Final Submittal
(Blue Paper)

FINAL RO/SRO WRITTEN

EXAMINATION REFERENCES

SURRY JAN./FEB. 2006 EXAM

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JANUARY 23 - FEBRUARY 3, 2006
FEBRUARY 8, 2006 (WRITTEN)

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Written Exam References

Dominion

SURRY POWER STATION

PROCEDURE NO: 1-OP-RC-011

REVISION NO: 16

PROCEDURE TYPE: OPERATING PROCEDURE

UNIT NO: 1

PROCEDURE TITLE: PRESSURIZER RELIEF TANK OPERATIONS

ISI						

REVISION SUMMARY:

Revised to incorporate OP FB 05-0042.

- Revised Step 5.6.5.b and 5.9.4.b.

PROCEDURE USED: ☐ Entirely ☐ Partially **Note:** If used partially, note reasons in remarks.

PROBLEMS ENCOUNTERED: ☐ NO ☐ YES **Note:** If YES, note problems in remarks.

REMARKS: _____

_____

_____

_____

_____

_____ (Use back for additional remarks.)

SHIFT SUPERVISION: DATE:

CONTINUOUS USE

TABLE OF CONTENTS

Section		Page
1.0	PURPOSE	3
2.0	REFERENCES	3
3.0	INITIAL CONDITIONS	5
4.0	PRECAUTIONS AND LIMITATIONS	5
5.0	INSTRUCTIONS	7
5.1	PRT Evolutions	7
5.2	Filling the PRT	8
5.3	Draining the PRT	9
5.4	Adding Nitrogen to the PRT	11
5.5	Venting/Purging the PRT to the Vent Vent System	16
5.6	Venting/Purging the PRT to the Process Vent System	23
5.7	Installing PRT Vent to the Overhead Gas System	32
5.8	Securing the PRT Vent to the Overhead Gas System	35
5.9	Venting the PRT through the Sample System to the Process Vent System	36
ATTACHMENTS		
1	PRT Purge to Vent Vent Continuation Sheet	42
2	PRT Purge to Process Vent Continuation Sheet	44

1.0 PURPOSE

1.1 To provide instructions for performing the following actions with the Pressurizer Relief Tank (PRT).

- Filling the PRT
- Draining the PRT
- Adding Nitrogen to the PRT
- Venting/Purging the PRT to Vent Vent System
- Venting/Purging the PRT to the Process Vent System
- Venting the PRT to the Overhead Gas System

1.2 To satisfy the open test of 1-RC-160 IAW the Inservice Testing Program Plan for Pumps and Valves. Completion of Subsection 5.2 satisfies this requirement.

2.0 REFERENCES

2.1 Source Documents

2.1.1 UFSAR, Section 4.2, Reactor Coolant System Design and Operation

2.2 Technical Specifications Surry Power Station Units 1 and 2

2.2.1 Technical Specifications 3.3.A.2, SI Accumulators

2.3 Technical References

2.3.1 1-OP-VS-001, Containment Ventilation

2.3.2 1-OP-23.1, Process Vent System

2.3.3 1-OP-RC-004, Draining the RCS to Reactor Flange Level.

2.3.4 1-OP-RC-005, Draining the RCS from Flange Level to Mid-Nozzle (Reduced Inventory)

2.3.5 1-GOP-2.5, Unit Shutdown, RCS Cooldown from 345°F-350°F to 195°F

2.3.6 11448-FM-82B, Sample System

2.3.7 11448-FM-83B, Vent and Drain System

2.3.8 11448-FM-86B, Reactor Coolant System

2.3.9 11448-FM-87A, RHR System

2.3.10 11448-FM-88C, CVCS System

2.3.11 11448-FM-89A and 89B, Safety Injection System

2.3.12 0-DRP-004, Precautions, Limitations and Setpoints

2.3.13 VPAP-2103, Offsite Dose Calculation Manual

2.3.14 SE 98-054, Rev. 0, PRT Vent Jumpers

2.3.15 ET S-01-0102, Hydrogen Release to the Process Vent via the Pressurizer Relief Tank

2.3.16 DCP 01-008, Instrument and Controls Upgrade Project, Unit 1

2.3.17 DCP 03-001, ERF Computer System Replacement/Surry/Unit 1 & 2

2.3.18 Inservice Testing Program Plan for Pumps and Valves

2.4 Commitment Documents

2.4.1 DR S-98-2607 Communications related to PRT release and containment purge.

2.4.2 DR S-98-1323, Ensure if PRZR PORVs are open, PRZR volume is accounted for in PRT release form

2.4.3 DR S-00-0492, PRT released with leakage through 2-RC-PCV-2455C

2.4.4 Plant Issue S-01-1369, Hydrogen Release from PRT to Process Vent

2.4.5 CAT 2 RCE S-2001-0845

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3.0 INITIAL CONDITIONS

None

4.0 PRECAUTIONS AND LIMITATIONS

4.1 Extreme care must be used when the N_2 transfer valves are being opened. The large ΔP between the PRT and the N_2 makeup source can generate a very high flow rate.

4.2 The Process Vent and Vent Vent radiation monitors must be watched closely when PRT vent/purge flow is being established.

4.3 If using an SI Accumulator as the nitrogen source for the PRT, SI Accumulator pressure will decrease. To prevent making the SI Accumulator inoperable, pressure must be maintained above the 600 psia limit specified in Tech Spec 3.3.A.2 when the Accumulator is required to be operable.

4.4 The hose used in Subsections 5.7 and 5.8 to vent the PRT to the Overhead should be stainless steel flex braid rated for at least 150 psig.

4.5 HP must be notified concerning the status of the PRZR PORVs to account for the additional gas from the RCS if the PORVs are open. **(Reference 2.4.2)**

4.6 To assure accurate accounting of discharged radioactivity, Health Physics personnel must periodically sample Vent-Vent or Process Vent as appropriate during the release of a PRT. HP must be notified prior to the start OR reinitiation of such a release **(Reference 2.4.1)**.

4.7 If the PRT gas sample indicates Xe-133 activity greater than or equal to 5×10^{-2} μCi/ml, the release shall be made to the Overhead Gas System.

4.8 If any unisolated leakage path exists into the PRT, the release shall be made to the Overhead Gas system.

4.9 Values for PRT pressure drop in Subsection 5.6 may not be exceeded. These limits ensure Hydrogen concentration in the Process Vent remains below the 4% flammability limit.

5.0 INSTRUCTIONS

5.1 PRT Evolutions

5.1.1 Compare PRT parameters with the following table.

Parameter (Normal band)	MCR Instrument	Computer Point	Annunciator	Annunciator Alarm Value
Level (60 to 80%)	LI-1-470	L0485A (PCS) L1RC001A (PCS (ERF, if not removed))	1C-G7 1C-H7	High - 83% Low - 59%
N_2 pressure (Normally 2 to 4 psig) (2 to 10 psig during draindown)	PI-1-472	P0485A (PCS) P1RC001A (PCS (ERF, if not removed))	1C-F7	High 10 psig
Temperature (70 to 120 °F)	TI-1-471	T0485A (PCS) T1RC001A (PCS (ERF, if not removed))	1C-E7	High - 125°F

5.1.2 Based on present conditions, perform the required subsection to adjust PRT parameters. (✓) Enter N/A for the subsections that will not be performed.

Status (✓)	Present Conditions	Actions to be Performed	Initials
	PRT Tank level low	Perform Subsection 5.2	_____
	PRT Tank level high	Perform Subsection 5.3	_____
	PRT Tank N_2 pressure low	Perform Subsection 5.4	_____
	PRT Tank N_2 pressure high or PRT to be vented/purged of hydrogen and radioactive gases	Perform Subsection 5.3, 5.5, 5.6, or 5.7	_____

Performed by: _____ _____ _____ _____
Signature Initial Print Date

_____ _____ _____ _____
Signature Initial Print Date

5.2 Filling the PRT

_____ 5.2.1 Notify the STA that the Unit 1 PRT will be filled.

_____ 5.2.2 Open 1-RC-TV-1519A, PRZR RELIEF TK PRI GRADE WTR OTSD TRIP VV.

_____ 5.2.3 Verify closed or close 1-RC-HCV-1523, PRT DRAIN.

_____ 5.2.4 Open 1-RC-HCV-1519B, PRT MAKEUP, to fill the PRT.

NOTE: When the Unit is in CSD or RSD, the PRT may be filled to 95% to assist in venting/purging the PRT to the Vent/Vent or Process Vent System.

_____ 5.2.5 WHEN the desired level is reached, THEN close 1-RC-HCV-1519B.

_____ 5.2.6 At the direction of Shift Supervision, close 1-RC-TV-1519A. Otherwise, enter N/A.

Performed by:

Signature	Initial	Print	Date

5.3 Draining the PRT

CAUTION

- If the Pressurizer relieves to the PRT with the PRT level below the sparger, and the PRT spray is not available, a rapid increase in PRT pressure will occur. To maintain PRT pressure control, the 1-RC-HCV-1519B, PRT MAKEUP, flowpath must remain available until the RCS temperature is less than 190°F.
- PRT pressure must not be allowed to decrease to less than 2 psig while the PRT is being drained unless the PRT is vented to the Process Vent System.

_____ 5.3.1 Notify the STA that Unit 1 PRT will be drained.

_____ 5.3.2 Verify either a positive pressure is present in the PRT or the PRT is vented to the Process Vent System. IF required, THEN perform Subsection 5.4 to establish a positive pressure before continuing.

CAUTION

- To prevent an unplanned RCS dilution, PRT draining is prohibited during Unit 1 or Unit 2 stripper degas evolutions.
- If Overhead Gas System pressure is high and the PRT is vented to the Process Vent System, then an unmonitored release may occur when the PRT drain is opened.

_____ 5.3.3 Open 1-RC-HCV-1523, PRT DRAIN, to begin draining the PRT.

NOTE: If the PRT level is greater than 10%, N_2 flow from the PRT to the Pressurizer will be restricted.

_____ 5.3.4 IF preparing to drain to Reactor Vessel Flange level in 1-OP-RC-004 or Mid-Nozzle in 1-OP-RC-005, THEN drain to between 5 percent and 10 percent level. Otherwise, enter N/A.

_____ 5.3.5 Monitor PDTT level and start Primary Drain Transfer pumps as required.

_____ 5.3.6 WHEN the desired level is obtained in the PRT, THEN close 1-RC-HCV-1523.

Performed by:

Signature	Initial	Print	Date
Signature	Initial	Print	Date
Signature	Initial	Print	Date

5.4 Adding Nitrogen to the PRT

_____ 5.4.1 Verify PRT pressure needs to be increased (normal operating range is 2 to 4 psig).

_____ 5.4.2 Verify one of the following substeps. (✓)

( ) 1-SI-TV-100, ACCUM & PRT N2 SUP O/S TV is closed with an upstream N_2 supply valved in.

OR

( ) Accumulator N_2 pressure is available for makeup.

5.4.3 Verify the following valves are closed.

_____ a. 1-SI-TV-101A, ACCUM VENT HDR I/S TV

_____ b. 1-SI-TV-101B, ACCUM VENT HDR O/S TV

_____ c. HCV-1936, ACCUMS VNT LINE FLOW SETPT

_____ d. HCV-1898, PRZR RELIEF TK N2 ISOL VV

_____ e. HCV-1853A, ACCUM N2 & VNT LINE ISOL VVS, ACCUM A

_____ f. HCV-1853B, ACCUM N2 & VNT LINE ISOL VVS, ACCUM B

_____ g. HCV-1853C, ACCUM N2 & VNT LINE ISOL VVS, ACCUM C

_____ 5.4.4 Determine if the needed increase in N_2 pressure is large (greater than 2 psig) or small (less than or equal to 2 psig), and perform one of the following steps. (✓)

( ) IF the needed N_2 pressure increase is large, THEN perform Step 5.4.5.

( ) IF the needed N_2 pressure increase is small, THEN perform Step 5.4.6.

CAUTION

PRT pressure must be closely monitored during the pressurization evolution and Nitrogen must be secured as close to the source as possible. Extreme care must be used when opening the N_2 transfer valves; the large ΔP between the PRT and the N_2 makeup source can generate a very high flow rate.

_____ 5.4.5 IF the needed N_2 pressure increase is large, THEN perform the following. Otherwise, enter N/A.

a. Verify open or open 1-RC-HCV-1549, PRT VENT.

CAUTION

If using an SI Accumulator as the nitrogen source for the PRT, SI Accumulator pressure will decrease. To prevent making the SI Accumulator inoperable, pressure must be maintained above the 600 psia limit specified in Tech Spec 3.3.A.2 when the Accumulator is required to be operable.

_____ b. Select and open one of the source valves. (✓) Maintain the SI Accumulators within the limits specified in Tech Spec 3.3.A.2.

( ) 1-SI-TV-100, ACCUM & PRZR RELIEF TK N2 SUP

( ) HCV-1853A, ACCUM N2 & VNT LINE ISOL VVS, ACCUM A

( ) HCV-1853B, ACCUM N2 & VNT LINE ISOL VVS, ACCUM B

( ) HCV-1853C, ACCUM N2 & VNT LINE ISOL VVS, ACCUM C

_____ c. Open HCV-1936 as required and observe the PRT pressure increasing.

_____ d. Close HCV-1936 at the desired PRT pressure.

_____ e. Close the source valve opened in Substep 5.4.5.b. (✓)

( ) 1-SI-TV-100, ACCUM & PRZR RELIEF TK N2 SUP

( ) HCV-1853A, ACCUM N2 & VNT LINE ISOL VVS, ACCUM A

( ) HCV-1853B, ACCUM N2 & VNT LINE ISOL VVS, ACCUM B

( ) HCV-1853C, ACCUM N2 & VNT LINE ISOL VVS, ACCUM C

_____ f. Close 1-RC-HCV-1549, PRT VENT.

CAUTION

If using an SI Accumulator as the nitrogen source for the PRT, SI Accumulator pressure will decrease. To prevent making the SI Accumulator inoperable, pressure must be maintained above the 600 psia limit specified in Tech Spec 3.3.A.2 when the Accumulator is required to be operable.

_____ 5.4.6 IF the needed N_2 pressure increase is small, THEN perform the following. Otherwise, enter N/A.

_____ a. Open HCV-1936, ACCUMS VNT LINE FLOW SETPT.

_____ b. Cycle one of the following source valves long enough to pressurize the transfer header. (✓)

( ) 1-SI-TV-100, ACCUM & PRZR RELIEF TK N2 SUP

( ) HCV-1853A, ACCUM N2 & VNT LINE ISOL VVS, ACCUM A

( ) HCV-1853B, ACCUM N2 & VNT LINE ISOL VVS, ACCUM B

( ) HCV-1853C, ACCUM N2 & VNT LINE ISOL VVS, ACCUM C

_____ c. Verify the source valve opened in Substep 5.4.6.b is closed. (✓)

( ) 1-SI-TV-100, ACCUM & PRZR RELIEF TK N2 SUP

( ) HCV-1853A, ACCUM N2 & VNT LINE ISOL VVS, ACCUM A

( ) HCV-1853B, ACCUM N2 & VNT LINE ISOL VVS, ACCUM B

( ) HCV-1853C, ACCUM N2 & VNT LINE ISOL VVS, ACCUM C

_____ d. Open 1-RC-HCV-1549, PRT VENT, and observe the PRT pressure increasing.

_____ e. Close 1-RC-HCV-1549, PRT VENT.

_____ f. Repeat Substeps 5.4.6.b through 5.4.6.e until desired pressure is achieved.

_____ g. Close HCV-1936, ACCUMS VNT LINE FLOW SETPT.

5.4.7 Verify the following valves are closed.

_____ a. 1-SI-TV-101A, ACCUM VENT HDR I/S TV

_____ b. 1-SI-TV-101B, ACCUM VENT HDR O/S TV

_____ c. HCV-1936, ACCUMS VNT LINE FLOW SETPT

_____ d. HCV-1898, PRZR RELIEF TK N2 ISOL VV

_____ e. HCV-1853A, ACCUM N2 & VNT LINE ISOL VVS, ACCUM A

_____ f. HCV-1853B, ACCUM N2 & VNT LINE ISOL VVS, ACCUM B

_____ g. HCV-1853C, ACCUM N2 & VNT LINE ISOL VVS, ACCUM C

Performed by:

Signature	Initial	Print	Date
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5.5 Venting/Purging the PRT to the Vent Vent System

CAUTION

- HP must be notified prior to the start or reinitiation of a PRT release to Vent Vent. **(Reference 2.4.1).**
- If the PRT gas sample indicates Xe-133 activity greater than or equal to 5×10^{-2} µCi/ml, the release shall be made to the Overhead Gas System.

NOTE: If the Pressurizer is solid, gas leakage through an unisolated Pressurizer PORV is considered terminated and PRT release to Process Vent or Vent-Vent is permissible with HP Count Room concurrence.

_____ 5.5.1 Verify that the following conditions are met before proceeding. (✓)

( ) Verify that no unisolated leakage path into the PRT exists. Otherwise, enter N/A for this Subsection and perform Subsection 5.7, Installing PRT Vent to the Overhead Gas System.

( ) Containment vacuum is broken and Containment purge is in operation IAW 1-OP-VS-001, Containment Ventilation.

( ) Health Physics Count Room has been notified that the Unit 1 PRT will be vented to the Vent Vent System and provide the status of the PRZR PORVs. **(Reference 2.3.13)**

( ) The following vent vent radiation monitors are operable.

- RI-VG109, VENT VNT SMPL - PARTIC
- RI-VG110, VENT VNT SMPL - GAS

( ) The following vent vent radiation monitors are operable.

- RI-VG-131-1, VNT STACK No. 2 EFFLUENT MON NORM RNG
- RI-VG-131-2, VNT STACK No. 2 EFFLUENT MON HI RNG

OR

- 1-RI-VG-123, Vent Stack No. 2 Inlet (H) Range Rad Monitor

_____ 5.5.2 Adjust PRT level by selecting desired condition and performing the associated substeps.

Desired Condition	Unit Mode	Actions	Initials
• The PRT needs to be purged or • The PRT needs to be vented due to leakage past the PRZR SVs or PORVs.	CSD or RSD	• Raise PRT level to less than or equal to 95% IAW Subsection 5.2, stopping level increase before PRT pressure exceeds 30 psig.	_____
• The PRT needs to be vented of excess nitrogen after draindown and the PRT lined up to the Process Vent System	CSD or RSD	• Verify PRT drained IAW Subsection 5.3 to between 5% and 10% as indicated on LI-1-470, PRZR RELIEF TK LVL.	_____

_____ 5.5.3 IF the PRT needs to be purged, THEN verify or increase PRT pressure to between 15 psig and 30 psig IAW Subsection 5.4. Otherwise, enter N/A.

5.5.4 Determine if PRT gas can be released to the Vent Vent System.

_____ a. Notify Chemistry Department to sample the PRT gas space for release.

_____ HP Count Room

b. IF PRT gas sample activity allows release to the Vent Vent System, THEN issue a MISC GRD BATCH Release Permit for venting the PRT to the Vent Vent System and record Release Form number below. Enter N/A if release NOT allowed to Vent Vent system or Release Form is NOT required.

_____ Release Form No.

_____ c. IF sample results indicate Xe-133 activity is greater than or equal to 5×10^{-2} µCi/ml, THEN enter N/A for Steps 5.5.5 through 5.5.12 and GO TO Subsection 5.7. Otherwise enter N/A.

_____ 5.5.5 Obtain a MISC GRD BATCH Release Permit for venting the PRT to the Vent Vent system. Enter N/A if Release Permit NOT required.

_____ 5.5.6 Connect a poly hose securely from 1-RC-ICV-5025, PRT PT-1472 VENT (-3 foot elev), to the nearest Containment Purge Exhaust ductwork vent (-27 foot elev).

5.5.7 Verify the following valves are closed.

_____ a. 1-RC-HCV-1549, PRT VENT

_____ b. 1-RC-HCV-1550, PRT NITROGEN SUPPLY

_____ c. HCV-1936, ACCUMS VNT LINE FLOW SETPT

_____ d. 1-SS-TV-104A, PRT GAS SPACE SMPL I/S TV

_____ e. 1-SS-TV-104B, PRT GAS SPACE SMPL O/S TV

_____ 5.5.8 Throttle open 1-RC-ICV-5025, PRT PT-1472 VENT, while keeping release rate low enough to not allow Rad Monitors beyond ALERT.

_____ 5.5.9 Monitor PRT pressure until pressure is between 0 to 2 psig.

_____ 5.5.10 Close 1-RC-ICV-5025, PRT PT-1472 VENT.

_____ 5.5.11 IF the PRT is to be purged to eliminate hydrogen gas, THEN monitor PRT pressure until pressure is 2 psig (1 to 3 psig) AND perform the following. Otherwise, enter N/A.

_____ a. Close or verify closed 1-RC-ICV-5025, PRT PT-1472 VENT.

b. Pressurize the PRT as follows.

_____ 1. Open HCV-1936, ACCUMS VNT LINE FLOW SETPT.

CAUTION

If using an SI Accumulator as the nitrogen source for the PRT, SI Accumulator pressure will decrease.

_____ 2. Open a Nitrogen source valve. (✓)

( ) 1-SI-TV-100, ACCUM & PRZR RELIEF TK N2 SUP

( ) HCV-1853A, ACCUM N2 & VNT LINE ISOL VVS, ACCUM A

( ) HCV-1853B, ACCUM N2 & VNT LINE ISOL VVS, ACCUM B

( ) HCV-1853C, ACCUM N2 & VNT LINE ISOL VVS, ACCUM C

_____ 3. Verify the PRT High Pressure Alarm (1C-F7) at 10 psig.

_____ 4. Adjust PRT pressure IAW Step 5.5.3, AND close the source valve opened in Substep 5.5.11.b.2. (✓)

( ) 1-SI-TV-100, ACCUM & PRZR RELIEF TK N2 SUP

( ) HCV-1853A, ACCUM N2 & VNT LINE ISOL VVS, ACCUM A

( ) HCV-1853B, ACCUM N2 & VNT LINE ISOL VVS, ACCUM B

( ) HCV-1853C, ACCUM N2 & VNT LINE ISOL VVS, ACCUM C

_____ 5. Obtain a MISC GRD BATCH Release Permit for venting the PRT to the Vent Vent System if required by HP.

_____ 6. To maintain Rad Monitors below the ALERT setpoint, throttle 1-RC-ICV-5025, PRT PT-1472 VENT, as necessary.

NOTE: Reduction of hydrogen concentration to a value as low as reasonably possible is desirable, with 4 percent hydrogen being the lower limit on flammability which must always be met.

_____ 7. WHEN PRT pressure is approximately 2 psig, THEN repeat Substeps 5.5.11.a and 5.5.11.b IAW Attachment 1, PRT Purge to Vent Vent Continuation Sheet to Vent Vent Continuation Sheet, as necessary until Chemistry determines that the PRT atmosphere is in spec. Record final results below and in the Unit Log.

Oxygen level (less than 2.0%) _____%

Hydrogen level (less than 4.0%) _____ %

_____ 5.5.12 WHEN PRT pressure and level are at the desired values, THEN verify the following valves are closed. (✓)

( ) 1-SI-TV-101A, ACCUM VENT HDR I/S TV

( ) 1-SI-TV-101B, ACCUM VENT HDR O/S TV

( ) 1-RC-HCV-1549, PRT VENT

( ) HCV-1936, ACCUMS VNT LINE FLOW SETPT

( ) 1-RC-ICV-5025, PRT PT-1472 VENT

Performed by:

Signature	Initial	Print	Date
Signature	Initial	Print	Date
Signature	Initial	Print	Date

5.6 Venting/Purging the PRT to the Process Vent System

CAUTION

A Waste Gas Decay Tank must NOT be released while this Subsection is in progress. Releasing a Waste Gase Decay Tank could result in an explosive Hydrogen mixture at the Process Vent Blowers.

_____ 5.6.1 Secure the PRT to Overhead Gas System jumper IAW Subsection 5.8. Enter N/A if jumper is NOT in service.

CAUTION

- HP must be notified prior to the start or reinitiation of a PRT release to Process Vent. **(Reference 2.4.1)**.
- If the PRT gas sample indicates Xe-133 activity greater than or equal to 5×10^{-2} µCi/ml, the release shall be made to the Overhead Gas System.

_____ 5.6.2 Verify the following conditions are met before proceeding. (✓)

( ) Verify that no unisolated leakage path into the PRT exists. Otherwise, enter N/A for this Subsection and perform Subsection 5.7, Installing PRT Vent to the Overhead Gas System.

( ) Health Physics Count Room has been notified that the Unit 1 PRT will be vented to the Process Vent System and provide the status of the PRZR PORVs. (Reference 2.3.13, **Reference 2.4.2**)

( ) The following process vent radiation monitors are operable.

- RI-GW101, PROCESS VNT PARTIC
- RI-GW102, PROCESS VNT - GAS
- RI-GW-130-1, PROCESS VNT EFFLUENT MON NORM RNG
- RI-GW-130-2, PROCESS VNT EFFLUENT MON HI RNG
- RM-GW-122, PROCESS VNT (GASEOUS WASTE)

( ) The Process Vent System is in operation IAW 1-OP-23.1, Process Vent System.

_____ 5.6.3 Adjust PRT level by selecting desired condition and performing the associated substeps.

Desired Condition	Unit Mode	CTMT Vacuum	Actions	Initials
• The PRT needs to be purged or • The PRT needs to be vented due to leakage past the PRZR SVs or PORVs.	Power Ops, HSD, or ISD	Broken or NOT Broken	• Raise PRT level to the high level alarm point (1C-G7, PRZ RELIEF TANK HI LEVEL) IAW Subsection 5.2, stopping level increase before PRT pressure exceeds 10 psig.	_____
• The PRT needs to be purged or • The PRT needs to be vented due to leakage past the PRZR SVs or PORVs.	CSD or RSD	Broken or NOT Broken	• Raise PRT level to less than or equal to 95% IAW Subsection 5.2, stopping level increase before PRT pressure exceeds 10 psig.	_____
• The PRT needs to be vented of excess nitrogen after draindown and the PRT lined up to the Process Vent System	ISD. CSD or RSD	Broken	• Verify PRT drained IAW Subsection 5.3 to between 5% and 10% as indicated on LI-1-470, PRZR RELIEF TK LVL.	_____

_____ 5.6.4 IF the PRT needs to be purged, or vented due to leakage past the PRZR SVs or PORVs, THEN verify or increase PRT pressure less than or equal to 10 psig IAW Subsection 5.4. Otherwise, enter N/A.

NOTE: PRT pressure must be approximately 10 psig for Chemistry to obtain a representative sample.

