ATTACHMENT (1)

UNIT 1

TECHNICAL SPECIFICATION

REVISED PAGES

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B 3/4 4-8

B 3/4 4-9

B 3/4 4-10

B 3/4 5-2

B 3/4 5-3

3/4.1.2 BORATION SYSTEMS

Flow Paths - Shutdown

LIMITING CONDITION FOR OPERATION

3.1.2.1 As a minimum, one of the following boron injection flow paths and one associated heat tracing circuit shall be **OPERABLE**:

a. A flow path from the boric acid storage tank via either a boric acid pump or a gravity feed connection and charging pump to the Reactor Coolant System if only the boric acid storage tank in Specification 3.1.2.7a is **OPERABLE**, or

b. The flow path from the refueling water tank via either a charging pump or a high pressure safety injection pump* to the Reactor Coolant System if only the refueling water tank in Specification 3.1.2.7b is **OPERABLE**.

APPLICABILITY: **MODES** 5 and 6.

ACTION: With none of the above flow paths **OPERABLE**, suspend all operations involving **CORE ALTERATIONS** or positive reactivity changes until at least one injection path is restored to **OPERABLE** status.

SURVEILLANCE REQUIREMENTS

4.1.2.1 At least one of the above required flow paths shall be demonstrated **OPERABLE**:

a. At least once per 7 days by verifying that the temperature of the heat traced portion of the flow path is above the temperature limit line shown on Figure 3.1.2-1 when a flow path from the concentrated boric acid tanks is used.

b. At least once per 31 days by verifying that each valve (manual, power-operated or automatic) in the flow path that is not locked, sealed, or otherwise secured in position, is in its correct position.

365

* At 355°F and less, the required **OPERABLE** HPSI pump shall be in pull-to-lock and will not start automatically. At 355°F and less, HPSI pump use will be conducted in accordance with Technical Specification 3.4.9.3.

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3/4.1 REACTIVITY CONTROL SYSTEMS

3/4.1.2 BORATION SYSTEMS

Charging Pump - Shutdown

LIMITING CONDITION FOR OPERATION

3.1.2.3 At least one charging pump or one high pressure safety injection pump* in the boron injection flow path required **OPERABLE** pursuant to Specification 3.1.2.1 shall be **OPERABLE** and capable of being powered from an **OPERABLE** emergency bus.

APPLICABILITY: **MODES** 5 and 6.

ACTION: With no charging pump or high pressure safety injection pump **OPERABLE**, suspend all operations involving **CORE ALTERATIONS** or positive reactivity changes until at least one of the required pumps is restored to **OPERABLE** status.

SURVEILLANCE REQUIREMENTS

4.1.2.3 No additional Surveillance Requirements other than those required by Specification 4.0.5.

365

* At ~~355~~°F and less, the required **OPERABLE** HPSI pump shall be in pull-to-lock and will not start automatically. At ~~355~~°F and less, HPSI pump use will be conducted in accordance with Technical Specification 3.4.9.3.

365

TABLE 3.3-3 (Continued)

TABLE NOTATION

\# Containment isolation of non-essential penetrations is also initiated by SIAS (functional units 1.a and 1.c).

@ When the RCS temperature is:

(a) Greater than 375°F, the required **OPERABLE** HPSI pumps must be able to start automatically upon receipt of a SIAS signal,

(b) Between 375°F and 355°F, a transition region exists where the **OPERABLE** HPSI pump will be placed in pull-to-lock on a cooldown and restored to automatic status on a heatup.

(c) At 355°F and less, the required **OPERABLE** HPSI pump shall be in pull-to-lock and will not start automatically.

* The provisions of Specification 3.0.4 are not applicable.

** Must be **OPERABLE** only in **MODE** 6 when the valves are required **OPERABLE** and they are open.

(a) Trip function may be bypassed in this **MODE** when pressurizer pressure is < 1800 psia; bypass shall be automatically removed when pressurizer pressure is ≥ 1800 psia.

(c) Trip function may be bypassed in this **MODE** below 785 psia; bypass shall be automatically removed at or above 785 psia.

3/4.4 **REACTOR COOLANT SYSTEM**

3/4.4.1 COOLANT LOOPS AND COOLANT CIRCULATION

HOT STANDBY

LIMITING CONDITION FOR OPERATION

3.4.1.2 a. The reactor coolant loops listed below shall be **OPERABLE**:

1. Reactor Coolant Loop #11 and at least one associated reactor coolant pump.

2. Reactor Coolant Loop #12 and at least once associated reactor coolant pump.

b. At least one of the above reactor coolant loops shall be in operation*.

APPLICABILITY: **MODE 3****.

ACTION:

a. With less than the above required reactor coolant loops **OPERABLE**, restore the required loops to **OPERABLE** status within 72 hours or be in **HOT SHUTDOWN** within the next 12 hours.

b. With no reactor coolant loop in operation, suspend all operations involving a reduction in boron concentration of the Reactor Coolant System and initiate corrective action to return the required loop to operation within one hour.

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* All reactor coolant pumps may be de-energized for up to 1 hour (up to 2 hours for low flow test) provided (1) no operations are permitted that would cause dilution of the Reactor Coolant System boron concentration, and (2) core outlet temperature is maintained at least 10°F below saturation temperature.

** A reactor coolant pump shall not be started with the RCS temperature less than or equal to 355°F (365) unless (1) the pressurizer water level is less than or equal to 170 inches, and (2) the secondary water temperature of each steam generator is less than or equal to 30°F above the RCS temperature, and (3) the pressurizer pressure is less than or equal to 300 psia.

3/4.4 REACTOR COOLANT SYSTEM

3/4.4.1 COOLANT LOOPS AND COOLANT CIRCULATION

Shutdown

LIMITING CONDITION FOR OPERATION

3.4.1.3 a. At least two of the coolant loops listed below shall be **OPERABLE**:

1. Reactor Coolant Loop #11 and its associated steam generator and at least one associated reactor coolant pump,
2. Reactor Coolant Loop #12 and its associated steam generator and at least one associated reactor coolant pump,
3. Shutdown Cooling Loop #11*,
4. Shutdown Cooling Loop #12*.

b. At least one of the above coolant loops shall be in operation**.

APPLICABILITY: **MODES** 4***# and 5***#.

ACTION:

a. With less than the above required reactor coolant loops **OPERABLE**, initiate corrective action to return the required coolant loops to **OPERABLE** status within one hour or be in **COLD SHUTDOWN** within 24 hours.

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* The normal or emergency power source may be inoperable in **MODE** 5.

** All reactor coolant pumps and shutdown cooling pumps may be de-energized for up to 1 hour provided (1) no operations are permitted that would cause dilution of the Reactor Coolant System boron concentration, and (2) core outlet temperature is maintained at least 10°F below saturation temperature.

*** A reactor coolant pump shall not be started with the RCS temperature less than or equal to 355°F (365) unless (1) the pressurizer water level is less than or equal to 170 inches, and (2) the secondary water temperature of each steam generator is less than or equal to 30°F above the RCS temperature, and (3) the pressurizer pressure is less than or equal to 300 psia.

\# See Special Test Exception 3.10.5.

3/4.4.9 PRESSURE/TEMPERATURE LIMITS

Reactor Coolant System

LIMITING CONDITION FOR OPERATION

3.4.9.1 The Reactor Coolant System (except the pressurizer) temperature and pressure shall be limited in accordance with the limit lines shown on Figures 3.4.9-1 and 3.4.9-2 during heatup, cooldown, criticality, and inservice leak and hydrostatic testing with:

a. A maximum heatup of:

Maximum Allowable Heatup Rate	RCS Temperature
30°F in any one hour period	70°F to 164°F
40°F in any one hour period	> 164°F to ~~328~~ 256°F
~~10°F in any one hour period~~	~~> 328°F to 355°F~~
60°F in any one hour period	> ~~355~~ 256°F

b. A maximum cooldown of:

Maximum Allowable Cooldown Rate	RCS Temperature
100°F in any one hour period	> ~~254~~ 270°F
20°F in any one hour period	~~254~~ 270°F to 184°F
10°F in any one hour period	< 184°F

c. A maximum temperature change of 5°F in any one hour period, during hydrostatic testing operations above system design pressure.

