are within the ASME Section III Cl 2 Code allowables.

CREE 96-12151-27

STP361 (06/94)	CALC NO. RC9032	SHT	OF
SOUTH TEXAS PROJECT ELECTRIC GENERATING STATION HOUSTON LIGHTING & POWER	REV.	PREPARER/DATE	REVIEWER/DATE
		Sauma 6/2/97	P. Camb. 6-3-97
GENERAL COMPUTATION SHEET			
SUBJECT SEE COVER SHEET UNIT/S 1&2			

While responding to **Generic Letter (GL) 96-06,** it was found that penetration **M29** on line 1" PS-1004-UB2 will experience a faulted internal pressure of 6,437 psig following a DBA. The elevaletd containment temperature following a DBA will heat up the trapped fluid between the isolation valves and cause this high pressure. Therefore, faulted stresses need to be reevaluated and compared against the ASME Section III Code allowables. The portion of piping from valve FV4466 to the penetration **M29**, outide containment, is analyzed in calculation RC9032 (DP 5 through 55). The portion inside containment is part of calculation RC7490 and the impact evaluation for this portion is performed separately.

The following is the evaluation for portion outside containment for penetration M29.

EVALUATION

Faulted peak pressure per GL 96-06, P_{peak} = **6,437 psig**

Outside dia of pipe, D_o = **1.315"**

Wall thickness, t = **0.133"**

Inside dia of pipe, d = 1.049"

Longitudinal pressure stress, s_{lp} = $P_{peak}\ D_o\ /\ 4\,t$

But, per Code Section NC 3651, this pressure term can be replaced with the following,

S_{lp} = $Pd^2 / (D^2 - d^2)$

= $6437 \times 1.049^2 / (1.315^2 - 1.049^2)$

= **11264 psi**

Maximum Eqn 9D stress from the design stress calculation, sheet 27, at DP 20, computer run X8133 dated 12/18/86 = 23,518 psi

This max stress includes the peak pressure stress, Slp, of 700 psi, per design calc.

Total equation 9D stress = 11,264 + (23518-700) **=34,082 psi < 37,680 psi**

(where allowable max stress for Eqn 9D = $2.4S_h$ = 37,680 psi

based on S_h = 15,700 psi at 150 ^{0} F)

Note: Per design stress calculation Unit 1&2 analyses are common due to similarity of piping configuration.

REFERENCES

1. CREE 96-12151-27 for peak pressure
2. Design stress calc RC9032 Revision 1
3. ASME Section III , Subsection NA

CONCLUSION

Faulted Level D stresses are within the ASME Section III Cl 2 Code allowables.

CREE 96-12151-27

STP361 (08/94)	CALC NO.	RC0808	SHT		OF	
SOUTH TEXAS PROJECT ELECTRIC GENERATING STATION HOUSTON LIGHTING & POWER	REV.	PREPARER/DATE		REVIEWER/DATE		
		[signature] 6/2/97		P. [signature] 6-2-97		
GENERAL COMPUTATION SHEET						
SUBJECT SEE COVER SHEET UNIT/s 1&2						

While responding to **Generic Letter (GL) 96-06**, it was found that penetration **M72** on line 2" ED-1124-SB2 will experience a faulted internal pressure of 437 psig following a DBA. The elevaletd containment temperature following a DBA will heat up the trapped fluid between the isolation valves and cause this higher pressure. Therefore, faulted stresses need to be reevaluated and compared against the ASME Section III Code allowables. The portion of piping from valve MOV0064B to the penetration **M72**, inside containment, is analyzed in calculation RC0808 (DP 5 through 47) The portion outside containment is part of calculation RC1291and the impact evaluation for this portion is performed separately.

The following is the evaluation for portion inside containment for penetration M72.

EVALUATION

Faulted peak pressure per GL 96-06, P_{peak} = 437 psi
Outside dia of pipe, D_o = 2.375" & 3.5" (Piping is partly 2" & 3" nominal)
Wall thickness, **t** = 0.154" & 0.216"
Longitudinal pressure stress, s_{lp} = $P_{peak}\ D_o\ /\ 4\ t$
=1685 psi & 1770 psi (for 2" & 3" dia respy.)
Therefore, use the higher value of S_{lp} for this evaluation
Conservaitively using the maximum Eqn 9D stress from the design stress calculation, sheet 34, at DP 5 = 5249 psi
This max stress includes the peak pressure stress used in the design calc. However, for conservatism, this is taken as only SSE inertia stress
Total equation 9D stress = 1770 + 5249 = 7019 **psi < 37680 psi**
(where allowable max stress for Eqn 9D = $2.4S_h$ = 37,680 psi
based on S_h = 15,700 psi at 150 $^{\circ}$ F)
Note: Per design stress calculation Unit 1&2 analyses are common due to similarity of piping configuration.

REFERENCES

1. CREE 96-12151-27 for peak pressure
2. Design stress calc RC0808 Revision 4
3. ASME Section III , Subsection NA, 1974 Edition

CONCLUSION

Faulted Level D stresses are within the ASME Section III Cl 2 Code allowables.

CREE 96-12151-27

STP361 (06/94)	CALC NO. RC1291	SHT	OF
SOUTH TEXAS PROJECT ELECTRIC GENERATING STATION HOUSTON LIGHTING & POWER	REV.	PREPARER/DATE	REVIEWER/DATE
		[signature] 6/2/97	P. [signature] 6-2-97
GENERAL COMPUTATION SHEET			
SUBJECT SEE COVER SHEET UNIT/S 1&2			

While responding to **Generic Letter (GL) 96-06,** it was found that penetration **M72** on line 2" ED-1124-SB2 will experience a faulted i... rnal pressure of 437 psig following a DBA. The elevaletd containment temperature following a DBA will heat up the trapped fluid between the isolation valves and cause this higher pressure. Therefore, faulted stresses need to be reevaluated and compared against the ASME Section III Code allowables. The portion of piping from valve 4B FV7800 to the penetration **M72**, outside containment, is analyzed in calculation RC1291 (DP 5 through 35) The portion inside containment is part of calculation RC0808 and the impact evaluation for this portion is performed separately.

