

Dept. NPE MECH

PENNSYLVANIA POWER & LIGHT COMPANY
CALCULATION SHEET

ER No 100450

Date 4/1 1981

Designed by H.C. Clarke

PROJECT SUSQUEHANNA SES

Sht. No. 1 of 3

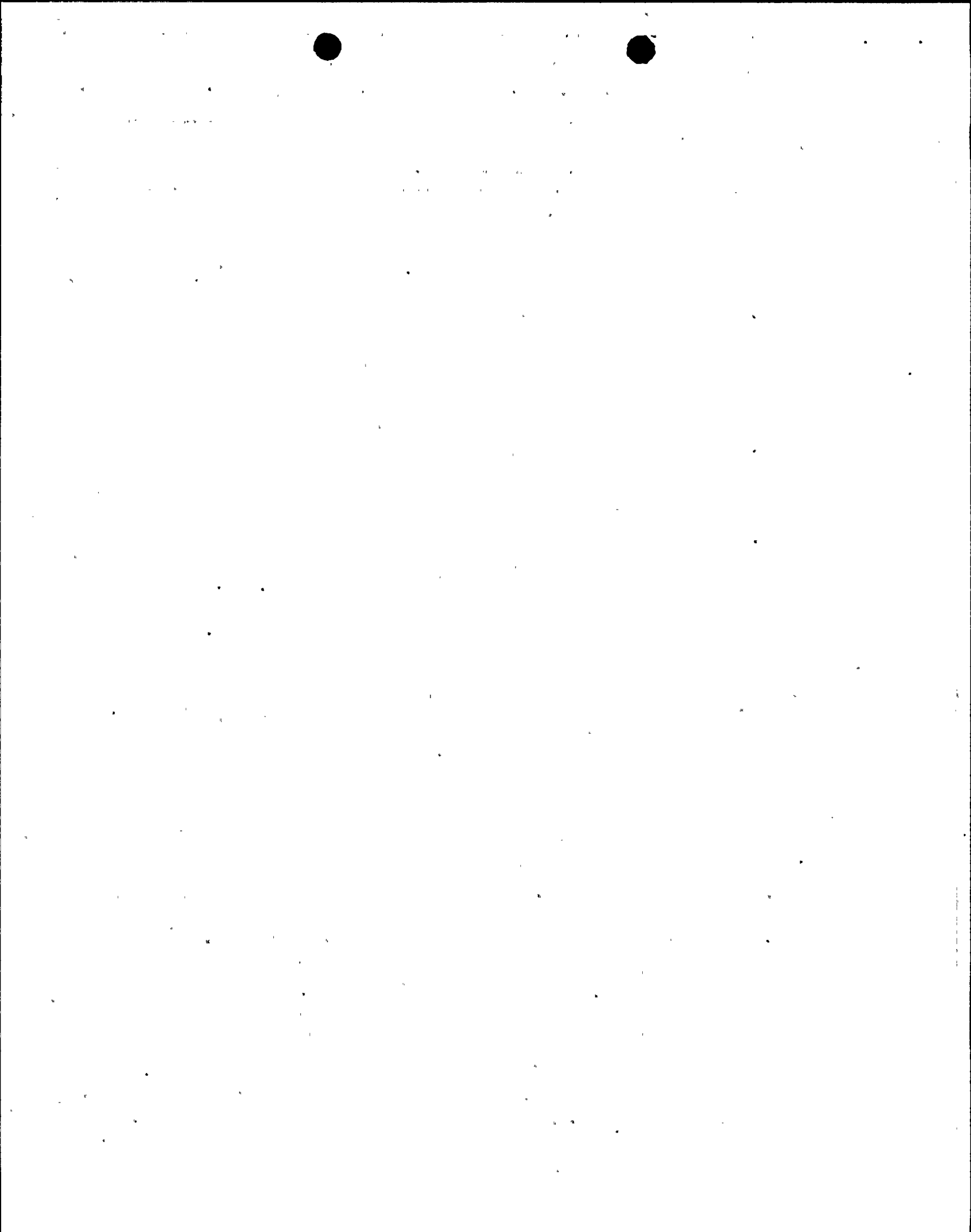
Approved by [Signature]

T.J. checked

CONTAINMENT HIGH PRESSURE
BY PASS LEAKAGE TEST

OBJECTIVE:

To demonstrate that the Susquehanna
containment meets the acceptable leakage
criteria set forth for high differential
pressure in SRP 6.2.11.6 App. A I.