APPLICABILITY: At all times.

ACTION: With any of the above limits exceeded, restore the temperature and/or pressure to within the limit within 30 minutes; perform an engineering evaluation to determine the effects of the out-of-limit condition on the fracture toughness properties of the Reactor Coolant System; determine that the Reactor Coolant System remains acceptable for continued operations or be in at least **HOT STANDBY** within the next 6 hours and reduce the RCS T_{avg} and pressure to less than 200°F and 300 psia, respectively, within the following 30 hours.

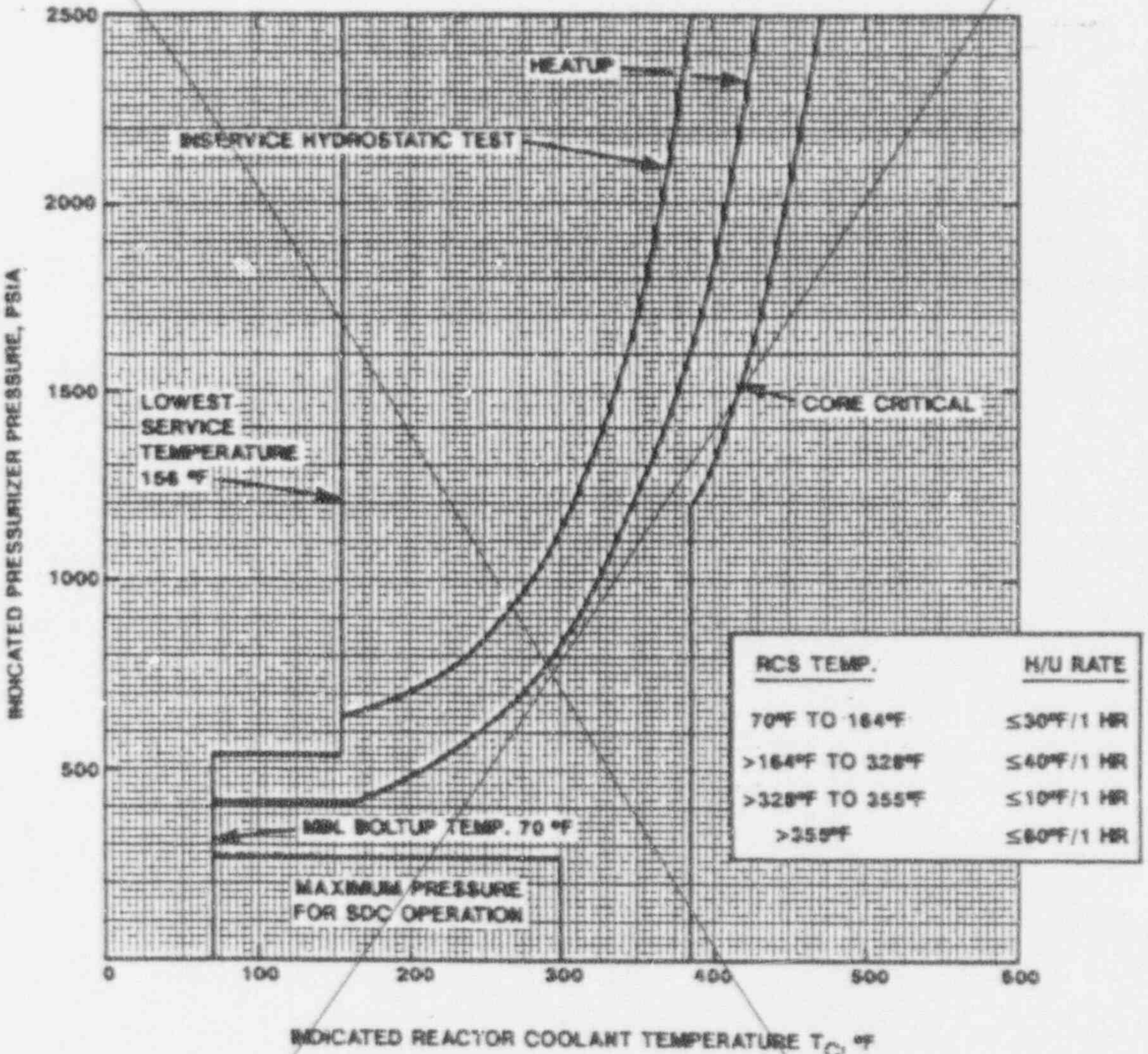


FIGURE 3.4.9-1

CALVERT CLIFFS UNIT 1 HEATUP CURVE
REACTOR COOLANT SYSTEM PRESSURE TEMPERATURE LIMITS
FOR FLUENCE ≤ 3.25 x 10^{18} n/cm^2 AT THE INNER SURFACE OF THE REACTOR VESSEL

