BECo Calculation M-662, Rev. E3

CALCULATION COVER SHEET

PILGRIM NUCLEAR POWER STATION

SHEET 1 OF 112

Including Attachments

CALC. NO. M-662	REV. E3	FILE NO.	SR ☒ NSR ☐	RTYPE B4.01
Subject: RHR and Core Spray Pump NPSH and Suction Pressure Drop			Preliminary Calc. ☐	
Discipline Division Manager: T.F. White			Finalization Due Date:	
Approval/s/: Thomas White J.		Date: 12/22/97	Final Calc. ☒	

Independent Reviewer: George V. Mileris /s/ [signature] Statement Attached ☑

Page(s)	By: Philip D. Harizi	Date	Ch'k'd George V. Mileris	Date	Agreed
All	/s/ Philip D. Harizi	12-15-97	/s/ [signature]	12/22/97	[signature]

Note:

Revision E1 provided NPSH analyses for 75°F heat sink temperature.

Revision E2 is based on new stacked-disc strainers and removes the debris head loss analysis.

Revision E3 is based on a new Containment Heatup analysis per License Amendment 173.

This design analysis ☒ DOES, ☐ DOES NOT require revision to affected design documents.
Affected Design Documents: *Refer to Calc M-664 for Potentially Affected Documents*
A PDC ☐ IS, ☒ IS NOT Required.
A Safety Evaluation ☒ IS, ☐ IS NOT Required. *Refer to SE-3127*
This design analysis ☐ DOES, ☒ DOES NOT affect the piping analysis index (PAI). If the PAI is affected, initiate a revision to Calculation M561.

Minor revisions made on pages _____ of this calculation. See next revision.

Replaces Calc. No.	Voided By Calc. No. _____ ☐ Or Attached Memo

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1.0 Statement of Problem

This calculation provides an analysis of NPSH conditions for the RHR and Core Spray Pumps during performance test conditions and determines the margin for NPSH available following the Design Basis Loss of Coolant Accident (DBA LOCA). Proper and reliable performance of Emergency Core Cooling System (ECCS) pumps requires adequate net positive suction head (NPSH) which is defined as the absolute pressure at the pump impeller datum less the vapor pressure of the fluid being pumped. If the available NPSH is less than the NPSH required by the pump, cavitation will occur within the pump. Cavitation reduces the pump performance and may cause mechanical damage.

It is necessary to calculate the head losses in the suction lines for the RHR and Core Spray Pumps under normal testing and accident conditions. The suction head losses will be used to evaluate pump NPSH at the normal testing and DBA LOCA conditions to determine the minimum margin that will be available to accommodate potential degradation of the suction strainers from LOCA-generated debris. A fixed amount of margin is subtracted from the total available and is used as the basis for the maximum allowable strainer head loss at normal conditions to be applied during pump In-Service Testing (IST).

It is necessary to perform a time dependent analysis of NPSH conditions following the DBA LOCA using the predicted suppression pool temperature profiles and postulated values for containment leakage to determine the minimum NPSH margin that will be available. The suppression pool profiles are based on the design basis recirculation line break DBA LOCA with 65°F and 75°F ultimate heat sinks. Results from the analysis are presented in new FSAR figures showing the minimum NPSH margin for the low pressure ECCS pumps following a DBA LOCA.

2.0 Summary of Results and Recommendations

Table 4 provides the suction pressure drop that is calculated for each RHR and Core Spray Pump operating at the normal IST performance test conditions and at accident conditions. The test condition value represents the pressure drop at the pump suction between the idle pump no-flow condition and with the normal pump test flow rate.

Tables 5, 6, and 7 provide calculations of the available NPSH and margin for suppression pool temperatures of 130°F, 166°F, and 185°F. These are the suppression pool temperatures at the start and at the peak for the 65°F and 75°F heat sink design cases [Refs. 10 & 37]. Table 8 gives the available NPSH at the point of minimum NPSH margin during the Suppression Pool cooldown when containment pressure drops back to 0 psig.

With the suction conditions degraded due to LOCA-generated debris, a positive NPSH margin must be maintained at the peak pool temperature based on the corresponding

wetwell pressure shown on Figures 4 and 6 (described below). Evaluation of the ECCS pump NPSH conditions with LOCA-generated debris is included in Calculation M-734 [Ref. 39]. Conditions associated with the DBA LOCA are used because this event produces the highest peak in suppression pool temperature.

Table 8 provides the available NPSH and margin for the point of minimum NPSH margin following a DBA LOCA based on the results shown in Figures 5 and 7 (described below). The 128°F data corresponds to the 5% per day leakage case at the point of minimum margin when the containment pressure has decreased to atmospheric pressure for the 65°F heat sink design case. The 124°F data corresponds to the 1% per day leakage case and the 132°F data corresponds to the 5% per day leakage case at the point of minimum margin when the containment pressure has decreased to atmospheric pressure for the 75°F heat sink design case.

Figures 4 and 6 provide graphical presentations of the calculated values for "primary containment pressure" and the "containment pressure necessary to meet NPSH required" for both the RHR and Core Spray pumps after a DBA LOCA with 65°F and 75°F heat sinks. Containment pressure is evaluated for a containment leakage rate equal to the Technical Specification (TS) limit (1%/day) and 5 times the TS limit (5%/day).

Figures 5 and 7 provide graphical presentations of NPSH margin as a function of time after a DBA LOCA with 65°F and 75°F heat sinks. The margin curves shown on this figure are the difference between the primary containment pressure and the containment pressure required to meet the $NPSH_R$ for the pump. The Core Spray pumps are predicted to have smaller NPSH margin throughout the accident response. For the 65°F heat sink case, the point of least margin for the Core Spray pump occurs during the suppression pool cooldown, approximately 39 hours after the accident at which time Core Spray pump margin is approximately 10.6 feet. The minimum RHR pump margin occurs at the same time and is approximately 11.7 feet. For the 75°F heat sink case, the point of least margin for the Core Spray pump occurs during the suppression pool cooldown, approximately 72 hours after the accident at which time Core Spray pump margin is approximately 10.0 feet. The minimum RHR pump margin occurs at the same time and is approximately 11.2 feet. From these total NPSH margin values, 2 feet are deducted and the remaining margin is the minimum available for accommodating LOCA-generated debris on the suction strainers.

Based on the information presented, substantial NPSH margin will be available to assure reliable operation of the RHR and Core Spray pumps. Available NPSH will exceed required NPSH over the entire range of suppression pool temperatures that are predicted following the DBA LOCA. To complete an analysis for the adequacy of NPSH available to the RHR and Core Spray pumps, a debris head loss analysis must be performed for comparison to the margin for NPSH available presented in this calculation. The debris analysis and comparison to the NPSH margin is included in Calculation M-734 [Ref. 39].

3.0 Calculation of Total Suction Losses and NPSH Available

3.A Method of Solution

This calculation determines the suction line losses for the RHR and Core Spray Pump. These losses are used to predict the suction pressure drop that will occur with a clean strainer. The suction line head loss is calculated at the conditions for temperature and pump flow rate for the pump performance In-Service Test (IST). The calculation for suction head loss is repeated at the predicted accident conditions for wetwell temperature, pressure, and pump flow rate. This calculation predicts the NPSH available at the ECCS pump suctions under accident conditions and the resulting margin between NPSH Available and NPSH Required.

A number of variables determine the margin for NPSH available to the pumps. Principally they are:

Suppression pool water level, temperature, and density.
Wetwell pressure.
Vapor Pressure of the suppression pool water.
Pump suction line head loss which is principally a function of geometry and flowrate (which includes the clean suction strainer head loss).

The suction pressure drop as would be read on a pressure gage mounted at the pump suction is also calculated. The pressure drop is the difference in the pressure read with the pump idle (0 gpm) and with the pump at the test flow rate. This measurement method cancels out the effect of gage height versus the datum such that only the delta-P is important.

There is a maximum amount of strainer fouling that can be tolerated such that there will be adequate NPSH to the ECCS pumps under containment accident conditions. This calculation determines the minimum margin for NPSH available to the ECCS pumps following the bounding DBA LOCA. A fixed amount of the total available margin is used to calculate the maximum pressure drop that may be allowed during routine pump performance testing. The allowable pressure drop for the test conditions is based on the calculated suction line losses at the accident conditions for wetwell temperature, pressure, and pump flow rate.

The pressure drop at the test conditions ($P_{GAGE\text{-}STATIC} - P_{GAGE\text{-}RUNNING}$) provides a measure of the dynamic pressure drop caused by resistances and restrictions in the suction line plus the conversion of static head to velocity head as follows.

$$dP = P_{GAGE\text{-}STATIC} - P_{GAGE\text{-}RUNNING} = \text{Suction Line Pressure Drop} + \text{Velocity Head}$$

The allowable suction dP is a fixed amount of NPSH margin allocated for surveillance testing purposes and must be of sufficient magnitude so that it is within a reasonable measurement range considering testing accuracy and repeatability.

3.B Input Data and Assumptions

The physical configurations of the suction lines to the RHR and Core Spray Pumps are taken from the drawings listed in the Reference section.

The head losses due to pipe fittings are in accordance with [Ref. 7].

Pipe friction values are based on the Moody diagram [Ref. 7]. The pipe roughness value was selected for steel pipe with light rust per [Ref. 8].

The strainer characteristics are in accordance with [Ref. 14].

The design basis accident conditions inside containment are in accordance with [Ref. 10, 37].

The 5600 gpm RHR Pump flow rate is the runout flow for single pump operation. This single pump value of flow bounds the per-pump flow for the two-pump case used in accident analyses [Ref. 11, 12]. The 4400 gpm Core Spray Pump flow rate is the runout flow rate assumed in the accident analysis (4100 gpm) plus a minimum flow recirculation flow rate of 300 gpm [Ref. 11, 12].

The following assumptions apply:

1. The RHR and Core Spray Pump accident flow rates of 5600 gpm and 4400 gpm, respectively, correspond to the flow at zero reactor pressure.

2. The RHR and Core Spray Pump performance test flow rates of 4800 gpm and 3300 gpm, respectively, correspond to the IST test conditions with 80°F torus water.

3.C Calculations / Analyses

3.C.1 Suction Line Head Loss Calculation

Definition of Terms

K	=	*resistance coefficient for velocity head loss calculation*
Q	=	*rate of flow (gpm)*
V	=	*mean velocity of flow (ft/sec)*
h_V	=	*velocity head (ft)*
$h_{LV\&F}$	=	*head loss due to fluid flow through valves and fittings (ft)*
$h_{L\ STRAINER}$	=	*head loss due to flow through a clean suction strainer (ft)*
$h_{L\ PIPE}$	=	*head loss due to flow through suction pipe (ft)*
h_{SL}	=	*total head loss due to flow in the suction line with a clean suction strainer (ft)*
ρ	=	*density (lbm ft^3)*
g	=	*acceleration of gravity equal to 32.2 ft/sec^2*
dP	=	*pressure drop at pump suction (psi)*
a	=	*cross sectional area of pipe or orifice, or flow area in valve (in^2)*
A	=	*cross sectional area of pipe or orifice, or flow area in valve (ft^2)*
d	=	*internal diameter of pipe (in)*
D	=	*internal diameter of pipe (ft)*
ε	=	*absolute roughness (in)*
ε/D	=	*relative roughness*
f	=	*friction factor in Equation 5 read from Moody diagram [Ref. 7]*
L	=	*length of pipe (ft)*
L/D	=	*equivalent length of a resistance to flow, in pipe diameters*
v	=	*kinematic viscosity (ft^2/sec)*

Head Loss Formulas

Average Flow Velocity

$$V = \frac{(Q \times 1\ 7\ 4805 \times 1\ 60)}{A} \qquad \textit{Eq. 1}$$

Velocity Head

$$h_V = \frac{V^2}{2g} \qquad \textit{Eq. 2}$$

Reynolds Number

$$\mathrm{Re} = \frac{D \times V}{\nu} \qquad \textit{Eq. 3}$$

Losses For Valves and Fittings

$$h_{LV\&F} = K\frac{V^2}{2g} \qquad \textit{Eq. 4}$$

Losses For Straight Pipe

$$h_{LPIPE} = \left(f\frac{L}{D}\right)\frac{V^2}{2g} \qquad \textit{Eq. 5}$$

Clean Strainer Losses

The clean strainer rated pressure drop was taken from Calculation M-667 [Ref. 38] and used to generate a table of values at different flow rates by using a flow-squared relationship.

In addition, the initial pipe spool piece is 16" ID which connects to the 17.25" ID suction lines. A head loss K-factor for the sudden enlargement (K = 0.036) was added to obtain the total K-factor for the valves and fittings in each suction line.

Total Line Loss

$$h_{SL} = h_{LV\&F} + h_{L\,PIPE} + h_{L\,STRAINER} \qquad \textit{Eq. 6}$$

Pump Suction Pressure Drop

$$dP = (h_{SL} + h_{V}) \times (\rho / 144) \qquad \textit{Eq. 7}$$

Note: This pressure drop (psi) represents the difference between the gage pressure readings taken at the pump suction with the pump idle (0 gpm) and with the pump at the normal flow rate. Since the gage is reading from a static pressure tap, the velocity head (h_V) is added to the line loss to give the total change in head.

3.C.2 Net Positive Suction Head Calculation

Definition of Terms

$NPSH_A$	=	*Net positive suction head available at the centerline of the pump inlet (ft)*
$NPSH_R$	=	*Net positive suction head required at the centerline of the pump inlet (ft)*
$NPSH_M$	=	*Net positive suction head margin; $NPSH_A$ - $NPSH_R$ (ft)*
h_Z	=	*Elevation head of suppression pool water measured at the centerline of the pump inlet (ft)*
h_{SL}	=	*Dynamic head loss caused by flow through a clean suction strainer and the suction line (ft)*
T_{POOL}	=	*Temperature of the suppression pool water (°F)*
P_C	=	*Primary containment positive pressure (psig)*
P_{VP}	=	*Saturation vapor pressure at the temperature of the pumped fluid (psia)*
V_{SP}	=	*Specific volume of fluid (ft^3/lbm)*

Equations

The NPSH available to the RHR and Core Spray pumps is:

$$NPSH_A = h_Z - h_{SL} + \left[\left(14.696 + P_C - P_{VP}\right)\left(144\right)\left(V_{SP}\right)\right] \qquad \text{Eq. 8}$$

The margin for NPSH available is:

$$NPSH_M = NPSH_A - NPSH_R \qquad \text{Eq. 9}$$

Total Available Margin is the arithmetic difference between the NPSH available and required as defined above. *Available Margin for LOCA Debris* is equal to the *Total Available Margin* minus the fixed head loss of 2 feet allocated for pump in-service testing.

Constant Inputs

$NPSH_R$	=	*RHR Pumps: 27 feet at 5600 gpm [Ref. 6]* *Core Spray Pumps: 29 feet at 4400 gpm [Ref. 5]*
h_Z	=	*12.5 feet from minimum normal suppression water level (-3'0") to the pump inlet centerline at (-15'6")*
P_{VP}	=	*From the ASME Steam Table 1 "Properties of Saturated Steam and Saturated Water (Temperature)".*
V_{SP}	=	*Same as above.*

3.C.3 Sump Hydraulic Performance

Sump hydraulic performance, with respect to air ingestion potential, can be evaluated on the basis of submergence level and inlet velocity. Submergence level refers to the water depth above the suction strainer outlet and inlet velocity is the water average velocity entering the strainer outlet pipe. These parameters are expressed nondimensionally as the Froude Number:

$$Froude\ Number = \frac{V}{\sqrt{g\,s}}$$

V = *mean velocity of flow (ft/sec)*
s = *water depth above strainer outlet pipe (ft)*
g = *acceleration of gravity equal to 32.2 ft/sec²*

For BWR's, the air ingestion is zero for Froude Numbers less than 0.8 with a minimum submergence of 6 feet [Ref. 3]. The limiting case for the Pilgrim ECCS suction strainers is the suction line to the RHR pump from the common ECCS strainer since the RHR velocity is greater than for the Core Spray pump, with the evaluation as follows (refer to Figure 1):

EL -3'0" = *minimum torus water level*

EL -12'3" = *strainer core pipe outlet top of opening*

7.69 *ft/sec* = *RHR inlet pipe mean velocity @ 5600 gpm (ID = 17.25")*

$$Froude\ Number = \frac{7.69}{\sqrt{(32.2)(12.25-3.00)}} = 0.45$$

Froude Number $0.45 < 0.8$ and submergence 9.25 ft > 6 ft.

$\therefore$ Air ingestion potential = ZERO

3.C.4 Maximum Allowable Pump Suction dP @ IST Conditions

The maximum allowable pump suction pressure drop as measured at the IST testing conditions is based on the total suction head losses plus the additional fixed head loss of 2 feet at the accident conditions for wetwell temperature, pressure, and pump flow rate. The total suction head loss (h_{SL}) is calculated at both the IST conditions for temperature and pump flow rate and for the accident conditions. The fixed head loss of 2 feet at the accident conditions is used to calculate a maximum dP for the test conditions that will ensure that $NPSH_A$ will meet or exceed the available margin for LOCA debris at the accident conditions using the following relationship:

$$dP_{MAX} = \left\{ \left[(h_{SL\text{-}PEAK} + h_{IST}) \times (h_{SL\text{-}TEST} / h_{SL\text{-}PEAK}) \right] + h_{V\text{-}TEST} \right\} \times (\rho_{TEST} / 144) \qquad Eq.\ 10$$

dP_{MAX} = *Maximum allowable suction pressure drop at IST conditions (psi)*
h_{IST} = *Fixed head loss of 2 feet at accident conditions allocated to pump In-Service Testing (IST) (ft)*
$h_{SL\text{-}PEAK}$ = *Suction head loss at accident conditions (ft)*
$h_{SL\text{-}TEST}$ = *Suction head loss at IST conditions (ft)*
$h_{V\text{-}TEST}$ = *Velocity head at IST conditions (ft)*
ρ_{TEST} = *Density at IST temperature (lbm/ft^3)*

3.C.5 Containment Initial Conditions

The initial conditions assumed for containment temperature and pressure prior to a DBA-LOCA are determined in accordance with BECo Calculation M-748 [Ref. 40]:

	Volume (ft^3)	Temperature (°F)	Pressure (psig)	Relative Humidity (ϕ)
Drywell	132,000	150	1.30	80
Wetwell Airspace	124,500	85	0.00	100

Calculate Initial Mass of Noncondensible Gas:

$$M_D = \frac{\left[\left(P_D + 14.696 \right) - \left(\phi P_{VP} \right) \right] \left(V_D \right) * 144 \, in^2 / ft^2}{R\left(T_D + 460 \right)} \qquad \text{(Drywell)}$$

$$M_W = \frac{\left[\left(P_W + 14.696\right) - \left(\phi P_{VP}\right)\right]\left(V_W\right) * 144\, in^2/ft^2}{R\left(T_W + 460\right)} \qquad \text{(Wetwell)}$$

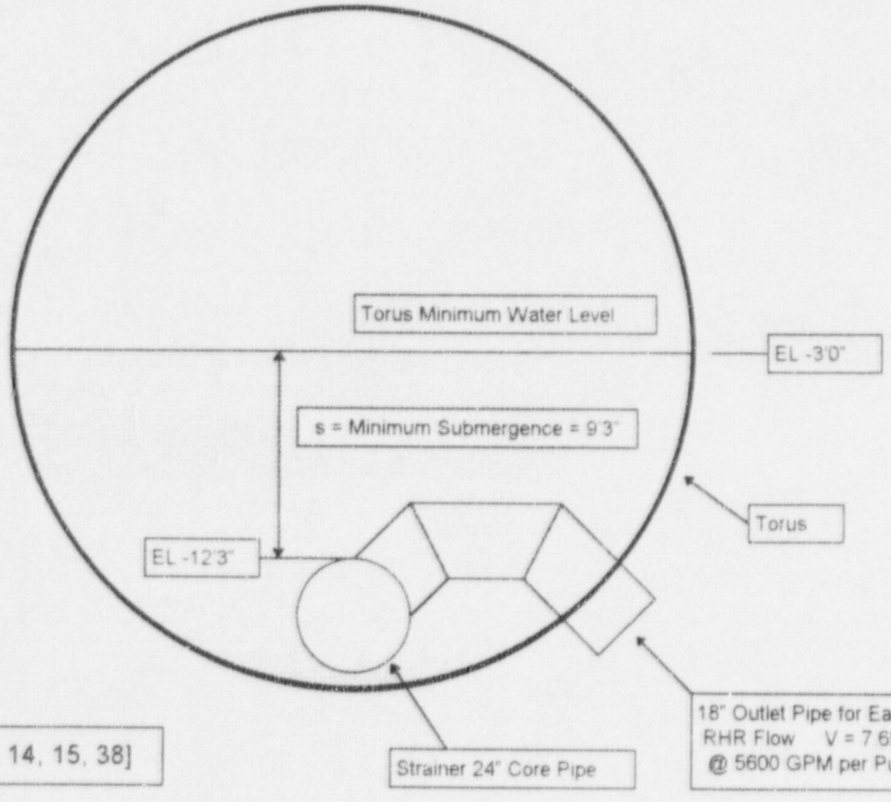
where: R = 53.3 ft-lbf/lbm-°R
P_{VP} = 3.7184 psia @ 150°F
.961 psia @ 85°F

Drywell	= 7,613 lbm
Wetwell Airspace	= 8,702 lbm
Total Noncondensible Gas	= 16,315 lbm

The value of 16,315 lbm is used as the initial nitrogen mass inside containment at the start of the DBA-LOCA. This mass of nitrogen is based on a Drywell volume of 132,000 ft^3 which is a conservatively low value for determining the minimum credible initial mass. The DBA-LOCA involves a breakdown of the reactor vessel pressure boundary with subsequent flooding of only the core volume within the reactor shroud. Therefore, the Drywell volume used to calculate the containment pressure P_C after a DBA-LOCA is conservatively based on the larger volume of 147,000 ft^3 as was used in the original FSAR NPSH analysis.

Evaluation of Sump Hydraulic Performance

2 Strainers w/ 2 RHR & 1 Core Spray Suction Nozzle Each
Stacked Disk Construction with Horizontal Core Tube
Strainer Screen Area = 670 ft^2 Each
Screen Openings = 1/8" Diameter 40% Open Area 0.120" Thick
Rated Head Loss = 0.5254 psi at 10,000 GPM



[Refs. 13, 14, 15, 38]

Figure 1

CALCULATION SHEET

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PREPARED BY: PDH

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Table 1 - Input Values

Friction Factor f for 18" Fitti. gs =	0.012
Piping Absolute Roughness e (in) =	0.006
e (ft) =	0.00050

K Values (Crane)	45 EL	90 LR EL	90 SR EL	Tee Branch	Tee Run	Gate Valve	B'fly Valve
Effective L/D for Fitting	10	14	20	60	20	8	25
f_T Turbulent Flow Friction Factor	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120	0.0120
$K = (L/D) * f_T$ FOR 18" FITTINGS	0.120	0.168	0.240	0.720	0.240	0.096	0.300

K Values (Calculated)	56 EL	64 EL	Flex Joint
Effective L/D for Fitting	12.4	14.2	8
f_T Turbulent Flow Friction Factor	0.0120	0.0120	0.0120
$K = (L/D) * f_T$ FOR 18" FITTINGS	0.149	0.170	0.096

K Values (Crane)	Expand	Reducer
Effective K for Fittings	Pipe	Eccentric
Independent of Friction Factor	16 x 17.25	18 x 12
K = fixed	0.036	0.090

RHR and Core Spray Pumps
Suction Strainer Loss (Clean)

Flow	Loss (psi)	Loss (ft)
3000	0.047	0.112
3300	0.057	0.136
3600	0.068	0.161
3750	0.074	0.175
4100	0.088	0.209
4400	0.102	0.241
4600	0.111	0.263
4800	0.121	0.287
5000	0.131	0.311
5100	0.137	0.324
5600	0.165	0.390
10000	0.525	1.245

Rated delta 0.5254 psi at 10000 gpm

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Table 2 - Pump Suction Line Configuration

Pipe No.	*L* Length (ft)	*d* Diameter (inches)	*D* Diameter (ft)	*a* Area (in^2)	*A* Area (ft^2)	Pipe Class	Pipe Schedule
CS A-1	79.0	17.25	1.44	233.71	1.62	18"-HL/HD	Std
CS A-2	1.0	11.25	0.94	99.40	0.69	12"-HD	Std
CS B-1	79.0	17.25	1.44	233.71	1.62	18"-HL/HD	Std
CS B-2	1.0	11.25	0.94	99.40	0.69	12"-HD	Std
RHR A	94.0	17.25	1.44	233.71	1.62	18"-HL/HB	Std
RHR B	56.0	17.25	1.44	233.71	1.62	18"-HL/HB	Std
RHR C	56.0	17.25	1.44	233.71	1.62	18"-HL/HB	Std
RHR D	94.0	17.25	1.44	233.71	1.62	18"-HL/HB	Std

Valve or Fitting	CS A-1 Count	CS A-1 *K*	CS A-2 Count	CS A-2 *K*	CS B-1 Count	CS B-1 *K*	CS B-2 Count	CS B-2 *K*
45 EL	4	0.480	0	0.000	4	0.480	0	0.000
90 LR EL	1	0.168	0	0.000	1	0.168	0	0.000
90 SR EL	3	0.720	0	0.000	3	0.720	0	0.000
56 EL	1	0.149	0	0.000	1	0.149	0	0.000
Flex Joint	1	0.096	0	0.000	1	0.096	0	0.000
Tee Branch	0	0.000	0	0.000	0	0.000	0	0.000
Tee Run	1	0.240	0	0.000	1	0.240	0	0.000
Gate Valve	1	0.096	0	0.000	1	0.096	0	0.000
Butterfly Valve	1	0.300	0	0.000	1	0.300	0	0.000
Expand	1	0.036	0	0.000	1	0.036	0	0.000
Reducer	0	0.000	1	0.090	0	0.000	1	0.090
V & F Total *K* =		2.285		0.090		2.285		0.090

Valve or Fitting	RHR A Count	RHR A *K*	RHR B Count	RHR B *K*	RHR C Count	RHR C *K*	RHR D Count	RHR D *K*
45 EL	3	0.360	3	0.360	3	0.360	3	0.360
90 LR EL	4	0.672	2	0.336	2	0.336	4	0.672
90 SR EL	0	0.000	0	0.000	0	0.000	0	0.000
56 EL	0	0.000	1	0.149	1	0.149	0	0.000
64 EL	1	0.170	0	0.000	0	0.000	1	0.170
Flex Joint	1	0.096	1	0.096	1	0.096	1	0.096
Tee Branch	0	0.000	0	0.000	0	0.000	0	0.000
Tee Run	1	0.240	1	0.240	1	0.240	1	0.240
Gate Valve	1	0.096	1	0.096	1	0.096	1	0.096
Butterfly Valve	1	0.300	1	0.300	1	0.300	1	0.300
Expand	1	0.036	1	0.036	1	0.036	1	0.036
Reducer	0	0.000	0	0.000	0	0.000	0	0.000
V & F Total *K* =		1.970		1.613		1.613		1.970

CALCULATION SHEET

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Table 3 - Pipe Line Losses

Pipe No.	Flow Rate Q (gpm)	(Eq 1) Velocity V (ft/sec)	(Eq 3) Reynolds Number Re	(Ref 8) Pipe Relative Roughness e / D	(Ref 7) Pipe Friction Factor f	(Eq 4) Valves & Fittings $h_{LV\&F}$ (ft)	(Eq 5) Pipe $h_{L\ PIPE}$ (ft)
For Torus Testing Temp T_{POOL} (F) =			80				
CS A-1	3300	4.53	6.93E+05	0.00035	0.0160	0.73	0.28
CS A-2	3300	10.65	1.06E+06	0.00053	0.0170	0.16	0.03
CS B-1	3300	4.53	6.93E+05	0.00035	0.0160	0.73	0.28
CS B-2	3300	10.65	1.06E+06	0.00053	0.0170	0.16	0.03
RHR A	4800	6.59	1.01E+06	0.00035	0.0160	1.33	0.71
RHR B	4800	6.59	1.01E+06	0.00035	0.0160	1.09	0.42
RHR C	4800	6.59	1.01E+06	0.00035	0.0160	1.09	0.42
RHR D	4800	6.59	1.01E+06	0.00035	0.0160	1.33	0.71
For Torus Peak Temp T_{POOL} (F) =			130				
CS A-1	4400	6.04	1.55E+06	0.00035	0.0158	1.29	0.49
CS A-2	4400	14.20	2.38E+06	0.00053	0.0170	0.28	0.06
CS B-1	4400	6.04	1.55E+06	0.00035	0.0158	1.29	0.49
CS B-2	4400	14.20	2.38E+06	0.00053	0.0170	0.28	0.06
RHR A	5600	7.69	1.98E+06	0.00035	0.0158	1.81	0.95
RHR B	5600	7.69	1.98E+06	0.00035	0.0158	1.48	0.56
RHR C	5600	7.69	1.98E+06	0.00035	0.0158	1.48	0.56
RHR D	5600	7.69	1.98E+06	0.00035	0.0158	1.81	0.95
For Torus Peak Temp T_{POOL} (F) =			166				
CS A-1	4400	6.04	2.05E+06	0.00035	0.0155	1.29	0.48
CS A-2	4400	14.20	3.15E+06	0.00053	0.0170	0.28	0.06
CS B-1	4400	6.04	2.05E+06	0.00035	0.0155	1.29	0.48
CS B-2	4400	14.20	3.15E+06	0.00053	0.0170	0.28	0.06
RHR A	5600	7.69	2.61E+06	0.00035	0.0155	1.81	0.93
RHR B	5600	7.69	2.61E+06	0.00035	0.0155	1.48	0.55
RHR C	5600	7.69	2.61E+06	0.00035	0.0155	1.48	0.55
RHR D	5600	7.69	2.61E+06	0.00035	0.0155	1.81	0.93

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Table 3 (Cont.) - Pipe Line Losses

		(Eq 1)	(Eq 3)	(Ref 8)	(Ref 7)	(Eq 4)	(Eq 5)
Pipe No.	Flow Rate Q (gpm)	Velocity V (ft/sec)	Reynolds Number Re	Pipe Relative Roughness e / D	Pipe Friction Factor f	Valves & Fittings $h_{LV\&F}$ (ft)	Pipe $h_{L\ PIPE}$ (ft)
For Torus Peak Temp T_{POOL} (F) =			185				
CS A-1	4400	6.04	2.32E+06	0.00035	0.0155	1.29	0.48
CS A-2	4400	14.20	3.55E+06	0.00053	0.0170	0.28	0.06
CS B-1	4400	6.04	2.32E+06	0.00035	0.0155	1.29	0.48
CS B-2	4400	14.20	3.55E+06	0.00053	0.0170	0.28	0.06
RHR A	5600	7.69	2.95E+06	0.00035	0.0155	1.81	0.93
RHR B	5600	7.69	2.95E+06	0.00035	0.0155	1.48	0.55
RHR C	5600	7.69	2.95E+06	0.00035	0.0155	1.48	0.55
RHR D	5600	7.69	2.95E+06	0.00035	0.0155	1.81	0.93

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Table 4 - Total Suction Loss

Pump No.	Flow Rate Q (gpm)	(Table 3) Valve & Fitting Losses $h_{LV\&F}$ (ft)	(Table 3) Total Piping Head Loss $h_{L\ PIPE}$ (ft)	(Table 1) Clean Suction Strainer $h_{L\ STRAINER}$ (ft)	(Eq 6) Total Suction Head Loss h_{SL} (ft)	(Eq 2) Velocity Head @ PI h_V (ft)	(Eq 7) Total Suction Pressure Drop (psi)
For Torus Testing Temp T_{POOL} (F) =			80				
Core Spray A	3300	0.89	0.31	0.14	1.33	1.76	1.34
Core Spray B	3300	0.89	0.31	0.14	1.33	1.76	1.34
RHR A	4800	1.33	0.71	0.29	2.32	0.67	1.29
RHR B	4800	1.09	0.42	0.29	1.79	0.67	1.07
RHR C	4800	1.09	0.42	0.29	1.79	0.67	1.07
RHR D	4800	1.33	0.71	0.29	2.32	0.67	1.29
For Torus Peak Temp T_{POOL} (F) =			130				
Core Spray A	4400	1.58	0.55	0.24	2.37	3.13	2.35
Core Spray B	4400	1.58	0.55	0.24	2.37	3.13	2.35
RHR A	5600	1.81	0.95	0.39	3.15	0.92	1.74
RHR B	5600	1.48	0.56	0.39	2.44	0.92	1.43
RHR C	5600	1.48	0.56	0.39	2.44	0.92	1.43
RHR D	5600	1.81	0.95	0.39	3.15	0.92	1.74
For Torus Peak Temp T_{POOL} (F) =			166				
Core Spray A	4400	1.58	0.54	0.24	2.36	3.13	2.32
Core Spray B	4400	1.58	0.54	0.24	2.36	3.13	2.32
RHR A	5600	1.81	0.93	0.39	3.13	0.92	1.71
RHR B	5600	1.48	0.55	0.39	2.43	0.92	1.41
RHR C	5600	1.48	0.55	0.39	2.43	0.92	1.41
RHR D	5600	1.81	0.93	0.39	3.13	0.92	1.71
For Torus Peak Temp T_{POOL} (F) =			185				
Core Spray A	4400	1.58	0.54	0.24	2.36	3.13	2.31
Core Spray B	4400	1.58	0.54	0.24	2.36	3.13	2.31
RHR A	5600	1.81	0.93	0.39	3.13	0.92	1.70
RHR B	5600	1.48	0.55	0.39	2.43	0.92	1.40
RHR C	5600	1.48	0.55	0.39	2.43	0.92	1.40
RHR D	5600	1.81	0.93	0.39	3.13	0.92	1.70

Table 5 - NPSH & Max Suction dP @ 130F

			(Table 4)			(Eq 8)	(Ref 5&6)	(Eq 9)		(Eq 10)
Torus Temp T_{POOL} (F)	Vapor Press P_{VP} (psia)	Spec Volume V_{SP} (ft^3/lbm)	Suction Elev Head h_Z (ft)	Suction Head Loss h_{SL} (ft)	Wetwell Press P_C (psig)	Available $NPSH_A$ (ft)	Required $NPSH_R$ (ft)	Total Available Margin $NPSH_M$ (ft)	Available Margin for LOCA Debris $NPSH_M$ (ft)	Max Suction dP Measured @ IST Conditions (psi)
Core Spray Pumps A & B @ 4400 GPM:										
130	2.2230	0.016247	12.50	2.38	0.00	39.30	29.00	10.30	8.30	1.82
					2.00	43.98	29.00	14.98	12.98	1.82
					5.00	51.00	29.00	22.00	20.00	1.82
RHR Pumps A & D @ 5600 GPM:										
130	2.2230	0.016247	12.50	3.20	0.00	38.48	27.00	11.48	9.48	1.92
					2.00	43.16	27.00	16.16	14.16	1.92
					5.00	50.18	27.00	23.18	21.18	1.92
RHR Pumps B & C @ 5600 GPM:										
130	2.2230	0.016247	12.50	2.46	0.00	39.22	27.00	12.22	10.22	1.70
					2.00	43.90	27.00	16.90	14.90	1.70
					5.00	50.92	27.00	23.92	21.92	1.70

Note: Wetwell pressures of 2.0 & 5.0 psig are presented for information.