The following is the evaluation for portion outside containment for penetration M72.

EVALUATION

Faulted peak pressure per GL 96-06, P_{peak} = 437 psig

Outside dia of pipe, D_o = 2.375" & 3.5" (Piping is partly 2" & 3" nominal)

Wall thickness, **t** = 0.154" & 0.216"

Longitudinal pressure stress, s_{lp} = P_{peak} D_o / 4 t

= **1684 psi & 1770 psi (for 2" & 3" dia respy.)**

Therefore, use the higher value of S_{lp} for this evaluation

Conservaitively using the maximum Eqn 9D stress from the design stress calculation, sheet 34, at DP 5 = 8100 psi

This max stress includes the peak pressure stress used in the design cal . However, for conservatism, this is taken as only SSE inertia stress

Total equation 9D stress = **1770 + 8100 = 9870 psi < 37680 psi**

(where allowable max stress for Eqn 9D = $2.4S_h$ = 37,680 psi

based on S_h = 15,700 psi at 150 ^{0} F)

Note: Per design stress calculation Unit 1&2 analyses are common due to similarity of piping configuration.

REFERENCES

1. CREE 96-12151-27 for peak pressure
2. Design stress calc RC1291 Revision 3
3. ASME Section III, Subsection NA, 1974 Edition

CONCLUSION

Faulted Level D stresses are within the ASME Section III Cl 2 Code allowables.

CREE 96-12151-27

STP361 (08/94)	CALC NO. RC0117	SHT	OF

SOUTH TEXAS PROJECT
ELECTRIC GENERATING STATION
HOUSTON LIGHTING & POWER

GENERAL COMPUTATION SHEET

SUBJECT SEE COVER SHEET UNIT/s 1&2

REV.	PREPARER/DATE	REVIEWER/DATE
	[signature] 5/13/97	P. [signature] / 5-13-97

While responding to **Generic Letter (GL) 96-06**, it was found that penetration **M55** on line 8" RH 1204 KB2, and penetration M76 on line 8" RH-1304-KB2 will experience a faulted pressure of 2111 psi following a DBA. Therefore, faulted stresses need to be reevaluated and compared against the ASME Section III Code allowables.The portions of piping from valve RH0064B to penetration **M55** (DP 160 TO 190) and portion from valve RH0064C to penetration **M76**(DP 205 to 230 are analyzed in calc RC0117. The portions inside containment are parts of calculations RC5112 and RC5114 respectively. The impact due to penetration overpressurization for these portions are evaluated separately.

The following is the evaluation for portion outside containment for penetrations **M55** and **M76**. The penetration material has higher allowable stresses and, therefore, is enveloped by the piping evaluation as mentioned below.

EVALUATION

Faulted peak pressure per GL 96-06, P_{peak} = **2,111 psi**
(Conservatively, higher pressure between 8" RH1204KB2 & 8" RH1304KB2 used)
Outside dia of pipe, **Do** = **8.625"**
Wall thickness, **t** = **0.322"**
Pipe material, SA312 TP 304, 304L, 316 & 316L.
Penetration M55 & M76 min wall thickness = 0.322"
Penetration material, SA312 TP304
Longitudinal Pressure stress, S_{lp} = P_{peak} **Do / 4 t**
= **14,136 psi**
Conservatively using maximum Eqn 9D stresses from the design stress calc, page 34, at DP190, and conservatively using this as SSE inertia stress = 12,626 psi
Total Eqn 9D stress = **14,136 psi + 12,626 psi**
= **26,762 psi < 37,680 psi**

Allowable max stress for Eqn 9D = 2.4 S_h = 37,680 psi
(Based on S_h 15,700 psi at 150°F which is the same for all above listed pipe material)

Note: Per Design Stress calc Unit 1& 2 analyses are common due to similarity.

CREE 96-12151-27

STP361 (08/94)	CALC NO. RC0117	SHT	OF
SOUTH TEXAS PROJECT ELECTRIC GENERATING STATION HOUSTON LIGHTING & POWER	REV.	PREPARER/DATE	REVIEWER/DATE
		[signature] 5/13/97	[signature] /5-13-97
GENERAL COMPUTATION SHEET			
SUBJECT SEE COVER SHEET UNIT/S 1&2			

REFERENCES

1. CREE 96-12151-27
2. Design Stress calculation RC0117 Revision 5
3, ASME Section III, Subsection NA, 1974 Edition
4. UFSAR Table 3.9-6A and 3.9-7A, Stress Criteria for ASME Section III Class 2
5. Paragragh NC/ND-3611.2 of Winter 1976 Addenda

CONCLUSION

Faulted Level D Stresses are still within the ASME SECTION III Class 2 Code allowables..

CREE 96-12151-27

STP361 (08/94)	CALC NO. RC5112	SHT	OF
	REV.	PREPARER/DATE	REVIEWER/DATE
		[signature] 5/13/97	[signature] 5/13/97

SOUTH TEXAS PROJECT
ELECTRIC GENERATING STATION
HOUSTON LIGHTING & POWER

GENERAL COMPUTATION SHEET

SUBJECT SEE COVER SHEET UNIT/S 1&2

While responding to **Generic Letter (GL) 96-06**, it was found that penetration **M55** on line 8" RH-1204-KB2 will experience a faulted internal pressure of 2,111 psi following a DBA. There is no inherent overpressure protection in this line due to the type of containment isolation valves. The elevated containment temperature following a DBA will heat up the trapped fluid between the valves and cause high pressure. Therefore, faulted stresses need to be reevaluated and compared against the ASME Section III Code allowables. The portion of piping from valve RH0063B to penetration **M55** is analyzed in calc RC5112 (Data Points 213 through 220). The portion outside containment is part of calculation RC0117 and the impact evaluation for this portion is done separately. The penetration material has higher allowable stresses. Therefore, the penetration evaluation is also covered by the piping evaluation.