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Approved by _____

During the Susquehanna SES Structural Integrity Test, a 33 psi differential was held across the containment diaphragm slab. Two compressors were used to establish this pressurization. Their total capacity was 1950 scfm (attachment D). The test engineers don't remember the compressors being run to maintain the pressure once it was established, however, records documenting the starting and stopping of the compressors are not available. Records indicating that the pressure was maintained are available. Assuming the compressors ran continuously, and that all leakage was across the diaphragm slab, one establishes a Structural Integrity Test leakage of 1950 scfm. When comparing this with an acceptable leakage of 3019 scfm that was calculated based on *SRP 6.2.1.1.C, Appendix I; it is demonstrated that SES bypass leakage is acceptable under high differential pressure. 1950 scfm represents 6.5% of Susquehanna's steam bypass capability.

* Per discussions with NRC, a realistic $A/R = .25 \text{ ft}^2$ was used for this calculation. Acceptable bypass capability for SES DBA is $.25 \text{ ft}^2$ while the $.05 \text{ ft}^2$ in the SRP corresponds to a small break accident. (FSAR Figure 6.2-17)

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$$\dot{m} = \frac{A}{\sqrt{K}} \sqrt{2 \rho g_c \Delta P_v}$$

$$\dot{m} = .25 \text{ ft}^2 \sqrt{2 \left(.075 \frac{\text{lbm}}{\text{ft}^3} \right) \left(32.2 \frac{\text{ft}}{\text{sec}^2} \right) \left(32.75 \frac{\text{lbf}}{\text{in}^2} \right) \left(144 \frac{\text{in}^2}{\text{ft}^2} \right) \left(\frac{\text{lbm}}{\text{lbf}} \right)}$$

