

**PSEG NUCLEAR L.L.C.
SALEM/OPERATIONS**

S1.OP-ST.RC-0008(Q) REV. 23

**REACTOR COOLANT SYSTEM
WATER INVENTORY BALANCE**

USE CATEGORY: **I**

-
- ◆ Biennial Review Performed: Yes ____ No ____ NA ☒
 - ◆ DCP Packages and Affected Document Numbers incorporated into this revision: None
 - ◆ The following OTSCs were incorporated into this revision: None
-

REVISION SUMMARY:

- ◆ Incorporated the following procedure enhancements based on **[70097392 / CRCA 70098383]** information previously reviewed and approved in Engineering procedure ER-AP-331-1003, RC Leakage Monitoring And Action Plan:
 - Added Step 3.22 - Definitions for “Baseline”, “Mean”, “Standard Deviation”, “Action Level 1”, and “Action Level 2”.
 - Attachment 6, changed “Monthly Average” to read “Quarterly Average”, and changed the “monthly values” to read “quarterly values”.

IMPLEMENTATION REQUIREMENTS

Effective Date: October 8, 2009

None

REACTOR COOLANT SYSTEM WATER INVENTORY BALANCE

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1.0 **PURPOSE**

- 1.1 To provide instructions necessary to: **[CM-SC-2008-122] [C0265]**
- 1.1.1 Calculate Unidentified Leakage IAW Technical Specification 3.4.6.2b.
This requirement is applicable in Modes 1-4.
 - 1.1.2 Evaluate Primary to Secondary Leakage (as determined by Chemistry procedures) IAW Technical Specification 3.4.6.2c. This requirement is applicable in Modes 1-4.
 - 1.1.3 Calculate Identified Leakage IAW Technical Specification 3.4.6.2d.
This requirement is applicable in Modes 1-4.
 - 1.1.4 Perform RCS Water Inventory Balance at least once per 72 hours to satisfy Technical Specification 4.4.6.2.d. This requirement is applicable in Modes 1-4 (*).
- 1.2 Perform the Inservice Inspection and Testing of 1RH21, RHR TO RWST STOP VALVE, IAW Technical Specification 4.0.5. This requirement is applicable in Modes 1-4. **[C0611]**
- 1.3 Performance of this procedure is required:
- 1.3.1 At least once per 72 hours in Modes 1-4 (*) to satisfy the requirements of Technical Specification 4.4.6.2.d.
 - 1.3.2 Once per 24 months to verify 1RH21 leak rate is ≤ 2.0 gpm to satisfy the requirements of Technical Specification 4.0.5 (Reference Calculation S-C-RH-SEE-0922 and PR #951220233). **[C0611]**
- (*) The provisions of Technical Specification 4.0.4 are NOT applicable for entry into Mode 4. As delineated in Technical Specification Surveillance Requirement 4.4.6.2, completion of the Reactor Coolant System Water Inventory Balance is NOT required until 12 hours after establishment of steady state operation.

2.0 PREREQUISITES

- ___ 2.1 **ENSURE** Charging, Letdown, and Seal Injection are in service IAW S1.OP-SO.CVC-0001(Q), Charging, Letdown, and Seal Injection.
- ___ 2.2 **ENSURE** Unit is in Mode 1-5 with Pressurizer bubble established.
- ___ 2.3 **ENSURE** Reactor power, Pressurizer level, Pressurizer pressure, and Tavg are stable.
- ___ 2.4 **NOTIFY** Chemistry that Accumulator Sampling System, and RCS Sampling System manipulations are NOT permitted during the RCS Water Inventory Balance.
- ___ 2.5 IF the RCS Water Inventory Balance is to be performed to satisfy the 1RH21 Leak Rate Surveillance requirement in Mode 4 or 5,
THEN ENSURE OPEN the respective RH19 valve for the RHR Pump in service.
- ___ 2.6 IF Plant Computer is used to calculate the RCS Water Inventory Balance,
THEN ENSURE the following computer points are available:
 - ◆ L0112N (L0112A OR L0114A as alternates) - VCT Level
 - ◆ T0140N (T0140A as alternate) - VCT Temperature
 - ◆ TRM1101N (TRM1101B as alternate) - Tavg
 - ◆ PRM0601N (PRM0601B as alternate) - Pressurizer Pressure
 - ◆ LRM0501N (LRM0501B as alternate) - Pressurizer Level
- ___ 2.6.1 Tavg is $\geq 547^{\circ}\text{F}$.
- ___ 2.6.2 All Reactor Coolant Pumps are operating.
- ___ 2.6.3 Pressurizer pressure is stable between 2225 and 2245 psig.