Table 6 - NPSH & Max Suction dP @ 166F

			(Table 4)			(Eq 8)	(Ref 5&S)	(Eq 9)		(Eq 10)
Torus Temp T_{POOL} (F)	Vapor Press P_{VP} (psia)	Spec Volume V_{SP} (ft^3/lbm)	Suction Elev Head h_Z (ft)	Suction Head Loss h_{SL} (ft)	Wetwell Press P_C (psig)	Available $NPSH_A$ (ft)	Required $NPSH_R$ (ft)	Total Available Margin $NPSH_M$ (ft)	Available Margin for LOCA Debris $NPSH_M$ (ft)	Max Suction dP Measured @ IST Conditions (psi)
Core Spray Pumps A & B @ 4400 GPM:										
166	5.4620	0.016428	12.50	2.38	0.00	31.96	29.00	2.96	0.96	1.82
					3.21	39.56	29.00	10.56	8.56	1.82
					4.70	43.08	29.00	14.08	12.08	1.82
RHR Pumps A & D @ 5600 GPM:										
166	5.4620	0.016428	12.50	3.20	0.00	31.14	27.00	4.14	2.14	1.92
					3.21	38.74	27.00	11.74	9.74	1.92
					4.70	42.26	27.00	15.26	13.26	1.92
RHR Pumps B & C @ 5600 GPM:										
166	5.4620	0.016428	12.50	2.46	0.00	31.88	27.00	4.88	2.88	1.70
					3.21	39.48	27.00	12.48	10.48	1.70
					4.70	43.00	27.00	16.00	14.00	1.70

Note: Wetwell pressure of 3.21 psig is the minimum required pressure at 166F to maintain the minimum NPSH margin of 10.56 ft from Table 8 for the limiting Core Spray Pump at 128F.
Wetwell pressure of 4.70 psig is the equilibrium pressure at the 166F peak pool temperature.

Table 7 - NPSH & Max Suction dP @ 185F

			(Table 4)			(Eq 8)	(Ref 5&6)	(Eq 9)		(Eq 10)
Torus Temp T_{POOL} (F)	Vapor Press P_{VP} (psia)	Spec Volume V_{SP} (ft^3/lbm)	Suction Elev Head h_Z (ft)	Suction Head Loss h_{SL} (ft)	Wetwell Press P_C (psig)	Available $NPSH_A$ (ft)	Required $NPSH_R$ (ft)	Total Available Margin $NPSH_M$ (ft)	Available Margin for LOCA Debris $NPSH_M$ (ft)	Max Suction dP Measured @ IST Conditions (psi)
Core Spray Pumps A & B @ 4400 GPM:										
185	8.3855	0.016541	12.50	2.38	0.00	25.15	29.00	-3.85	-5.85	n/a
					2.46	31.01	29.00	2.01	0.01	1.82
					5.82	39.01	29.00	10.01	8.01	1.82
					8.00	44.21	29.00	15.21	13.21	1.82
RHR Pumps A & D @ 5600 GPM:										
185	8.3855	0.016541	12.50	3.20	0.00	24.33	27.00	-2.67	-4.67	n/a
					2.46	30.19	27.00	3.19	1.19	1.92
					5.82	38.19	27.00	11.19	9.19	1.92
					8.00	43.39	27.00	16.39	14.39	1.92
RHR Pumps B & C @ 5600 GPM:										
185	8.3855	0.016541	12.50	2.46	0.00	25.07	27.00	-1.93	-3.93	n/a
					2.46	30.93	27.00	3.93	1.93	1.70
					5.82	38.93	27.00	11.93	9.93	1.70
					8.00	44.13	27.00	17.13	15.13	1.70

Note: Wetwell pressure of 2.46 psig is the minimum required pressure at 185F to maintain a positive Available Margin for LOCA Debris for the limiting Core Spray Pump.
Wetwell pressure of 5.82 psig is the minimum required pressure at 185F to maintain the minimum NPSH margin of 10.0 ft from Table 8 for the limiting Core Spray Pump.
Wetwell pressure of 8.00 psig is the equilibrium pressure at 185F peak pool temperature.

Table 8 - NPSH & Max Suction dP @ 0 PSIG

			(Table 4)			(Eq 8)	(Ref 5&6)	(Eq 9)		(Eq 10)
To , Temp T_{POOL} (F)	Vapor Press P_{VP} (psia)	Spec Volume V_{SP} (ft^3/lbm)	Suction Elev Head h_Z (ft)	Suction Head Loss h_{SL} (ft)	Wetwell Press P_C (psig)	Available $NPSH_A$ (ft)	Required $NPSH_R$ (ft)	Total Available Margin $NPSH_M$ (ft)	Available Margin for LOCA Debris $NPSH_M$ (ft)	Max Suction dP Measured @ IST Conditions (psi)
Core Spray Pumps A & B @ 4400 GPM										
Pool Temp @ 0 psig:										
124	1.8901	0.016221	12.50	2.38	0.00	40.03	29.00	11.03	9.03	1.82
128	2.1068	0.016238	12.50	2.38	0.00	39.56	29.00	10.56	8.56	1.82
132	2.3445	0.016256	12.50	2.38	0.00	39.03	29.00	10.03	8.03	1.82
RHR Pumps A & D @ 5600 GPM										
Pool Temp @ 0 psig:										
124	1.8901	0.016221	12.50	3.20	0.00	39.21	23.00	16.21	14.21	1.92
128	2.1068	0.016238	12.50	3.20	0.00	38.74	27.00	11.74	9.74	1.92
132	2.3445	0.016256	12.50	3.20	0.00	38.21	27.00	11.21	9.21	1.92
RHR Pumps B & C @ 5600 GPM										
Pool Temp @ 0 psig:										
124	1.8901	0.016221	12.50	2.46	0.00	39.95	23.00	16.95	14.95	1.70
128	2.1068	0.016238	12.50	2.46	0.00	39.48	27.00	12.48	10.48	1.70
132	2.3445	0.016256	12.50	2.46	0.00	38.95	27.00	11.95	9.95	1.70

Note: This data gives the point of Minimum NPSH Margin during the cooldown when P_C drops to 0 psig.
The 124 & 132 deg F data corresponds to the 1% & 5% per Day leakage cases for a 75 deg F heat sink.

Section 4.0 Updated FSAR NPSH Analyses and Figures

Section 4.A Method of Solution

This section of the calculation prepares updated NPSH analysis for the FSAR. The original analysis was submitted to the AEC during the Pilgrim licensing review via Amendments 9 and 24 to the SAR. This analysis was incorporated into the FSAR as Figures 14.5-9, 14.5-10, and 14.5-13 and Section 14.5.3.1.3. The revised analysis in this calculation will be incorporated into the UFSAR.

The same approach used in the original FSAR analysis is used. Considering a known suppression pool temperature profile, the coincident containment pressure is calculated using simple thermal equilibrium assumptions. The "Containment Pressure Required" to provide the necessary NPSH is calculated and plotted with the coincident containment pressure. The difference between the containment pressure at any point in time and the containment pressure required represents NPSH margin. Calculation results are plotted as figures.

Section 4.B Input Data and Assumptions

Table 9 - Section 4 Inputs

Parameter	Amendment 9 Benchmark	Ref. See Note 1	65°F Seawater Temperature Revised Analysis	Ref. See Note 1	75°F Seawater Temperature Revised Analysis	Ref. See Note 1
Containment Leakage Rate	0.5%/day	31,33c	1%/day	34f	1%/day	34f
Impaired Containment Leakage Rate	5%/day	31,33c	5%/day	33c	5%/day	33c
Pool temperature profile	Amendment 9 Figure 1-2 FSAR Fig. 14.5-10	31,33c	FSAR Fig. 14.5-7	33d (6)	FSAR Fig. 14.5-17	37 (8)
Ultimate Heat Sink Temperature	65°F	31,33c	65°F	33c	75°F	37
Operator action time to initiate containment cooling	10 min	33b	10 min	33b	10 min	37
SSW Flowrate	5000 gpm	33d	4500 gpm	33c	4500 gpm	37
Core Spray NPSH Required	28 feet	31,33c	29 ft at 4400 gpm	8	29 ft at 4400 gpm	8
RHR NPSH Required	28 feet	31,33c	27 ft at 5600 gpm	9	27 ft at 5600 gpm	9
Drywell Free Volume	147,000 ft^3	33a	147,000 ft^3	33a	147,000 ft^3	33a
Wetwell Free Volume	120,000 ft^3	33a	124,500 ft^3	35a	124,500 ft^3	35a
Torus Water Volume	5.2E6 lbm	31,33c	84,000 ft^3	34a	84,000 ft^3	34a
Initial Torus Water Temperature	80°F	31,33c	80°F	40	85°F	40
Initial Drywell Relative Humidity	100%	31,33c	80%	40 (5)	80%	40 (5)
Initial Wetwell Relative Humidity	100%	31,33c	100%	40	100%	40

Table 9 - Section 4 Inputs

Parameter	Amendment 9 Benchmark	Ref. See Note 1	65°F Seawater Temperature Revised Analysis	Ref. See Note 1	75°F Seawater Temperature Revised Analysis	Ref. See Note 1
Initial Wetwell Airspace Temperature	80°F	31,33c	80°F	40 (3)	85°F	40 (3)
Initial Drywell Temperature	150°F	31,33c	150°F	40 (4)	150°F	40 (4)
Initial Drywell Pressure	0 psig	31,33c	1.30 psig	40	1.30 psig	40
Initial Wetwell Airspace Pressure	0 psig	31,33c	0 psig	40	0 psig	40
Initial Mass of Nitrogen	15,666 lbm	40	16,315 lbm	40	16,315 lbm	40
Containment Reference Pressure P_T	n/a		45 psig or 59.7 psia	34f	45 psig or 59.7 psia	34f
Containment Reference Leak Rate L_T	n/a		1%/day of Mt	34f	1%/day of Mt	34f
RHR Pump Suction line Head Loss	4.2 feet	(7)	3.20 feet	Table 6	3.20 feet	Table 7
CS Pump Suction line Head Loss	4.2 feet	(7)	2.38 feet	Table 6	2.38 feet	Table 7
Elevation head	12.5 feet	Section 3.C.2.b	12.5 feet	Section 3.C.2.b	12.5 feet	Section 3.C.2.b

Notes for Table 9

1. Numbers in parentheses refer to the following notes. References are given at the end of this section.
2. Initial "Drywell Airspace Pressure" is assumed at 1.30 psig. Drywell and Wetwell pressure, temperature, and humidity are used to calculate the initial mass of noncondensible gas inside containment. The combination of the values selected for each of these six parameters provides a conservative estimate of the initial mass of noncondensible gas.
3. Initial Wetwell airspace temperature is assumed to equal the initial suppression pool temperature.

4. Initial Drywell Temperature is assumed to equal a uniform value of 150°F instead of the 135°F (General area temperature per FSAR Table 5.2-2 "Drywell Atmosphere Cooling Data Sheet") which is used in containment and decay heat removal system analysis. A higher initial temperature is conservative because less initial noncondensible mass is present in containment. Therefore, the partial pressure of noncondensible gas is less initially and less over the course of the transient and cooldown resulting in a lower value for NPSHA.
5. The initial Drywell humidity used is 80% versus 100% assumed in the Amendment 9 analysis as described in the reference.
6. A table of values for suppression pool temperature as a function of time after the accident is taken from the pool temperature curve specified.
7. Amendment 9 analysis was prepared before the actual piping configuration was known. The suction line head loss used in the benchmark analysis was estimated between 4.2 and 4.7 feet. Use of the value of 4.2 feet gives good agreement between the benchmark case for Figure 14.5-10. Use of the value of 4.7 feet gives good agreement between the benchmark case and Figure 14.5-9. The actual suction line head losses are lower based on the as-built piping configuration.
8. The data table for the suppression pool temperature curve contained in reference 37 was provided by GE.

Section 4.C Calculations/Analyses

Section 4.C.1 Definition of Terms

Hz	*Elevation of suppression pool water surface above the pump centerline, ft*
Hsl	*Suction line losses, ft*
L_T	*Reference mass leakage rate at reference pressure P_T, lbm/sec*
Mt	*Initial mass of dry air inside the Drywell and Wetwell, lbm*
*Mt**	*Mass of dry air remaining inside the Drywell and Wetwell after leakage, lbm*
m_{gas}	*Mass of air/nitrogen in mixture, lbm*
m_{leak}	*Mass leakage rate from containment, lbm/sec*
m_{water}	*Mass of water vapor in mixture, lbm*
NPSHA	*Net positive suction head available, feet*
NPSHM	*Net positive suction head margin, feet*
NPSHR	*Net positive suction head required, feet*
Pc	*Pressure of primary containment, psia*
Pc Req'd	*Pressure of primary containment required to provide NPSHR, psia*
Pd	*Initial pressure of Drywell, psia*
Pgas	*Pressure of gas in a mixture of gas and water vapor, psia*
Ps	*Initial pressure of Wetwell air space, psia*
P_T	*Reference pressure for mass leakage rate L_T, 45 psig or 59.7 psia*
Pvp	*Saturation vapor pressure, psia*
R or Rgas	*Specific gas constant for air/nitrogen, 53.3 ft-lbf/lbm-°R*
Rwater	*Specific gas constant for water vapor, 85.8 ft-lbf/lbm-°R*
ΔT	*Length of time step, sec*
Td	*Temperature in Drywell, °R*
Tp	*Temperature of suppression pool water, °F*
Ts	*Temperature in Wetwell air space, °R*
Vs	*Volume of free air space in Wetwell, ft^3*
Vd	*Free Drywell volume, ft^3*
ρ	*Density of water in pool, lb/ft^3*
ϕ	*Relative Humidity*
ω	*Humidity Ratio*

Section 4.C.2 Equations

An expression for calculating the initial mass of noncondensible gas inside the Drywell and torus can be derived based on the ideal gas law:

$$PV = MRT$$

Solving for the mass (M):

$$M = \frac{PV}{RT}$$

The total initial mass of noncondensible gas inside containment is the sum of the initial mass located in two separate volumes (torus airspace, and Drywell):

$$Mt = Md + Ms$$

The initial mass in each volume is composed of water vapor and noncondensible gas (air/nitrogen). To calculate the initial mass of noncondensible gas, the contribution to the initial pressure from water vapor is subtracted. The magnitude of this water vapor contribution is a function of relative humidity ϕ and the saturation pressure corresponding to the mixture temperature:

Per Dalton's Rule:

$$P_{mixture} = P_{gas} + \left(\phi P_{vp}\right)$$

so $$P_{gas} = P_{mixture} - \left(\phi P_{vp}\right)$$

Equation 11 is used to calculate the total initial mass in the Drywell and Wetwell airspace. As discussed above the equation is derived from the ideal gas law, Dalton's rule and the definition of relative humidity. The result of Equation 11 provides the initial mass of noncondensible gas in primary containment:

Eq. 11
$$M_1 = \frac{\left[Pd - (\phi\, Pvp)\right](144\frac{in^2}{ft^2})Vd}{R\,Td} + \frac{\left[Ps - (\phi\, Pvp)\right](144\frac{in^2}{ft^2})Vs}{R\,Ts}$$

Equation 11 is the general equation to calculate the initial mass of noncondensible gas inside containment as a function of initial pressure, humidity, and temperature. Amendment 9 analysis used Eq. 12 which is derived from Eq. 11 by setting Drywell pressure equal to 14.7 psia (0 gage), Wetwell airspace pressure equal to 14.7 psia (0 gage), and Drywell and Wetwell humidity equal to 100%. Equation 12 was used to calculate the Amendment 9 FSAR curves.

Eq. 12 $$M_t = \frac{(14.7 - Pvp)(144\frac{in^2}{ft^2})Vd}{RTd} + \frac{(14.7 - Pvp)(144\frac{in^2}{ft^2})Vs}{RTs}$$

Equations 13a and 13b were used in the Amendment 9 analysis to calculate the percentage of the original mass of noncondensibles in containment after 1.5 days:

Eq. 13a At 5% per day: $M_t^* = (0.95)^{1.5} M_t = 0.926 M_t$

Eq. 13b At 0.5% per day $M_t^* = (0.995)^{1.5} M_t = 0.9925 M_t$

The above ratio's for 5%/day and 0.5%/day were applied as a flat amount in Amendment 9 analysis. Although conservative, this approach is unrealistic and arbitrary. FSAR Appendix R (Equation R.49) provides a rational basis for calculating the leakage from containment based on the calculated pressure during any time step, and a reference leakage at a reference pressure. This equation is presented as Equation 14:

Eq. 14 $$m_{leak} = L_T \left[\frac{1 - \left(\frac{1}{P}\right)^2}{1 - \left(\frac{1}{P_T}\right)^2} \right]^{0.5}$$ (atmosphere's)

Where: L_T = *Leak rate at reference pressure (lbm unit time)*
P_T = *Reference pressure in atmospheres*
P = *Containment pressure at time step in atmospheres*

Equation 14 is modified as shown in Equation 15 to calculate leakage as a function of pressure measured in units of psia.

Eq. 15 $$m_{leak} = L_T \left[\frac{1 - \left(\frac{14.7}{P_C} \right)^2}{1 - \left(\frac{14.7}{P_T} \right)^2} \right]^{0.5} \quad \text{(psia)}$$

Only a portion of the mass leaked from the containment is gas since the mixture leaking from containment is a mixture of water vapor and noncondensible gas. The humidity ratio (w) can be used to determine the amount of dry gas contained in the vapor/gas mixture. This ratio is derived from the ideal gas law since the water vapor and gas are homogeneously mixed in the containment volume (Drywell and Wetwell) and both the water vapor and gas are at the suppression pool temperature. Also, the containment atmosphere is assumed to be at 100% relative humidity (saturated) after the event has been initiated. Equation 16 which provides the humidity ratio based on the ratio of gas and water vapor pressure is derived from the ideal gas law as follows:

$$\omega = \frac{m_{water}}{m_{gas}} = \frac{R_{gas}\ P_{vp}}{R_{water}\ P_{gas}} = \frac{53.3\ P_{vp}}{85.8\ P_{gas}}$$

$$\omega = 0.621 \frac{P_{vp}}{P_{gas}}$$

$$P_{gas} = P_c - P_{vp}$$

Eq. 16 $$\omega = 0.621 \frac{P_{vp}}{P_c - P_{vp}}$$

Since "m_{leak}" from Equation 15 is a mixture gas and water vapor where:

$$m_{leak} = m_{water} + m_{gas}$$

and $$\omega = \frac{m_{water}}{m_{gas}}$$

Solving for and m_{water}:

$$m_{water} = \omega\, m_{gas}$$

Substituting $\omega\, m_{gas}$ for m_{water} in the first equation yields:

$$m_{leak} = \omega\, m_{gas} + m_{gas}$$

Solving for m_{gas} yields:

Eq. 17
$$m_{gas} = \frac{m_{leak}}{(\omega + 1)}$$

Equation 17 provides the mass of noncondensible gas in a mixture with total mass equal to m_{leak} and a humidity ratio ω.

The noncondensible gas remaining in containment at any time after the containment isolates is the initial mass minus the mass of noncondensible gas that has leaked. The remaining mass (Mt^*) is calculated by the following formula:

Eq. 18
$$Mt^* = Mt - \sum \frac{m_{leak}}{(\omega + 1)} (\Delta t)$$

Equation 19 is used to calculate the containment pressure at any time as the sum of the partial pressure of the remaining noncondensible gas and the vapor pressure corresponding to the suppression pool temperature.

Eq. 19
$$Pc = \frac{Mt^* R\, Tp}{Vd + Vs} \left(\frac{ft^2}{144 in^2} \right) + Pvp$$

NPSHA is defined by the following terms:

Eq. 20
$$NPSHA = (Pc - Pvp) \frac{\left(144 \frac{in^2}{ft^2} \right)}{\rho} + H_z - H_{sl}$$

The term *(Pc-Pvp)* represents the net pressure above the vapor pressure provided by the noncondensible gas inside containment. Therefore:

Eq. 21
$$Pgas = (Pc - Pvp)$$

NPSHA is calculated as follows, where Pgas is measured in feet of water:

Eq. 22 $$NPSHA = Pgas \frac{\left(144 \frac{in^2}{ft^2}\right)}{\rho} + H_z - H_{sl}$$

The containment pressure required to provide adequate NPSH is derived using Equation 20 by letting NPSHA equal NPSHR and solving for the containment pressure *Pc*. When NPSHA equals NPSHR the containment pressure is by definition equal to the required containment pressure *Pc Req'd*.

Eq. 23 $$Pc\ Req'd = Pvp + (NPSHR - Hz + Hsl) \frac{\rho}{\left(144 \frac{in^2}{ft^2}\right)}$$

The NPSH margin is the difference between the containment pressure that is available and the containment pressure required.

Eq. 24 $$NPSHM = (Pc - Pc\ Req'd) \frac{\left(144 \frac{in^2}{ft^2}\right)}{\rho}$$

or $$NPSHM = NPSHA - NPSHR$$

The following three equations are general conversions used throughout this calculation.

Eq. 25 $$P(feet) = P(psi) \frac{144\left(in^2/ft^2\right)}{\rho\left(lbm/ft^3\right)}$$

Eq. 26 $$P(psi) = P(feet) \frac{\rho\left(lbm/ft^3\right)}{144\left(in^2/ft^2\right)}$$

Eq. 27 $$T(^\circ R) = T(^\circ F) + 460$$

Section 4.C.3 Benchmark Case

The calculation performed to prepare the curves currently presented in the FSAR is repeated to benchmark the methodology. This case is the first case performed and is hereafter referred to as the "Benchmark Case".

Per Amendment 9 to the FSAR, the following methodology is used:

1. Calculate the initial mass of air [or nitrogen] inside the primary containment assuming atmospheric pressure and a 100% relative humidity in both the Wetwell and Drywell. The initial Drywell temperature was assumed to be 150°F, and the Wetwell temperature 80°F. The total mass is given by Equation 12.
2. Assume the containment leaked at a constant rate of 5% free vol/day for 1.5 days, the time required following an accident for the pool temperature to return to 130°F with one RHR loop operating. The reduced mass is then given by Equation 13a and 13b.
3. Due to flow through the Drywell vents or vacuum breakers, the Drywell and Wetwell pressures will be approximately equal, i.e., $Pd = Ps$.
4. The Drywell and Wetwell airspace masses and volumes can be combined and the containment (Drywell and Wetwell) pressure calculated as a function of the suppression pool temperature for the following reasons:

   Water from the pool is being pumped into the reactor vessel by a core spray cooling system pump. This water is heated by the decay heat of the reactor core and pours out of the vessel via the break and into the suppression pool via the Drywell vent system. The water which returns to the Wetwell is hotter than the suppression pool water by approximately 50°F.

   Because of the large flow of water involved, the low thermal capacity of the Drywell atmosphere, and the slow time rate of change of the temperature of the water flowing through the Drywell, the Drywell atmospheric temperature will track the water temperature.

   The Drywell airspace temperature will always be hotter than the pool temperature because of the elevated temperature of the break flow.
5. The containment pressure is then given by Equation 19.
6. The total NPSH available to the pumps is given by Equation 20.

In the following table the methodology used to calculate values plotted on the original FSAR Figure 14.5-10 is repeated. Based on a comparison, the values contained in the following table and plotted on the attached Figure 2 are consistent with the results presented in original FSAR Figure 14.5-10.

Table 10 - Benchmark Case Containment Pressure Available and Required at 0.5% and 5%/day Leakage

	F14.5-10	Eq. 27	Lookup	Eq. 13a	Eq. 19	Eq. 21	Eq. 13b	Eq. 19	Eq. 21			Eq. 23
Time (sec)	Pool Temp (°F)	Tp (°R)	Pvp (psia)	Mt*/Mt @ 5%/day Leakage Rate (%)	Pc @ 5% Leakage (psia)	Pgas (feet)	Mt*/Mt @ 0.5%/day Leakage Rate (%)	Pc @ 0.5% Leakage (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	Pc Req'd for NPSHA of 28 feet (psia)
	Values below plotted on Figure 2 ⇓				*Values below plotted on Figure 2* ⇓			*Values below plotted on Figure 2* ⇓				*Values below plotted on Figure 2* ⇓
100	126.0	586	1.996	0.926	14.696	29.68	0.9925	14.696	29.68	12.5	4.2	10.42
200	126.2	586	2.007	0.926	14.696	29.66	0.9925	14.696	29.66	12.5	4.2	10.44
300	127.3	587	2.069	0.926	14.696	29.52	0.9925	14.732	29.61	12.5	4.2	10.49
400	128.8	589	2.153	0.926	14.696	29.34	0.9925	14.849	29.70	12.5	4.2	10.58
500	130.0	590	2.225	0.926	14.696	29.18	0.9925	14.947	29.77	12.5	4.2	10.64
600	131.0	591	2.286	0.926	14.696	29.04	0.9925	15.029	29.82	12.5	4.2	10.70
700	132.0	592	2.347	0.926	14.696	28.91	0.9925	15.111	29.88	12.5	4.2	10.76
800	133.0	593	2.407	0.926	14.696	28.77	0.9925	15.194	29.94	12.5	4.2	10.82
900	134.0	594	2.473	0.926	14.696	28.63	0.9925	15.281	30.00	12.5	4.2	10.88
1000	134.8	595	2.526	0.926	14.696	28.52	0.9925	15.351	30.05	12.5	4.2	10.93
2000	140.5	601	2.928	0.926	15.008	28.35	0.9925	15.876	30.39	12.5	4.2	11.32
3000	144.5	605	3.242	0.926	15.402	28.57	0.9925	16.276	30.62	12.5	4.2	11.63
4000	147.5	608	3.496	0.926	15.717	28.74	0.9925	16.595	30.81	12.5	4.2	11.87
5000	150.0	610	3.721	0.926	15.993	28.88	0.9925	16.874	30.95	12.5	4.2	12.09

Table 10 - Benchmark Case Containment Pressure Available and Required at 0.5% and 5%/day Leakage

	F14.5-10	Eq. 27	Lookup	Eq. 13a	Eq. 19	Eq. 21	Eq. 13b	Eq. 19	Eq. 21			Eq. 23
Time (sec)	Pool Temp (°F)	Tp (°R)	Pvp (psia)	Mt*/Mt @ 5%/day Leakage Rate (%)	Pc @ 5% Leakage (psia)	Pgas (feet)	Mt*/Mt @ 0.5%/day Leakage Rate (%)	Pc @ 0.5% Leakage (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	Pc Req'd for NPSHA of 28 feet (psia)
6000	152.0	612	3.908	0.926	16.220	28.99	0.9925	17.104	31.08	12.5	4.2	12.27
7000	154.0	614	4.103	0.926	16.454	29.11	0.9925	17.342	31.20	12.5	4.2	12.46
8000	156.0	616	4.311	0.926	16.703	29.22	0.9925	17.593	31.32	12.5	4.2	12.67
9000	157.5	618	4.468	0.926	16.890	29.31	0.9925	17.782	31.41	12.5	4.2	12.82
10000	159.0	619	4.633	0.926	17.085	29.39	0.9925	17.980	31.50	12.5	4.2	12.98
15000	163.2	623	5.118	0.926	17.655	29.63	0.9925	18.555	31.76	12.5	4.2	13.45
20000	165.0	625	5.336	0.926	17.909	29.73	0.9925	18.812	31.87	12.5	4.2	13.67
25000	165.5	626	5.401	0.926	17.984	29.76	0.9925	18.888	31.90	12.5	4.2	13.73
30000	165.0	625	5.336	0.926	17.909	29.73	0.9925	18.812	31.87	12.5	4.2	13.67
40000	162.0	622	4.972	0.926	17.485	29.56	0.9925	18.384	31.68	12.5	4.2	13.31
50000	158.2	618	4.542	0.926	16.979	29.35	0.9925	17.872	31.45	12.5	4.2	12.89
60000	154.0	614	4.103	0.926	16.454	29.11	0.9925	17.342	31.20	12.5	4.2	12.46
70000	149.0	609	3.631	0.926	15.882	28.82	0.9925	16.762	30.89	12.5	4.2	12.00
80000	144.0	604	3.200	0.926	15.350	28.54	0.9925	16.223	30.59	12.5	4.2	11.59
90000	140.0	600	2.889	0.926	14.959	28.32	0.9925	15.826	30.36	12.5	4.2	11.28
100000	136.5	597	2.640	0.926	14.696	28.26	0.9925	15.502	30.15	12.5	4.2	11.04
150000	125.5	586	1.970	0.926	14.696	29.74	0.9925	14.696	29.74	12.5	4.2	10.40
200000	118.0	578	1.601	0.926	14.696	30.55	0.9925	14.696	30.55	12.5	4.2	10.05

In the following table the methodology used to calculate values plotted on the original FSAR Figure 14.5-9 is repeated, and the results of the recalculation are plotted. Based on a comparison, the values contained in the following table and plotted on the attached Figure 3 are consistent with the results presented in the original FSAR and Amendment 9.

Table 11 - Benchmark Case NPSH Available and Required

	Eq. 27	Lookup			Eq. 13a	Eq. 19	Eq. 21	Eq. 22	
Pool Temperature (°F)	Tp (°R)	Pvp (psia)	Hz (feet)	Hsl (feet)	Mt*/Mt @ 5% Leakage (%)	Pc @ 5% Leakage (psia)	Pgas (feet)	NPSHA (feet)	NPSHR (feet)
								Values below plotted on Fig 3 ⇓	*Values below plotted on Fig 3* ⇓
140	600	2.889	12.5	4.2	0.926	14.959	28.3	36.6	28
150	610	3.721	12.5	4.2	0.926	15.993	28.9	37.2	28
160	620	4.746	12.5	4.2	0.926	17.219	29.4	37.7	28
170	630	5.995	12.5	4.2	0.926	18.669	30.0	38.3	28
180	640	7.511	12.5	4.2	0.926	20.386	30.6	38.9	28

	Eq. 27	Lookup			Eq. 13a	Eq. 19	Eq. 21	Eq. 22	
Pool Temperature (°F)	Tp (°R)	Pvp (psia)	Hz (feet)	Hsl (feet)	Mt*/Mt @ .5% Leakage (%)	Pc @ .5% Leakage (psia)	Pgas (feet)	NPSHA (feet)	NPSHR (feet)
								Values below plotted on Fig 3 ⇓	*Values below plotted on Fig 3* ⇓
140	600	2.889	12.5	4.2	0.9925	15.826	30.4	38.7	28
150	610	3.721	12.5	4.2	0.9925	16.874	31.0	39.3	28
160	620	4.746	12.5	4.2	0.9925	18.114	31.6	39.9	28
170	630	5.995	12.5	4.2	0.9925	19.579	32.2	40.5	28
180	640	7.511	12.5	4.2	0.9925	21.311	32.8	41.1	28

Section 4.C.4 Updated FSAR NPSH Analysis and Figures

The calculation performed to prepare the updated FSAR curves is fundamentally consistent with that used in the "Benchmark Case". Revised inputs are utilized in this analysis per Table 9.

The following methodology is used:

1. Calculate the initial mass of air (or nitrogen) inside the primary containment. The total initial mass is given in Section 3.C.5 as 16,315 lbm.

2. Calculate the reference leakage rate L_T:

   The reference leakage rate is a percentage of the initial mass of noncondensibles per unit time.
   So for the 1%/day and 5%/day cases, the reference leak rate is:

$$L_T[1\%] = 16315\,lbm\,(.01/day) = 163.15\,lbm/day \text{ or } 0.001888\,lbm/\text{sec}$$
$$L_T[5\%] = 16315\,lbm\,(.05/day) = 815.75\,lbm/day \text{ or } 0.009442\,lbm/\text{sec}$$

3. In successive steps from after the accident until the point of minimum NPSHM is passed, calculate:

   Mass leakage (water vapor + gas) from containment (m_{leak}) using Eq. 15
   Relative humidity ω using Eq. 16
   Noncondensible gas leakage from containment (m_{gas}) using Eq. 17
   Remaining mass of noncondensible gas in containment (Mt^*) using Eq. 18
   Containment pressure (Pc) using Eq. 19.

   This calculation is performed for:

   1%/Day leakage rate - Table 12 for a 65°F seawater temperature
   Table 18 for a 75°F seawater temperature
   5%/Day leakage rate - Table 13 for a 65°F seawater temperature
   Table 19 for a 75°F seawater temperature

4. Using the same suppression pool temperature data and time steps from the previous step, calculate:

   Pressure provided by the remaining mass of noncondensible gas in containment ($Pgas$) is calculated using Eq. 21,
   NPSHA using Eq. 22,
   $Pc\ Req'd$ using Eq. 23,
   NPSHM using Eq. 24.

