3/4.6.4 VACUUM RELIEF

LIMITING CONDITION FOR OPERATION

3.6.4 Each pair of suppression chamber - drywell vacuum breakers shall be OPERABLE and closed.

APPLICABILITY: OPERATIONAL CONDITIONS 1, 2 and 3.

ACTION:

a. With one or more vacuum breakers in one pair of suppression chamber - drywell vacuum breakers inoperable for opening but known to be closed, restore the inoperable pair of vacuum breakers to OPERABLE status within 72 hours or be in at least HOT SHUTDOWN within the next 12 hours and in COLD SHUTDOWN within the following 24 hours.

b. With one suppression chamber - drywell vacuum breaker open, verify the other vacuum breaker in the pair to be closed within 2 hours. Restore the open vacuum breaker to the closed position within 72 hours or be in at least HOT SHUTDOWN within the next 12 hours and in COLD SHUTDOWN within the following 24 hours.

c. With one position indicator of any suppression chamber - drywell vacuum breaker inoperable:

   1. Verify the other vacuum breaker in the pair to be closed within 2 hours and at least once per 15 days thereafter, or

   2. Verify the vacuum breaker(s) with the inoperable position indicator to be closed by conducting a test which demonstrates that the ΔP is maintained at greater than or equal to 0.7 psi for one hour without makeup within 24 hours and at least once per 15 days thereafter.

   Otherwise, be in at least HOT SHUTDOWN within the next 12 hours and in COLD SHUTDOWN within the following 24 hours.

SURVEILLANCE REQUIREMENTS

4.6.4 Each suppression chamber - drywell vacuum breaker shall be:

a. Verified closed at least once per 7 days.

b. Demonstrated OPERABLE:*

1. At least once per 31 days and within 2 hours after any discharge of steam to the suppression chamber from the safety-relief valves, by cycling each vacuum breaker through at least one complete cycle of full travel.

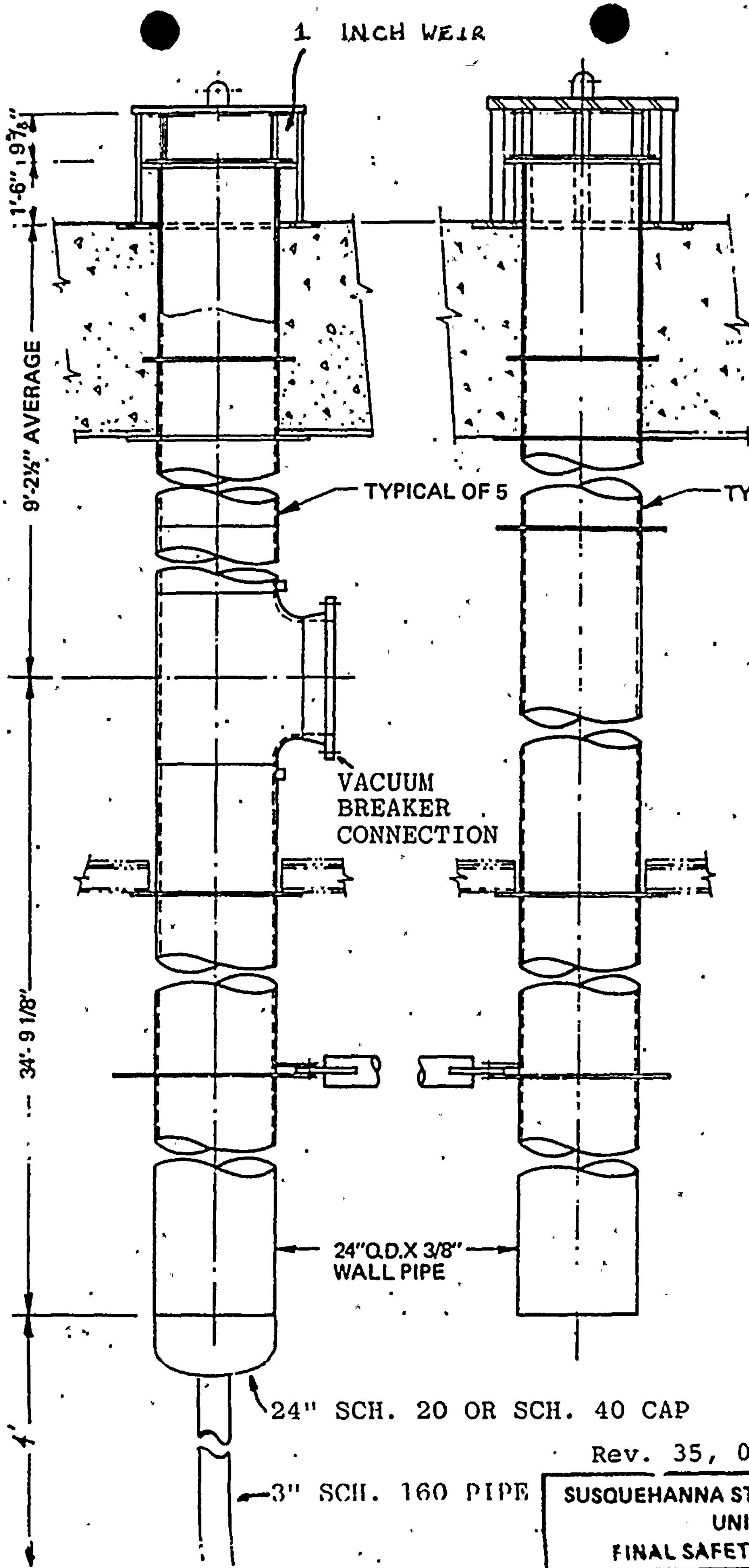
2. At least once per 31 days by verifying both position indicators OPERABLE by observing expected valve movement during the cycling test.