5.6.5 Determine if PRT gas can be released to the Process Vent System.

_____ a. Notify Chemistry Department to sample the PRT gas space for release.

_____ b. IF sample results indicate Xe-133 activity is less than 5×10^{-2} µCi/ml, THEN issue a MISC MIXED MODE BATCH Release Permit for venting the PRT to Process Vent. Otherwise, enter N/A. IF sample results indicate no activity in the PRT, THEN obtain HP permission and continue in this procedure. (no Misc Mixed Mode Batch Release Permit required to release PRT gas space)

HPCount Room

_____ c. IF sample results indicate Xe-133 activity is greater than or equal to 5×10^{-2} µCi/ml, or Shift Supervision directs release to the overhead, THEN enter N/A for Steps 5.6.6 through 5.6.12 and GO TO Subsection 5.7. Otherwise enter N/A.

_____ 5.6.6 Obtain a MISC MIXED MODE BATCH Release Permit for venting the PRT to the Process Vent system.

5.6.7 Verify that Unit 2 PRT is not aligned to the Process Vent System by performing the following.

_____ a. Verify closed 2-SI-TV-201A, ACCUM VENT HDR I/S TV.

_____ b. Verify closed 2-SI-TV-201B, ACCUM VENT HDR O/S TV.

CAUTION

High pressure N_2 must not be lined up to the Process Vent System.

5.6.8 Verify the following valves are closed.

_____ a. Verify closed 1-SI-TV-100, ACCUM & PRZR RELIEF TK N2 SUP.

_____ b. Verify closed 1-SI-TV-101A, ACCUM VENT HDR I/S TV.

_____ c. Verify closed 1-SI-TV-101B, ACCUM VENT HDR O/S TV.

_____ d. Verify closed HCV-1936, ACCUMS VNT LINE FLOW SETPT.

_____ e. Verify closed HCV-1898, PRZR RELIEF TK N2 ISOL VV.

_____ f. Verify closed HCV-1853A, ACCUM N2 & VNT LINE ISOL VVS, ACCUM A.

_____ g. Verify closed HCV-1853B, ACCUM N2 & VNT LINE ISOL VVS, ACCUM B.

_____ h. Verify closed HCV-1853C, ACCUM N2 & VNT LINE ISOL VVS, ACCUM C.

_____ i. Verify closed 1-SS-TV-104A, PRT GAS SPACE SMPL I/S TV.

_____ j. Verify closed 1-SS-TV-104B, PRT GAS SPACE SMPL O/S TV.

k. Verify closed 1-SI-312, ACCUMS VENT HDR OUTSIDE ISOL.

_____ 5.6.9 Open 1-RC-HCV-1549, PRT VENT.

5.6.10 IF the PRT is to be vented once to the Process Vent System, THEN perform the following. Otherwise, enter N/A.

_____ a. Record the PRT pressure and level on the release form.

_____ b. Open 1-SI-TV-101A, ACCUM VENT HDR I/S TV.

_____ c. Open 1-SI-TV-101B, ACCUM VENT HDR O/S TV.

_____ d. Record PRT Hydrogen concentration.

_____%

NOTE: • For PRT Hydrogen concentrations between the values listed, the higher Hydrogen concentration (lower rate) must be used.

• The maximum allowable PRT pressure drop values are based on a maximum PRT pressure of 10 psig.

_____ e. Based on PRT Hydrogen concentration, note the maximum allowable PRT pressure drop allowed in a ten minute period.

PRT H_2 CONCENTRATION	PRT PRESSURE DROP / 10 MIN
100%	.3 PSIG / 10 MIN
75%	.5 PSIG / 10 MIN
50%	1.2 PSIG / 10 MIN
25%	4.8 PSIG / 10 MIN

NOTE: Valve 1-SI-312 should be adjusted as PRT Hydrogen concentration decreases to maintain maximum release rate.

_____ f. To maintain Rad Monitors below the ALERT setpoint, AND to prevent exceeding the maximum allowable pressure drop, SLOWLY throttle open 1-SI-312, ACCUMS VENT HDR OUTSIDE ISOL.

NOTE: PRT level can be increased IAW Subsection 5.2 to maximize volume released.

_____ g. Monitor PRT pressure until pressure is approximately at <u>one</u> of the following. (✓)

( ) 0 to 2 psig if Containment vacuum has been broken.

( ) Between 6 and 8 psig if Containment vacuum has not been broken.

_____ h. Close the following accumulator vent trip valves and GW isolation valve.

( ) Close 1-SI-TV-101A, ACCUM VENT HDR I/S TV.

( ) Close 1-SI-TV-101B, ACCUM VENT HDR O/S TV.

( ) Close 1-SI-312, ACCUMS VENT HDR OUTSIDE ISOL.

_____ i. Record the PRT pressure and level on the release form.

5.6.11 <u>IF</u> the PRT is to be <u>purged</u> to obtain satisfactory vapor space chemistry or eliminate radioactive gas, <u>THEN</u> perform the following. Otherwise, enter N/A.

_____ a. Open 1-SI-TV-101A and 1-SI-TV-101B.

_____ b. Record PRT sample results.

_____ % Hydrogen

_____ % Oxygen

_____ % Nitrogen

NOTE: • For PRT Hydrogen concentrations between the values listed, the higher Hydrogen concentration (lower rate) must be used.

• The maximum allowable PRT pressure drop values are based on a maximum PRT pressure of 10 psig.

_____ c. Based on PRT Hydrogen concentration, note the maximum allowable PRT pressure drop allowed in a ten minute period.

PRT H_2 CONCENTRATION	PRT PRESSURE DROP / 10 MIN
100%	.3 PSIG / 10 MIN
75%	.5 PSIG / 10 MIN
50%	1.2 PSIG / 10 MIN
25%	4.8 PSIG / 10 MIN

NOTE: Valve 1-SI-312 should be adjusted as PRT Hydrogen concentration decreases to maintain maximum release rate.

_____ d. To maintain Rad Monitors below the ALERT setpoint, AND to prevent exceeding the maximum allowable pressure drop, SLOWLY throttle open 1-SI-312, ACCUMS VENT HDR OUTSIDE ISOL.

NOTE: Reduction of hydrogen concentration to a value as low as reasonably possible is desirable, with 4% hydrogen being the lower limit on flammability which must always be met.

e. Continue PRT release while maintaining 10 psig in the PRT IAW the following:

_____ 1. Verify or raise PRT level to the level specified in Step 5.6.3.

_____ 2. WHEN PRT pressure stops decreasing, THEN close one of the following: (✓)

( ) 1-SI-312

( ) 1-SI-TV-101A and 1-SI-TV-101B

_____ 3. Drain the PRT to 60% IAW Subsection 5.3.

_____ 4. Verify or increase PRT pressure to 10 psig IAW Subsection 5.4.

NOTE: PRT pressure must be approximately 10 psig for Chemistry to obtain a representative sample.

_____ 5. Notify Chemistry to periodically sample the PRT and to notify MCR of results.

_____ 6. Initiate Attachment 2 for additional purges.

_____ f. WHEN the following limits are reached, THEN GO TO Step 5.6.12.

Oxygen level (less than 2.0%)_____ %

Hydrogen level (less than 4.0%)_____ %

5.6.12 Return the PRT to service by performing either Substep 5.6.12.a or Substep 5.6.12.b.

a. IF no bubble exists in the Pressurizer, THEN align the PRT to continuously vent to the Process Vent System by performing the following.

_____ 1. Verify PRT level between 5 percent and 10 percent.

_____ 2. Add N_2 to the PRT using Subsection 5.4 to maintain less than or equal to 8 psig, as indicated on PI-1472, PRZR RELIEF TK PRESS (PCS Point - P0485A).

_____ 3. Verify open or open 1-SI-TV-101A, ACCUM VENT HDR I/S TV.

_____ 4. Verify open or open 1-SI-TV-101B, ACCUM VENT HDR O/S TV.

_____ 5. Verify open or open 1-SI-312, ACCUMS VENT HDR OUTSIDE ISOL.

_____ 6. Verify closed HCV-1936, ACCUMS VNT LINE FLOW SETPT.

_____ 7. Verify open 1-RC-HCV-1549, PRT VENT.

_____ 8. Notify the Unit 2 SRO, RO and Health Physics Count Room that the Unit 1 RCS will remain aligned to the Process Vent System until the Outage is complete and the Unit 1 RCS is filled and vented.

_____ b. IF a bubble exists in the Pressurizer, THEN return PRT pressure and level to their normal values, AND perform the following. (✓)

( ) Close 1-SI-TV-101A, ACCUM VENT HDR I/S TV.

( ) Close 1-SI-TV-101B, ACCUM VENT HDR O/S TV.

( ) Verify closed 1-SS-TV-104A, PRT GAS SPACE SMPL I/S TV.

( ) Verify closed 1-SS-TV-104B, PRT GAS SPACE SMPL O/S TV.

( ) Verify closed 1-RC-HCV-1519B, PRT MAKEUP.

( ) Verify closed 1-RC-HCV-1523, PRT DRAIN.

( ) Verify closed or close 1-RC-HCV-1549, PRT VENT.

( ) Verify closed 1-RC-HCV-1550, PRT NITROGEN SUPPLY.

( ) Verify closed HCV-1936, ACCUMS VNT LINE FLOW SETPT.

( ) Open 1-SI-312, ACCUMS VENT HDR OUTSIDE ISOL.

Performed by:

Signature	Initial	Print	Date
Signature	Initial	Print	Date
Signature	Initial	Print	Date
Signature	Initial	Print	Date

5.7 Installing PRT Vent to the Overhead Gas System

NOTE: Unit 2 PRT continuous venting to the Overhead Gas system, if in service, will be secured by performing the following subsection. If Unit 2 PRT is not vented to the Overhead Gas system, enter N/A as required.

_____ SS

5.7.1 Have Shift Supervision authorize removal of the jumper from the Unit 2 PRT to the Overhead Gas system and authorize alignment of the jumper from the Unit 1 PRT to the Overhead Gas system. Enter N/A for Steps 5.7.1 through 5.7.4 if not installed.

_____

5.7.2 Inform the Unit 2 RO that the continuous vent of the PRT to the Overhead Gas system will be secured.

_____

5.7.3 Inform Chemistry that any sample requiring use of the Gaseous Purge header will not be allowed while the continuous vent of the Unit 2 PRT to the Overhead Gas system is secured. (Ref. 2.3.14)

5.7.4 Secure the Unit 2 PRT continuous vent by performing the following:

_____

a. Close 2-SS-TV-204A, PRT Gas Space Sample I/S TV.

_____

b. Close 2-SS-TV-204B, PRT Gas Space Sample O/S TV.

_____

c. Close 2-SS-131, PRT Gas Space Sample Isol.

_____

d. Close 1-SS-80, Gaseous Sample Ret Isol.

_____ _____

e. **TM:** Disconnect the flexible hose jumper from 2-SS-131. (Ref 2.3.14)

f. Remove Blue Tags from the following components. **(Ref 2.4.5)**

_____

- 2-SS-131

_____

- Jumper hose connection at 2-SS-131

_____

- 1-SS-80

_____

- Jumper hose connection at 1-SS-80

_____ g. Log in the Unit 2 Narrative that the Unit 2 PRT jumper to the Overhead Gas system has been secured.

_____ 5.7.5 Align the Unit 1 PRT to the Overhead Gas system by performing the following:

a. Close or verify closed 1-SS-131, PRT Gas Space Sample Isol.

NOTE: Loosening the fitting on 1-SS-80 may be required to allow rotation of the flexible hose jumper into correct alignment.

_____ _____ b. **TM:** Connect the flexible hose jumper to 1-SS-131 and tighten all fittings. (Ref 2.3.14)

_____ _____ c. **TM:** Connect the flexible hose jumper to 1-SS-80 and tighten all fittings.

d. Place Blue Tags on the following components. **(Ref 2.4.5)**

_____ • 1-SS-131

_____ • Jumper hose connection at 1-SS-131

_____ • 1-SS-80

_____ • Jumper hose connection at 1-SS-80

_____ e. Close or verify closed 1-SS-80A, Flex Hose Sample Isol.

_____ f. Open 1-SS-TV-104A, PRT GAS SPACE SMPL I/S TV.

_____ g. Open 1-SS-TV-104B, PRT GAS SPACE SMPL O/S TV.

NOTE: Vent/Vent Radiation Monitors 1-RI-VG-109 and 1-RI-VG-110 must be monitored while pressurizing the jumper hose.

_____ h. Open 1-SS-131 in a small increment and pressurize the jumper hose.

_____ i. Snoop the jumper hose fittings and tighten any leaking fittings as necessary.

_____ j. Open 1-SS-80, Gaseous Sample Ret Isol.

_____ k. Throttle open 1-SS-131, PRT Gas Space Sample Isol, as required.

_____ l. Log in the Unit 1 Narrative that the Unit 1 PRT jumper to the Overhead Gas system is in service.

_____ m. Monitor PRT and Overhead Gas system pressure.

Performed by:

Signature	Initial	Print	Date
Signature	Initial	Print	Date
Signature	Initial	Print	Date

5.8 Securing the PRT Vent to the Overhead Gas System

SS 5.8.1 Have Shift Supervision authorize removal of the jumper from the Unit 1 PRT to the Overhead Gas system.

5.8.2 Secure the Unit 1 PRT to the Overhead Gas system by performing the following:

a. Close 1-SS-TV-104A, PRT GAS SPACE SMPL I/S TV.

b. Close 1-SS-TV-104B, PRT GAS SPACE SMPL O/S TV.

c. Close 1-SS-131, PRT Gas Space Sample Isol.

d. Close 1-SS-80, Gaseous Sample Ret Isol.

e. Log in the Unit 1 Narrative that the Unit 1 PRT jumper to the Overhead Gas system has been secured.

f. **TM:** Disconnect the flexible hose jumper from 1-SS-131, PRT GAS SPACE SAMPLE ISOL. (Ref 2.3.14)

g. **TM:** Disconnect the flexible hose jumper from 1-SS-80, Gaseous Sample Ret Isol. (Ref 2.3.14)

h. Remove Blue Tags from the following components. **(Ref 2.4.5)**

- 1-SS-131
- Jumper hose connection at 1-SS-131
- 1-SS-80
- Jumper hose connection at 1-SS-80

Performed by:

Signature	Initial	Print	Date
Signature	Initial	Print	Date

5.9 Venting the PRT through the Sample System to the Process Vent System

CAUTION

HP must be notified prior to the start or reinitiation of a PRT release to Process Vent **(Reference 2.4.1)**.

If the PRT gas sample indicates Xe-133 activity greater than or equal to 5×10^{-2} µCi/ml, the release shall be made to the Overhead Gas System.

_____ 5.9.1 Verify the following conditions are met before proceeding. (✓)

( ) Verify that no unisolated leakage path into the PRT exists. Otherwise, enter N/A for this Subsection and perform Subsection 5.7, Installing PRT Vent to the Overhead Gas System.

( ) Health Physics Count Room has been notified that the Unit 1 PRT will be vented to the Process Vent System and provide the status of the PRZR PORVs. (Reference 2.3.13)

( ) The following process vent radiation monitors are operable.

( ) RI-GW-101, PROCESS VNT PARTIC

( ) RI-GW-102, PROCESS VNT - GAS

( ) RI-GW-130-1, PROCESS VNT EFFLUENT MON NORM RNG

( ) RI-GW-130-2, PROCESS VNT EFFLUENT MON HI RNG

( ) RM-GW-122, PROCESS VNT (GASEOUS WASTE)

( ) The Process Vent System is in operation IAW 1-OP-23.1, Process Vent System.

5.9.2 Adjust PRT level by selecting desired condition and performing the associated substeps.

Desired Condition	Unit Mode	CTMT Vacuum	Actions	Initials
• The PRT needs to be purged or • The PRT needs to be vented due to leakage past the PRZR SVs or PORVs.	Power Ops, HSD, or ISD	NOT Broken	• Raise PRT level to the high level alarm point (1C-G7, PRZ RELIEF TANK HI LEVEL) IAW Subsection 5.2, stopping level increase before PRT pressure exceeds 10 psig.	_____
• The PRT needs to be purged or • The PRT needs to be vented due to leakage past the PRZR SVs or PORVs.	CSD or RSD	Broken or NOT Broken	• Raise PRT level to less than or equal to 95% IAW Subsection 5.2, stopping level increase before PRT pressure exceeds 10 psig.	_____
• The PRT needs to be vented of excess nitrogen after draindown and the PRT lined up to the Process Vent System	ISD, CSD or RSD	Broken	• Verify PRT drained IAW Subsection 5.3 to between 5% and 10% as indicated on LI-1-470, PRZR RELIEF TK LVL.	_____

_____ 5.9.3 Adjust PRT pressure to less than or equal to 10 psig IAW Subsection 5.4. IF venting the PRT of excess nitrogen after draindown, THEN enter N/A.

NOTE: PRT pressure must be approximately 10 psig for Chemistry to obtain a representative sample.

5.9.4 Determine if PRT gas can be released to the Process Vent System.

_____ a. Notify Chemistry Department to sample the PRT gas space for release.

_____ b. IF sample results indicate Xe-133 activity is less than 5×10^{-2} µCi/ml, THEN issue a MISC MIXED MODE BATCH Release Permit for venting the PRT to Process Vent. Otherwise, enter N/A. IF sample results indicate no activity in the PRT, THEN obtain HP permission and continue in this procedure. (no Misc Mixed Mode Batch Release Permit required to release PRT gas space)

HPCount Room

_____ c. IF sample results indicate Xe-133 activity is greater than or equal to 5×10^{-2} µCi/ml, THEN enter N/A for Steps 5.9.5 through 5.9.8 and GO TO Subsection 5.7. Otherwise enter N/A.

_____ 5.9.5 Obtain a MISC MIXED MODE BATCH Release Permit for venting the PRT to the Process Vent system.

5.9.6 Verify that Unit 2 is not aligned to the Process Vent System by performing the following.

_____ a. Verify closed 2-SI-TV-201A, ACCUM VENT HDR I/S TV.

_____ b. Verify closed 2-SI-TV-201B, ACCUM VENT HDR O/S TV.

_____ c. Verify closed 2-SS-TV-204A, PRT GAS SPACE SMPL I/S TV.

_____ d. Verify closed 2-SS-TV-204B, PRT GAS SPACE SMPL O/S TV.

CAUTION

High pressure N_2 must not be lined up to the Process Vent System.

5.9.7 Verify the following valves are closed.

_____ a. Verify closed 1-SI-TV-100, ACCUM & PRZR RELIEF TK N2 SUP.

_____ b. Verify closed 1-SI-TV-101A, ACCUM VENT HDR I/S TV.

_____ c. Verify closed 1-SI-TV-101B, ACCUM VENT HDR O/S TV.

_____ d. Verify closed HCV-1936, ACCUMS VNT LINE FLOW SETPT.

_____ e. Verify closed HCV-1898, PRZR RELIEF TK N2 ISOL VV.

_____ f. Verify closed HCV-1853A, ACCUM N2 & VNT LINE ISOL VVS, ACCUM A.

_____ g. Verify closed HCV-1853B, ACCUM N2 & VNT LINE ISOL VVS, ACCUM B.

_____ h. Verify closed HCV-1853C, ACCUM N2 & VNT LINE ISOL VVS, ACCUM C.

_____ i. Verify closed 1-SS-TV-104A, PRT GAS SPACE SMPL I/S TV.

_____ j. Verify closed 1-SS-TV-104B, PRT GAS SPACE SMPL O/S TV.

_____ k. Verify closed 2-SS-130, PRT Gas Space Sample Hdr Drain.

_____ l. Verify closed 2-SS-131, PRT Gas Space Sample Throttle Valve.

_____ m. Verify closed 1-SS-130, PRT Gas Space Sample purge to PV system.

_____ n. Verify Closed 1-SS-92, Gaseous Sample Return to Process Vent.

5.9.8 Vent the PRT to the Process Vent System by performing the following substeps.

_____ a. Record the PRT pressure and level on the release form.

_____ b. Open 1-SS-TV-104A, PRT GAS SPACE SMPL I/S TV.

_____ c. Open 1-SS-TV-104B, PRT GAS SPACE SMPL O/S TV.

_____ d. Record PRT Hydrogen concentration.

_____%

NOTE: For PRT Hydrogen concentrations between the values listed, the higher Hydrogen concentration (lower rate) must be used.

- The maximum allowable PRT pressure drop values are based on a maximum PRT pressure of 10 psig.

_____ e. Based on PRT Hydrogen concentration, note the maximum allowable PRT pressure drop allowed in a ten minute period.

PRT H_2 CONCENTRATION	PRT PRESSURE DROP / 10 MIN
100%	.3 PSIG / 10 MIN
75%	.5 PSIG / 10 MIN
50%	1.2 PSIG / 10 MIN
25%	4.8 PSIG / 10 MIN

NOTE: Valve 1-SI-312 should be adjusted as PRT Hydrogen concentration decreases to maintain maximum release rate.

_____ f. To maintain Rad Monitors below the ALERT setpoint, AND to prevent exceeding the maximum allowable pressure drop, SLOWLY throttle open 1-SS-130, PRT Gas Space Sample Purge to PV System.

NOTE: PRT level can be increased IAW Subsection 5.2 to maximize volume released.

_____ g. Monitor PRT pressure until pressure is approximately at <u>one</u> of the following. (✓)

( ) 0 to 2 psig if Containment vacuum has been broken.

( ) Between 6 and 8 psig if Containment vacuum has not been broken.

_____ h. Close the following PRT Sample trip valves and Sample System isolation valve.

( ) Close 1-SS-TV-104A, PRT GAS SPACE SMPL I/S TV.

( ) Close 1-SS-TV-104B, PRT GAS SPACE SMPL O/S TV.

( ) Close 1-SS-130, PRT Gas Space Sample purge to PV system.

_____ i. Record the PRT pressure and level on the release form.

Performed by:

Signature	Initial	Print	Date
Signature	Initial	Print	Date
Signature	Initial	Print	Date
Signature	Initial	Print	Date
Signature	Initial	Print	Date

(Page 1 of 2)

Attachment 1

PRT PURGE TO VENT VENT CONTINUATION SHEET

Date								
5.5.11.a: Close or verify closed 1-RC-ICV-5025, PRT PT-1472 VENT.								
5.5.11.b.1: Open HCV-1936, ACCUMS VNT LINE FLOW SETPT.								
5.5.11.b.2: Open a Nitrogen source valve IAW Step 5.5.11.b.2.								
5.5.11.b.3: Verify the PRT High Pressure Alarm (1C-F7) at 10 psig.								
5.5.11.b.4: Adjust PRT pressure IAW Step 5.5.3								
5.5.11.b.4: Close the source valve opened in Substep 5.5.11.b.2.								
5.5.11.b.5: Obtain a MISC GRD BATCH Release Permit for venting the PRT to the Vent Vent System if required by HP.								
5.5.11.b.6: To maintain Rad Monitors below the ALERT setpoint, open 1-RC-ICV-5025, PRT PT-1472 VENT, as necessary.								
5.5.11.b.7: WHEN PRT pressure is approximately 2 psig, THEN close or verify closed 1-RC-ICV-5025.								
Return to Step 5.5.11.b.7.								

(Page 2 of 2)

Attachment 1

PRT PURGE TO VENT VENT CONTINUATION SHEET

Performed by:

Signature	Initial	Print	Date

(Page 1 of 2)

Attachment 2

PRT PURGE TO PROCESS VENT CONTINUATION SHEET

Date								
5.6.11.c: Note maximum PRT pressure drop allowed in a 10 minute period.								
5.6.11.d: To maintain PROCESS VNT PARTIC and GAS Monitors below the ALERT setpoint and to prevent exceeding the maximum allowable pressure drop, throttle 1-SI-312, ACCUMS VENT HDR OUTSIDE ISOL or reopen 1-SI-TV-101A and 1-SI-TV-101B.								
5.6.11.e.1: Raise PRT level to the level specified in Step 5.6.3.								
5.6.11.e.2: Close 1-SI-312 or 1-SI-TV-101A and 1-SI-TV-101B.								
5.6.11.e.3: Drain PRT to 60%.								
5.6.11.e.4: Verify PRT pressure at 10 psig.								
5.6.11.e.5: Notify Chemistry to sample.								
5.6.11.e.6: Return to Step 5.6.11.c.								
5.6.11.f: GO TO Step 5.6.12.								

(Page 2 of 2)

Attachment 2

PRT PURGE TO PROCESS VENT CONTINUATION SHEET

Performed by:

Signature	Initial	Print	Date
Signature	Initial	Print	Date
Signature	Initial	Print	Date
Signature	Initial	Print	Date
Signature	Initial	Print	Date
Signature	Initial	Print	Date
Signature	Initial	Print	Date
Signature	Initial	Print	Date
Signature	Initial	Print	Date

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
8.	__VERIFY SERVICE WATER AVAILABLE:	
	a) Check Intake Canal level - BEING MAINTAINED BY CW PUMPS	a) Do the following: 1) Start all available Emergency SW pumps IAW 0-OP-SW-002, EMERGENCY SERVICE WATER PUMP OPERATION. 2) GO TO Step 9.
	b) GO TO Step 12	

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

* *

CAUTION:
- If only one train of ESF equipment is operating, SW flow should NOT be isolated on the operating train.
- Operation of an OSRS pump without an operating CS pump could cause cavitation as indicated by fluctuating amperage.

* *

NOTE: If spray system components are inoperable on both A and B SW headers, SW should be isolated to inoperable components on each SW header.

9. __CHECK IF SW FLOW TO RS HXs CAN BE REDUCED:

a) Verify CTMT pressure - LESS THAN 14 PSIA
- 1-LM-PI-100A
- 1-LM-PI-100B
- 1-LM-PI-100C
- 1-LM-PI-100D

a) GO TO Step 13. WHEN pressure less than 14 psia, THEN do Steps 9 through 12.

b) Reset CLS

c) Check AC emergency buses - BOTH ENERGIZED

c) GO TO Step 10.

(STEP 9 CONTINUED ON NEXT PAGE)

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

9. CHECK IF SW FLOW TO RS HXs CAN BE REDUCED (Continued):

d) Verify all spray system components on the SW A header operating:

- 1-CS-P-1B - RUNNING
- 1-RS-P-1A - RUNNING
- 1-RS-P-2B - RUNNING

- 1-RS-MOV-155B - OPEN
- 1-RS-MOV-156B - OPEN

- 1-SW-MOV-103A or B - OPEN

- 1-SW-MOV-104A and D - OPEN
- 1-SW-MOV-105A and D - OPEN

d) Verify all spray system components on the SW B header operating:

- 1-CS-P-1A - RUNNING
- 1-RS-P-1B - RUNNING
- 1-RS-P-2A - RUNNING

- 1-RS-MOV-155A - OPEN
- 1-RS-MOV-156A - OPEN

- 1-SW-MOV-103C or D - OPEN

- 1-SW-MOV-104B and C - OPEN
- 1-SW-MOV-105B and C - OPEN

IF all SW B header components are operating, THEN do the following:

1) Stop RS HX RAD Monitor PPs:

   - 1-SW-P-5A
   - 1-SW-P-5D

2) Manually or locally close the following MOVs:

   - 1-SW-MOV-104A and D
   - 1-SW-MOV-105A and D

3) Stop the following pumps and put in PTL:

   - 1-RS-P-1A
   - 1-RS-P-2B

4) GO TO Step 11.

