DRAINING THE REACTOR COOLANT SYSTEM TO A CVCS HUT WITHOUT ENTERING REDUCED INVENTORY

Unit _____
Date _____
DSS _____

RECORD
PROCEDURE VERIFIED CURRENT AND CHECKED FOR TEMPORARY CHANGES. IF FIELD COPIES REQUIRED, USE PBF-0026; LAW NP 1.2.4 AND DO NOT COMPLETE THIS BLOCK.
BY: _____ DATE: _____

DISCUSSION

This procedure provides the direction for draining the RCS without entering reduced inventory. If it is necessary to enter reduced inventory, OP-4D Part 2 should be used.

This procedure details the required action to drain the RCS from a solid depressurized condition to a partially drained condition (>55% RV level). In this procedure, reactor coolant is pumped via the RHR system and the letdown divert portion of the CVCS to a CVCS HUT. A nitrogen backfill of the RCS is employed to fill the voided areas in the RCS eliminating O_2 contact and as a controlled vacuum break of the coolant captive in each steam generator tube bundle. This section is in concert with, and a sequel to, OP-3C.

A. DRAINING THE RCS TO A CVCS HUT

1.0 PURPOSE

This procedure provides operator guidance in:

1.1 Draining the RCS via the RHR and letdown divert system to a CVCS HUT.

1.2 Nitrogen backfilling of the RCS to maintain a slightly positive pressure in the RCS.

1.3 Preparing the RCS for a containment integrated leak rate test.

1.4 Steam generator tube bundle vacuum breaking and a controlled letdown of coolant therein.

1.5 Inventorying the amount of reactor coolant drained as a check on reactor vessel water level indication.

1.6 Purging and isolating the RCDT from the vent header and the gas analyzer.

1.7 Aligning the letdown, purification, and charging system from RHR for a drained down operating mode.

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REFERENCE USE

2.0 REFERENCES

IR 96-006, NRC Inspection Report; NRC Commitment for Operations procedures PMT/QC reviews.

3.0 PRECAUTIONS AND LIMITATIONS

NOTE: Asterisk (*) indicates a Technical Specification requirement.

3.1* Both RHR trains shall be operable when RCS temperature is <140°F. One train at a time may be temporarily out of service for surveillance requirements.

NOTE: The RCS is open to the atmosphere when any one of the following conditions is satisfied:

a. At least one primary manway is removed

b. One PORV is maintained open.

c. The reactor vessel head is unbolted.

d. One pressurizer safety valve is removed.

3.2* When the RCS is <360°F and not open to the atmosphere, the LTOP system must be operable and enabled.

3.3* When the RCS is not open to the atmosphere and either cold leg temperature is ≤275°F, no more than one high head SI pump shall be operable. The inoperable pump shall have its associated 4160 volt breaker racked out or its discharge valve shut and operator power removed.

3.4 Observe the applicable Health Physics procedures for handling radioactive liquids and for venting vapors and gases. Special precautions are required when the VNPSE system is not operating as in the preparation of the RCS for a containment ILRT by purging the PRT to a lower acceptable level of H_2 and radgas concentration.

3.5 Reactor vessel level must be maintained ≥3/4 pipe corresponding to ≥22% on LI-447/LI-447A to ensure reliable operation of the RHR system.

3.6 Concurrence of the DSS and the DCS is required to lower reactor vessel level to <3/4 pipe. In no case will reactor vessel level be lowered intentionally to <1/2 pipe, corresponding to <14.5% on LI-447/LI-447A, when fuel is in the core.

3.7 Reactor vessel level instruments, LT-447/LT-447A, are pressure sensitive. Ensure that each transmitter is thoroughly purged of liquid in the reference leg and air in the variable leg prior to placing it in service.

3.8 When the local level indicator, LI-447B, is used to indicate reactor vessel level, the RCS must be depressurized to containment atmospheric pressure to obtain an accurate level indication. If level is below 55%, seal injection must be secured to the B RCP-Unit 1 (A RCP-Unit 2).

3.9 The RVLIS must not be used for definitive reactor vessel level indication. It should be used to verify level trends on the associated recorder especially when level is in the blind spot from off scale low on pressurizer level to on scale high on LI-447/LI-447A.

3.10 Implement OP-4F prior to commencing the draining of the reactor coolant system (except for verification of single train decay heat removal which is contained within the body of this procedure). OP-4F is required to be in effect prior to draining the RCS to <55% as indicated on LI-447/447A. This level is ~3' below the reactor vessel flange.

3.11 Prior to opening or allowing maintenance on the RCS, verify single train RHR decay heat removal capability to maintain the RCS at ≤ the desired temp at ≤ the specified RHR flow rate. When performing the demonstration, CCW flow shall be established through only one RHR heat exchanger. The CCW flow rate through the RHR heat exchanger selected may be increased to the design flow rate (per local plaque) and the service water flow through the CCW heat exchanger(s) should be set at ~4 psid.

3.11.1 For a refueling shutdown, demonstrate the ability of one train of RHR to maintain the RCS at ≤140°F at ≤1500 gpm RHR flow.

3.11.2 For a cold shutdown, demonstrate the ability of one train of RHR to maintain the RCS at ≤160°F at ≤1500 gpm RHR flow.

3.12 If, during the performance of this procedure RHR cooling becomes impaired or lost, reduce RHR flow to 1000 gpm ±100 gpm, secure draining and proceed to SEP-1 degraded RHR system capability.

3.13 Do not cooldown while @ 3/4 pipe without first increasing the reactor vessel level to compensate for the change in water density.