These steps are performed separately for the RHR and Core Spray pumps. The results are contained in the following tables:

RHR pump at 1%/Day leakage rate - 65°F Seawater Temperature (Table 14)
RHR pump at 5%/Day leakage rate - 65°F Seawater Temperature (Table 16)
CS pump at 1%/Day leakage rate - 65°F Seawater Temperature (Table 15)
CS pump at 5%/Day leakage rate - 65°F Seawater Temperature (Table 17)

RHR pump at 1%/Day leakage rate - 75°F Seawater Temperature (Table 20)
RHR pump at 5%/Day leakage rate - 75°F Seawater Temperature (Table 22)
CS pump at 1%/Day leakage rate - 75°F Seawater Temperature (Table 21)
CS pump at 5%/Day leakage rate - 75°F Seawater Temperature (Table 23)

5. As in the Amendment 9 methodology, due to flow through the Drywell vents or vacuum breakers, the Drywell and Wetwell pressures will be approximately equal, i.e., $Pd = Ps$. The Drywell and Wetwell airspace masses and volumes can be combined and the containment (Drywell and Wetwell) pressure calculated as a function of the suppression pool temperature for the following reasons:

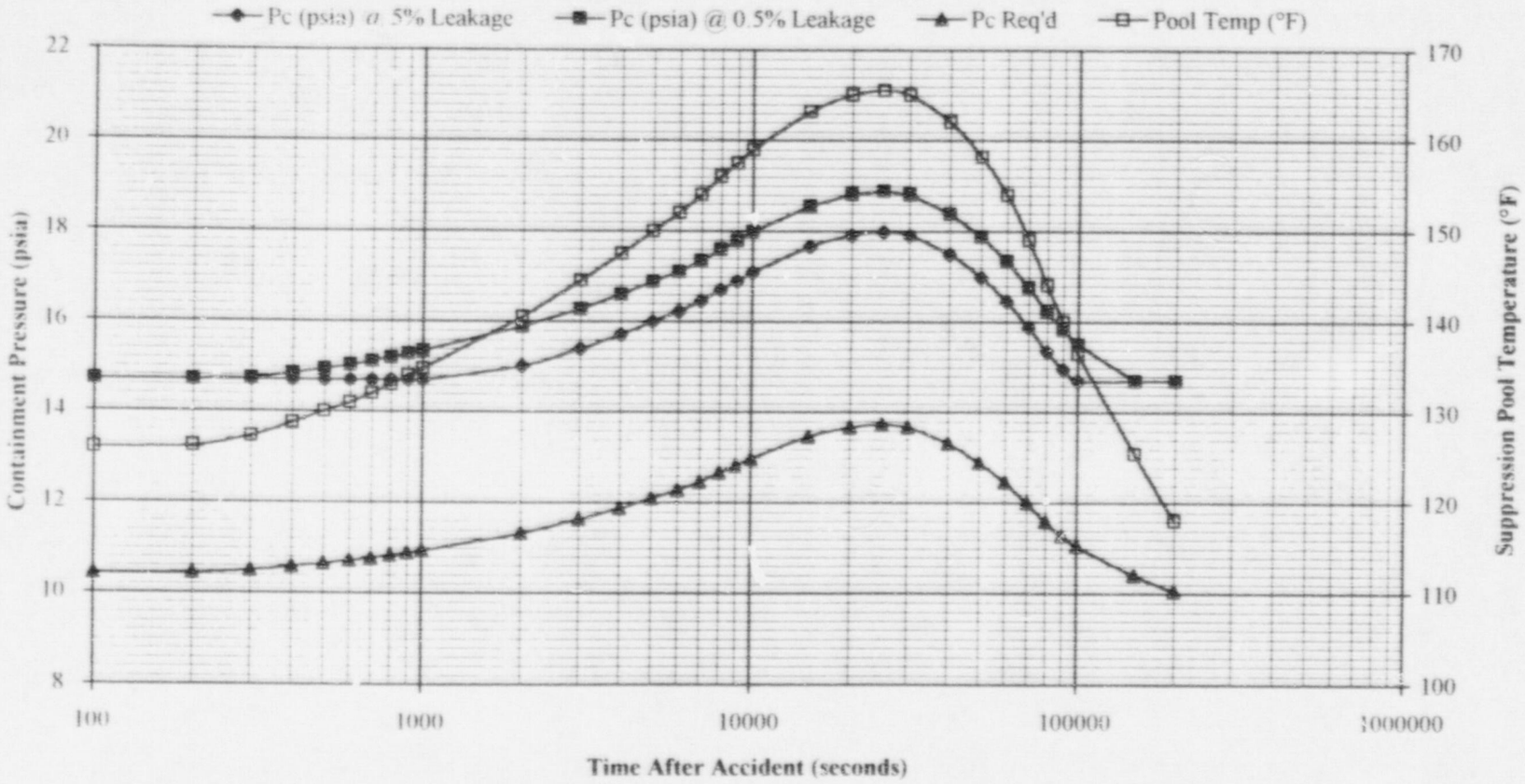
   Water from the pool is being pumped into the reactor vessel by a core spray cooling system pump for the 65°F case (by a Core Spray pump and LPCI pump for the 75°F). This water is heated by the decay heat of the reactor core and pours out of the vessel via the break and into the suppression pool via the Drywell vent system.

   Because of the large flow of water involved, the low thermal capacity of the Drywell atmosphere, and the slow time rate of change of the temperature of the water flowing through the Drywell, the Drywell atmospheric temperature will track the water temperature.

   The Drywell airspace temperature will always be hotter than the pool temperature because of the elevated temperature of the break flow.

PILGRIM STATION

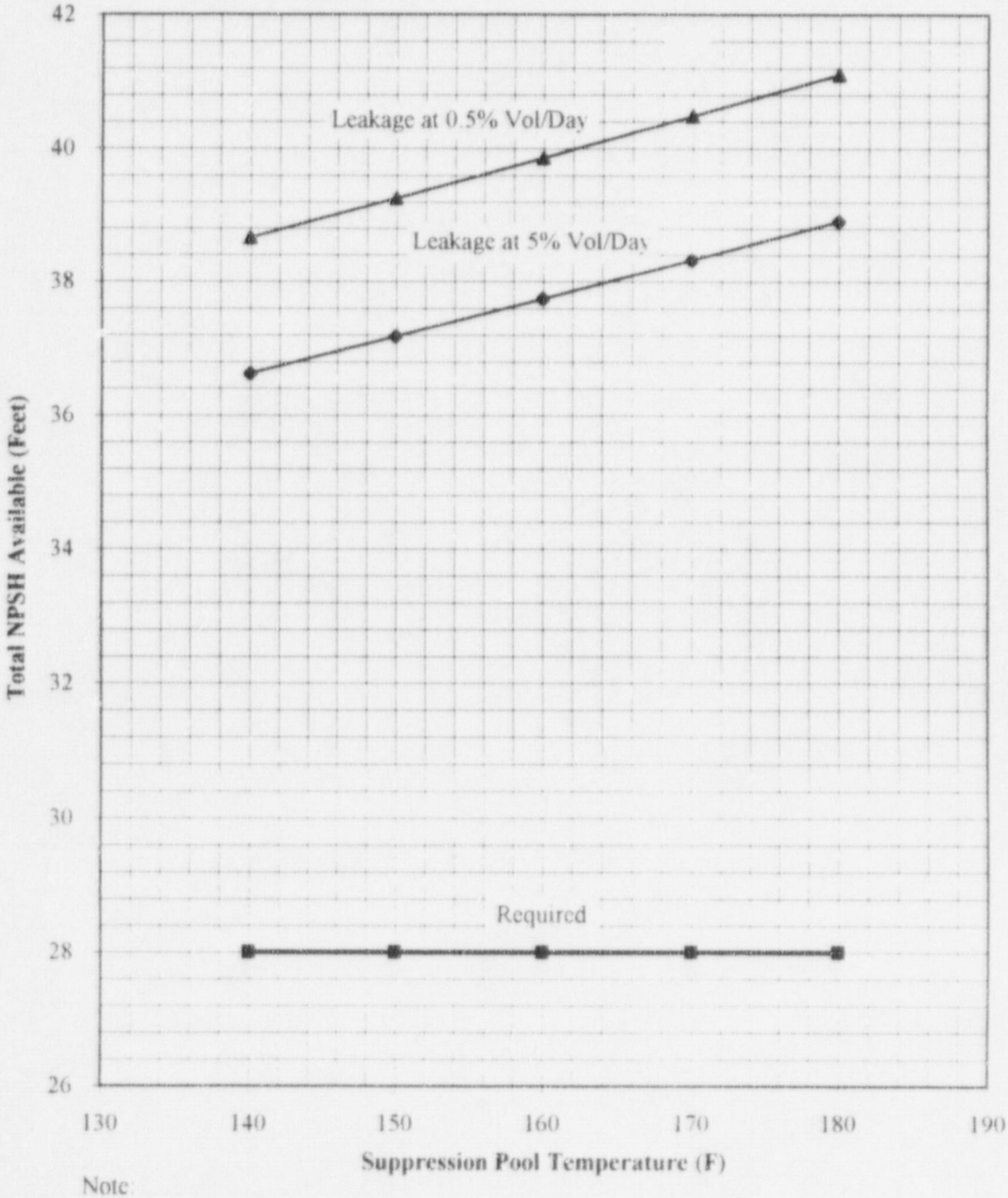
NPSH Availability for RHR and Core Spray System



Amendment 9 Benchmark Case

Original FSAR Figure 14.5-10 NPSH Availability for RHR and Core Spray System

Figure 2



Note:
Drywell Initially Saturated at 150 F and 0 psig

Amendment 9 Benchmark Case
Original FSAR Figure 14.5-9 Total NPSH Available Rated Flow

Figure 3

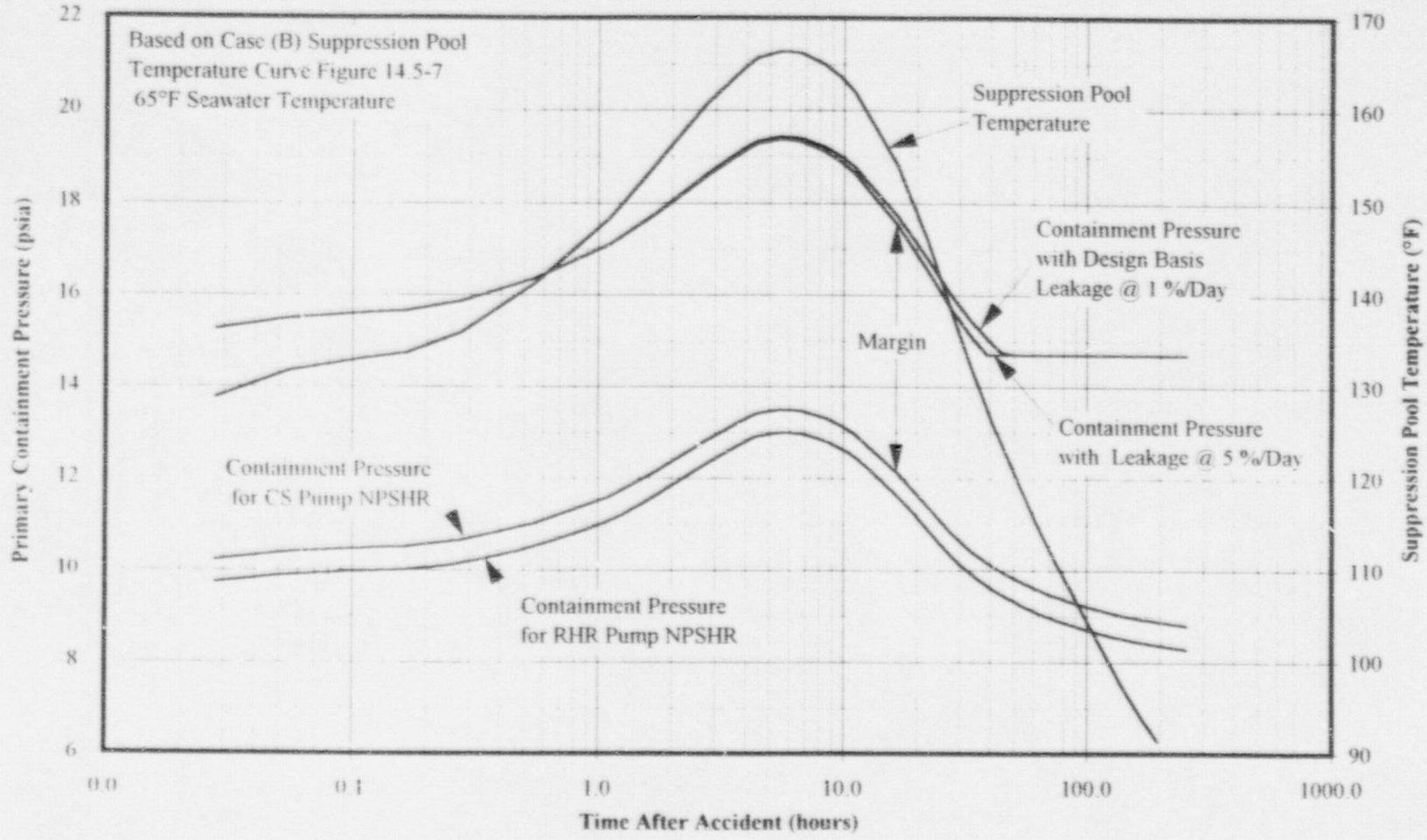


Figure 14.5-10 NPSH Availability for RHR and Core Spray Pumps After a DBA-LOCA

Figure 4

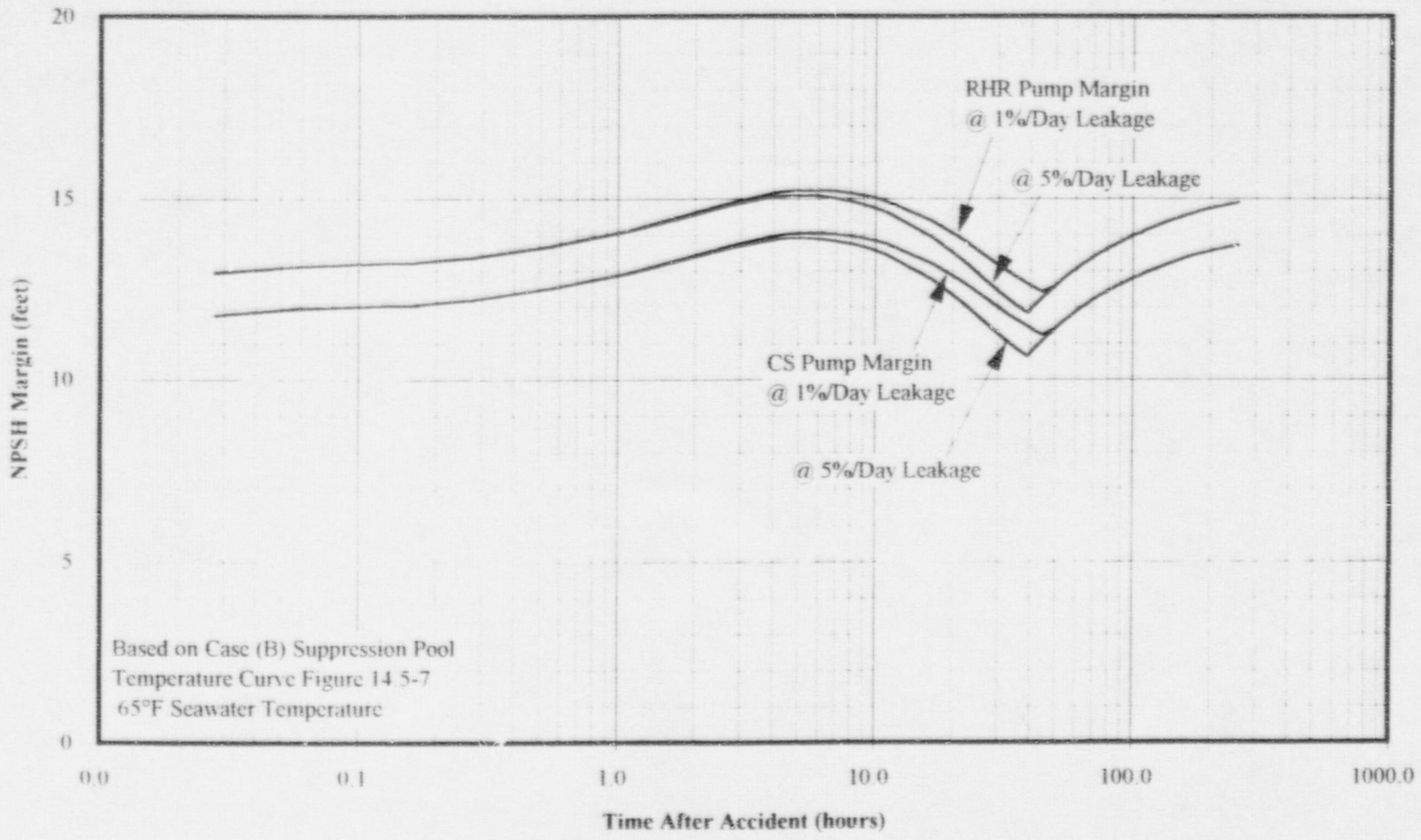
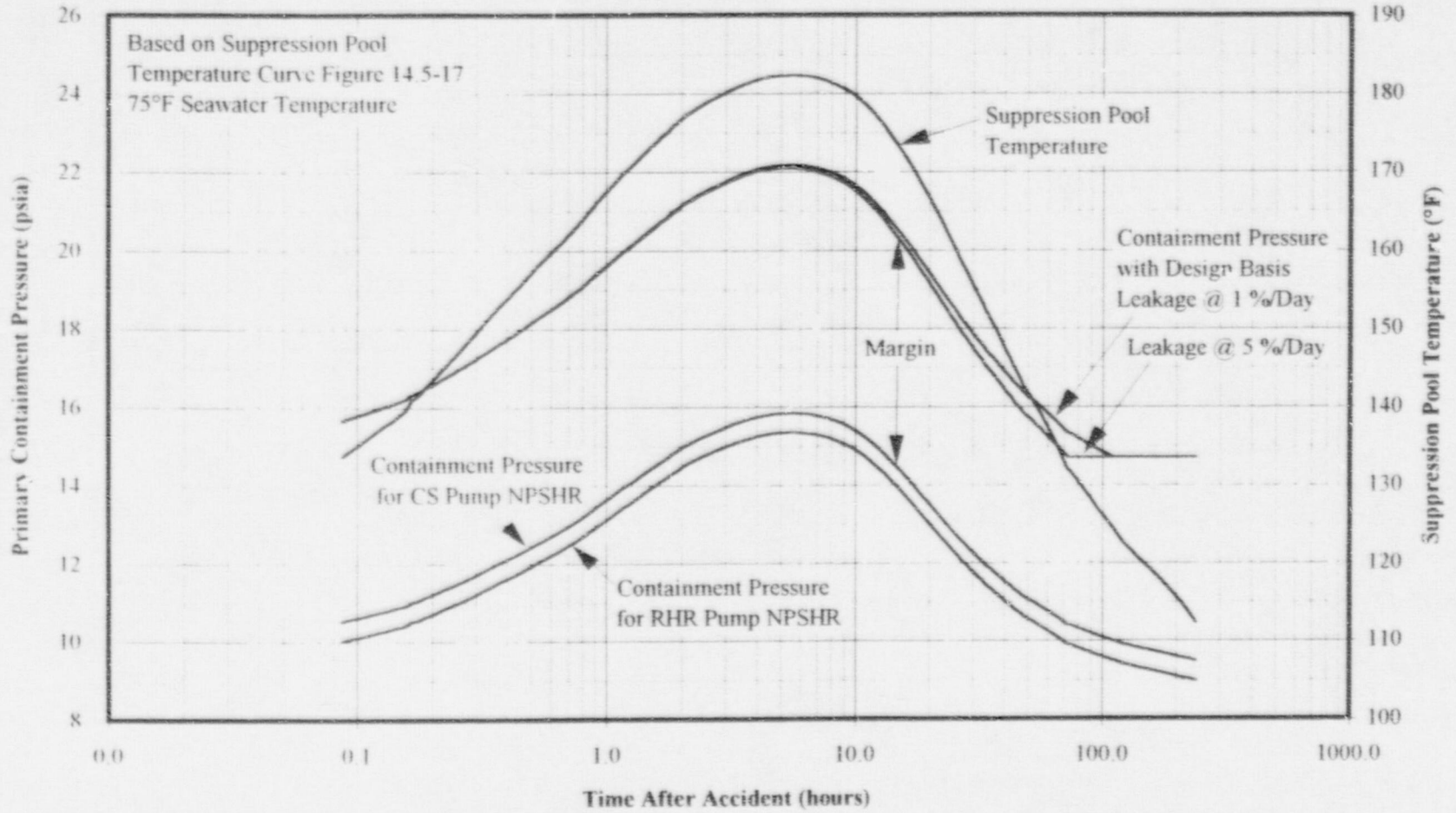


Figure 14.5-13 NPSH Margin for RHR and Core Spray Pumps After a DBA-LOCA

Figure 5



FSAR Figure 14.5-18 NPSH Availability for RHR and Core Spray Pumps After a DBA-LOCA

Figure 6

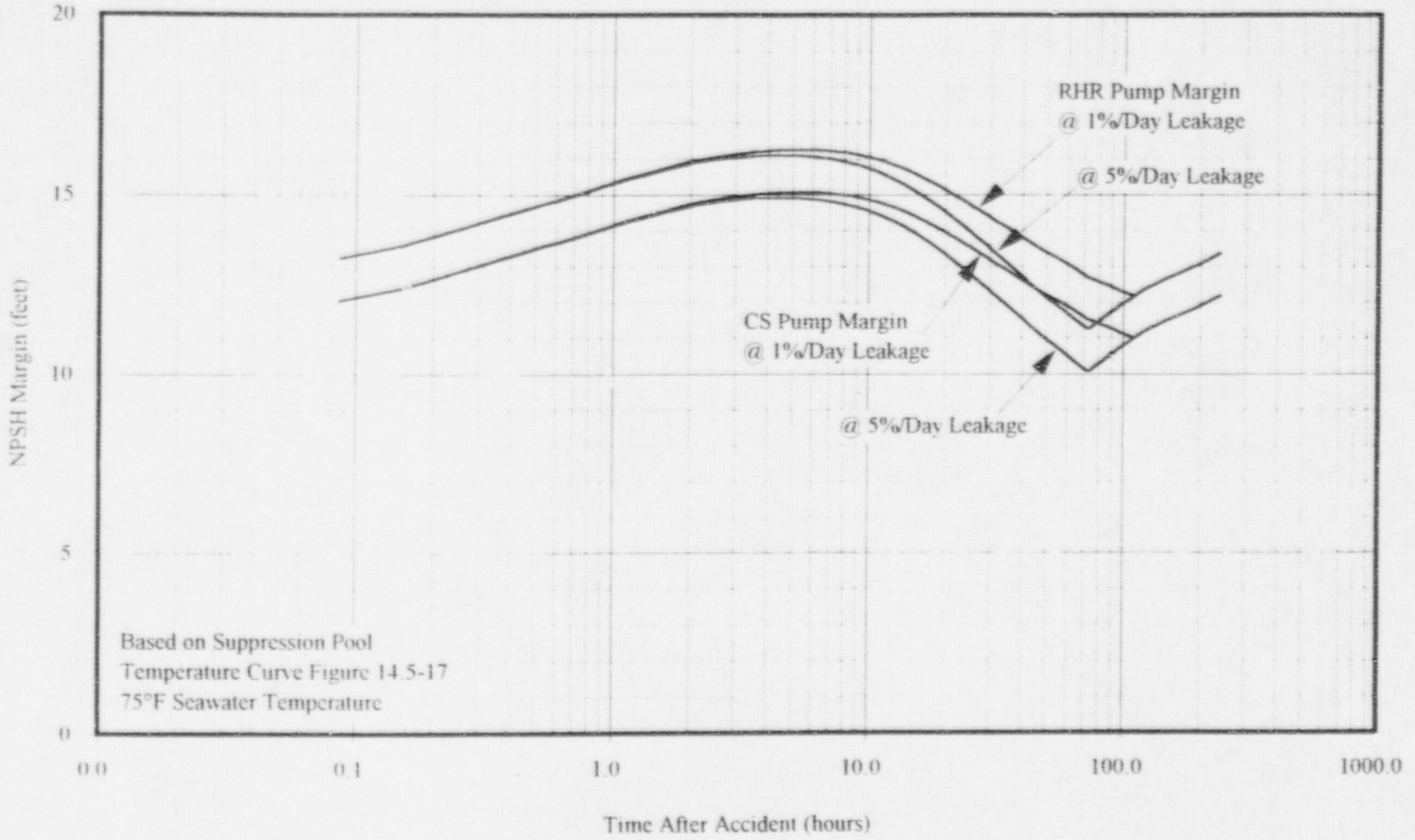
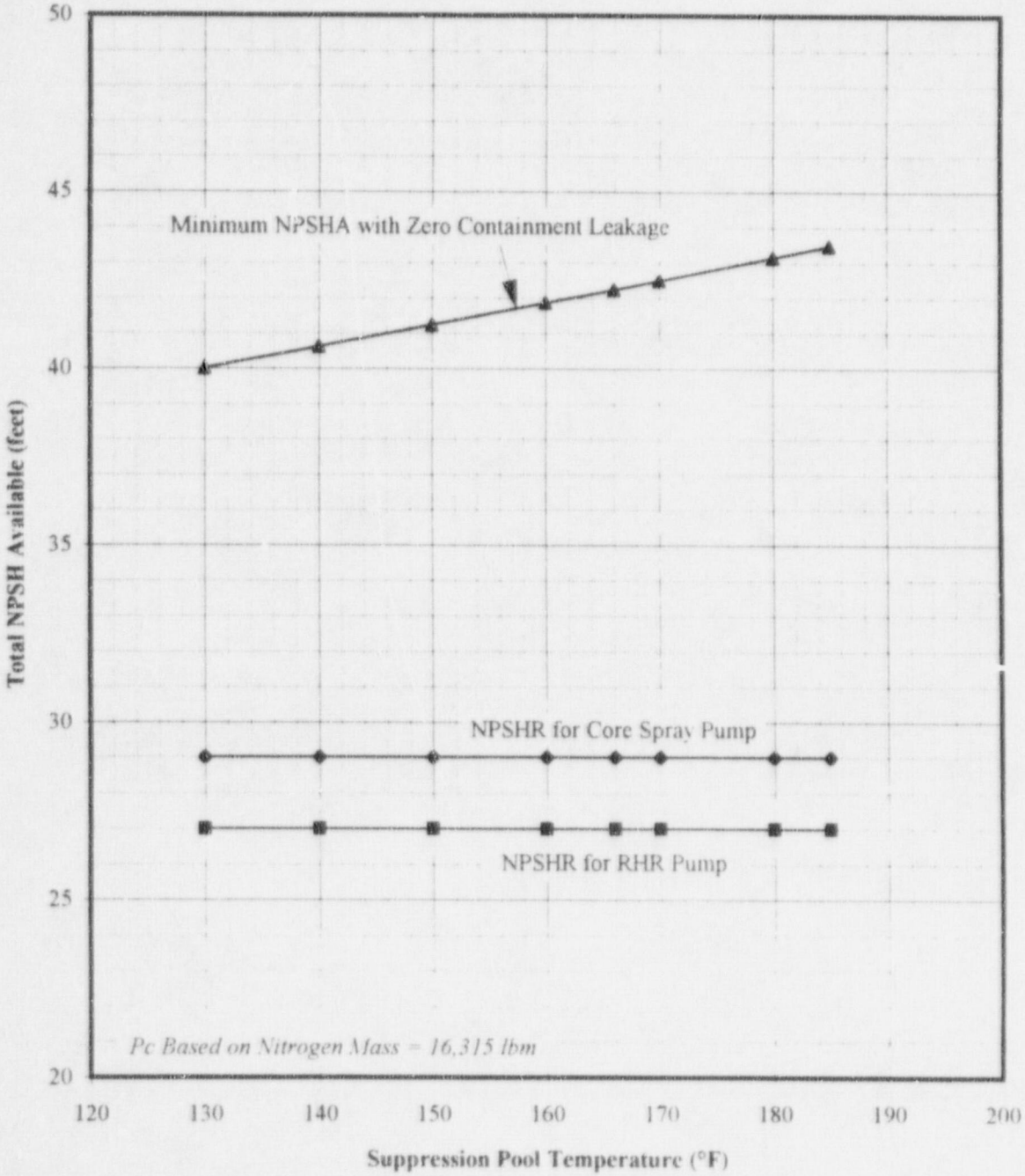


Figure 14.5-19 NPSH Margin for RHR and Core Spray Pumps After a DBA-LOCA

Figure 7



Initial Conditions:
Drywell 150°F, 80% RH, 1.3 psig, 132,000 ft^3
Wetwell 85°F, 100% RH, 0 psig, 124,500 ft^3

Figure 14.5-9 Total NPSH Available at Maximum Flow

Figure 8

Table 12 - Containment Pressure Available @ 1%/Day Leakage Rate - 65°F Seawater Temperature

	Lookup			Eq. 15	Eq. 16	Eq. 17		Eq. 18	Eq. 19
Time (seconds)	Tp (°F)	Tp (°R)	Pvp (psia)	m_{LEAK} (lbm/sec)	ω (n/a)	m_{GAS} (lbm/sec)	ΔT (sec)	Mt* (lbm)	P_c (psia)
	128.8	588.8	2.150					16,315	15.25
100	128.8	588.8	2.150	0.00052	0.102	0.00047	100	16,315	15.25
200	131.8	591.8	2.329	0.00052	0.102	0.00047	100	16,315	15.49
400	133.1	593.1	2.414	0.00061	0.110	0.00055	200	16,315	15.61
600	133.7	593.7	2.453	0.00065	0.114	0.00059	200	16,315	15.66
1000	135.9	595.9	2.598	0.00067	0.116	0.00060	400	16,314	15.85
2000	141.3	601.3	2.984	0.00073	0.122	0.00065	1000	16,314	16.36
4000	148.3	608.3	3.568	0.00085	0.139	0.00075	2000	16,312	17.10
6000	153.7	613.7	4.068	0.00099	0.164	0.00085	2000	16,311	17.71
10000	160.7	620.7	4.822	0.00109	0.185	0.00092	4000	16,307	18.62
14000	164.5	624.5	5.275	0.00120	0.217	0.00098	4000	16,303	19.16
16000	165.7	625.7	5.419	0.00125	0.236	0.00101	2000	16,301	19.32
20000	166.4	626.4	5.514	0.00126	0.242	0.00102	4000	16,297	19.43
24000	166.2	626.2	5.488	0.00127	0.246	0.00102	4000	16,293	19.40
30000	165.0	625.0	5.341	0.00127	0.245	0.00102	6000	16,287	19.22
35000	163.6	623.6	5.168	0.00126	0.239	0.00101	5000	16,282	19.01
40000	162.0	622.0	4.972	0.00124	0.232	0.00100	5000	16,277	18.77
60000	154.0	614.0	4.103	0.00121	0.224	0.00099	20000	16,257	17.71
80000	146.0	606.0	3.361	0.00109	0.188	0.00092	20000	16,238	16.78
100000	138.2	598.2	2.758	0.00094	0.156	0.00081	20000	16,222	15.99
120000	132.3	592.3	2.360	0.00077	0.130	0.00068	20000	16,209	15.45
140000	127.5	587.5	2.079	0.00060	0.112	0.00054	20000	16,198	15.05
150000	125.5	585.5	1.969	0.00042	0.100	0.00038	10000	16,194	14.90
160000	123.8	583.8	1.880	0.00031	0.095	0.00029	10000	16,191	14.77
180000	120.8	580.8	1.729	0.00018	0.091	0.00017	20000	16,188	14.70
190000	119.3	579.3	1.658	0.00000	0.083	0.00000	10000	16,188	14.70
200000	118.0	578.0	1.601	0.00000	0.079	0.00000	10000	16,188	14.70

Table 12 - Containment Pressure Available @ 1%/Day Leakage Rate - 65°F Seawater Temperature

	Lookup			Eq. 15	Eq. 16	Eq. 17		Eq. 18	Eq. 19
Time (seconds)	Tp (°F)	Tp (°R)	Pvp (psia)	m_{LEAK} (lbm/sec)	ω (n/a)	m_{GAS} (lbm/sec)	ΔT (sec)	Mt* (lbm)	P_C (psia)
210000	116.8	576.8	1.546	0.00000	0.076	0.00000	10000	16,188	14.70
220000	115.6	575.6	1.495	0.00000	0.073	0.00000	10000	16,188	14.70
230000	114.5	574.5	1.451	0.00000	0.070	0.00000	10000	16,188	14.70
240000	113.5	573.5	1.410	0.00000	0.068	0.00000	10000	16,188	14.70
250000	112.5	572.5	1.370	0.00000	0.066	0.00000	10000	16,188	14.70
260000	111.5	571.5	1.333	0.00000	0.064	0.00000	10000	16,188	14.70
270000	110.7	570.7	1.301	0.00000	0.062	0.00000	10000	16,188	14.70
280000	110.0	570.0	1.275	0.00000	0.060	0.00000	10000	16,188	14.70
290000	109.1	569.1	1.243	0.00000	0.059	0.00000	10000	16,188	14.70
300000	108.4	568.4	1.217	0.00000	0.057	0.00000	10000	16,188	14.70
310000	107.8	567.8	1.194	0.00000	0.056	0.00000	10000	16,188	14.70
320000	107.0	567.0	1.169	0.00000	0.055	0.00000	10000	16,188	14.70
330000	106.3	566.3	1.146	0.00000	0.054	0.00000	10000	16,188	14.70
340000	105.8	565.8	1.127	0.00000	0.053	0.00000	10000	16,188	14.70
350000	105.1	565.1	1.105	0.00000	0.052	0.00000	10000	16,188	14.70
360000	104.4	564.4	1.083	0.00000	0.051	0.00000	10000	16,188	14.70
380000	103.4	563.4	1.051	0.00000	0.049	0.00000	20000	16,188	14.70
400000	102.3	562.3	1.016	0.00000	0.048	0.00000	20000	16,188	14.70
500000	97.5	557.5	0.880	0.00000	0.046	0.00000	100000	16,188	14.70
600000	94.0	554.0	0.791	0.00000	0.040	0.00000	100000	16,188	14.70
700000	91.4	551.4	0.729	0.00000	0.035	0.00000	100000	16,188	14.70
800000	89.3	549.3	0.682	0.00000	0.032	0.00000	100000	16,188	14.70
900000	87.4	547.4	0.643	0.00000	0.030	0.00000	100000	16,188	14.70
920000	87.0	547.0	0.635	0.00000	0.028	0.00000	20000	16,188	14.70