IF any of the SW B header components are NOT operating, THEN GO TO Step 9f.

(STEP 9 CONTINUED ON NEXT PAGE)

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
9.	CHECK IF SW FLOW TO RS HXs CAN BE REDUCED (Continued):	
	e) Isolate the SW B header from RS HXs:	
	1) Stop RS HX RAD Monitor PPs: • 1-SW-P-5B • 1-SW-P-5C	
	2) Close the following MOVs: • 1-SW-MOV-104B and C • 1-SW-MOV-105B and C	2) Locally close MOV(s).
	3) Stop the following pumps and put in PTL: • 1-RS-P-1B • 1-RS-P-2A	
	4) GO TO Step 11	
	f) Isolate SW to RS HXs associated with inoperable components	
	g) Verify or place in service two RS HXs and associated pumps: • 1-RS-P-1A, RS HX A • 1-RS-P-1B, RS HX B • 1-RS-P-2A, RS HX C • 1-RS-P-2B, RS HX D	
	h) GO TO Step 11	

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
*10.	ISOLATE SW TO ONE TRAIN OF RS EQUIPMENT: a) Check emergency bus 1H - ENERGIZED	a) Isolate SW to Train A RS HXs: 1) Stop RS HX RAD Monitor PPs: • 1-SW-P-5A • 1-SW-P-5C 2) Locally close one of the following valves: • 1-SW-MOV-105A • 1-SW-MOV-104A 3) Locally close one of the following valves: • 1-SW-MOV-105C • 1-SW-MOV-104C 4) Put the following pumps in PTL: • 1-RS-P-1A • 1-RS-P-2A 5) GO TO Step 11.
	b) Isolate SW to Train B RS HXs: 1) Stop RS HX RAD Monitor PPs: • 1-SW-P-5B • 1-SW-P-5D 2) Locally close one of the following MOVs: • 1-SW-MOV-105B • 1-SW-MOV-104B 3) Locally close one of the following MOVs: • 1-SW-MOV-105D • 1-SW-MOV-104D 4) Put the following pumps in PTL: • 1-RS-P-1B • 1-RS-P-2B	

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
*11.	__CHECK EMERGENCY SW PUMPS - THREE RUNNING	Do the following within 24 hours from event initiation: • Restore offsite power and start a circ water pump. OR • Restore third Emergency SW pump. OR • Isolate SW flow to a third RS HX at 24 hours.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
12.	__CHECK IF CTMT DEPRESSURIZATION EQUIPMENT CAN BE STOPPED:	
	a) CTMT pressure - LESS THAN 12 PSIA • 1-LM-PI-100A • 1-LM-PI-100B • 1-LM-PI-100C • 1-LM-PI-100D	a) GO TO Step 13. <u>WHEN</u> pressure less than 12 psia, <u>THEN</u> do Steps 12b through 12g.
	b) Verify both trains of CLS reset	b) Reset both trains of CLS.
	c) Stop OSRS pump(s) and put in AUTO	
	d) Stop CS pump(s) and put in AUTO	
	e) Close CS discharge valves: • 1-CS-MOV-101A • 1-CS-MOV-101B • 1-CS-MOV-101C • 1-CS-MOV-101D	e) Close suction MOV on CS pump(s) with an open discharge MOV.
	f) Close CHEM ADD TK OUTLT valves: • 1-CS-MOV-102A • 1-CS-MOV-102B	
	g) Operate ISRS pump(s) with SW aligned to maintain CTMT pressure between 10 psia and 13 psia	

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

* *

CAUTION: RCS pressure should be monitored. If RCS pressure decreases in an uncontrolled manner to less than 250 psig [400 psig], one LHSI pump must be manually restarted to supply water to the RCS.

* *

*13. __CHECK IF LHSI PUMPS SHOULD BE STOPPED:

a) Check RCS pressure:

1) Pressure - GREATER THAN 250 PSIG [400 PSIG] — 1) GO TO Step 15.

2) Pressure - STABLE OR INCREASING — 2) GO TO Step 14.

b) Reset both trains of SI if necessary

c) Stop LHSI pumps and put in AUTO

14. __CHECK RCS AND SG PRESSURES: — RETURN TO Step 1.

- Check pressure in all SGs - STABLE OR INCREASING
- Check RCS pressure - STABLE OR DECREASING

15. __CHECK IF EDGs CAN BE STOPPED:

a) Verify AC emergency buses - ENERGIZED BY OFFSITE POWER — a) Initiate 1-AP-10.07, LOSS OF UNIT 1 POWER.

b) Reset both trains of SI if necessary

c) Stop any unloaded EDGs IAW Attachment 1

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

* *

CAUTION: Voiding may occur in the RCS during RCS depressurization. Voiding will result in a rapidly increasing PRZR level.

* *

28. __DEPRESSURIZE RCS TO MINIMIZE RCS SUBCOOLING:

a) Use normal PRZR spray

a) Use one PRZR PORV. IF NO PORV is available, THEN use auxiliary spray.

b) Turn on PRZR heaters

c) Depressurize RCS until EITHER of the following conditions satisfied:

- PRZR level - GREATER THAN 69%

OR

- RCS subcooling based on CETCs - LESS THAN 40°F [95°F]

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

18. VERIFY OR ESTABLISH ALTERNATE STEAM RELEASE: (Continued)

e) Deenergize MS NRVs:

- ☐ • MS NRV A, ( )A1-1W 1A
- ☐ • MS NRV B, ( )B1-2W 1A
- ☐ • MS NRV C, ( )C1-1W 1A

f) Open one of the following Steam Dump Valves:

- ☐ • ( )-MS-TCV-( )05A
- ☐ • ( )-MS-TCV-( )05B

☐ g) Control steam flow to maintain RCS subcooling temperature IAW Attachment 2 - GREATER THAN 50°F

* *

CAUTION: CHG PP CC Pumps are required for Cold Shutdown. Procedure 0-ECM-1401-02, EMERGENCY OPERATION OF CHARGING PUMP COMPONENT COOLING WATER MOTORS, provides for operation of the CHG PP CC Pump motors from the local MCC.

* *

19.___ INITIATE RCS COOLDOWN:

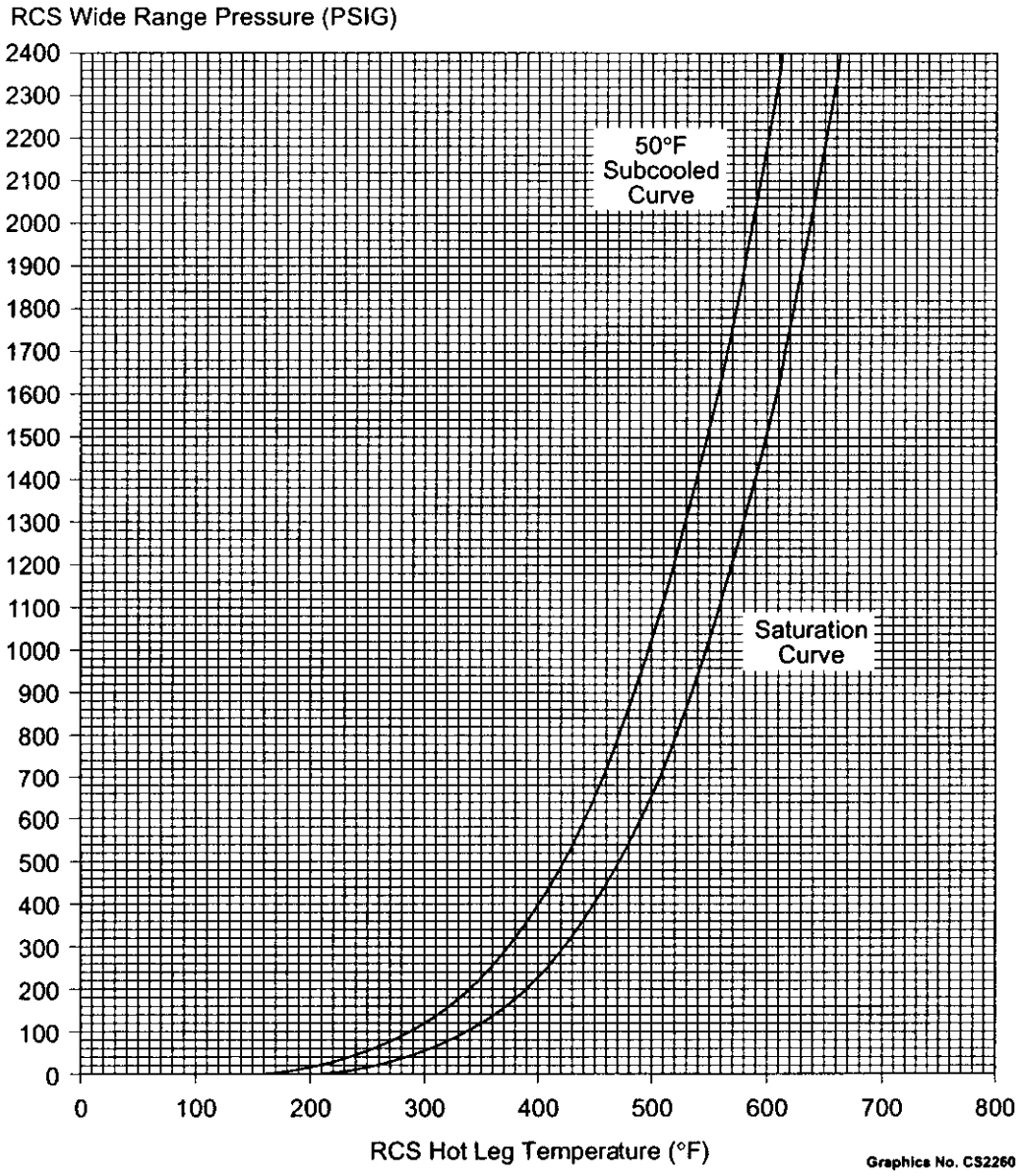
☐ a) Determine RCS cooldown rate IAW Attachment 2

☐ b) Adjust steam release rate to establish RCS cooldown

☐ c) Maintain RCS Cold Leg temperature within limits of Attachment 2

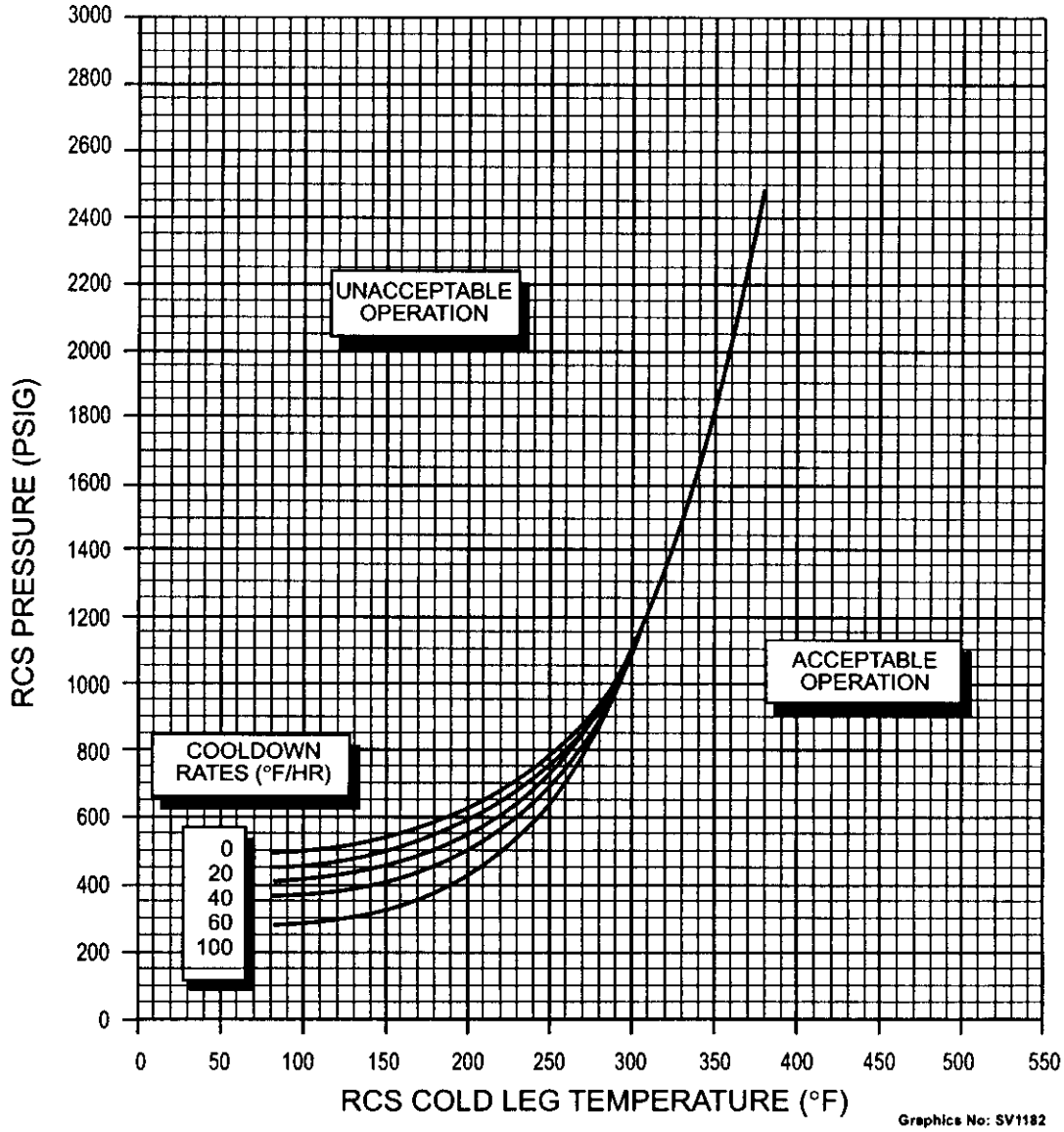
☐ d) Adjust RCS makeup to maintain a stable PRZR level

NUMBER 0-FCA-17.00	ATTACHMENT TITLE SATURATION CURVE	ATTACHMENT 1
REVISION 22		PAGE 1 of 1



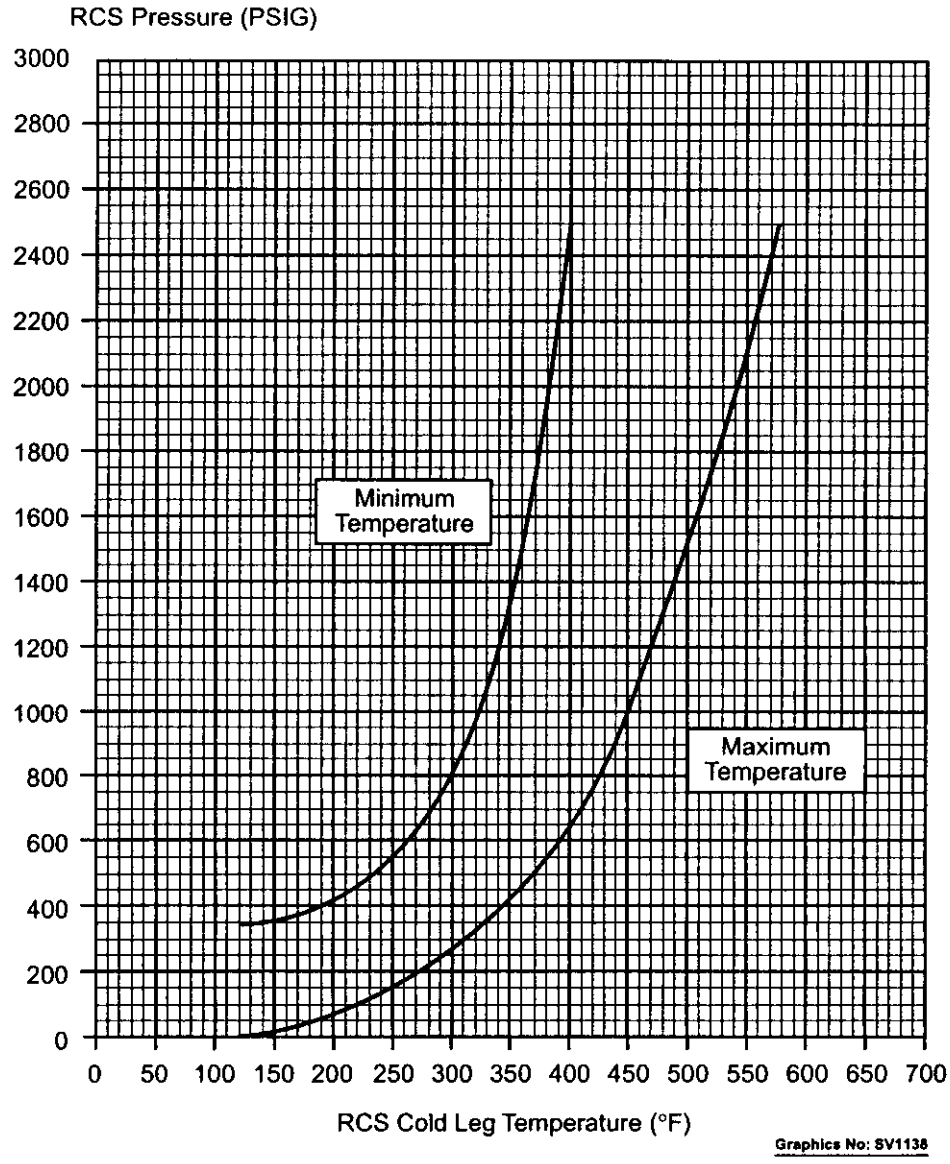
NUMBER 0-FCA-17.00	ATTACHMENT TITLE COOLDOWN CURVES	ATTACHMENT 2
REVISION 22		PAGE 1 of 3

FORCED FLOW



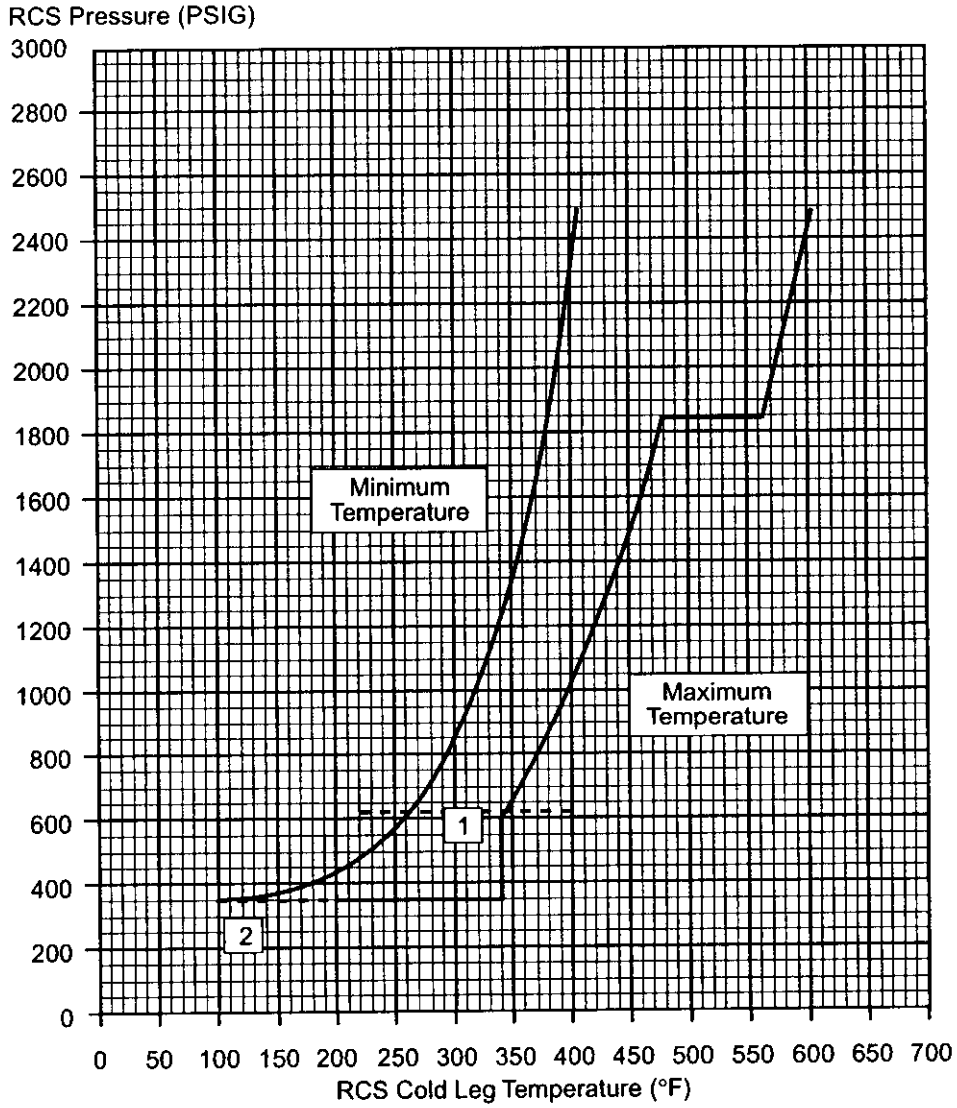
NATURAL CIRCULATION COOLDOWN WITH THREE CRDM FANS IN OPERATION

Cooldown rate is 25°F/HR.



NATURAL CIRCULATION COOLDOWN WITH LESS THAN THREE CRDM FANS IN OPERATION

Cooldown rate is 25°F/HR to 470°F and 10°F/HR thereafter.



(1) When temperature decreases to 340°F, pressure must be maintained greater than 620 psig for 6 hours.

(2) When temperature is decreased to 200°F, pressure must be maintained greater than 350 psig for 29 hours before depressurization.

Graphics No: SV1139

Dominion

SURRY POWER STATION

ABNORMAL PROCEDURE

NUMBER	PROCEDURE TITLE	REVISION
1-AP-27.00	LOSS OF DECAY HEAT REMOVAL CAPABILITY (WITH 11 ATTACHMENTS)	12
		PAGE 1 of 18

PURPOSE

To provide guidance when the RHR System fails to remove decay heat.

ENTRY CONDITIONS

1) No RHR pumps running due to failure or loss of power.
2) Air-binding of the operating RHR pump as indicated by any of the following:
   - Motor amperage oscillations
   - Flow oscillations
   - Excessive pump noise
   - RHR HX LO FLOW annunciator, 1B-G6
3) Failure of the RHR system to control RCS temperature due to loss of Component Cooling or valve failure.
4) Loss of RCS inventory while on RHR as indicated by any of the following:
   - Increasing PRT level, pressure, or temperature
   - Local observation of RCS inventory loss
   - CTMT SUMP HI LVL annunciator, 1B-A3
   - SHUTDOWN COOLING LO LVL annunciator, 1B-G8
   - Decreasing trend on 1-RC-LR-105, COLD SHUTDOWN RCS LEVEL - NARROW RANGE
5) Transition from 1-FR-C.3, RESPONSE TO SATURATED CORE COOLING.

CONTINUOUS USE

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

* *

CAUTION:
- Loss of RHR due to a total loss of IA is addressed by 0-AP-40.00, NON-RECOVERABLE LOSS OF IA.
- Loss of RHR may cause CTMT radiological and heat stress conditions to degrade. Local actions in CTMT should be coordinated with HP.
- During solid plant operation, inadvertent actuation of the OPMS may occur if letdown is isolated.

* *

1. ___ CHECK RCS INVENTORY - DECREASING — ☐ GO TO Step 4.

☐ • PRZR level - DECREASING
☐ • Standpipe level - DECREASING
☐ • Reactor cavity level - DECREASING
☐ • RCS Narrow Range level - DECREASING

☐ • CTMT sump level - INCREASING
☐ • Makeup rate - INCREASING
☐ • PRT level, pressure, or temperature - INCREASING
☐ • PDTT level - INCREASING

☐ • RWST level - INCREASING

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
2. ___	ATTEMPT TO IDENTIFY AND STOP INVENTORY LOSS:	
	☐ a) Stop any known draining evolution	
	b) Close RHR LETDOWN FLOW valve	☐ b) Close 1-CH-PCV-1145.
	☐ • 1-RH-HCV-1142	
	c) Close or verify closed RCS loop drains	
	☐ • 1-RC-HCV-1557A ☐ • 1-RC-HCV-1557B ☐ • 1-RC-HCV-1557C	
	☐ d) Increase RCS makeup	
	e) Terminate any activities that could cause leakage	
	☐ • Valve alignments ☐ • Periodic testing ☐ • Maintenance	
	☐ f) Coordinate local walkdowns with HP to identify and isolate RCS leakage	
	☐ g) Check RCS level - STABLE OR INCREASING	☐ g) IF RCS temperature greater than 200°F, THEN GO TO 1-AP-16.01, SHUTDOWN LOCA. ☐ IF RCS temperature less than 200°F, THEN align any available SI flowpath to maintain stable or increasing RCS level.
3. ___	GO TO STEP 15	

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

* *

CAUTION: RCS temperature may increase if RHR flow rate is less than required based on time after shutdown. (Attachment 1)

* *

NOTE: • Changes in RCS pressure can result in vessel water level changes not shown by the RCS vessel level indicator.

• Any dilution of the RCS should be stopped until RHR flow has been reestablished.