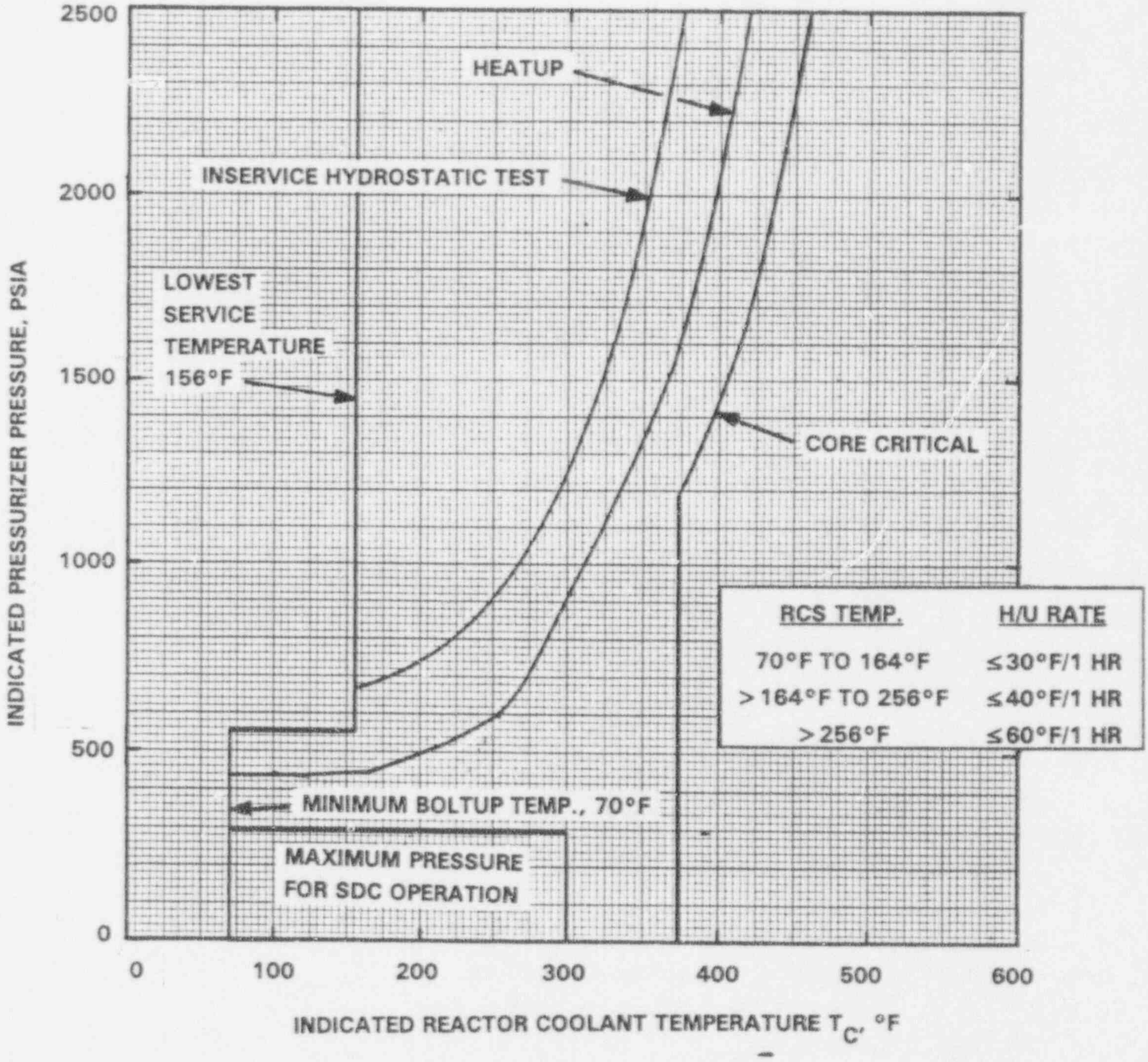


FIGURE 3.4.9-1

CALVERT CLIFFS UNIT 1 HEATUP CURVE
REACTOR COOLANT SYSTEM PRESSURE TEMPERATURE LIMITS
FOR FLUENCE $\leq 2.61 \times 10^{19}$ n/cm^2 AT THE INNER SURFACE OF THE REACTOR VESSEL

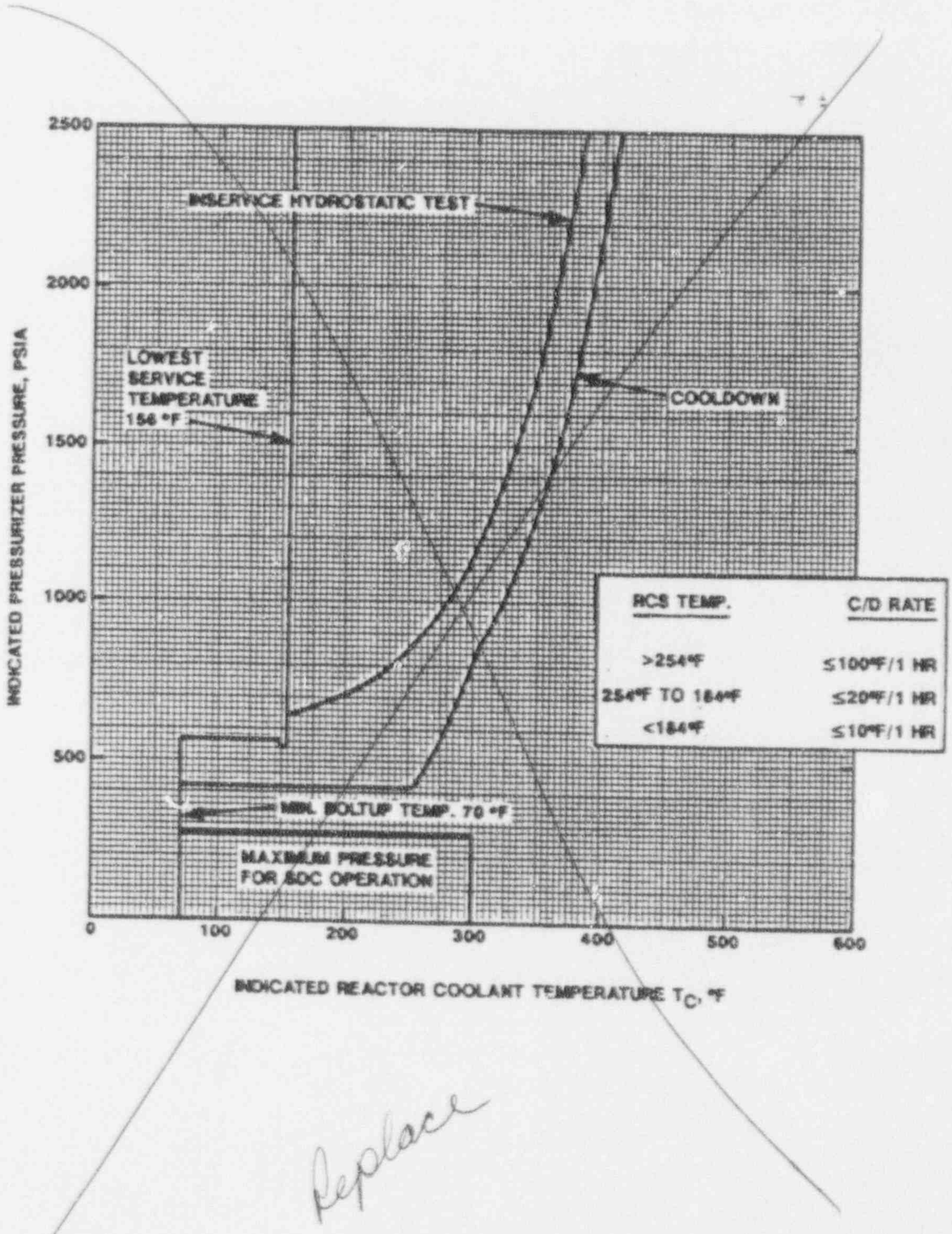


FIGURE 3.4.9-2

CALVERT CLIFFS UNIT 1 COOLDOWN CURVE
REACTOR COOLANT SYSTEM PRESSURE TEMPERATURE LIMITS
FOR FLUENCE ≤ 3.25×10^{19} n/cm² AT THE INNER SURFACE OF THE REACTOR VESSEL