INITIALS

4 INITIAL CONDITIONS

4.1 The RCS is solid and depressurized. _____

4.2 The reactor has been shutdown for >65 hours or the decay heat load has been demonstrated to be within the heat removal capability of a single train of RHR to maintain the unit at cold shutdown (<200°F). For demonstrating single train capability, RHR flow should be ≤1500 gpm and CCW flow through only one RHR HX. _____

4.3 RCS temperature is being maintained:

For a cold shutdown ≤160°F, or
For a refueling shutdown <140°F, or
For a containment ILRT 100-110°F _____

4.4 1 Train of RHR is in operation and with flow set at 1500 gpm ± 100. _____

4.5 The letdown gas stripper is off line. _____

4.6 Letdown alignment is in the degas mode bypassing the VCT inlet. _____

4.7 The equivalent of one empty CVCS HUT is available to store the reactor coolant. _____

4.8 An equivalent of 1½ GDTs gas storage space is available. _____

4.9 The waste gas system is operable. _____

4.10 The nitrogen supply system is available. _____

4.11 The containment purge supply and exhaust system is operating, except when a containment ILRT is planned. _____

4.12 A one-inch hose is installed between the PRT at RC-590 and the purge exhaust fan suction as in Figure 1. (Figure 1A) _____

4.13 Isotopic chemical analysis of the RCS indicates that the concentration of radioisotopes is within an acceptable level for draindown. _____

INITIALS

4.14 The PRT gas space is:

4.14.1 ≤10% H_2 for a normal RCS draindown

OR

4.14.2 ≤4% H_2 and ≤1x10E^{-3} µc/cc Xe-133 for draindown prior to an ILRT. _____

4.15 Any restrictions on the number of operable charging pumps per REI 19.0 is met. _____

NOTE: ***As a good operating practice, OP-4F is to be implemented prior to commencing draindown. OP-4F is required to be implemented prior to entering reduced inventory.***

4.16 Implement OP-4F, "Reactor Coolant System Reduced Inventory Requirements" except for single train decay heat removal capability at 1500 gpm which will be performed in this procedure. _____

5.0 PROCEDURE

5.1 Verify pressurizer spray valves, RC-431A&B, are open _____

REFERENCE USE

INITIALS

NOTE 1: In loop valves will be positioned by CL-4D for refueling shutdowns only. Not required for cold shutdown unless steam generator tubes are to be drained.

NOTE 2: El. 66' for Unit 1; Pressurizer compartment for Unit 2.

NOTE 3: N/A when ILRT is planned. Leave valve open.

NOTE 4: Valve is normally locked shut.

5.2 Position the following:

RC-545A	A SG cold leg vent isolation	(Note 1) Open	_____
RC-547A	A SG hot leg vent isolation	(Note 1) Open	_____
RC-546A	B SG hot leg vent isolation	(Note 1) Open	_____
RC-548A	B SG cold leg vent isolation	(Note 1) Open	_____
RC-571	Reactor head vent orifice bypass	Open	_____
RC-572	Reactor head vent orifice bypass	Open	_____
RC-576	Pressurizer vent orifice bypass	(Note 2) Open	_____
RC-577	Pressurizer vent orifice bypass	(Note 2) Open	_____
RC-575C	Manual isolation of RC-575B	(Note 3) Shut	_____
RC-584	Gas vent to low pressure fill & vent	(Note 4) Open	_____
RC-583	Gas Vent to PRT relief header isolation	Shut	_____
RC-585	Low pressure fill and vent PRT isolation	Open	_____
RC-595	Nitrogen to PRT isolation	Open	_____
RC-441(PCV)	PRT nitrogen regulator	3-4 psi	_____
MOB No. 372 (482) RC-570A DC Breaker in 1C-20 (2C-20)		Close	_____
MOB No. 374 (484) RC-580A DC Breaker in 1C-20 (2C-20)		Close	_____
MOB No. 376 (486) RC-575A DC Breaker in 1C-20 (2C-20)		Close	_____
MOB No. 387 (497) RC-570B DC Breaker in 1C-20 (2C-20)		Close	_____
MOB No. 389 (499) RC-580B DC Breaker in 1C-20 (2C-20)		Close	_____
MOB No. 391 (501) RC-575B DC Breaker in 1C-20 (2C-20)		Close	_____

INITIALS

5.2.1 Verify RC-589 shut. Shut _____

Then shut RC-532. Shut _____

5.2.2 Verify the PRT N_2 supply line is free of liquid by:

a. Drain at RC-1420A, the low point drain down stream of RC-528. _____

b. When line is dry and N_2 flow is verified, shut and cap RC-1420A. _____

5.2.3 Open RC-532, N_2 supply to PRT. Open _____

5.2.4 Shut and red tag the PRT to gas analyzer isolation valves

RC-538 Red Tag Shut _____

RC-539 Red Tag Shut _____

5.2.5 Rack out and red tag all pressurizer heater breakers. _____

5.3 Align letdown divert to the desired HUT. _____

Record: T8A, B, or C level at _____% (Circle one)

5.4 Verify CV-112A, letdown divert valve, control switch in "AUTO." _____

INITIALS

NOTE: PI-493 will indicate a 275" reference leg water column ~10 psig when the RCS is at atmospheric pressure.