Table 13 - Containment Pressure Available @ 5%/Day Leakage Rate - 65°F Seawater Temperature

	Lookup			Eq. 15	Eq. 16	Eq. 17		Eq. 18	Eq. 19
Time (seconds)	Tp (°F)	Tp (°R)	Pvp (psia)	m_{LEAK} (lbm/sec)	ω (n/a)	m_{GAS} (lbm/sec)	ΔT (sec)	Mt* (lbm)	P_C (psia)
	128.8	588.8	2.150					16,315	15.25
100	128.8	588.8	2.150	0.00258	0.102	0.00234	100	16,315	15.25
200	131.8	591.8	2.329	0.00258	0.102	0.00234	100	16,315	15.49
400	133.1	593.1	2.414	0.00307	0.110	0.00277	200	16,314	15.61
600	133.7	593.7	2.453	0.00327	0.114	0.00294	200	16,313	15.66
1000	135.9	595.9	2.598	0.00335	0.116	0.00301	400	16,312	15.85
2000	141.3	601.3	2.984	0.00364	0.122	0.00325	1000	16,309	16.35
4000	148.3	608.3	3.568	0.00427	0.139	0.00375	2000	16,301	17.09
6000	153.7	613.7	4.068	0.00497	0.164	0.00427	2000	16,293	17.70
10000	160.7	620.7	4.822	0.00543	0.186	0.00458	4000	16,275	18.59
14000	164.5	624.5	5.275	0.00597	0.218	0.00490	4000	16,255	19.11
16000	165.7	625.7	5.419	0.00623	0.237	0.00503	2000	16,245	19.27
20000	166.4	626.4	5.514	0.00630	0.243	0.00507	4000	16,225	19.37
24000	166.2	626.2	5.488	0.00634	0.248	0.00508	4000	16,204	19.32
30000	165.0	625.0	5.341	0.00632	0.247	0.00507	6000	16,174	19.12
35000	163.6	623.6	5.168	0.00623	0.241	0.00502	5000	16,149	18.90
40000	162.0	622.0	4.972	0.00612	0.234	0.00496	5000	16,124	18.65
60000	154.0	614.0	4.103	0.00599	0.226	0.00489	20000	16,026	17.52
80000	146.0	606.0	3.361	0.00530	0.190	0.00445	20000	15,937	16.53
100000	138.2	598.2	2.758	0.00445	0.159	0.00384	20000	15,860	15.69
120000	132.3	592.3	2.360	0.00341	0.133	0.00301	20000	15,800	15.12
140000	127.5	587.5	2.079	0.00227	0.115	0.00204	20000	15,759	14.70
150000	125.5	585.5	1.969	0.00014	0.102	0.00013	10000	15,758	14.70
160000	123.8	583.8	1.880	0.00000	0.096	0.00000	10000	15,758	14.70
180000	120.8	580.8	1.729	0.00000	0.091	0.00000	20000	15,758	14.70
190000	119.3	579.3	1.658	0.00000	0.083	0.00000	10000	15,758	14.70
200000	118.0	578.0	1.601	0.00000	0.079	0.00000	10000	15,758	14.70

Table 13 - Containment Pressure Available @ 5%/Day Leakage Rate - 65°F Seawater Temperature

	Lookup			Eq. 15	Eq. 16	Eq. 17		Eq. 18	Eq. 19
Time (seconds)	Tp (°F)	Tp (°R)	Pvp (psia)	m_{LEAK} (lbm/sec)	ω (n/a)	m_{GAS} (lbm/sec)	ΔT (sec)	Mt* (lbm)	P_C (psia)
210000	116.8	576.8	1.546	0.00000	0.076	0.00000	10000	15,758	14.70
220000	115.6	575.6	1.495	0.00000	0.073	0.00000	10000	15,758	14.70
230000	114.5	574.5	1.451	0.00000	0.070	0.00000	10000	15,758	14.70
240000	113.5	573.5	1.410	0.00000	0.068	0.00000	10000	15,758	14.70
250000	112.5	572.5	1.370	0.00000	0.066	0.00000	10000	15,758	14.70
260000	111.5	571.5	1.333	0.00000	0.064	0.00000	10000	15,758	14.70
270000	110.7	570.7	1.301	0.00000	0.062	0.00000	10000	15,758	14.70
280000	110.0	570.0	1.275	0.00000	0.060	0.00000	10000	15,758	14.70
290000	109.1	569.1	1.243	0.00000	0.059	0.00000	10000	15,758	14.70
300000	108.4	568.4	1.217	0.00000	0.057	0.00000	10000	15,758	14.70
310000	107.8	567.8	1.194	0.00000	0.056	0.00000	10000	15,758	14.70
320000	107.0	567.0	1.169	0.00000	0.055	0.00000	10000	15,758	14.70
330000	106.3	566.3	1.146	0.00000	0.054	0.00000	10000	15,758	14.70
340000	105.8	565.8	1.127	0.00000	0.053	0.00000	10000	15,758	14.70
350000	105.1	565.1	1.105	0.00000	0.052	0.00000	10000	15,758	14.70
360000	104.4	564.4	1.083	0.00000	0.051	0.00000	10000	15,758	14.70
380000	103.4	563.4	1.051	0.00000	0.049	0.00000	20000	15,758	14.70
400000	102.3	562.3	1.016	0.00000	0.048	0.00000	20000	15,758	14.70
500000	97.5	557.5	0.880	0.00000	0.046	0.00000	100000	15,758	14.70
600000	94.0	554.0	0.791	0.00000	0.040	0.00000	100000	15,758	14.70
700000	91.4	551.4	0.729	0.00000	0.035	0.00000	100000	15,758	14.70
800000	89.3	549.3	0.682	0.00000	0.032	0.00000	100000	15,758	14.70
900000	87.4	547.4	0.643	0.00000	0.030	0.00000	100000	15,758	14.70
920000	87.0	547.0	0.635	0.00000	0.028	0.00000	20000	15,758	14.70

Table 14 - RHR Pump with 1%/Day Leakage Rate - 65°F Seawater Temperature

		F14.5-10	Lookup	Lookup	Eq. 19	Eq. 21			Eq. 22	Eq. 23	Eq. 24
Time (secs)	Time (hours)	Tp (°F)	Density (lbm/ft^3)	Pvp (psia)	P_C (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	NPSHA (feet)	P_c Req'd for NPSHA of 27 feet (psia)	Margin (feet)
		Plotted on Fig 4			*Plotted on Fig 4*					*Plotted on Fig 4*	*Plotted on Fig 5*
100	0.03	128.8	61.57	2.150	15.25	30.63	12.5	3.20	39.9	9.72	12.9
200	0.06	131.8	61.52	2.329	15.49	30.81	12.5	3.20	40.1	9.89	13.1
400	0.11	133.1	61.50	2.414	15.61	30.89	12.5	3.20	40.2	9.97	13.2
600	0.17	133.7	61.49	2.453	15.66	30.93	12.5	3.20	40.2	10.01	13.2
1000	0.28	135.9	61.45	2.598	15.85	31.06	12.5	3.20	40.4	10.15	13.4
2000	0.56	141.3	61.35	2.984	16.36	31.39	12.5	3.20	40.7	10.53	13.7
4000	1.11	148.3	61.22	3.568	17.10	31.82	12.5	3.20	41.1	11.09	14.1
6000	1.67	153.7	61.12	4.068	17.71	32.15	12.5	3.20	41.4	11.58	14.4
10000	2.78	160.7	60.98	4.822	18.62	32.59	12.5	3.20	41.9	12.32	14.9
14000	3.89	164.5	60.90	5.275	19.16	32.82	12.5	3.20	42.1	12.76	15.1
16000	4.44	165.7	60.88	5.419	19.32	32.89	12.5	3.20	42.2	12.90	15.2
20000	5.56	166.4	60.86	5.514	19.43	32.93	12.5	3.20	42.2	13.00	15.2
24000	6.67	166.2	60.87	5.488	19.40	32.91	12.5	3.20	42.2	12.97	15.2
30000	8.33	165.0	60.89	5.341	19.22	32.82	12.5	3.20	42.1	12.83	15.1
35000	9.72	163.6	60.92	5.168	19.01	32.72	12.5	3.20	42.0	12.66	15.0
40000	11.11	162.0	60.95	4.972	18.77	32.61	12.5	3.20	41.9	12.46	14.9
60000	16.67	154.0	61.11	4.103	17.71	32.06	12.5	3.20	41.4	11.61	14.4
80000	22.22	146.0	61.27	3.361	16.78	31.53	12.5	3.20	40.8	10.89	13.8
100000	27.78	138.2	61.41	2.758	15.99	31.02	12.5	3.20	40.3	10.31	13.3
120000	33.33	132.3	61.51	2.360	15.45	30.64	12.5	3.20	39.9	9.92	12.9
140000	38.89	127.5	61.59	2.079	15.05	30.33	12.5	3.20	39.6	9.65	12.6

Table 14 - RHR Pump with 1%/Day Leakage Rate - 65°F Seawater Temperature

		F14.5-10	Lookup	Lookup	Eq. 19	Eq. 21			Eq. 22	Eq. 23	Eq. 24
Time (secs)	Time (hours)	Tp (°F)	Density (lbm/ft^3)	Pvp (psia)	P_c (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	NPSHA (feet)	P_c Req'd for NPSHA of 27 feet (psia)	Margin (feet)
150000	41.67	125.5	61.63	1.969	14.90	30.21	12.5	3.20	39.5	9.54	12.5
160000	44.44	123.8	61.65	1.880	14.77	30.10	12.5	3.20	39.4	9.46	12.4
180000	50.00	120.8	61.70	1.729	14.70	30.27	12.5	3.20	39.6	9.31	12.6
190000	52.78	119.3	61.72	1.658	14.70	30.43	12.5	3.20	39.7	9.25	12.7
200000	55.56	118.0	61.74	1.601	14.70	30.55	12.5	3.20	39.9	9.19	12.9
210000	58.33	116.8	61.76	1.546	14.70	30.67	12.5	3.20	40.0	9.14	13.0
220000	61.11	115.6	61.78	1.495	14.70	30.78	12.5	3.20	40.1	9.09	13.1
230000	63.89	114.5	61.80	1.451	14.70	30.87	12.5	3.20	40.2	9.05	13.2
240000	66.67	113.5	61.81	1.410	14.70	30.96	12.5	3.20	40.3	9.01	13.3
250000	69.44	112.5	61.82	1.370	14.70	31.05	12.5	3.20	40.3	8.97	13.3
260000	72.22	111.5	61.84	1.333	14.70	31.13	12.5	3.20	40.4	8.93	13.4
270000	75.00	110.7	61.85	1.301	14.70	31.20	12.5	3.20	40.5	8.90	13.5
280000	77.78	110.0	61.86	1.275	14.70	31.25	12.5	3.20	40.6	8.88	13.6
290000	80.56	109.1	61.87	1.243	14.70	31.32	12.5	3.20	40.6	8.85	13.6
300000	83.33	108.4	61.88	1.217	14.70	31.37	12.5	3.20	40.7	8.82	13.7
310000	86.11	107.8	61.89	1.194	14.70	31.42	12.5	3.20	40.7	8.80	13.7
320000	88.89	107.0	61.90	1.169	14.70	31.48	12.5	3.20	40.8	8.78	13.8
330000	91.67	106.3	61.91	1.146	14.70	31.53	12.5	3.20	40.8	8.76	13.8
340000	94.44	105.8	61.92	1.127	14.70	31.57	12.5	3.20	40.9	8.74	13.9
350000	97.22	105.1	61.93	1.105	14.70	31.61	12.5	3.20	40.9	8.72	13.9
360000	100.00	104.4	61.94	1.083	14.70	31.66	12.5	3.20	41.0	8.70	14.0
380000	105.56	103.4	61.95	1.051	14.70	31.73	12.5	3.20	41.0	8.67	14.0
400000	111.11	102.3	61.97	1.016	14.70	31.80	12.5	3.20	41.1	8.63	14.1

Table 14 - RHR Pump with 1%/Day Leakage Rate - 65°F Seawater Temperature

		F14.5-10	Lookup	Lookup	Eq. 19	Eq. 21			Eq. 22	Eq. 23	Eq. 24
Time (secs)	Time (hours)	Tp (°F)	Density (lbm/ft^3)	Pvp (psia)	P_C (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	NPSHA (feet)	P_c Req'd for NPSHA of 27 feet (psia)	Margin (feet)
500000	138.89	97.5	62.03	0.880	14.70	32.08	12.5	3.20	41.4	8.50	14.4
600000	166.67	94.0	62.07	0.791	14.70	32.27	12.5	3.20	41.6	8.42	14.6
700000	194.44	91.4	62.10	0.729	14.70	32.40	12.5	3.20	41.7	8.36	14.7
800000	222.22	89.3	62.12	0.682	14.70	32.49	12.5	3.20	41.8	8.32	14.8
900000	250.00	87.4	62.15	0.643	14.70	32.57	12.5	3.20	41.9	8.28	14.9
920000	255.56	87.0	62.15	0.635	14.70	32.59	12.5	3.20	41.9	8.27	14.9

Table 15 - Core Spray Pump with 1%/Day Leakage Rate - 65°F Seawater Temperature

		F14.5-10	Lookup	Lookup	Eq. 19	Eq. 21			Eq. 22	Eq. 23	Eq. 24
Time (secs)	Time (hours)	Tp (°F)	Density (lbm/ft^3)	Pvp (psia)	P_c (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	NPSHA (feet)	P_c Req'd for NPSHA of 29 feet (psia)	Margin (feet)
		Plotted on Fig 4			*Plotted on Fig 4*					*Plotted on Fig 4*	*Plotted on Fig 5*
100	0.03	128.8	61.57	2.150	15.25	30.63	12.5	2.38	40.7	10.22	11.7
200	0.06	131.8	61.52	2.329	15.49	30.81	12.5	2.38	40.9	10.40	11.9
400	0.11	133.1	61.50	2.414	15.61	30.89	12.5	2.38	41.0	10.48	12.0
600	0.17	133.7	61.49	2.453	15.66	30.93	12.5	2.38	41.0	10.51	12.0
1000	0.28	135.9	61.45	2.598	15.85	31.06	12.5	2.38	41.2	10.65	12.2
2000	0.56	141.3	61.35	2.984	16.36	31.39	12.5	2.38	41.5	11.03	12.5
4000	1.11	148.3	61.22	3.568	17.10	31.82	12.5	2.38	41.9	11.59	12.9
6000	1.67	153.7	61.12	4.068	17.71	32.15	12.5	2.38	42.3	12.08	13.3
10000	2.78	160.7	60.98	4.822	18.62	32.59	12.5	2.38	42.7	12.82	13.7
14000	3.89	164.5	60.90	5.275	19.16	32.82	12.5	2.38	42.9	13.26	13.9
16000	4.44	165.7	60.88	5.419	19.32	32.89	12.5	2.38	43.0	13.40	14.0
20000	5.56	166.4	60.86	5.514	19.43	32.93	12.5	2.38	43.0	13.49	14.0
24000	6.67	166.2	60.87	5.488	19.40	32.91	12.5	2.38	43.0	13.47	14.0
30000	8.33	165.0	60.89	5.341	19.22	32.82	12.5	2.38	42.9	13.32	13.9
35000	9.72	163.6	60.92	5.168	19.01	32.72	12.5	2.38	42.8	13.16	13.8
40000	11.11	162.0	60.95	4.972	18.77	32.61	12.5	2.38	42.7	12.96	13.7
60000	16.67	154.0	61.11	4.103	17.71	32.06	12.5	2.38	42.2	12.12	13.2
80000	22.22	146.0	61.27	3.361	16.78	31.53	12.5	2.38	41.6	11.39	12.6
100000	27.78	138.2	61.41	2.758	15.99	31.02	12.5	2.38	41.1	10.81	12.1
120000	33.33	132.3	61.51	2.360	15.45	30.64	12.5	2.38	40.8	10.43	11.8
140000	38.89	127.5	61.59	2.079	15.05	30.33	12.5	2.38	40.5	10.15	11.5

Table 15 - Core Spray Pump with 1%/Day Leakage Rate - 65°F Seawater Temperature

		F14.5-10	Lookup	Lookup	Eq. 19	Eq. 21			Eq. 22	Eq. 23	Eq. 24
Time (secs)	Time (hours)	Tp (°F)	Density (lbm/ft^3)	Pvp (psia)	P_C (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	NPSHA (feet)	P_c Req'd for NPSHA of 29 feet (psia)	Margin (feet)
150000	41.67	125.5	61.63	1.969	14.90	30.21	12.5	2.38	40.3	10.05	11.3
160000	44.44	123.8	61.65	1.880	14.77	30.10	12.5	2.38	40.2	9.96	11.2
180000	50.00	120.8	61.70	1.729	14.70	30.27	12.5	2.38	40.4	9.82	11.4
190000	52.78	119.3	61.72	1.658	14.70	30.43	12.5	2.38	40.5	9.75	11.5
200000	55.56	118.0	61.74	1.601	14.70	30.55	12.5	2.38	40.7	9.70	11.7
210000	58.33	116.8	61.76	1.546	14.70	30.67	12.5	2.38	40.8	9.64	11.8
220000	61.11	115.6	61.78	1.495	14.70	30.78	12.5	2.38	40.9	9.60	11.9
230000	63.89	114.5	61.80	1.451	14.70	30.87	12.5	2.38	41.0	9.55	12.0
240000	66.67	113.5	61.81	1.410	14.70	30.96	12.5	2.38	41.1	9.51	12.1
250000	69.44	112.5	61.82	1.370	14.70	31.05	12.5	2.38	41.2	9.48	12.2
260000	72.22	111.5	61.84	1.333	14.70	31.13	12.5	2.38	41.2	9.44	12.2
270000	75.00	110.7	61.85	1.301	14.70	31.20	12.5	2.38	41.3	9.41	12.3
280000	77.78	110.0	61.86	1.275	14.70	31.25	12.5	2.38	41.4	9.39	12.4
290000	80.56	109.1	61.87	1.243	14.70	31.32	12.5	2.38	41.4	9.36	12.4
300000	83.33	108.4	61.88	1.217	14.70	31.37	12.5	2.38	41.5	9.33	12.5
310000	86.11	107.8	61.89	1.194	14.70	31.42	12.5	2.38	41.5	9.31	12.5
320000	88.89	107.0	61.90	1.169	14.70	31.48	12.5	2.38	41.6	9.28	12.6
330000	91.67	106.3	61.91	1.146	14.70	31.53	12.5	2.38	41.6	9.26	12.6
340000	94.44	105.8	61.92	1.127	14.70	31.57	12.5	2.38	41.7	9.24	12.7
350000	97.22	105.1	61.93	1.105	14.70	31.61	12.5	2.38	41.7	9.22	12.7
360000	100.00	104.4	61.94	1.083	14.70	31.66	12.5	2.38	41.8	9.20	12.8
380000	105.56	103.4	61.95	1.051	14.70	31.73	12.5	2.38	41.8	9.17	12.8
400000	111.11	102.3	61.97	1.016	14.70	31.80	12.5	2.38	41.9	9.14	12.9

Table 15 - Core Spray Pump with 1%/Day Leakage Rate - 65°F Seawater Temperature

		F14.5-19	Lookup	Lookup	Eq. 19	Eq. 21			Eq. 22	Eq. 23	Eq. 24
Time (secs)	Time (hours)	Tp (°F)	Density (lbm/ft^3)	Pvp (psia)	P_C (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	NPSHA (feet)	P_c Req'd for NPSHA of 29 feet (psia)	Margin (feet)
500000	138.89	97.5	62.03	0.880	14.70	32.08	12.5	2.38	42.2	9.01	13.2
600000	166.67	94.0	62.07	0.791	14.70	32.27	12.5	2.38	42.4	8.93	13.4
700000	194.44	91.4	62.10	0.729	14.70	32.40	12.5	2.38	42.5	8.87	13.5
800000	222.22	89.3	62.12	0.682	14.70	32.49	12.5	2.38	42.6	8.83	13.6
900000	250.00	87.4	62.15	0.643	14.70	32.57	12.5	2.38	42.7	8.79	13.7
920000	255.56	87.0	62.15	0.635	14.70	32.59	12.5	2.38	42.7	8.78	13.7

Table 16 - RHR Pump with 5%/Day Leakage Rate - 65°F Seawater Temperature

		F14.5-10	Lookup	Lookup	Eq. 19	Eq. 21			Eq. 22	Eq. 23	Eq. 24
Time (secs)	Time (hours)	Tp (°F)	Density (lbm/ft³)	Pvp (psia)	P_c (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	NPSHA (feet)	P_c Req'd for NPSHA of 27 feet (psia)	Margin (feet)
		Plotted on Fig 4			*Plotted on Fig 4*					*Plotted on Fig 4*	*Plotted on Fig 5*
100	0.03	128.8	61.57	2.150	15.25	30.63	12.5	3.20	39.9	9.72	12.9
200	0.06	131.8	61.52	2.329	15.49	30.81	12.5	3.20	40.1	9.89	13.1
400	0.11	133.1	61.50	2.414	15.61	30.89	12.5	3.20	40.2	9.97	13.2
600	0.17	133.7	61.49	2.453	15.66	30.92	12.5	3.20	40.2	10.01	13.2
1000	0.28	135.9	61.45	2.598	15.85	31.05	12.5	3.20	40.4	10.15	13.4
2000	0.56	141.3	61.35	2.984	16.35	31.38	12.5	3.20	40.7	10.53	13.7
4000	1.11	148.3	61.22	3.568	17.09	31.80	12.5	3.20	41.1	11.09	14.1
6000	1.67	153.7	61.12	4.068	17.70	32.11	12.5	3.20	41.4	11.58	14.4
10000	2.78	160.7	60.98	4.822	18.59	32.52	12.5	3.20	41.8	12.32	14.8
14000	3.89	164.5	60.90	5.275	19.11	32.72	12.5	3.20	42.0	12.76	15.0
16000	4.44	165.7	60.88	5.419	19.27	32.77	12.5	3.20	42.1	12.90	15.1
20000	5.56	166.4	60.86	5.514	19.37	32.78	12.5	3.20	42.1	13.00	15.1
24000	6.67	166.2	60.87	5.488	19.32	32.73	12.5	3.20	42.0	12.97	15.0
30000	8.33	165.0	60.89	5.341	19.12	32.59	12.5	3.20	41.9	12.83	14.9
35000	9.72	163.6	60.92	5.168	18.90	32.45	12.5	3.20	41.8	12.66	14.8
40000	11.11	162.0	60.95	4.972	18.65	32.30	12.5	3.20	41.6	12.46	14.6
60000	16.67	154.0	61.11	4.103	17.52	31.61	12.5	3.20	40.9	11.61	13.9
80000	22.22	146.0	61.27	3.361	16.53	30.94	12.5	3.20	40.2	10.89	13.2
100000	27.78	138.2	61.41	2.758	15.69	30.33	12.5	3.20	39.6	10.31	12.6
120000	33.33	132.3	61.51	2.360	15.12	29.87	12.5	3.20	39.2	9.92	12.2
140000	38.89	127.5	61.59	2.079	14.70	29.51	12.5	3.20	38.8	9.65	11.8

Table 16 - RHR Pump with 5%/Day Leakage Rate - 65°F Seawater Temperature

		F14.5-10	Lookup	Lookup	Eq. 19	Eq. 21			Eq. 22	Eq. 23	Eq. 24
Time (secs)	Time (hours)	Tp (°F)	Density (lbm/ft^3)	Pvp (psia)	P_C (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	NPSHA (feet)	P_c Req'd for NPSHA of 27 feet (psia)	Margin (feet)
150000	41.67	125.5	61.63	1.969	14.70	29.75	12.5	3.20	39.0	9.54	12.0
160000	44.44	123.8	61.65	1.880	14.70	29.94	12.5	3.20	39.2	9.46	12.2
180000	50.00	120.8	61.70	1.729	14.70	30.27	12.5	3.20	39.6	9.31	12.6
190000	52.78	119.3	61.72	1.658	14.70	30.43	12.5	3.20	39.7	9.25	12.7
200000	55.56	118.0	61.74	1.601	14.70	30.55	12.5	3.20	39.9	9.19	12.9
210000	58.33	116.8	61.76	1.546	14.70	30.67	12.5	3.20	40.0	9.14	13.0
220000	61.11	115.6	61.78	1.495	14.70	30.78	12.5	3.20	40.1	9.09	13.1
230000	63.89	114.5	61.80	1.451	14.70	30.87	12.5	3.20	40.2	9.05	13.2
240000	66.67	113.5	61.81	1.410	14.70	30.96	12.5	3.20	40.3	9.01	13.3
250000	69.44	112.5	61.82	1.370	14.70	31.05	12.5	3.20	40.3	8.97	13.3
260000	72.22	111.5	61.84	1.333	14.70	31.13	12.5	3.20	40.4	8.93	13.4
270000	75.00	110.7	61.85	1.301	14.70	31.20	12.5	3.20	40.5	8.90	13.5
280000	77.78	110.0	61.86	1.275	14.70	31.25	12.5	3.20	40.6	8.88	13.6
290000	80.56	109.1	61.87	1.243	14.70	31.32	12.5	3.20	40.6	8.85	13.6
300000	83.33	108.4	61.88	1.217	14.70	31.37	12.5	3.20	40.7	8.82	13.7
310000	86.11	107.8	61.89	1.194	14.70	31.42	12.5	3.20	40.7	8.80	13.7
320000	88.89	107.0	61.90	1.169	14.70	31.48	12.5	3.20	40.8	8.78	13.8
330000	91.67	106.3	61.91	1.146	14.70	31.53	12.5	3.20	40.8	8.76	13.8
340000	94.44	105.8	61.92	1.127	14.70	31.57	12.5	3.20	40.9	8.74	13.9
350000	97.22	105.1	61.93	1.105	14.70	31.61	12.5	3.20	40.9	8.72	13.9
360000	100.00	104.4	61.94	1.083	14.70	31.66	12.5	3.20	41.0	8.70	14.0
380000	105.56	103.4	61.95	1.051	14.70	31.73	12.5	3.20	41.0	8.67	14.0
400000	111.11	102.3	61.97	1.016	14.70	31.80	12.5	3.20	41.1	8.63	14.1

Table 16 - RHR Pump with 5%/Day Leakage Rate - 65°F Seawater Temperature

		F14.5-10	Lookup	Lookup	Eq. 19	Eq. 21			Eq. 22	Eq. 23	Eq. 24
Time (secs)	Time (hours)	Tp (°F)	Density (lbm/ft^3)	Pvp (psia)	P_C (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	NPSHA (feet)	P_c Req'd for NPSHA of 27 feet (psia)	Margin (feet)
500000	138.89	97.5	62.03	0.880	14.70	32.08	12.5	3.20	41.4	8.50	14.4
600000	166.67	94.0	62.07	0.791	14.70	32.27	12.5	3.20	41.6	8.42	14.6
700000	194.44	91.4	62.10	0.729	14.70	32.40	12.5	3.20	41.7	8.36	14.7
800000	222.22	89.3	62.12	0.682	14.70	32.49	12.5	3.20	41.8	8.32	14.8
900000	250.00	87.4	62.15	0.643	14.70	32.57	12.5	3.20	41.9	8.28	14.9
920000	255.56	87.0	62.15	0.635	14.70	32.59	12.5	3.20	41.9	8.27	14.9

Table 17 - Core Spray Pump with 5%/Day Leakage Rate - 65°F Seawater Temperature

		F14.5-10	Lookup	Lookup	Eq. 19	Eq. 21			Eq. 22	Eq. 23	Eq. 24
Time (secs)	Time (hours)	Tp (°F)	Density (lbm/ft^3)	Pvp (psia)	P_c (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	NPSHA (feet)	P_c Req'd for NPSHA of 29 feet (psia)	Margin (feet)
		Plotted on Fig 4			*Plotted on Fig 4*					*Plotted on Fig 4*	*Plotted on Fig 5*
100	0.03	128.8	61.57	2.150	15.25	30.63	12.5	2.38	40.7	10.22	11.7
200	0.06	131.8	61.52	2.329	15.49	30.81	12.5	2.38	40.9	10.40	11.9
400	0.11	133.1	61.50	2.414	15.61	30.89	12.5	2.38	41.0	10.48	12.0
600	0.17	133.7	61.49	2.453	15.66	30.92	12.5	2.38	41.0	10.51	12.0
1000	0.28	135.9	61.45	2.598	15.85	31.05	12.5	2.38	41.2	10.65	12.2
2000	0.56	141.3	61.35	2.984	16.35	31.38	12.5	2.38	41.5	11.03	12.5
4000	1.11	148.3	61.22	3.568	17.09	31.80	12.5	2.38	41.9	11.59	12.9
6000	1.67	153.7	61.12	4.068	17.70	32.11	12.5	2.38	42.2	12.08	13.2
10000	2.78	160.7	60.98	4.822	18.59	32.52	12.5	2.38	42.6	12.82	13.6
14000	3.89	164.5	60.90	5.275	19.11	32.72	12.5	2.38	42.8	13.26	13.8
16000	4.44	165.7	60.88	5.419	19.27	32.77	12.5	2.38	42.9	13.40	13.9
20000	5.56	166.4	60.86	5.514	19.37	32.78	12.5	2.38	42.9	13.49	13.9
24000	6.67	166.2	60.87	5.488	19.32	32.73	12.5	2.38	42.8	13.47	13.8
30000	8.33	165.0	60.89	5.341	19.12	32.59	12.5	2.38	42.7	13.32	13.7
35000	9.72	163.6	60.92	5.168	18.90	32.45	12.5	2.38	42.6	13.16	13.6
40000	11.11	162.0	60.95	4.972	18.65	32.30	12.5	2.38	42.4	12.96	13.4
60000	16.67	154.0	61.11	4.103	17.52	31.61	12.5	2.38	41.7	12.12	12.7
80000	22.22	146.0	61.27	3.361	16.53	30.94	12.5	2.38	41.1	11.39	12.1
100000	27.78	138.2	61.41	2.758	15.69	30.33	12.5	2.38	40.5	10.81	11.5
120000	33.33	132.3	61.51	2.360	15.12	29.87	12.5	2.38	40.0	10.43	11.0
140000	38.89	127.5	61.59	2.079	14.70	29.51	12.5	2.38	39.6	10.15	10.6

Table 17 - Core Spray Pump with 5%/Day Leakage Rate - 65°F Seawater Temperature

		F14.5-10	Lookup	Lookup	Eq. 19	Eq. 21			Eq. 22	Eq. 23	Eq. 24
Time (secs)	Time (hours)	Tp (°F)	Density (lbm/ft^3)	Pvp (psia)	P_c (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	NPSHA (feet)	P_c Req'd for NPSHA of 29 feet (psia)	Margin (feet)
150000	41.67	125.5	61.63	1.969	14.70	29.75	12.5	2.38	39.9	10.05	10.9
160000	44.44	123.8	61.65	1.880	14.70	29.94	12.5	2.38	40.1	9.96	11.1
180000	50.00	120.8	61.70	1.729	14.70	30.27	12.5	2.38	40.4	9.82	11.4
190000	52.78	119.3	61.72	1.658	14.70	30.43	12.5	2.38	40.5	9.75	11.5
200000	55.56	118.0	61.74	1.601	14.70	30.55	12.5	2.38	40.7	9.70	11.7
210000	58.33	116.8	61.76	1.546	14.70	30.67	12.5	2.38	40.8	9.64	11.8
220000	61.11	115.6	61.78	1.495	14.70	30.78	12.5	2.38	40.9	9.60	11.9
230000	63.89	114.5	61.80	1.451	14.70	30.87	12.5	2.38	41.0	9.55	12.0
240000	66.67	113.5	61.81	1.410	14.70	30.96	12.5	2.38	41.1	9.51	12.1
250000	69.44	112.5	61.82	1.370	14.70	31.05	12.5	2.38	41.2	9.48	12.2
260000	72.22	111.5	61.83	1.333	14.70	31.13	12.5	2.38	41.2	9.44	12.2
270000	75.00	110.7	61.85	1.301	14.70	31.20	12.5	2.38	41.3	9.41	12.3
280000	77.78	110.0	61.86	1.275	14.70	31.25	12.5	2.38	41.4	9.39	12.4
290000	80.56	109.1	61.87	1.243	14.70	31.32	12.5	2.38	41.4	9.36	12.4
300000	83.33	108.4	61.88	1.217	14.70	31.37	12.5	2.38	41.5	9.33	12.5
310000	86.11	107.8	61.89	1.194	14.70	31.42	12.5	2.38	41.5	9.31	12.5
320000	88.89	107.0	61.90	1.169	14.70	31.48	12.5	2.38	41.6	9.28	12.6
330000	91.67	106.3	61.91	1.146	14.70	31.53	12.5	2.38	41.6	9.26	12.6
340000	94.44	105.8	61.92	1.127	14.70	31.57	12.5	2.38	41.7	9.24	12.7
350000	97.22	105.1	61.93	1.105	14.70	31.61	12.5	2.38	41.7	9.22	12.7
360000	100.00	104.4	61.94	1.083	14.70	31.66	12.5	2.38	41.8	9.20	12.8
380000	105.56	103.4	61.95	1.051	14.70	31.73	12.5	2.38	41.8	9.17	12.8
400000	111.11	102.3	61.97	1.016	14.70	31.80	12.5	2.38	41.9	9.14	12.9