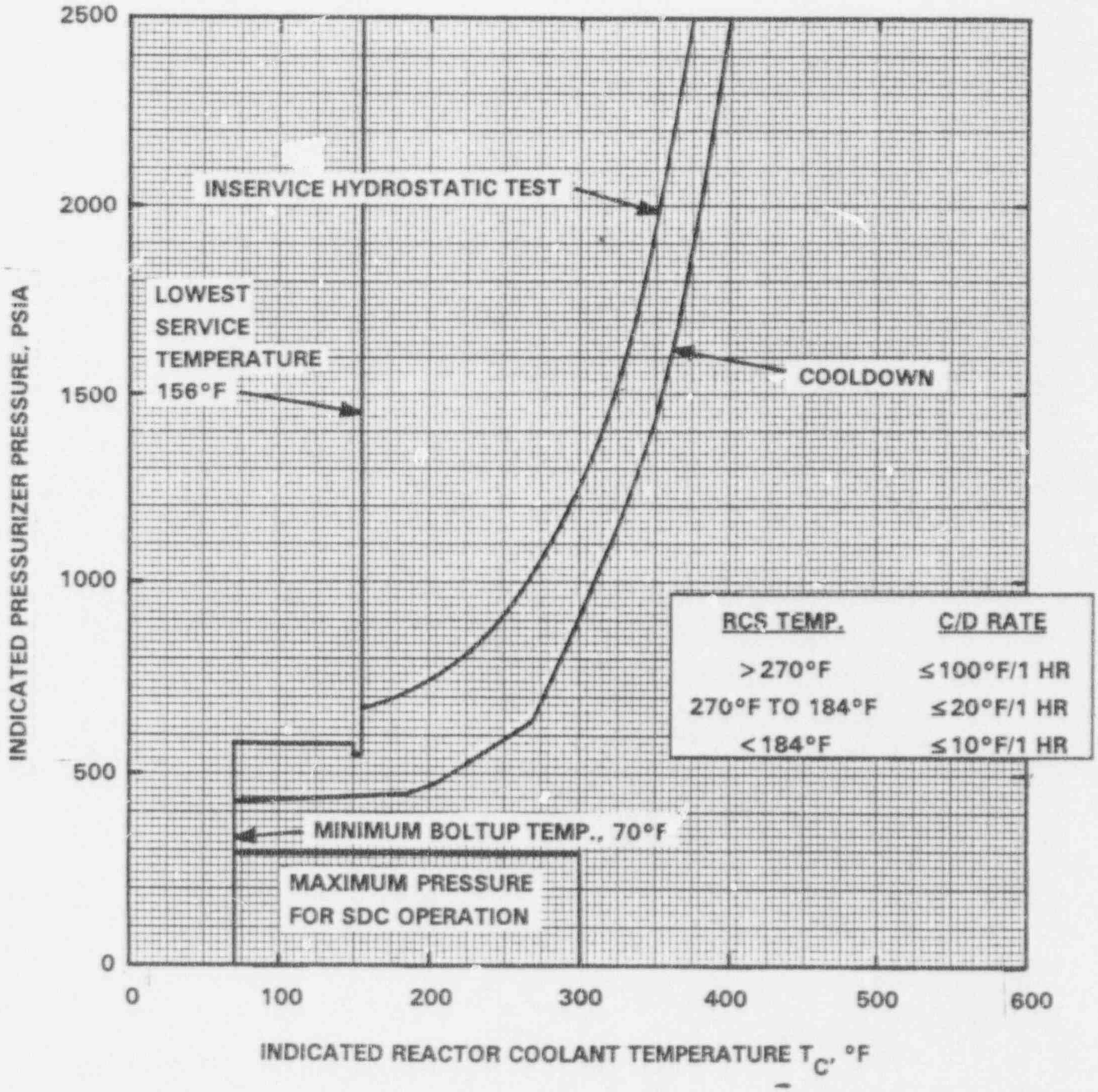


FIGURE 3.4.9-2

CALVERT CLIFFS UNIT 1 COOLDOWN CURVE
REACTOR COOLANT SYSTEM PRESSURE TEMPERATURE LIMITS
FOR FLUENCE $\leq 2.61 \times 10^{19}$ n/cm^2 AT THE INNER SURFACE OF THE REACTOR VESSEL

3/4.4.9 PRESSURE/TEMPERATURE LIMITS

Overpressure Protection Systems

LIMITING CONDITION FOR OPERATION

3.4.9.3 The following overpressure protection requirements shall be met:

a. One of the following three Overpressure Protection Systems shall be in place:

1. Two power-operated relief valves (PORVs) with a trip setpoint ~~≤ 429~~ psia or below the curve in Figure 3.4.9-3*

2. A single PORV with a trip setpoint ~~of ≤ 429 psia~~ and a Reactor Coolant System vent of ≥ 1.3 square inches, or

3. A Reactor Coolant System (RCS) vent ≥ 2.6 square inches.

b. Two high pressure safety injection (HPSI) pumps# shall be disabled by either removing (racking out) their motor circuit breakers from the electrical power supply circuit, or by locking shut their discharge valves.

c. The HPSI loop motor operated valves (MOVs)# shall be prevented from automatically aligning HPSI pump flow to the PCS by placing their hand switches in pull-to-override.

d. No more than one **OPERABLE** high pressure safety injection pump with suction aligned to the Refueling Water Tank may be used to inject flow into the RCS and when used, it must be under manual control and one of the following restrictions shall apply:

1. The total high pressure safety injection flow shall be limited to ≤ ~~200~~ 210 gpm OR

2. A Reactor Coolant System vent of ≥ 2.6 square inches shall exist.

e. When not in use, the above **OPERABLE** high pressure safety injection pump shall have its handswitch in pull-to-lock.

APPLICABILITY: When the RCS temperature is ≤ ~~355°F~~ 365°F and the RCS is vented to < 8 square inches.

(* When on Shutdown Cooling the PORV trip setpoint shall be ≤ 429 psia)

EXCEPT when required for testing.

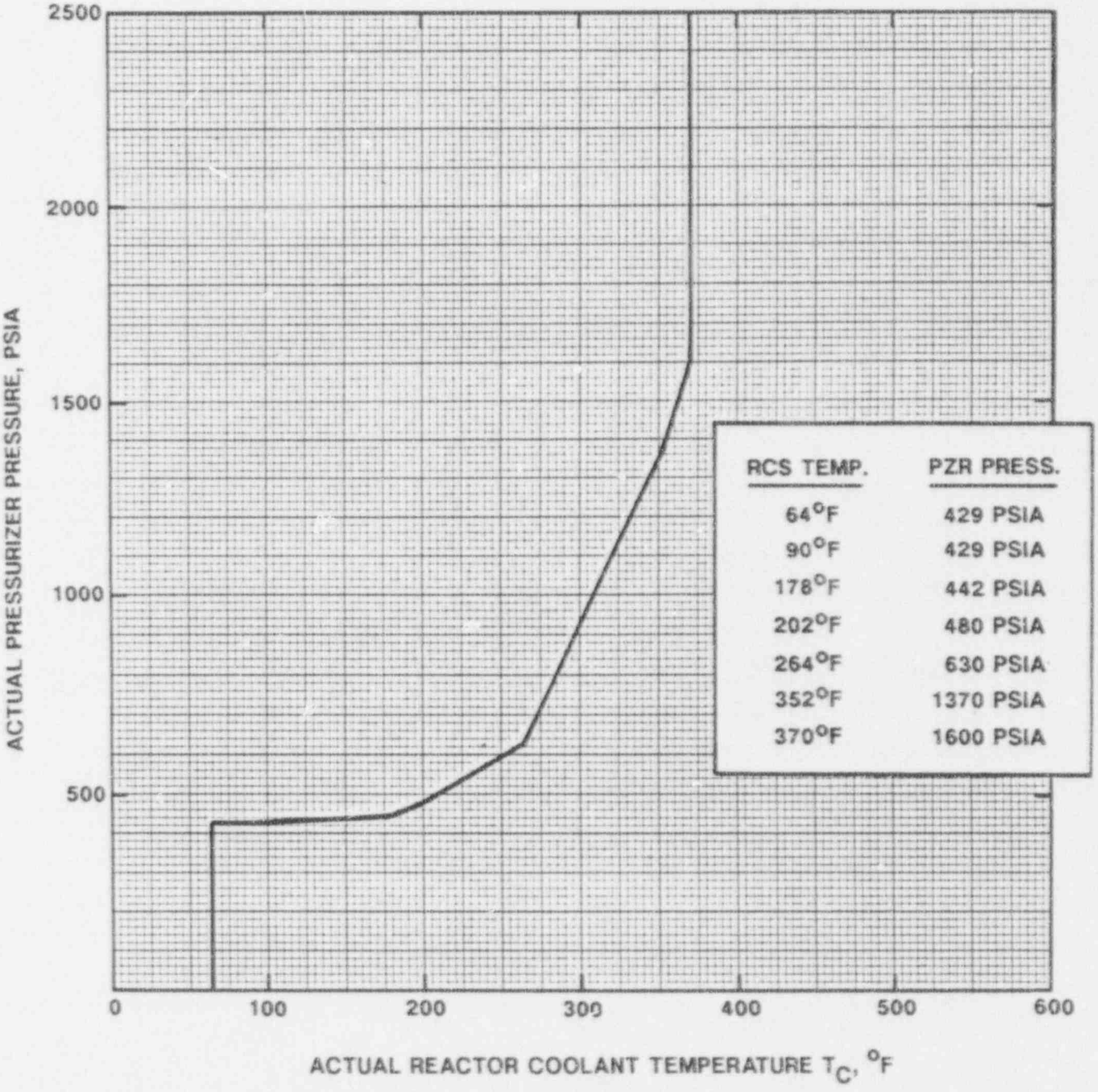


FIGURE 3.4.9-3

CALVERT CLIFFS UNIT 1
MAXIMUM PORV OPENING PRESSURE vs TEMPERATURE
FOR FLUENCE $\leq 2.61 \times 10^{19}$ n/cm^2 AT THE INNER SURFACE OF THE REACTOR VESSEL