The following is the evaluation for portion inside containment for penetration **M55**.

EVALUATION

Faulted peak pressure per GL 96-06, P_{peak} = **2,111 psi**
Outside dia of pipe, D_o = **8.625"**
Wall thickness, **t** = **0.322"**
Penetration material SA312 TP304
Penetration min wall thickness = 0.322"
Longitudinal Pressure Stress, S_{lp} = $P_{peak} D_o / 4t$
= **14,136 psi**
Maximum Deadweight stress in the portion between penetration
and isolation valve, at DP 213 = **1,289 psi**
(Ref. Snum X6014 dated 8/16/86)
Maximum SSE inertia stress at DP213 = **4064 psi**
(Ref. Snum X6014 date 8/16/86)
Maximum LOCA stress, at DP 216 = **72 psi**
(Ref. Snum X035 dated 7/10/86)
Maximum Jetload stress, at DP 213 = **198 psi**
(Ref, Snum X5214 dated 7/15/86)
By inspection SSE stress is higher than Jet & LOCA stress
Therefore, total max **Eqn 9D** stress
Peak pressure stress, S_{lp} + deadweight + SSE
=14136 psi+ 1289 psi + 4064 psi = **19,489 psi < 37,680 psi**
(Allowable maximum stress for Eqn 9D = 2.4 S_h =37,680 psi
based on Sh of 15700 psi at 150°F)

CREE 96-12151-27

STP361 (06/94)	CALC NO. RC5112	SHT	OF
SOUTH TEXAS PROJECT ELECTRIC GENERATING STATION HOUSTON LIGHTING & POWER	REV.	PREPARER/DATE	REVIEWER/DATE
		[signature] 5/13/97	P. [signature] 5/13/97
GENERAL COMPUTATION SHEET			
SUBJECT SEE COVER SHEET UNIT/s 1&2			

Note: Unit 1 calc is applicable for Unit 2 also, except LOCA at the small bore branch and Thermal loadcase and minor changes as shown in Attachment G. There is no impact in the portion of piping being evaluated here.

REFERENCES

1. CREE 96-12151-27 for peak pressure calculation (Except those covered by Ref 2)
2. Design Stress calc RC5112 Revision 8
3. ASME Section III, Subsection NA, 1974 Edition
4. UFSAR Table 3.9-6A and 3.9-7A, Stress Criteria for ASME III Code Class 2 & 3
5. Paragraph NC/ND-3611.2 of Winter 1976 Addenda

CONCLUSION

Faulted Level D stresses are still within the ASME Section III Class 2 Code allowables.

CR-EXE: 96-12151-27

STP361 (06/94)	CALC NO. RC5114	SHT	OF

SOUTH TEXAS PROJECT
ELECTRIC GENERATING STATION
HOUSTON LIGHTING & POWER

GENERAL COMPUTATION SHEET

SUBJECT: SEE COVER SHEET   UNIT/s: 1&2

REV.	PREPARER/DATE	REVIEWER/DATE
	[signature] 5/13/97	P. [signature] 5/13/97

While responding to **Generic Letter (GL) 96-06,** it was found that penetration **M76** on line 8" RH-1304-KB2 will experience a faulted internal pressure of 2092 psig following a DBA. The elevaletd containment temperature following a DBA will heat up the trapped fluid between the isolation valves and cause this higher pressure. Therefore, faulted stresses need to be reevaluated and compared against the ASME Section III Code allowables. The portion of piping from valve RH0063C to the penetration **M76**, inside containment, is analyzed in calculation RC5114 (DP 485 through 495) The portion outside containment is part of calculation RC0117and the impact evaluation for this portion is performed separately. The following is the evaluation for portion inside containment for penetration M76. The penetration material has higher allowable stresses and therefore, the evaluation for penetration is enveloped by the piping evaluation.

EVALUATION

Faulted peak pressure per GL 96-06, P_{peak} = **2,092 psig**

Outside dia of pipe, D_o = **8.625"**

Wall thickness, **t** = **0.322"**

Pipe material, SA312 TP304,304L,316,316L

Penetration min wall thickness = 0.322"

Penetration material = SA312 TP 304

Longitudinal pressure stress, s_{lp} = $P_{peak}\ D_o\ /\ 4\ t$

= **14,008 psi**

Maximum Eqn 9D stress in this portion at DP 485 = **13,701** psi

Ref Snum x 6028 dated 8/16/86

But, this max Eqn 9D stress includes pressure stress S_{lp} of 9756 psi

Therefore, sustituting this with S_{lp} calculated for the new peak pressure,

Max Eqn 9D stress at DP 485 = 14,008 + (13701 - 9756)

= 17,953 psi < 37,680 psi

(where allowable max stress for Eqn 9D = $2.4S_h$ = 37,680 psi based on S_h = 15,700 psi at 150 ° F)

Note: Per design stress calculation Unit 1&2 analyses are common, except minor reevaluations as shown in Appendix E of design calc. However, there is no impact in this portion of piping.

CREE 96-12151-27

STP361 (08/94)	CALC NO. RC5114	SHT	OF
SOUTH TEXAS PROJECT ELECTRIC GENERATING STATION HOUSTON LIGHTING & POWER	REV.	PREPARER/DATE	REVIEWER/DATE
		[signature] 5/13/97	P. [signature] 5-13-97
GENERAL COMPUTATION SHEET			
SUBJECT RC COVER SHEET UNIT/s 1&2			

REFERENCES

1. CREE 96-12151-27
2. Design Stress calculation RC5114 Revision 7
3, ASME Section III, Subsection NA, 1974 Edition
4. UFSAR Table 3.9-6A and 3.9-7A, Stress Criteria for ASME Section III Class 2
5. Paragragh NC/ND-3611.2 of Winter 1976 Addenda

CONCLUSION

Faulted Level D Stresses are still within the ASME SECTION III Class 2 Code allowables..