Table 17 - Core Spray Pump with 5%/Day Leakage Rate - 65°F Seawater Temperature

		F14.5-10	Lookup	Lookup	Eq. 19	Eq. 21			Eq. 22	Eq. 23	Eq. 24
Time (secs)	Time (hours)	Tp (°F)	Density (lbm/ft^3)	Pvp (psia)	P_c (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	NPSHA (feet)	P_c Req'd for NPSHA of 29 feet (psia)	Margin (feet)
500000	138.89	97.5	62.03	0.880	14.70	32.08	12.5	2.38	42.2	9.01	13.2
600000	166.67	94.0	62.07	0.791	14.70	32.27	12.5	2.38	42.4	8.93	13.4
700000	194.44	91.4	62.10	0.729	14.70	32.40	12.5	2.38	42.5	8.87	13.5
800000	222.22	89.3	62.12	0.682	14.70	32.49	12.5	2.38	42.6	8.83	13.6
900000	250.00	87.4	62.15	0.643	14.70	32.57	12.5	2.38	42.7	8.79	13.7
920000	255.56	87.0	62.15	0.635	14.70	32.59	12.5	2.38	42.7	8.78	13.7

Table 18 - Containment Pressure Available @ 1%/Day Leakage Rate - 75°F Seawater Temperature

	Lookup			Eq. 15	Eq. 16	Eq. 17		Eq. 18	Eq. 19
Time (seconds)	Tp (°F)	Tp (°R)	Pvp (psia)	m_{LEAK} (lbm/sec)	ω (n/a)	m_{GAS} (lbm/sec)	ΔT (sec)	Mt* (lbm)	P_c (psia)
	130.0	590.0	2.223					16315	15.35
312	133.7	593.7	2.453	0.00056	0.105	0.00051	312	16315	15.66
557	139.5	599.5	2.853	0.00067	0.116	0.00060	245	16315	16.19
588	140.6	600.6	2.935	0.00082	0.133	0.00072	31	16315	16.29
619	141.3	601.3	2.988	0.00084	0.137	0.00074	31	16315	16.36
656	142.0	602.0	3.041	0.00086	0.139	0.00075	37	16315	16.43
969	147.8	607.8	3.521	0.00087	0.141	0.00076	313	16314	17.04
1,281	152.1	612.1	3.916	0.00099	0.162	0.00085	312	16314	17.53
1,594	155.3	615.3	4.235	0.00106	0.179	0.00090	313	16314	17.92
1,906	158.0	618.0	4.520	0.00111	0.192	0.00093	313	16314	18.26
2,219	160.1	620.1	4.753	0.00116	0.205	0.00096	313	16313	18.54
2,531	162.0	622.0	4.972	0.00119	0.214	0.00098	313	16313	18.81
2,844	163.7	623.7	5.176	0.00122	0.224	0.00099	313	16313	19.05
3,156	165.4	625.4	5.387	0.00124	0.232	0.00101	313	16312	19.30
3,469	166.9	626.9	5.579	0.00126	0.241	0.00102	313	16312	19.52
3,781	168.2	628.2	5.749	0.00128	0.249	0.00103	313	16312	19.72
4,094	169.4	629.4	5.912	0.00130	0.256	0.00103	313	16311	19.91
4,406	170.4	630.4	6.049	0.00131	0.263	0.00104	313	16311	20.07
4,719	171.3	631.3	6.175	0.00133	0.268	0.00105	313	16311	20.21
5,031	172.2	632.2	6.303	0.00134	0.274	0.00105	313	16310	20.36
5,344	173.0	633.0	6.420	0.00135	0.279	0.00105	313	16310	20.49
5,656	173.7	633.7	6.522	0.00136	0.284	0.00106	313	16310	20.61
5,969	174.4	634.4	6.626	0.00137	0.288	0.00106	313	16309	20.73
6,281	175.0	635.0	6.717	0.00137	0.292	0.00106	313	16309	20.84
6,594	175.7	635.7	6.823	0.00138	0.296	0.00107	313	16309	20.96
6,906	176.2	636.2	6.901	0.00139	0.300	0.00107	313	16308	21.05
7,157	176.7	636.7	6.979	0.00139	0.303	0.00107	251	16308	21.14

Table 18 - Containment Pressure Available @ 1%/Day Leakage Rate - 75°F Seawater Temperature

	Lookup			Eq. 15	Eq. 16	Eq. 17		Eq. 18	Eq. 19
Time (seconds)	Tp (°F)	Tp (°R)	Pvp (psia)	m_{LEAK} (lbm/sec)	ω (n/a)	m_{GAS} (lbm/sec)	ΔT (sec)	Mt* (lbm)	P_C (psia)
7,188	176.8	636.8	6.995	0.00140	0.307	0.00107	31	16308	21.15
9,033	178.8	638.8	7.315	0.00140	0.307	0.00107	1,845	16306	21.52
12,498	181.0	641.0	7.681	0.00142	0.320	0.00108	3,465	16302	21.93
15,848	182.0	642.0	7.850	0.00145	0.335	0.00108	3,350	16299	22.12
19,325	182.3	642.3	7.903	0.00146	0.342	0.00108	3,477	16295	22.17
22,924	182.2	642.2	7.885	0.00146	0.344	0.00108	3,599	16291	22.15
26,735	181.7	641.7	7.799	0.00146	0.344	0.00108	3,811	16287	22.05
30,495	181.0	641.0	7.681	0.00145	0.340	0.00108	3,760	16283	21.91
34,328	180.1	640.1	7.528	0.00144	0.336	0.00108	3,834	16279	21.73
38,118	179.0	639.0	7.348	0.00144	0.330	0.00108	3,790	16275	21.53
42,011	177.7	637.7	7.137	0.00142	0.322	0.00108	3,892	16270	21.28
45,918	176.3	636.3	6.916	0.00141	0.314	0.00107	3,907	16266	21.03
49,869	174.8	634.8	6.687	0.00139	0.305	0.00107	3,952	16262	20.76
53,881	173.3	633.3	6.463	0.00138	0.296	0.00106	4,012	16258	20.50
57,880	171.8	631.8	6.246	0.00136	0.286	0.00106	3,999	16254	20.25
61,998	170.3	630.3	6.035	0.00134	0.277	0.00105	4,118	16249	20.00
66,179	168.7	628.7	5.817	0.00132	0.269	0.00104	4,181	16245	19.74
70,369	167.2	627.2	5.618	0.00130	0.260	0.00103	4,191	16241	19.51
74,594	165.7	625.7	5.425	0.00128	0.252	0.00102	4,225	16236	19.27
78,915	164.2	624.2	5.237	0.00126	0.244	0.00101	4,321	16232	19.05
83,272	162.8	622.8	5.068	0.00124	0.236	0.00100	4,357	16227	18.85
87,590	161.4	621.4	4.903	0.00122	0.229	0.00099	4,318	16223	18.65
91,959	160.0	620.0	4.741	0.00120	0.222	0.00098	4,369	16219	18.45
96,315	158.7	618.7	4.597	0.00118	0.215	0.00097	4,355	16215	18.27
100,723	157.5	617.5	4.466	0.00116	0.209	0.00096	4,409	16210	18.11
105,128	156.3	616.3	4.339	0.00114	0.204	0.00095	4,405	16206	17.96
109,611	155.1	615.1	4.215	0.00112	0.198	0.00093	4,484	16202	17.80

Table 18 - Containment Pressure Available @ 1%/Day Leakage Rate - 75°F Seawater Temperature

	Lookup			Eq. 15	Eq. 16	Eq. 17		Eq. 18	Eq. 19
Time (seconds)	Tp (°F)	Tp (°R)	Pvp (psia)	m_{LEAK} (lbm/sec)	ω (n/a)	m_{GAS} (lbm/sec)	ΔT (sec)	Mt* (lbm)	P_C (psia)
114,124	154.0	614.0	4.103	0.00110	0.193	0.00092	4,512	16198	17.66
118,662	153.0	613.0	4.005	0.00108	0.188	0.00091	4,539	16194	17.54
123,306	151.9	611.9	3.897	0.00106	0.184	0.00090	4,644	16190	17.40
127,955	151.0	611.0	3.812	0.00104	0.179	0.00088	4,649	16186	17.29
132,637	150.0	610.0	3.718	0.00103	0.176	0.00087	4,682	16181	17.18
137,298	149.0	609.0	3.628	0.00101	0.172	0.00086	4,662	16177	17.06
141,980	148.1	608.1	3.547	0.00099	0.168	0.00085	4,682	16174	16.96
146,749	147.1	607.1	3.460	0.00097	0.165	0.00083	4,769	16170	16.84
151,545	146.2	606.2	3.383	0.00095	0.161	0.00082	4,796	16166	16.74
156,333	145.3	605.3	3.307	0.00093	0.157	0.00081	4,789	16162	16.64
161,157	144.5	604.5	3.241	0.00091	0.154	0.00079	4,823	16158	16.56
165,970	143.7	603.7	3.176	0.00090	0.151	0.00078	4,813	16154	16.47
170,814	142.9	602.9	3.112	0.00088	0.149	0.00077	4,844	16150	16.39
172,800	142.6	602.6	3.089	0.00086	0.146	0.00075	1,987	16149	16.36
176,400	142.2	602.2	3.054	0.00085	0.145	0.00075	3,600	16146	16.31
180,000	141.7	601.7	3.020	0.00084	0.143	0.00074	3,600	16144	16.26
183,600	141.3	601.3	2.987	0.00083	0.142	0.00073	3,600	16141	16.22
187,200	140.8	600.8	2.954	0.00082	0.140	0.00072	3,609	16138	16.17
190,800	140.4	600.4	2.921	0.00081	0.139	0.00071	3,600	16136	16.13
194,400	140.0	600.0	2.887	0.00080	0.138	0.00070	3,600	16133	16.08
198,000	139.5	599.5	2.856	0.00079	0.136	0.00070	3,600	16131	16.04
201,600	139.1	599.1	2.824	0.00078	0.135	0.00069	3,600	16128	16.00
205,200	138.7	598.7	2.792	0.00077	0.133	0.00068	3,600	16126	15.95
208,800	138.2	598.2	2.760	0.00076	0.132	0.00067	3,600	16123	15.91
212,400	137.8	597.8	2.729	0.00075	0.131	0.00066	3,600	16121	15.87
216,000	137.3	597.3	2.699	0.00073	0.129	0.00065	3,600	16119	15.83
219,600	136.9	596.9	2.668	0.00072	0.128	0.00064	3,600	16116	15.78

Table 18 - Containment Pressure Available @ 1%/Day Leakage Rate - 75°F Seawater Temperature

	Lookup			Eq. 15	Eq. 16	Eq. 17		Eq. 18	Eq. 19
Time (seconds)	Tp (°F)	Tp (°R)	Pvp (psia)	m_{LEAK} (lbm/sec)	ω (n/a)	m_{GAS} (lbm/sec)	ΔT (sec)	Mt* (lbm)	P_C (psia)
223,200	136.5	596.5	2.638	0.00071	0.127	0.00063	3,600	16114	15.74
226,800	136.0	596.0	2.607	0.00070	0.125	0.00062	3,600	16112	15.70
230,400	135.6	595.6	2.578	0.00068	0.124	0.00061	3,600	16110	15.66
234,000	135.2	595.2	2.549	0.00067	0.123	0.00060	3,600	16108	15.62
237,600	134.7	594.7	2.520	0.00066	0.121	0.00059	3,600	16106	15.58
241,200	134.3	594.3	2.491	0.00064	0.120	0.00058	3,600	16103	15.54
244,800	133.8	593.8	2.462	0.00063	0.119	0.00056	3,600	16101	15.50
248,400	133.4	593.4	2.434	0.00062	0.117	0.00055	3,600	16099	15.46
252,000	133.0	593.0	2.407	0.00060	0.116	0.00054	3,600	16097	15.42
255,600	132.5	592.5	2.379	0.00059	0.115	0.00053	3,600	16096	15.38
259,200	132.1	592.1	2.351	0.00057	0.114	0.00051	3,600	16094	15.34
262,800	131.9	591.9	2.337	0.00056	0.113	0.00050	3,600	16092	15.32
266,400	131.7	591.7	2.324	0.00055	0.112	0.00049	3,600	16090	15.30
270,000	131.5	591.5	2.311	0.00054	0.111	0.00049	3,600	16088	15.28
273,600	131.2	591.2	2.298	0.00053	0.111	0.00048	3,600	16087	15.26
277,200	131.0	591.0	2.285	0.00052	0.110	0.00047	3,600	16085	15.25
280,800	130.8	590.8	2.272	0.00052	0.110	0.00047	3,600	16083	15.23
284,400	130.6	590.6	2.258	0.00051	0.109	0.00046	3,600	16082	15.21
288,000	130.4	590.4	2.245	0.00050	0.108	0.00045	3,600	16080	15.19
291,600	130.2	590.2	2.232	0.00049	0.108	0.00044	3,600	16078	15.17
295,200	129.9	589.9	2.219	0.00048	0.107	0.00043	3,600	16077	15.15
298,800	129.7	589.7	2.207	0.00047	0.107	0.00043	3,600	16075	15.13
302,400	129.5	589.5	2.194	0.00046	0.106	0.00042	3,600	16074	15.11
306,000	129.3	589.3	2.181	0.00045	0.106	0.00041	3,600	16072	15.09
309,600	129.1	589.1	2.169	0.00044	0.105	0.00040	3,600	16071	15.08
313,200	128.9	588.9	2.156	0.00043	0.105	0.00039	3,600	16069	15.06
316,800	128.6	588.6	2.144	0.00042	0.104	0.00038	3,600	16068	15.04

Table 18 - Containment Pressure Available @ 1%/Day Leakage Rate - 75°F Seawater Temperature

	Lookup			Eq. 15	Eq. 16	Eq. 17		Eq. 18	Eq. 19
Time (seconds)	Tp (°F)	Tp (°R)	Pvp (psia)	m_{LEAK} (lbm/sec)	ω (n/a)	m_{GAS} (lbm/sec)	ΔT (sec)	Mt* (lbm)	P_C (psia)
320,400	128.4	588.4	2.131	0.00041	0.103	0.00037	3,600	16067	15.02
324,000	128.2	588.2	2.118	0.00040	0.103	0.00036	3,600	16065	15.00
327,600	128.0	588.0	2.106	0.00039	0.102	0.00035	3,600	16064	14.98
331,200	127.8	587.8	2.094	0.00038	0.102	0.00034	3,600	16063	14.97
334,800	127.6	587.6	2.082	0.00037	0.101	0.00033	3,600	16062	14.95
338,400	127.3	587.3	2.070	0.00035	0.101	0.00032	3,600	16061	14.93
342,000	127.1	587.1	2.058	0.00034	0.100	0.00031	3,600	16060	14.91
345,600	126.9	586.9	2.046	0.00033	0.100	0.00030	3,600	16058	14.89
349,200	126.7	586.7	2.036	0.00031	0.099	0.00029	3,600	16057	14.88
352,800	126.6	586.6	2.027	0.00030	0.099	0.00028	3,600	16056	14.87
356,400	126.4	586.4	2.017	0.00029	0.098	0.00026	3,600	16055	14.85
360,000	126.2	586.2	2.008	0.00028	0.098	0.00025	3,600	16055	14.84
363,600	126.0	586.0	1.998	0.00027	0.097	0.00024	3,600	16054	14.82
367,200	125.9	585.9	1.989	0.00025	0.097	0.00023	3,600	16053	14.81
370,800	125.7	585.7	1.980	0.00024	0.096	0.00022	3,600	16052	14.80
374,400	125.5	585.5	1.971	0.00022	0.096	0.00020	3,600	16051	14.78
378,000	125.4	585.4	1.962	0.00021	0.096	0.00019	3,600	16051	14.77
381,600	125.2	585.2	1.953	0.00019	0.095	0.00017	3,600	16050	14.76
385,200	125.0	585.0	1.944	0.00017	0.095	0.00016	3,600	16049	14.74
388,800	124.9	584.9	1.935	0.00015	0.094	0.00014	3,600	16049	14.73
392,400	124.7	584.7	1.926	0.00013	0.094	0.00012	3,600	16049	14.72
396,000	124.5	584.5	1.917	0.00010	0.094	0.00009	3,600	16048	14.71
399,600	124.3	584.3	1.908	0.00005	0.093	0.00005	3,600	16048	14.70
403,200	124.2	584.2	1.899	0.00000	0.093	0.00000	3,600	16048	14.70
406,800	124.0	584.0	1.890	0.00000	0.092	0.00000	3,600	16048	14.70
410,400	123.8	583.8	1.881	0.00000	0.092	0.00000	3,600	16048	14.70
414,000	123.7	583.7	1.873	0.00000	0.091	0.00000	3,600	16048	14.70

Table 18 - Containment Pressure Available @ 1%/Day Leakage Rate - 75°F Seawater Temperature

	Lookup			Eq. 15	Eq. 16	Eq. 17		Eq. 18	Eq. 19
Time (seconds)	Tp (°F)	Tp (°R)	Pvp (psia)	m_{LEAK} (lbm/sec)	ω (n/a)	m_{GAS} (lbm/sec)	ΔT (sec)	Mt* (lbm)	P_C (psia)
417,600	123.5	583.5	1.864	0.00000	0.091	0.00000	3,600	16048	14.70
421,200	123.3	583.3	1.855	0.00000	0.090	0.00000	3,600	16048	14.70
424,800	123.1	583.1	1.847	0.00000	0.090	0.00000	3,600	16048	14.70
428,400	123.0	583.0	1.838	0.00000	0.089	0.00000	3,600	16048	14.70
432,000	122.8	582.8	1.830	0.00000	0.089	0.00000	3,600	16048	14.70
518,400	120.2	580.2	1.702	0.00000	0.088	0.00000	86,400	16048	14.70
604,800	118.2	578.2	1.610	0.00000	0.081	0.00000	86,400	16048	14.70
691,200	116.2	576.2	1.522	0.00000	0.077	0.00000	86,400	16048	14.70
777,600	114.3	574.3	1.442	0.00000	0.072	0.00000	86,400	16048	14.70
864,000	112.3	572.3	1.362	0.00000	0.068	0.00000	86,400	16048	14.70

Table 19 - Containment Pressure Available @ 5%/Day Leakage Rate - 75°F Seawater Temperature

	Lookup			Eq. 15	Eq. 16	Eq. 17		Eq. 18	Eq. 19
Time (seconds)	Tp (°F)	Tp (°R)	Pvp (psia)	m_{LEAK} (lbm/sec)	ω (n/a)	m_{GAS} (lbm/sec)	ΔT (sec)	Mt* (lbm)	P_C (psia)
	130.0	590.0	2.223					16315	15.35
312	133.7	593.7	2.453	0.00280	0.105	0.00253	312	16314	15.66
557	139.5	599.5	2.853	0.00335	0.116	0.00301	245	16313	16.19
588	140.6	600.6	2.935	0.00408	0.133	0.00360	31	16313	16.29
619	141.3	601.3	2.988	0.00420	0.137	0.00370	31	16313	16.36
656	142.0	602.0	3.041	0.00428	0.139	0.00375	37	16313	16.43
969	147.8	607.8	3.521	0.00435	0.141	0.00381	313	16312	17.04
1,281	152.1	612.1	3.916	0.00492	0.162	0.00424	312	16311	17.53
1,594	155.3	615.3	4.235	0.00531	0.179	0.00450	313	16309	17.92
1,906	158.0	618.0	4.520	0.00557	0.193	0.00467	313	16308	18.26
2,219	160.1	620.1	4.753	0.00578	0.205	0.00480	313	16306	18.54
2,531	162.0	622.0	4.972	0.00594	0.214	0.00489	313	16305	18.80
2,844	163.7	623.7	5.176	0.00607	0.224	0.00496	313	16303	19.04
3,156	165.4	625.4	5.387	0.00619	0.232	0.00502	313	16302	19.29
3,469	166.9	626.9	5.579	0.00631	0.241	0.00508	313	16300	19.51
3,781	168.2	628.2	5.749	0.00641	0.249	0.00513	313	16298	19.71
4,094	169.4	629.4	5.912	0.00649	0.256	0.00517	313	16297	19.90
4,406	170.4	630.4	6.049	0.00656	0.263	0.00520	313	16295	20.05
4,719	171.3	631.3	6.175	0.00663	0.269	0.00522	313	16294	20.20
5,031	172.2	632.2	6.303	0.00668	0.274	0.00524	313	16292	20.34
5,344	173.0	633.0	6.420	0.00673	0.279	0.00526	313	16290	20.48
5,656	173.7	633.7	6.522	0.00678	0.284	0.00528	313	16289	20.59
5,969	174.4	634.4	6.626	0.00682	0.288	0.00530	313	16287	20.71
6,281	175.0	635.0	6.717	0.00686	0.293	0.00531	313	16285	20.82
6,594	175.7	635.7	6.823	0.00690	0.296	0.00532	313	16284	20.94
6,906	176.2	636.2	6.901	0.00694	0.301	0.00533	313	16282	21.02
7,157	176.7	636.7	6.979	0.00696	0.304	0.00534	251	16281	21.11

Table 19 - Containment Pressure Available @ 5%/Day Leakage Rate - 75°F Seawater Temperature

	Lookup			Eq. 15	Eq. 16	Eq. 17		Eq. 18	Eq. 19
Time (seconds)	Tp (°F)	Tp (°R)	Pvp (psia)	m_{LEAK} (lbm/sec)	ω (n/a)	m_{GAS} (lbm/sec)	ΔT (sec)	Mt* (lbm)	P_C (psia)
7,188	176.8	636.8	6.995	0.00699	0.307	0.00535	31	16280	21.13
9,033	178.8	638.8	7.315	0.00700	0.308	0.00535	1,845	16271	21.48
12,498	181.0	641.0	7.681	0.00710	0.321	0.00538	3,465	16252	21.88
15,848	182.0	642.0	7.850	0.00722	0.336	0.00540	3,350	16234	22.06
19,325	182.3	642.3	7.903	0.00726	0.344	0.00541	3,477	16215	22.10
22,924	182.2	642.2	7.885	0.00727	0.346	0.00540	3,599	16196	22.06
26,735	181.7	641.7	7.799	0.00726	0.346	0.00540	3,811	16175	21.95
30,495	181.0	641.0	7.681	0.00723	0.343	0.00539	3,760	16155	21.80
34,328	180.1	640.1	7.528	0.00719	0.338	0.00537	3,834	16134	21.61
38,118	179.0	639.0	7.348	0.00714	0.333	0.00536	3,790	16114	21.39
42,011	177.7	637.7	7.137	0.00708	0.326	0.00534	3,892	16093	21.13
45,918	176.3	636.3	6.916	0.00700	0.317	0.00531	3,907	16072	20.86
49,869	174.8	634.8	6.687	0.00691	0.309	0.00528	3,952	16051	20.58
53,881	173.3	633.3	6.463	0.00682	0.299	0.00525	4,012	16030	20.30
57,880	171.8	631.8	6.246	0.00672	0.290	0.00521	3,999	16010	20.04
61,998	170.3	630.3	6.035	0.00662	0.282	0.00516	4,118	15988	19.77
66,179	168.7	628.7	5.817	0.00652	0.273	0.00512	4,181	15967	19.50
70,369	167.2	627.2	5.618	0.00640	0.264	0.00506	4,191	15946	19.25
74,594	165.7	625.7	5.425	0.00629	0.256	0.00501	4,225	15925	19.01
78,915	164.2	624.2	5.237	0.00618	0.248	0.00495	4,321	15903	18.77
83,272	162.8	622.8	5.068	0.00606	0.241	0.00488	4,357	15882	18.55
87,590	161.4	621.4	4.903	0.00594	0.234	0.00482	4,318	15861	18.34
91,959	160.0	620.0	4.741	0.00582	0.227	0.00475	4,369	15840	18.13
96,315	158.7	618.7	4.597	0.00570	0.220	0.00467	4,355	15820	17.94
100,723	157.5	617.5	4.466	0.00558	0.214	0.00460	4,409	15800	17.77
105,128	156.3	616.3	4.339	0.00547	0.209	0.00453	4,405	15780	17.60
109,611	155.1	615.1	4.215	0.00535	0.204	0.00445	4,484	15760	17.43

Table 19 - Containment Pressure Available @ 5%/Day Leakage Rate - 75°F Seawater Temperature

	Lookup			Eq. 15	Eq. 16	Eq. 17		Eq. 18	Eq. 19
Time (seconds)	Tp (°F)	Tp (°R)	Pvp (psia)	m_{LEAK} (lbm/sec)	ω (n/a)	m_{GAS} (lbm/sec)	ΔT (sec)	Mt* (lbm)	P_C (psia)
114,124	154.0	614.0	4.103	0.00523	0.198	0.00437	4,512	15740	17.28
118,662	153.0	613.0	4.005	0.00512	0.194	0.00429	4,539	15721	17.14
123,306	151.9	611.9	3.897	0.00501	0.190	0.00421	4,644	15701	17.00
127,955	151.0	611.0	3.812	0.00489	0.185	0.00413	4,649	15682	16.88
132,637	150.0	610.0	3.718	0.00478	0.182	0.00405	4,682	15663	16.74
137,298	149.0	609.0	3.628	0.00466	0.178	0.00396	4,662	15645	16.62
141,980	148.1	608.1	3.547	0.00454	0.174	0.00387	4,682	15626	16.50
146,749	147.1	607.1	3.460	0.00443	0.170	0.00378	4,769	15608	16.38
151,545	146.2	606.2	3.383	0.00430	0.167	0.00368	4,796	15591	16.27
156,333	145.3	605.3	3.307	0.00417	0.163	0.00359	4,789	15574	16.16
161,157	144.5	604.5	3.241	0.00404	0.160	0.00349	4,823	15557	16.06
165,970	143.7	603.7	3.176	0.00393	0.157	0.00339	4,813	15540	15.97
170,814	142.9	602.9	3.112	0.00380	0.154	0.00329	4,844	15524	15.87
172,800	142.6	602.6	3.089	0.00367	0.152	0.00319	1,987	15518	15.84
176,400	142.2	602.2	3.054	0.00362	0.151	0.00315	3,600	15507	15.78
180,000	141.7	601.7	3.020	0.00355	0.149	0.00309	3,600	15496	15.73
183,600	141.3	601.3	2.987	0.00347	0.148	0.00302	3,600	15485	15.68
187,200	140.8	600.8	2.954	0.00339	0.146	0.00296	3,600	15474	15.63
190,800	140.4	600.4	2.921	0.00331	0.145	0.00289	3,600	15464	15.58
194,400	140.0	600.0	2.887	0.00322	0.144	0.00282	3,600	15454	15.53
198,000	139.5	599.5	2.856	0.00314	0.142	0.00275	3,600	15444	15.48
201,600	139.1	599.1	2.824	0.00305	0.141	0.00267	3,600	15434	15.43
205,200	138.7	598.7	2.792	0.00296	0.139	0.00260	3,600	15425	15.38
208,800	138.2	598.2	2.760	0.00287	0.138	0.00252	3,600	15416	15.33
212,400	137.8	597.8	2.729	0.00277	0.137	0.00244	3,600	15407	15.29
216,000	137.3	597.3	2.699	0.00267	0.135	0.00235	3,600	15398	15.24
219,600	136.9	596.9	2.668	0.00257	0.134	0.00226	3,600	15390	15.19

Table 19 - Containment Pressure Available @ 5%/Day Leakage Rate - 75°F Seawater Temperature

	Lookup			Eq. 15	Eq. 16	Eq. 17		Eq. 18	Eq. 19
Time (seconds)	Tp (°F)	Tp (°R)	Pvp (psia)	m_{LEAK} (lbm/sec)	ω (n/a)	m_{GAS} (lbm/sec)	ΔT (sec)	Mt* (lbm)	P_C (psia)
223,200	136.5	596.5	2.638	0.00246	0.133	0.00217	3,600	15382	15.15
226,800	136.0	596.0	2.607	0.00235	0.131	0.00208	3,600	15375	15.10
230,400	135.6	595.6	2.578	0.00223	0.130	0.00197	3,600	15368	15.06
234,000	135.2	595.2	2.549	0.00211	0.129	0.00187	3,600	15361	15.01
237,600	134.7	594.7	2.520	0.00198	0.127	0.00176	3,600	15355	14.97
241,200	134.3	594.3	2.491	0.00184	0.126	0.00163	3,600	15349	14.93
244,800	133.8	593.8	2.462	0.00169	0.125	0.00150	3,600	15343	14.88
248,400	133.4	593.4	2.434	0.00153	0.123	0.00136	3,600	15339	14.84
252,000	133.0	593.0	2.407	0.00135	0.122	0.00120	3,600	15334	14.80
255,600	132.5	592.5	2.379	0.00115	0.121	0.00102	3,600	15331	14.76
259,200	132.1	592.1	2.351	0.00090	0.119	0.00080	3,600	15328	14.72
262,800	131.9	591.9	2.337	0.00055	0.118	0.00049	3,600	15326	14.70
266,400	131.7	591.7	2.324	0.00023	0.118	0.00021	3,600	15325	14.70
270,000	131.5	591.5	2.311	0.00000	0.117	0.00000	3,600	15325	14.70
273,600	131.2	591.2	2.298	0.00000	0.116	0.00000	3,600	15325	14.70
277,200	131.0	591.0	2.285	0.00000	0.115	0.00000	3,600	15325	14.70
280,800	130.8	590.8	2.272	0.00000	0.114	0.00000	3,600	15325	14.70
284,400	130.6	590.6	2.258	0.00000	0.114	0.00000	3,600	15325	14.70
288,000	130.4	590.4	2.245	0.00000	0.113	0.00000	3,600	15325	14.70
291,600	130.2	590.2	2.232	0.00000	0.112	0.00000	3,600	15325	14.70
295,200	129.9	589.9	2.219	0.00000	0.111	0.00000	3,600	15325	14.70
298,800	129.7	589.7	2.207	0.00000	0.111	0.00000	3,600	15325	14.70
302,400	129.5	589.5	2.194	0.00000	0.110	0.00000	3,600	15325	14.70
306,000	129.3	589.3	2.181	0.00000	0.109	0.00000	3,600	15325	14.70
309,600	129.1	589.1	2.169	0.00000	0.108	0.00000	3,600	15325	14.70
313,200	128.9	588.9	2.156	0.00000	0.108	0.00000	3,600	15325	14.70
316,800	128.6	588.6	2.144	0.00000	0.107	0.00000	3,600	15325	14.70

Table 19 - Containment Pressure Available @ 5%/Day Leakage Rate - 75°F Seawater Temperature

	Lookup			Eq. 15	Eq. 16	Eq. 17		Eq. 18	Eq. 19
Time (seconds)	Tp (°F)	Tp (°R)	Pvp (psia)	m_{LEAK} (lbm/sec)	ω (n/a)	m_{GAS} (lbm/sec)	ΔT (sec)	Mt* (lbm)	P_C (psia)
320,400	128.4	588.4	2.131	0.00000	0.106	0.00000	3,600	15325	14.70
324,000	128.2	588.2	2.118	0.00000	0.105	0.00000	3,600	15325	14.70
327,600	128.0	588.0	2.106	0.00000	0.105	0.00000	3,600	15325	14.70
331,200	127.8	587.8	2.094	0.00000	0.104	0.00000	3,600	15325	14.70
334,800	127.6	587.6	2.082	0.00000	0.103	0.00000	3,600	15325	14.70
338,400	127.3	587.3	2.070	0.00000	0.103	0.00000	3,600	15325	14.70
342,000	127.1	587.1	2.058	0.00000	0.102	0.00000	3,600	15325	14.70
345,600	126.9	586.9	2.046	0.00000	0.101	0.00000	3,600	15325	14.70
349,200	126.7	586.7	2.036	0.00000	0.101	0.00000	3,600	15325	14.70
352,800	126.6	586.6	2.027	0.00000	0.100	0.00000	3,600	15325	14.70
356,400	126.4	586.4	2.017	0.00000	0.099	0.00000	3,600	15325	14.70
360,000	126.2	586.2	2.008	0.00000	0.099	0.00000	3,600	15325	14.70
363,600	126.0	586.0	1.998	0.00000	0.098	0.00000	3,600	15325	14.70
367,200	125.9	585.9	1.989	0.00000	0.098	0.00000	3,600	15325	14.70
370,800	125.7	585.7	1.980	0.00000	0.097	0.00000	3,600	15325	14.70
374,400	125.5	585.5	1.971	0.00000	0.097	0.00000	3,600	15325	14.70
378,000	125.4	585.4	1.962	0.00000	0.096	0.00000	3,600	15325	14.70
381,600	125.2	585.2	1.953	0.00000	0.096	0.00000	3,600	15325	14.70
385,200	125.0	585.0	1.944	0.00000	0.095	0.00000	3,600	15325	14.70
388,800	124.9	584.9	1.935	0.00000	0.095	0.00000	3,600	15325	14.70
392,400	124.7	584.7	1.926	0.00000	0.094	0.00000	3,600	15325	14.70
396,000	124.5	584.5	1.917	0.00000	0.094	0.00000	3,600	15325	14.70
399,600	124.3	584.3	1.908	0.00000	0.093	0.00000	3,600	15325	14.70
403,200	124.2	584.2	1.899	0.00000	0.093	0.00000	3,600	15325	14.70
406,800	124.0	584.0	1.890	0.00000	0.092	0.00000	3,600	15325	14.70
410,400	123.8	583.8	1.881	0.00000	0.092	0.00000	3,600	15325	14.70
414,000	123.7	583.7	1.873	0.00000	0.091	0.00000	3,600	15325	14.70

Table 19 - Containment Pressure Available @ 5%/Day Leakage Rate - 75°F Seawater Temperature