$$\dot{m} = 37.73 \text{ lbm/sec}$$

$$\dot{m} = 2263.87 \text{ lbm/min}$$

$$\dot{m} = \underline{30,185 \text{ scfm}}$$

ASSUME 10% ACCEPTANCE CRITERIA

ACCEPTABLE LEAKAGE = 3019 scfm

$$\frac{A}{\sqrt{K}} = .25 \text{ ft}^2 \quad \text{SSES FSAR Figure 6.2-17}$$

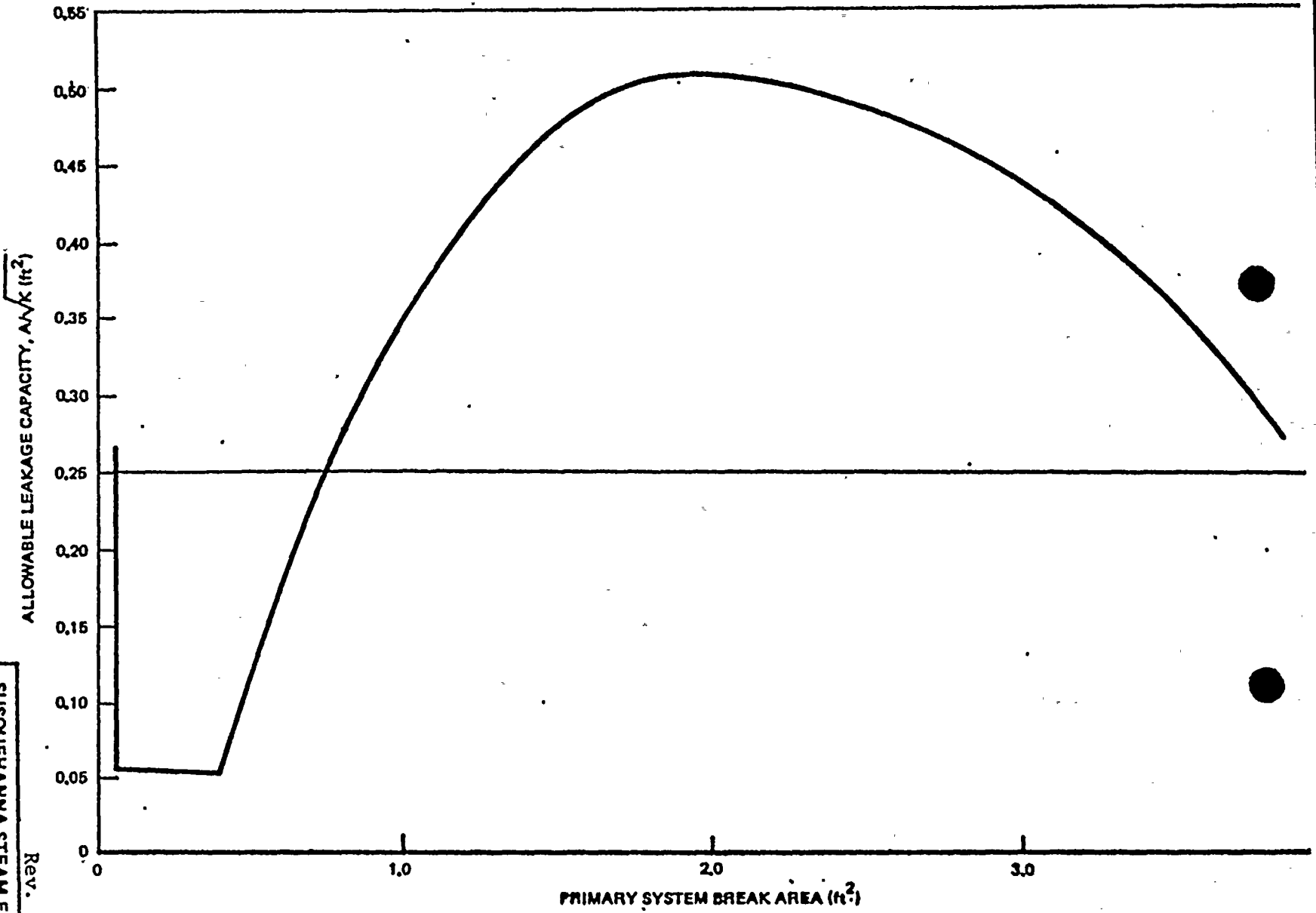
$$\rho = .075 \frac{\text{lbm}}{\text{ft}^3} \quad \text{Air}$$

$$\Delta P_v = 32.75 \text{ psi} \quad \text{Figure attached}$$

Note: ① The density of air was very conservatively assumed to be .075 lbm/ft³ corresponding to 70°F and 0 psig. Downwell pressure was actually 6.25 psig.