3. At least once per 18 months by;

a) Verifying the opening setpoint, from the closed position, to be 0.5 psid ± 5%, and

b) Verifying both position indicators OPERABLE by performance of a CHANNEL CALIBRATION.

* Vacuum Breaker PSV-25704E1 may be considered OPERABLE without performing surveillance requirements 4.6.4b.1 and 4.6.4b.2 for the period beginning April 19, 1987 until an outage requiring primary containment entry occurs. Prior to startup following such an outage, surveillance requirements 4.6.4b.1 and 4.6.4b.2 must be performed, and on the required frequencies thereafter.

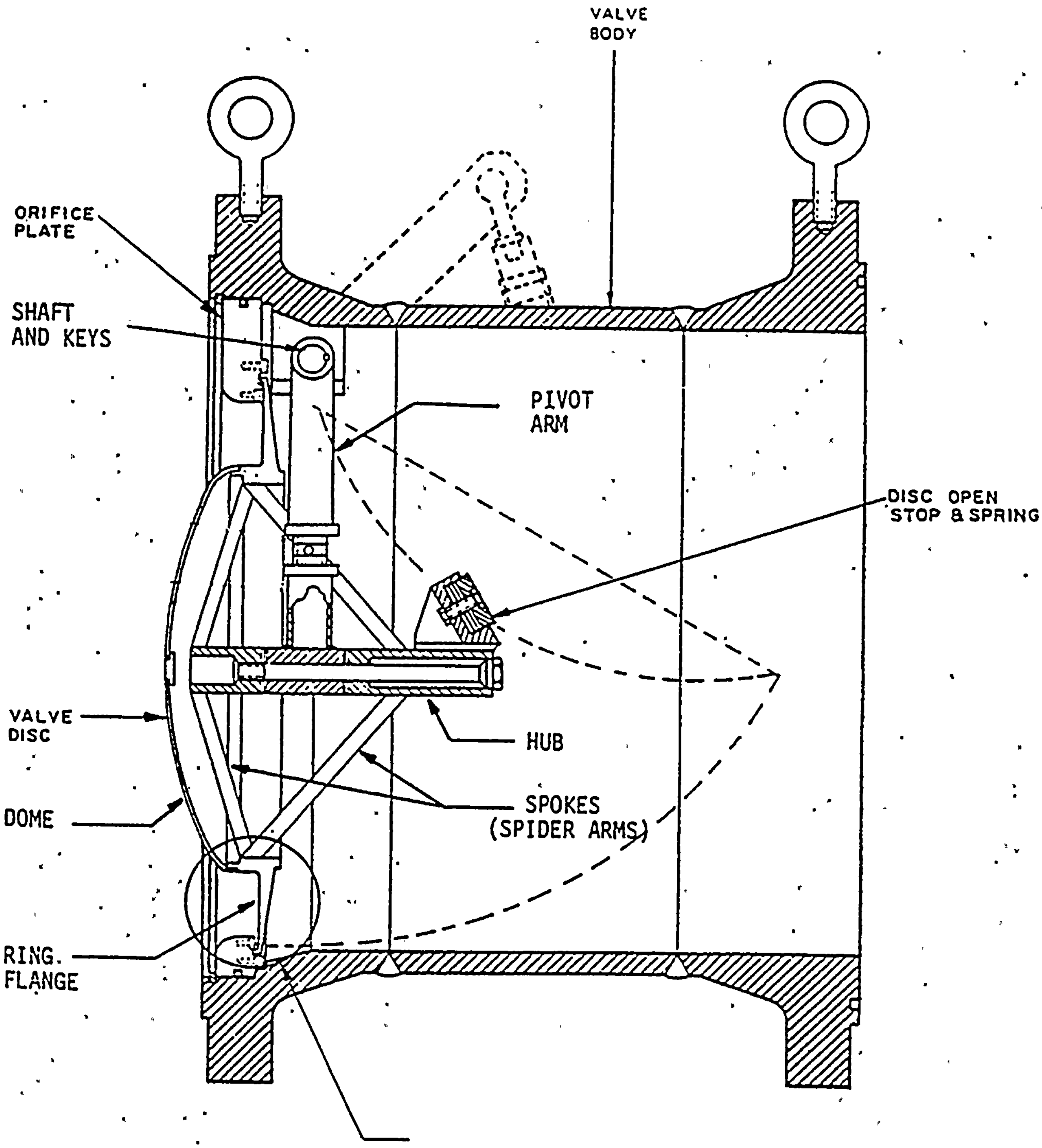


Rev. 35, 07/84

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

DRYWELL TO WETWELL DOWNCOMERS

FIGURE 6.2-56



Rev. 35, 07/84

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

VACUUM BREAKER
DISC/ARM ASSEMBLY-
UNIT 2

FIGURE 6.2-57 Sh. 2

If RHR pumps can't be started, suppression pool sprays may be supplied by RHRSW. Open RHR/RHRSW Crosstie Valves HV-22F073A(B) and HV-22F075A(B).

PC/P-9 (PC/P-2) CAN SUPP CHAMBER PRESSURE BE MAINTAINED BELOW LOWER CURVE

This step tests suppresion pool spray effectiveness in controlling pressure below PSP (see PC/P-8). If pressure is under control, continue performance of previous actions. If anticipated that curve will be exceeded, more drastic action is necessary.

PC/P-10 CONTINUE PRESSURE REDUCTION

If suppression chamber pressure can be maintained below PSP curve, containment's pressure suppression function is working as intended. Continue using systems given in previous steps to bring pressure back to normal.

PC/P-11 (PC/P-2) HAS PC BEEN VENTED RESULTING IN SUPP CHAMBER PRESSURE BELOW CURVE

Refer to Step DW/T-7 for bases behind this step and Drywell Spray Initiation Pressure Limit.