LIMITING CONDITION FOR OPERATION (Continued)

ACTION:

a. With one PORV inoperable, either restore the inoperable PORV to **OPERABLE** status within 5 days or depressurize and vent the RCS through a $\geq$ 1.3 square inch vent(s) within the next 48 hours; maintain the RCS in a vented condition until both PORVs have been restored to **OPERABLE** status.

b. With both PORVs inoperable, depressurize and vent the RCS through a $\geq$ 2.6 square inch vent(s) within 48 hours; maintain the RCS in a vented condition until either one **OPERABLE PORV** and a vent of $\geq$ 1.3 square inches has been established or both PORVs have been restored to **OPERABLE** status.

c. In the event either the PORVs or the RCS vent(s) are used to mitigate a RCS pressure transient, a Special Report shall be prepared and submitted to the Commission pursuant to Specification 6.9.2 within 30 days. The report shall describe the circumstances initiating the transient, the effect of the PORVs or vent(s) on the transient and any corrective action necessary to prevent recurrence.

d. With less than two HPSI pumps# disabled, place at least two HPSI pump handswitches in pull-to-lock within fifteen minutes and disable two HPSI pumps within the next four hours.

e. With one or more HPSI loop MOVs# not prevented from automatically aligning a HPSI pump to the RCS, immediately place the MOV handswitch in pull-to-override, or shut and disable the affected MOV or isolate the affected HPSI header flowpath within four hours, and implement the **ACTION** requirements of Specifications 3.1.2.1, 3.1.2.3, and 3.5.3, as applicable.

f. With HPSI flow exceeding ~~200~~ 210 gpm while suction is aligned to the RWT and an RCS vent of < 2.6 square inches exists,

   1. Immediately take action to reduce flow to less than or equal to ~~200~~ 210 gpm.

   2. Verify the excessive flow condition did not raise pressure above the maximum allowable pressure for the given RCS temperature on Figure 3.4.9-1 or Figure 3.4.9-2.

\# EXCEPT when required for testing.

SURVEILLANCE REQUIREMENTS

4.5.2 Each ECCS subsystem shall be demonstrated **OPERABLE***:

a. At least once per 12 hours by verifying that the following valves are in the indicated positions with power to the valve operators removed:

Valve Number	Valve Function	Valve Position
1. MOV-659	Mini-flow Isolation	Open
2. MOV-660	Mini-flow Isolation	Open
3. CV-306	Low Pressure SI Flow Control	Open

b. At least once per 31 days by:

1. Verifying that upon a Recirculation Actuation Test Signal, the containment sump isolation valves open.

2. Verifying that each valve (manual, power-operated or automatic) in the flow path that is not locked, sealed, or otherwise secured in position, is in its correct position.

c. By a visual inspection which verifies that no loose debris (rags, trash, clothing, etc.) is present in the containment which could be transported to the containment sump and cause restriction of the pump suctions during LOCA conditions. This visual inspection shall be performed:

1. For all accessible areas of the containment prior to establishing **CONTAINMENT INTEGRITY**, and

2. Of the areas affected within containment at the completion of containment entry when **CONTAINMENT INTEGRITY** is established.

d. Within 4 hours prior to increasing the RCS pressure above 1750 psia by verifying, via local indication at the valve, that CV-306 is open.

---

* Whenever flow testing into the RCS is required at RCS temperatures of 355°F and less, the high pressure safety injection pump shall recirculate RCS water (suction from RWT isolated) or the controls of Technical Specification 3.4.9.3 shall apply.

3/4.5.3 ECCS SUBSYSTEMS - MODES 3 (< 1750 PSIA) AND 4

LIMITING CONDITION FOR OPERATION

3.5.3 As a minimum, one ECCS subsystem comprised of the following shall be **OPERABLE**:

a. One# **OPERABLE** high-pressure safety injection pump, and

b. An **OPERABLE** flow path capable of taking suction from the refueling water tank on a Safety Injection Actuation Signal and automatically transferring suction to the containment sump on a Recirculation Actuation Signal.

APPLICABILITY: **MODES** 3* and 4.

ACTION:

a. With no ECCS subsystem **OPERABLE**, restore at least one ECCS subsystem to **OPERABLE** status within 1 hour or be in **COLD SHUTDOWN** within the next 20 hours.

b. In the event the ECCS is actuated and injects water into the Reactor Coolant System, a Special Report shall be prepared and submitted to the Commission pursuant to Specification 6.9.2 within 90 days describing the circumstances of the actuation and the total accumulated actuation cycles to date.

SURVEILLANCE REQUIREMENTS

4.5.3.1 The ECCS subsystem shall be demonstrated **OPERABLE** per the applicable Surveillance Requirements of 4.5.2.

\# Between 375°F and 355°F, a transition region exists where the **OPERABLE** HPSI pump will be placed in pull-to-lock on a cooldown and restored to automatic status on a heatup. At 355°F and less, the required **OPERABLE** HPSI pump shall be in pull-to-lock and will not start automatically. At 355°F and less, HPSI pump use will be conducted in accordance with Technical Specification 3.4.9.3.

* With pressurizer pressure < 1750 psia.

3/4.4.1 COOLANT LOOPS AND COOLANT CIRCULATION

The plant is designed to operate with both reactor coolant loops and associated reactor coolant pumps in operation, and maintain DNBR above 1.195 during all normal operations and anticipated transients.

A single reactor coolant loop with its steam generator filled above the low level trip setpoint provides sufficient heat removal capability for core cooling while in **MODES** 2 and 3; however, single failure considerations require plant shutdown if component repairs and/or corrective actions cannot be made within the allowable out-of-service time.

In **MODES** 4 and 5, a single reactor coolant loop or shutdown cooling loop provides sufficient heat removal capability for removing decay heat; but single failure considerations require that at least two loops be **OPERABLE**. Thus, if the reactor coolant loops are not **OPERABLE**, this specification requires two shutdown cooling loops to be **OPERABLE**.

The operation of one Reactor Coolant Pump or one shutdown cooling pump provides adequate flow to ensure mixing, prevents stratification and produces gradual reactivity changes during boron concentration reductions in the Reactor Coolant System. The reactivity change rate associated with boron reductions will, therefore, be within the capability of operator recognition and control.

The restrictions on starting a Reactor Coolant Pump during **MODES** 3, 4 and 5 with the RCS temperature ≤ ~~355~~ 365°F are provided to prevent RCS pressure transients, caused by energy additions from the Secondary System, which could exceed the limits of 10 CFR Part 50, Appendix G (see Bases 3/4.4.9). For ~~operation of~~ starting the reactor coolant pumps the following criteria apply; (1) restricting the water volume in the pressurizer (170 inches) and thereby providing a volume for the primary coolant to expand into and (2) by restricting starting of the RCPs to when the indicated secondary water temperature of each steam generator is less than or equal to 30°F above the Reactor Coolant System temperature, (3) limit the initial indicated pressure of the pressurizer to less than or equal to 300 psia. ← Add Insert A

3/4.4.2 SAFETY VALVES

The pressurizer code safety valves operate to prevent the RCS form being pressurized above its Safety Limit of 2750 psia. Each safety valve is designed to relieve approximately 3 x 10^5 lbs per hour of saturated steam at the valve setpoint. The relief capacity of a single safety valve is adequate to relieve any overpressure condition which could occur during shutdown. In the event that no safety valves are **OPERABLE**, an operating

INSERT A

The limit on initial pressurizer pressure will prevent the PORV from lifting during the pressure transient.