② Flow assumed to be incompressible





Rev. 15, 4/80

SUSQUEHANNA STEAM ELECTRIC STATION
 UNITS 1 AND 2
 FINAL SAFETY ANALYSIS REPORT

Allowable Leakage Capacity

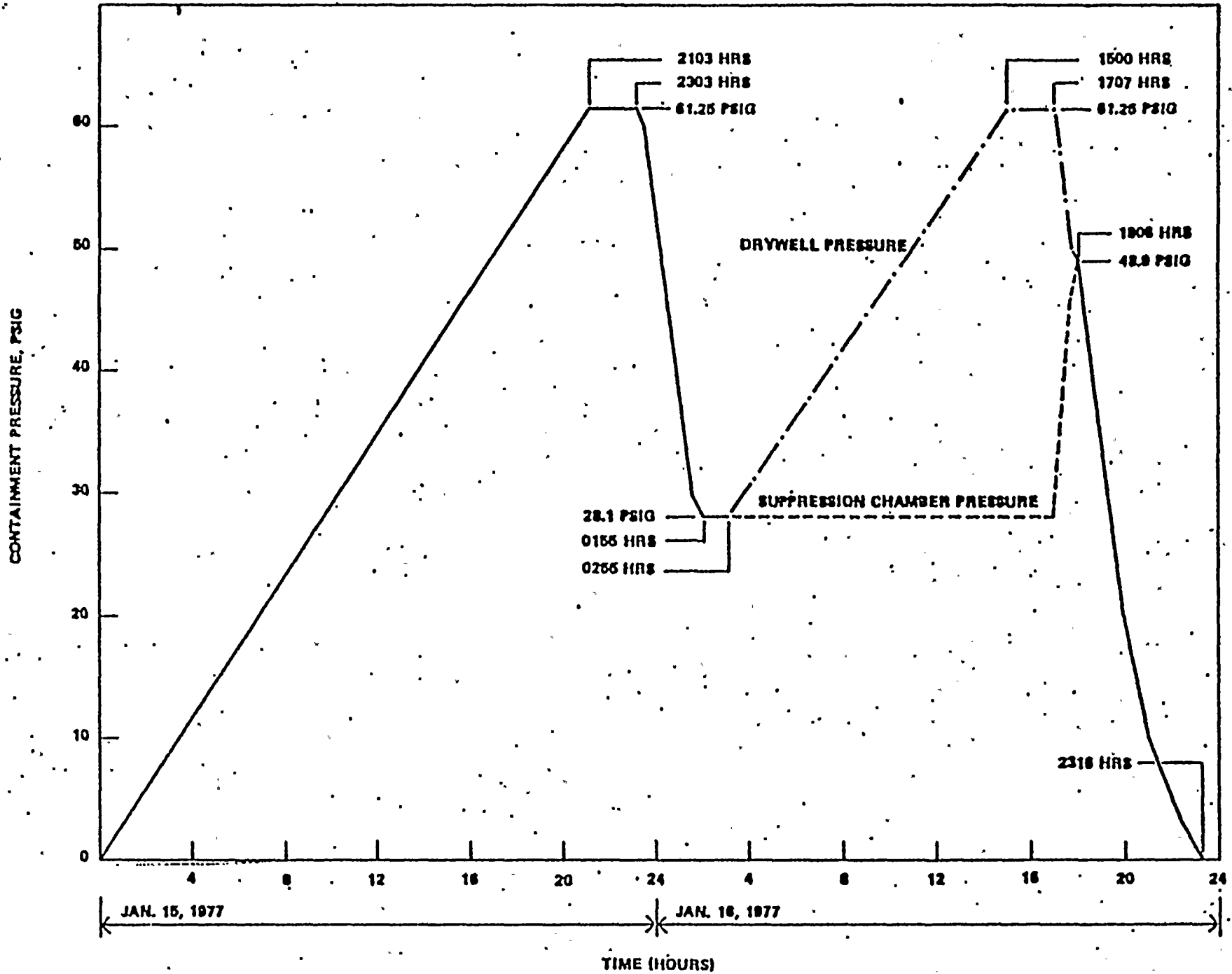
FIGURE 6.2-17

$\frac{.61,25}{.24,10}$
 33.15 ACTUAL

$\frac{33.15}{-.40}$
 32.75 WITH TOLERANCE

±.2psi

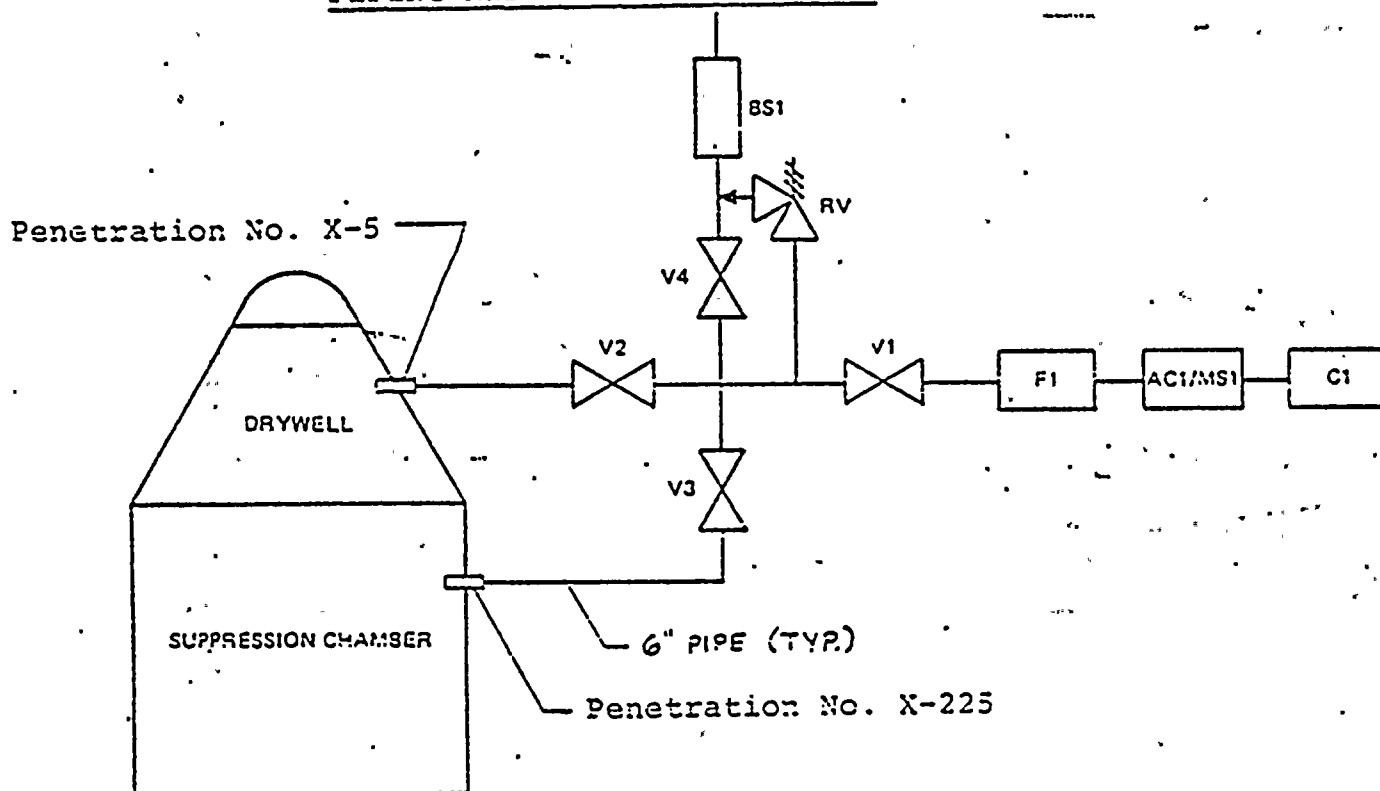
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2150 U U
 SCHEDULIZATION SCHEDULE

D. Revise Attachment B as follows:

ATTACHMENT B
PIPING AND VALVING SCHEMATIC



PHASE (REFER TO ATTACH. A)	V1	V2	V3	V4	C1
1. INITIAL PRESSURIZATION	OPEN	OPEN	OPEN	CLOSED	ON
2. 115% DESIGN PRESS. HOLD	CLOSED	OPEN	OPEN	CLOSED	OFF
3. BLOWDOWN TO 23.2 PSIG	CLOSED	OPEN	OPEN	OPEN	OFF
4. HOLD AT 28.2 PSIG	CLOSED	OPEN	OPEN	CLOSED	OFF
5. PRESSURIZE DRYWELL TO 61 PSIG	OPEN	OPEN	CLOSED	CLOSED	ON
6. 32.8 PSIG HOLD	CLOSED	CLOSED	CLOSED	CLOSED	OFF
7. VENT DRYWELL TO S.C.	CLOSED	OPEN	OPEN	CLOSED	OFF
8. FINAL BLOWDOWN	CLOSED	OPEN	OPEN	OPEN	OFF