	Lookup			Eq. 15	Eq. 16	Eq. 17		Eq. 18	Eq. 19
Time (seconds)	Tp (°F)	Tp (°R)	Pvp (psia)	m_{LEAK} (lbm/sec)	ω (n/a)	m_{GAS} (lbm/sec)	ΔT (sec)	Mt* (lbm)	P_C (psia)
417,600	123.5	583.5	1.864	0.00000	0.091	0.00000	3,600	15325	14.70
421,200	123.3	583.3	1.855	0.00000	0.090	0.00000	3,600	15325	14.70
424,800	123.1	583.1	1.847	0.00000	0.090	0.00000	3,600	15325	14.70
428,400	123.0	583.0	1.838	0.00000	0.089	0.00000	3,600	15325	14.70
432,000	122.8	582.8	1.830	0.00000	0.089	0.00000	3,600	15325	14.70
518,400	120.2	580.2	1.702	0.00000	0.088	0.00000	86,400	15325	14.70
604,800	118.2	578.2	1.610	0.00000	0.081	0.00000	86,400	15325	14.70
691,200	116.2	576.2	1.522	0.00000	0.077	0.00000	86,400	15325	14.70
777,600	114.3	574.3	1.442	0.00000	0.072	0.00000	86,400	15325	14.70
864,000	112.3	572.3	1.362	0.00000	0.068	0.00000	86,400	15325	14.70

Table 20 - RHR Pump with 1%/Day Leakage Rate - 75°F Seawater Temperature

		F14.5-10	Lookup	Lookup	Eq. 19	Eq. 21			Eq. 22	Eq. 23	Eq. 24
Time (secs)	Time (hours)	Tp (°F)	Density (lbm/ft^3)	Pvp (psia)	P_C (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	NPSHA (feet)	P_C Req'd for NPSHA of 27 feet (psia)	Margin (feet)
		Plotted on Fig 6			*Plotted on Fig 6*					*Plotted on Fig 6*	*Plotted on Fig 7*
312	0.09	133.7	61.49	2.453	15.66	30.93	12.50	3.20	40.2	10.01	13.2
557	0.15	139.5	61.38	2.853	16.19	31.28	12.50	3.20	40.6	10.40	13.6
588	0.16	140.6	61.36	2.935	16.29	31.35	12.50	3.20	40.6	10.48	13.6
619	0.17	141.3	61.35	2.988	16.36	31.39	12.50	3.20	40.7	10.53	13.7
656	0.18	142.0	61.34	3.041	16.43	31.43	12.50	3.20	40.7	10.58	13.7
969	0.27	147.8	61.23	3.521	17.04	31.79	12.50	3.20	41.1	11.05	14.1
1,281	0.36	152.1	61.15	3.916	17.53	32.06	12.50	3.20	41.4	11.43	14.4
1,594	0.44	155.3	61.09	4.235	17.92	32.26	12.50	3.20	41.6	11.74	14.6
1,906	0.53	158.0	61.04	4.520	18.26	32.43	12.50	3.20	41.7	12.02	14.7
2,219	0.62	160.1	60.99	4.753	18.54	32.56	12.50	3.20	41.9	12.25	14.9
2,531	0.70	162.0	60.95	4.972	18.81	32.68	12.50	3.20	42.0	12.46	15.0
2,844	0.79	163.7	60.92	5.176	19.05	32.79	12.50	3.20	42.1	12.66	15.1
3,156	0.88	165.4	60.88	5.387	19.30	32.89	12.50	3.20	42.2	12.87	15.2
3,469	0.96	166.9	60.85	5.579	19.52	32.99	12.50	3.20	42.3	13.06	15.3
3,781	1.05	168.2	60.82	5.749	19.72	33.07	12.50	3.20	42.4	13.23	15.4
4,094	1.14	169.4	60.80	5.912	19.91	33.15	12.50	3.20	42.4	13.38	15.4
4,406	1.22	170.4	60.78	6.049	20.07	33.21	12.50	3.20	42.5	13.52	15.5
4,719	1.31	171.3	60.76	6.175	20.21	33.27	12.50	3.20	42.6	13.64	15.6
5,031	1.40	172.2	60.74	6.303	20.36	33.33	12.50	3.20	42.6	13.77	15.6
5,344	1.48	173.0	60.72	6.420	20.49	33.38	12.50	3.20	42.7	13.88	15.7
5,656	1.57	173.7	60.71	6.522	20.61	33.42	12.50	3.20	42.7	13.98	15.7
5,969	1.66	174.4	60.69	6.626	20.73	33.47	12.50	3.20	42.8	14.09	15.8

Table 20 - RHR Pump with 1%/Day Leakage Rate - 75°F Seawater Temperature

		F14.5-10	Lookup	Lookup	Eq. 19	Eq. 21			Eq. 22	Eq. 23	Eq. 24
Time (secs)	Time (hours)	Tp (°F)	Density (lbm/ft^3)	Pvp (psia)	P_C (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	NPSHA (feet)	P_C Req'd for NPSHA of 27 feet (psia)	Margin (feet)
6,281	1.74	175.0	60.68	6.717	20.84	33.51	12.50	3.20	42.8	14.18	15.8
6,594	1.83	175.7	60.66	6.823	20.96	33.55	12.50	3.20	42.9	14.28	15.9
6,906	1.92	176.2	60.65	6.901	21.05	33.58	12.50	3.20	42.9	14.36	15.9
7,157	1.99	176.7	60.64	6.979	21.14	33.61	12.50	3.20	42.9	14.43	15.9
7,188	2.00	176.8	60.64	6.995	21.15	33.62	12.50	3.20	42.9	14.45	15.9
9,033	2.51	178.8	60.60	7.315	21.52	33.75	12.50	3.20	43.0	14.76	16.0
12,498	3.47	181.0	60.55	7.681	21.95	33.88	12.50	3.20	43.2	15.12	16.2
15,848	4.40	182.0	60.53	7.850	22.12	33.94	12.50	3.20	43.2	15.29	16.2
19,325	5.37	182.3	60.52	7.903	22.17	33.95	12.50	3.20	43.3	15.34	16.3
22,924	6.37	182.2	60.52	7.885	22.15	33.94	12.50	3.20	43.2	15.32	16.2
26,735	7.43	181.7	60.53	7.799	22.05	33.90	12.50	3.20	43.2	15.24	16.2
30,495	8.47	181.0	60.55	7.681	21.91	33.84	12.50	3.20	43.1	15.12	16.1
34,328	9.54	180.1	60.57	7.528	21.73	33.77	12.50	3.20	43.1	14.97	16.1
38,118	10.59	179.0	60.59	7.348	21.53	33.69	12.50	3.20	43.0	14.80	16.0
42,011	11.67	177.7	60.62	7.137	21.28	33.60	12.50	3.20	42.9	14.59	15.9
45,918	12.75	176.3	60.65	6.916	21.03	33.50	12.50	3.20	42.8	14.37	15.8
49,869	13.85	174.8	60.68	6.687	20.76	33.40	12.50	3.20	42.7	14.15	15.7
53,881	14.97	173.3	60.72	6.463	20.50	33.29	12.50	3.20	42.6	13.93	15.6
57,880	16.08	171.8	60.75	6.246	20.25	33.19	12.50	3.20	42.5	13.71	15.5
61,998	17.22	170.3	60.78	6.035	20.00	33.08	12.50	3.20	42.4	13.51	15.4
66,179	18.38	168.7	60.81	5.817	19.74	32.97	12.50	3.20	42.3	13.29	15.3
70,369	19.55	167.2	60.85	5.618	19.51	32.87	12.50	3.20	42.2	13.10	15.2
74,594	20.72	165.7	60.88	5.425	19.27	32.76	12.50	3.20	42.1	12.91	15.1
78,915	21.92	164.2	60.91	5.237	19.05	32.66	12.50	3.20	42.0	12.72	15.0
83,272	23.13	162.8	60.94	5.068	18.85	32.56	12.50	3.20	41.9	12.56	14.9

Table 20 - RHR Pump with 1%/Day Leakage Rate - 75°F Seawater Temperature

		F14.5-10	Lookup	Lookup	Eq. 19	Eq. 21			Eq. 22	Eq. 23	Eq. 24
Time (secs)	Time (hours)	Tp (°F)	Density (lbm/ft^3)	Pvp (psia)	P_C (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	NPSHA (feet)	P_C Req'd for NPSHA of 27 feet (psia)	Margin (feet)
87,590	24.33	161.4	60.97	4.903	18.65	32.46	12.50	3.20	41.8	12.40	14.8
91,959	25.54	160.0	60.99	4.741	18.45	32.37	12.50	3.20	41.7	12.24	14.7
96,315	26.75	158.7	61.02	4.597	18.27	32.28	12.50	3.20	41.6	12.10	14.6
100,723	27.98	157.5	61.04	4.466	18.11	32.19	12.50	3.20	41.5	11.97	14.5
105,128	29.20	156.3	61.07	4.339	17.96	32.11	12.50	3.20	41.4	11.84	14.4
109,611	30.45	155.1	61.09	4.215	17.80	32.03	12.50	3.20	41.3	11.72	14.3
114,124	31.70	154.0	61.11	4.103	17.66	31.95	12.50	3.20	41.2	11.61	14.2
118,662	32.96	153.0	61.13	4.005	17.54	31.88	12.50	3.20	41.2	11.52	14.2
123,306	34.25	151.9	61.15	3.897	17.40	31.80	12.50	3.20	41.1	11.41	14.1
127,955	35.54	151.0	61.17	3.812	17.29	31.74	12.50	3.20	41.0	11.33	14.0
132,637	36.84	150.0	61.19	3.718	17.18	31.67	12.50	3.20	41.0	11.24	14.0
137,298	38.14	149.0	61.21	3.628	17.06	31.60	12.50	3.20	40.9	11.15	13.9
141,980	39.44	148.1	61.23	3.547	16.96	31.53	12.50	3.20	40.8	11.07	13.8
146,749	40.76	147.1	61.25	3.460	16.84	31.47	12.50	3.20	40.8	10.99	13.8
151,545	42.10	146.2	61.26	3.383	16.74	31.40	12.50	3.20	40.7	10.91	13.7
156,333	43.43	145.3	61.28	3.307	16.64	31.34	12.50	3.20	40.6	10.84	13.6
161,157	44.77	144.5	61.30	3.241	16.56	31.28	12.50	3.20	40.6	10.78	13.6
165,970	46.10	143.7	61.31	3.176	16.47	31.23	12.50	3.20	40.5	10.71	13.5
170,814	47.45	142.9	61.32	3.112	16.39	31.17	12.50	3.20	40.5	10.65	13.5
172,800	48.00	142.6	61.33	3.089	16.36	31.15	12.50	3.20	40.5	10.63	13.5
176,400	49.00	142.2	61.34	3.054	16.31	31.12	12.50	3.20	40.4	10.59	13.4
180,000	50.00	141.7	61.34	3.020	16.26	31.09	12.50	3.20	40.4	10.56	13.4
183,600	51.00	141.3	61.35	2.987	16.22	31.06	12.50	3.20	40.4	10.53	13.4
187,200	52.00	140.8	61.36	2.954	16.17	31.02	12.50	3.20	40.3	10.50	13.3
190,800	53.00	140.4	61.37	2.921	16.13	30.99	12.50	3.20	40.3	10.46	13.3

Table 20 - RHR Pump with 1%/Day Leakage Rate - 75°F Seawater Temperature

		F14.5-10	Lookup	Lookup	Eq. 19	Eq. 21			Eq. 22	Eq. 23	Eq. 24
Time (secs)	Time (hours)	Tp (°F)	Density (lbm/ft^3)	Pvp (psia)	P_C (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	NPSHA (feet)	P_C Req'd for NPSHA of 27 feet (psia)	Margin (feet)
194,400	54.00	140.0	61.38	2.887	16.08	30.96	12.50	3.20	40.3	10.43	13.3
198,000	55.00	139.5	61.38	2.856	16.04	30.93	12.50	3.20	40.2	10.40	13.2
201,600	56.00	139.1	61.39	2.824	16.00	30.90	12.50	3.20	40.2	10.37	13.2
205,200	57.00	138.7	61.40	2.792	15.95	30.87	12.50	3.20	40.2	10.34	13.2
208,800	58.00	138.2	61.41	2.760	15.91	30.84	12.50	3.20	40.1	10.31	13.1
212,400	59.00	137.8	61.41	2.729	15.87	30.81	12.50	3.20	40.1	10.28	13.1
216,000	60.00	137.3	61.42	2.699	15.83	30.77	12.50	3.20	40.1	10.25	13.1
219,600	61.00	136.9	61.43	2.668	15.78	30.74	12.50	3.20	40.0	10.22	13.0
223,200	62.00	136.5	61.44	2.638	15.74	30.71	12.50	3.20	40.0	10.19	13.0
226,800	63.00	136.0	61.45	2.607	15.70	30.68	12.50	3.20	40.0	10.16	13.0
230,400	64.00	135.6	61.45	2.578	15.66	30.65	12.50	3.20	40.0	10.13	13.0
234,000	65.00	135.2	61.46	2.549	15.62	30.62	12.50	3.20	39.9	10.10	12.9
237,600	66.00	134.7	61.47	2.520	15.58	30.59	12.50	3.20	39.9	10.08	12.9
241,200	67.00	134.3	61.48	2.491	15.54	30.56	12.50	3.20	39.9	10.05	12.9
244,800	68.00	133.8	61.48	2.462	15.50	30.53	12.50	3.20	39.8	10.02	12.8
248,400	69.00	133.4	61.49	2.434	15.46	30.50	12.50	3.20	39.8	9.99	12.8
252,000	70.00	133.0	61.50	2.407	15.42	30.47	12.50	3.20	39.8	9.97	12.8
255,600	71.00	132.5	61.51	2.379	15.38	30.44	12.50	3.20	39.7	9.94	12.7
259,200	72.00	132.1	61.51	2.351	15.34	30.41	12.50	3.20	39.7	9.91	12.7
262,800	73.00	131.9	61.52	2.337	15.32	30.39	12.50	3.20	39.7	9.90	12.7
266,400	74.00	131.7	61.52	2.324	15.30	30.38	12.50	3.20	39.7	9.89	12.7
270,000	75.00	131.5	61.53	2.311	15.28	30.36	12.50	3.20	39.7	9.87	12.7
273,600	76.00	131.2	61.53	2.298	15.26	30.35	12.50	3.20	39.6	9.86	12.6
277,200	77.00	131.0	61.53	2.285	15.25	30.33	12.50	3.20	39.6	9.85	12.6
280,800	78.00	130.8	61.54	2.272	15.23	30.31	12.50	3.20	39.6	9.84	12.6

Table 20 - RHR Pump with 1%/Day Leakage Rate - 75°F Seawater Temperature

		F14.5-10	Lookup	Lookup	Eq. 19	Eq. 21			Eq. 22	Eq. 23	Eq. 24
Time (secs)	Time (hours)	Tp (°F)	Density (lbm/ft^3)	Pvp (psia)	P_C (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	NPSHA (feet)	P_C Req'd for NPSHA of 27 feet (psia)	Margin (feet)
284,400	79.00	130.6	61.54	2.258	15.21	30.30	12.50	3.20	39.6	9.82	12.6
288,000	80.00	130.4	61.54	2.245	15.19	30.28	12.50	3.20	39.6	9.81	12.6
291,600	81.00	130.2	61.55	2.232	15.17	30.27	12.50	3.20	39.6	9.80	12.6
295,200	82.00	129.9	61.55	2.219	15.15	30.25	12.50	3.20	39.6	9.78	12.6
298,800	83.00	129.7	61.55	2.207	15.13	30.23	12.50	3.20	39.5	9.77	12.5
302,400	84.00	129.5	61.56	2.194	15.11	30.22	12.50	3.20	39.5	9.76	12.5
306,000	85.00	129.3	61.56	2.181	15.09	30.20	12.50	3.20	39.5	9.75	12.5
309,600	86.00	129.1	61.57	2.169	15.08	30.19	12.50	3.20	39.5	9.74	12.5
313,200	87.00	128.9	61.57	2.156	15.06	30.17	12.50	3.20	39.5	9.72	12.5
316,800	88.00	128.6	61.57	2.144	15.04	30.16	12.50	3.20	39.5	9.71	12.5
320,400	89.00	128.4	61.58	2.131	15.02	30.14	12.50	3.20	39.4	9.70	12.4
324,000	90.00	128.2	61.58	2.118	15.00	30.13	12.50	3.20	39.4	9.69	12.4
327,600	91.00	128.0	61.58	2.106	14.98	30.11	12.50	3.20	39.4	9.68	12.4
331,200	92.00	127.8	61.59	2.094	14.97	30.09	12.50	3.20	39.4	9.66	12.4
334,800	93.00	127.6	61.59	2.082	14.95	30.08	12.50	3.20	39.4	9.65	12.4
338,400	94.00	127.3	61.60	2.070	14.93	30.06	12.50	3.20	39.4	9.64	12.4
342,000	95.00	127.1	61.60	2.058	14.91	30.05	12.50	3.20	39.3	9.63	12.3
345,600	96.00	126.9	61.60	2.046	14.89	30.03	12.50	3.20	39.3	9.62	12.3
349,200	97.00	126.7	61.61	2.036	14.88	30.02	12.50	3.20	39.3	9.61	12.3
352,800	98.00	126.6	61.61	2.027	14.87	30.01	12.50	3.20	39.3	9.60	12.3
356,400	99.00	126.4	61.61	2.017	14.85	30.00	12.50	3.20	39.3	9.59	12.3
360,000	100.00	126.2	61.61	2.008	14.84	29.99	12.50	3.20	39.3	9.58	12.3
363,600	101.00	126.0	61.62	1.998	14.82	29.98	12.50	3.20	39.3	9.57	12.3
367,200	102.00	125.9	61.62	1.989	14.81	29.96	12.50	3.20	39.3	9.56	12.3
370,800	103.00	125.7	61.62	1.980	14.80	29.95	12.50	3.20	39.3	9.55	12.3

Table 20 - RHR Pump with 1%/Day Leakage Rate - 75°F Seawater Temperature

		F14.5-10	Lookup	Lookup	Eq. 19	Eq. 21			Eq. 22	Eq. 23	Eq. 24
Time (secs)	Time (hours)	Tp (°F)	Density (lbm/ft^3)	Pvp (psia)	P_C (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	NPSHA (feet)	P_C Req'd for NPSHA of 27 feet (psia)	Margin (feet)
374,400	104.00	125.5	61.63	1.971	14.78	29.94	12.50	3.20	39.2	9.55	12.2
378,000	105.00	125.4	61.63	1.962	14.77	29.93	12.50	3.20	39.2	9.54	12.2
381,600	106.00	125.2	61.63	1.953	14.76	29.92	12.50	3.20	39.2	9.53	12.2
385,200	107.00	125.0	61.63	1.944	14.74	29.91	12.50	3.20	39.2	9.52	12.2
388,800	108.00	124.9	61.64	1.935	14.73	29.90	12.50	3.20	39.2	9.51	12.2
392,400	109.00	124.7	61.64	1.926	14.72	29.89	12.50	3.20	39.2	9.50	12.2
396,000	110.00	124.5	61.64	1.917	14.71	29.87	12.50	3.20	39.2	9.49	12.2
399,600	111.00	124.3	61.64	1.908	14.70	29.88	12.50	3.20	39.2	9.48	12.2
403,200	112.00	124.2	61.65	1.899	14.70	29.90	12.50	3.20	39.2	9.48	12.2
406,800	113.00	124.0	61.65	1.890	14.70	29.92	12.50	3.20	39.2	9.47	12.2
410,400	114.00	123.8	61.65	1.881	14.70	29.94	12.50	3.20	39.2	9.46	12.2
414,000	115.00	123.7	61.65	1.873	14.70	29.96	12.50	3.20	39.3	9.45	12.3
417,600	116.00	123.5	61.66	1.864	14.70	29.98	12.50	3.20	39.3	9.44	12.3
421,200	117.00	123.3	61.66	1.855	14.70	30.00	12.50	3.20	39.3	9.43	12.3
424,800	118.00	123.1	61.66	1.847	14.70	30.02	12.50	3.20	39.3	9.43	12.3
428,400	119.00	123.0	61.66	1.838	14.70	30.04	12.50	3.20	39.3	9.42	12.3
432,000	120.00	122.8	61.67	1.830	14.70	30.05	12.50	3.20	39.4	9.41	12.4
518,400	144.00	120.2	61.71	1.702	14.70	30.33	12.50	3.20	39.6	9.29	12.6
604,800	168.00	118.2	61.74	1.610	14.70	30.53	12.50	3.20	39.8	9.20	12.8
691,200	192.00	116.2	61.77	1.522	14.70	30.72	12.50	3.20	40.0	9.11	13.0
777,600	216.00	114.3	61.80	1.442	14.70	30.89	12.50	3.20	40.2	9.04	13.2
864,000	240.00	112.3	61.83	1.362	14.70	31.06	12.50	3.20	40.4	8.96	13.4

Table 21 - Core Spray Pump with 1%/Day Leakage Rate - 75°F Seawater Temperature

		F14.5-10	Lookup	Lookup	Eq. 19	Eq. 21			Eq. 22	Eq. 23	Eq. 24
Time (secs)	Time (hours)	Tp (°F)	Density (lbm/ft^3)	Pvp (psia)	P_c (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	NPSHA (feet)	P_c Req'd for NPSHA of 29 feet (psia)	Margin (feet)
		Plotted on Fig 6			*Plotted on Fig 6*					*Plotted on Fig 6*	*Plotted on Fig 7*
312	0.09	133.7	61.49	2.453	15.66	30.93	12.50	2.38	41.0	10.51	12.0
557	0.15	139.5	61.38	2.853	16.19	31.28	12.50	2.38	41.4	10.90	12.4
588	0.16	140.6	61.36	2.935	16.29	31.35	12.50	2.38	41.5	10.98	12.5
619	0.17	141.3	61.35	2.988	16.36	31.39	12.50	2.38	41.5	11.03	12.5
656	0.18	142.0	61.34	3.041	16.43	31.43	12.50	2.38	41.6	11.08	12.6
969	0.27	147.8	61.23	3.521	17.04	31.79	12.50	2.38	41.9	11.55	12.9
1,281	0.36	152.1	61.15	3.916	17.53	32.06	12.50	2.38	42.2	11.93	13.2
1,594	0.44	155.3	61.09	4.235	17.92	32.26	12.50	2.38	42.4	12.24	13.4
1,906	0.53	158.0	61.04	4.520	18.26	32.43	12.50	2.38	42.5	12.52	13.5
2,219	0.62	160.1	60.99	4.753	18.54	32.56	12.50	2.38	42.7	12.75	13.7
2,531	0.70	162.0	60.95	4.972	18.81	32.68	12.50	2.38	42.8	12.96	13.8
2,844	0.79	163.7	60.92	5.176	19.05	32.79	12.50	2.38	42.9	13.16	13.9
3,156	0.88	165.4	60.88	5.387	19.30	32.89	12.50	2.38	43.0	13.37	14.0
3,469	0.96	166.9	60.85	5.579	19.52	32.99	12.50	2.38	43.1	13.56	14.1
3,781	1.05	168.2	60.82	5.749	19.72	33.07	12.50	2.38	43.2	13.72	14.2
4,094	1.14	169.4	60.80	5.912	19.91	33.15	12.50	2.38	43.3	13.88	14.3
4,406	1.22	170.4	60.78	6.049	20.07	33.21	12.50	2.38	43.3	14.02	14.3
4,719	1.31	171.3	60.76	6.175	20.21	33.27	12.50	2.38	43.4	14.14	14.4
5,031	1.40	172.2	60.74	6.303	20.36	33.33	12.50	2.38	43.4	14.27	14.4
5,344	1.48	173.0	60.72	6.420	20.49	33.38	12.50	2.38	43.5	14.38	14.5
5,656	1.57	173.7	60.71	6.522	20.61	33.42	12.50	2.38	43.5	14.48	14.5
5,969	1.66	174.4	60.69	6.626	20.73	33.47	12.50	2.38	43.6	14.58	14.6

Table 21 - Core Spray Pump with 1%/Day Leakage Rate - 75°F Seawater Temperature

		F14.5-10	Lookup	Lookup	Eq. 19	Eq. 21			Eq. 22	Eq. 23	Eq. 24
Time (secs)	Time (hours)	Tp (°F)	Density (lbm/ft^3)	Pvp (psia)	P_C (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	NPSHA (feet)	P_C Req'd for NPSHA of 29 feet (psia)	Margin (feet)
6.281	1.74	175.0	60.68	6.717	20.84	33.51	12.50	2.38	43.6	14.67	14.6
6.594	1.83	175.7	60.66	6.823	20.96	33.55	12.50	2.38	43.7	14.78	14.7
6.906	1.92	176.2	60.65	6.901	21.05	33.58	12.50	2.38	43.7	14.85	14.7
7.157	1.99	176.7	60.64	6.979	21.14	33.61	12.50	2.38	43.7	14.93	14.7
7.188	2.00	176.8	60.64	6.995	21.15	33.62	12.50	2.38	43.7	14.95	14.7
9.033	2.51	178.8	60.60	7.315	21.52	33.75	12.50	2.38	43.9	15.26	14.9
12.498	3.47	181.0	60.55	7.681	21.93	33.88	12.50	2.38	44.0	15.62	15.0
15.848	4.40	182.0	60.53	7.850	22.12	33.94	12.50	2.38	44.1	15.79	15.1
19.325	5.37	182.3	60.52	7.903	22.17	33.95	12.50	2.38	44.1	15.84	15.1
22.924	6.37	182.2	60.52	7.885	22.15	33.94	12.50	2.38	44.1	15.82	15.1
26.735	7.43	181.7	60.53	7.799	22.05	33.90	12.50	2.38	44.0	15.74	15.0
30.495	8.47	181.0	60.55	7.681	21.91	33.84	12.50	2.38	44.0	15.62	15.0
34.328	9.54	180.1	60.57	7.528	21.73	33.77	12.50	2.38	43.9	15.47	14.9
38.118	10.59	179.0	60.59	7.348	21.53	33.69	12.50	2.38	43.8	15.29	14.8
42.011	11.67	177.7	60.62	7.137	21.28	33.60	12.50	2.38	43.7	15.08	14.7
45.918	12.75	176.3	60.65	6.910	21.03	33.50	12.50	2.38	43.6	14.87	14.6
49.869	13.85	174.8	60.68	6.687	20.76	33.40	12.50	2.38	43.5	14.64	14.5
53.881	14.97	173.3	60.72	6.463	20.50	33.29	12.50	2.38	43.4	14.42	14.4
57.880	16.08	171.8	60.75	6.246	20.25	33.19	12.50	2.38	43.3	14.21	14.3
61.998	17.22	170.3	60.78	6.035	20.00	33.08	12.50	2.38	43.2	14.00	14.2
66.179	18.38	168.7	60.81	5.817	19.74	32.97	12.50	2.38	43.1	13.79	14.1
70.369	19.55	167.2	60.85	5.618	19.51	32.87	12.50	2.38	43.0	13.60	14.0
74.594	20.72	165.7	60.88	5.425	19.27	32.76	12.50	2.38	42.9	13.41	13.9
78.915	21.92	164.2	60.91	5.237	19.05	32.66	12.50	2.38	42.8	13.22	13.8
83.272	23.13	162.8	60.94	5.068	18.85	32.56	12.50	2.38	42.7	13.06	13.7

Table 21 - Core Spray Pump with 1%/Day Leakage Rate - 75°F Seawater Temperature

		F14.5-10	Lookup	Lookup	Eq. 19	Eq. 21			Eq. 22	Eq. 23	Eq. 24
Time (secs)	Time (hours)	Tp (°F)	Density (lbm/ft^3)	Pvp (psia)	P_C (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	NPSHA (feet)	P_C Req'd for NPSHA of 29 feet (psia)	Margin (feet)
87,590	24.33	161.4	60.97	4.903	18.65	32.46	12.50	2.38	42.6	12.90	13.6
91,959	25.54	160.0	60.99	4.741	18.45	32.37	12.50	2.38	42.5	12.74	13.5
96,315	26.75	158.7	61.02	4.597	18.27	32.28	12.50	2.38	42.4	12.60	13.4
100,723	27.98	157.5	61.04	4.466	18.11	32.19	12.50	2.38	42.3	12.47	13.3
105,128	29.20	156.3	61.07	4.339	17.96	32.11	12.50	2.38	42.2	12.35	13.2
109,611	30.45	155.1	61.09	4.215	17.80	32.03	12.50	2.38	42.1	12.22	13.1
114,124	31.70	154.0	61.11	4.103	17.66	31.95	12.50	2.38	42.1	12.12	13.1
118,662	32.96	153.0	61.13	4.005	17.54	31.88	12.50	2.38	42.0	12.02	13.0
123,306	34.25	151.9	61.15	3.897	17.40	31.80	12.50	2.38	41.9	11.91	12.9
127,955	35.54	151.0	61.17	3.812	17.29	31.74	12.50	2.38	41.9	11.83	12.9
132,637	36.84	150.0	61.19	3.718	17.18	31.67	12.50	2.38	41.8	11.74	12.8
137,298	38.14	149.0	61.21	3.628	17.06	31.60	12.50	2.38	41.7	11.65	12.7
141,980	39.44	148.1	61.23	3.547	16.96	31.53	12.50	2.38	41.7	11.57	12.7
146,749	40.76	147.1	61.25	3.460	16.84	31.47	12.50	2.38	41.6	11.49	12.6
151,545	42.10	146.2	61.26	3.383	16.74	31.40	12.50	2.38	41.5	11.41	12.5
156,333	43.43	145.3	61.28	3.307	16.64	31.34	12.50	2.38	41.5	11.34	12.5
161,157	44.77	144.5	61.30	3.241	16.56	31.28	12.50	2.38	41.4	11.28	12.4
165,970	46.10	143.7	61.31	3.176	16.47	31.23	12.50	2.38	41.3	11.21	12.3
170,814	47.45	142.9	61.32	3.112	16.39	31.17	12.50	2.38	41.3	11.15	12.3
172,800	48.00	142.6	61.33	3.089	16.36	31.15	12.50	2.38	41.3	11.13	12.3
176,400	49.00	142.2	61.34	3.054	16.31	31.12	12.50	2.38	41.2	11.10	12.2
180,000	50.00	141.7	61.34	3.020	16.26	31.09	12.50	2.38	41.2	11.06	12.2
183,600	51.00	141.3	61.35	2.987	16.22	31.06	12.50	2.38	41.2	11.03	12.2
187,200	52.00	140.8	61.36	2.954	16.17	31.02	12.50	2.38	41.1	11.00	12.1
190,800	53.00	140.4	61.37	2.921	16.13	30.99	12.50	2.38	41.1	10.97	12.1

Table 21 - Core Spray Pump with 1%/Day Leakage Rate - 75°F Seawater Temperature

		F14.5-10	Lookup	Lookup	Eq. 19	Eq. 21			Eq. 22	Eq. 23	Eq. 24
Time (secs)	Time (hours)	Tp (°F)	Density (lbm/ft^3)	Pvp (psia)	P_C (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	NPSHA (feet)	P_C Req'd for NPSHA of 29 feet (psia)	Margin (feet)
194,400	54.00	140.0	61.38	2.887	16.08	30.96	12.50	2.38	41.1	10.93	12.1
198,000	55.00	139.5	61.38	2.856	16.04	30.93	12.50	2.38	41.0	10.90	12.0
201,600	56.00	139.1	61.39	2.824	16.00	30.90	12.50	2.38	41.0	10.87	12.0
205,200	57.00	138.7	61.40	2.792	15.95	30.87	12.50	2.38	41.0	10.84	12.0
208,800	58.00	138.2	61.41	2.760	15.91	30.84	12.50	2.38	41.0	10.81	12.0
212,400	59.00	137.8	61.41	2.729	15.87	30.81	12.50	2.38	40.9	10.78	11.9
216,000	60.00	137.3	61.42	2.699	15.83	30.77	12.50	2.38	40.9	10.75	11.9
219,600	61.00	136.9	61.43	2.668	15.78	30.74	12.50	2.38	40.9	10.72	11.9
223,200	62.00	136.5	61.44	2.638	15.74	30.71	12.50	2.38	40.8	10.69	11.8
226,800	63.00	136.0	61.45	2.607	15.70	30.68	12.50	2.38	40.8	10.66	11.8
230,400	64.00	135.6	61.45	2.578	15.66	30.65	12.50	2.38	40.8	10.64	11.8
234,000	65.00	135.2	61.46	2.549	15.62	30.62	12.50	2.38	40.7	10.61	11.7
237,600	66.00	134.7	61.47	2.520	15.58	30.59	12.50	2.38	40.7	10.58	11.7
241,200	67.00	134.3	61.48	2.491	15.54	30.56	12.50	2.38	40.7	10.55	11.7
244,800	68.00	133.8	61.48	2.462	15.50	30.53	12.50	2.38	40.7	10.52	11.7
248,400	69.00	133.4	61.49	2.434	15.46	30.50	12.50	2.38	40.6	10.50	11.6
252,000	70.00	133.0	61.50	2.407	15.42	30.47	12.50	2.38	40.5	10.47	11.6
255,600	71.00	132.5	61.51	2.379	15.38	30.44	12.50	2.38	40.6	10.44	11.6
259,200	72.00	132.1	61.51	2.351	15.34	30.41	12.50	2.38	40.5	10.42	11.5
262,800	73.00	131.9	61.52	2.337	15.32	30.39	12.50	2.38	40.5	10.40	11.5
266,400	74.00	131.7	61.52	2.324	15.30	30.38	12.50	2.38	40.5	10.39	11.5
270,000	75.00	131.5	61.53	2.311	15.28	30.36	12.50	2.38	40.5	10.38	11.5
273,600	76.00	131.2	61.53	2.298	15.26	30.35	12.50	2.38	40.5	10.37	11.5
277,200	77.00	131.0	61.53	2.285	15.25	30.33	12.50	2.38	40.4	10.35	11.4
280,800	78.00	130.8	61.54	2.272	15.23	30.31	12.50	2.38	40.4	10.34	11.4