***CAUTION* AN INDICATION OF <10 PSIG ON PI-493 IS AN INDICATION OF A VACUUM IN THE RCS. VERIFY N_2 BACKFILL ALIGNMENT OR DECREASE THE DRAIN RATE. A NEGATIVE RCS PRESSURE WILL DISTORT THE CALIBRATION OF PRESSURIZER LEVEL INSTRUMENTATION.**

5.5 Adjust letdown and/or charging flow until RCS pressure on PI-493 is 10-13 psig. _____

5.6 Open RCGVS valves to establish N_2 backfill path.

RC-580A	RCGVS pressurizer SOV	Open	_____
RC-580B	RCGVS pressurizer SOV	Open	_____
RC-575A	RCGVS PRT SOV	Open	_____

5.7 To commence drain of RCS:

5.7.1 Reduce charging to 1 pump at minimum speed. _____

5.7.2 Shut CV-142 to maintain normal RCP seal injection flow. _____

***CAUTION* DO NOT EXCEED 40 GPM THROUGH THE CATION BED DEMINERALIZER. THROTTLE OPEN THE CATION BYPASS AS REQUIRED.**

5.7.3 Adjust letdown flow to achieve desired drain rate by opening CV-135. _____

5.7.4 Verify CV-112A auto diverts as VCT level increases to the modulating level of ~56%. _____

INITIALS

*NOTE: **Steps 5.8 through 5.11 are N/A unless a containment ILRT is scheduled at the beginning of a refueling outage.***

5.8 PZR Level for ILRT

Secure RCS draindown when pressurizer level approaches 60% and stabilize level at 55-65% per LI-433, the pressurizer cold calibrated level indicator. _____

5.9 LTOP for ILRT

5.9.1 Mechanically block open RC-430 (or 431C) PORV. _____

5.9.2 Verify RC-516 (or 515), the associated PORV block valve for the blocked open PORV, is maintained open. _____

5.9.3 Install red tags on the selected PORV and the selected PORV block valve control switches on C04. _____

5.10 Alignment of RCS, PRT and RCDT for an ILRT

5.10.1 Shut RC-595, PRT N_2 supply isolation. _____

5.10.2 Fill the RCDT from the PRT to a level of 95% while venting the RCDT to the VH. Adjust VH pressure to <2.0 psig _____

5.10.3 Shut and red tag:

WG-1786	Containment VH isolation	Red Tag Shut _____
WG-1787	Containment VH isolation	Red Tag Shut _____
WG-1788	RCDT/GA isolation	Red Tag Shut _____
WG-1789	RCDT/GA isolation	Red Tag Shut _____

5.10.4 Open RC-527, PRT to VH AOV, and slowly pump the RCDT to a level of ≤30% while observing a positive pressure in the PRT and RCDT during the pumpdown. _____

INITIALS

5.10.5 Depressurize RCDT, PRT and pressurizer to containment pressure by opening:

RC-586	Low pressure fill & vent PRT isolation	Open	_____
RC-589	Low pressure fill & vent N_2 supply	Open	_____
RC-590	Low pressure fill & vent PRT exhaust	Open	_____

5.10.6 When the system is depressurized:

a. Shut RC-527 PRT to VH AOV — Shut _____

b. Then open WG-1609 RCDT local vent — Open _____

5.10.7 Verify open RC-575C, RCGVS standpipe manual isolation, to permit remote venting of RCS during ILRT. _____

5.10.8 Continue with the preparation for the ILRT per ORT 9, then the ILRT per ORT 17. _____

5.11 Post-ILRT RCS, RCDT, and PRT Alignment to Resume Draindown

5.11.1 When N_2 cylinders for RC-430 and 431C PORVs are reconnected per ORT 10, then verify that the PORV N_2 backup system is aligned for LTOP service per CL-4C. _____

5.11.2 Verify the LTOP system is in service per the requirements of OP-3C, Section 4.9. _____

5.11.3 Remove the mechanical block open device on RC-430 (431C) PORV installed in Step 5.9. _____

PMT

5.11.4 Stroke RC-430(431C) to verify valve moves without binding. Timing is not required since mechanically blocking valve should not affect operability. _____

5.11.5 Shut RC-575C, RCGVS standpipe manual isolation. Shut _____

INITIALS

5.11.6 Shut the following valves at the PRT:

RC-586	Low pressure fill & vent PRT isolation	Shut	_____
RC-589	Low pressure fill & vent N_2 supply	Shut	_____
RC-590	Low pressure fill & vent PRT exhaust	Shut	_____

5.11.7 Verify open the following valves at the PRT:

RC-532	N_2 supply to PRT	Open	_____
RC-585	Low pressure fill & vent PRT isolation	Open	_____
RC-584	Gas vent to low pressure fill & vent	Open	_____

5.11.8 Reconnect the vent hose at RC-590. _____

5.11.9 Reinstall the pressure gauge at RC-441 N_2 regulator. _____

5.11.10 Open NG-1662, N_2 supply to containment. Open _____

5.11.11 Vent the RCDT to the PRT:

a. Shut WG-1609 RCDT local vent. Shut _____

b. Open RC-527 PRT to VH AOV. Open _____

5.11.12 To resume RCS draindown:

a. Verify open:

RC-575A	RCGVS PRT SOV	Open	_____
RC-580A	RCGVS pressurizer SOV	Open	_____
RC-580B	RCGVS pressurizer SOV	Open	_____

b. Adjust RC-441, PRT N_2 regulator, for a delivery pressure of 3-4 psig. _____

c. Open RC-595 PRT N_2 supply isolation. Open _____

REFERENCE USE

INITIALS

d. When PRT and pressurizer indicate a N_2 overpressure of 3-4 psig, reduce charging flow to minimum to maintain normal RCP seal injection flow with CV-142 and maximize letdown flow by opening CV-135 as in previous steps of this procedure. _____

5.12 Purge of VCT Gas Space

5.12.1 Adjust CV-114, VCT N_2 regulator, to ~30 psig. _____

5.12.2 Purge the VCT gas space to the VH by allowing the VCT level to rise to 90-95%, then lower the level while backfilling with N_2. _____

5.12.3 Return CV-112A, letdown divert valve, control switch to "AUTO" and verify that VCT level returns and controls at the auto divert setpoint of ~56%. _____

5.12.4 Adjust CV-114, VCT N_2 regulator to 20 psig. _____

5.13 When pressurizer level is <50% on LI-433A, open the following valves to provide N_2 backfill to the RV head:

RC-570A Open _____

RC-570B Open _____

5.14 When the pressurizer level indication is ~5% on LI-433A, stop the draindown by reducing letdown flow to equal charging/seal injection flow. _____

5.15 Perform IT-700(705), "Inservice Test of RCGVS Valves," if required. _____

5.16 Assign an SRO to oversee the remainder of the draindown operation until level is stabilized @ the desired level (but not ≤55%). The draindown operation will be his primary responsibility. _____

5.17 A senior line manager shall conduct a briefing for the Operations personnel involved in the draindown. It shall be given to each shift involved in the draindown until the draindown is complete and a stable level is achieved. _____

INITIALS

5.18 Place the reactor vessel level transmitters (LT-447/447A) in service as follows:

NOTE: Narrow range RVLIS indication and recorder traces should be used to support the response of RV level indicators, LI-447/LI-447A.