Figure 3.4.8-1 increase the 2 hour thyroid dose at the **SITE BOUNDARY** by a factor of up to 20 following a postulated steam generator tube rupture.

Reducing T_{avg} to < 500°F prevents the release of activity should a steam generator tube rupture since the saturation pressure of the primary coolant is below the lift pressure of the atmospheric steam relief valves. The surveillance requirements provide adequate assurance that excessivespecific activity levels in the primary coolant will be detected in sufficient time to take corrective action. Information obtained on iodine spiking will be used to assess the parameters associated with spiking phenomena. A reduction in frequency of isotopic analyses following power changes may be permissible if justified by the data obtained.

3/4.4.9 PRESSURE/TEMPERATURE LIMITS

All components in the Reactor Coolant System are designed to withstand the effects of cyclic loads due to system temperature and pressure changes. These cyclic loads are introduced by normal load transients, reactor trips, and **STARTUP** and shutdown operation. The various categories of load cycles used for design purposes are provided in Section 4.1.1 of the UFSAR. During **STARTUP** and shutdown, the rates of temperature and pressure changes are limited so that the maximum specified heatup and cooldown rates are consistent with the design assumptions and satisfy the stress limits for cyclic operation.

Operation within the appropriate heatup and cooldown curves assures the integrity of the reactor vessel against fracture induced by combinative thermal and pressure stresses. As the vessel is subjected to increasing fluence, the toughness of the limiting material continues to decline, and ever more restrictive Pressure/Temperature limits must be observed. The current limits, Figures 3.4.9-1 and 3.4.9-2, are ~~for a peak neutron fluence to the inner surface of the reactor vessel of ≤ 3.25x10^19 N/cm² (E ≥ 1 MeV), which corresponds to approximately 22 Effective Full Power Years (EFPY) of operation.~~ (2.61) (Add Insert B)

The reactor vessel materials have been tested to determine their initial RT_{NDT}; the results of these tests are shown in Section 4.1.5 of the UFSAR. Reactor operation and resultant fast neutron (E > 1 MeV) irradiation will cause an increase in the RT_{NDT}. The actual shift in RT_{NDT} of the vessel material will be established periodically during operation by removing and evaluating reactor vessel material irradiation surveillance specimens installed near the inside wall of the reactor vessel in the core area. The number of reactor vessel irradiation surveillance specimens and the frequencies for removing and testing these specimens are provided in UFSAR Table 4-13 and are approved by the NRC prior to implementation in compliance with the requirements of 10 CFR Part 50, Appendix H.

The shift in the material fracture toughness, as represented by RT_{NDT}, is calculated using Regulatory Guide 1.99, Revision 2. For a fluence of ~~3.25~~ (2.61) x10^{19} N/cm², the adjusted reference temperature (ART) value at the 1/4 T position is ~~253.7~~ (244.9) °F. At the 3/4 T position the ART value is ~~193.8~~ (181.0) °F.

INSERT B

This fluence corresponds to the Pressurized Thermal Shock Screening Criteria defined in 10 CFR 50.61 for weld 2-203 A,B,C.

These values are used with procedures developed in the ASME Boiler and Pressure Vessel Code, Section III, Appendix G to calculate heatup and cooldown limits in accordance with the requirements of 10 CFR Part 50, Appendix G.

To develop composite pressure-temperature limits for the heatup transient, the isothermal, 1/4 T heatup, and 3/4 T heatup pressure-temperature limits are compared for a given thermal rate. Then the most restrictive pressure-temperature limits are combined over the complete temperature interval resulting in a composite limit curve for the reactor vessel beltline for the heatup event. No ¶

~~To develop a~~ The composite pressure-temperature limit for the cooldown ~~event,~~ transient ~~the isothermal pressure-temperature limit must be calculated. The isothermal pressure-temperature limit is then compared to the pressure-temperature limit associated with a cooling rate and the more restrictive allowable pressure-temperature limit is chosen resulting in a composite limit curve for the reactor vessel beltline~~. Add Insert C

Both 10 CFR Part 50, Appendix G and ASME, Code Appendix G require the development of pressure-temperature limits which are applicable to inservice hydrostatic tests. The minimum temperature for the inservice hydrostatic test pressure can be determined by entering the curve at the test pressure (1.1 times normal operating pressure) and locating the corresponding temperature. This curve is shown for a fluence of $\leq$ ~~3.25~~ 2.61 $\times 10^{19}$ N/cm^2 on Figures 3.4.9-1 and 3.4.9-2.

Similarly, 10 CFR Part 50 specifies that core critical limits be established based on material considerations. This limit is shown on the heatup curve, Figure 3.4.9-1. Note that this limit does not consider the core reactivity safety analyses that actually control the temperature at which the core can be brought critical.

The Lowest Service Temperature is the minimum allowable temperature at pressures above 20% of the pre-operational system hydrostatic test pressure (625 psia). This temperature is defined as equal to the most limiting RT_{NDT} for the balance of the Reactor Coolant System components plus 100°F, per Article NB 2332 of Section III of the ASME Boiler and Pressure Vessel Code.

The horizontal line between the minimum boltup temperature and the Lowest Service Temperature is defined by the ASME Boiler and Pressure Vessel Code as 20% of the pre-operational hydrostatic test pressure. The change in the line at 150°F on ~~the cooldown curve~~ Figure 3.4.9-2 is due to a cessation of RCP flow induced pressure deviation, since no RCPs are permitted to operate during a cooldown below 150°F.

INSERT C

is developed similarly. The Appendix G limits in Figures 3.4.9-1 and 3.4.9-2 assume the following number of RCPs are running:

Heatup

Indicated RCS Temperature	Maximum Number of RCPs Operating
70°F to 330°F	2
>330°F	4

Cooldown

Indicated RCS Temperature	Maximum Number of RCPs Operating
>350°F	4
350°F to 150°F	2
<150°F	0

The minimum boltup temperature is the minimum allowable temperature at pressures below 20% of the pre-operational system hydrostatic test pressure. The minimum is defined as the initial RT_{NDT} for the material of the higher stressed region of the reactor vessel plus any effects for irradiation per Article G-2222 of Section III of the ASME Boiler and Pressure Vessel Code. The initial reference temperature of the reactor vessel and closure head flanges was determined using the certified material test reports and Branch Technical Position MTEB 5-2. The maximum initial RT_{NDT} associated with the stressed region of the closure head flange is -10°F. However, in order to comply with the 10 CFR 50, Appendix G limits, the minimum allowable reactor vessel temperature with the reactor head attached is 70°F. Hence, the minimum boltup temperature used in Figures and 3.4.9-1 and 3.4.9-2.

(Add Insert D)

The design basis events in the low temperature region ~~assuming a water solid system~~ are:

- An RCP start with hot steam generators; and,
- An inadvertent HPSI actuation with concurrent charging.

(Add Insert E)

Any measures which will prevent or mitigate the design basis events are sufficient for any less severe incidents. Therefore, this section will discuss the results of the RCP start and mass addition transient analyses. Also discussed is the effectiveness of a pressurizer steam bubble and a single PORV relative to mitigating the design basis events.

