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MURRAY R. EDELMAN
SR. VICE PRESIDENT
NUCLEAR

July 10, 1986
PY-CEI/NRR-0480 L

Dr. W. R. Butler, Director
BWR Project Directorate No. 4
Division of BWR Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Perry Nuclear Power Plant
Docket Nos. 50-440; 50-441
Emergency Containment Venting

Dear Dr. Butler:

The purpose of this letter is to submit the Perry plant unique analysis for emergency containment venting in accordance with our commitment made in our letter of September 11, 1985 (PY-CEI/NRR-0340 L). This commitment was discussed in Perry SSER 8, section 13.5.2.2.1, in which the NRC Staff found acceptable our proposal to submit the plant-unique analysis and resulting venting pressure value for Perry prior to exceeding 5% power.

Attachment 1 provides a discussion of the plant specific analysis and resulting containment pressure limit for Perry. The analysis utilizes the guidance of Appendix C to the BWROG EPGs Revision 3 submitted in NEDO-24934, and includes additional information on the four points specifically made by the staff in SSER 8. Attachment 2 contains copies of the containment pressure limit curves used in PEI-D23.

This submittal completes those actions required by our license commitment, Emergency Containment Venting SSER 8 contained in Appendix 1B of the Perry FSAR.

Should you have any questions, please feel free to call me.

Very truly yours,

Murray R. Edelman
Sr. Vice President
Nuclear Group

MRE:jsd

Attachments

cc: Jay Silberg, Esq.
John Stefano (2)
J. Grobe

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ATTACHMENT 1

TO

PY-CEI/NRR-0480 L

PERRY UNIQUE ANALYSIS

EMERGENCY CONTAINMENT VENTING

SUMMARY

The Perry Nuclear Power Plant (PNPP) Plant Emergency Instruction for Drywell and Containment Pressure Control is based on the Boiling Water Reactors Owners' Group (BWROG) Emergency Procedure Guidelines (EPG) contained in NEDO-24934, Revision 3, December 8, 1982. The EPGs call for emergency venting as the last step in a sequence of procedural steps designed to reduce containment pressure. The staff SER on the EPGs established an interim limit of twice the design pressure for emergency venting with the understanding that a more precise analysis be made to establish a plant specific containment venting pressure limit. The PNPP PEIs provide instructions necessary to restore and maintain containment pressure less than the design pressure of 15.0 psig. Should containment pressure exceed this value and become high enough to threaten containment integrity, the PEI directs the operator to vent containment through a series of vent paths designed to minimize the release of fission products to the atmosphere while protecting the containment structure.

Perry's containment has a 15 psig design pressure. All points analyzed for structural limits well exceeded the operability limits of the vent paths and the safety relief valves. The containment venting pressure limit was found to be limited to 50 psig by SRV operability. This is approximately three times the design pressure, but well below the ultimate capacity (see Figure 1). The venting procedure incorporates a sequential use of preferred vent paths prioritized by considerations of vent path size and minimizing off-site dose rates. The cumulative vent path area is sufficient to remove decay heat associated with a generation rate at 10 minutes after shutdown as recommended by the BWROG Generic EPG Calculational Procedures (see Figure 2).

The containment and drywell purge and vent system was not used due to operability limitations of the valves against high containment pressures. In addition, none of the paths selected involves ductwork, therefore ductwork failure is not a concern.

CONTAINMENT VENTING PRESSURE CALCULATIONS

The primary function of the containment venting procedure is to provide a predetermined capability for venting containment atmosphere at a rate that will prevent damaging the containment structure due to over-pressurization. Containment pressure is directly dependent on the energy added to the containment atmosphere due to decay heat generation following reactor shutdown and serves as the basis for determining the required relief capability of the vent paths. The containment pressure limit is calculated to assure that primary containment venting at conditions such that:

1. The containment is not expected to fail,

2. The vent may be operated and is sufficiently sized to remove decay heat,

3. The SRVs remain operable.

In addition, it is desirable to avoid venting until absolutely necessary to ensure containment integrity is maintained and the safety relief valves remain operable. The limiting primary containment pressure is determined for each one of these considerations. Service Level D pressure limits were utilized in the analysis since they best describe the ultimate capacity of the containment at the specified points. Allowance is made for water in the containment which adds to the static loads on the containment structure and may effect the pressure measured at the pressure instrument tap. The containment venting pressure limit is then the lowest pressure indicated by a series of curves giving a constant pressure at the evaluation point for varying containment water levels.