NOTE: Reference Figure 1 for Unit 1 and Figure 1A for Unit 2.

NOTE: Reference HP 2.5.2 for venting/draining of systems in contact with RCS.

NOTE: RC-500B is not red tagged open due to its location in the keyway with limited access.

NOTE: RC-500N, RC-500P, RC-525C, and RC-525D are not red tagged to allow for operational flexibility to vent/purge transmitter and/or I&C testing (as required).

5.18.1 AT C-20 Red Tag Open the following valves:

RC-580A	PZR vent isolation valve	Red Tag Open _____
RC-580B	PZR vent isolation valve	Red Tag Open _____
RC-570A	Rx vessel head vent	Red Tag Open _____
RC-570B	Rx vessel head vent	Red Tag Open _____

5.18.2 At C-04 shut the following Do Not Red Tag:

RC-597	RV flange leakoff SOV	Shut _____

5.18.3 At 21' Containment shut the following Do Not Red Tag:

RC-522	RV flange leakoff to drain tank	Shut _____
RC-525C	LT-447 variable leg isolation	Shut _____
RC-525D	LT-447 reference leg isolation	Shut _____
RC-500N	LT-447A variable leg isolation	Shut _____
RC-500P	LT-447A reference leg isolation	Shut _____

INITIALS

5.18.4 At 21' Containment Red Tag Shut

RC-525 Reactor vessel level cross-connect isolation	Red Tag Shut	_____

5.18.5 At the PRT shut the following Do Not Red Tag

RC-587 LT-477 reference leg isolation to PRT	Shut	_____

5.18.6 At the PZR shut the following Do Not Red Tag

SC-950B PZR steam space sample	Shut	_____

5.18.7 At the PZR Red Tag Open the following:

RC-500Q LT-447A reference leg isolation	Red Tag Open	_____
SC-950 PZR steam space sample isolation	Red Tag Open	_____
RC-535 PZR to gas vent system isolation	Red Tag Open	_____

5.18.8 At the 66' U1 (PZR U2) Red Tag Open the following:

RC-576 PZR vent orifice bypass	Red Tag Open	_____
RC-577 PZR vent orifice bypass	Red Tag Open	_____

5.18.9 At the 66' Red Tag Open the following:

RC-573	Reactor head vent isolation	Red Tag Open _____
RC-572	Reactor head vent orifice bypass	Red Tag Open _____
RC-571	Reactor head vent orifice bypass	Red Tag Open _____
RC-587A	LT-447 reference leg isolation	Red Tag Open _____
RC-579	LT-447 reference leg isolation	Red Tag Open _____
RC-578	PZR vent isolation	Red Tag Open _____

5.18.10 At the Reactor Head Red Tag Open the following:

RC-500 Reactor head vent isolation	Red Tag Open	_____

INITIALS

5.18.11 At the 8' Red Tag Open the following:

RC-500D	Reactor vessel level variable leg isolation	Red Tag Open _____
RC-500J	LT-447/447A variable leg isolation	Red Tag Open _____
RC-500K	LT-447/447A variable leg isolation	Red Tag Open _____

5.18.12 Place LT-447/447A in service as follows:

Drain LT-447 N_2 side of all liquid via RC-525B and verify a positive outflow of N_2. Drained _____

Vent LT-447 liquid side of all gas via RC-525A and verify solid stream of liquid. Vented _____

Verify LT-447 body vent and drain valves are shut. Vent Shut _____
Drain Shut _____

Drain LT-447A N_2 side of all liquid via RC-500M and verify a positive outflow of N_2. Drained _____

Vent LT-447A liquid side of all gas via RC-500L and verify solid stream of liquid. Vented _____

Verify LT-447A body vent and drain valves are shut. Vent Shut _____
Drain Shut _____

RC-525D	LT-447 reference leg isolation	Open _____
RC-525C	LT-447 variable leg isolation	Open _____

NOTE: ***Abruptly starting/stopping the venting/draining can adversely affect LT-447 calibration.***

Complete the purge of LT-447 by carefully venting/draining the DP cell with the valves provided at the cell. _____

RC-500P	LT-447A reference leg isolation	Open _____
RC-500N	LT-447A variable leg isolation	Open _____

INITIALS

NOTE: ***Abruptly starting/stopping the venting/draining can adversely affect LT-447A calibration.***

Complete the purge of LT-447A by carefully venting/draining the DP cell with the valves provided at the cell. _____

5.18.13 Set the low level alarm setpoint for LC-447/447A @ 58%.

LC-447 @ 58% _____

LC-447A @ 58% _____

5.18.14 Set the high level alarm setpoint for LC-447/447A @ 100%.

LC-447 @ 100% _____

LC-447A @ 100% _____

5.18.15 Place the reactor vessel low level alarm bypass switch to ENABLE for LC-447/447A.

LC-447 Enable _____

LC-447A Enable _____

INITIALS

NOTE: ***Volume between pressurizer level off-scale low and RVLIS indicating a decreasing reactor vessel level is approximately 1200 gallons.***