The RCP start transient is a severe LTOP challenge for (Add Insert F) ~~a water solid RCS~~. Therefore, during water solid operations all four RCPs are tagged out of service. (Add Insert G) ~~Analysis indicates the transient is adequately controlled by placing restrictions on three parameters: initial pressurizer pressure and level, and the secondary-to-primary temperature difference.~~ With these restrictions in place, the transient is adequately controlled without the assistance of the PORVs. (Add Insert H)

(Add Insert I)

~~The inadvertent actuation of one HPSI pump in conjunction with one charging pump is the most severe mass addition overpressurization event.~~ To preclude this event from happening while water solid, all HPSI pumps and two charging pumps are tagged out-of-service during water solid operations.

INSERT D

The Low-Temperature Overpressure Protection (LTOP) system consists of administrative controls coupled with low-pressure setpoint PORVs. The administrative controls provide the first line of defense against overpressurization events; the PORVs provide a backup to the administrative controls. The following section discusses the bases for the PORV setpoint and administrative controls.

Low-Temperature Overpressure Protection uses a variable PORV setpoint to take advantage of the increased Appendix G limits at higher RCS temperatures. Reactor Coolant System temperature is measured at the cold leg RTDs. This provides an accurate temperature indication during forced circulation, and is also adequate for natural circulation. However, the T_{cold} RTDs are not accurate when on shutdown cooling (SDC) because they are not in the flow stream. For this reason, the lowest PORV setpoint is maintained whenever on SDC. This setpoint, which is independent of RCS temperature, is manually set when SDC is initiated and maintained until forced circulation is established after the RCPs are started.

The PORV setpoint is chosen to protect the most limiting of the heatup or cooldown Appendix G limits. Figure 3.4.9-3 shows the maximum PORV opening pressure. This includes corrections for static and dynamic head, and pressure overshoot to account for PORV response time and the maximum pressurization rate. The actual PORV setpoint is controlled by procedure and accounts for device uncertainty, calibration uncertainty and loop drift.

INSERT E

These transients are most severe when the RCS is initially water solid.

INSERT F

that can quickly exceed the Appendix G limits

INSERT G

and their motor circuit breakers are disabled. However, the transient is adequately mitigated by restricting three parameters: 1) the initial water volume in the pressurizer to 170 inches (indicated), thereby providing a volume for the primary coolant to expand into; 2) the indicated secondary water temperature for each steam generator to 30°F above the RCS temperature; and 3) the initial pressure of the pressurizer to 300 psia.

INSERT H

Failure to maintain one of the initial conditions could cause the PORVs to open following an RCP start.

INSERT I

The mass addition transient from HPSI or multiple charging pumps is a severe LTOP challenge for a water solid system due to PORV response time.

BASES

Analyses were performed for a ~~single~~ HPSI ~~pump and one~~ charging ~~pump~~, and the expansion ~~to~~ the RCS water volume following loss of decay heat removal, assuming one PORV available (due to single-failure criteria) ~~with the existing orifice area of 1.29 in².~~ This mass addition, determined at the point when the RCS reached water solid conditions, must be less than the capability of a single PORV to limit the LTOP event. Sufficient overpressure protection results when the equilibrium pressure does not exceed the limiting Appendix G curve pressure. Because the equilibrium pressure exceeds the minimum Appendix G limit for full HPSI flow, HPSI flow is throttled to no more than 200 gpm indicated when the HPSI pump is used for mass addition. The HPSI flow limit includes allowances for instrumentation uncertainty, charging pump flow addition and RCS expansion following loss of decay heat removal. The HPSI flow is injected through only one HPSI loop MOV to limit instrumentation uncertainty. No more than one charging pump (44 gpm) is allowed to operate during the HPSI mass addition.

~~Comparison of the PORV discharge pressure with the analytical limit critical pressurizer pressure of 444.5 psia indicates that adequate protection is provided by a single PORV for RCS temperatures of 70°F or above when HPSI flow is limited to 200 gpm.~~

~~A PORV trip setpoint of ≤ 429 psia was selected. The actual PORV trip setpoint is controlled by plant procedures and is calculated considering response time and total loop uncertainties. Total loop uncertainties include allowances for loop drift, calibration uncertainties and instrument device uncertainties. The loop drift was considered in the technical specification trip setpoint, which is an allowable value calculated per Instrument Society of America Standard ISA-S67.04.~~

To provide single failure protection against a HPSI pump mass addition transient when in MPT enable, the HPSI loop MOV handswitches must be placed in pull-to-override so the valves do not automatically actuate upon receipt of a SIAS signal. Alternative actions, described in the **ACTION** statement, are to disable the affected MOV (by racking out its motor circuit breaker or equivalent), or to isolate the affected HPSI header. Examples of HPSI header isolation actions include; (1) de-energizing and tagging shut the HPSI header isolation valves; (2) locking shut and tagging all three HPSI pump discharge valves; and (3) disabling all three HPSI pumps.

Three 100% capacity HPSI pumps are installed at Calvert Cliffs. Procedures will require that two of the three HPSI pumps be disabled (breakers racked out) at RCS temperatures less than or equal to 355°F and that the remaining HPSI pump handswitch be placed in pull-to-lock. Additionally, the HPSI pump normally in pull-to-lock shall be throttled to less than or equal to 200 gpm when used to add mass to the RCS. Exceptions are provided for ECCS testing and for response to LOCAs.

~~A pressurizer steam volume and a single PORV will provide satisfactory control of all mass addition transients with the exception of a spurious actuation of full flow from a HPSI pump. Overpressurization due to this transient will be precluded for temperatures 355°F and less by disabling two HPSI pumps, placing the third in pull-to-lock, and by throttling the third pump to less than or equal to 200 gpm flow when it is used to add mass to the RCS.~~

~~Note that only the design bases events are discussed in detail since the less severe transients are bounded by the RCP start and inadvertent HPSI actuation analysis.~~

RCS temperature, as used in the applicability statement, is determined as follows: (1) with the RCPs running, the RCS cold leg temperature is the appropriate indication, (2) with the Shutdown Cooling System in operation, the shutdown cooling temperature indication is appropriate, (3) if neither the RCPs or shutdown cooling is in operation, the core exit thermocouples are the appropriate indicators of RCS temperature.

3/4.4.10 STRUCTURAL INTEGRITY

The inspection programs for the ASME Code Class 1, 2, and 3 components ensure that the structural integrity of these components will be maintained at an acceptable level throughout the life of the plant. To the extent applicable, the inspection program for these components is in compliance with Section XI of the ASME Boiler and Pressure Vessel Code.

3/4.4.11 CORE BARREL MOVEMENT

This specification is provided to ensure early detection of excessive core barrel movement if it should occur. Core barrel movement will be detected by using four excore neutron detectors to obtain Amplitude Probability Distribution (APD) and Spectral Analysis (SA). Baseline core barrel movement Alert Levels and Action Levels will be confirmed during each reactor startup test program following a core reload.

Data from these detectors is to be reduced in two forms. Root mean square (RMS) values are computed from the APD of the signal amplitude. These RMS magnitudes include variations due both to various neutronic effects and internals motion. Consequently, these signals alone can only provide a gross measure of core barrel motion. A more accurate assessment of core barrel motion is obtained from the Auto and Cross Power Spectral Densities (PSD, XPSD), phase (ϕ) and coherence (COH) of these signals. These data result from the SA of the excore detector signals.

A modification to the required monitoring program may be justified by an analysis of the data obtained and by an examination of the affected parts during the plant shutdown at the end of any fuel cycle.

pipe downward. In addition, each ECCS subsystem provides long term core cooling capability in the recirculation mode during the accident recovery period.

Portions of the Low Pressure Safety Injection (LPSI) System flowpath are common to both subsystems. This includes the low pressure safety injection flow control valve, CV-306, the flow orifice downstream of CV-306, and the four low pressure safety injection loop isolation valves. Although the portions of the flowpath are common, the system design is adequate to ensure reliable ECCS operation due to the short period of LPSI System operation following a design basis Loss of Coolant Incident prior to recirculation. The LPSI System design is consistent with the assumptions in the safety analysis.