CREE 96-12151-27

STP361 (03/94)	CALC NO. RC7491	SHT	OF

SOUTH TEXAS PROJECT
ELECTRIC GENERATING STATION
HOUSTON LIGHTING & POWER

GENERAL COMPUTATION SHEET

SUBJECT ACE COVER SHEET UNIT/s 1&2

REV.	PREPARER/DATE	REVIEWER/DATE
	[signature] 5/13/97	P. [signature] 5/13/97

While responding to **Generic Letter (GL) 96-06**, it was found that penetration **M85** on line 1" PS-1016-BB2 will experience a faulted internal pressure of 6935 psig following a DBA. The elevaietd containment temperature following a DBA will heat up the trapped fluid between the isolation valves and cause this higher pressure. Therefore, faulted stresses need to be reevaluated and compared against the ASME Section III Code allowables. The portion of piping from valve FV4451 and PS004 to the penetration **M85**, inside containment, is analyzed in calculation RC7491 (DP 10 through 30) The portion outside containment is part of calculation RC9033 and the impact evaluation for this portion is performed separately. The following is the evaluation for portion inside containment for penetration M85. The penetration material has the same allowable stresses as the piping and therefore, the following evaluation is applicable for the piping and the penetration.

EVALUATION

Faulted peak pressure per GL 96-06, P_{peak} = **6,935 psig**

Outside dia of pipe, D_o = **1.315"**

Wall thickness, t = **0.25"**

Pipe material, SA312 TP304,304L,316,316L

Penetration min wall thickness = **0.25"**

Penetration material SA312 TP 316L

Longitudinal pressure stress, s_{lp} = $P_{peak}\, D_o / 4t$

= **9,119 psi**

Maximum Eqn 9D stress in this portion at DP 10 = **4,403 psi**

Ref Snum x 1342 dated 1/21/1987

This value is conservative since it includes Longitudinal pressure stress

Conservatively adding this with S_{lp} calculated for the new peak pressure,

Max Eqn 9D stress at DP 10 = 4,403 + 9,119

= 13,522 psi < 37,680 psi

where allowable max stress for Eqn 9D,for the piping

= $2.4S_h$ = 37,680 psi

(based on S_h = 15,700 psi at 150 ^{0} F)

Note: Per design stress calculation Unit 1&2 analyses are common.

CREE 96-12151-27

STP361 (08/94)	CALC NO. RC7491	SHT	OF

SOUTH TEXAS PROJECT
ELECTRIC GENERATING STATION
HOUSTON LIGHTING & POWER

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-	[signature] 5/13/97	P. [signature] 5/13/97

GENERAL COMPUTATION SHEET

SUBJECT SEE COVER SHEET | UNIT/s 1&2

REFERENCES

1. CREE 96-12151-27
2. Design Stress calculation RC7491 Revision 1
3, ASME Section III, Subsection NA, 1974 Edition
4. UFSAR Table 3.9-6A and 3.9-7A, Stress Criteria for ASME Section III Class 2
5. Paragragh NC/ND-3611.2 of Winter 1976 Addenda

CONCLUSION

Faulted Level D Stresses are still within the ASME Section III Class 2 Code allowables..

CREXE 96-12151-27

STP361 (03/94)	CALC NO.	RC9033	SHT	OF
SOUTH TEXAS PROJECT ELECTRIC GENERATING STATION HOUSTON LIGHTING & POWER	REV.	PREPARER/DATE	REVIEWER/DATE	
		[signature] 5/13/97	[signature] 5/13/97	

GENERAL COMPUTATION SHEET

SUBJECT: SEE COVER SHEET UNIT/s 1&2

While responding to **Generic Letter (GL) 96-06**, it was found that penetration **M85** on line 1" PS-1016-BB2 including piping between valves FV4451A & PS0004 and FV4451B will experience a faulted pressure of 6935 psi following a DBA. The elevated containment teperature following a DBA will heat up the trapped fluid between the isolation valves and cause this high pressure. Therefore, faulted stresses need to be reevaluated and compared against the ASME Section III Code allowables.The portions of piping from valve FV4451B to penetration **M85** (DP5 to 40) are analyzed in calc RC9033. The portions inside containment are parts of calculations RC7491. The impact due to penetration overpressurization for the portion inside containment are evaluated separately.

The following is the evaluation for portion outside containment for penetrations **M85.** The penetration material has the same allowable stresses as the piping and, therefore, the following evaluation is applicable for both the penetration and the piping.

EVALUATION

Faulted peak pressure per GL 96-06, P_{peak} **= 6,935 psi**
Outside dia of pipe, **Do** **= 1.315"**
Wall thickness, **t** **= 0.250"**
Pipe material, SA312 TP 304, 304L, 316 & 316L.
Penetration M85 min wall thickness = 0.25"
Penetration material, SA312 TP316L
Longitudinal Pressure stress, S_{lp} **= P_{peak} Do / 4 t**
= 9,120 psi

Unit -1

Maximum Eqn 9D stresses from the design stress calc, page 26,
at DP20, including pressure stress = 22,478 psi
Pressure stress used in the calc, S_{lp} = 1394 psi
Total Eqn 9D stress based on new pressure = (22478-1394) + 9120 psi
= 30,204 psi < 37,680 psi

Allowable max stress for Eqn 9D = 2.4 S_h = 37,680 psi
(Based on S_h 15,700 psi at 150^{0}F which is the same for all above listed pipe material)

ST-?361 (08/94)	CALC NO. RC9033	SHT	OF
SOUTH TEXAS PROJECT ELECTRIC GENERATING STATION HOUSTON LIGHTING & POWER	REV.	PREPARER/DATE	REVIEWER/DATE
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SUBJECT SEE COVER SHEET UNIT/s 1&2			