PC/P-12 (PC/P-2) S/D DW COOLERS AND RECIRC PUMPS

INITIATE DW SPRAYS

IF ADEQUATE CORE COOLING IS NOT ASSURED,
THEN MAINTAIN RHR IN LPCI MODE

Use drywell sprays to condense steam and reduce containment pressure prior to exceeding PSP curve (see PC/P-8). Continue sprays as necessary to control pressure below limit. Maintain each RHR Loop in LPCI mode if required for adequate core cooling.

Shutdown drywell coolers and recirculation pumps prior to initiating sprays to increase probability that they may be restarted, if needed, when drywell sprays are no longer required.

If RHR pumps can't be started, drywell sprays may be supplied by RHRSW. Open RHR/RHRSW Crosstie Valves HV-22F073A(B) and HV-22F075A(B).

DW/T-6 CONTINUE DW COOLDOWN

Continue conventional methods to control drywell temperature, including:

- o Drywell coolers
- o RPV cooldown
- o Minimizing heat sources
- o Suppression pool sprays (if conditions are met)

DW/T-7 (DW/T-3) HAS PC BEEN VENTED RESULTING IN SUPP CHAMBER PRESSURE BELOW CURVE

If primary containment has been vented, it is possible that non-condensible atmosphere was reduced to the point where initiation of drywell sprays could fail containment on negative pressure.

Drywell Spray Initiation Pressure Limit curve (Attachment G) ensures that a sufficient non-condensible air mass exists in suppression chamber (drywell atmosphere would be primarily steam at this point) to keep containment pressure above -5 psig (design) if all steam were instantaneously condensed.

Read suppression chamber temperature on panel 2C693 or computer points MAT10 and MAT11.

If containment has not been vented or a sufficient non-condensible air mass can be confirmed by curve, initiate drywell sprays. Otherwise, do not.