NOTE: ***Volume between pressurizer level off-scale low and refueling level instrument (LI-447/LI-447A) on-scale high is approximately 2000 gallons.***

CAUTION **DO NOT DRAIN MORE THAN 3000 GALLONS FROM THE TIME PRESSURIZER LEVEL IS OFF-SCALE UNTIL LT-447/LT-447A IS ON-SCALE WITHOUT INVESTIGATING FOR THE DISCREPANCY.**

CAUTION **IF DURING THE PERFORMANCE OF THIS EVOLUTION, RHR COOLING BECOMES IMPAIRED OR LOST, REDUCE RHR FLOW TO 1000±100 GPM, SECURE DRAINING AND PROCEED TO SEP-1, "DEGRADED RHR SYSTEM CAPABILITY."**

5.19 Drain the RCS from just on scale on the pressurizer level instruments to on scale on the reactor vessel level instruments per the following steps:

5.19.1 Record the level in the HUT lined up to receive letdown

T8A, B, C (Circle One) _____%

NOTE: ***To maintain a constant charging and seal injection flow rate, 1 charging pump operating at minimum speed is recommended.***

5.19.2 Establish the desired drainage rate by increasing letdown/reducing charging flow.

INITIALS

5.19.3 Calculate when RVLIS should start trending down, when the reactor vessel level transmitters (LT-447/447A) should come on scale, and when 3000 gallons would be drained.

Record time when LI-433A goes off scale _____ _____

Letdown flow rate - (charging and seal injection) = drain rate in gpm
1200 ÷ Drain Rate = _____ minutes for RVLIS to start trending
2000 ÷ Drain Rate = _____ minutes for LT-447/447A to come on scale
3000 ÷ Drain Rate = _____ minutes (max allowed per caution)

5.19.4 During the draindown, monitor for expected response from RVLIS and reactor vessel level transmitters. Use the HUT level change as a backup to the calculated drainage time. _____

5.19.5 Perform a channel check of reactor vessel level instruments @ ~90% reactor vessel level by comparing the 2 channels. Use computer addresses LT-447 and YXLT-447A, if available. If deviation between LI-447/447A is <3%, then indications are satisfactory. _____

If deviation between LI-447/447A is >3%, then perform another vent and purge of LI-447/447A air and liquid sides. _____

If, after venting and purging LI-447/447A, they still do not agree within 3%, then notify I&C to perform a calibration check of LI-447/447A before proceeding. _____

5.20 Continue draining to a level of 60% which corresponds to approximately 2½' below the RV flange, then:

NOTE: ***The following step will minimize RCP seal injection flow. Ensure the CVCS system stabilizes without VCT divert.***

5.20.1 Secure the operating charging pump. _____

5.20.2 Place the VCT divert valve control switch to the VCT position. _____

5.20.3 Decrease letdown flow to equal total charging flow. _____

INITIALS

5.20.4 Isolate the RCGVS from the PRT by shutting the following valves:

RC-585 Shut _____

RC-589 Shut _____

***CAUTION* THE FOLLOWING STEP WILL HAVE A DYNAMIC EFFECT ON THE INDICATED REACTOR VESSEL LEVEL (LT-447/447A). THE GREATER THE N_2 PRESSURE IN THE RCS, THE GREATER THE EFFECT. AS GAS IS BEING VENTED, LT-447 WILL INDICATE A LEVEL INCREASE AND LT-447A WILL INDICATE A LEVEL DECREASE. IF IT IS NECESSARY TO CHECK REACTOR VESSEL LEVEL PRIOR TO COMPLETING THE VENTING OF THE RCS, THEN SHUT RC-586 OR RC-590, RCS PRESSURE SHOULD QUICKLY EQUALIZE, AND LT-447/447A SHOULD REFLECT ACTUAL LEVEL.**

5.20.5 Vent the RCGVS to the purge exhaust duct by opening the following valves:

RC-586 Open _____

RC-590 Open _____

5.21 Steam Generator Tube Bundle Draining

5.21.1 Verify 3 to 4 psig N_2 pressure in the PRT. _____ /

5.21.2 Record the following when the draindown is started:

SG	Time	Selected HUT level %	Net Drain Rate	
A	_____	_____	_____ gpm	_____
B	_____	_____	_____ gpm	_____

REFERENCE USE

INITIALS

5.21.3 Open RC-545C (548C), N_2 supply to the A (B) steam generator cold leg vent. ____/____

5.21.4 Allow RV level to rise to >80% on LI-447/LI-447A. ____/____

5.21.5 Place the VCT divert valve control switch to auto and establish a drain rate by increasing letdown flow with PCV-135 consistent with, but not greater than, the N_2 backfill rate; i.e., LI-447/LI-447A stable or increasing. ____/____

5.21.6 Maintain a stable drain rate until RV level returns to 60% when draining the 1st S/G and ~ 70% when draining the 2nd S/G, then reduce letdown flow to equal total charging flow. ____/____

NOTE: ***The volume of each steam generator tube bundle is approximately 7000 gallons. For Unit 2, this volume must be adjusted based on the percentage of tubes plugged.***

5.21.7 Calculate and record volume drained as time vs. net drain rate and change in selected HUT level:

SG	Time	Drain rate Volume	Selected HUT level %	HUT Δ Volume	
A	_____	_____ gal	_____	_____ gal	_____
B	_____	_____ gal	_____	_____ gal	_____

5.21.8 Shut RC-545C (548C) and repeat Steps 5.21.1 through 5.21.7 for the other steam generator. _____

5.22 Reduce PRT N_2 supply regulator pressure to 1 psig. _____

INITIALS

5.23 Equalize pressure throughout the RCS loops by opening or verifying open all hot and cold leg vents.

545C	Open	_____
546C	Open	_____
547C	Open	_____
548C	Open	_____

5.24 RCDT Alignment

*NOTE: **This section is N/A if the RCDT was previously aligned for an ILRT per Section 5.10.***