15.___ CHECK IF RHR PUMPS SHOULD BE STOPPED:

☐ a) RHR Pumps - ANY RUNNING

b) RCS level - WITHIN ACCEPTABLE REGION

☐ • 1-RC-LI-100A (Attachment 2)

OR

☐ • 1-RC-LR-105 (Attachment 3)

c) RHR pumps - VORTEXING

☐ • Flow indication on 1-RH-FI-1605 - OSCILLATING

☐ • Amperage indication - OSCILLATING

☐ d) Stop RHR pumps

☐ a) GO TO Step 16.

b) Do the following:

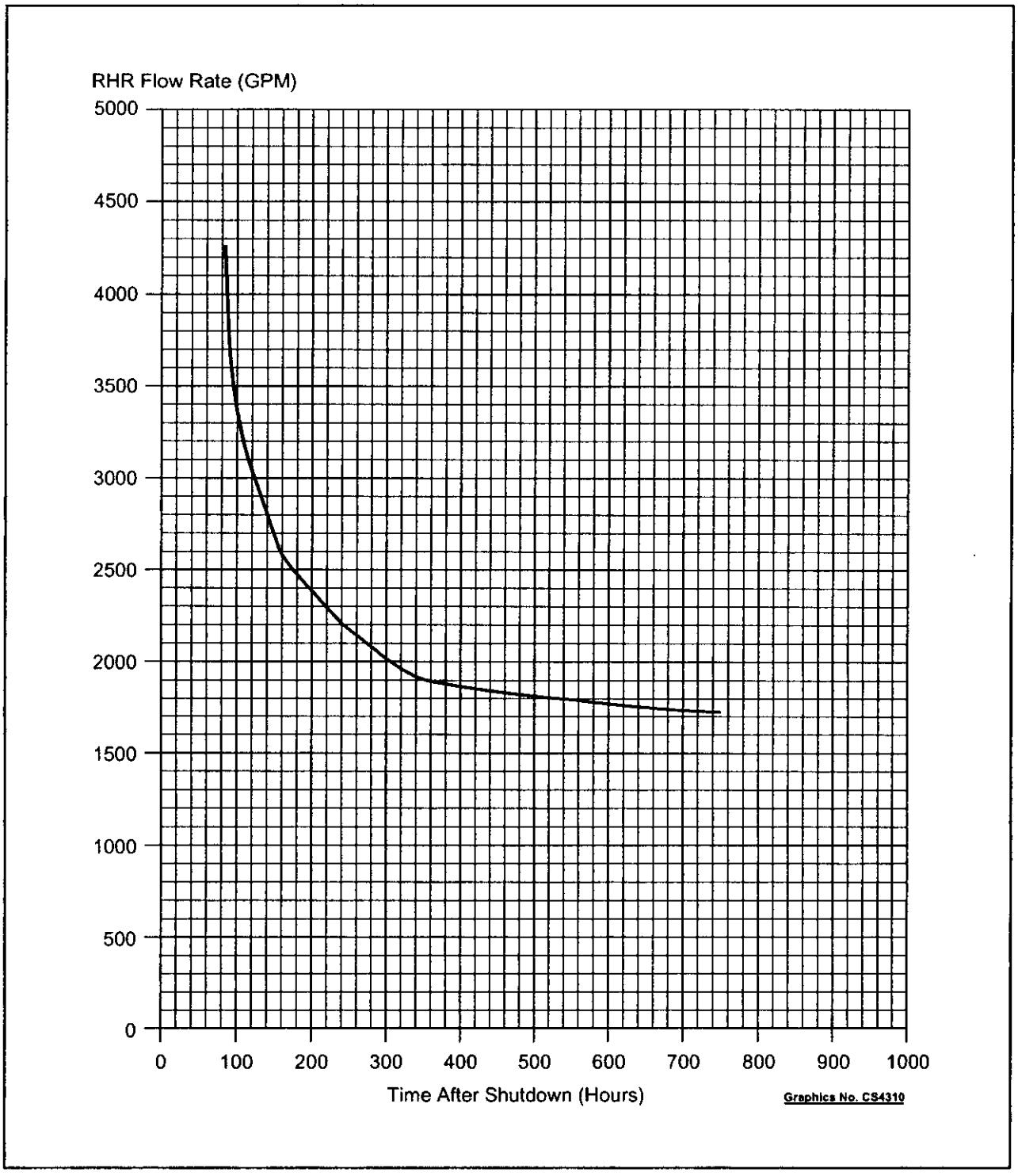
☐ • Restore RCS level to Acceptable Region of Attachment 2 or 3

OR

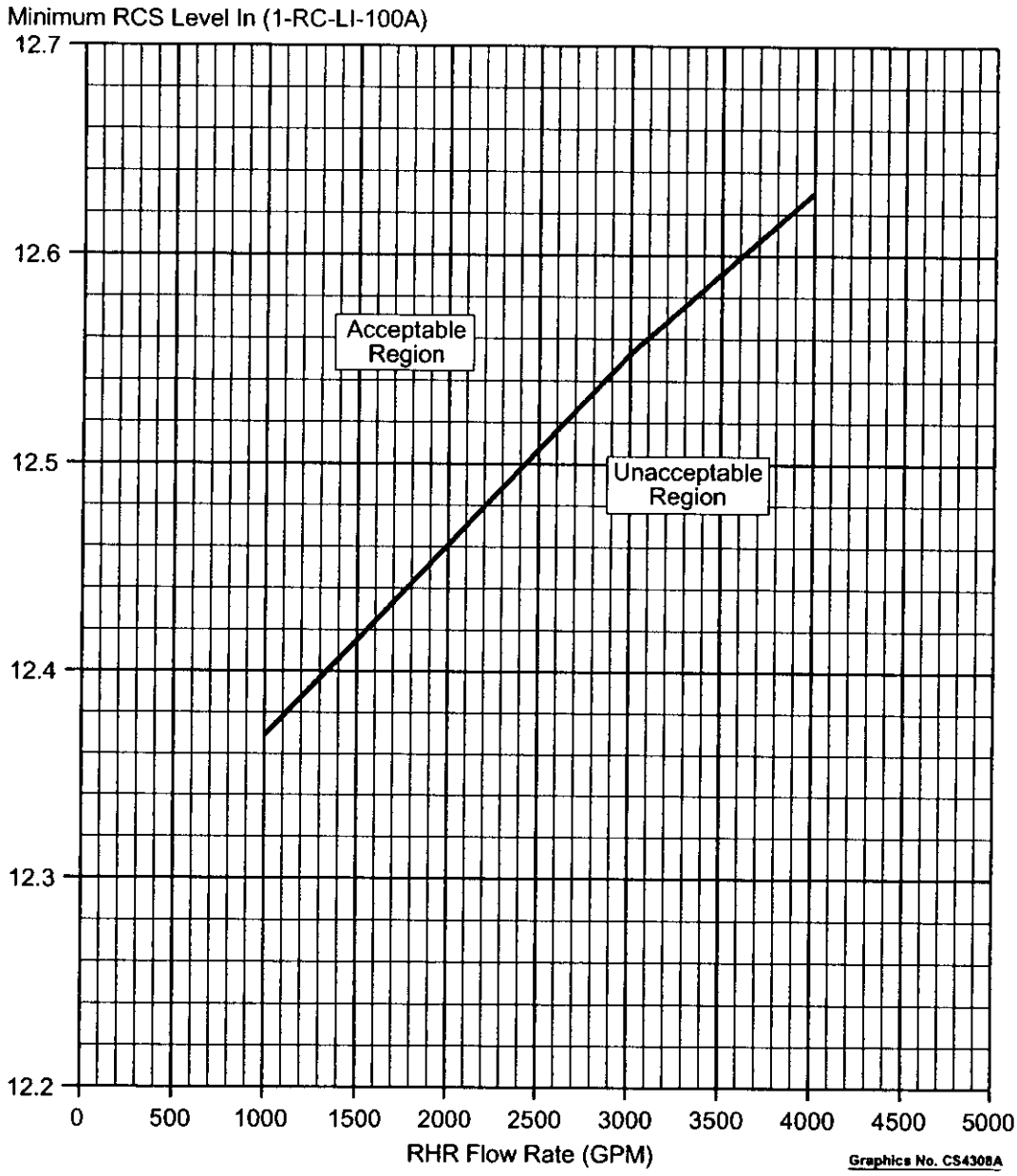
☐ • Reduce RHR flow to Acceptable Region of Attachment 2 or 3 using 1-RH-FCV-1605 or 1-RH-HCV-1758

☐ c) RETURN TO appropriate plant procedure.

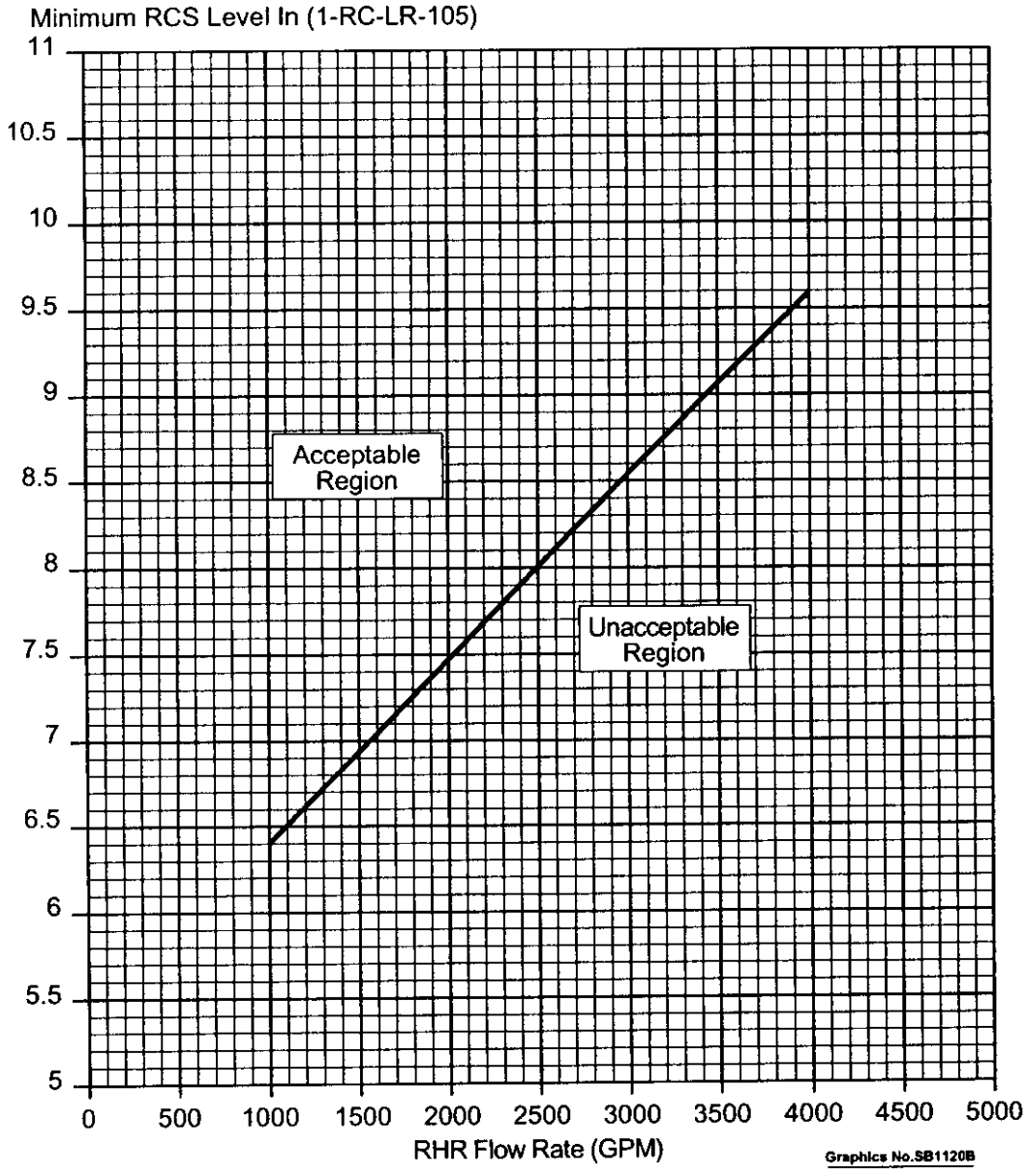
NUMBER 1-AP-27.00	ATTACHMENT TITLE RHR FLOW REQUIREMENT VERSUS TIME AFTER SHUTDOWN	ATTACHMENT 1
REVISION 12		PAGE 1 of 1



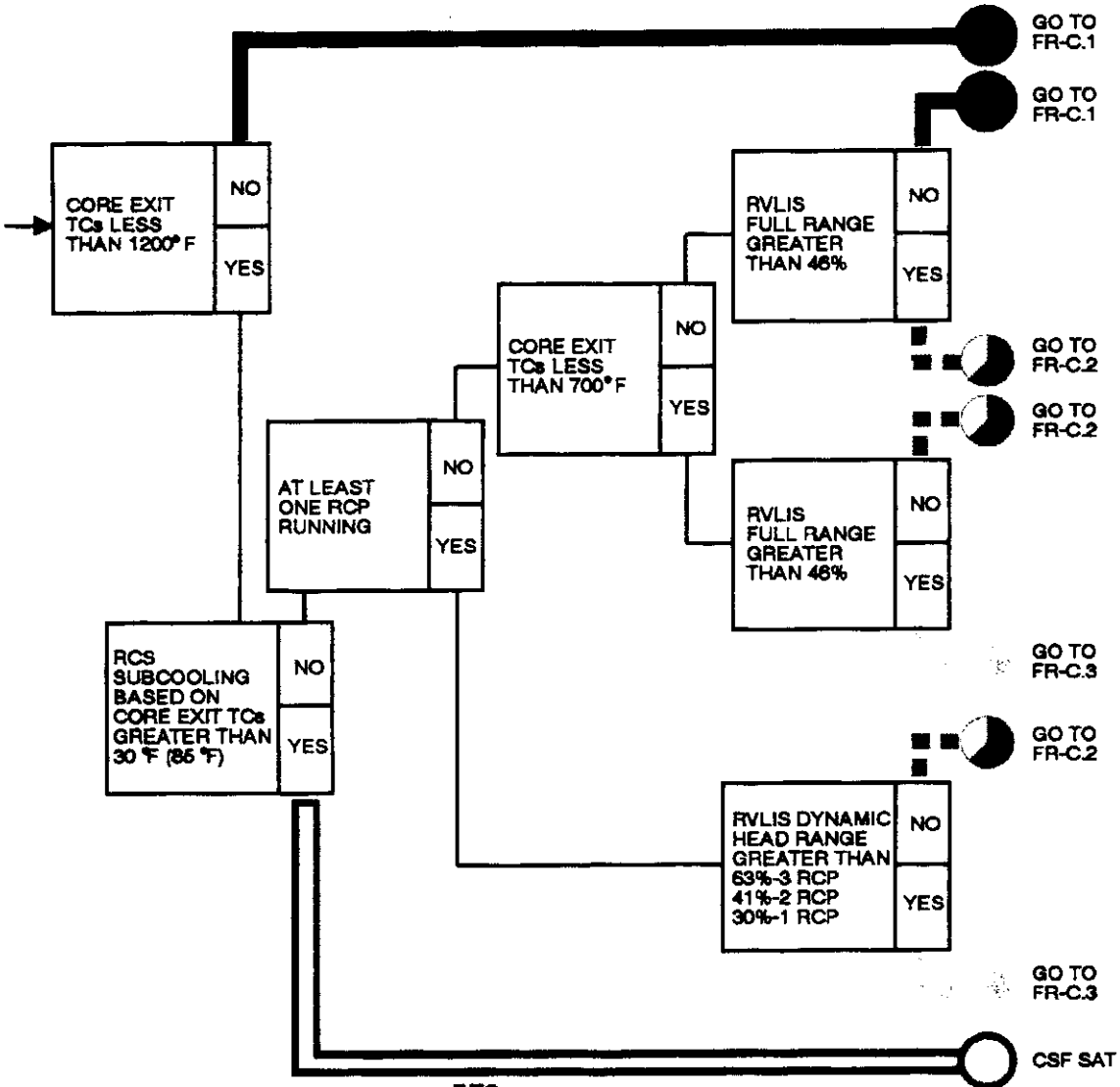
NUMBER 1-AP-27.00	ATTACHMENT TITLE MINIMUM RCS LEVEL VERSUS RHR FLOW (1-RC-LI-100A)	ATTACHMENT 2
REVISION 12		PAGE 1 of 1



NUMBER 1-AP-27.00	ATTACHMENT TITLE MINIMUM RCS LEVEL VERSUS RHR FLOW (1-RC-LR-105)	ATTACHMENT 3
REVISION 12		PAGE 1 of 1



Number:	Title:	Revision:
F-2	CORE COOLING	1A



SNSOC CHAIRMAN

DEC 29 1989

DATE

Drawing No. C8999

Dominion

SURRY POWER STATION

ABNORMAL PROCEDURE

NUMBER	PROCEDURE TITLE	REVISION
0-AP-23.01	RAPID RCS COOLDOWN (WITH 9 ATTACHMENTS)	5
		PAGE 1 of 16

PURPOSE

To provide guidance for performance of a unit cooldown to a minimum of 350°F, when the cooldown must be performed more rapidly than as specified in the normal plant cooldown procedure.

ENTRY CONDITIONS

1) The Shift Supervisor has directed that a unit cooldown be performed at an accelerated rate for either of the following reasons.
   - To comply with a Tech Spec LCO
   - Operations management direction

AND

2) The Unit is being maintained between less than 5% power and HSD IAW plant Abnormal, Emergency, or General Operating procedures.

CONTINUOUS USE

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
1. ___	CONSULT WITH OMOC	
2. ___	INITIATE ( )-OP-RX-002, SHUTDOWN MARGIN (CALCULATED AT ZERO POWER)	
3. ___	CHECK REACTOR - BEING MAINTAINED BETWEEN LESS THAN 5% POWER AND HSD IAW PLANT ABNORMAL, EMERGENCY, OR GENERAL OPERATING PROCEDURES	Do the following: ☐ a) Establish conditions IAW plant procedures. ☐ b) WHEN conditions established, THEN GO TO Step 4.

NOTE: • Steps in this procedure may be performed concurrently with Shift Supervisor permission.

• The I & C, Electrical, and Chemistry Departments should be contacted to provide assistance.

4. ___	CHECK REACTOR - NOT TRIPPED	☐ GO TO Step 25.
5. ___	VERIFY OR ESTABLISH AUXILIARY STEAM HEADER SUPPLY FROM THE OPPOSITE UNIT OR THE BOILERS	
6. ___	MONITOR REACTOR POWER ON NUCLEAR INSTRUMENTATION RECORDERS	
7. ___	CONTROL RCS TAVG DURING CHANGING PLANT CONDITIONS, AS DIRECTED BY THE SHIFT SUPERVISOR	
8. ___	VERIFY THAT THE AUDIO COUNT RATE CHANNEL SELECTOR SWITCH IS IN THE N31 OR N32 POSITION	
9. ___	POSITION THE AUDIO MULTIPLIER SWITCH AS REQUIRED BY THE EXISTING COUNT RATE AND ADJUST THE VOLUME CONTROL SWITCH TO A POSITION ABOVE MIN	

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

10.___ VERIFY OR PLACE THE FOLLOWING SWITCHES IN THE BLOCK POSITION

☐ • HIGH FLUX AT SHUTDOWN N31 NORMAL - BLOCK SWITCH

☐ • HIGH FLUX AT SHUTDOWN N32 NORMAL - BLOCK SWITCH

11.___ BORATE AS NECESSARY SO THAT CONTROL BANK D WILL BE GREATER THAN 50 STEPS WHEN THE REACTOR IS TRIPPED

NOTE: An Operator should be briefed and stationed in Safeguards with admin keys IAW ( )-OP-MS-005 prior to tripping the Reactor.

12.___ MANUALLY TRIP THE RX AND VERIFY ANNUNCIATOR ( )E-B8, MAN RX TRIP, COMES IN

13.___ CHECK RCS TAVG - UNDER OPERATOR CONTROL

IF RCS Tavg decreasing uncontrollably, THEN do the following:

☐ a) Notify the Unit SRO.

☐ b) Close the MSTVs.

☐ c) Establish RCS temperature control on the MSTV Bypass valves IAW ( )-OP-MS-005.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

NOTE: The Blender must be set for CSD boron concentration.

14.___ START RCS BORATION IAW EITHER OF THE FOLLOWING:

☐ • ( )-OP-CH-007, BLENDER OPERATIONS

☐ • ( )-OP-CH-018, RCS BORATION USING EMERGENCY BORATION FLOWPATH

15.___ CHECK IF SOURCE RANGE DETECTORS SHOULD BE ENERGIZED

☐ a) Check intermediate range flux - LESS THAN 5 x 10^{-11} AMPS

☐ a) GO TO Step 19. WHEN flux less than 5 x 10^{-11} amps, THEN perform Steps 15b through 18.

☐ b) Verify source range detectors - ENERGIZED

☐ b) Manually energize source range detectors.

☐ c) Monitor Source Range counts

16.___ HAVE I & C RESET THE N31 AND N32 TRIP POINTS FOR THE NIS SOURCE RNG SHUTDN HI FLUX ALARM WHILE CONTINUING IN THE PROCEDURE

17.___ VERIFY OR PLACE AT LEAST ONE OF THE FOLLOWING SWITCHES IN NORMAL

☐ • HIGH FLUX AT SHUTDOWN N31 NORMAL - BLOCK SWITCH

☐ • HIGH FLUX AT SHUTDOWN N32 NORMAL - BLOCK SWITCH

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
18.	VERIFY ANNUNCIATOR ( )G-C1, NIS SOURCE RNG S/D HI FLUX - NOT LIT	
19.	CHECK GEN OUTPUT BKR OCBs - HAVE BEEN OPEN FOR AT LEAST ONE HOUR	Do the following: ☐ a) WHEN breakers have been open for one hour, THEN perform Attachment 1. ☐ b) GO TO Step 21.
20.	INITIATE ATTACHMENT 1	
21.	PLACE THE NON-RUNNING CN PUMP CONTROL SWITCH IN PTL	
22.	STOP ONE OF THE RUNNING CN PUMPS AND PLACE IN PTL	
23.	OPEN THE CN PUMP HIGH PRESSURE BALANCE LINE ISOLATION VALVE ASSOCIATED WITH THE CN PUMP STOPPED IN STEP 22 ☐ • ( )-CN-34 for ( )-CN-P-1A ☐ • ( )-CN-46 for ( )-CN-P-1B ☐ • ( )-CN-58 for ( )-CN-P-1C	
	NOTE: Condensate header flow can be monitored on PCS point U9005.	
24.	VERIFY OR CHANGE THE SETPOINT ON THE CONDENSATE RECIRC FLOW CONTROLLER, ( )-CN-FIC-( )07, TO 3600 GPM	
25.	CHECK COOLDOWN - DUE TO A TECH SPEC LCO	☐ GO TO Step 27.

STEP	ACTION/ EXPECTED RESPONSE	RESPONSE NOT OBTAINED

26. ___ VERIFY COMPLETE OR HAVE THE SHIFT SUPERVISOR PERFORM AN EAL TAB EVALUATION

27. ___ NOTIFY THE ELECTRICAL DEPARTMENT THAT AN ELECTRICIAN WILL BE REQUIRED FOR REMOVING LOOP STOPS FROM BACKSEATS

* *

CAUTION: ( )-IPT-FT-RC-P-403 and ( )-IPT-FT-RC-P-458 must be completed for operable PORV(s) before RCS pressure decreases to less than 1000 psig.

* *

28. ___ NOTIFY I & C TO INITIATE RCS PRESSURE LOOP FUNCTIONAL TESTS

* *

CAUTION: The Loop Stop valves must be removed from their backseat before the RCS temperature decreases to less than 500°F.

* *

29. ___ INITIATE ATTACHMENT 2

30. ___ REVIEW AND CONFIRM CONDITIONS LISTED ON ATTACHMENT 3, RAPID COOLDOWN PRECAUTIONS, ARE BEING MET DURING RAPID COOLDOWN

STEP | ACTION/ EXPECTED RESPONSE | RESPONSE NOT OBTAINED

31.___ REMOVE TAGS, ENERGIZE BREAKERS, AND VERIFY VALVE POSITIONS OF THE FOLLOWING VALVES ON THE APPROPRIATE UNIT

Valve No.	Description	Remove Tags	Verify Light
1-SI-MOV-1869A (if Unit 1 affected)	HHSI TO HOT LEGS	1H1-1 3C	Green Light Lit
2-SI-MOV-2869A (if Unit 2 affected)	HHSI TO HOT LEGS	2H1-1 9A	Green Light Lit
( )-SI-MOV-( )869B	HHSI TO HOT LEGS	( )J1-1 9A	Green Light Lit
( )-SI-MOV-( )890A	LHSI TO HOT LEGS	( )H1-2N 8A	Green Light Lit
( )-SI-MOV-( )890B	LHSI TO HOT LEGS	( )J1-2E 8B	Green Light Lit
( )-SI-MOV-( )890C	LHSI TO COLD LEGS	( )H1-2N 9A	Red Light Lit

32.___ SHUT DOWN BOTH ROD MG SETS IAW ( )-OP-RX-007, OPERATION OF THE ROD DRIVE MG SETS

33.___ GO TO ATTACHMENT 4 FOR GUIDANCE ON CONTROLLING PRZR TEMPERATURE

NOTE: • At least one RCP must remain running.

• RCPs should be run as specified in Attachment 4 to provide PRZR spray.

34.___ STOP THE DESIRED RCP(S) BY PLACING THE CONTROL SWITCHES IN PTL

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

NOTE:
- The maximum RCS cooldown rate to 350°F is 75°F/hr.
- PRZR level should be maintained between 17% and 32%.
- There is an approximate one to one relationship between RCS cooldown rate and required RCS makeup. (At a cooldown rate of 75°F/hr, 75 gpm charging flow (with no letdown) will be required to maintain PRZR level.
- Letdown may be reduced or secured as necessary to maintain PRZR level.
- Makeup to the RWST should be initiated to prevent the RWST Tech Spec low level from being reached.
- Steam dumps may be manually jacked open to achieve the desired cooldown rate.

35. ___ CHECK THE MAIN CONDENSER - AVAILABLE

Do the following:

☐ a) Start the cooldown using the SG PORVs.

☐ b) GO TO Step 37.

36. ___ ADJUST ( )-MS-PC-( )464B, STEAM HDR PRESS CNTRL TO OPEN THE COOLDOWN DUMPS TO START THE RCS COOLDOWN

☐ • ( )-MS-TCV-( )05A

☐ • ( )-MS-TCV-( )05B

37. ___ VERIFY THE FOLLOWING ANNUNCIATORS - LIT

Do the following:

☐ • ( )H-D4, LO TAVG INTERLK LOOP 1A

☐ • ( )H-E4, LO TAVG INTERLK LOOP 1B

☐ • ( )H-F4, LO TAVG INTERLK LOOP 1C

☐ a) WHEN annunciators LIT, THEN perform Steps 38 through 43.

☐ b) GO TO Step 44.

38. ___ CHECK MAIN CONDENSER - BEING USED FOR COOLDOWN

☐ GO TO Step 41.

39. ___ HOLD THE STM DUMP CNTRL SWITCH IN BYP INTLK UNTIL BYPASS STATUS LIGHT D2 IS LIT

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

40. ___ RELEASE THE STM DUMP CONTR SWITCH AND VERIFY THAT ( )-MS-TCV-( )05A AND ( )-MS-TCV-( )05B DO NOT CLOSE

NOTE: SI may be blocked without CSD boron concentration in the RCS.