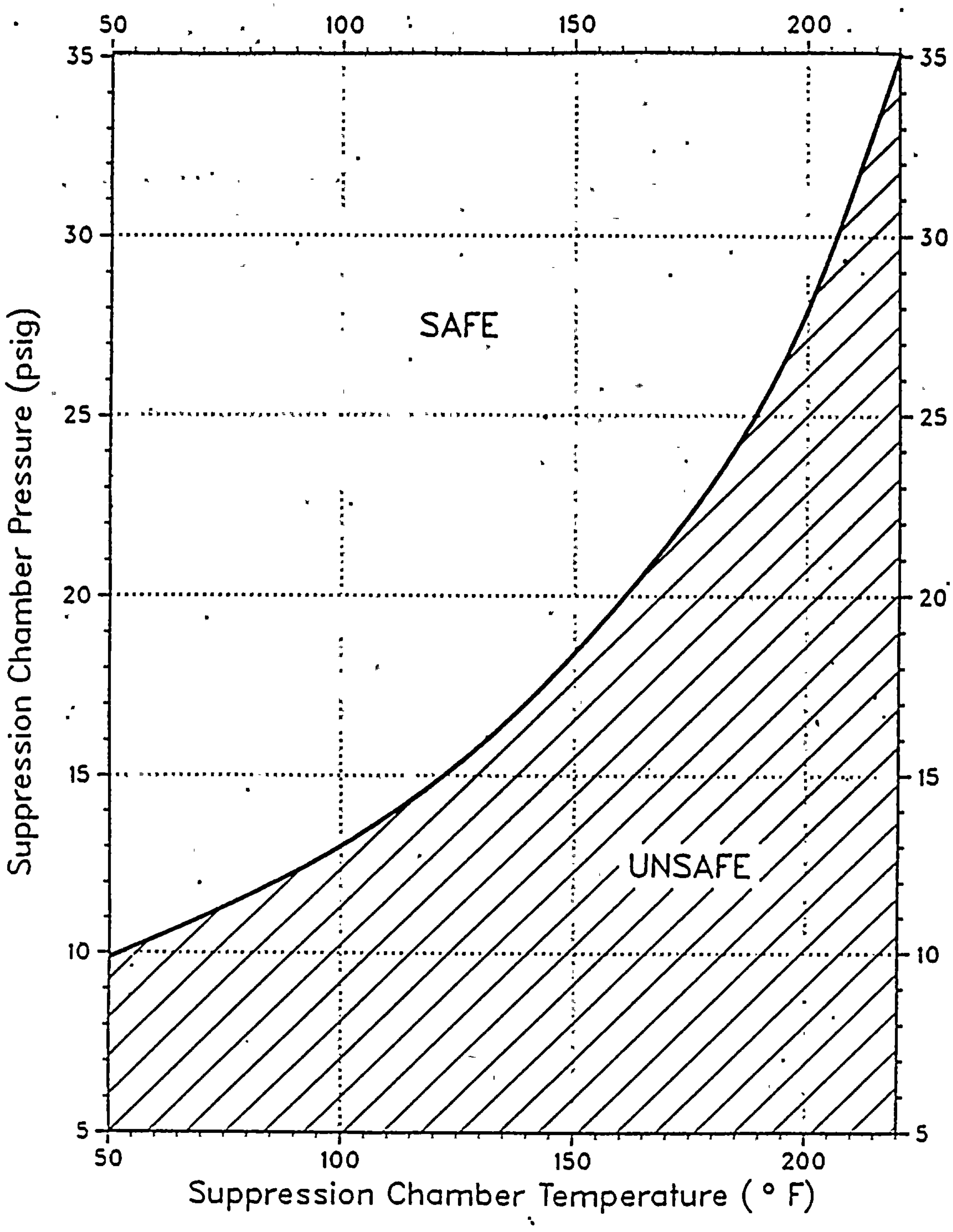
DW/T-8 (DW/T-3) S/D DRYWELL COOLERS

INITIATE DRYWELL SPRAYS

IF ADEQUATE CORE COOLING IS NOT ASURED,
THEN MAINTAIN RHR IN LPCI MODE

Use drywell sprays to cool containment when temperatures approach design (340°F) to prevent failure of containment and related equipment (i.e. SRV's). Continue sprays until drywell heatup is reversed and average drywell temperature can be maintained below 320°F, or primary containment pressure reaches 0 psig, whichever occurs first.