The measured pressure used in entering the curves will be affected by the height of the containment water level above (or below) the pressure instrument tap. For Perry, two channels of instrumentation are provided for measuring containment pressure. As these channels have taps at different elevations (Escpi), the pressure/elevation calculations were conducted twice. The figures and curves contained in the following sections are appropriately annotated.

Although the BWROG EPGs allow for the effects of water head due to submergence of the pressure tap, the PEI must also account for the affects of the water head compressing the air inside the instrument line. For this reason, a final calculation was performed yielding a family of curves for the instrument with the lower pressure tap elevation when water level is above the tap. This family of curves can be seen in Figure 3a included in Attachment 2.

VENTING PATHS

Nine potential vent paths were considered in developing the analysis. These included the:

1) upper personnel airlock door seal,
2) backup hydrogen purge system (M51),
3) floor drain (G61),
4) equipment drain system (G61),
5) lower personnel airlock,
6) containment pool skimmers (G41),
7) A containment spray ring (E12),
8) B containment spray ring (E12),
9) RCIC vacuum system.

Of these, paths 6, 7, and 8 were selected and used in the procedure. The remaining 6 potential paths were rejected since they were below the maximum containment water level and contributed insignificant areas to the total, or were found to be unworkable.

The venting sequence specified in the Plant Emergency Instruction (PEI) was determined on the basis of consideration of fission product retention,

limiting the rate of depressuration, and availability of containment and core cooling flow. Prioritization of the vent paths in the PEI is as follows:

A - Path 6 - Fuel Pool Cooling and Cleaning System
B - Path 7 - Containment Spray Header *
C - Path 8 - Containment Spray Header

Path 6 utilizes eleven skimmers in the Fuel Transfer and Fuel Storage Pool, the reactor well, and the separator storage pool. The smallest size line in the path is a 10" Schedule 40 pipe. The path discharges through the FPCC Surge Tank to the fuel handling building atmosphere through the five skimmers in the Spent Fuel Storage Pool. Paths 7 and 8 vent containment through the Containment Spray Spargers. Each of the 345 sparger nozzles are 3/8" in diameter resulting in an equivalent pipe diameter of approximately 7 inches in each path. These paths discharge through the RHR and FPCC Supplemental Cooling connection and out to the Fuel Handling Building atmosphere through the FPCC siphon breakers in the Spent Fuel Storage Pool.

The Fuel Pool Cooling and Cleanup system is used first to take advantage of the scrubbing action of the FPCC surge tank and Fuel Handling Building ventilation system filters. Use of the FPCC first also maintains the RHR system available for containment spray and/or core cooling as long as possible. The containment spray ring path also vents to the Fuel Handling Building and will be filtered by the ventilation system. All of the paths are designed as water systems and will withstand pressures well in excess of the 50 psig venting limit.

The containment and drywell purge and exhaust system was not used due to operability limitations of the valves against the postulated high containment pressures. None of the paths selected involves ductwork, therefore ductwork failure was not considered in the analysis. MSIV operability was also not considered since the MSIVs were not required to achieve sufficient venting area and will not be utilized as a vent path.

If the venting operation occurs with high containment pressure and a large size vent path, there is a potential for pool swell flashing of the suppression pool water. PNPP has conducted a thermodynamic analysis of the rate of suppression pool boiling for various vent sizes and initial pressure conditions. The analysis included the conservative assumption that the pool is at saturation temperature. Heat addition from the reactor (which would tend to slow the depressurization rate) was assumed to be zero. The results were compared with an independent calculation made based on energy balance equations. The resulting steaming rates were found to be insignificant compared to those analyzed in the PNPP FSAR Appendix 3B. In addition, bubble formation during containment venting would occur from the "top down" during containment venting while Appendix 3B analyzes suppression pool loads resulting from a more severe case of steam bubble injection near the bottom of the pool. Based on the above, CEI has concluded that the hydrodynamic loads from flashing of the suppression pool water are insignificant and will not exceed the design capability of the suppression pool.

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*Spray Header A or B may be used in either order.