Unit 2

There were deviations between Unit 1 and Unit 2 piping and therefore, Unit 2 was reanalized.
The maximum Eqn 9D stresses at DP 5, per Page _3 of Attachment 3,
= 28,077 psi

This includes a pressure stress of 2091 psi (Ref: page 26, Attach. 3)
Therefore, Total Eqn 9D stress based on faulted pressure= (28,077 - 2091)+ 9120
=35,106 psi < 37,680 psi

Allowable maximum stress for Eqn 9D = 2.4 S_h = 37,680 psi
(Based on S_h = 15,700 psi at 150° F as mentioned before)

REFERENCES

1. CREE 96-12151-27
2. Design Stress Calculation RC9033 Rev 2
3. ASME Section III, Subsection NA, 1974 Edition
4. UFSAR Table 3.9-6A and 3.9-7A, Stress Criteria for ASME Section III Class 2
5. Paragraph NC/ND-3611.2 of Winter 1976 Addenda

CONCLUSION

Faulted Level D stresses are still within ASME Section III Class 2 allowables.

CREE 96-12151-...

STP361 (06/94)

SOUTH TEXAS PROJECT
ELECTRIC GENERATING STATION
HOUSTON LIGHTING & POWER

GENERAL COMPUTATION SHEET

SUBJECT SEE COVER SHEET UNIT/s 1&2

CALC NO. RC1234 SHT ____ OF ____

REV.	PREPARER/DATE	REVIEWER/DATE
	[signature] 5/29/97	[signature] 6/4/97

EVALUATION OF IMPACT DUE TO ADDED INSULATION

In order to reduce the impact of the peak pressure susequent to a DBA, per GL 96-06, 1" Nukon insulation is added to line 3" WL-1009-RB2 from Containment penetration M56 to wall penetration 155 inside containment. This impacts calc RC1234. The bending stresses are increased by the factor of weght differential per lineal foot. The total stresses are compared against the allowables as follows.

Weight per lineal foot of 1" Nukon insulation per vendor info (Ref: C006-0016-AOO)
= 1.0 lb/ft
Weight per foot of 3" pipe, including contents = 10.78 lbs/ft (Ref calc Rc1234 Rev 5)
Total weght including insulation = 11.78 lbs/ft
Ratio of weights per lineal foot = 11.78/10.78 = 1.093
Therefore, the bending stresses can be multiplied by the above factor

ASME PORTION FROM MOV 312 TO PENET M56

Peak pressure during accident condition per GL 96-06 = 2,690 psi
Pressure stress for this faulted pressure = S_{lp} = P Do/(4t)
= 2690 x 3.5/(4 x 0.216) = 10,896 psi
Maximum bending stress for Eqn 9D, excluding longitudinal pressure stress from the existing analysis = 3819 -365 = 3454 psi (without insulation)
Increased bending stress with 1" insulation, Eqn 9D = 3454 X 1.093 = 3775 PSI
Total pressure + Bending stresses for eqn 9D
= 10,896 + 3775 = 14,671 psi < 37,680 psi (allowable)

ANSI B31.1INSULATED PORTION FROM MOV 312 TO PENET 155

Max stress, for EQN 12D from existing calc = 4033 psi
Increased Eqn 12D Stress due to 1" insulation = 4033 x 1.093
= 4408 psi < 30,408 psi (allowable)

CREE 96-12151-27

STP361 (08/94)	CALC NO.	RC1234	SHT	OF
SOUTH TEXAS PROJECT ELECTRIC GENERATING STATION HOUSTON LIGHTING & POWER	REV.	PREPARER/DATE		REVIEWER/DATE
		[signature] 2/18/97		P. [signature] 6/4/97
GENERAL COMPUTATION SHEET				
SUBJECT SEE COVER SHEET UNIT/s 1&2				

Nozzle Loads Evaluation

The only equipment nozzles in this calculation are the Reactor Coolant Drain Tank. And these are non-safety related and therefore do not have to meet any faulted condition loads.Besides, the insulation extends only upto penetration 155, far away from the equipments and therefore, there is no impact on the nozzle loads.

Support Loads Evaluation

The addition of insulation caused additional weight of only 1lb/ft and extends to a portion of only 25 ft of piping, maximum. There are three supports in this region which will share the loads due to the addition of insulation, in addition to the penetration which is a virtual anchor. The supports are WL-1009-HL5002, WL-1008-GU401, & WL-1008-GU402. Thus the total addition of 25 lbs due to insulation can be shared between these supports. The supports have been already designed with 15% margin over the previous loads.

Active Valve End Loads

Active valve end loads for valve MOV 312 have significant margins per the existing calculation. The minor increase in moments would cause insignificant impact due to additional insulation weight. Besides, the original allowable forces and moments are based on yield strength of connecting pipe being much lower than the actual installed piping. Therefore, valve end loads would still meet the allowables.

Evaluation of Penetration M-56

Calculation RC9894, which has a detailed finite element analysis of the penetration, was reviewed. It was found that significant margin exists for all sections of the penetration, including the sleeve and cap. The least margin for the faulted loadcase was for the cap which had a total stress of 39.88% of the allowable of 42,000 psi.

Total faulted stress intensity = Po + W + SSE (Inertia)
= 2,690 + (16748 x 1.098)
= 21079 psi < 42,000 psi (allowable)

(Conservatively, total current stresses from the calc were increased by factor of 1.098 to account for the weight of insulation)

Therefore, the penetration stresses meet the project criteria. Also, CMTRs for Penetration M56 revealed that the material strength is much higher than the piping.

STP361 (08/94)

SOUTH TEXAS PROJECT
ELECTRIC GENERATING STATION
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CALC NO.	RC6371	SHT	OF
REV.	PREPARER/DATE	REVIEWER/DATE	
	[signature] 5/28/97	P. [signature] 6/2/97	

GENERAL COMPUTATION SHEET

SUBJECT SEE COVER SHEET UNIT/s 1&2

RECONCILIATION OF PIPE STRESS

The longitudinal pressure stress is calculated based on the peak pressure calculated due to GL 96-06. This is applicable only from penetration M56 to FV4913.