The trisodium phosphate dodecahydrate (TSP) stored in dissolving baskets located in the containment basement is provided to minimize the possibility of corrosion cracking of certain metal components during operation of the ECCS following a LOCA. The TSP provides this protection by dissolving in the sump water and causing its final pH to be raised to $\geq$ 7.0. The requirement to dissolve a representative sample of TSP in a sample of RWT water provides assurance that the stored TSP will dissolve in borated water at the postulated post LOCA temperatures.

The Surveillance Requirements provided to ensure **OPERABILITY** of each component ensure that as a minimum, the assumptions used in the safety analyses are met and the subsystem **OPERABILITY** is maintained. The surveillance requirement for flow balance testing provides assurance that proper ECCS flows will be maintained in the event of a LOCA. Maintenance of proper flow resistance and pressure drop in the piping system to each injection point is necessary to: (1) prevent total pump flow from exceeding runout conditions when the system is in its minimum resistance configuration, (2) provide the proper flow split between injection points in accordance with the assumptions used in the ECCS-LOCA analyses, and (3) provide an acceptable level of total ECCS flow to all injection points equal to or above that assumed in the ECCS-LOCA analyses. Minimum HPSI flow requirements for temperatures above 355°F (365) are based upon small break LOCA calculations which credit charging pump flow following an SIAS. Surveillance testing includes allowances for instrumentation and system leakage uncertainties. The 470 gpm requirement for minimum HPSI flow from the three lowest flow legs includes instrument uncertainties but not system check valve leakage. The **OPERABILITY** of the charging pumps and the associated flow paths is assured by the Boration System Specification 3/4.1.2. Specification of safety injection pump total developed head ensures pump performance is consistent with safety analysis assumptions.

At temperatures of 355°F and less, HPSI injection flow is limited to less than or equal to 200 gpm except in response to excessive reactor coolant leakage. With excessive RCS leakage (LOCA), make-up requirements could exceed an HPSI flow of 200 gpm. Overpressurization is prevented by controlling other parameters, such as RCS pressure and subcooling. This provides overpressure protection in the low temperature region. An analysis has been performed which shows this flow rate is more than adequate to meet core cooling safety analysis assumptions. HPSI pumps are not required to auto-start when the RCS is in the MPT enable condition. The Safety Injection Tanks provide immediate injection of borated water into the core in the event of an accident, allowing adequate time for an operator to take action to start a HPSI pump.

Surveillance testing of HPSI pumps is required to ensure pump **OPERABILITY**. Some surveillance testing requires that the HPSI pumps deliver flow to the RCS. To allow this testing to be done without increasing the potential for overpressurization of the RCS, either the RWT must be isolated or the HPSI pump flow must be limited to less than or equal to 200 gpm or an RCS vent greater than 2.6 square inches must be provided.

3/4.5.4 REFUELING WATER TANK (RWT)

The **OPERABILITY** of the RWT as part of the ECCS ensures that a sufficient supply of borated water is available for injection by the ECCS in the event of a LOCA. The limits on RWT minimum volume and boron concentration ensure that 1) sufficient water is available within containment to permit recirculation cooling flow to the core, and 2) the reactor will remain subcritical in the cold condition following mixing of the RWT and the RCS water volumes with all control rods inserted except for the most reactive control assembly. These assumptions are consistent with the LOCA analyses.

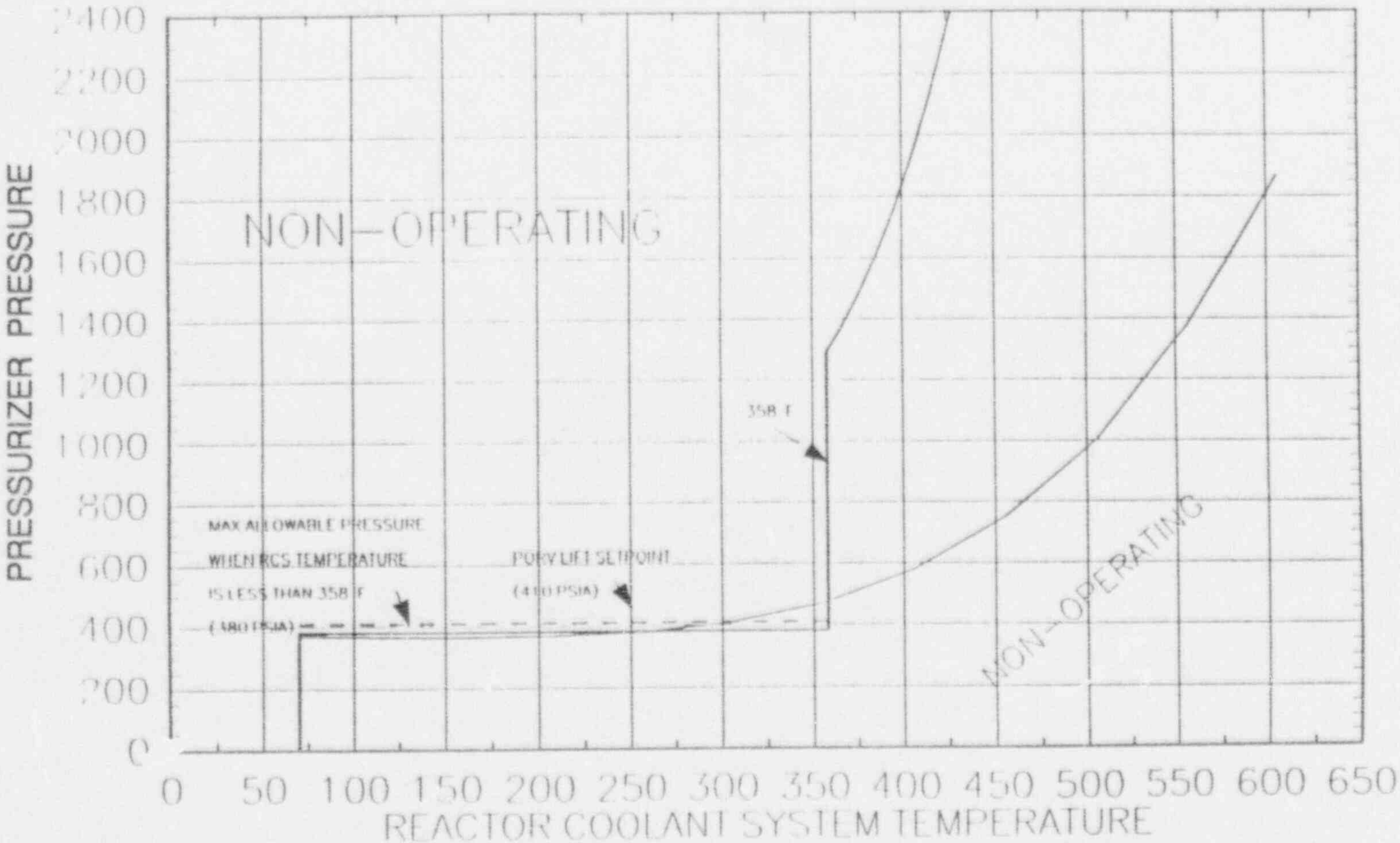
The contained water volume limit includes an allowance for water not usable because of tank discharge line location or other physical characteristics.

ATTACHMENT (2)

ONE RCP EACH LOOP OPERATING LIMITS

RCS PRESSURE / TEMPERATURE OPERATING LIMITS

11A OR 11B AND 12A OR 12B RCP (22 EFPY)



RCS PRESSURE / TEMPERATURE OPERATING LIMITS

11A AND 11B RCPs (22 EFPY)