41. ___ BLOCK HIGH STEAM FLOW/LOW TAVE SI

42. ___ CHECK PERMISSIVE STATUS LIGHT F1 - LIT

- ☐ • LO TAVE SI BLOCKED STM FLOW AND PRESS

43. ___ CHECK THE FOLLOWING ANNUNCIATORS - LIT

- ☐ • ( )A-E3, SI BLOCKED TRAIN A
- ☐ • ( )A-E4, SI BLOCKED TRAIN B

44. ___ CHECK LOOP STOP VALVES - ANY ON BACKSEAT — ☐ GO TO Step 46.

45. ___ PERFORM THE FOLLOWING TO RELIEVE LOOP STOP VALVE STEM STRESS

- ☐ a) Stop the cooldown
- ☐ b) Initiate Attachment 8 at intervals not to exceed 50°F
- ☐ c) Repeat Attachment 8 as required

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

* *

CAUTION: Pressurizer temperature must be closely monitored during depressurization. The maximum PRZR cooldown rate of 200°F/hr must not be exceeded.

* *

NOTE: RCS pressure will have to be manually lowered during the cooldown to keep RCS pressure within the limits of the Pressure - Temperature Curve IAW ( )-DRP-003, Curve Book, Heatup and Cooldown Curve.

46. ___ REDUCE RCS PRESSURE BY MANUALLY OPERATING PRESSURIZER SPRAY OR AUXILIARY SPRAY

NOTE: Letdown may be reduced or secured as necessary to maintain PRZR level.

47. ___ CONTROL LETDOWN FLOW AS RCS PRESSURE DECREASES USING ( )-CH-PCV-( )145, LTDN LINE PRESS CNTRL

NOTE: Adjustment of local RCP Seal Flow Metering valves ( )-CH-294, ( )-CH-297, and ( )-CH-300 will be needed for control of RCP seal injection.

48. ___ MAINTAIN RCP SEAL INJECTION FLOW BETWEEN 6.5 AND 13 GPM BY ADJUSTING ( )-CH-HCV-( )186, RCP SEAL INJECTION FLOW

49. ___ CHECK PERMISSIVE STATUS LIGHT C3 - LIT

- ☐ • PERM TO BLOCK SI PRZR LO PRESS HDR TO LINE

Do the following:

- ☐ a) WHEN Permissive Status light LIT, THEN perform Steps 50 and 51.
- ☐ b) GO TO Step 52.

STEP	ACTION/ EXPECTED RESPONSE	RESPONSE NOT OBTAINED

NOTE: SI may be blocked without CSD boron concentration in the RCS.

50. ___ BLOCK LOW PRZR PRESS SI

51. ___ CHECK PERMISSIVE STATUS LIGHT C2 - LIT

- ☐ • SI BLOCKED PRZR LO PRESS HDR TO LINE

52. ___ CHECK RCS TEMPERATURE - LESS THAN OR EQUAL TO 500°F — ☐ Continue cooldown to 500°F.

53. ___ CHECK COOLDOWN - IN PROGRESS DUE TO TECH SPEC LCO 3.1.D.1 — ☐ GO TO Step 55.

54. ___ PERFORM THE FOLLOWING:

- ☐ a) Stabilize Unit conditions
- ☐ b) Consult Operations management on desired course of action
- ☐ c) GO TO Step 71

STEP	ACTION/ EXPECTED RESPONSE	RESPONSE NOT OBTAINED

* *

CAUTION: PI-( )-403 is the most accurate (due to static head differences) RCS Narrow Range Pressure instrument and therefore the preferred pressure instrument to plot RCS Narrow Range Pressure vs. Cold Leg Temperature.

* *

55.___ VERIFY THAT I & C HAS COMPLETED THE FOLLOWING PROCEDURES FOR OPERABLE PORV(s)

- ☐ • ( )-IPT-FT-RC-P-403
- ☐ • ( )-IPT-FT-RC-P-458

Do the following:

- ☐ a) Maintain RCS pressure greater than 1000 psig.
- ☐ b) Continue the RCS cooldown.
- ☐ c) WHEN I & C procedures complete, THEN perform Steps 56 through 58.
- ☐ d) GO TO Step 59.

56.___ CONTINUE RCS COOLDOWN AND DEPRESSURIZATION USING PI-( )-403 (PREFERRED) OR PI-( )-458

57.___ CHECK RCS PRESSURE - LESS THAN 1000 PSIG

Do the following:

- ☐ a) WHEN RCS pressure less than 1000 psig, THEN perform Step 58.
- ☐ b) GO TO Step 59.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

58. ___ ISOLATE SI ACCUMULATORS

a) Locally close the following breakers (key required)

- UNIT 1
  - ☐ • 1H1-2N 5B
  - ☐ • 1J1-2E 1B
  - ☐ • 1J1-2E 1C

OR

- UNIT 2
  - ☐ • 2H1-2N 5B
  - ☐ • 2J1-2E 1B
  - ☐ • 2J1-2W 9A

b) Put ACC interlock key switches in DEFEAT: (keys 11, 12, and 13)

- ☐ • MOV-( )865A
- ☐ • MOV-( )865B
- ☐ • MOV-( )865C

c) Close the following MOVs:

- ☐ • ( )-SI-MOV-( )865A
- ☐ • ( )-SI-MOV-( )865B
- ☐ • ( )-SI-MOV-( )865C

d) Locally open the following breakers:

- UNIT 1
  - ☐ • 1H1-2N 5B
  - ☐ • 1J1-2E 1B
  - ☐ • 1J1-2E 1C

OR

- UNIT 2
  - ☐ • 2H1-2N 5B
  - ☐ • 2J1-2E 1B
  - ☐ • 2J1-2W 9A

STEP	ACTION/ EXPECTED RESPONSE	RESPONSE NOT OBTAINED
59.___	CHECK RHR SYSTEM - WILL BE PLACED IN SERVICE	☐ GO TO Step 61.
60.___	INITIATE ( )-OP-RH-001, RHR OPERATIONS	
61.___	INITIATE ATTACHMENT 5 TO ALIGN MFW SYSTEM	
62.___	STABILIZE RCS TEMPERATURE BETWEEN 351°F AND 355°F	

* *

CAUTION: When RCS temperature is less than or equal to 350°F, only ONE CH pump control switch will be out of PTL, except momentarily while transferring from one CH pump to another.

* *

NOTE: Charging pumps should be run in the following order of priority: C, B, A.

63.___ PLACE THE CONTROL SWITCHES FOR THE TWO NON-RUNNING CHG PUMPS IN PTL IAW THE APPROPRIATE PROCEDURES

- ☐ ( )-OP-CH-002
- ☐ ( )-OP-CH-003
- ☐ ( )-OP-CH-004

STEP	ACTION/ EXPECTED RESPONSE	RESPONSE NOT OBTAINED

* *

CAUTION: If PORVs are inoperable, PRZR level must be less than 33% in order to decrease RCS temperature below 350°F.

* *

64.___ CHECK PRZR PORVs - AT LEAST ONE OPERABLE

Do the following:

☐ a) Review Tech Spec 3.1.G for required actions.

☐ b) GO TO Step 66.

65.___ CHECK IF OVERPRESSURE MITIGATION SYSTEM CAN BE PLACED IN SERVICE:

a) Check RCS pressure - LESS THAN 365 PSIG

☐ • PI-1-403 (NQ)

☐ a) GO TO Step 66. WHEN RCS pressure is less than 365 psig, THEN do Steps 65b and 65c.

☐ b) Check PRZR PORV block valve(s) for operable PORV(s) - OPEN

☐ b) Open valve(s).

☐ c) Put Overpressure Mitigation system key switches for operable PORV(s) in - ENABLE (keys 53 and 54)

NOTE: Below 350°F, the cooldown rate will be limited to the administrative limit of less than or equal to 50°F/hr.

66.___ CHECK RCS - BORATED TO CSD XENON FREE CONDITIONS

☐ WHEN RCS borated to CSD Xenon free conditions, THEN continue with Step 67.

67.___ RECOMMENCE RCS COOLDOWN AT LESS THAN OR EQUAL TO 50°F/HR

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
68. ___	CHECK RCS TEMPERATURE - LESS THAN OR EQUAL TO 350°F	Do the following: ☐ a) WHEN RCS less than or equal to 350°F, THEN perform Step 69. ☐ b) GO TO Step 70.
69. ___	VERIFY INITIATED OR INITIATE ( )-OSP-ZZ-003, UNIT ( ) SAFETY SYSTEMS STATUS LIST FOR REACTOR ≥ 200°F	
70. ___	INITIATE ATTACHMENT 7 TO PERFORM CTMT WALKDOWN	
71. ___	CONSULT OPERATIONS MANAGEMENT ON DESIRED COURSE OF ACTION	

- END -

NUMBER 0-AP-23.01	ATTACHMENT TITLE MAIN TRANSFORMER COOLING SYSTEM SHUTDOWN	ATTACHMENT 1
REVISION 5		PAGE 1 of 2

* *

CAUTION: The Main Transformer Cooling System must be shutdown when the GEN OUTPUT BKR OCBs are open. Continuous operation of the cooling system pumps when the transformer is not energized has the potential to cause transformer failure at power.

* *

NOTE: The Main Transformer Cooling System should remain in operation for at least one hour after deenergizing the Main Transformer. If the transformer will be reenergized within eight hours, the Main Transformer cooling system should be left in operation.

1. ___ Verify that the GEN OUTPUT BKRs have been open for at least one hour.

2. ___ Notify the Unit CRO that Annunciator K-F-2, MAIN XFMR COOLING TROUBLE, will come IN when the first control switch is turned to OFF.

NOTE: The control switch for Unit 1 Transformer A transformer cooling fans and pumps is located on the swing out panel inside the Transformer Control Cabinet.

3. ___ For Unit 1 Transformer A, turn the TRANS A control switch to OFF and verify that the fans and pumps stop.

4. ___ For Unit 1 Transformer B, open the following breakers and verify that the fans and pumps stop.

- ☐ • 1-EP-BKR-1B-52-1, 1-EP-TX-1B Cooling Bank #1 Power Supply
- ☐ • 1-EP-BKR-1B-52-2, 1-EP-TX-1B Cooling Bank #2 Power Supply
- ☐ • 1-EP-BKR-1B-52-3, 1-EP-TX-1B Cooling Bank #3 Power Supply
- ☐ • 1-EP-BKR-1B-52-4, 1-EP-TX-1B Cooling Bank #4 Power Supply
- ☐ • 1-EP-BKR-1B-52-5, 1-EP-TX-1B Cooling Bank #5 Power Supply
- ☐ • 1-EP-BKR-1B-52-6, 1-EP-TX-1B Cooling Bank #6 Power Supply

5. ___ For Unit 1 Transformer C, open the following breakers and verify that the fans and pumps stop.
   - ☐ • 1-EP-BKR-1C-52-1, 1-EP-TX-1C Cooling Bank #1 Power Supply
   - ☐ • 1-EP-BKR-1C-52-2, 1-EP-TX-1C Cooling Bank #2 Power Supply
   - ☐ • 1-EP-BKR-1C-52-3, 1-EP-TX-1C Cooling Bank #3 Power Supply
   - ☐ • 1-EP-BKR-1C-52-4, 1-EP-TX-1C Cooling Bank #4 Power Supply
   - ☐ • 1-EP-BKR-1C-52-5, 1-EP-TX-1C Cooling Bank #5 Power Supply
   - ☐ • 1-EP-BKR-1C-52-6, 1-EP-TX-1C Cooling Bank #6 Power Supply

   NOTE: The control switches for Unit 2 Transformer cooling fans and pumps are located inside the Transformer Control Cabinet.

6. ___ Notify the Unit CRO that Annunciator K-F-2, MAIN XFMR COOLING TROUBLE, will come IN when the first control switch is turned to OFF.

7. ___ For Unit 2 Transformer A, turn the following switches to OFF and verify that the fans and pumps stop.
   - ☐ • 2-EP-43-2A-1, A Phase Main Transformer Cooling Control Switch
   - ☐ • 2-EP-43-2A-2, A Phase Main Transformer Cooling Control Switch

8. ___ For Unit 2 Transformer B, turn the following switches to OFF and verify that the fans and pumps stop.
   - ☐ • 2-EP-43-2B-1, B Phase Main Transformer Cooling Control Switch
   - ☐ • 2-EP-43-2B-2, B Phase Main Transformer Cooling Control Switch

9. ___ For Unit 2 Transformer C, turn the following switches to OFF and verify that the fans and pumps stop.
   - ☐ • 2-EP-43-2C-1, C Phase Main Transformer Cooling Control Switch
   - ☐ • 2-EP-43-2C-2, C Phase Main Transformer Cooling Control Switch

10. ___ Verify that annunciator K-F-2 is LIT.

NUMBER 0-AP-23.01	ATTACHMENT TITLE PREPARATIONS FOR COOLDOWN	ATTACHMENT 2
REVISION 5		PAGE 1 of 1

1. ___ Put one of the loop wide range Tc points on trend.

   ☐ • Loop A - T0406A

   ☐ • Loop B - T0426A

   ☐ • Loop C - T0446A

2. ___ Put RCS wide range pressure on trend.

   ☐ • P0499A

3. ___ Plot data points on Operators curve at 25°F intervals. Use ( )-DRP-003, Curve Book, Heatup and Cooldown Curve.

4. ___ Refer to Subsection 5.2 of ( )-GOP-2.4, Unit Cooldown, HSD to 351°F, for guidance on removing the RCS Loop Stop Valves from the backseat.

NUMBER 0-AP-23.01	ATTACHMENT TITLE RAPID COOLDOWN PRECAUTIONS	ATTACHMENT 3
REVISION 5		PAGE 1 of 1

1. At least one RCP will remain running to ensure adequate mixing during the cooldown to 350°F.

2. All Rod bottom lights must be LIT prior to beginning the evolution or the shutdown margin procedure must be completed to account for any stuck rods.

3. The appropriate BAST shall be (or have been) tested and verified to be within the concentration band of TS.

4. The RCS shall be sampled and tested for boron concentration at approximately 50°F intervals.

5. Makeup concentrations shall be adequate to maintain the required shutdown margin throughout the evolution. Shutdown margin calculations shall be performed IAW ( )-OP-RX-002 at 50°F intervals or until the most conservative shutdown boron concentration has been determined and reached. If adequate shutdown margin is not verified, the cooldown must be stopped.

6. For cooldown below 350°F, makeup from the CVCS shall be at or greater than the required CSD concentration. (If the RWST concentration is greater than the required CSD concentration, the RWST can be used for a makeup source less than 350°F).

7. Source Range count rate must be continuously monitored during the cooldown evolution. Cooldown shall be suspended upon detection of any unexplained increase in count rate.

8. Normal or auxiliary spray (if letdown is in service) should be used during the cooldown to provide boron mixing in the PRZR.

9. PRZR level should be maintained between 17% and 32%.

10. The cooldown to 350°F must not exceed 75°F/hr.

11. The cooldown rate below 350°F must not exceed the normal administrative rate of 50°F/hr.

12. Boric Acid flow has been verified by independent indications (BAST Level decrease, Boric Acid Integrator, recorder).

1. ___ Indicate the method to be used for providing continuous PRZR spray. The list below is ranked from highest to lowest priority.

   ( ) Only RCP C to be run (RCP C will provide adequate spray flow.)

   ( ) RCP A and RCP B are to be run (RCP A and RCP B running together will provide adequate spray flow.)

   ( ) Only RCP A to be run (RCP A may not provide adequate spray flow. Aux spray will be needed to provide the continuous out surge from the PRZR.)

   ( ) Only RCP B to be run (RCP B may not provide adequate spray flow. Aux spray will be needed to provide the continuous out surge from the PRZR.)

2. ___ Monitor the following PCS points.

   ☐ • T0481A - PRZR Steam Temperature

   ☐ • T0480A - PRZR Water Temperature

   ☐ • T0482A - Surge Line Temperature

   ☐ • U0906 - RCS Fill Rate at Shutdown

* *

CAUTION: As long as the temperature differential between the RCS and the PRZR is less than or equal to 100°F, the PRZR heatup/cooldown limits will not be exceeded, even on insurges and outsurges. A continuous outsurge becomes critical for ensuring thermal limits are not exceeded once the temperature differential between the RCS and the PRZR increases to greater than 100°F.

* *

NOTE: Adequate PRZR heaters should (not mandatory if it can be assured that RCS temperature will remain with 100°F of the PRZR liquid temperature) remain energized to maintain a continuous spray flow and thereby ensure a continuous outsurge from the PRZR. This will ensure the PRZR surge line will not stratify and provide adequate boron mixing.

3. ___ Monitor PRZR liquid temperature, Surge Line temperature, and RCS temperature. IF PRZR Surge line or Liquid temperature unexpectedly drops by 50°F due to a PRZR insurge, THEN immediately perform the following steps.

   ___ a. Immediately stop the insurge to the PRZR.

   ___ b. Stabilize PRZR level.

   ___ c. Verify that all available PRZR heaters are energized.

   ___ d. Allow PRZR liquid temperature to heatup to within 30°F of the temperature prior to the unexpected drop.

   ___ e. WHEN PRZR liquid temperature has recovered, THEN RETURN TO the procedure step in effect.

4. ___ IF normal spray is to be used, THEN perform the following. Otherwise, enter N/A.

   ___ a. Energize sufficient PRZR Heaters to support PRZR spray flow, and stabilize RCS pressure.

   ___ b. Maximize pressurizer spray by placing the control station in MANUAL and closing the PRZR spray PCV associated with the RCP that is to be stopped. Enter N/A for the PCV that is not placed in MANUAL and closed.

      ___ 1. ( )-RC-PCV-( )455A, PRZR SPRAY FROM LOOP A ( )-RC-P-1A

      ___ 2. ( )-RC-PCV-( )455B, PRZR SPRAY FROM LOOP C ( )-RC-P-1C

5. ___ IF Aux spray is to be used, THEN contact OMOC AND perform the following. Otherwise, enter N/A.

___ a. Verify that the temperature difference between the PRZR Steam space (T0418A) and the Charging Aux Spray Water (T0126A) is less than 320°F. Maintain verification of the delta T between the PRZR Steam Space and Charging Water.

NOTE: Closing ( )-CH-HCV-( )310A, CHG LINE ISOL, may be necessary to provide Auxiliary Spray flow.

___ b. Place Auxiliary Spray in operation as follows.

___ 1. Reduce charging Flow to minimum. (Maintain greater than or equal to 40 gpm if Letdown is in service.)

___ 2. Open ( )-CH-HCV-( )311, CHG AUX SPRAY.

___ 3. Verify closed or close ( )-RC-PCV-1455A, PRZR SPRAY FROM LOOP A ( )-RC-P-1A.

___ 4. Verify closed or close ()-RC-PCV-1455B, PRZR SPRAY FROM LOOP A ( )-RC-P-1C.

___ c. Slowly increase charging flow to allow gradual cooldown of the PRZR Aux Spray line and adjust charging flow as required to control PRZR spray. (Maximizing Letdown flow will minimize the differential between the PRZR Steam space and charging water.)

NOTE: Charging Line Isolation Valve ( )-CH-HCV-( )310A must be opened before ( )-CH-HCV-( )311 is closed.

___ d. Energize sufficient PRZR Heaters to support PRZR spray flow, THEN stabilize RCS pressure. IF PRZR heaters can NOT maintain pressure, THEN cycle ( )-CH-HCV-( )311, as necessary to maintain pressure.

___ e. RETURN TO procedure Step 32.

1. ___ Verify that SG pressure is less than 500 psig.

NOTE: Both breakers for the shutdown Feed Pump must be in TEST and closed to complete the logic to permit opening the FEED PUMP DISCH.

2. ___ Rack the breakers from CONNECT to TEST, for the shutdown SG Feed Pump, IAW Attachment 6. Enter N/A for the running pump.

___ a. ( )-FW-P-1A

___ b. ( )-FW-P-1B

3. ___ Close the breakers in TEST for the shutdown SG Feed Pump. Enter N/A for the running pump.

___ a. ( )-FW-P-1A

___ b. ( )-FW-P-1B

4. ___ Open the FEED PUMP DISCH for the shutdown SG Feed Pump. Enter N/A for the running pump.

___ a. ( )-FW-MOV-( )50A, FEED PUMP A DISCH

___ b. ( )-FW-MOV-( )50B, FEED PUMP B DISCH

5. ___ Place the Auxiliary Lube Oil Pump switch in HAND for the running SG Feed Pump and verify that lube oil pressure increases. Enter N/A for the shutdown SG Feed Pump.

___ a. ( )-FW-P-1A

___ b. ( )-FW-P-1B

6. ___ Close the FEED PUMP DISCH for the running SG Feed Pump. (Enter N/A for the shutdown pump.)

___ a. ( )-FW-MOV-( )50A, FEED PUMP A DISCH

___ b. ( )-FW-MOV-( )50B, FEED PUMP B DISCH

7. ___ WHEN condensate feed to the SGs has been verified, THEN stop the running SG Feed Pump AND check that the FW PP RECIRC VV POSTN green light is LIT.

8. ___ Rack the breakers from CONNECT to TEST, for the SG Feed Pump that was shut down in Step 6, IAW with Attachment 6. Enter N/A for the pump that was NOT shut down in Step 6.

   ___ a. ( )-FW-P-1A

   ___ b. ( )-FW-P-1B

9. ___ Close the breakers in TEST for the SG Feed Pump that was shut down in Step 6. Enter N/A for the pump that was NOT shut down in Step 6.

   ___ a. ( )-FW-P-1A

   ___ b. ( )-FW-P-1B

10. ___ Open the FEED PUMP DISCH for the SG Feed Pump that was shut down in Step 6. Enter N/A for the pump that was NOT shut down in Step 6.

    ___ a. ( )-FW-MOV-( )50A, FEED PUMP A DISCH

    ___ b. ( )-FW-MOV-( )50B, FEED PUMP B DISCH

11. ___ Control SG levels in manual using the bypass HCVs.

FW PUMP 1A

1. ___ Put the control switches (two) in PTL for ( )-FW-P-1A, FW Pump 1A.

   ___ ( )-EP-BKR-( )5A5 and ___ ( )-EP-BKR-( )5A6

2. ___ Complete Substeps a and b for the first breaker before doing the second.

   a. Using the mechanical indicator, verify that the breaker is OPEN.

      ___ ( )-EP-BKR-( )5A5 and ___ ( )-EP-BKR-( )5A6

* *

WARNING: The racking crank must not be connected to the racking screw unless the breaker cubicle door is CLOSED and secured with all three screws.

* *

   b. Rack the breaker from CONNECT to TEST.

      ___ ( )-EP-BKR-( )5A5 and ___ ( )-EP-BKR-( )5A6

FW PUMP 1B

1. ___ Put the control switches (two) in PTL for ( )-FW-P-1B, FW Pump 1B.

   ___ ( )-EP-BKR-( )5B5 and ___ ( )-EP-BKR-( )5C5

2. ___ Complete Substeps a and b for the first breaker before doing the second.

   a. Using the mechanical indicator, verify that the breaker is OPEN.

      ___ ( )-EP-BKR-( )5B5 and ___ ( )-EP-BKR-( )5C5

* *

WARNING: The racking crank must not be connected to the racking screw unless the breaker cubicle door is CLOSED and secured with all three screws.

* *

   b. Rack the breaker from CONNECT to TEST.

      ___ ( )-EP-BKR-( )5B5 and ___ ( )-EP-BKR-( )5C5

NUMBER 0-AP-23.01	ATTACHMENT TITLE CONTAINMENT WALKDOWN	ATTACHMENT 7
REVISION 5		PAGE 1 of 1

1. ___ Initiate VPAP-0106, SUBATMOSPHERIC CONTAINMENT ENTRY, and make the Containment entry.

2. Record the PRZR PORV air bottle pressures.

   ___ a. ( )-RC-PCV-( )456, PRZR PORV air bottle: _____ psig

   ___ b. ( )-RC-PCV-( )455C, PRZR PORV air bottle: _____ psig

   NOTE: The RHR system is normally depressurized with ( )-RH-HCV-( )142, RHR Letdown Flow, closed. The RHR system will be filled IAW ( )-OP-RH-001.

3. ___ Check ( )-RH-HCV-( )758, RHR HXS FLOW, and ( )-RH-FCV-( )605, RHR HXS BYP FLOW, IAW ( )-OPT-RH-001, Stroke Test of ( )-RH-FCV-( )605 and ( )-RH-HCV-( )758, and report the results to the Shift Supervisor.

4. ___ Open or verify open ( )-RH-25.

5. ___ Check the oil levels and shaft seals on the RHR pumps.

6. ___ Identify and record all noted primary and secondary leaks.

7. ___ Complete the remaining items on the Containment Entry Checklist after leaving Containment.

NUMBER 0-AP-23.01	ATTACHMENT TITLE RELIEVING VALVE STEM STRESS ON LOOP STOP VALVES	ATTACHMENT 8
REVISION 5		PAGE 1 of 1

1. ___ Record RCS temperature and pressure.

   ☐ RCS temperature _____ °F

   ☐ RCS pressure _____ psig

2. ___ Determine the PDTT inleakage rate to establish a baseline for determining packing leakage.

   NOTE: Manual Loop Stop valve closure must be performed slowly.

3. ___ Manually throttle closed each of the Loop Stop valves on the backseat until any of the following occur.

   ☐ • Zero deflection is obtained.

   ☐ • There is a noticeable decrease in the amount of effort required to operate the valve.

   ☐ • There is a significant increase in PDTT inleakage.

   ☐ • Direction from the MCR.

4. ___ Determine the change in PDTT level.

   PDTT inleakage rate _____ gpm

5. ___ IF leakage exceeds either of the following, THEN perform Step 6. Otherwise, enter N/A.

   • Approximately five gpm for each individual Loop Stop valve

   • 10 gpm Total for all Loop Stop valves

6. ___ Open each Loop Stop valve as directed by the Shift Supervisor to meet the requirements of Step 5. Enter N/A if leakage is acceptable.

7. ___ Restart the RCS cooldown.