Table 21 - Core Spray Pump with 1%/Day Leakage Rate - 75°F Seawater Temperature

		F14.5-10	Lookup	Lookup	Eq. 19	Eq. 21			Eq. 22	Eq. 23	Eq. 24
Time (secs)	Time (hours)	Tp (°F)	Density (lbm/ft^3)	Pvp (psia)	P_C (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	NPSHA (feet)	P_C Req'd for NPSHA of 29 feet (psia)	Margin (feet)
284,400	79.00	130.6	61.54	2.258	15.21	30.30	12.50	2.38	40.4	10.33	11.4
288,000	80.00	130.4	61.54	2.245	15.19	30.28	12.50	2.38	40.4	10.31	11.4
291,600	81.00	130.2	61.55	2.232	15.17	30.27	12.50	2.38	40.4	10.30	11.4
295,200	82.00	129.9	61.55	2.219	15.15	30.25	12.50	2.38	40.4	10.29	11.4
298,800	83.00	129.7	61.55	2.207	15.13	30.23	12.50	2.38	40.4	10.28	11.4
302,400	84.00	129.5	61.56	2.194	15.11	30.22	12.50	2.38	40.3	10.26	11.3
306,000	85.00	129.3	61.56	2.181	15.09	30.20	12.50	2.38	40.3	10.25	11.3
309,600	86.00	129.1	61.57	2.169	15.08	30.19	12.50	2.38	40.3	10.24	11.3
313,200	87.00	128.9	61.57	2.156	15.06	30.17	12.50	2.38	40.3	10.23	11.3
316,800	88.00	128.6	61.57	2.144	15.04	30.16	12.50	2.38	40.3	10.22	11.3
320,400	89.00	128.4	61.58	2.131	15.02	30.14	12.50	2.38	40.3	10.20	11.3
324,000	90.00	128.2	61.58	2.118	15.00	30.13	12.50	2.38	40.2	10.19	11.2
327,600	91.00	128.0	61.58	2.106	14.98	30.11	12.50	2.38	40.2	10.18	11.2
331,200	92.00	127.8	61.59	2.094	14.97	30.09	12.50	2.38	40.2	10.17	11.2
334,800	93.00	127.6	61.59	2.082	14.95	30.08	12.50	2.38	40.2	10.16	11.2
338,400	94.00	127.3	61.60	2.070	14.93	30.06	12.50	2.38	40.2	10.15	11.2
342,000	95.00	127.1	61.60	2.058	14.91	30.05	12.50	2.38	40.2	10.13	11.2
345,600	96.00	126.9	61.60	2.046	14.89	30.03	12.50	2.38	40.2	10.12	11.2
349,200	97.00	126.7	61.61	2.036	14.88	30.02	12.50	2.38	40.1	10.11	11.1
352,800	98.00	126.6	61.61	2.027	14.87	30.01	12.50	2.38	40.1	10.10	11.1
356,400	99.00	126.4	61.61	2.017	14.85	30.00	12.50	2.38	40.1	10.10	11.1
360,000	100.00	126.2	61.61	2.008	14.84	29.99	12.50	2.38	40.1	10.09	11.1
363,600	101.00	126.0	61.62	1.998	14.82	29.98	12.50	2.38	40.1	10.08	11.1
367,200	102.00	125.9	61.62	1.989	14.81	29.96	12.50	2.38	40.1	10.07	11.1
370,800	103.00	125.7	61.62	1.980	14.80	29.95	12.50	2.38	40.1	10.06	11.1

Table 21 - Core Spray Pump with 1%/Day Leakage Rate - 75°F Seawater Temperature

		F14.5-10	Lookup	Lookup	Eq. 19	Eq. 21			Eq. 22	Eq. 23	Eq. 24
Time (secs)	Time (hours)	Tp (°F)	Density (lbm/ft^3)	Pvp (psia)	P_C (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	NPSHA (feet)	P_C Req'd for NPSHA of 29 feet (psia)	Margin (feet)
374,400	104.00	125.5	61.63	1.971	14.78	29.94	12.50	2.38	40.1	10.05	11.1
378,000	105.00	125.4	61.63	1.962	14.77	29.93	12.50	2.38	40.0	10.04	11.0
381,600	106.00	125.2	61.63	1.953	14.76	29.92	12.50	2.38	40.0	10.03	11.0
385,200	107.00	125.0	61.63	1.944	14.74	29.91	12.50	2.38	40.0	10.02	11.0
388,800	108.00	124.9	61.64	1.935	14.73	29.90	12.50	2.38	40.0	10.02	11.0
392,400	109.00	124.7	61.64	1.926	14.72	29.89	12.50	2.38	40.0	10.01	11.0
396,000	110.00	124.5	61.64	1.917	14.71	29.87	12.50	2.38	40.0	10.00	11.0
399,600	111.00	124.3	61.64	1.908	14.70	29.88	12.50	2.38	40.0	9.99	11.0
403,200	112.00	124.2	61.65	1.899	14.70	29.90	12.50	2.38	40.0	9.98	11.0
406,800	113.00	124.0	61.65	1.890	14.70	29.92	12.50	2.38	40.0	9.97	11.0
410,400	114.00	123.8	61.65	1.881	14.70	29.94	12.50	2.38	40.1	9.96	11.1
414,000	115.00	123.7	61.65	1.873	14.70	29.96	12.50	2.38	40.1	9.96	11.1
417,600	116.00	123.5	61.66	1.864	14.70	29.98	12.50	2.38	40.1	9.95	11.1
421,200	117.00	123.3	61.66	1.855	14.70	30.00	12.50	2.38	40.1	9.94	11.1
424,800	118.00	123.1	61.66	1.847	14.70	30.02	12.50	2.38	40.1	9.93	11.1
428,400	119.00	123.0	61.66	1.838	14.70	30.04	12.50	2.38	40.2	9.92	11.2
432,000	120.00	122.8	61.67	1.830	14.70	30.05	12.50	2.38	40.2	9.91	11.2
518,400	144.00	120.2	61.71	1.702	14.70	30.33	12.50	2.38	40.5	9.79	11.5
604,800	168.00	118.2	61.74	1.610	14.70	30.53	12.50	2.38	40.7	9.70	11.7
691,200	192.00	116.2	61.77	1.522	14.70	30.72	12.50	2.38	40.8	9.62	11.8
777,600	216.00	114.3	61.80	1.442	14.70	30.89	12.50	2.38	41.0	9.55	12.0
864,000	240.00	112.3	61.83	1.362	14.70	31.06	12.50	2.38	41.2	9.47	12.2

Table 22 - RHR Pump with 5%/Day Leakage Rate - 75°F Seawater Temperature

		F14.5-10	Lookup	Lookup	Eq. 19	Eq. 21			Eq. 22	Eq. 23	Eq. 24
Time (secs)	Time (hours)	Tp (°F)	Density (lbm/ft^3)	Pvp (psia)	P_c (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	NPSHA (feet)	P_c Req'd for NPSHA of 27 feet (psia)	Margin (feet)
		Plotted on Fig 6			*Plotted on Fig 6*					*Plotted on Fig 6*	*Plotted on Fig 7*
312	0.09	133.7	61.49	2.453	15.66	30.92	12.50	3.20	40.2	10.01	13.2
557	0.15	139.5	61.38	2.853	16.19	31.28	12.50	3.20	40.6	10.40	13.6
588	0.16	140.6	61.36	2.935	16.29	31.34	12.50	3.20	40.6	10.48	13.6
619	0.17	141.3	61.35	2.988	16.36	31.39	12.50	3.20	40.7	10.53	13.7
656	0.18	142.0	61.34	3.041	16.43	31.43	12.50	3.20	40.7	10.58	13.7
969	0.27	147.8	61.23	3.521	17.04	31.79	12.50	3.20	41.1	11.05	14.1
1,281	0.36	152.1	61.15	3.916	17.53	32.05	12.50	3.20	41.4	11.43	14.4
1,594	0.44	155.3	61.09	4.235	17.92	32.25	12.50	3.20	41.5	11.74	14.5
1,906	0.53	158.0	61.04	4.520	18.26	32.42	12.50	3.20	41.7	12.02	14.7
2,219	0.62	160.1	60.99	4.753	18.54	32.55	12.50	3.20	41.8	12.25	14.8
2,531	0.70	162.0	60.95	4.972	18.80	32.66	12.50	3.20	42.0	12.46	15.0
2,844	0.79	163.7	60.92	5.176	19.04	32.77	12.50	3.20	42.1	12.66	15.1
3,156	0.88	165.4	60.88	5.387	19.29	32.87	12.50	3.20	42.2	12.87	15.2
3,469	0.96	166.9	60.85	5.579	19.51	32.97	12.50	3.20	42.3	13.06	15.3
3,781	1.05	168.2	60.82	5.749	19.71	33.05	12.50	3.20	42.3	13.23	15.3
4,094	1.14	169.4	60.80	5.912	19.90	33.12	12.50	3.20	42.4	13.38	15.4
4,406	1.22	170.4	60.78	6.049	20.05	33.18	12.50	3.20	42.5	13.52	15.5
4,719	1.31	171.3	60.76	6.175	20.20	33.24	12.50	3.20	42.5	13.64	15.5
5,031	1.40	172.2	60.74	6.303	20.34	33.29	12.50	3.20	42.6	13.77	15.6
5,344	1.48	173.0	60.72	6.420	20.48	33.34	12.50	3.20	42.6	13.88	15.6
5,656	1.57	173.7	60.71	6.522	20.59	33.38	12.50	3.29	42.7	13.98	15.7
5,969	1.66	174.4	60.69	6.626	20.71	33.42	12.50	3.20	42.7	14.09	15.7

Table 22 - RHR Pump with 5%/Day Leakage Rate - 75°F Seawater Temperature

		F14.5-10	Lookup	Lookup	Eq. 19	Eq. 21			Eq. 22	Eq. 23	Eq. 24
Time (secs)	Time (hours)	Tp (°F)	Density (lbm/ft^3)	Pvp (psia)	P_c (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	NPSHA (feet)	P_c Req'd for NPSHA of 27 feet (psia)	Margin (feet)
6,281	1.74	175.0	60.68	6.717	20.82	33.46	12.50	3.20	42.8	14.18	15.8
6,594	1.83	175.7	60.66	6.823	20.94	33.50	12.50	3.20	42.8	14.28	15.8
6,906	1.92	176.2	60.65	6.901	21.02	33.53	12.50	3.20	42.8	14.36	15.8
7,157	1.99	176.7	60.64	6.979	21.11	33.56	12.50	3.20	42.9	14.43	15.9
7,188	2.00	176.8	60.64	6.995	21.13	33.56	12.50	3.20	42.9	14.45	15.9
9,033	2.51	178.8	60.60	7.315	21.48	33.67	12.50	3.20	43.0	14.76	16.0
12,498	3.47	181.0	60.55	7.681	21.88	33.78	12.50	3.20	43.1	15.12	16.1
15,848	4.40	182.0	60.53	7.850	22.06	33.80	12.50	3.20	43.1	15.29	16.1
19,325	5.37	182.3	60.52	7.903	22.10	33.78	12.50	3.20	43.1	15.34	16.1
22,924	6.37	182.2	60.52	7.885	22.06	33.74	12.50	3.20	43.0	15.32	16.0
26,735	7.43	181.7	60.53	7.799	21.95	33.66	12.50	3.20	43.0	15.24	16.0
30,495	8.47	181.0	60.55	7.681	21.80	33.58	12.50	3.20	42.9	15.12	15.9
34,328	9.54	180.1	60.57	7.528	21.61	33.47	12.50	3.20	42.8	14.97	15.8
38,118	10.59	179.0	60.59	7.348	21.39	33.36	12.50	3.20	42.7	14.80	15.7
42,011	11.67	177.7	60.62	7.137	21.13	33.24	12.50	3.20	42.5	14.59	15.5
45,918	12.75	176.3	60.65	6.916	20.86	33.10	12.50	3.20	42.4	14.37	15.4
49,869	13.85	174.8	60.68	6.687	20.58	32.96	12.50	3.20	42.3	14.15	15.3
53,881	14.97	173.3	60.72	6.463	20.30	32.83	12.50	3.20	42.1	13.93	15.1
57,880	16.08	171.8	60.75	6.246	20.04	32.69	12.50	3.20	42.0	13.71	15.0
61,998	17.22	170.3	60.78	6.035	19.77	32.55	12.50	3.20	41.8	13.51	14.8
66,179	18.38	168.7	60.81	5.817	19.50	32.41	12.50	3.20	41.7	13.29	14.7
70,369	19.55	167.2	60.85	5.618	19.25	32.27	12.50	3.20	41.6	13.10	14.6
74,594	20.72	165.7	60.88	5.425	19.01	32.13	12.50	3.20	41.4	12.91	14.4
78,915	21.92	164.2	60.91	5.237	18.77	32.00	12.50	3.20	41.3	12.72	14.3
83,272	23.13	162.8	60.94	5.068	18.55	31.87	12.50	3.20	41.2	12.56	14.2

Table 22 - RHR Pump with 5%/Day Leakage Rate - 75°F Seawater Temperature

		F14.5-10	Lookup	Lookup	Eq. 19	Eq. 21			Eq. 22	Eq. 23	Eq. 24
Time (secs)	Time (hours)	Tp (°F)	Density (lbm/ft^3)	Pvp (psia)	P_C (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	NPSHA (feet)	P_C Req'd for NPSHA of 27 feet (psia)	Margin (feet)
87,590	24.33	161.4	60.97	4.903	18.34	31.74	12.50	3.20	41.0	12.40	14.0
91,959	25.54	160.0	60.99	4.741	18.13	31.61	12.50	3.20	40.9	12.24	13.9
96,315	26.75	158.7	61.02	4.597	17.94	31.49	12.50	3.20	40.8	12.10	13.8
100,723	27.98	157.5	61.04	4.466	17.77	31.38	12.50	3.20	40.7	11.97	13.7
105,128	29.20	156.3	61.07	4.339	17.60	31.26	12.50	3.20	40.6	11.84	13.6
109,611	30.45	155.1	61.09	4.215	17.43	31.15	12.50	3.20	40.5	11.72	13.5
114,124	31.70	154.0	61.11	4.103	17.28	31.05	12.50	3.20	40.3	11.61	13.3
118,662	32.96	153.0	61.13	4.005	17.14	30.95	12.50	3.20	40.2	11.52	13.2
123,306	34.25	151.9	61.15	3.897	17.00	30.84	12.50	3.20	40.1	11.41	13.1
127,955	35.54	151.0	61.17	3.812	16.88	30.75	12.50	3.20	40.1	11.33	13.1
132,637	36.84	150.0	61.19	3.718	16.74	30.65	12.50	3.20	40.0	11.24	13.0
137,298	38.14	149.0	61.21	3.628	16.62	30.56	12.50	3.20	39.9	11.15	12.9
141,980	39.44	148.1	61.23	3.547	16.50	30.47	12.50	3.20	39.8	11.07	12.8
146,749	40.76	147.1	61.25	3.460	16.38	30.37	12.50	3.20	39.7	10.99	12.7
151,545	42.10	146.2	61.26	3.383	16.27	30.29	12.50	3.20	39.6	10.91	12.6
156,333	43.43	145.3	61.28	3.307	16.16	30.20	12.50	3.20	39.5	10.84	12.5
161,157	44.77	144.5	61.30	3.241	16.06	30.12	12.50	3.20	39.4	10.78	12.4
165,970	46.10	143.7	61.31	3.176	15.97	30.04	12.50	3.20	39.3	10.71	12.3
170,814	47.45	142.9	61.32	3.112	15.87	29.96	12.50	3.20	39.3	10.65	12.3
172,800	48.00	142.6	61.33	3.089	15.84	29.93	12.50	3.20	39.2	10.63	12.2
176,400	49.00	142.2	61.34	3.054	15.78	29.89	12.50	3.20	39.2	10.59	12.2
180,000	50.00	141.7	61.34	3.020	15.73	29.84	12.50	3.20	39.1	10.56	12.1
183,600	51.00	141.3	61.35	2.987	15.68	29.79	12.50	3.20	39.1	10.53	12.1
187,200	52.00	140.8	61.36	2.954	15.63	29.75	12.50	3.20	39.0	10.50	12.0
190,800	53.00	140.4	61.37	2.921	15.58	29.70	12.50	3.20	39.0	10.46	12.0

Table 22 - RHR Pump with 5%/Day Leakage Rate - 75°F Seawater Temperature

		F14.5-10	Lookup	Lookup	Eq. 19	Eq. 21			Eq. 22	Eq. 23	Eq. 24
Time (secs)	Time (hours)	Tp (°F)	Density (lbm/ft^3)	Pvp (psia)	P_C (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	NPSHA (feet)	P_C Req'd for NPSHA of 27 feet (psia)	Margin (feet)
194,400	54.00	140.0	61.38	2.887	15.53	29.66	12.50	3.20	39.0	10.43	12.0
198,000	55.00	139.5	61.38	2.856	15.48	29.61	12.50	3.20	38.9	10.40	11.9
201,600	56.00	139.1	61.39	2.824	15.43	29.57	12.50	3.20	38.9	10.37	11.9
205,200	57.00	138.7	61.40	2.792	15.38	29.53	12.50	3.20	38.8	10.34	11.8
208,800	58.00	138.2	61.41	2.760	15.33	29.48	12.50	3.20	38.8	10.31	11.8
212,400	59.00	137.8	61.41	2.729	15.29	29.44	12.50	3.20	38.7	10.28	11.7
216,000	60.00	137.3	61.42	2.699	15.24	29.40	12.50	3.20	38.7	10.25	11.7
219,600	61.00	136.9	61.43	2.668	15.19	29.36	12.50	3.20	38.7	10.22	11.7
223,200	62.00	136.5	61.44	2.638	15.15	29.32	12.50	3.20	38.6	10.19	11.6
226,800	63.00	136.0	61.45	2.607	15.10	29.28	12.50	3.20	38.6	10.16	11.6
230,400	64.00	135.6	61.45	2.578	15.06	29.24	12.50	3.20	38.5	10.13	11.5
234,000	65.00	135.2	61.46	2.549	15.01	29.20	12.50	3.20	38.5	10.10	11.5
237,600	66.00	134.7	61.47	2.520	14.97	29.16	12.50	3.20	38.5	10.08	11.5
241,200	67.00	134.3	61.48	2.491	14.93	29.13	12.50	3.20	38.4	10.05	11.4
244,800	68.00	133.8	61.48	2.462	14.88	29.09	12.50	3.20	38.4	10.02	11.4
248,400	69.00	133.4	61.49	2.434	14.84	29.06	12.50	3.20	38.4	9.99	11.4
252,000	70.00	133.0	61.50	2.407	14.80	29.03	12.50	3.20	38.3	9.97	11.3
255,600	71.00	132.5	61.51	2.379	14.76	28.99	12.50	3.20	38.3	9.94	11.3
259,200	72.00	132.1	61.51	2.351	14.72	28.96	12.50	3.20	38.3	9.91	11.3
262,800	73.00	131.9	61.52	2.337	14.70	28.95	12.50	3.20	38.2	9.90	11.2
266,400	74.00	131.7	61.52	2.324	14.70	28.97	12.50	3.20	38.3	9.89	11.3
270,000	75.00	131.5	61.53	2.311	14.70	29.00	12.50	3.20	38.3	9.87	11.3
273,600	76.00	131.2	61.53	2.298	14.70	29.03	12.50	3.20	38.3	9.86	11.3
277,200	77.00	131.0	61.53	2.285	14.70	29.05	12.50	3.20	38.4	9.85	11.4
280,800	78.00	130.8	61.54	2.272	14.70	29.08	12.50	3.20	38.4	9.84	11.4

Table 22 - RHR Pump with 5%/Day Leakage Rate - 75°F Seawater Temperature

		F14.5-10	Lookup	Lookup	Eq. 19	Eq. 21			Eq. 22	Eq. 23	Eq. 24
Time (secs)	Time (hours)	Tp (°F)	Density (lbm/ft^3)	Pvp (psia)	P_C (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	NPSHA (feet)	P_C Req'd for NPSHA of 27 feet (psia)	Margin (feet)
284,400	79.00	130.6	61.54	2.258	14.70	29.11	12.50	3.20	38.4	9.82	11.4
288,000	80.00	130.4	61.54	2.245	14.70	29.14	12.50	3.20	38.4	9.81	11.4
291,600	81.00	130.2	61.55	2.232	14.70	29.17	12.50	3.20	38.5	9.80	11.5
295,200	82.00	129.9	61.55	2.219	14.70	29.20	12.50	3.20	38.5	9.78	11.5
298,800	83.00	129.7	61.55	2.207	14.70	29.23	12.50	3.20	38.5	9.77	11.5
302,400	84.00	129.5	61.56	2.194	14.70	29.25	12.50	3.20	38.6	9.76	11.6
306,000	85.00	129.3	61.56	2.181	14.70	29.28	12.50	3.20	38.6	9.75	11.6
309,600	86.00	129.1	61.57	2.169	14.70	29.31	12.50	3.20	38.6	9.74	11.6
313,200	87.00	128.9	61.57	2.156	14.70	29.34	12.50	3.20	38.6	9.72	11.6
316,800	88.00	128.6	61.57	2.144	14.70	29.37	12.50	3.20	38.7	9.71	11.7
320,400	89.00	128.4	61.58	2.131	14.70	29.39	12.50	3.20	38.7	9.70	11.7
324,000	90.00	128.2	61.58	2.118	14.70	29.42	12.50	3.20	38.7	9.69	11.7
327,600	91.00	128.0	61.58	2.106	14.70	29.45	12.50	3.20	38.7	9.68	11.7
331,200	92.00	127.8	61.59	2.094	14.70	29.47	12.50	3.20	38.8	9.66	11.8
334,800	93.00	127.6	61.59	2.082	14.70	29.50	12.50	3.20	38.8	9.65	11.8
338,400	94.00	127.3	61.60	2.070	14.70	29.53	12.50	3.20	38.8	9.64	11.8
342,000	95.00	127.1	61.60	2.058	14.70	29.55	12.50	3.20	38.9	9.63	11.9
345,600	96.00	126.9	61.60	2.046	14.70	29.58	12.50	3.20	38.9	9.62	11.9
349,200	97.00	126.7	61.61	2.036	14.70	29.60	12.50	3.20	38.9	9.61	11.9
352,800	98.00	126.6	61.61	2.027	14.70	29.62	12.50	3.20	38.9	9.60	11.9
356,400	99.00	126.4	61.61	2.017	14.70	29.64	12.50	3.20	38.9	9.59	11.9
360,000	100.00	126.2	61.61	2.008	14.70	29.66	12.50	3.20	39.0	9.58	12.0
363,600	101.00	126.0	61.62	1.998	14.70	29.68	12.50	3.20	39.0	9.57	12.0
367,200	102.00	125.9	61.62	1.989	14.70	29.70	12.50	3.20	39.0	9.56	12.0
370,800	103.00	125.7	61.62	1.980	14.70	29.72	12.50	3.20	39.0	9.55	12.0

Table 22 - RHR Pump with 5%/Day Leakage Rate - 75°F Seawater Temperature

		F14.5-10	Lookup	Lookup	Eq. 19	Eq. 21			Eq. 22	Eq. 23	Eq. 24
Time (secs)	Time (hours)	Tp (°F)	Density (lbm/ft^3)	Pvp (psia)	P_C (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	NPSHA (feet)	P_C Req'd for NPSHA of 27 feet (psia)	Margin (feet)
374,400	104.00	125.5	61.63	1.971	14.70	29.74	12.50	3.20	39.0	9.55	12.0
378,000	105.00	125.4	61.63	1.962	14.70	29.76	12.50	3.20	39.1	9.54	12.1
381,600	106.00	125.2	61.63	1.953	14.70	29.78	12.50	3.20	39.1	9.53	12.1
385,200	107.00	125.0	61.63	1.944	14.70	29.80	12.50	3.20	39.1	9.52	12.1
388,800	108.00	124.9	61.64	1.935	14.70	29.82	12.50	3.20	39.1	9.51	12.1
392,400	109.00	124.7	61.64	1.926	14.70	29.84	12.50	3.20	39.1	9.50	12.1
396,000	110.00	124.5	61.64	1.917	14.70	29.86	12.50	3.20	39.2	9.49	12.2
399,600	111.00	124.3	61.64	1.908	14.70	29.88	12.50	3.20	39.2	9.48	12.2
403,200	112.00	124.2	61.65	1.899	14.70	29.90	12.50	3.20	39.2	9.48	12.2
406,800	113.00	124.0	61.65	1.890	14.70	29.92	12.50	3.20	39.2	9.47	12.2
410,400	114.00	123.8	61.65	1.881	14.70	29.94	12.50	3.20	39.2	9.46	12.2
414,000	115.00	123.7	61.65	1.873	14.70	29.96	12.50	3.20	39.3	9.45	12.3
417,600	116.00	123.5	61.66	1.864	14.70	29.98	12.50	3.20	39.3	9.44	12.3
421,200	117.00	123.3	61.66	1.855	14.70	30.00	12.50	3.20	39.3	9.43	12.3
424,800	118.00	123.1	61.66	1.847	14.70	30.02	12.50	3.20	39.3	9.43	12.3
428,400	119.00	123.0	61.66	1.838	14.70	30.04	12.50	3.20	39.3	9.42	12.3
432,000	120.00	122.8	61.67	1.830	14.70	30.05	12.50	3.20	39.4	9.41	12.4
518,400	144.00	120.2	61.71	1.702	14.70	30.33	12.50	3.20	39.6	9.29	12.6
604,800	168.00	118.2	61.74	1.610	14.70	30.53	12.50	3.20	39.8	9.20	12.8
691,200	192.00	116.2	61.77	1.522	14.70	30.72	12.50	3.20	40.0	9.11	13.0
777,600	216.00	114.3	61.80	1.442	14.70	30.89	12.50	3.20	40.2	9.04	13.2
864,000	240.00	112.3	61.83	1.362	14.70	31.06	12.50	3.20	40.4	8.96	13.4

Table 23 - Core Spray Pump with 5%/Day Leakage Rate - 75°F Seawater Temperature

		F14.5-10	Lookup	Lookup	Eq. 19	Eq. 21			Eq. 22	Eq. 23	Eq. 24
Time (secs)	Time (hours)	Tp (°F)	Density (lbm/ft^3)	Pvp (psia)	P_C (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	NPSHA (feet)	P_C Req'd for NPSHA of 29 feet (psia)	Margin (feet)
		Plotted on Fig 6			*Plotted on Fig 6*					*Plotted on Fig 6*	*Plotted on Fig 7*
312	0.09	133.7	61.49	2.453	15.66	30.92	12.50	2.38	41.0	10.51	12.0
557	0.15	139.5	61.38	2.853	16.19	31.28	12.50	2.38	41.4	10.90	12.4
588	0.16	140.6	61.36	2.935	16.29	31.34	12.50	2.38	41.5	10.98	12.5
619	0.17	141.3	61.35	2.988	16.36	31.39	12.50	2.38	41.5	11.03	12.5
656	0.18	142.0	61.34	3.041	16.43	31.43	12.50	2.38	41.6	11.08	12.6
969	0.27	147.8	61.23	3.521	17.04	31.79	12.50	2.38	41.9	11.55	12.9
1,281	0.36	152.1	61.15	3.916	17.53	32.05	12.50	2.38	42.2	11.93	13.2
1,594	0.44	155.3	61.09	4.235	17.92	32.25	12.50	2.38	42.4	12.24	13.4
1,906	0.53	158.0	61.04	4.520	18.26	32.42	12.50	2.38	42.5	12.52	13.5
2,219	0.62	160.1	60.99	4.753	18.54	32.55	12.50	2.38	42.7	12.75	13.7
2,531	0.70	162.0	60.95	4.972	18.80	32.66	12.50	2.38	42.8	12.96	13.8
2,844	0.79	163.7	60.92	5.176	19.04	32.77	12.50	2.38	42.9	13.16	13.9
3,156	0.88	165.4	60.88	5.387	19.29	32.87	12.50	2.38	43.0	13.37	14.0
3,469	0.96	166.9	60.85	5.579	19.51	32.97	12.50	2.38	43.1	13.56	14.1
3,781	1.05	168.2	60.82	5.749	19.71	33.05	12.50	2.38	43.2	13.72	14.2
4,094	1.14	169.4	60.80	5.912	19.90	33.12	12.50	2.38	43.2	13.88	14.2
4,406	1.22	170.4	60.78	6.049	20.05	33.18	12.50	2.38	43.3	14.02	14.3
4,719	1.31	171.3	60.76	6.175	20.20	33.24	12.50	2.38	43.4	14.14	14.4
5,031	1.40	172.2	60.74	6.303	20.34	33.29	12.50	2.38	43.4	14.27	14.4
5,344	1.48	173.0	60.72	6.420	20.48	33.34	12.50	2.38	43.5	14.38	14.5
5,656	1.57	173.7	60.71	6.522	20.59	33.38	12.50	2.38	43.5	14.48	14.5
5,969	1.66	174.4	60.69	6.626	20.71	33.42	12.50	2.38	43.5	14.58	14.5

Table 23 - Core Spray Pump with 5%/Day Leakage Rate - 75°F Seawater Temperature

		F14.5-10	Lookup	Lookup	Eq. 19	Eq. 21			Eq. 22	Eq. 23	Eq. 24
Time (secs)	Time (hours)	Tp (°F)	Density (lbm/ft^3)	Pvp (psia)	P_C (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	NPSHA (feet)	P_C Req'd for NPSHA of 29 feet (psia)	Margin (feet)
6,281	1.74	175.0	60.68	6.717	20.82	33.46	12.50	2.38	43.6	14.67	14.6
6,594	1.83	175.7	60.66	6.823	20.94	33.50	12.50	2.38	43.6	14.78	14.6
6,906	1.92	176.2	60.65	6.901	21.02	33.53	12.50	2.38	43.6	14.85	14.6
7,157	1.99	176.7	60.64	6.979	21.11	33.56	12.50	2.38	43.7	14.93	14.7
7,188	2.00	176.8	60.64	6.995	21.13	33.56	12.50	2.38	43.7	14.95	14.7
9,033	2.51	178.8	60.60	7.315	21.48	33.67	12.50	2.38	43.8	15.26	14.8
12,498	3.47	181.0	60.55	7.681	21.88	33.78	12.50	2.38	43.9	15.62	14.9
15,848	4.40	182.0	60.53	7.850	22.06	33.80	12.50	2.38	43.9	15.79	14.9
19,325	5.37	182.3	60.52	7.903	22.10	33.78	12.50	2.38	43.9	15.84	14.9
22,924	6.37	182.2	60.52	7.885	22.06	33.74	12.50	2.38	43.9	15.82	14.9
26,735	7.43	181.7	60.53	7.799	21.95	33.66	12.50	2.38	43.8	15.74	14.8
30,495	8.47	181.0	60.55	7.681	21.80	33.58	12.50	2.38	43.7	15.62	14.7
34,328	9.54	180.1	60.57	7.528	21.61	33.47	12.50	2.38	43.6	15.47	14.6
38,118	10.59	179.0	60.59	7.348	21.39	33.36	12.50	2.38	43.5	15.29	14.5
42,011	11.67	177.7	60.62	7.137	21.13	33.24	12.50	2.38	43.4	15.08	14.4
45,918	12.75	176.3	60.65	6.916	20.86	33.10	12.50	2.38	43.2	14.87	14.2
49,869	13.85	174.8	60.68	6.687	20.58	32.96	12.50	2.38	43.1	14.64	14.1
53,881	14.97	173.3	60.72	6.463	20.30	32.83	12.50	2.38	42.9	14.42	13.9
57,880	16.08	171.8	60.75	6.246	20.04	32.69	12.50	2.38	42.8	14.21	13.8
61,998	17.22	170.3	60.78	6.035	19.77	32.55	12.50	2.38	42.7	14.00	13.7
66,179	18.38	168.7	60.81	5.817	19.50	32.41	12.50	2.38	42.5	13.79	13.5
70,369	19.55	167.2	60.85	5.618	19.25	32.27	12.50	2.38	42.4	13.60	13.4
74,594	20.72	165.7	60.88	5.425	19.01	32.13	12.50	2.38	42.3	13.41	13.3
78,915	21.92	164.2	60.91	5.237	18.77	32.00	12.50	2.38	42.1	13.22	13.1
83,272	23.13	162.8	60.94	5.068	18.55	31.87	12.50	2.38	42.0	13.06	13.0

Table 23 - Core Spray Pump with 5%/Day Leakage Rate - 75°F Seawater Temperature

		F14.5-10	Lookup	Lookup	Eq. 19	Eq. 21			Eq. 22	Eq. 23	Eq. 24
Time (secs)	Time (hours)	Tp (°F)	Density (lbm/ft^3)	Pvp (psia)	P_C (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	NPSHA (feet)	P_C Req'd for NPSHA of 29 feet (psia)	Margin (feet)
87,590	24.33	161.4	60.97	4.903	18.34	31.74	12.50	2.38	41.9	12.90	12.9
91,959	25.54	160.0	60.99	4.741	18.13	31.61	12.50	2.38	41.7	12.74	12.7
96,315	26.75	158.7	61.02	4.597	17.94	31.49	12.50	2.38	41.6	12.60	12.6
100,723	27.98	157.5	61.04	4.466	17.77	31.38	12.50	2.38	41.5	12.47	12.5
105,128	29.20	156.3	61.07	4.339	17.60	31.26	12.50	2.38	41.4	12.35	12.4
109,611	30.45	155.1	61.09	4.215	17.43	31.15	12.50	2.38	41.3	12.22	12.3
114,124	31.70	154.0	61.11	4.103	17.28	31.05	12.50	2.38	41.2	12.12	12.2
118,662	32.96	153.0	61.13	4.005	17.14	30.95	12.50	2.38	41.1	12.02	12.1
123,306	34.25	151.9	61.15	3.897	17.00	30.84	12.50	2.38	41.0	11.91	12.0
127,955	35.54	151.0	61.17	3.812	16.88	30.75	12.50	2.38	40.9	11.83	11.9
132,637	36.84	150.0	61.19	3.718	16.74	30.65	12.50	2.38	40.8	11.74	11.8
137,298	38.14	149.0	61.21	3.628	16.62	30.56	12.50	2.38	40.7	11.65	11.7
141,980	39.44	148.1	61.23	3.547	16.50	30.47	12.50	2.38	40.6	11.57	11.6
146,749	40.76	147.1	61.25	3.460	16.38	30.37	12.50	2.38	40.5	11.49	11.5
151,545	42.10	146.2	61.26	3.383	16.27	30.29	12.50	2.38	40.4	11.41	11.4
156,333	43.43	145.3	61.28	3.307	16.16	30.20	12.50	2.38	40.3	11.34	11.3
161,157	44.77	144.5	61.30	3.241	16.06	30.12	12.50	2.38	40.2	11.28	11.2
165,970	46.10	143.7	61.31	3.176	15.97	30.04	12.50	2.38	40.2	11.21	11.2
170,814	47.45	142.9	61.32	3.112	15.87	29.96	12.50	2.38	40.1	11.15	11.1
172,800	48.00	142.6	61.33	3.089	15.84	29.93	12.50	2.38	40.1	11.13	11.1
176,400	49.00	142.2	61.34	3.054	15.78	29.89	12.50	2.38	40.0	11.10	11.0
180,000	50.00	141.7	61.34	3.020	15.73	29.84	12.50	2.38	40.0	11.06	11.0
183,600	51.00	141.3	61.35	2.987	15.68	29.79	12.50	2.38	39.9	11.03	10.9
187,200	52.00	140.8	61.36	2.954	15.63	29.75	12.50	2.38	39.9	11.00	10.9
190,800	53.00	140.4	61.37	2.921	15.58	29.70	12.50	2.38	39.8	10.97	10.8