FIGURE 1

Vent Pressure Limiting Conditions

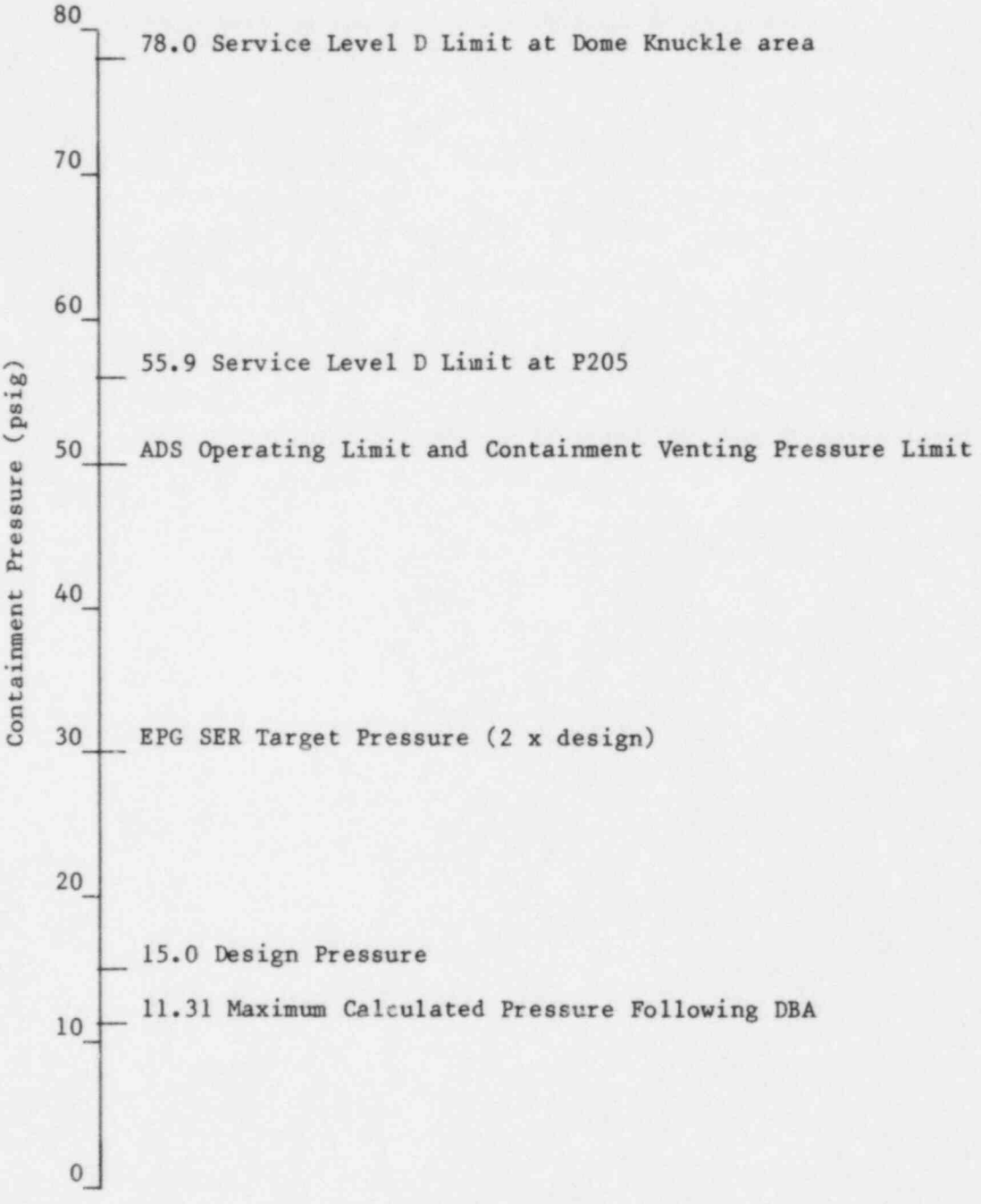
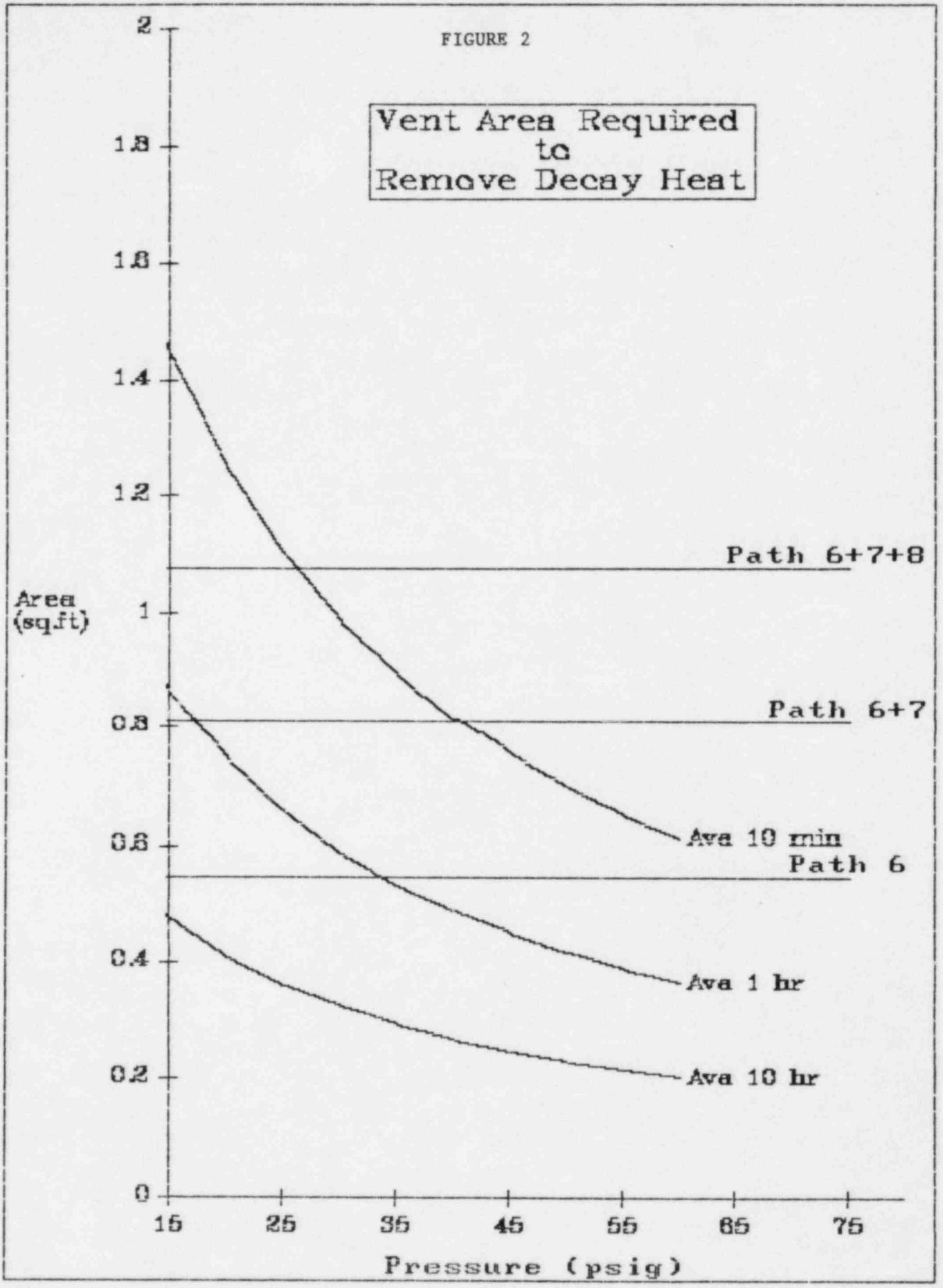