I. PROBABLE CAUSES

1. Cooldown at higher than normal rate necessitated to comply with a Tech Spec LCO

II. REFERENCES

1. ( )-GOP-2.3, UNIT SHUTDOWN, 2% REACTOR POWER TO HSD
2. ( )-GOP-2.4, UNIT COOLDOWN, HSD TO 351°F
3. ( )-GOP-2.5, UNIT COOLDOWN, 351°F TO LESS THAN 205°F
4. Station Deviation S-96-0332, RCS COOLDOWN/SHUTDOWN PROCEDURAL ISSUES
5. UFSAR Sections 4.2.6, 9.1.2.4, 9.1.3.5.2, 14.3.2, 14.5
6. TS 3.1.A.6, PORVs and Blocking Valves
7. TS 3.1.G.1.b (1), Max Charging Pumps
8. TS 3.1.G.1.b (2), SI Accumulator Isol Valves
9. TS 3.1.G.1.c, Overpressure Mitigation
10. ( )-OP-CH-007, BLENDER OPERATIONS
11. ( )-OP-CH-018, RCS BORATION USING EMERGENCY BORATION FLOWPATH
12. ( )-OP-RX-007, OPERATION OF THE ROD DRIVE MG SETS
13. ( )-DRP-003, CURVE BOOK
14. ( )-IPT-FT-RC-P-403, REACTOR COOLANT SYSTEM PRESSURE LOOP P-( )-403 FUNCTIONAL TEST
15. ( )-IPT-FT-RC-P-458, REACTOR COOLANT SYSTEM PRESSURE LOOP P-( )-458 FUNCTIONAL TEST
16. ( )-OP-RH-001, RHR OPERATIONS
17. ( )-OSP-ZZ-003, UNIT ( ) SAFETY SYSTEMS STATUS LIST FOR REACTOR ≥ 200°F
18. Safety Evaluation No. 96-165
19. DR S-97-0648, Removing Loop Stop Valves from Backseat
20. DCP 01-008, Instrument and Controls Upgrade Project, Unit 1

21. DCP 01-011, Plant Computer Replacement, Surry/Unit 2

22. DCP 04-017, Generator Step Up Transformer Replacement

23. DCP 04-016, Generator Step Up Transformer Replacement

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

NOTE: Shutdown margin should be monitored during RCS cooldown.

15. __INITIATE RCS COOLDOWN TO CSD:

a) Maintain cooldown rate in RCS cold legs - LESS THAN 100°F/HR

b) Dump steam to condenser from intact SG(s)

b) Dump steam from intact SG(s):

- Manually use SG PORV(s).

OR

- Locally use SG PORV(s) IAW Attachment 8.

IF no intact SG available, THEN use faulted SG.

16. __CHECK IF SI IN SERVICE:

- HHSI to cold legs - FLOW INDICATED

OR

- LHSI pumps - ANY RUNNING

GO TO Step 24.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
17.	__VERIFY NO BACKFLOW FROM RWST TO SUMP:	
	a) LHSI suction from sump - ANY OPEN • 1-SI-MOV-1860A • 1-SI-MOV-1860B	a) IF BOTH valves closed, THEN GO TO Step 18.
	b) LHSI suction from RWST in same train - CLOSED • 1-SI-MOV-1862A • 1-SI-MOV-1862B	b) Manually or locally close valve(s).

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

* *

CAUTION: If all RCP seal cooling had been previously lost, the affected RCP(s) should NOT be started without prior evaluation.

* *

NOTE: RCPs should be run in the following order of priority to provide PRZR spray: C, A.

18. __CHECK IF AN RCP SHOULD BE STARTED:

a) All RCPs - STOPPED	a) Do the following: 1) Stop all but one RCP. 2) Close spray valve(s) on stopped RCPs. 3) GO TO Step 19.
b) RCS subcooling based on CETCs - GREATER THAN 30°F [85°F]	b) GO TO Step 19.
c) Try to start one RCP: 1) Establish conditions for starting an RCP IAW 1-OP-RC-001, STARTING AND RUNNING ANY RCP 2) Start one RCP	c) GO TO Step 19.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
*19.	__CHECK IF SI CAN BE TERMINATED:	
	a) Check RVLIS indication: • Full range - GREATER THAN 63% IF NO RCP RUNNING OR • Dynamic range - GREATER THAN 36% IF ONE RCP RUNNING	a) GO TO Step 24.
	b) RCS subcooling based on CETCs - GREATER THAN 80°F [135°F]	b) IF minimum SI flow required as determined from Attachment 2 is less than or equal to 150 gpm, THEN GO TO Step 21. IF minimum SI flow required as determined from Attachment 2 is greater than 150 gpm, THEN do the following: 1) Consult with TSC to determine if SI valves should be throttled, using Attachment 3 to remove seal-in contacts from MOVs. 2) GO TO Step 24.
*20.	__CHECK IF CLS CAN BE RESET:	
	a) CTMT pressure - LESS THAN 14 PSIA	a) GO TO Step 21. WHEN CTMT pressure less than 14 psia, THEN do Steps 20b.
	b) Reset both trains of CLS if necessary	

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

21. __STOP LHSI PUMPS AND PUT IN AUTO:

a) Check LHSI pump suctions from CTMT sump - BOTH CLOSED

- 1-SI-MOV-1860A
- 1-SI-MOV-1860B

a) GO TO Step 22.

b) Stop LHSI pumps and place in Auto

22. __ISOLATE HHSI TO COLD LEGS:

a) Check CHG pump miniflow RECIRC valves - OPEN

- 1-CH-MOV-1275A
- 1-CH-MOV-1275B
- 1-CH-MOV-1275C
- 1-CH-MOV-1373

a) Manually open valves.

b) Close HHSI to Cold Leg

- 1-SI-MOV-1867C
- 1-SI-MOV-1867D
- 1-SI-MOV-1842

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

23. __ESTABLISH CHARGING FLOW:

a) Close CHG flow control

- 1-CH-FCV-1122

b) Verify CHG line isolation - OPEN

- 1-CH-HCV-1310A

b) Manually open valve.

c) Open CHG line isolation MOVs

- 1-CH-MOV-1289A
- 1-CH-MOV-1289B

c) Locally open valve(s).

d) Establish desired charging flow using CHG flow control

24. __VERIFY ADEQUATE RCS MAKEUP FLOW:

a) Check RVLIS indication:

- Full range - GREATER THAN 63% IF NO RCP RUNNING

OR

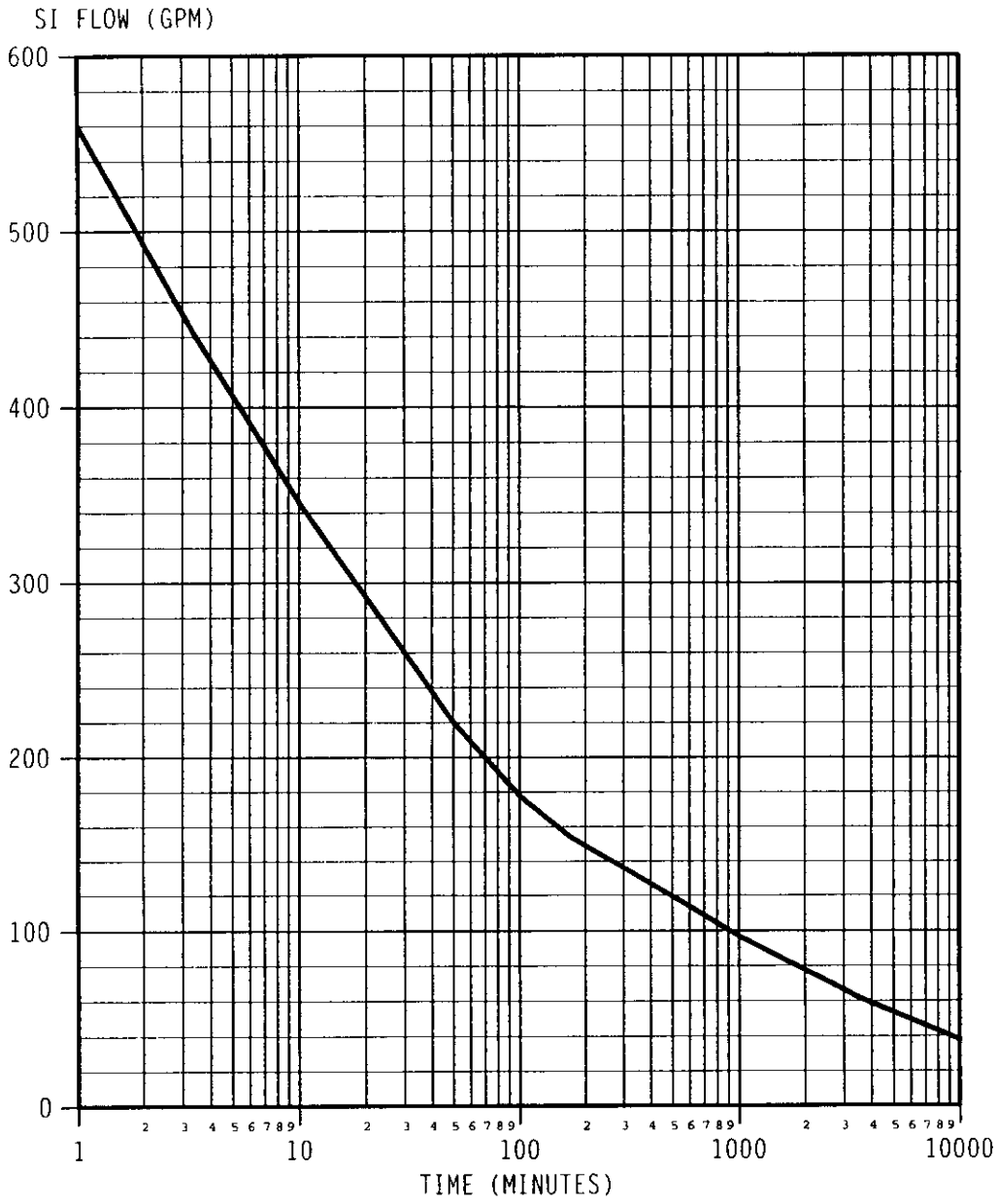
- Dynamic range - GREATER THAN 36% IF ONE RCP RUNNING

a) Raise RCS makeup flow to maintain RVLIS indication as necessary.

b) CETCs - STABLE OR DECREASING

b) Raise RCS makeup flow to maintain CETCs stable or decreasing.

NUMBER	ATTACHMENT TITLE	REVISION
1-ECA-1.1	MINIMUM SI FLOWRATE FOR DECAY HEAT REMOVAL VERSUS TIME FROM REACTOR TRIP	23
ATTACHMENT 2		PAGE 1 of 1



Dominion

SURRY POWER STATION

ABNORMAL PROCEDURE

NUMBER	PROCEDURE TITLE	REVISION
1-AP-9.00	RCP ABNORMAL CONDITIONS (WITH 7 ATTACHMENTS)	21
		PAGE 1 of 16

PURPOSE

To provide guidance for responding to Reactor Coolant Pump abnormal conditions.

ENTRY CONDITIONS

1) Transition from the following Annunciator Response Procedures:
   - 1C-F2, RCP BEARING HI TEMP
   - 1C-D3, E3, F3, RCP 1( ) SHAFT SEAL WTR LO INJ FLOW
   - 1C-D4, E4, F4, RCP 1( ) SEAL LKOFF LO FLOW
   - 1C-A4, B4, C4, RCP 1( ) SEAL LKOFF HI FLOW
   - 1C-A1, B1, C1, RCP 1( ) CC RETURN LO FLOW
   - 1C-D1, E1, F1, RCP 1( ) CC RETURN HI TEMP
   - 1B-A8, B8, C8, RCP 1( ) VAPOR SEAL TK HI LVL
   - 1B-D8, E8, F8, RCP 1( ) VAPOR SEAL TK LO LVL
2) Transition from 1-OP-RC-001, STARTING AND RUNNING ANY REACTOR COOLANT PUMP.
3) Transition from 1-AP-16.00, EXCESSIVE RCS LEAKAGE.
4) Detection through visual observation of an RCP abnormal condition.
5) Detection through visual observation that RCP Seal Leakoff on any RCP is less than 1.0 gpm.
6) Detection through visual observation that RCP Seal Leakoff on any RCP is greater than 4.0 gpm
7) Transition from 1-PT-36, Instrument Surveillance

CONTINUOUS USE

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

* *

CAUTION: An RCP with high or low seal leakoff should be secured immediately (within 5 minutes) after a manual Reactor trip if any Attachment 2 parameter is continuously increasing or at Action level.

* *

NOTE: • Attachment 5 lists PCS points which may be used to monitor RCP performance.

• This is an OC-93 applicable procedure.

*1. ___ VERIFY SEAL INJECTION - FLOW INDICATED

Do the following:

☐ a) Check Thermal Barrier CC Flow.

b) IF Seal Injection AND Thermal Barrier CC Flow NOT indicated, THEN perform the following:

☐ 1) Trip Reactor and initiate 1-E-0.

☐ 2) Stop all running RCPs.

☐ 3) GO TO 1-AP-9.02, LOSS OF RCP SEAL COOLING.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

* *

CAUTION: • Total No. 1 Seal leakoff is the total of the indicated leakoff from No. 1 Seal and calculated No. 2 Seal leakoff.

• Number 2 Seal leakoff rate should be determined by the difference between PDTT inleakage rate before (from previously calculated 1-OPT-RC-10.0) and after the increase in Number 2 Seal leakoff.

* *

*2.___ VERIFY SEAL LEAKOFF - WITHIN NORMAL OPERATING RANGE IAW ATTACHMENT 1

☐ • 1-CH-FR-1190

☐ IF affected RCP is NOT running, THEN GO TO Step 10.

☐ IF affected pump is running, THEN do the following:

☐ a) IF Number 1 Seal leakoff is low, AND is caused by high Number 2 Seal leakage, THEN GO TO Step 16.

• PDTT Level - INCREASING
• Standpipe Level - HI ALARM IN

☐ b) IF seal leakoff is less than 0.8 gpm, THEN GO TO Step 14.

☐ c) IF seal leakoff is between 0.8 gpm and 1.0 gpm, THEN GO TO Step 16.

☐ d) IF Total No. 1 seal leakoff is greater than 6.0 gpm, THEN assign Admin Control IAW Attachment 6 AND GO TO Step 37.

☐ e) IF seal leakoff is between 5.0 gpm and 6.0 gpm, THEN assign Admin Control IAW Attachment 6 AND GO TO Step 6.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
3.	CHECK SEAL LEAKOFF FLOW - GREATER THAN 4 GPM	☐ GO TO Step 26
4.	ASSIGN ADMIN CONTROL IAW ATTACHMENT 6	
5.	GO TO STEP 26	
6.	VERIFY SEAL INJECTION FLOW - GREATER THAN SEAL LEAKOFF	☐ Adjust seal injection to greater than seal leakoff.
7.	MONITOR RCP PARAMETERS IAW ATTACHMENT 2 - NORMAL	☐ IF any parameter reaches action level, THEN GO TO Step 37.
8.	CONTACT SYSTEM ENGINEERING	
9.	GO TO STEP 42	
10.	VERIFY SEAL WATER RETURN VALVE LINEUP - CORRECT ☐ • 1-CH-MOV-1381 - OPEN	☐ Establish proper lineup.
11.	VERIFY VCT PRESSURE - NORMAL	☐ IF VCT pressure is high, THEN reduce pressure.
12.	VERIFY SEAL WATER RETURN FILTER ΔP - NORMAL	☐ Initiate a Work Request to change filter cartridge.
13.	GO TO STEP 15	

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

* *

CAUTION:
- A local check of No. 1 Seal Leakoff may be performed to verify the accuracy of the leakoff flow indication.
- If a local check is not performed, Operations Management should be consulted on stopping the RCP within 8 hours if leakoff remains less than 0.8 gpm and no parameters are at action level IAW Attachment 2.
- An RCP should be secured for low seal leakoff (less than 0.8 gpm) using the following time limits:

  1) Stop the RCP immediately (within five minutes) after a manual Reactor trip if any Attachment 2 parameter is continuously increasing or at Action level.

  2) Stop the RCP within 8 hours if Attachment 2 parameters are stable.

* *

14.___ CONSULT WITH SS TO DETERMINE IF A LOCAL SEAL LEAKOFF CHECK SHOULD BE PERFORMED

☐ GO TO Step 36.

STEP	ACTION/ EXPECTED RESPONSE	RESPONSE NOT OBTAINED
15. ___	LOCALLY VERIFY NO. 1 SEAL FLOW INSTRUMENTATION OPERABLE:	
	☐ a) Perform local seal leakoff flow check IAW Attachment 3	
	☐ b) Verify leakoff flow from seal - NORMAL IAW Attachment 1	b) Do the following: ☐ 1) IF affected pump NOT running, THEN GO TO Attachment 4. 2) IF affected pump is running, THEN do the following: ☐ a. IF seal leakoff is less than 0.8 gpm, THEN GO TO Step 36. ☐ b. IF seal leakoff is between 0.8 gpm and 1.0 gpm, THEN GO TO Step 16.
	☐ c) Initiate a Work Request to repair flow instrumentation	
	☐ d) Verify pump status - PREPARATIONS FOR START IN PROGRESS	d) GO TO Step 42.
	☐ e) RETURN TO 1-OP-RC-001, STARTING AND RUNNING ANY REACTOR COOLANT PUMP	
*16. ___	CHECK NO. 2 SEAL - HIGH LEAKOFF	☐ GO TO Step 24.
	☐ • PDTT Level - INCREASING	
	☐ • Standpipe Level - ALARM IN	

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

NOTE: If low No. 1 Seal Leakoff flow is caused by No. 2 Seal leakage and affected pump has been running for less than 24 hours, pump operation should continue until No. 1 Seal Leakoff returns to normal or until 24 hours has elapsed since pump start.

17. ___ CHECK RCP RUN TIME - GREATER THAN 24 HOURS

Do the following:

- ☐ a) Refer to Attachment 1 for safe operating ranges for seal leakoff.
- ☐ b) Monitor pump parameters IAW Attachment 2.
- ☐ c) IF any parameter reaches action level, THEN GO TO Step 37.
- ☐ d) IF No. 1 Seal leakoff does NOT return to safe operating range within 24 hours, THEN shut down affected pump within 8 hours.
- ☐ e) IF leakoff returns to safe operating range within 24 hours, THEN RETURN TO procedure in effect.

NOTE: Number 2 Seal leakoff rate should be determined by the difference between PDTT inleakage rate before (from previously calculated 1-OPT-RC-10.0) and after the increase in Number 2 Seal leakoff.

18. ___ CALCULATE NO. 2 SEAL LEAKOFF RATE

NOTE: Total No. 1 Seal leakoff is the total of the indicated leakoff from No. 1 Seal and calculated No. 2 Seal leakoff.

19. ___ CALCULATE TOTAL NO. 1 SEAL LEAKOFF RATE

20. ___ CHECK TOTAL NO. 1 SEAL LEAKOFF - GREATER THAN 0.8 GPM

☐ GO TO Step 36.

STEP	ACTION/ EXPECTED RESPONSE	RESPONSE NOT OBTAINED

* *

CAUTION: If affected pump has been running for greater than 24 hours and No. 2 Seal Leakoff is high, pump operation may continue as long as the PDTT can handle the increased leakage AND RCP vibration does not increase. The seal should be replaced as soon as possible.

* *

21.___ VERIFY RCP VIBRATION ANNUNCIATORS - CLEAR — ☐ GO TO Step 37.

- ☐ • 1C-H5, RCP SHAFT DANGER
- ☐ • 1C-H4, RCP FRAME DANGER

22.___ INITIATE A WORK REQUEST TO REPLACE NO. 2 SEAL AS SOON AS POSSIBLE

23.___ GO TO STEP 42

*24.___ VERIFY SEAL LEAKOFF - GREATER THAN 6 GPM — ☐ GO TO Step 26.

25.___ GO TO STEP 37

* *

CAUTION: When operating without Thermal Barrier CC flow, a loss of Seal Injection flow may result in pump damage. Thermal Barrier CC should be restored as soon as possible. If RCP Thermal Barrier CC and Seal Injection flow have been lost, 1-AP-9.02, LOSS OF RCP COOLING, should be initiated.

* *

*26.___ CHECK SEAL INJECTION - LOST — ☐ GO TO Step 29.

STEP	ACTION/ EXPECTED RESPONSE	RESPONSE NOT OBTAINED

* *

CAUTION: RCP Seal Injection Needle valves should be throttled in a controlled manner to limit bearing cooldown to approximately 1°F/MIN to avoid thermal shock to pump parts.

* *

*27.___ VERIFY RCP PARAMETERS IAW ATTACHMENT 2 - ANY AT ACTION LEVEL

Bearing	PCS RCP A	PCS RCP B	PCS RCP C
Upper Thrust	T0414A	T0434A	T0454A
Lower Thrust	T0416A	T0436A	T0456A
Upper Radial	T0413A	T0433A	T0453A
Lower Radial	T0415A	T0435A	T0455A

Do the following:

☐ a) Continue to monitor RCP parameters IAW Attachment 2.

☐ b) IF RCP seal leakoff flow less than 2.5 gpm, THEN GO TO Step 37.

☐ c) Continue efforts to restore seal injection.

☐ d) IF any parameter reaches action level, THEN GO TO Step 37.

☐ e) WHEN seal injection is restored, THEN GO TO Step 41.

28.___ GO TO STEP 37

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

* *

CAUTION: This procedure assumes that CC is available to the RCP oil and air coolers. Loss of CC is covered by the individual pump alarms for LOW CC FLOW and HI CC TEMP.

* *

*29.___ CHECK RCP MOTOR BEARINGS - ANY ONE GREATER THAN OR EQUAL TO 195°F

IF bearing temperature(s) are greater than 175°F, THEN do the following:

☐ a) Continue to monitor bearing temperatures.

☐ b) Monitor RCP parameters IAW Attachment 2.

☐ c) Investigate cause for high bearing temperature:

- CC leak to cooler
- Failed bearing
- Loss of CC to cooler(s)
- Low injection flow

- Low seal leakoff
- High seal leakoff
- High injection water temperature

☐ d) Monitor pump vibration.

☐ e) IF vibration increases, THEN notify SS and System Engineering.

☐ f) IF any bearing temperature reaches 195°F, THEN GO TO Step 36.

☐ g) GO TO Step 31.

☐ IF bearing temperatures are less than 175°F, THEN GO TO Step 31.

30.___ GO TO STEP 32

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

NOTE: Control Operations can monitor the RCP Speed Sensing Panel for additional information on RCP motor performance.

*31. ___ CHECK RCP STATOR TEMPERATURES - ANY GREATER THAN 300°F

- PCS points

☐ • T4014A, RCP A

☐ • T4015A, RCP B

☐ • T4016A, RCP C

IF stator temperature(s) are greater than 275°F, THEN do the following:

☐ a) Continue to monitor stator temperatures.

☐ b) Monitor RCP parameters IAW Attachment 2.

☐ c) Investigate cause for high stator temperature:

- CC leak to cooler
- Loss of CC flow or high CC temperature
- CTMT Ventilation problems

☐ d) Monitor pump vibration.

☐ e) IF vibration increases, THEN notify SS and System Engineering.

☐ f) IF any stator temperature reaches 300°F, THEN GO TO Step 36.

☐ g) GO TO Step 41.

☐ IF stator temperatures are less than 275°F, THEN GO TO Step 41.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

* *

CAUTION: If an RTD is failed, pump operation may continue if no parameters in Attachment 2 reach the action level.

* *

32.___ CHECK TEMPERATURE INSTRUMENTATION - FAILED

☐ GO TO Step 36.

33.___ INITIATE A WORK REQUEST TO REPAIR RTD

34.___ MONITOR RCP PARAMETERS IAW ATTACHMENT 2 - NORMAL

☐ IF any parameter reaches action level, THEN GO TO Step 37.

35.___ GO TO STEP 41

NOTE:
- The need to shutdown the affected pump should be discussed with Operations Management.
- The Reactor shall not remain critical with less than three RCPs running.
- If an RCP needs to be tripped with the Reactor critical, a Reactor trip must be performed before securing the RCP.

36.___ CONSULT WITH SS AND OMOC TO DETERMINE THE NEED TO SHUTDOWN THE AFFECTED PUMP

☐ GO TO Step 42.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

* *

CAUTION:
- An RCP should be secured for low seal leakoff (less than 0.8 gpm) within 8 hours if Attachment 2 parameters are stable.
- An RCP should be secured for high seal leakoff using the following time limits:

  1) If RCP Seal leakoff has increased to greater than 8 gpm AND leakoff is confirmed by corresponding changes in seal return temperature or pump bearing temperature, then the Reactor must be tripped, and the RCP secured immediately (within five minutes).

  2) Stop the RCP within 8 hours if Total No. 1 seal leakoff flow is greater than 6 gpm and Attachment 2 parameters are stable.
- An RCP with high or low seal leakoff should be secured immediately (within 5 minutes) after a manual Reactor trip if any Attachment 2 parameter is continuously increasing or at Action level.

* *

37.___ CHECK UNIT STATUS - ON LINE

☐ GO TO Step 39.

38.___ REMOVE UNIT FROM SERVICE IAW SS DIRECTION:

☐ • GOP-2 Series Operating Procedures

OR

☐ • 1-E-0, REACTOR TRIP OR SAFETY INJECTION

OR

☐ • 0-AP-23.00, RAPID LOAD REDUCTION

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

* *

CAUTION: If an immediate (within 5 minutes) RCP trip was performed due to high or low seal leakoff, the RCP SEAL LKOFF ISOL VV should be closed within five minutes after pump trip.

* *

39.___ TRIP AFFECTED RCP IAW SS DIRECTION

40.___ CLOSE THE AFFECTED RCP SEAL LEAKOFF ISOLATION VALVE AS NECESSARY:

- ☐ • PP A/HCV-1303A, RCP A
- ☐ • PP B/HCV-1303B, RCP B
- ☐ • PP C/HCV-1303C, RCP C

41.___ CHECK THERMAL BARRIER CC FLOW ON AFFECTED RCP - IN SERVICE

Do the following:

a) Verify open or open the following valves:

- ☐ • TV-CC-120A, B, or C
- ☐ • 1-CC-TV-140A
- ☐ • 1-CC-TV-140B

(STEP 41 CONTINUED ON NEXT PAGE)

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

41. CHECK THERMAL BARRIER CC FLOW ON AFFECTED RCP - IN SERVICE (Continued)

b) Check for Thermal Barrier tube leakage:

- ☐ • CC Surge Tank Level - INCREASING AT 1% PER MINUTE INDICATES APPROXIMATELY 35 GPM LEAKAGE
- ☐ • Thermal Barrier CC temperature - INCREASING
- ☐ • Thermal Barrier CC flow - HIGHER THAN NORMAL
- ☐ • PRZR level - DECREASING
- ☐ • PRZR pressure - DECREASING

c) IF a Thermal Barrier tube leak exists, THEN do the following:

1) Close the following valves:

- ☐ • TV-CC-120A, B, or C
- ☐ • 1-CC-TV-140A
- ☐ • 1-CC-TV-140B

2) Locally isolate CC from thermal barrier manual isolation for the affected pump: (ladder required)

- ☐ • RCP A, 1-CC-28
- ☐ • RCP B, 1-CC-57
- ☐ • RCP C, 1-CC-87

☐ 3) Reopen 1-CC-TV-140A and 1-CC-TV-140B.