Peak Pressure during accident condition per GL 96-06 = 2,690 psi

Revised peak pressure stress, S_{lp} = P Do/(4t)
= 2690 x 3.5/(4 x0.216)
= 10,897 psi

Maximum bending stress for Equation 9D from the existing analysis,
excluding S_{lp} = 4257-315
= 3942 psi

Total Eqn 9D stress = 10,897 + 3942
= 14,839 psi < 37680 psi

PENETRATION & FUNCTIONAL CAPABILITY EVALUATION

The penetration stresses and loads were reviewed and as evaluated in calc RC1234, there is significant margin and also the CMTR's reveal that the material has higher yield strengths. Functional capability requirements are met since faulted stresses are within upset allowables.

There is no other impact in this portion of line.

Author: James M Wigginton at FS5-1-STP-HLP
Date: 4/29/97 9:39 AM
Priority: Normal
TO: Quoc K Huynh at FS6-2-STP-HLP
CC: Charles R Albury
CC: Safdar Hafeez
Subject: New peak line pressures with corresponding line temperatures

Message Contents

The following pressures were generated with a preliminary version of the code we are developing to perform the pipe pressurization analyses. The code was benchmarked against the analyses performed for CREE 96-12151-16. These results and the results of the benchmarking study have been reviewed, and found to be accaptable by Safdar Hafeez. We do not expect these peak pressures to change, however, since the code is not yet verified changes are possible.

RH-1204

	20 psig	100 psig	600 psig
65 deg. F	2332 psia	2417 psia	2946 psia
70 deg. F	2238 psia	2322 psia	
75 deg. F	2126 psia	2209 psia	

RH-1304

	20 psig	100 psig	600 psig
65 deg. F	2312 psia	2398 psia	2926 psia
70 deg. F	2219 psia	2303 psia	
75 deg. F	2107 psia	2190 psia	

WL-1009

	150 psig
65 deg. F	2924 psia
70 deg. F	2824 psia
75 deg. F	2705 psia

PS-1016

	2300 psia
65 deg. F	6950 psia

Paek Temperatures

RH-1204

	20 psig	100 psig	600 psig

65 deg. F	124.3 deg.F	124.3 deg.F	124.3 deg.F
70 deg. F	124.5 deg.F	124.5 deg.F	
75 deg. F	124.8 deg.F	124.8 deg.F	

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RH-1304

	20 psig	100 psig	600 psig
65 deg. F	124.0 deg.F	124.0 deg.F	124.0 deg.F
70 deg. F	124.2 deg.F	124.2 deg.F	
75 deg. F	124.4 deg.F	124.4 deg.F	

WL-1009

	150 psig (IRC / ORC)
65 deg. F	126.9 deg.F / 126.6 deg.F
70 deg. F	127.3 deg.F / 126.9 deg.F
75 deg. F	127.7 deg.F / 127.2 deg.F

PS-1016

	2300 psia (IRC / ORC)
65 deg. F	142.3 deg.F / 142.0 deg.F

CREE 96-12151-27

	0PGP05-ZA-0002	Rev. 5	
	10CFR50.59 Evaluations		
Form 1	10CFR50.59 Screening Form		Page 1 of 3

☒ UNIT #1 ☐ UFSAR CN ☐ DESIGN CHANGE ☒ OTHER CREE

☒ UNIT #2

TPNS # N/A

System two-letter designator RH,SI,PS,ED,WL UNIT 1 ☐ UNIT 2 ☐ BOTH ☒

ORIGINATING DOCUMENT NO. CREE 96-12152-27 REV. NO. 0

DESCRIPTION OF CHANGE

The purpose of this safety evaluation is to evaluate the effects of thermal overpressure on the structural integrity of 10 RH, SI, PS, WL and ED lines that penetrate the containment boundary per NRC Generic Letter 96-06. The concern is that elevated containment temperature following a DBA will heat up the fluid trapped between the containment isolation valves and could create pressures high enough to affect containment integrity via bypass leakage.

PRELIMINARY SCREENING

		YES	NO
1.	Does the proposed change represent a change to the Plant Technical Specifications?	☐	☒
2.	Is an Unreviewed Safety Question known to be associated with the subject change?	☐	☒
	NOTE: If "YES" to either questions 1 or 2 refer to 0PGP05-ZN-0004.		
	Does the proposed change represent:		
3.	A change to only correct a typographical, editorial or drafting error?	☐	☒
4.	A change which is identical to and addressed in its entirety by an existing approved 10CFR50.59 Screening/USQE or NRC approved licensing submittal?	☐	☒
5.	A spare or replacement part/component change with an equivalent part/component? (See Section 2.3 for a definition of equivalent)	☐	☒
6.	A configuration change within existing design specifications?	☐	☒

If all answers to the above questions are "NO" perform the final screening and mark N/A in the approval blocks below.
If the answer to any question (3) through (6) is "YES" a final screening is not necessary.
Sign approval blocks below and discard pages 2 and 3.
Provide a justification and references if any of items (3) through (6) is answered "YES".

The UFSAR requires revision per 0PGP05-ZN-0004? ☐ YES ☒ NO

The Condition Report Action for changing the UFSAR is N/A.

Prepared by: N/A
Originator Date

Approved by: N/A
Qualified Reviewer Date

	0PGP05-ZA-0002	Rev. 5	
	10CFR50.59 Evaluations		
Form 1	10CFR50.59 Screening Form	Page 2 of 3	

Originating Document No. CREE 96-12151-27 Rev. No. 0

FINAL SCREENING

In response to the questions below, if the change involves something that is not described in the SAR and is not part of the licensing basis, the "NO" is appropriate. However, this decision must be clearly documented with adequate technical justification for each question and the sections reviewed of applicable documents and applicable attributes reviewed should be indicated. The listing of attributes and documents for 10CFR50.59 screening can be found in Addendum 5.