FIGURE PC-5



DRYWELL SPRAY INITIATION PRESSURE LIMIT

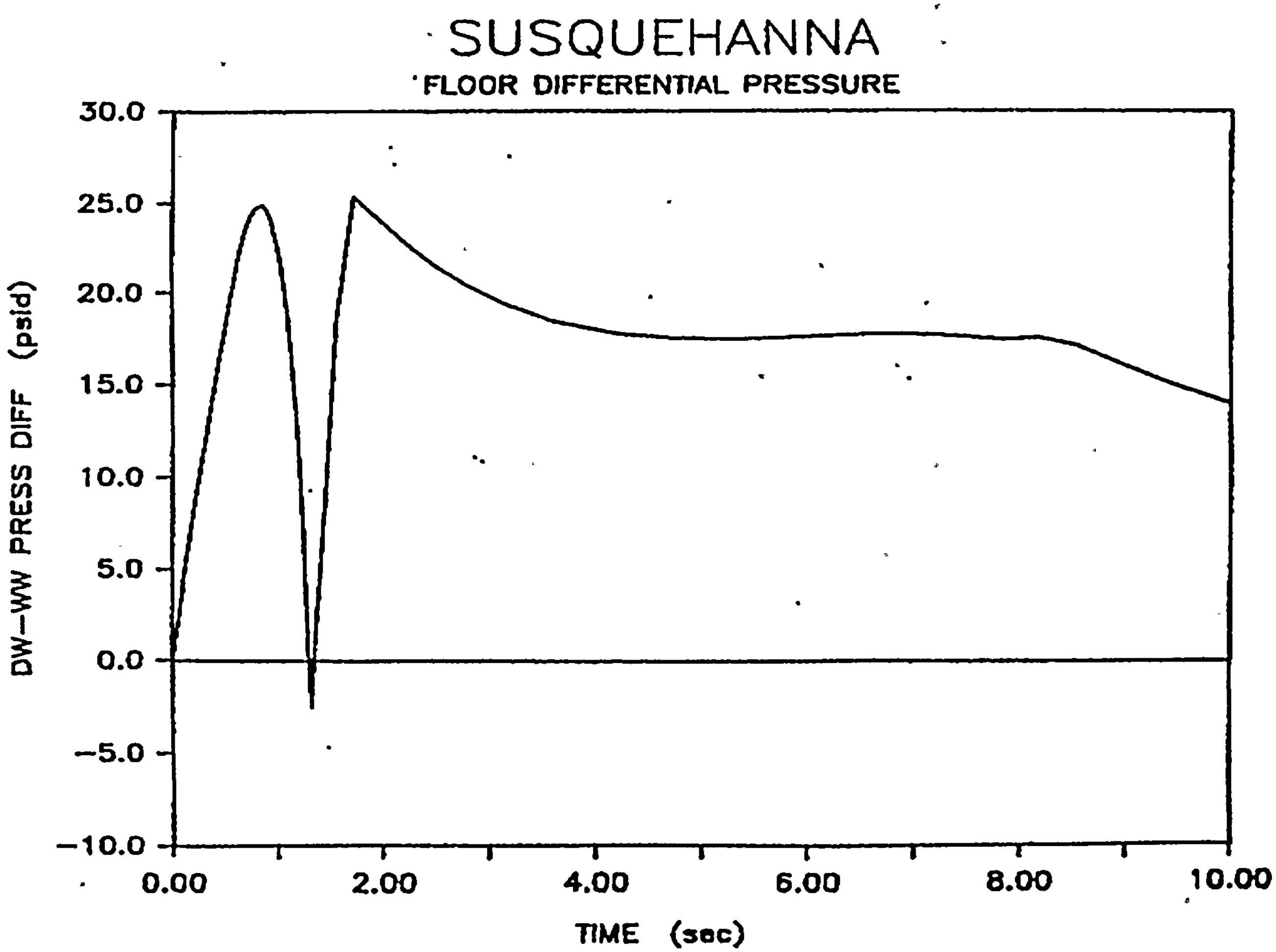


Figure 3 - Drywell-to-Suppression Chamber Differential Pressure History

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Cat. #973401

Dept. NF+SE
Date 4/14 1987
Designed by JJKefling
Approved by ______

PENNSYLVANIA POWER & LIGHT COMPANY
CALCULATION SHEET

PROJECT ~~Est~~ Estimate of ΔP accross wetwell to drywell floor during DBA LOCA.