(STEP 41 CONTINUED ON NEXT PAGE)

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

41. CHECK THERMAL BARRIER CC FLOW ON AFFECTED RCP - IN SERVICE (Continued)

d) IF a Thermal Barrier tube leak does NOT exist, THEN fail open TV-CC-120A, B, or C by opening the appropriate breaker:

- ☐ • TV-CC-120A, 1MR1, Breaker 22
- ☐ • TV-CC-120B, 1MR1, Breaker 23
- ☐ • TV-CC-120C, 1MR1, Breaker 24

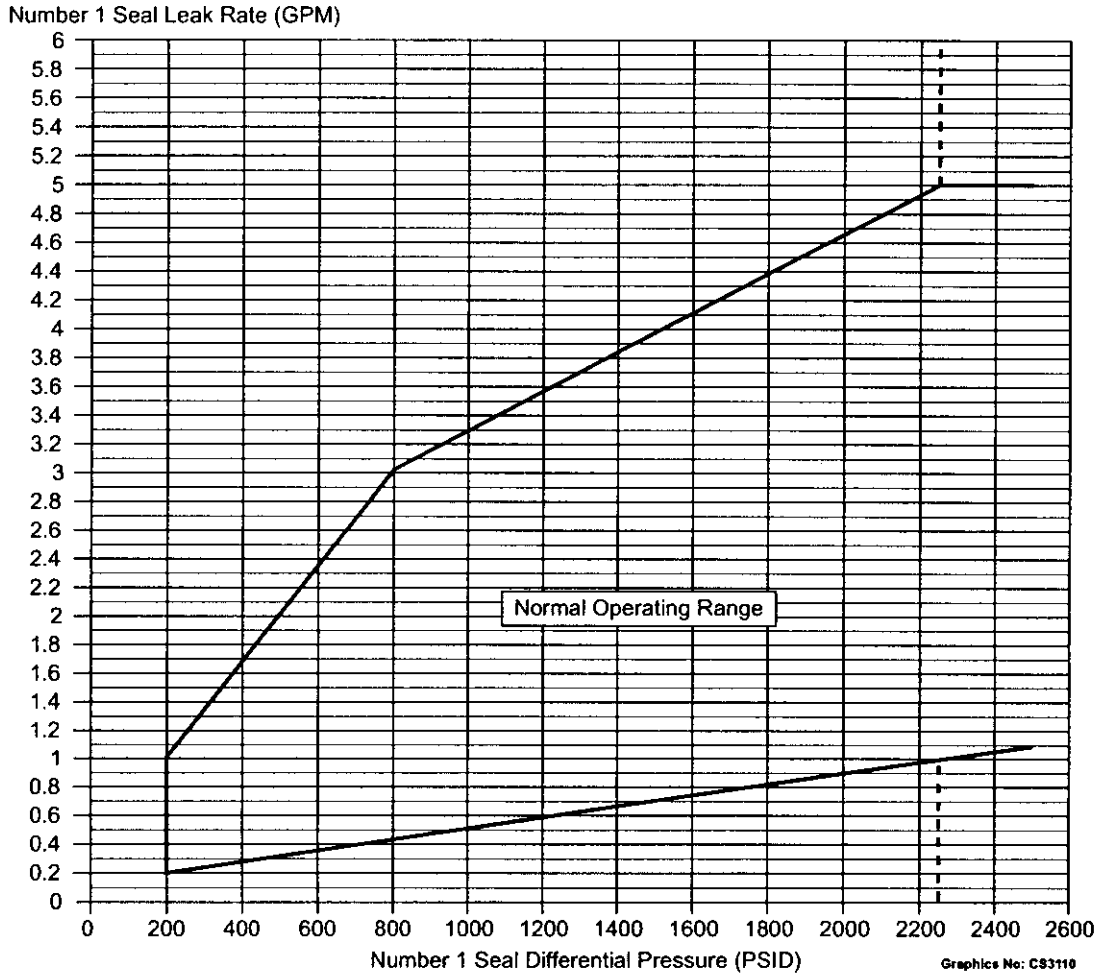
42. ___ PROVIDE NOTIFICATIONS AS NECESSARY:

- ☐ • OMOC
- ☐ • STA
- ☐ • Shift Supervision

- END -

NUMBER 1-AP-9.00	ATTACHMENT TITLE NO. 1 SEAL PERFORMANCE PARAMETERS	ATTACHMENT 1
REVISION 21		PAGE 1 of 2

NOTE: See Notes on page 2 of this Attachment for instrumentation to be used.



NOTE: Number 1 Seal differential pressure should be determined using one of the following, based on RCS pressure:

- Less than 400 psig - 1-CH-PI-1156A/1155A/1154A, RCP A/B/C No. 1 Seal D/P
- Greater than or equal to 400 psig - 1-RC-PI-1402 or 1402-1, RCS Wide Range Pressure (digital value from either ICCM) minus 1-CH-PI-1117, VCT Pressure

NUMBER 1-AP-9.00	ATTACHMENT TITLE RCP PARAMETERS	ATTACHMENT 2
REVISION 21		PAGE 1 of 1

NOTE: If the Lower Bearing Seal Water temperature RTD is not operable, indirect monitoring of bearing temperature can be achieved by increased surveillance of Seal Water outlet temperature.

PARAMETERS	INSTRUMENT	ACTION LEVEL
RCP A, B, C Stator Winding Temperature	PCS Points: T4014A, RCP A T4015A, RCP B T4016A, RCP C	Greater than 300°F
RCP A, B, C Motor Upper Thrust Brg Temperature	PCS Points: T0414A, RCP A T0434A, RCP B T0454A, RCP C	Greater than 195°F
RCP A, B, C Mtr Upper Radial Brg Temperature	T0413A, RCP A T0433A, RCP B T0453A, RCP C	Greater than 195°F
RCP A, B, C Motor Lower Radial Brg Temperature	T0415A, RCP A T0435A, RCP B T0455A, RCP C	Greater than 195°F
RCP A, B, C Motor Lower Thrust Brg Temperature	T0416A, RCP A T0436A, RCP B T0456A, RCP C	Greater than 195°F
RCP A, B, C Lower Bearing Seal Water Temperature	PCS Points: T0417A, RCP A T0437A, RCP B T0457A, RCP C	Greater than 225°F
RCP A, B, C Seal Water Outlet Temperature	PCS Points: T0181A, RCP A T0182A, RCP B T0183A, RCP C	Greater than 235°F
Seal Water Inlet Temp	1-CH-TI-1116	Greater than 150°F
RCP Vibration: RCP Shaft Danger RCP Frame Danger	 Annunciator 1C-H5 Annunciator 1C-H4	 LIT LIT

NUMBER 1-AP-9.00	ATTACHMENT TITLE REACTOR COOLANT PUMP NUMBER 1 SEAL LEAKOFF LOCAL FLOW CHECK	ATTACHMENT 3
REVISION 21		PAGE 1 of 3

1. ___ Notify I & C that a local RCP Seal Leakoff flow check is required, using the Rosemount Model 3051C Indicating dP transmitter and necessary power supply.

NOTE: The remainder of this attachment is to be performed by I & C Technicians.

2. ___ Have Operations provide the projected flow rate for current plant conditions and record the projected flow rate below.

_____ gpm

3. ___ Using the conversion table provided with this attachment, calculate the equivalent inches H2O dP for the gpm recorded in Step 2. Record below.

_____ inches H2O

4. ___ IF Step 3 is greater than 250 inches, THEN get appropriate range pressure gauge(s) to measure the dP AND GO TO Step 7.

NOTE:
- The Rosemount Smart Transmitter calibrator may be used to facilitate transmitter ranges.
- Maximum range of the transmitter is 250 inches H2O dP.

5. ___ Span the transmitter to approximately twice the value recorded in Step 3.

6. ___ Energize transmitter.

7. ___ Connect test equipment to the required HP and LP test connections listed below.

___ • RCP A, 1-CH-746 (HP) and 1-CH-747 (LP)

___ • RCP B, 1-CH-749 (HP) and 1-CH-750 (LP)

___ • RCP C, 1-CH-752 (HP) and 1-CH-753 (LP)

8. ___ Open the HP and LP test connection valves.

9. ___ Record dP and equivalent gallons per minute (use attached table).

_____ inches H2O_____ gpm

10. ___ Close the HP and LP test connection valves.

11. ___ Have Operations RETURN TO procedure Step 15b.

Flow (gpm)	dp (in. WC)
0.172	0.2655
0.239	0.5311
0.291	0.7966
0.334	1.0621
0.372	1.3277
0.406	1.5932
0.438	1.8587
0.467	2.1242
0.495	2.3898
0.521	2.6553
0.546	2.9208
0.570	3.1864
0.592	3.4519
0.614	3.7174
0.635	3.9830
0.656	4.2485
0.675	4.5140
0.695	4.7795
0.713	5.0451
0.732	5.3106
0.749	5.5761
0.767	5.8417
0.783	6.1072
0.800	6.3727
0.816	6.6382
0.832	6.9083

Flow (gpm)	dp (in. WC)
0.846	7.1693
0.863	7.4348
0.878	7.7004
0.893	7.9659
0.907	8.2314
0.921	8.4970
0.936	8.7625
0.949	9.0280
0.963	9.2936
0.976	9.5591
0.990	9.8246
1.003	10.0901
1.016	10.3557
1.028	10.6212
1.041	10.8867
1.053	11.1523
1.066	11.4178
1.078	11.6833
1.090	11.9489
1.102	12.2144
1.114	12.4799
1.125	12.7454
1.137	13.0110
1.148	13.2765
1.616	26.5531
1.976	39.8296

Flow (gpm)	dp (in. WC)
2.278	53.1061
2.545	66.3827
2.786	79.6592
3.008	92.9358
3.214	106.2123
3.408	119.4888
3.591	132.7654
3.765	146.0419
3.931	159.3184
4.091	172.5950
4.245	185.8715
4.393	199.1481
4.536	212.4246
4.675	225.7011
4.810	238.9777
4.941	252.2542
5.069	265.5307
5.193	278.8073
5.315	292.0838
5.434	305.3603
5.550	318.6369
5.664	331.9134
5.776	345.1900
5.885	358.4665
5.993	371.7430
6.099	385.0196

Flow (gpm)	dp (in. WC)
6.203	398.2961
6.305	411.5726
6.405	424.8492
6.504	438.1257
6.601	451.4023
6.697	464.6788
6.792	477.9553
6.885	491.2319
6.978	504.5084
7.068	517.7849
7.158	531.0615
7.247	544.3380
7.334	557.6145
7.421	570.8911
7.506	584.1676
7.591	597.4442
7.674	610.7207
7.757	623.9972
7.839	637.2738
7.920	650.5503
8.000	663.8268

NUMBER 1-AP-9.00	ATTACHMENT TITLE CLEARING CRUD BLOCKAGE FROM NO. 1 SEAL INLET	ATTACHMENT 4
REVISION 21		PAGE 1 of 3

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

* *

CAUTION: When clearing crud blockage, no other RCP should be running.

* *

1. ___	VERIFY BRG OIL LFT PP - ON	☐ Turn pump ON.
2. ___	VERIFY NO OTHER RCPs RUNNING	☐ Consult with SS to determine course of action.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

* *

CAUTION: The torque applied to the pump shaft should not exceed 750 ft-lbs.

* *

NOTE: If seal flow drops back to zero, Step 3 should be repeated.

3. ___ HAND ROTATE THE PUMP SHAFT COUNTERCLOCKWISE 20 TIMES

IF pump shaft will NOT break free at less than 750 ft-lbs, THEN do the following:

☐ a) Slowly lower RCS pressure AND hand rotate the shaft.

☐ b) IF RCS system pressure falls below 100 psig, THEN verify seal bypass and leakoff isolation valves are closed.

☐ c) IF shaft will NOT break away and turn at any pressure down to zero, THEN investigate oil lift system.

☐ d) WHEN shaft breaks free, THEN continue rotating shaft while raising system pressure back to minimum required for pump operation.

☐ e) WHEN system pressure is above 100 psig, THEN open seal leakoff isolation valve.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

* *

CAUTION: If seal flow cannot be established, crud blockage is not the problem. No. 1 seal may have failed and should be investigated before any further attempts are made to start the affected RCP.

* *

4.___ VERIFY SEAL LEAKOFF - GREATER THAN 0.2 GPM

☐ Initiate a Work Request to investigate No.1 Seal.

5.___ RETURN TO 1-OP-RC-001, STARTING AND RUNNING ANY REACTOR COOLANT PUMP

NUMBER 1-AP-9.00	ATTACHMENT TITLE PCS RCP MONITORING POINTS	ATTACHMENT 5
REVISION 21		PAGE 1 of 1

RCP A

T4014A - Stator Winding Temp

T0631A - Stator Cooling Water Outlet Temp

T0417A - Lower Bearing Seal Water Temp

T0181A - Seal Water Outlet Temp

T0413A - Motor Upper Radial Bearing Temp

T0414A - Motor Upper Thrust Bearing Temp

T0415A - Motor Lower Radial Bearing Temp

T0416A - Motor Lower Thrust Bearing Temp

T0635A - Thermal Barrier Cooling Water Outlet Temp

RCP B

T4015A - Stator Winding Temp

T0651A - Stator Cooling Water Outlet Temp

T0437A - Lower Bearing Seal Water Temp

T0182A - Seal Water Outlet Temp

T0433A - Motor Upper Radial Bearing Temp

T0434A - Motor Upper Thrust Bearing Temp

T0435A - Motor Lower Radial Bearing Temp

T0436A - Motor Lower Thrust Bearing Temp

T0655A - Thermal Barrier Cooling Water Outlet Temp

RCP C

T4016A - Stator Winding Temp

T0671A - Stator Cooling Water Outlet Temp

T0457A - Lower Bearing Seal Water Temp

T0183A - Seal Water Outlet Temp

T0453A - Motor Upper Radial Bearing Temp

T0454A - Motor Upper Thrust Bearing Temp

T0455A - Motor Lower Radial Bearing Temp

T0456A - Motor Lower Thrust Bearing Temp

T0675A - Thermal Barrier Cooling Water Outlet Temp

NUMBER 1-AP-9.00	ATTACHMENT TITLE ADMINISTRATIVE CONTROL OF LOCAL TRIPPING OF RCP BREAKERS	ATTACHMENT 6
REVISION 21		PAGE 1 of 1

1. ___ Perform a pre-job briefing covering the following requirements for establishing Administrative Control of Reactor Coolant Pump Breaker local tripping.

   ___ a) The person assigned Administrative Control of Reactor Coolant Pump Breaker local tripping understands that no other concurrent job responsibilities have been or shall be accepted during performance of this procedure.

   ___ b) The person assigned Administrative Control of Reactor Coolant Pump Breaker local tripping understands the requirement to remain available at all times when RCP seal leakoff is greater than 4 gpm.

   ___ c) The person assigned Administrative Control of Reactor Coolant Pump Breaker local tripping understands that continuous communication capability shall be maintained with the Main Control Room at all times by use of either a Portable Radio, (primary method) or Gai-Tronics (secondary method).

   ___ d) The person assigned Administrative Control of Reactor Coolant Pump Breaker local tripping understands that whenever a fire in the Main Control Room or the Emergency Switchgear Room occurs, he/she is to report to the Normal Switchgear Room immediately.

   ___ e) The person assigned Administrative Control of Reactor Coolant Pump Breaker local tripping, understands that Reactor Coolant Pump Breaker local tripping shall be accomplished IAW 0-FCA-15.00, Local Circuit Breaker Operation, upon Notification from the Main Control Room.

   ___ f) The Main Control Room shall notify the operator who has assumed Administrative Control to perform Reactor Coolant Pump Breaker local tripping when Reactor Coolant Pump breakers cannot be opened from the Main Control Room to ensure that the time limit is not exceeded.

2. ___ Record the name of the person assigned Administrative Control of Reactor Coolant Pump Breaker local tripping in the Unit 1 Narrative Log.

NUMBER 1-AP-9.00	ATTACHMENT TITLE PROBABLE CAUSES AND REFERENCES	ATTACHMENT 7
REVISION 21		PAGE 1 of 1

I. PROBABLE CAUSES:

1. Thermal Barrier trouble
2. Loss of Seal Injection
3. High No.1 Seal Leakoff
4. Low No.1 Seal Leakoff
5. High RCP Bearing temperature(s)
6. High RCP Stator temperature(s)

II. REFERENCES:

1. UFSAR 9.0
2. 11448-FM-72, 88
3. 0-DRP-004, Precautions, Limitations and Setpoints
4. Westinghouse Technical Bulletin NSD-TB-93-01-R1, 10-10-95
5. Westinghouse Technical Addendum, dated September 30, 1976
6. Westinghouse Reactor Coolant Pump Technical Manual
7. Engineering Transmittal S-94-0132
8. DCP 93-054-3, Reassessed CRDR (Relocation), Step 18 and Attachment 2
9. WSNAL 99-001, Step 27b RNO
10. DCP 01-008, Instrument and Controls Upgrade Project, Unit 1
11. PI S-2005-0876, Use of Alternate Indications to confirm High Seal Leakoff

CONDITION/APPLICABILITY	INDICATION	CLASSIFICATION
1. Core damage with possible loss of coolable geometry ABOVE CSD CONDITION	a) Fuel clad failure as indicated by any of the following: • RCS Specific activity GREATER THAN 60 µCi/gm dose equivalent I-131 OR High Range Letdown Radiation Monitor: 1-CH-RM-118, 2-CH-RM-218: GREATER THAN 1.4×10^6 cpm AND b) Loss of cooling as indicated by any of the following: • 5 confirmed core exit thermocouples - GREATER THAN 1200° F OR Core delta T - ZERO OR Core delta T - RAPIDLY DIVERGING	SITE AREA EMERGENCY

	CONDITION/APPLICABILITY	INDICATION	CLASSIFICATION
2.	Severe Fuel Clad Damage ABOVE CSD CONDITION	• RCS specific activity GREATER THAN 300 µCi/gm dose equivalent I-131 OR High Range Letdown Radiation Monitor: Either of the following indications occur within 30 minutes and remain for at least 15 minutes: 1-CH-RM-118, 2-CH-RM-218: GREATER THAN 5.8×10^4 cpm (indicating 1% fuel failure)	ALERT
3.	Fuel clad damage indication ABOVE CSD CONDITION	• Intentional reduction in power, load, or temperature IAW T.S. 3.1.D reactor coolant activity limit Action Statement - HAS COMMENCED OR High Range Letdown Radiation Monitor: Either of the following indications occur within 30 minutes and remain for at least 15 minutes: 1-CH-RM-118, 2-CH-RM-218: GREATER THAN 5.8×10^3 cpm (indicating 0.1% fuel failure)	NOTIFICATION OF UNUSUAL EVENT

	CONDITION/APPLICABILITY	INDICATION	CLASSIFICATION
4.	Probable large radioactivity release initiated by LOCA with ECCS failure leading to core degradation ABOVE CSD CONDITION	• Loss of reactor or secondary coolant - IN PROGRESS AND • RCS specific activity - GREATER THAN 300 µCi/gm dose equivalent I-131 OR CHRRMS (Inside) Containment High Range Radiation Monitor: RM-RMS-127 or -227, RM-RMS-128 or -228: GREATER THAN 2 x 10^3 R/hr AND • High or Low Head ECCS flow - NOT being delivered to the core (if expected by plant conditions)	GENERAL EMERGENCY
5.	Probable large radioactivity release initiated by loss of heat sink leading to core degradation ABOVE CSD CONDITION	• Loss of Main Feedwater System and Condensate System AND • Loss of Auxiliary Feedwater System AND • RHR System - NOT OPERABLE	GENERAL EMERGENCY

	CONDITION/APPLICABILITY	INDICATION	CLASSIFICATION
6.	Probable large radioactivity release initiated by failure of protection system to bring reactor subcritical and causing core degradation ABOVE CSD CONDITION	• Reactor nuclear power after trip remains - GREATER THAN 5% AND • RCS pressure GREATER THAN 2485 psig and NOT decreasing OR Containment pressure and temperature - RAPIDLY INCREASING	GENERAL EMERGENCY
7.	Probable large radioactivity release initiated by loss of AC and all feedwater ABOVE CSD CONDITION	• Loss of all onsite and offsite AC power AND • Turbine Driven Auxiliary Feedwater Pump - NOT OPERABLE AND • Restoration of either of the above NOT LIKELY within 2 hours	GENERAL EMERGENCY

	CONDITION/APPLICABILITY	INDICATION	CLASSIFICATION
8.	Probable large radioactivity release initiated by LOCA with loss of ECCS and containment cooling ABOVE CSD CONDITION	• Loss of reactor or secondary coolant - IN PROGRESS AND • High or Low Head ECCS flow NOT being delivered to the core (if expected by plant conditions) AND • Containment RS sump temperature - GREATER THAN 190° F and NOT decreasing OR All Containment Spray and Recirculation Spray Systems - NOT OPERABLE	GENERAL EMERGENCY
9.	Major fuel damage accident with radioactive release to containment or fuel buildings ALL CONDITIONS	• Water level in reactor vessel during refueling - BELOW TOP OF CORE OR Water level in Spent Fuel Pit verified - BELOW TOP OF SPENT FUEL AND • Verified damage to irradiated fuel resulting in readings on Ventilation Vent Kaman Monitor: RM-VG-131 GREATER THAN 4.2×10^7 µCi/sec	SITE AREA EMERGENCY

	CONDITION/APPLICABILITY	INDICATION	CLASSIFICATION
10.	Fuel damage accident with release of radioactivity to containment or fuel buildings ALL CONDITIONS	• Verified accident involving damage to irradiated fuel AND • HP confirms fission product release from fuel OR Readings on Ventilation Vent Kaman Monitor: RM-VG-131 GREATER THAN 2.8×10^5 µCi/sec	ALERT
11.	Loss of cask/fuel containment barriers or accidental criticality ALL CONDITIONS	• Verified loss of all cask/fuel containment barriers AND • HP confirms fission product release	ALERT
12.	Spent Fuel Storage Facility accident ALL CONDITIONS	• Verified Spent Fuel Storage Cask seal leakage OR Spent Fuel Storage Cask dropped or mishandled	NOTIFICATION OF UNUSUAL EVENT

	CONDITION/APPLICABILITY	INDICATION	CLASSIFICATION
1.	Release imminent or in progress and site boundary doses projected to exceed 1.0 Rem TEDE or 5.0 Rem Thyroid CDE ALL CONDITIONS	HP assessment indicates actual or projected doses at or beyond Site Boundary - GREATER THAN 1.0 Rem TEDE or 5.0 Rem Thyroid CDE	GENERAL EMERGENCY
2.	Release imminent or in progress and site boundary doses projected to exceed 100 mrem TEDE or 500 mrem Thyroid CDE ALL CONDITIONS	HP assessment indicates actual or projected doses at or beyond Site Boundary - GREATER THAN 100 mrem TEDE or 500 mrem Thyroid CDE	SITE AREA EMERGENCY

CONDITION/APPLICABILITY	INDICATION	CLASSIFICATION
3. High radiation or airborne contamination levels indicate a severe degradation in control of radioactive material ALL CONDITIONS	a) Valid unexpected readings on any of the following monitors have increased by a factor of 1000: • Control Room Area — RM-RMS-157 • Auxiliary Building Control Area — RM-RMS-154 • Auxiliary Building Drumming Area — RM-RMS-155 • Decontamination Building Area — RM-RMS-151 • Fuel Pit Bridge Area — RM-RMS-153 • New Fuel Storage Area — RM-RMS-152 • Laboratory Area — RM-RMS-158 • Sample Room Area — RM-RMS-156 OR b) Surry Radwaste Facility reports valid unexpected readings on any of the following monitors have increased by a factor of 1000: • Control Room — RRM-121 • Chemistry Laboratory — RRM-122 • Local Control Panel — RRM-129 • Bitumen Control Room — RRM-130	ALERT

CONDITION/APPLICABILITY	INDICATION	CLASSIFICATION
4. Effluent release GREATER THAN 10 times ODCM allowable limit ALL CONDITIONS	a) Any of the following monitors indicate valid readings above specified value for GREATER THAN 15 minutes: • Vent Vent Kaman RM-VG-131 GREATER THAN 2.84×10^5 µCi/sec • Process Vent Kaman RM-GW-130 GREATER THAN 4.59×10^7 µCi/sec • Discharge Tunnel RM-SW-120 or -220 GREATER THAN 3.3×10^5 cpm OR b) HP assessment (sample results or dose projections) indicates GREATER THAN 10 times ODCM allowable limit OR c) Surry Radwaste Facility Monitor GREATER THAN 10 times ODCM allowable limit as determined by HP: • RRM-101: Ventilation Stack Noble Gas monitor OR RRM-131: Liquid Effluent Monitor	ALERT

CONDITION/APPLICABILITY	INDICATION	CLASSIFICATION
5. Effluent release GREATER THAN ODCM allowable limit ALL CONDITIONS	a) Any of the following monitors indicate valid readings above specified value for GREATER THAN one hour: • Vent Vent Kaman RM-VG-131 GREATER THAN 2.84×10^4 µCi/sec • Process Vent Kaman RM-GW-130 GREATER THAN 4.59×10^6 µCi/sec • Discharge Tunnel RM-SW-120 or -220 GREATER THAN 3.3×10^4 cpm OR b) HP assessment (sample results or dose projections) indicate GREATER THAN 100% ODCM allowable limit OR c) Surry Radwaste Facility Monitor GREATER THAN 100% ODCM allowable limit as determined by HP: • RRM-101: Ventilation Stack Noble Gas monitor OR RRM-131: Liquid Effluent Monitor	NOTIFICATION OF UNUSUAL EVENT

VIRGINIA POWER
SURRY POWER STATION

FUNCTION RESTORATION PROCEDURE

NUMBER	PROCEDURE TITLE	REVISION
1-FR-P.1	RESPONSE TO IMMINENT PRESSURIZED THERMAL SHOCK CONDITION (With 2 Attachments)	12
		PAGE 1 of 20

PURPOSE

To provide guidance to avoid, or limit, thermal shock or pressurized thermal shock to the reactor pressure vessel, or overpressure conditions at low temperature.

ENTRY CONDITIONS

Transition from F-4, INTEGRITY, when a RED or ORANGE path existed.

APPROVAL RECOMMENDED	**APPROVED**	DATE
REVIEWED	CHAIRMAN STATION NUCLEAR SAFETY AND OPERATING COMMITTEE	

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
1.	__CHECK RCS PRESSURE - GREATER THAN 185 PSIG [250 PSIG]	IF LHSI pump flow greater than 1000 gpm, THEN RETURN TO procedure and step in effect.