5.24.1 Fill the RCDT to approximately 95% level while venting to the vent header. _____

5.24.2 Red tag RCDT to vent header valves:

WG-1786	Red tag shut	_____
WG-1787	Red tag shut	_____

5.24.3 Red tag shut RCDT to gas analyzer valves:

WG-1788	Red tag shut	_____
WG-1789	Red tag shut	_____

5.24.4 Vent the RCDT to the PRT by opening and maintaining open RC-527. _____

5.24.5 Pump the RCDT to a normal operating level. _____

5.25 Secure RCP seal injection by shutting:

CV-300A	"A" RCP seal injection throttle valve	Shut	_____
CV-300B	"B" RCP seal injection throttle valve	Shut	_____

INITIALS

CAUTION **WHEN VENTING THE S/G CHANNEL HEADS TO CONTAINMENT ATMOSPHERIC PRESSURE, THE RCS LEVEL WILL DECREASE. MAINTAIN THE REACTOR VESSEL LEVEL AT THE DESIRED LEVEL BY: OPEN CV-112B CHG PUMP SUCTION FROM RWST, TEMPORARILY SECURING LETDOWN BY SHUTTING CV-135 LETDOWN PCV, AND UTILIZE A CHARGING PUMP TO MAINTAIN RV LEVEL AT THE DESIRED LEVEL. DO NOT ALLOW RV LEVEL TO DECREASE TO <60%. WHEN VENTING IS COMPLETE, RETURN THE LETDOWN AND CHARGING LINEUP TO AS FOUND.**

5.26 Vent the RCS to containment atmospheric pressure.

5.26.1 Shut the PRT N_2 supply valve RC-595. Shut _____

NOTE: ***The presence of water in the vent line may inhibit venting. Check for water in the Tygon hose downstream of RC-590. Drain as necessary.***

5.26.2 Vent the PRT and the RCS to the purge exhaust by opening RC-585. Open _____

5.26.3 If it is desired to speed up the venting process, perform the following. If not required, N/A Steps a-e.

a. Open RC-589 to vent the PRT to the purge exhaust system. _____

b. Verify the head vent standpipe is drained via RC-588. _____

c. Open RC-575C standpipe manual isolation valve. _____

d. Open RC-575B standpipe solenoid valve at C-20. _____

INITIALS

e. When venting is complete, shut the following:

RC-589	Shut	_____
RC-575C	Shut	_____
RC-575B	Shut	_____

*NOTE: **Verification of redundant decay heat removal capability is required on only the initial drain down after shutdown. If verification was previously completed at the specified flow rate and temperature, then N/A all of step 5.27.***

5.27 Prior to opening or allowing maintenance on the RCS, verify single train (redundant) decay heat removal capability.

Verify redundant decay heat removal capability to maintain the RCS at ≤ the desired temperature at ≤ the specified RHR flow. Reference Precaution and Limitations 3.11.

5.27.1 For a refueling shutdown, demonstrate the ability to maintain the RCS temperature ≤ 140°F at ≤1,500 gpm RHR flow as follows.

OR

5.27.2 For a cold shutdown, demonstrate the ability to maintain the RCS temperature ≤ 160°F at ≤ 1,500 gpm RHR flow as follows.

a. If not previously done, reduce RHR trains to only one in operation. _____

b. Shut the RHR HX bypass valve, RH-626. _____

c. Shut the idle RHR train's HX outlet valve, RH-624 or RH-625. _____

d. Set RHR flow to 1,500 gpm. _____

INITIALS

e. Shut the idle train's RHR HX CCW inlet valve CC-738A or CC-738B. _____

f. If required, set the active train's RHR HX CCW throttle valve CC-824A or CC-824B at design flow (40° open). _____

g. If required, set the CCW HX service water flow @ ~4 psid for the CCW HXs lined up to the unit shutdown. _____

NOTE: ***If leakby is suspected on RH-626, the valve may be manually isolated for this test by shutting RH-714A or RH-714B, the inlet or outlet isolation for RH-626.***

NOTE: ***If leakby is suspected on the idle RHR loop HX flow control valve (RH-624 or RH-625), the idle train may be manually isolated by shutting RH-716A or RH-716B. A designated operator is required to open this valve in the event of failure of the active RHR train.***

h. Verify that one train of RHR is able to maintain the RCS at ≤ 140°F for a refueling shutdown (≤ 160°F for a cold shutdown). _____

5.27.3 Realign the RHR system.

a. Verify both RHR HX CCW throttle valves CC-824A and CC-824B set at 30° open. _____

b. Open the idle train's RHR HX CCW inlet valve CC-738A or CC-738B. _____

c. Verify open the idle RHR train's HX flow control valve manual isolation RH-716A or RH-716B. _____

d. Verify open the manual isolation valves for RH-626, RH-714A, and RH-714B. _____

INITIALS

e. Set RHR flow to 1,500 ± 100 gpm and adjust RH-624, RH-625, and RH-626 as required to maintain the desired temperature. _____

f. If required, reduce service water flow through the CCW Hxs to maintain the desired CCW/RHR temp. _____

5.28 Maintain RHR flow at 1000-1500 gpm. _____

*NOTE: **The local level indicator, LI-447B, should only be valved in when taking a reading. After taking a reading it should be valved out by shutting RC-522A.***

*NOTE: **There is a 3 1/2" offset between the indicator on LI-447B and actual level. The scale on LI-447B is set to account for this so level can be read directly from the scale. If a Tygon tube is used to measure level, you must use the tape on the wall or subtract 3 1/2" if you use the scale attached to LI-447B.***

*NOTE: **RC-524 should have been opened during the performance of CL-4D or CL-4D Appendix A and seal injection to RCPs should have been secured in previous Step 5.25.***

5.29 Place the reactor vessel level local indicator LI-447B in service by securing seal injection to B RCP Unit 1 (A RCP Unit 2) and opening RC-524, RC-523, and RC-522A. _____

*NOTE: **Abrupt starting/stopping the venting/draining of LT-447/LT-447A can adversely affect their calibration.***

5.30 With RCS at atmospheric pressure, compare LI-447/447A indicated level to local level. Reference attached Table 1 for level cross reference values. Use computer addresses LT-447 and YXLT-447A if available.