[C0611]

3.0 PRECAUTIONS AND LIMITATIONS

- ___ 3.1 Steps identified with a dollar sign (\$) are those items required to meet Technical Specification acceptance criteria. Such steps, if not satisfactorily completed, may have reportability requirements and should be brought to the immediate attention of the SM/CRS.
- ___ 3.2 Deborating Demineralizer alignment should NOT be changed throughout the duration of this surveillance test.
- ___ 3.3 Instruments monitored for indications of RCS leakage are to be the same for initial and final parameters.
- ___ 3.4 Any Plant computer point used in determining an average value (for example; L0480A, L0481A, L0482A used to determine average Pressurizer level LRM0501B) that is malfunctioning or undergoing testing or calibration is to be removed from scan by Maintenance Controls IAW SC.OP-DL.ZZ-0010(Q), Control Room Instrumentation and Alarms, until the RCS Water Inventory Balance test is completed. Failure to remove malfunctioning points, or points undergoing testing or calibration from scan may invalidate test results.
- ___ 3.5 Negative calculated RCS leak rate results are to be reviewed by SM/CRS to determine validity. Engineering is to be informed if a negative RCS leakrate result is considered valid.
- ___ 3.6 The Salem Station Administrative limit for single Steam Generator Primary to Secondary leakage is 140 gallons per day.
- ___ 3.7 IF a manual RCS Water Inventory Balance is required due to inoperability of the Plant Computer, Tavg <547°F, RCS pressure <2225 psig, or less than 4 RCPs operating, THEN a Plant Computer Primary System Leak Rate should be performed as soon as conditions permit.
- ___ 3.8 IF RHR is in service and all RCPs are secured, THEN manual RCS Water Inventory Balance data should be obtained from the following:
- ◆ Plant Computer point T0630A (RHR Loop 11 operating)
 - ◆ Plant Computer point T0631A (RHR Loop 12 operating)

- ___ 3.9 IF historical data is to be used to determine Primary System Leak Rate,
THEN **VERIFY** the following for the time period the RCS Water Inventory Balance is to be calculated:
- ___ ◆ Sampling of Accumulator Sampling System, and RCS Sampling System manipulations have NOT occurred.
 - ___ ◆ Reactor power, Pressurizer level, Pressurizer pressure, and Tav_g or RCS temperature are stable during the period.
 - ___ ◆ RCDT pumps have NOT run during the period.
 - ___ ◆ PRT pressure and temperature has NOT been adjusted during the period.
- ___ 3.10 IF RCS pressure is <1700 psig,
THEN RCS Pressure should be obtained from:
- ◆ Plant P0499A (RCL SYS PRESS I), P2752A (RCL SYS PRESS II),
Computer: or PRM2027B (RCL SYS PRESS AVG I & II).
 - ◆ Console: 1PI405 (RCS Pressure).
- ___ 3.11 Changes to Pressurizer level should be minimized during performance of this procedure.
- ___ 3.12 Any of the following may invalidate RCS Water Inventory Balance test results requiring restart of test:
- ◆ Makeup to the VCT
 - ◆ Chemical addition to the RCS
 - ◆ Changes in CVCS Demineralizer or Filter alignments
 - ◆ Letdown diversion to CVCS Holdup Tanks
 - ◆ Filling venting, or draining Pressurizer Relief Tank (during PRT leakrate)
 - ◆ Pressurizer level change is greater than 0.5% from initial to final data points
 - ◆ Tav_g temperature change is greater than 0.5° F from initial to final data points
 - ◆ Reactor Thermal Power change is greater than 3.4 MW_{th} (0.1%) from initial to final data points (*preferred*) OR Reactor Power change is greater than 0.5% from initial to final data points (*alternate*) [applicable in Modes 1 and 2 only]
 - ◆ Reactor Coolant Drain Tank pump down (during RCDT leakrate)
 - ◆ Failure of Plant Computer during Primary System Leak Rate
 - ◆ Failure of Plant Computer point used in Primary System Leak Rate
 - ◆ Changes in RCS (RCP starts, RHR Pump starts, HX alignment, etc.)
 - ◆ Filling RCP Standpipe(s)
 - ◆ Starting Safety Injection Pump(s)
 - ◆ Starting RHR Pump(s)
 - ◆ Filling Safety Injection Accumulator(s)
 - ◆ Automatic or Manual Start of the Primary Water Pump(s) (except to adjust PRT after leakrate IAW S1.OP-SO.PZR-0003(Q), Pressurizer Relief Tank Operations)

___ 3.13 Double isolation (1WR80 and 1WR82 closed) of the Primary Water source is required to ensure isolation of this NON-RCS source of leakage to the PRT. In addition, the Primary Water Pumps will not be operated during the PRT leakrate to ensure no lifting of the valves from their seats.