* *

CAUTION:
- If the TD AFW pump is the only available source of feed flow, steam supply to the TD AFW pump must be maintained from at least one SG.
- Alternate water sources for AFW pumps will be necessary if ECST level decreases to less than 20%.

* *

NOTE: A faulted SG is any SG that is depressurizing in an uncontrolled manner or is completely depressurized.

2.	__CHECK RCS COLD LEG TEMPERATURES - STABLE OR INCREASING	Try to stop RCS cooldown: a) Close or verify closed SG PORVs. b) Stop dumping steam. c) IF RHR system in service, THEN stop any cooldown from RHR system. d) Control feed flow to non-faulted SG(s) to stop RCS cooldown. Maintain total feed flow greater than 350 gpm [450 gpm] until narrow range level greater than 12% [18%] in at least one non-faulted SG.

(STEP 2 CONTINUED ON NEXT PAGE)

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
2.	CHECK RCS COLD LEG TEMPERATURES - STABLE OR INCREASING (CONTINUED)	e) Minimize cooldown from faulted SG(s): 1) Close or verify closed the MSTV for each faulted SG. 2) Locally close steam supply valves from faulted SG(s) to TD AFW pump. • SG A, 1-MS-87 • SG B, 1-MS-120 • SG C, 1-MS-158 3) IF all SG(s) faulted, THEN control feed flow at 60 gpm [100 gpm] to each SG. 4) IF any SG NOT faulted, THEN isolate all feedwater to faulted SG(s) unless necessary for RCS temperature control. IF a faulted SG is necessary for RCS temperature control, THEN control feed flow at 60 gpm [100 gpm] to that SG.
3.	__CHECK PRZR PORV BLOCK VALVES:	
	a) Power to PRZR PORV block valves - AVAILABLE	a) Locally close the following breakers: • 1H1-2S 6A for 1-RC-MOV-1535 • 1J1-2W 8A for 1-RC-MOV-1536
	b) PRZR PORV block valves - AT LEAST ONE OPEN	b) Open one block valve unless closed to isolate an open or faulty PORV.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

* *

CAUTION: If any PRZR PORV opens because of high PRZR pressure, the PORV must be verified closed or isolated after pressure decreases to less than 2335 psig.

* *

4. __CHECK IF PRZR PORVs SHOULD BE CLOSED:

a) Check the following:

- PRZR pressure - LESS THAN 2335 PSIG IF OPMS DISABLED
- RCS pressure - LESS THAN 365 PSIG IF OPMS ENABLED
  - PI-1-1403 (NQ)

a) Open or verify opened at least one PRZR PORV. GO TO Step 5. WHEN pressure less than setpoint, THEN do Step 4b.

b) Check PRZR PORVs - CLOSED

b) Manually close PORV. IF any valve can NOT be closed, THEN manually close associated block valve.

5. __CHECK IF SI IN SERVICE:

- HHSI to cold legs - FLOW INDICATED

GO TO Step 14.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

6. __CHECK IF SI CAN BE TERMINATED:

   - RCS subcooling based on CETCs - GREATER THAN 80°F [135°F]
   - RVLIS indication - GREATER THAN REQUIRED

RCPs RUNNING	RVLIS INDICATION	
	Full Range	Dynamic Range
0	GREATER THAN 63%	——
1	——	GREATER THAN 36%
2	——	GREATER THAN 51%
3	——	GREATER THAN 82%

Do the following:

IF RCS subcooling based on CETCs greater than 30°F [85°F] AND NO RCP running, THEN try to start an RCP IAW 1-OP-RC-001, STARTING AND RUNNING ANY RCP AND GO TO Step 27.

IF RCS subcooling based on CETCs less than 30°F [85°F] OR RVLIS indication less than required, THEN GO TO Step 27.

7. __RESET BOTH TRAINS OF SI

8. __RESET CLS:

   a) Check CTMT pressure - LESS THAN 14 PSIA

   b) Reset both trains of CLS if necessary

a) GO TO Step 9. WHEN CTMT pressure less than 14 psia, THEN do Step 8b.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
9.	__CHECK CC SYSTEM STATUS:	
	a) Check SW to RS HXs - ISOLATED	a) IF intake canal level NOT being maintained by CW pumps, THEN do the following: 1) Verify initiated or initiate 0-AP-12.01, LOSS OF INTAKE CANAL LEVEL. 2) GO TO Step 10.
	b) Check SW to CC HXs - IN SERVICE	b) Restore SW to CC HXs IAW 0-AP-12.01, LOSS OF INTAKE CANAL LEVEL.
	c) Check CC pumps - AT LEAST ONE RUNNING	c) Do the following: 1) IF RCP seal water return temperature greater than 235°F, THEN close 1-CC-TV-140A and B. • RCP A, T0181A • RCP B, T0182A • RCP C, T0183A 2) Locally throttle CC pump discharge valve to approximately 25% open: • 1-CC-558 for 1-CC-P-1A • 1-CC-564 for 1-CC-P-1B 3) Locally close stub bus tie breaker. 4) Start one CC pump. 5) Locally open discharge valve. IF a CC pump can NOT be started, THEN attempt to crosstie CC systems.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
10.	__VERIFY INSTRUMENT AIR AVAILABLE:	
	a) Check annunciator B-E-6 - NOT LIT	a) Initiate Attachment 1.
	b) Check at least one CTMT IA compressor - RUNNING	b) IF CC pump running, THEN start one CTMT IA compressor. IF NOT, THEN locally crosstie to turbine building IA (key required): • Use 1-OP-IA-005, Administrative Control of Unit 1 IA to Unit 1 CTMT Valves 1-IA-446 and 1-IA-447 OR • Use 1-OP-IA-006, Administrative Control of Unit 2 IA to Unit 1 CTMT Valves 2-IA-446 and 2-IA-447
	c) Verify 1-IA-TV-100 - OPEN	c) Open valve 1-IA-TV-100.
11.	__STOP SI PUMPS AND PUT IN AUTO: • All but one CHG pump • LHSI pumps	

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

12. __ISOLATE HHSI TO COLD LEGS:

a) Verify the following:

1) CHG pump suctions from RWST - OPEN

- 1-CH-MOV-1115B
- 1-CH-MOV-1115D

2) Check CHG pump miniflow recirc valves - OPEN

- 1-CH-MOV-1275A
- 1-CH-MOV-1275B
- 1-CH-MOV-1275C
- 1-CH-MOV-1373

a) IF RMT in progress OR CHG pump recirc can NOT be established, THEN do the following:

1) Close CHG flow control valve:

- 1-CH-FCV-1122

2) Verify open or open CHG line isolation:

- 1-CH-HCV-1310A

3) Open CHG line isolation MOVs:

- 1-CH-MOV-1289A
- 1-CH-MOV-1289B

4) Open CHG flow control valve to establish at least 60 gpm CHG flow.

5) Close HHSI to Cold Leg:

- 1-SI-MOV-1867C
- 1-SI-MOV-1867D
- 1-SI-MOV-1842

6) Establish and maintain at least 60 gpm charging flow using charging flow control valve.

7) GO TO Step 14.

b) Close HHSI to Cold Leg:

- 1-SI-MOV-1867C
- 1-SI-MOV-1867D
- 1-SI-MOV-1842

b) Locally close valve(s).

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

13. __ESTABLISH CHG FLOW:

a) Close CHG flow control

- 1-CH-FCV-1122

b) Verify CHG line isolation - OPEN

- 1-CH-HCV-1310A

b) Manually open valve.

c) Open CHG line isolation MOVs

- 1-CH-MOV-1289A
- 1-CH-MOV-1289B

c) Locally open valve(s).

d) Establish desired charging flow using CHG flow control

*14. __VERIFY SI FLOW NOT REQUIRED:

- RCS subcooling based on CETCs - GREATER THAN 30°F [85°F]
- RVLIS indication - GREATER THAN REQUIRED

RCPs RUNNING	RVLIS INDICATION	
	Full Range	Dynamic Range
0	GREATER THAN 63%	———
1	———	GREATER THAN 36%
2	———	GREATER THAN 51%
3	———	GREATER THAN 82%

Manually start CHG pumps and align HHSI flow path to RCS cold legs. Do the following:

IF RCS subcooling based on CETCs greater than 30°F [85°F] and NO RCP running, THEN try to start an RCP IAW 1-OP-RC-001, STARTING AND RUNNING ANY RCP AND GO TO Step 27.

IF RCS subcooling based on CETCs less than 30°F [85°F] OR RVLIS indication less than required, THEN GO TO Step 27.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
15.	__CHECK RCS HOT LEG TEMPERATURES - STABLE	IF increasing, THEN control feed flow AND dump steam to establish stable RCS hot leg temperatures. IF decreasing, THEN verify actions of Step 2 have been completed before continuing with this procedure.
16.	__CHECK IF SI ACCUMULATORS SHOULD BE ISOLATED:	
	a) Check PRZR pressure - LESS THAN 2000 PSIG	a) GO TO Step 17. WHEN PRZR pressure less than 2000 psig, THEN perform Steps 16b, 16c and 16d.

(STEP 16 CONTINUED ON NEXT PAGE)

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

16. CHECK IF SI ACCUMULATORS SHOULD BE ISOLATED (Continued):

b) Check the following:

- Check RCS subcooling based on CETCs - GREATER THAN 30°F [85°F]
- Check required RVLIS indication:

RCPs RUNNING	RVLIS INDICATION	
	Full Range	Dynamic Range
0	GREATER THAN 63%	——
1	——	GREATER THAN 36%
2	——	GREATER THAN 51%
3	——	GREATER THAN 82%

- Check RVLIS indication - GREATER THAN REQUIRED

b) RETURN TO Step 14.

c) Check power to Accumulator discharge isolation valves - AVAILABLE

c) Locally close the following breakers: (key required)

- 1H1-2N 5B
- 1J1-2E 1B
- 1J1-2E 1C

(STEP 16 CONTINUED ON NEXT PAGE)

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

16. CHECK IF SI ACCUMULATORS SHOULD BE ISOLATED (Continued):

d) Isolate SI Accumulators:

1) Put ACC interlock key switches in DEFEAT: (keys 11, 12, and 13)

- 1-SI-MOV-1865A
- 1-SI-MOV-1865B
- 1-SI-MOV-1865C

2) Close the following:

- 1-SI-MOV-1865A
- 1-SI-MOV-1865B
- 1-SI-MOV-1865C

3) Locally open the following breakers:

- 1H1-2N 5B
- 1J1-2E 1B
- 1J1-2E 1C

d) IF CTMT and Turbine BLDG IA available, THEN do the following to vent any unisolated SI ACC:

1) Consult with TSC or HP.

2) Verify or place in service the Process Vent system.

3) Close or verify closed 2-SI-TV-201A and B.

4) Close or verify closed 1-RC-HCV-1549.

5) Open ACC vent line isolation valve, HCV-1853A, B, or C.

6) Open 1-SI-TV-101A and B.

7) Adjust HCV-1936 to vent SI ACC(s).

IF accumulators can NOT be vented, THEN do the following:

1) Maintain SG pressure greater than 150 psig.

2) Consult with TSC.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
*17.	__VERIFY PRESSURE FOR ANY ISOLATED SI ACC(S) REMAINS STABLE AS RCS PRESSURE DECREASES BELOW ACCUMULATOR PRESSURE	IF CTMT and Turbine BLDG IA available, THEN do the following to vent any unisolated SI ACC: a) Consult with TSC or HP. b) Verify or place in service the Process Vent system. c) Close or verify closed 2-SI-TV-201A and B. d) Close or verify closed 1-RC-HCV-1549. e) Open ACC vent line isolation valve, HCV-1853A, B, or C. f) Open 1-SI-TV-101A and B. g) Adjust HCV-1936 to vent SI ACC(s). IF accumulators can NOT be vented, THEN do the following: a) Maintain SG pressure greater than 150 psig. b) Consult with TSC.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

* *

CAUTION: Voiding may occur in the RCS during RCS depressurization. Voiding will result in a rapidly increasing PRZR level.

* *

18. __DEPRESSURIZE RCS TO REDUCE SUBCOOLING:

a) Use normal PRZR spray

a) IF normal spray NOT available, THEN use one PRZR PORV. Manually operate CHG pumps to maintain RCS subcooling greater than 30°F [85°F].

IF RCS can NOT be depressurized using any PRZR PORV, THEN use auxiliary spray.

b) Depressurize RCS until ANY of the following conditions satisfied:

- RCS subcooling based on CETCs - LESS THAN 40°F [95°F]

OR

- PRZR level - GREATER THAN 69%

OR

- RCS pressure - LESS THAN 125 PSIG [200 PSIG]

c) Stop RCS depressurization

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

* *

CAUTION: An increase in RCS pressure may result in excessive reactor vessel stress. RCS pressure and temperature should be maintained stable during completion of this procedure.

* *

19. __ESTABLISH RCP SEAL RETURN FLOW:

a) Check CC pumps - AT LEAST ONE RUNNING

a) GO TO Step 24. WHEN CC in service, THEN do Steps 19b through 23.

b) Open RCP seal return valve

- 1-CH-MOV-1381

20. __CHECK PRZR LEVEL - GREATER THAN 35% [63%]

Do the following:

a) Control CHG flow to restore PRZR level.

b) WHEN PRZR level greater than 35% [63%], THEN perform Step 21.

c) GO TO Step 22.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
21.	__ESTABLISH LETDOWN: a) Adjust CHG line flow to establish greater than 40 gpm b) Open letdown line pressure control valve • 1-CH-PCV-1145 c) Verify closed or close letdown orifice isolation valves • 1-CH-HCV-1200A • 1-CH-HCV-1200B • 1-CH-HCV-1200C d) Open letdown isolation valves • 1-CH-TV-1204A • 1-CH-TV-1204B • 1-CH-LCV-1460A • 1-CH-LCV-1460B e) Open letdown orifice isolation valve(s) f) Adjust letdown line pressure control valve to maintain letdown pressure • 1-CH-PCV-1145 g) Adjust NRHX outlet temperature control valve to control letdown temperature, if necessary • 1-CC-TCV-103	Establish excess letdown IAW 1-OP-CH-006, SHIFTING LETDOWN.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
22.	__CHECK VCT MAKEUP CONTROLS:	
	a) Verify one BATP operating and aligned to Unit 1	a) Align one BATP IAW 1-OP-CH-010, BAST ALIGNMENTS.
	b) Verify at least one PG pump operating	b) Start PG pump.
	c) Verify Boric Acid and PG flow set for one of the following: • Greater than RCS boron concentration OR • 2300 ppm	c) Adjust controls.
	d) Verify makeup set for AUTO control	d) Put in AUTO.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
23.	__ALIGN CHG PUMP SUCTION TO VCT:	
	a) Verify VCT level - GREATER THAN 27%	a) GO TO Step 24. WHEN VCT level greater than 34%, THEN do Steps 23b through 23d.
	b) Open CHG pump suction from VCT MOVs: • 1-CH-MOV-1115C • 1-CH-MOV-1115E	b) Locally open valve(s).
	c) Close CHG pump suction from RWST MOVs: • 1-CH-MOV-1115B • 1-CH-MOV-1115D	c) Locally close valve(s).
	d) Check RWST crosstie valves - CLOSED • 1-SI-TV-102A • 1-SI-TV-102B • 2-SI-TV-202A • 2-SI-TV-202B	d) Close valves.
24.	__CHECK PRZR LEVEL - LESS THAN 69%	Control charging and letdown flow. IF necessary, THEN establish excess letdown IAW 1-OP-CH-006, SHIFTING LETDOWN.
25.	__CONTROL PRZR PRESSURE: • Turn on PRZR heaters and operate normal PRZR spray to maintain pressure stable	IF normal spray NOT available AND normal letdown is in service, THEN use auxiliary spray. IF auxiliary spray NOT available, THEN use one PRZR PORV.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
26.	__VERIFY ADEQUATE RCS DEPRESSURIZATION: • RCS subcooling based on CETCs - LESS THAN 40°F [95°F] OR • RCS pressure - LESS THAN 125 PSIG [200 PSIG]	Depressurize RCS using normal spray. IF normal spray NOT available AND letdown in service, THEN use auxiliary spray. RETURN TO Step 18b. IF normal spray and auxiliary spray NOT available, THEN RETURN TO Step 18a.
27.	__DETERMINE IF RCS TEMPERATURE SOAK IS REQUIRED: a) Check cooldown rate in RCS cold legs - GREATER THAN 100°F IN ANY 60 MINUTE PERIOD b) Do ALL of the following: 1) Do NOT cooldown RCS until temperatures have been stable for 1 hour 2) Do NOT increase RCS pressure during soak period 3) Do actions required in other procedures in effect that do not cooldown or pressurize the RCS until the soak period is completed 4) RCS cooldown is permitted after 1 hour, if desired 5) Maintain RCS pressure and cold leg temperatures within the limits of Attachment 2 6) After soak period, maintain cooldown rate in RCS cold legs - LESS THAN 50°F/HR	a) GO TO Step 28.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

28. __RETURN TO PROCEDURE AND STEP IN EFFECT

- END -

NUMBER	ATTACHMENT TITLE	REVISION
1-FR-P.1	INSTRUMENT AIR RESTORATION	12
ATTACHMENT 1		PAGE 1 of 1

___ 1. IF Unit 2 IA available, THEN crosstie IA from Unit 2 by opening 1-IA-44 and 2-IA-44.

2. IF Unit 2 IA NOT available, THEN do the following:

___ a. Verify or place BC system in service. IF BC NOT available, THEN locally establish fire water cooling to IA compressor IAW the following:

- To align 1-IA-C-1 do the following:

  ___ 1. Open 1-BC-170.

  ___ 2. Open 1-BC-3.

  ___ 3. Close 1-BC-231.

  ___ 4. Close 1-BC-232.

- To align 2-IA-C-1 do the following:

  ___ 1. Open 2-BC-170.

  ___ 2. Open 2-BC-3.

  ___ 3. Close 2-BC-168.

  ___ 4. Close 2-BC-2.

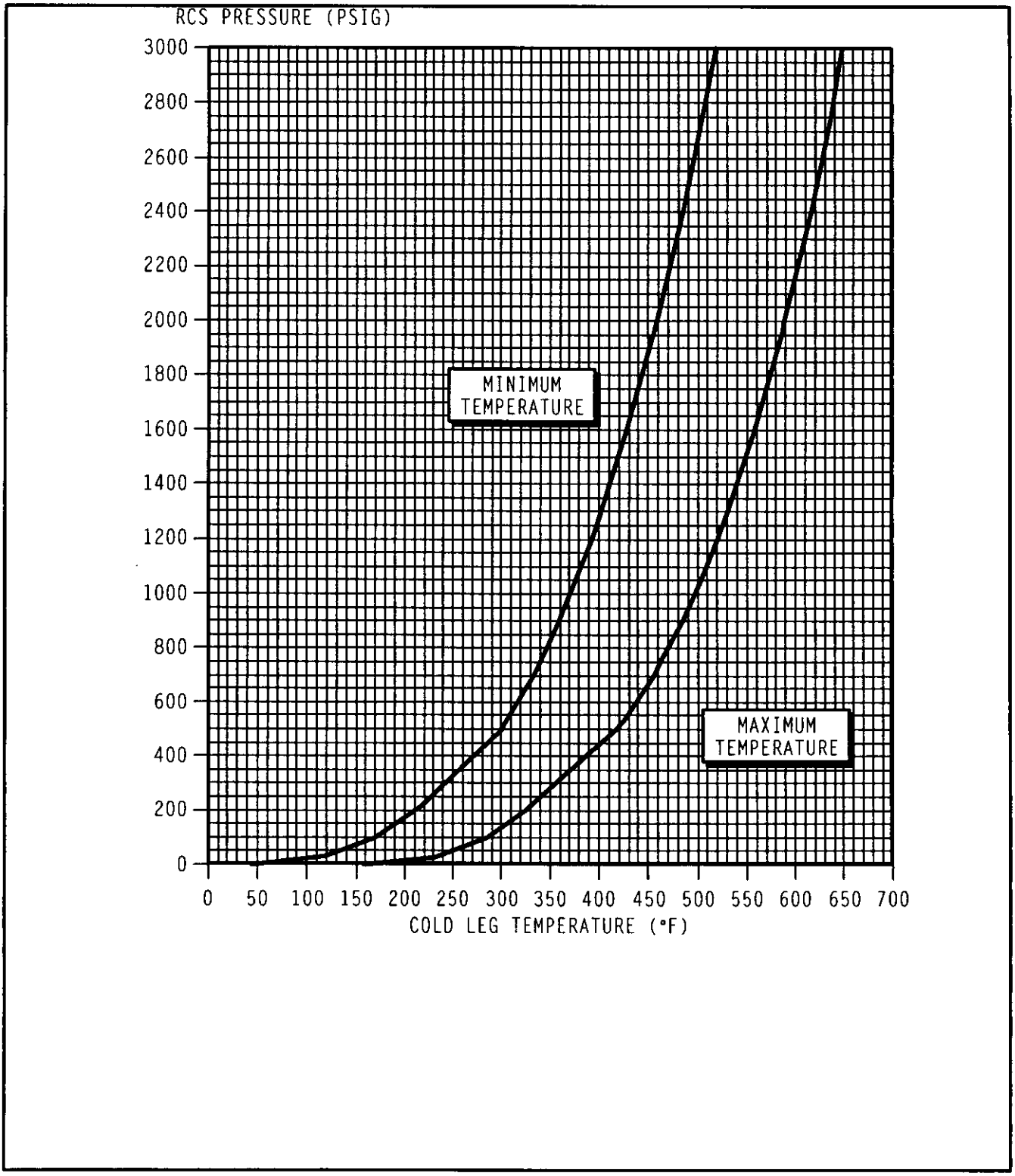
  ___ 5. Open 1-IA-44 and 2-IA-44.

___ b. Cool down IA compressor(s), if necessary.

___ c. Reset the IA compressor(s) high temperature switches, if necessary.

___ d. Locally start at least one IA compressor.

NUMBER 1-FR-P.1	ATTACHMENT TITLE POST - SOAK COOLDOWN LIMIT	**REVISION** 12
ATTACHMENT 2		**PAGE** 1 of 1



SURRY LORP EQUATION SHEETS

$$\Delta E = 931\,\Delta m$$

$$\frac{1}{M} = \frac{CR_1}{CR_x}$$

$$P = P_o e^{\left(\frac{t}{\tau}\right)}$$

$$P = P_o 10^{-SUR\,(t)}$$

$$SUR = \frac{26.06}{\tau}$$

$$SUR = \frac{26\rho}{1^* + (\beta - \rho)T}$$

$$SUR = \frac{26.06(\lambda_{eff}\rho)}{(\beta - \rho)}$$

$$\tau = \frac{\beta - \rho}{\lambda_{eff}\rho}$$

$$\tau = \frac{l^*}{\rho} + \left[\frac{(\beta - \rho)}{\lambda_{eff}\rho}\right]$$

$$\lambda_{eff} = 0.1\,\text{sec}^{-1}$$

$$\ell^* = 2\text{x}10^{-5}\ \text{sec}$$

$$\tau = \frac{l^*}{(\rho - \beta)}$$

$$\rho = \frac{\ell^*}{\tau} + \frac{\beta}{1 + \lambda_{eff}\tau}$$

MAX DAC HRS for any particular task = 40

$$\rho = \frac{(K_{eff} - 1)}{K_{eff}}$$

$$K_{eff} = \frac{1}{(1 - \rho)}$$

$$CR_{s/D} = \frac{S}{(1 - K_{eff})}$$

$$CR_1(1 - K_{eff\,1}) = CR_2(1 - K_{eff\,2})$$

$$DRW \propto \frac{\phi^2_{tip}}{\phi^2_{avg}}$$

$$SDM = \frac{(1 - K_{eff})}{K_{eff}}$$

$$A = A_0 e^{-\lambda t}$$

$$\lambda = \frac{\ln 2}{T_{1/2}}$$

$$E = mc^2$$

$$\frac{R}{hr} = \frac{6CE}{d^2(feet)}$$

$$\frac{R}{hr} = \frac{(0.5CE)}{d^2(meters)}$$

$I_1 d_1 = I_2 d_2$ – Line source

$I_1 d_1^{\,2} = I_2 d_2^{\,2}$ – Point source

$1\ Curie = 3.7\,x\,10^{10}\ dps$

$2000\,DAC - hrs = 1\,ALI = 5.0\ \text{Re}\,m$

SURRY LORP EQUATION SHEETS

$$\dot{Q} = \dot{m} c_p \Delta T$$

$$\dot{Q} = \dot{m} \Delta h$$

$$\dot{Q} = UA\Delta T$$

$$\dot{Q} \propto \dot{m}^3{}_{NatCirc}$$

$$\Delta T \propto \dot{m}^2{}_{NatCirc}$$

$$KE = \frac{1}{2} m v^2$$

$$w = v\Delta P$$

$$\dot{W}_{pump} = \dot{m}\Delta P v$$

$$Pwr = W_f \dot{m}$$

$$Pwr = W_f \Delta h$$

$$Cycle\ Effeciency = \frac{Net\ Work\ Out}{Energy\ In}$$

$$s = v_0 t + \frac{1}{2} a t^2$$

$$v = s/t$$

$$V_f = V_0 + at$$

$$a = \frac{(V_f - V_0)}{t}$$

$$w = \frac{\theta}{t}$$

$$f = ma$$
$$w = mg$$
$$PE = mgn$$
$$F = PA$$

$$\dot{m} = v_{av} A \rho$$

$$\dot{m} = \rho A v$$

$$v(P_e - P_1) + \frac{1}{2}(v_e^{-2} - v_1^{-2}) + g(z_e - z_1) = 0$$

$$Z_1 + P_1 v_1 + \frac{v_1^{-2}}{2g} + h_p = Z_2 + P_2 v_2 + \frac{v_2^{-2}}{2g} + h_L$$

$$g_c = \frac{32.2\, lbm - ft}{lbf - \sec^2}$$

$$\dot{V} \propto N$$

$$H_p \propto N^2$$

$$BHP \propto N^3$$

$$H_L = K\frac{\dot{v}^2}{2}$$

$$H_L = f\frac{LV^2}{2D}$$

$$1 Mw = 3.41x10^6\ Btu/hr$$

$$1 hp = 2.54x10^3\ Btu/hr$$

$$1 Btu = 778\, ft\ lbf$$

$$°C = (5/9)(°F - 32)$$

$$°F = (9/5)(°C) + 32$$

$$1 kg = 2.21\ lbm$$

$$1 ft^3 = 7.48\ gal$$