5.30.1 If LI-447B agrees with LI-447/447A within 3% (3"), then indications are satisfactory. _____

5.30.2 If LI-447B does not agree with LI-447/447A within 3% (3"), then vent and purge the air and liquid sides of LI-447/447A. _____

REFERENCE USE

INITIALS

5.30.3 If, after venting and purging LI-447/447A, they still do not agree with LI-447B, with 3% (3"), then request I&C to perform a calibration check of LI-447/447A. _____

5.31 Valve out LI-447B by shutting RC-522A. Shut _____

5.32 RHR Letdown and Charging Valve Alignment

NOTE: ***Letdown flow control should be with CV-135. RHR letdown isolation valves, RH-715C and CV-369A should be wide open and not used as throttle valves.***

NOTE: ***A normal charging path through at least one charging pump should be maintained when the charging pumps are secured.***

5.32.1 Verify letdown flow is bypassing the VCT as follows:

CV-110B Open _____

CV-110C Open _____

CV-256A VCT Inlet Isolation Shut _____

5.32.2 Position the letdown divert valve, CV-112A, to the "VCT" position. _____

NOTE: ***If a boration of the RCS is to be performed, then N/A the following step because it will be completed after borating.***

5.32.3 Shut CV-256B, divert manual isolation valve. Shut _____

5.32.4 Disable the VCT auto makeup feature with the "Reactor Makeup" switch. _____

5.32.5 Fully open charging flow control valve, CV-142. _____

5.32.6 Secure any operating charging pumps. _____

INITIALS

*NOTE: **Interlock between CV-112B&C prevents the closure of the VCT outlet, CV-112C, unless the emergency makeup, CV-112B, is not fully closed.***

5.32.7 Shut the VCT outlet MOV CV-112C as follows:

a. Momentarily open CV-112B. _____

b. Shut CV-112C. _____

c. Shut CV-112B. _____

5.32.8 Adjust CV-115 for the desired purification flow rate. _____

5.32.9 Verify that letdown flow equals charging flow by control board indication. _____

*NOTE: **If boration of the RCS has been completed or is not required, then N/A steps 5.33.1 through 5.33.13.***

5.33 Borate the RCS and RHR system to a refueling shutdown concentration, if required, using the following method.

5.33.1 Determine the total gallons of boric acid required to raise RCS boron concentration from the present value to 2000 ppm using the 300°F blender table.

Present Boron Conc. _____ppm

V_0 = _____gal. _____

5.33.2 Calculate an adjusted volume (V_1).

$$V_1 = 0.52 \times \frac{3.75}{C_{BAT}} \times V_0$$

Where C_{BAT} is the present boric acid concentration in % of the BAT to be used.

V_1 = _____gal. _____

INITIALS

5.33.3 Align the auxiliary charging line for service, then open auxiliary charging valve, CV-1296, and shut normal charging valve, CV-1298. _____

*NOTE: **Record the following:***

BAT START LEVEL _____ %
BORIC ACID TOTALIZER START _____ gal. _____

*NOTE: **Allow reactor vessel level to increase while borating the RCS.***

5.33.4 Borate V_1 gallons of boric acid to the RCS while maintaining at least a two-to-one ratio of letdown flow to boric acid flow. _____

*NOTE: **Record the following:***

BAT STOP LEVEL _____ %
BORIC ACID TOTALIZER STOP _____ gal. _____

5.33.5 Operate each RHR train, individually or simultaneously, for at least 30 minutes after boration to equilibrate the RCS with the RHR system. _____

5.33.6 Sample the RCS for current boron concentration.
_____ ppm _____

5.33.7 If required, and using V_1 as a guide, add additional boric acid to bring RCS/RHR system to >2000 ppm.
_____ gal. _____

5.33.8 Return to the normal charging path and secure auxiliary charging. _____

INITIALS

CAUTION **IF, DURING THE PERFORMANCE OF THIS EVOLUTION, RHR COOLING BECOMES IMPAIRED OR LOST, REDUCE RHR FLOW TO 1000 ±100 GPM, SECURE DRAINING AND PROCEED TO SEP-1, "DEGRADED RHR SYSTEM CAPABILITY."**

5.33.9 Adjust RHR flow to 1500 ±100 gpm. _____

5.33.10 Drain the RCS to desired level (but not ≤55%) on LI-447/LI-447A, by diverting to the HUT via CV-112A and controlling divert rate with CV-135. _____

5.33.11 When at desired level (but not ≤55%), position CV-112 to the VCT position and shut divert line manual isolation, CV-256B. _____

5.33.12 Maintain RHR flow at 1000-1500 gpm. _____

5.33.13 Adjust letdown flow with CV-135 to obtain the desired purification flow. Verify that letdown flow equals charging flow by control board indication. _____

5.34 Set the reactor vessel level high alarm 3% above actual level for LC-447/447A.

LC-447 3% above actual level _____

LC-447A 3% above actual level _____

5.35 Shut/check shut boric acid flow control valve CV-110A by placing the control switch on C04 in the close position. _____

5.36 Shut the S/G channel head vents to the PRT:

RC-545C Shut _____

RC-546C Shut _____

RC-547C Shut _____

RC-548C Shut _____

INITIALS

5.37 After Maintenance has removed:

Reactor head vent system spoolpiece _____

AND

Blank flange between RC-576 and RC-577 _____

Then clear the red tags and shut the following valves:

RC-570A	Reactor vessel head vent solenoid valve	_____
RC-570B	Reactor vessel head vent solenoid valve	_____
RC-580A	Pressurizer vent isolation valve	_____
RC-580B	Pressurizer vent isolation valve	_____
RC-575A	Combine gas vent to PRT SOV	_____

5.38 Further reactor vessel level adjustments should be per OP-5A, Section B. Recovery from a condition that has caused or could lead to inadequate core cooling must be per SEP-1 Degraded RHR System Capability.