Inter-discipline Coordination Required? ☒ YES ☐ NO
If "yes", obtain appropriate concurrence.

☐ Risk and Reliability Analysis ☐ Thermal Hydraulics ☐ Reactor Engr.
☒ Civil ☐ Mech ☐ Elect ☐ EQ ☐ Other

	YES	NO
1. Does the subject of this review involve a change to the facility as described in the Safety Analysis Report?	☐	☒

A review of the UFSAR Sections 3.1, 3.8, and 6.2 was perfromed. The portions of the RH, SI, PS ans ED lines that penetrate the containment are part of the Containment Isolation System (CIS). The design function of these components is to ensure that the piping penetrating the containment is provided with isolation barriers so that no single active failure can result in either a loss of isolation or excessive leakage.

The affected piping and components are designed in accordance with the requirements of ASME Section III, Subsection NC for Class 2. The exposure of these portions of the CIS piping and components to the conservatively postulated increased pressure will result in stresses that are in compliance with the ASME code requirements and form the basis for assuring that the piping system is capable of performing its design function under postulated plant condition.

Therefore, the incresed pressure does not constitute a change to the facility as described in the UFSAR.

	YES	NO
2. Does the subject of this review involve a change to the procedures as described in the Safety Analysis Report? Refer to 0PAP01-ZA-0103.	☐	☒

This evaluation does not propose a change to any procedure described in the UFSAR.

CREE 96-12151-27

Originating Document No. CREE 96-12151-27 Rev. No. 0

	YES	NO
3. Does the subject of this review propose the conduct of test or experiments not described in the Safety Analysis Report?	☐	☒

This evaluation does not propose a test or experiment.

	YES	NO
4. Does the proposed change affect conditions or bases assumed in the Safety Analysis Report or safety-related functions of equipment/systems, even though the proposed change does not entail any physical change in existing structures, systems, or procedures as described in the SAR?	☐	☒

The subject of this evaluation does not affect the resultant stresses in the pipe, penetration, valve ends when subjected to the conservative peak pressure analyzed. These components have been determined to have resultant stresses which are within the ASME Code allowable limits. Therefore, the structural integrity of the piping, components and the penetrations is not affected and conditions or bases assumed in the UFSAR related to these penetrations are not affected.

If any answer is affirmative, complete the screening form and perform an Unreviewed Safety Question Evaluation.

If all answers are negative, no Unreviewed Safety Question Evaluation is required.

	YES	NO
The UFSAR requires revision per 0PGP05-ZN-0004?	☐	☒

The Condition Report Action for changing the UFSAR is N/A.

Prepare by: Quoc Huynh / Quoc K. Huynh (signature) Originator — 6/3/97 Date

Approved by: K. D. House / (signature) Qualified Reviewer — 6/4/97 Date

ATTACHMENT 3

Page 1 of 4

CROSS-REFERENCE TABLE

CASE NO.	DATA	DRAWINGS SUBMITTED
CASE # 1: Line No. 3/4"SI1321BB2: Inboard Valve No. FV3970 Outboard Valve No. FV3971	**PIPING:** Pipe Size: 3/4", Schedule 160S Pipe Thickness: 0.219" Pipe Length: 23 feet Pipe Material: S.S. SA312 TP304 or 304L **INSULATION:** Insulation Thickness: None Insulation Type: None **VALVE # A1SI-FV-3971:** Actual Benchset Pressure: 23 psig Benchset Pressure used: 41 psig	P&ID # 5N129F05016#1 ISO # 5M369PSI272 Sht. A01 ISO # 5C362PSI472 Sht. A05 Valves FV3970/3971 Dwg # 0220(1)-00119-WN
CASE # 2: Line No. 1"PS1005BB2 Inboard Valve No. FV4450 Outboard Valve No. FV4452	**PIPE:** Pipe Size: 1", Schedule 160S Pipe Thickness: 0.25" Pipe Length: 15 feet Pipe Material: S.S. SA312 TP304 or 304L **INSULATION:** Insulation Thickness: 2.5" Insulation Type: Nukon Blanket Insulation **VALVE # C1PS-FV-4452:** Actual Benchset Pressure: 24 psig Benchset Pressure used: 27 psig	P&ID # 5Z329Z00045#1 ISO # 2C369PPS485 Sht. A01 ISO # 5M369PPS285 Sht. A01 Valve FV4452 Dwg # 4026-01146-WV Valve FV4450 Dwg # 4407-00019-RZ Valve FV4450 Dwg # 4407-00009-RZ Valve FV4450A Dwg # 4050-00007-TG Valve FV4450A Dwg # 4050-01001-TG Valve PS0015 Dwg # 4032-01076-KT