FIGURE 2


Vent Area Required
to
Remove Decay Heat
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Area
(sq.ft)
Path 6+7+8
Path 6+7
Path 6
Ava 10 min
Ava 1 hr
Ava 10 hr
15
25
35
45
55
65
75
Pressure (psig)

ATTACHMENT 2

TO

PY-CEI/NRR-0480 L

PERRY UNIQUE ANALYSIS

EMERGENCY CONTAINMENT VENTING

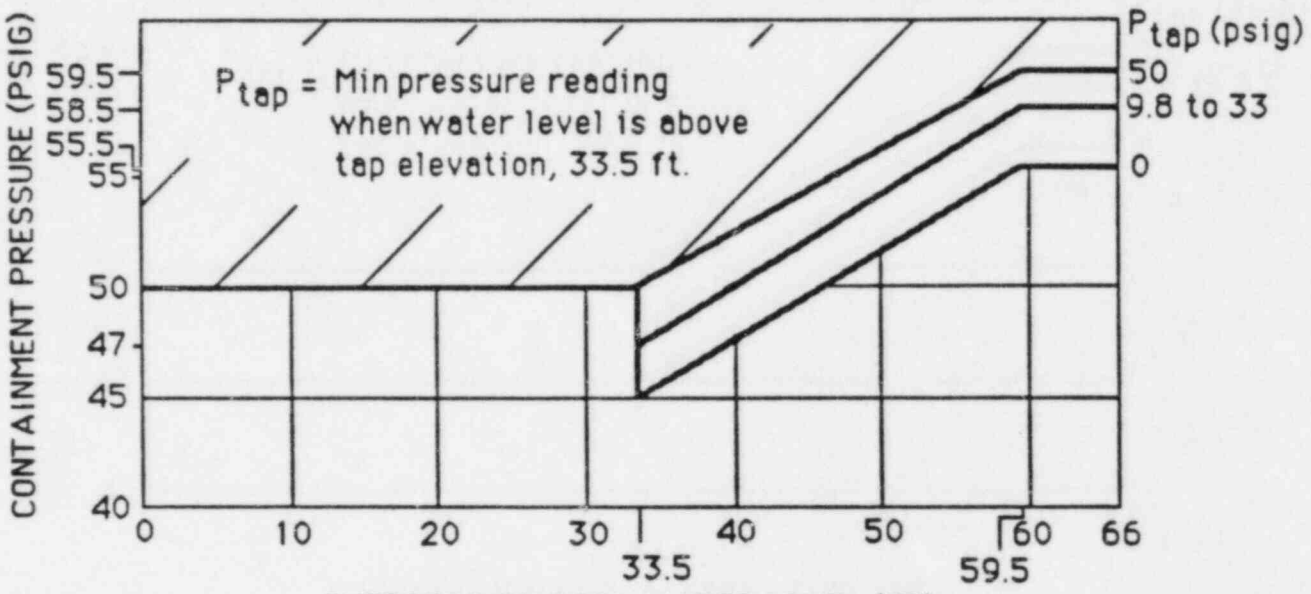


Figure 3a - CONTAINMENT PRESSURE LIMIT

NOTE: To determine the Containment Pressure Limit, enter with Suppression Pool Level and read the Containment Pressure Limit from the appropriate P_{tap} curve. P_{tap} is the minimum pressure during the time interval when the suppression pool level is above the Channel A instrument tap elevation of 33.5 ft.

Containment pressure Channel A readings may be taken from the following:

1. D23-R024A recorder on H13-P883, wide range
2. D23-N270A onERIS Containment pressure validation screen #75

Figure 3a - Channel A

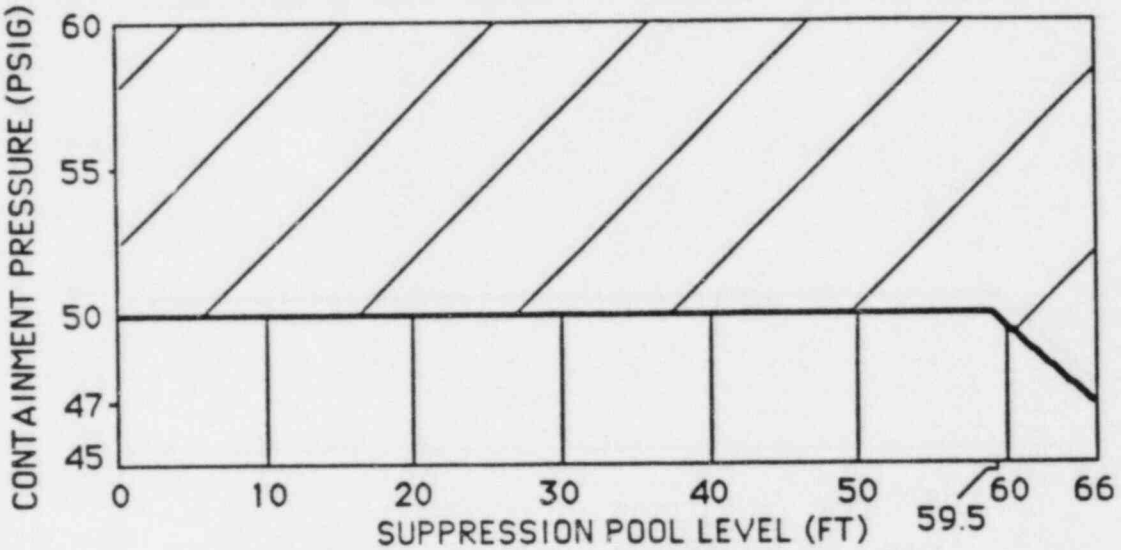


Figure 3b - CONTAINMENT PRESSURE LIMIT

NOTE: To determine the Containment Pressure Limit, enter with Suppression Pool Level and read the Containment Pressure Limit from the curve.

Containment pressure Channel B readings may be taken from the following:

1. D23-R250B recorder on H13-P883, wide range
2. D23-N270B on ERIS Containment pressure validation screen #75

Figure 3b - Channel B

DW/PEI1B/J/mac