Table 23 - Core Spray Pump with 5%/Day Leakage Rate - 75°F Seawater Temperature

		F14.5-10	Lookup	Lookup	Eq. 19	Eq. 21			Eq. 22	Eq. 23	Eq. 24
Time (secs)	Time (hours)	Tp (°F)	Density (lbm/ft^3)	Pvp (psia)	P_C (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	NPSHA (feet)	P_C Req'd for NPSHA of 29 feet (psia)	Margin (feet)
194,400	54.00	140.0	61.38	2.887	15.53	29.66	12.50	2.38	39.8	10.93	10.8
198,000	55.00	139.5	61.38	2.856	15.48	29.61	12.50	2.38	39.7	10.90	10.7
201,600	56.00	139.1	61.39	2.824	15.43	29.57	12.50	2.38	39.7	10.87	10.7
205,200	57.00	138.7	61.40	2.792	15.38	29.53	12.50	2.38	39.6	10.84	10.6
208,800	58.00	138.2	61.41	2.760	15.33	29.48	12.50	2.38	39.6	10.81	10.6
212,400	59.00	137.8	61.41	2.729	15.29	29.44	12.50	2.38	39.6	10.78	10.6
216,000	60.00	137.3	61.42	2.699	15.24	29.40	12.50	2.38	39.5	10.75	10.5
219,600	61.00	136.9	61.43	2.668	15.19	29.36	12.50	2.38	39.5	10.72	10.5
223,200	62.00	136.5	61.44	2.638	15.15	29.32	12.50	2.38	39.4	10.69	10.4
226,800	63.00	136.0	61.45	2.607	15.10	29.28	12.50	2.38	39.4	10.66	10.4
230,400	64.00	135.6	61.45	2.578	15.06	29.24	12.50	2.38	39.4	10.64	10.4
234,000	65.00	135.2	61.46	2.549	15.01	29.20	12.50	2.38	39.3	10.61	10.3
237,600	66.00	134.7	61.47	2.520	14.97	29.16	12.50	2.38	39.3	10.58	10.3
241,200	67.00	134.3	61.48	2.491	14.93	29.13	12.50	2.38	39.2	10.55	10.2
244,800	68.00	133.8	61.48	2.462	14.88	29.09	12.50	2.38	39.2	10.52	10.2
248,400	69.00	133.4	61.49	2.434	14.84	29.06	12.50	2.38	39.2	10.50	10.2
252,000	70.00	133.0	61.50	2.407	14.80	29.03	12.50	2.38	39.1	10.47	10.1
255,600	71.00	132.5	61.51	2.379	14.76	28.99	12.50	2.38	39.1	10.44	10.1
259,200	72.00	132.1	61.51	2.351	14.72	28.96	12.50	2.38	39.1	10.42	10.1
262,800	73.00	131.9	61.52	2.337	14.70	28.95	12.50	2.38	39.1	10.40	10.1
266,400	74.00	131.7	61.52	2.324	14.70	28.97	12.50	2.38	39.1	10.39	10.1
270,000	75.00	131.5	61.53	2.311	14.70	29.00	12.50	2.38	39.1	10.38	10.1
273,600	76.00	131.2	61.53	2.298	14.70	29.03	12.50	2.38	39.1	10.37	10.1
277,200	77.00	131.0	61.53	2.285	14.70	29.05	12.50	2.38	39.2	10.35	10.2
280,800	78.00	130.8	61.54	2.272	14.70	29.08	12.50	2.38	39.2	10.34	10.2

Table 23 - Core Spray Pump with 5%/Day Leakage Rate - 75°F Seawater Temperature

		F14.5-10	Lookup	Lookup	Eq. 19	Eq. 21			Eq. 22	Eq. 23	Eq. 24
Time (secs)	Time (hours)	Tp (°F)	Density (lbm/ft^3)	Pvp (psia)	P_C (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	NPSHA (feet)	P_C Req'd for NPSHA of 29 feet (psia)	Margin (feet)
284,400	79.00	130.6	61.54	2.258	14.70	29.11	12.50	2.38	39.2	10.33	10.2
288,000	80.00	130.4	61.54	2.245	14.70	29.14	12.50	2.38	39.3	10.31	10.3
291,600	81.00	130.2	61.55	2.232	14.70	29.17	12.50	2.38	39.3	10.30	10.3
295,200	82.00	129.9	61.55	2.219	14.70	29.20	12.50	2.38	39.3	10.29	10.3
298,800	83.00	129.7	61.55	2.207	14.70	29.23	12.50	2.38	39.3	10.28	10.3
302,400	84.00	129.5	61.56	2.194	14.70	29.25	12.50	2.38	39.4	10.26	10.4
306,000	85.00	129.3	61.56	2.181	14.70	29.28	12.50	2.38	39.4	10.25	10.4
309,600	86.00	129.1	61.57	2.169	14.70	29.31	12.50	2.38	39.4	10.24	10.4
313,200	87.00	128.9	61.57	2.156	14.70	29.34	12.50	2.38	39.5	10.23	10.5
316,800	88.00	128.6	61.57	2.144	14.70	29.37	12.50	2.38	39.5	10.22	10.5
320,400	89.00	128.4	61.58	2.131	14.70	29.39	12.50	2.38	39.5	10.20	10.5
324,000	90.00	128.2	61.58	2.118	14.70	29.42	12.50	2.38	39.5	10.19	10.5
327,600	91.00	128.0	61.58	2.106	14.70	29.45	12.50	2.38	39.6	10.18	10.6
331,200	92.00	127.8	61.59	2.094	14.70	29.47	12.50	2.38	39.6	10.17	10.6
334,800	93.00	127.6	61.59	2.082	14.70	29.50	12.50	2.38	39.6	10.16	10.6
338,400	94.00	127.3	61.60	2.070	14.70	29.53	12.50	2.38	39.6	10.15	10.6
342,000	95.00	127.1	61.60	2.058	14.70	29.55	12.50	2.38	39.7	10.13	10.7
345,600	96.00	126.9	61.60	2.046	14.70	29.58	12.50	2.38	39.7	10.12	10.7
349,200	97.00	126.7	61.61	2.036	14.70	29.60	12.50	2.38	39.7	10.11	10.7
352,800	98.00	126.6	61.61	2.027	14.70	29.62	12.50	2.38	39.7	10.10	10.7
356,400	99.00	126.4	61.61	2.017	14.70	29.64	12.50	2.38	39.8	10.10	10.8
360,000	100.00	126.2	61.61	2.008	14.70	29.66	12.50	2.38	39.8	10.09	10.8
363,600	101.00	126.0	61.62	1.998	14.70	29.68	12.50	2.38	39.8	10.08	10.8
367,200	102.00	125.9	61.62	1.989	14.70	29.70	12.50	2.38	39.8	10.07	10.8
370,800	103.00	125.7	61.62	1.980	14.70	29.72	12.50	2.38	39.8	10.06	10.8

Table 23 - Core Spray Pump with 5%/Day Leakage Rate - 75°F Seawater Temperature

		F14.5-10	Lookup	Lookup	Eq. 19	Eq. 21			Eq. 22	Eq. 23	Eq. 24
Time (secs)	Time (hours)	Tp (°F)	Density (lbm/ft^3)	Pvp (psia)	P_C (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	NPSHA (feet)	P_C Req'd for NPSHA of 29 feet (psia)	Margin (feet)
374,400	104.00	125.5	61.63	1.971	14.70	29.74	12.50	2.38	39.9	10.05	10.9
378,000	105.00	125.4	61.63	1.962	14.70	29.76	12.50	2.38	39.9	10.04	10.9
381,600	106.00	125.2	61.63	1.953	14.70	29.78	12.50	2.38	39.9	10.03	10.9
385,200	107.00	125.0	61.63	1.944	14.70	29.80	12.50	2.38	39.9	10.02	10.9
388,800	108.00	124.9	61.64	1.935	14.70	29.82	12.50	2.38	39.9	10.02	10.9
392,400	109.00	124.7	61.64	1.926	14.70	29.84	12.50	2.38	40.0	10.01	11.0
396,000	110.00	124.5	61.64	1.917	14.70	29.86	12.50	2.38	40.0	10.00	11.0
399,600	111.00	124.3	61.64	1.908	14.70	29.88	12.50	2.38	40.0	9.99	11.0
403,200	112.00	124.2	61.65	1.899	14.70	29.90	12.50	2.38	40.0	9.98	11.0
406,800	113.00	124.0	61.65	1.890	14.70	29.92	12.50	2.38	40.0	9.97	11.0
410,400	114.00	123.8	61.65	1.881	14.70	29.94	12.50	2.38	40.1	9.96	11.1
414,000	115.00	123.7	61.65	1.873	14.70	29.96	12.50	2.38	40.1	9.96	11.1
417,600	116.00	123.5	61.66	1.864	14.70	29.98	12.50	2.38	40.1	9.95	11.1
421,200	117.00	123.3	61.66	1.855	14.70	30.00	12.50	2.38	40.1	9.94	11.1
424,800	118.00	123.1	61.66	1.847	14.70	30.02	12.50	2.38	40.1	9.93	11.1
428,400	119.00	123.0	61.66	1.838	14.70	30.04	12.50	2.38	40.2	9.92	11.2
432,000	120.00	122.8	61.67	1.830	14.70	30.05	12.50	2.38	40.2	9.91	11.2
518,400	144.00	120.2	61.71	1.702	14.70	30.33	12.50	2.38	40.5	9.79	11.5
604,800	168.00	118.2	61.74	1.610	14.70	30.53	12.50	2.38	40.7	9.70	11.7
691,200	192.00	116.2	61.77	1.522	14.70	30.72	12.50	2.38	40.8	9.62	11.8
777,600	216.00	114.3	61.80	1.442	14.70	30.89	12.50	2.38	41.0	9.55	12.0
864,000	240.00	112.3	61.83	1.362	14.70	31.06	12.50	2.38	41.2	9.47	12.2

This table contains calculated values of NPSHA and NPSHR for RHR and CS pumps as presented on FSAR Figure 14.5-9. Containment leakage is assumed equal to zero in this calculation.

Table 24 - ECCS Pump NPSHA Over a Range of Pool Temperatures and Zero Containment Leakage

Core Spray Pump *Pc Based on Nitrogen Mass = 16.315 lbm*

	Eq. 27	Lookup	Eq. 19	Eq. 21			Eq. 22	
Suppression Pool Temperature (°F)	Tp (°R)	Pvp (psia)	0% Leakage Pc (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	NPSHA (feet)	CS NPSHR (feet)
								Values plotted Fig 8
130	590.0	2.2230	15.346	30.702	12.5	2.38	40.82	29
140	600.0	2.8892	16.235	31.311	12.5	2.38	41.43	29
150	610.0	3.7184	17.286	31.931	12.5	2.38	42.05	29
160	620.0	4.7414	18.532	32.557	12.5	2.38	42.68	29
166	626.0	5.4623	19.386	32.938	12.5	2.38	43.06	29
170	630.0	5.9926	20.005	33.195	12.5	2.38	43.32	29
180	640.0	7.5110	21.746	33.843	12.5	2.38	43.96	29
185	645.0	8.3855	22.732	34.171	12.5	2.38	44.29	29

RHR Pump *Pc Based on Nitrogen Mass = 16.315 lbm*

	Eq. 27	Lookup	Eq. 19	Eq. 21			Eq. 22	
Suppression Pool Temperature (°F)	Tp (°R)	Pvp (psia)	0% Leakage Pc (psia)	Pgas (feet)	Hz (feet)	Hsl (feet)	NPSHA (feet)	RHR NPSHR (feet)
							Values plotted Fig 8	*Values plotted Fig 8*
130	590.0	2.2230	15.346	30.702	12.5	3.20	40.00	27
140	600.0	2.8892	16.235	31.311	12.5	3.20	40.61	27
150	610.0	3.7184	17.286	31.931	12.5	3.20	41.23	27
160	620.0	4.7414	18.532	32.557	12.5	3.20	41.86	27
166	626.0	5.4623	19.386	32.938	12.5	3.20	42.24	27
170	630.0	5.9926	20.005	33.195	12.5	3.20	42.50	27
180	640.0	7.5110	21.746	33.843	12.5	3.20	43.14	27
185	645.0	8.3855	22.732	34.171	12.5	3.20	43.47	27

Section 5.0 References

1. FSAR Section 4.8, Residual Heat Removal System
2. FSAR Section 6.4, Core Spray System
3. Regulatory Guide 1.82 Rev. 1, "Water Sources for Long-Term Recirculation Cooling Following a Loss-of-Coolant Accident", U.S. Nuclear Regulatory Commission, November, 1985
4. GE Report GE-NE-523-A044-0595
5. Bingham Pump Curve No. 27956 and 27763 (Core Spray Pumps)
6. Bingham Pump Curve No. 28457, 28167, 28168, and 28169 (RHR Pumps)
7. Crane Technical Paper No. 410, Crane Co., New York, N.Y., 1981
8. Brater & King, *Handbook of Hydraulics*, Sixth Edition, McGraw-Hill, New York, NY, 1976
9. General Electric Report GE-NE-523-A044-0595, "PNPS Decay Heat Removal Capability", May 1995 (SUDDS/RF #95-127 Rev. 1)
10. FSAR Section 14.5, Postulated Design Basis Accidents
11. General Electric Report NEDC-31852P Rev. 1, "PNPS SAFER/GESTR-LOCA Loss-of-Coolant Accident Analysis", 1992
12. BECo Calculation N110, Rev. 0, "OPL-4 (ECCS Parameters) for SAFER/GESTR-LOCA Analysis for PNPS"
13. Pilgrim ECCS Suction Strainer Data Sheet per Specification M-618
14. C1A363, Rev. E0 "ECCS Suction Strainer Installation Branch Pipes #1 & #2"
15. C1A365, Rev. E0 "ECCS Suction Strainer Installation Branch Pipe #3"
16. M100-51-7, "Core Spray System Suction Piping to Core Spray Pump P-215A"
17. M100-54, Rev. E2, "Core Spray System Core Spray Line Rerouting Assembly"
18. M100-256-4, Rev. E2, "Core Spray Critical Piping, S.E. Quadrant Below Elev. 23'-0"
19. M100-52-6, Rev. E2, "Core Spray System Suction Piping to Core Spray Pump P-215B"
20. M100-265-4, Rev. E2, "Core Spray Critical Piping, N.W Quadrant Below Elev. 23'-0"
21. M100-251-4, Rev. E1, "RHR Nuclear Piping S.E. Quadrant Below Elev. 23'-0"

22. M100-43-7, Rev. E1, "RHR Nuclear Piping, S.E. Quadrant Below Elev. 23'-0"
23. M100-47-8, Rev. E1, "RHR Nuclear Piping, NW Quadrant Below Elev. 23'-0"
24. M100-266-3, "RHR Nuclear Piping, N.W. Quadrant Below Elev. 23'-0"
25. M100-262-4, Rev. E1, "RHR Nuclear Piping, N.W. Quadrant Below Elev. 23'-0"
26. M100-42-9, Rev. E1, "RHR Nuclear Piping S.E. Quadrant Below Elev. 23'-0"
27. M100-252-4, Rev. E1, "RHR Nuclear Piping, S.E. Quadrant Below Elev. 23'-0"
28. M100-47-6, Rev. E1, "RHR Nuclear Piping, N.W. Quadrant Below Elev. 23'-0"
29. M100-263-3, Rev. E1, "RHR Nuclear Piping, N.W. Quadrant Below Elev. 23'-0"
30. M100-264-6, Rev. E1, "RHR Nuclear Piping, N.W. Quadrant Below Elev. 23'-0"
31. Amendment 9 to License Application Filed June 30, 1967 (Docket No. 50-293), 03/11/68
32. Amendment 24 to License Application (Docket No. 50-293)
33. FSAR:
    a) Table 5.2-1 Primary Containment System Principal Design Parameters and Characteristics
    b) Section 14.5.3.1.2 Containment Response
    c) Section 14.5.3.1.3 Core Standby Cooling System Pump Net Positive Suction Head
    d) FSAR Figure 14.5-7 Loss of Coolant Accident Suppression Pool Temperature Response
    e) FSAR Table 14.5-1 Loss of Coolant Accident Primary Containment Response Summary
34. Technical Specifications for Pilgrim Nuclear Power Station:
    a) Minimum water volume per LCO 3.7.A.1.a.
    b) Maximum water volume per LCO 3.7.A.1.b.
    c) Maximum suppression pool temperature during normal continuous power operation per LCO 3.7.A.1.c.
    d) Minimum differential pressure between drywell and suppression chamber per LCO 3.7.A.1.i.
    e) Allowable suppression chamber water level range per LCO 3.7.A.1.m.
    f) Maximum containment leakage rate per surveillance requirement 4.7.A.2.a.

35. BECo Calculation S&SA-91 Rev. E1, "Containment and Decay Heat Removal Analysis Inputs"

36. GE Specification, 22A5756, Containment Data, Rev. 3, February 1982

37. GE Report GE-NE-T23-00749-01 "Containment Heatup Analysis with ANS 5.1 Plus 2 Sigma Decay Heat" December 1997 with Transmittal of Data Tables as Attachment, SUDDS/RF # 97-96

38. BECo Calculation M-667 Rev. 1 "RHR System Hydraulic Analysis"

39. BECo Calculation M-734 Rev. 1 "RHR and Core Spray Pump Suction Strainer Debris Head Loss NPSH Evaluation"

40. BECo Calculation M-748 Rev. 0 "Containment Temperature & Humidity Conditions and Nitrogen Mass"

41. PCI Report PCI-NP-PNS-01 Rev. 0 "Suction Strainer Head Loss Analysis" February 1997, SUDDS/RF # 97-48

42. BECo Dwg C1A300 Rev. E0 "RHR/CS Strainer Assembly Drawing"

43. BECo Dwg C1A363 Rev. E0 "RHR/CS Strainer Branch Pipe Design"

44. BECo Dwg C1A365 Rev. E0 "RHR/CS Strainer Branch Pipe Design"

Section 6.0 Attachments

Attachment 1 = Independent Verification Statement Record

Calculation - Independent Verification Statement Record

Calculation # M-662 , Revision # E3 has been independently verified by the following method(s), as noted below:

Mark each item yes, no or not applicable (N/A) and initial each item checked by you.

Design Review ☑ including verification that:

- Design inputs were correctly selected and included in the calculation.
- Assumptions are adequately described and are reasonable.
- Input or assumptions requiring confirmation are identified, and if any exist, the calculation has been identified as "Preliminary" and a "Finalization Due Date" has been specified.
- Design requirements from applicable codes, standards and regulatory documents are identified and reflected in the design.
- Applicable construction and operating experience was considered in the design.
- The calculation number has been properly obtained and entered.
- An appropriate design method or computer code was used.
- A mathematical check has been performed.
- The output is reasonable compared to the input.

Alternate Calculation ☑ including verification of asterisked items noted above.
The alternate calculation (8 pages) is attached.

Qualification Testing ☐ for design feature including verification of asterisked items noted above and the following:

- The test was performed in accordance with written test procedures.
- Most adverse design conditions were used in the test.
- Scaling laws were established and verified and error analyses were performed, if applicable.
- Test acceptance criteria were clearly related to the design calculation.
- Test results (documented in) were reviewed by the calculation Preparer or other cognizant engineer.

Independent Reviewer Comments: See 8 pages 3 attachments
Comments are personnel clarifications
or minor corrections with no effect on
calculated values.

/S/ [signature] 12/16/97
Independent Reviewer /Date

Preparer concurrence with findings and comment resolution

/S/ Philip D. Hariji 12-16-97
Preparer or Other Cognizant Engineer

Review of Calc M-662 Rev 3

	WATER PROPERTIES-Cameron Hydraulic Data							
V_{SP}-ft^3/lbm	ρ - lbm/ft^3	gm/cm^3	centistokes	centipoises	μ-lbf-sec/ft^2	ν-ft^2/sec	P_{VP}-psia	Temp ^{0}F
	62.37	0.9991	1.12	1.118992	2.34E-05	1.21E-05		60
	62.27	0.9974	0.9	0.89766	1.87E-05	9.69E-06		75
	62.22							80
	62	0.9931	0.69	0.685239	1.43E-05	7.43E-06		100
0.016247	61.56	0.986	0.51	0.50286	1.05E-05	5.49E-06	2.223	130
	60.79	0.9737	0.38	0.370006	7.73E-06	4.09E-06		170
	60.61	0.971	0.364	0.353444	7.38E-06	3.92E-06		178
	60.57	0.9703	0.36	0.349308	7.3E-06	3.88E-06		180
	60.87		0.392			4.22E-06		166
	60.455		0.345			3.71E-06		185

	M_D =	**7612.601**	OK	
	M_W =	**8702.102**	OK	
	M_{TOT} =	**16314.7**	OK	
	Strainer Suction Loss @ 5600 gpm =		**0.16518** psi	OK
	Should also ref Dwgs C1A300, C1A350, C1A369 all Rev. E0 and SUDL[illegible]/RF 97-048 References should be changed to Rev. E0 for Dwgs C1A363 and C1A36[illegible].			
Tables 1&2				
	Replace wording of 45^0 LR EL with 45^0 EL since at least one SR 45 is used on each strainer line and the L/D and K used is for SR 45			
Table 3				
	Velocity =	**7.687755** ft/sec for 17.25 pipe id and 5600 gpm flow		OK
	Re =	**2013698** for 130F and 5600 gpm 18" line		OK close to calc value
	Re =	**2619862** for 166F and 5600 gpm 18" line		OK close to calc value
	Re =	**2976771** for 185F and 5600 gpm 18" line		OK close to calc value
	HL v&f =	**1.808977** Eqa 4 for RHR D @ 130F		OK
	HL line =	**0.948403** Eqa 5 for RHR D @ 130F		OK
Table 4				
	HL vel =	**0.918262** Eqa 2 for RHR D @ 130F		OK close to calc value
	HL suct =	**3.15** Eqa 6 for RHR D @ 130F		OK close to calc value
	dp =	**1.739925** Eqa 7 for RHR D @ 130F		OK close to calc value
Table 5	$NPSH_A$ =	**38.48143** Eqa 8 for RHR D @ 130F and Pc = 0		OK
	$NPSH_M$ =	**11.48** Eqa 9 for RHR D @ 130F and Pc = 0		OK
	DP IST =	**1.91845** Eqa 10 for RHR D @ 130F and Pc = 0		OK
		Note: Table 4 values for suction loss were rounded up slightly (increased) for input into Table 5 for conservatism.		
Table 6/7	Same as Table 5 but at 166 and 185F and not recalculated. It is noted that the max IST DP for the B & C RHR lines could be increased to 1.92 psi and still provide more total margin than the A & D RHR lines.			

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Table 8	$NPSH_A$ =	39.03318	Eqa 8 for CS @ 132F		OK			
	$NPSH_M$ =	10.03	Eqa 9 for CS @ 132F		OK			
	DP IST =	1.818054	Eqa 10 for CS @ 132F		OK			
	Checked point of minimum margin.							
Table 9	Same as Rev 2 Table 8 with minor changes except that suction head loss values have been revised for CS and RHR as recalculated in previous sections.							
Section 4.C.1	m_{leak} units should be labeled as lbm/sec not lbm - typo.							
	Define ref pressure P_T = (45psig + 14.7) = 59.7psia							
Tables 10 & 11	Benchmark same as previous calc rev except tables were numbered 9 & 10.							
Table 12	m_{LEAK} =	0.000767	Eqa 15 - 120000 sec and 1% leakage 65F			OK		
	φ =	0.129438	Eqa 16	"		OK		
	m_{GAS} =	0.000679	Eqa 17	"		OK		
	Mt* =	16208.43	Eqa 18	"		OK		
	Pc =	15.44859	Eqa 19	"		OK		
	Notes:	for eqa 15 & 16 use P_C and P_V from previous step.						
		for eqa 18 used M* from previous step for Mt						
		for eqa 19 used 147000 for drywell volume for conservatism.						
	The symbol for time in eqa 18 should be t instead of T which is used elsewhere for temperature							
Table 13	Similar to Table 12 except leakage rate highter and Pc same time as Table 12 is less.							
Table 14	Pgas =	30.10803	Eqa 21 for 160000 seconds and 1% leakage RHR				OK	
	NPSHA =	39.4	Eqa 22	"			OK	
	Pc req. =	9.457813	Eqa 23	"			OK	
	NPSHm =	12.4	Eqa 24	"			OK	
	NPSHm =	12.40292	Eqa 24 alt	"			OK	
Table 15	NPSHA =	40.22	Eqa 22 at 160000 sec 1% leak CS				OK	
	Pc req. =	9.963	Eqa 23 at 160000 sec 1% leak CS				OK	
	NPSHm =	11.2	Eqa 24 at 160000 sec 1% leak CS				OK	
Table 16	Similar to Table 14 but highter leakage and NPSH margin less at 160000 sec.							
Table 17	Similar to Table 15 but highter leakage and NPSH margin less at 160000 sec.							
Table 18	m_{LEAK} =	0.000844	Eqa 15 - 180000 sec and 1% leakage 75F				OK	
	φ =	0.14307	Eqa 16	"			OK	
	m_{GAS} =	0.000738	Eqa 17	"			OK	
	Mt* =	16143.34	Eqa 18	"			OK	
	Pc =	16.26299	Eqa 19	"			OK	
Table 19	Similar to Table 18 except 5% leak rate and for same time Mt* and Pc are lower							

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Table 20	Similar to Table 14 but 75F water temperature vs 65F.							
	Pgas =	31.08184	Eqa 21 for 180000 seconds and 1% leakage RHR				OK	
	NPSHA =	40.39	Eqa 22	"			OK	
	Pc req. =	10.55971	Eqa 23	"			OK	
	NPSHm =	13.4	Eqa 24	"			OK	
	NPSHm =	13.38115	Eqa 24 alt	"			OK	
Table 21	Similar to Table 20 except for CS							
	NPSHA =	41.21	Eqa 22 at 180000 sec 1% leak CS			OK		
	Pc req. =	11.06236	Eqa 23 at 180000 sec 1% leak CS			OK		
	NPSHm =	12.2	Eqa 24 at 180000 sec 1% leak CS			OK		
Table 22	Similar to Table 20 but highter leakage and NPSH margin less at 180000 sec.							
Table 23	Similar to Table 21 but highter leakage and NPSH margin less at 180000 sec.							
Table 24	Pc =	15.34603	Eqa 19 for 130F		OK			
	Pgas =	30.69714			OK			
	NPSHA=	40.82			OK			
	Note: under CS NPSHR, RHR NPSHR and NPSHA should refer to figure 8 not figure 6.							

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	WATER PROPERTIE		
V_{SP}-ft^3/lbm	ρ - lbm/ft^3	gm/cm^3	centistokes
	62.37	0.9991	1.12
	62.27	0.9974	0.9
	62.22		
	62	0.9931	0.69
0.016247	61.56	0.986	0.51
	60.79	0.9737	0.38
	60.61	0.971	0.364
	60.57	0.9703	0.36
	60.87		0.392
	60.455		0.345
	M_D =	=((1.3+14.696)-(0.8*3.7184))*132000*144/53.3/(460+150)	
	M_W =	=((14.696)-(1*0.5961))*124500*144/53.3/(460+85)	
	M_{TOT} =	=SUM(C16:C17)	
		Strainer Suction Loss @ 5600 gpm =	=(5600/5100)^2*0.137
		Should also ref Dwgs C1A300, C1A350, C1A369 all Rev. E	
		References should be changed to Rev. E0 for Dwgs C1A36	
Tables 1&2			
		Replace wording of 45^0 LR EL with 45^0 EL since at least one	
		on each strainer line and the L/D and K used is for SR 45	
Table 3			
	Velocity =	=5600/7.4805/60/(17.25^2*0.7854)*144	
	Re =	=17.25/12*7.69/G9	
	Re =	=17.25/12*7.69/G13	
	Re =	=17.25/12*7.69/G14	
	HL v&f =	=1.97*(7.69)^2/64.4	
	HL line =	=(0.0158*94/1.438)*(7.69)^2/64.4	

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Table 4			
	HL vel =	=(7.69)^2/64.4	
	HL suct =	=1.81+0.95+0.39	
	dp =	=(0.92+3.15)*61.56/144	
Table 5	$NPSH_A$ =	=12.5-3.2+((14.696-2.223)*144*0.016247)	
	$NPSH_M$ =	=38.48-27	
	DP IST =	=(((3.2+2)*(2.32/3.2))+0.67)*(62.22/144)	
		Note: Table 4 values for suction loss were rounded up slightl	
		input into Table 5 for conservatism.	
Table 6/7	Same as Table 5 but		
	IST DP for the B & C		
	total margin than the		
Table 8	$NPSH_A$ =	=12.5-2.38+((14.696-2.3445)*144*0.016256)	
	$NPSH_M$ =	=39.03-29	
	DP IST =	=(((2.38+2)*(1.33/2.38))+1.76)*(62.22/144)	
	Checked point of mini		
Table 9	Same as Rev 2 Table		
	have been revised for		
Section 4.C.1		m_{leak} units should be labeled as lbm/sec not lbm - typo.	
		Define ref pressure P_T = (45psig + 14.7) = 59.7psia	
Tables 10 & 11	Benchmark same as		
Table 12	m_{LEAK} =	=0.001888*((1-(14.7/15.99)^2)/(1-(14.7/59.7)^2))^0.5	
	φ =	=0.621*(2.758/(15.99-2.758))	
	m_{GAS} =	=C65/(C66+1)	
	Mt* =	=16222-((C65/(C66+1))*(120000-100000))	
	P_C =	=((16209*53.3*592.3/(147000+124500))/144)+2.36	
	Notes:	for eqa 15 & 16 use P_C and P_V from previous step.	

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		for eqa 18 used M* from previous step for Mt	
		for eqa 19 used 147000 for drywell volume for conservatism	
	The symbol for time i		
Table 13	Similar to Table 12 ex		
Table 14	Pgas =	=(14.77-1.88)*144/61.65	
	NPSHA =	=30.1+12.5-3.2	
	Pc req. =	=1.88+((27-12.5+3.2)*61.65/144)	
	NPSHm =	=39.4-27	
	NPSHm =	=(14.77-9.46)*144/61.65	
Table 15	NPSHA =	=30.1+12.5-2.38	
	Pc req. =	=1.88+((29-12.5+2.38)*61.65/144)	
	NPSHm =	=40.2-29	
Table 16	Similar to Table 14 b		
Table 17	Similar to Table 15 b		
Table 18	m_{LEAK} =	=0.001888*((1-(14.7/16.31)^2)/(1-(14.7/59.7)^2))^0.5	
	φ =	=0.621*(3.054/(16.31-3.054))	
	m_{GAS} =	=C91/(C92+1)	
	Mt* =	=16146-((C91/(C92+1))*(180000-176400))	
	Pc =	=((16144*53.3*601.7/(147000+124500))/144)+3.02	
Table 19	Similar to Table 18 ex		
Table 20	Similar to Table 14 b		
	Pgas =	=(16.26-3.02)*144/61.34	
	NPSHA =	=31.09+12.5-3.2	
	Pc req. =	=3.02+((27-12.5+3.2)*61.34/144)	
	NPSHm =	=40.4-27	
	NPSHm =	=(16.26-10.56)*144/61.34	

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Table 21	Similar to Table 20 ex		
	NPSHA =	=31.09+12.5-2.38	
	Pc req. =	=3.02+((29-12.5+2.38)*1.34/144)	
	NPSHm =	=41.2-29	
Table 22	Similar to Table 20 b		
Table 23	Similar to Table 21 b		
Table 24	Pc =	=((16315*53.3*590/(147000+124500))/144)+2.223	
	Pgas =	=(C116-2.223)*144/61.56	
	NPSHA=	=30.7+12.5-2.38	
	Note: under CS NPS		

centipoises	μ-lbf-sec/ft^2	ν–ft^2/sec	P_{VP}-psia	Temp ^{0}F	
=C5*D5	=E5*0.0000208854	=D5*0.0000107639		60	
=C6*D6	=E6*0.0000208854	=D6*0.0000107639		75	
				80	
=C8*D8	=E8*0.0000208854	=D8*0.0000107639		100	
=C9*D9	=E9*0.0000208854	=D9*0.0000107639	2.223	130	
=C10*D10	=E10*0.0000208854	=D10*0.0000107639		170	
=C11*D11	=E11*0.0000208854	=D11*0.0000107639		178	
=C12*D12	=E12*0.0000208854	=D12*0.0000107639		180	
		=D13*0.0000107639		166	
		=D14*0.0000107639		185	

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BECo Calculation M-734, Rev. 2