CASE # 3: Line No. 1"PS1002BB2 Inboard Valve No. FV4454 Inboard Valve No. FV4455 Outboard Valve No. FV4456 Outboard Valve No. FV2455A	**PIPE:** Pipe Size: 1", Schedule 160S Pipe Thickness: 0.25" Pipe Length: 21 feet Pipe Material: S.S. SA312 TP304 or 304L **INSULATION:** Insulation Thickness: 2.5" Insulation Type: Nukon Blanket Insulation **VALVE # B1PS-FV-4456:** Actual Benchset Pressure: 24 psig Benchset Pressure used: 27 psig	P&ID # 5Z329Z00045#1 P&ID # 5Z549Z47501#1 ISO # 2C369PPS485 Sht. A01 ISO # 5M369PPS285 Sht. A01 ISO # 5M369PAP287 Sht. A01 Valve FV4456 Dwg # 4026-01146-DWV Valves FV4454A/4455A Dwg # 4050-00007-TG Valves FV4454A/4455A Dwg # 4050-01001-TG Valves FV4454/4455/2455A Dwg # 4407-00019-RZ Valves FV4454/4455/2455A Dwg # 4407-00009-RZ Valve PS0011 Dwg # 4032-01076-KT
CASE # 4: Line No. 1"PS1003UB2 Inboard Valve No. FV4823 Outboard Valve No. FV4461 Outboard Valve No. FV2454	**PIPE:** Size: 1", Schedule 40S Pipe Thickness: 0.133" Pipe Length: 19 feet Pipe Material: S.S. SA312 TP304 or 304L **INSULATION:** Insulation Thickness: 1" Insulation Type: Nukon Blanket Insulation **VALVE # C1PS-FV-4461:** Actual Benchset Pressure: 10 psig Benchset Pressure used: 15 psig	P&ID # 5Z329Z00045#1 P&ID # 5Z549Z47501#1 ISO # 2C369PPS485 Sht. A01 ISO # 5M369PPS285 Sht. A01 ISO # 5M369PAP287 Sht. A01 Valve FV4461 Drawing # 4026-01145-WV Valves FV4823/2454 Dwg # 4407-00013-RZ Valves FV4823/2454 Dwg # 4407-00018-RZ Valve PS0008 Dwg # 4032-01076-KT

CASE # 5: Line No. 1"PS1004UB2 Inboard Valve No. FV4824 Outboard Valve No. FV4466	**PIPE:** Pipe Size: 1", Schedule 40S Pipe Thickness: 0.133" Pipe Length: 21 feet Pipe Material: S.S. SA312 TP304 or 304L **INSULATION:** Insulation Thickness: 1" Insulation Type: Nukon Blanket Insulation **VALVE # B1PS-FV-4466:** Actual Benchset Pressure: 16 psig Benchset Pressure used: 16 psig	P&ID # 5Z329Z00045#1 ISO # 2C369PPS485 Sht. A01 ISO # 5M369PPS285 Sht. A01 Valve FV4466 Dwg # 4026-01147-WV Valve FV4824 Dwg # 4407-00013-RZ Valve FV4824 Dwg # 4407-00018-RZ Valve PS0001 Dwg # 4032-00016-KT
CASE # 6: Line No. 2"ED1124SB2 Inboard Valve No. MOV0064 Outboard Valve No. FV7800 Outboard Valve No. FV2453	**PIPE:** Pipe Size: 1", 2" and 3", Schedule 40S Pipe Thickness: 0.133", 0.154" and 0.216" Pipe Length:4 ft (1"), 10 ft (2") and 7 ft (3") Pipe Material: S.S. SA312 TP304 or 304L **INSULATION:** Insulation Thickness: 1" Insulation Type: Nukon Blanket Insulation **VALVE # A1ED-FV-7800:** Actual Benchset Pressure: 13.22 psig Benchset Pressure used: 29 psig	P&ID # 5Q069F05030#1 P&ID # 5Z549Z47501#1 ISO # 5M369PED226 Sht. A29 ISO # 5M361PED226 Sht. 32 ISO # 5C369PED426 Sht. 05 ISO # 5M369PAP287 Sht. A01 Valve MOV0064 Dwg # 4038-01149-AD Valve FV7800 Dwg # 4026-01144-WV Valve ED0056 Dwg # 6373-00023-NY

CASE # 7 AND 8 Line No. 8"RH1204KB2 Inboard Valve No. XRH0063B Outboard Valve # XRH0064B Line No. 8"RH1304KB2 Inboard Valve No. XRH0063C Outboard Valve # XRH0064C	**PIPE:** Size: 8", Schedule 40S Pipe Thickness: 0.322" Pipe Length: 15 feet each Pipe Material: S.S. SA312 TP304 or 304L **INSULATION:** Insulation Thickness: 1.5" Insulation Type: Nukon Blanket Insulation	P&ID # 5R169F20000#1 ISO # 2M369PRH259 Sht. 02 ISO # 2C369PRH459 Sht. 02 ISO # 2C369PRH459 Sht. 05 Valves XRH0063B/0064B Dwg # 0220(1)-09097-WN
CASE # 9: Line No. 1"PS1016BB2 Inboard Valve No. FV4451 Outboard Valve No. FV4451B	**PIPE:** Pipe Size: 1", Schedule 160S Pipe Thickness: 0.25" Pipe Length: 12 feet Pipe Material: S.S. SA312 TP304 or 304L **INSULATION:** Insulation Thickness: 2.5" Insulation Type: Nukon Blanket Insulation	P&ID # 5Z329Z00045#1 ISO # 2C369PPS485 Sht. A01 ISO # 5M369PPS285 Sht. A01 Valve FV4451B Dwg # 4409-00177-VT Valve FV4451 Dwg # 4407-00019-RZ Valve FV4451 Dwg # 4407-00009-RZ Valve FV4451A Dwg # 4050-00007-TG Valve FV4451A Dwg # 4050-01001-TG Valve PS0004 Dwg # 4032-01076-KT
CASE # 10: Line No. 3"WL1009RB2: Inboard Valve No. MOV0312 Outboard Valve No. FV4913	**PIPE:** Size: 3", Schedule 40S Pipe Thickness: 0.216" Pipe Material: S.S. SA312 TP316 or 316L Pipe Length: 17 feet **INSULATION:** Thickness: 1" Insulation Type: Nukon Blanket Insulation	P&ID # 5R309F05022#1 ISO # 5M369PWL277 Sht. 04 ISO # 5C369PWL477 Sht. 01 Valve MOV0312 Dwg # 4038-01135-AD Valve FV4913 Dwg # 4026-01143-WV Valve WL0636 Dwg # 4032-01076-KT

ATTACHMENT 4

DRAWINGS FOR PIPING AND VALVES

OVERSIZE DOCUMENT PAGE(S) PULLED

SEE APERTURE CARD FILES

APERTURE CARD/PAPER COPY AVAILABLE THROUGH NRC FILE CENTER

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