5.39 As soon as practical, start processing the drain down water in the CVCS HUT to increase the boron concentration to ~2000 ppm so it can be used to refill the RWST/cavity.

TABLE 1
REACTOR VESSEL LEVEL COMPARISON TABLE

	Elevation	LI-447/447A	LI-447B or Tygon
NIS top hats	41' 3"	96.1%	96 1/8"
Incore seal table	41' 2"	95.1%	95 1/8"
Steam generator tubesheet bottom	41' 1 1/2"	>94.6%	94 5/8"
Reactor vessel flange	40' 8"	89.1%	89 1/8"
RCP volute flange	38' 3"	60.1%	60 1/8"
Steam generator channel head	36' 2 1/2"	35.6%	35 5/8"
Reactor vessel Th nozzle top	35' 7 3/8"	29.0%	29"
Reactor vessel Th nozzle 3/4	35' 5/8"	22.0%	22"
Reactor vessel Th nozzle centerline	34' 5 3/8"	14.5%	14 1/2"
Reactor vessel Th nozzle bottom	33' 2 7/8"	0%	0"

REFERENCE USE

FIGURE 1

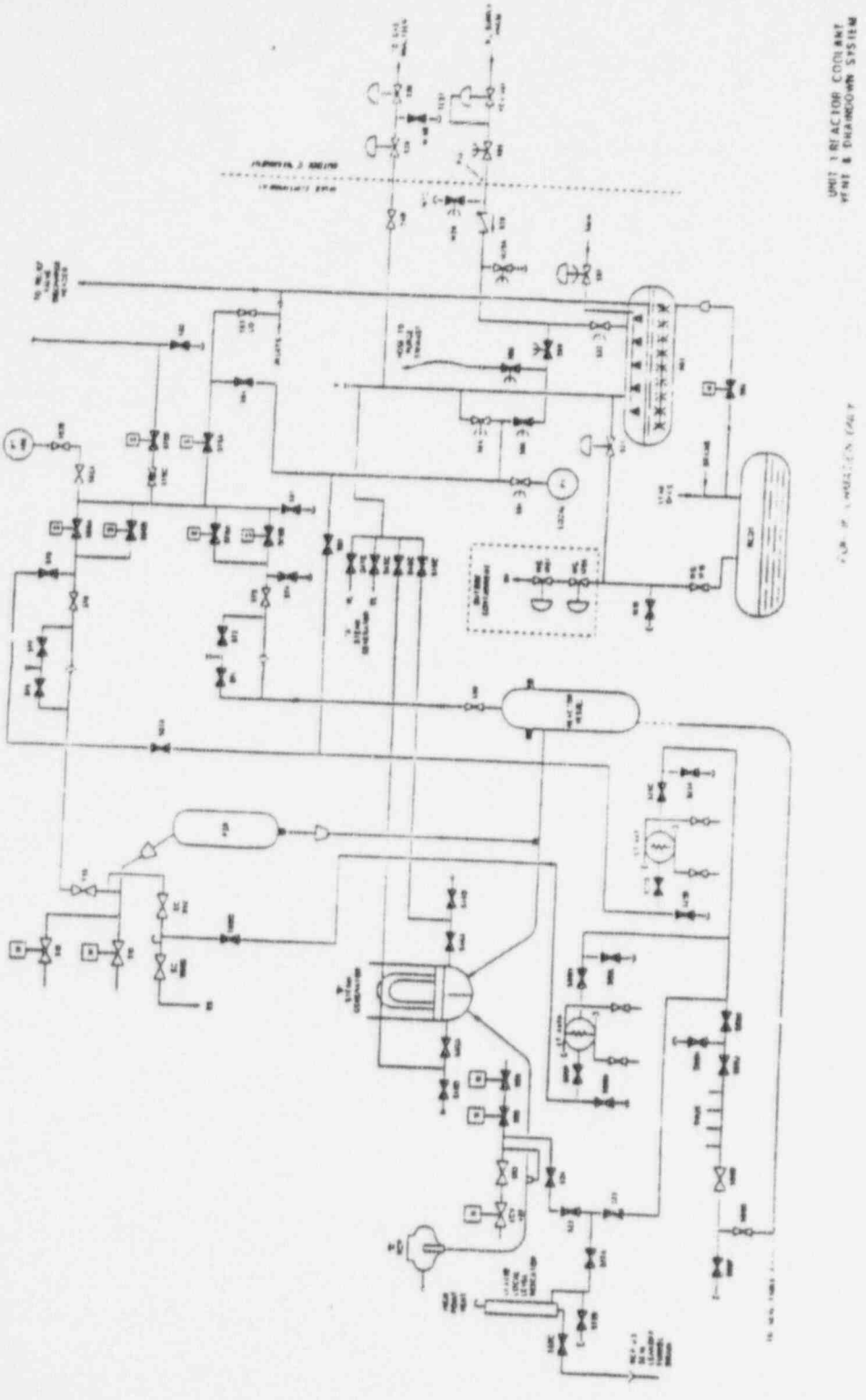

FIGURE 1A