SEE ATTACHMENT D FOR EQUIPMENT DESCRIPTION

ATTACHMENT D

PRESSURIZATION SYSTEM EQUIPMENT

<u>ITEM</u>	<u>NO. REQ'D</u>	<u>DESCRIPTION</u>
C-1	1 (RENTED)	<u>Air Compressor</u> - Portable Engine Driven Screw Type, <u>Capacity of 1200 scfm</u> , oil free, @ 100 psi Ingersoll-Rand Model Spiro-Flow 1200 or equivalent.
C-1	2 (RENTED)	<u>Air Compressor</u> - Portable Engine Driven Screw Type, <u>Capacity of 750 scfm</u> , oil free.
AC-1	1	<u>Aftercooler</u> - Minimum capacity of 5000 scfm (14.7 psia and 60°F) with a 10° approach temperature i.e. the difference between the air temperature leaving the aftercooler and cooling water inlet temperature. Shell side design pressure/temperature - 150 psig/250°F. Tube side design pressure/temperature - 150 psig/400°F. American Standard Type A300, size 12040.
MS-1	1	<u>Moisture Separator</u> - American Standard Model 8T, Part No. 2-176-5-08-215-01, design pressure/temperature - 150 psig/400°F, with automatic trap, Part No. 2-196-7-06-120-01.
F-1	1	<u>Compressed Air Filter</u> - Minimum capacity of 6300 scfm @100 psig operating pressure. Collection efficiency capable of removing 99.9% of 0.6 micron and larger dirt particles and 95% of 0.009 micron and larger oil droplets from the air, with Automatic Drain System, Model ST-3 with preset timer for 10-second blow-down interval every 2 hours. Zurn "MICROFIBER" Coalescing Oil Filter, Model F 1200, or equivalent.
V1, 2, 3, 4	4	<u>Motor Operator Butterfly Valves</u> - Minimum capacity of 5000 scfm @ 110 psig, bubble tight @ 150 psig complete with position indicators by Raymond Control Systems. Centerline Wafer Type 6" Series "A" 1/60/115 with "Mar

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50" motor driven actuator with manual
override switch control or equivalent
control.

RV

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Pressure Relief Valve - Minimum relief
capacity of 4800 scfm @ 70 psig. Kunkle
Type #252.

BS-1

1

Blowdown Silencer - Auditco Type 4+1
Series MGO 6" muffler..

79319110414

PRESSURIZATION STAGE	R= RECORD B= BACKUP	DATE	TIME	TEST PRESSURE		COMMENTS
				DRYWELL	SUPP. CHMBR	
24	R	JAN 16	05 36	35	28.2	
24	B		05 39	35		
25	R		07 28	40		
25	B		07 31	40		
26	R		09 25	45		
26	B		09 29	45		
27	R		11 08	50		
27	B		11 11	50	28.2	
28	R		12 50	55	28.1	
28	B		12 53	55		
29	R		14 33	60		
29	B		14 36	60		
30	R		15 00	61.25		
30	B		15 03	61.25		
30A	R		16 00	61.25		
30A	B		16 03	61.25		
30B	R		17 00	61.11.		
30B	B		17 03	61.25	28.1	
31	R		17 10	60.3	29.3	
32	R		17 25	55.3	37.38	
33	R		17 48	50.3	46.2	
33A	R	JAN 16	18 00	49.0	48.5	

28-4



100-100000-100000

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