ER No. ______
Sht. No. ____ of ____

Determination of Δp accross vacuum breakers during LOCA, assuming three operable valves rather than four. The pressure drop a ccross a valve can be taken as (Ref 1).

$$\Delta p = K(\tfrac{1}{2}\rho V^2) \qquad (1)$$

where Δp = pressure loss lbf/in^2

K = Valve coefficient $\frac{lbf\ ft^2\ sec}{lbm\ in^2}$

ρ = fluid density lbm/ft^3

V = fluid velocity ft/sec.

For the case of four vacuum breakers

$$\Delta p_1 = K(\tfrac{1}{2}\rho_1 V_1^2) = -2.5 \text{ (Reference 2)}$$

For the Case of three vacuum breakers

$$\Delta p_2 = K(\tfrac{1}{2}\rho_2 V_2^2)$$

Assuming that the mass flow rate must be the same between wet well air space and drywell to allow the proper amount of mass transfer, such that the containment is stabilized, we find that

$$w = w_1 = w_2 = \rho_1 V_1 A_1 = \rho_2 V_2 A_2$$

~~Th~~where w = mass flow rate of fluid lbm/s

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Cat. #973401

Dept. ______ Date ______ 19____ Designed by ______ Approved by ______

PENNSYLVANIA POWER & LIGHT COMPANY
CALCULATION SHEET

PROJECT ______

ER No. ______

Sht. No. ____ of ____

and A_1 = total vacuum breaker flow area for 4 valves

A_2 = total vacuum break flow area for 3 valves

thus $\frac{A_2}{A_1} = \frac{3}{4}$

since the individual valve areas are constant.

Therefore

$$\frac{\Delta P_2}{\Delta P_1} = \frac{K(\frac{1}{2}\rho_2 V_2^2)}{K(\frac{1}{2}\rho_1 V_1^2)} \quad (2)$$

The K's can be taken as constant since the valve geometry does not change. The ρ's are also very close to the same since the pressure difference between case 1 and case 2 will be small (~ 2 psia). Thus

$$\frac{\Delta P_2}{\Delta P_1} = \frac{V_2^2}{V_1^2} = \frac{W^2/(\rho_2 A_2)^2}{W^2/(\rho_1 A_1)^2}$$

$$= \left(\frac{A_1}{A_2}\right)^2 = \left(4/3\right)^2 = 1.78$$

$$\Delta P_2 \doteq (\Delta P_1)(1.78) \doteq -4.4$$

Ref 1. Bird, Stewart and Lightfoot, Transport Phenomena, Wiley, 1960.

2. GE Containment Analysis Performed for PP&L, Spring 1987.

5.0 DESIGN FEATURES

5.1 SITE

EXCLUSION AREA

5.1.1 The exclusion area shall be as shown in Figure 5.1.1-1.

LOW POPULATION ZONE

5.1.2 The low population zone shall be as shown in Figure 5.1.2-1.

MAP DEFINING UNRESTRICTED AREAS FOR RADIOACTIVE GASEOUS AND LIQUID EFFLUENTS

5.1.3 Information regarding radioactive gaseous and liquid effluents, which will allow identification of structures and release points as well as definition of UNRESTRICTED AREAS within the SITE BOUNDARY that are accessible to MEMBERS OF THE PUBLIC, shall be as shown in Figures 5.1.3-1a and 5.1.3-1b.

5.2 CONTAINMENT

CONFIGURATION

5.2.1 The primary containment is a steel lined reinforced concrete structure consisting of a drywell and suppression chamber. The drywell is a steel-lined reinforced concrete vessel in the shape of a truncated cone on top of a water filled suppression chamber and is attached to the suppression chamber through a series of downcomer vents. The drywell has a minimum free air volume of 239,600 cubic feet. The suppression chamber has an air region of 148,590 cubic feet and a water region of 142,160 cubic feet.

DESIGN TEMPERATURE AND PRESSURE

5.2.2 The primary containment is designed and shall be maintained for:

a. Maximum internal pressure 53 psig.

b. Maximum internal temperature: drywell 340°F.
suppression chamber 220°F.

c. Maximum external pressure 5 psig.

d. Maximum floor differential pressure: 28 psid, downward.
5.5 psid, upward.

SECONDARY CONTAINMENT

5.2.3 The secondary containment consists of the Unit 1 and Unit 2 Reactor Buildings, the Reactor Building recirculation fan room, the equipment access structure and a portion of the main steam tunnel and has a minimum free volume of 5,755,600 cubic feet.