___ 3.14 The Shift Manager shall notify the Shift Operations Manager for communication to the Operations Director within 24 hours of any of the following:

◆ Referring to Attachment 6, RCS Leakrate Trending Data Sheet:

Absolute Action Levels:

- o Any seven (7) day rolling average of Unidentified RCS Leakrate exceeds 0.10 gpm, or
- o Any two (2) of three (3) consecutive RCS Unidentified leakrates exceed 0.15 gpm, or
- o Any RCS Unidentified leakrate exceeds 0.30 gpm, or
- o Any unexpected measurable, confirmed rise in RCS Unidentified leakrate as determined by the SM/CRS.

Deviation from Baseline Mean (Monthly Average) Action Levels:

- o Any nine (9) consecutive RCS Unidentified leakrates exceed the Monthly Average, or
- o Any two (2) of three (3) consecutive RCS Unidentified leakrates exceed the Action Level I value, or
- o Any RCS Unidentified leakrate exceeds the Action Level II value.

◆ PRT in-leakage ≥ 0.5 gpm*

- * Each 0.25 gpm rise above 0.5 gpm requires the notification process to continue. Should the leakage experience a prompt rise over a short duration (for example: a rise from 1.2 gpm to 1.45 gpm over a 24 hour period), then all means shall be utilized to determine the validity of the rise in leakage. This would include, but not limited to, using redundant indications and re-performance of the leak rate calculation.

The above indicated criteria is to be utilized for trending only. Exceeding ANY of the above indicated parameters or action levels does NOT impact Reactor Coolant System Operational Leakage as delineated in Technical Specification 3.4.6.2.

___ 3.15 A routine RCS Water Inventory Balance that is performed to satisfy Technical Specification Surveillance Requirement 4.4.6.2.d should normally be performed over a two hour duration.

- ___ 3.16 IF an RCS Water Inventory Balance is to be performed for reasons other than to satisfy the requirements of Technical Specification Surveillance Requirement 4.4.6.2.d, THEN the time interval of the RCS Water Inventory Balance may be determined at the discretion of the SM/CRS.
- ___ 3.17 IF conditions require performance of an RCS Water Inventory Balance over a time interval of less than two hours AND the leakrate will be utilized to satisfy the requirements of Technical Specification Surveillance Requirement 4.4.6.2.d, THEN Section 5.1 of this procedure should be performed in parallel with Section 5.2. While the RCS Leakrate test data obtained in Section 5.1 may NOT be used to satisfy the requirements of Technical Specification 4.4.6.2.d, performance of a Plant Computer RCS Water Inventory Balance will be useful in validating the abbreviated RCS Leakrate. When Section 5.1 is performed in support on abbreviated RCS Leakrate, test data should be forwarded to System Engineering.
- ___ 3.18 RCS Leakrates should NOT be performed over a time interval of less than 30 minutes.
- ___ 3.19 Technical Specification 4.4.6.2.d (*) provides guidance indicating performance of the Reactor Coolant System Water Inventory Balance is NOT required to be completed until 12 hours after establishment of steady state operation. Based on this guidance, it is permissible to change Modes without a current RCS leakrate provided the requirement to perform a RCS leakrate within 12 hours of establishment of steady state conditions is complied with.

As delineated in the Bases for Technical Specification 3/4.4.6.2, Reactor Coolant System Operational Leakage, for RCS operational leakage determination by water inventory balance, steady state operation is defined as stable RCS pressure, temperature, power level, pressurizer and makeup tank levels, makeup and letdown, and Reactor Coolant Pump seal injection and return flows.

- ___ 3.20 During performance of the RCS Water Inventory Balance, manipulation of CFCUs (e.g., starting and stopping CFCUs, performing CFCU flushes, etc.) should be minimized to ensure consistent RCS Leakrate test results. Experience has indicated the potential for elevated RCS Leakrate conditions exist when CFCUs are manipulated during performance of the RCS Water Inventory Balance.

___ 3.21 When calculating the RCS Unidentified Leakrate Seven (7) Day Rolling Average IAW Attachment 7, the following guidance should be utilized: [WCAP-16465-NP]

- ___ ◆ ANY negative RCS Unidentified Leakrate (ULR) values should be set to 0.0 gpm prior to performing the average.
- ___ ◆ ANY missing RCS Unidentified Leakrate (ULR) values for a specific day should be set to the value recorded for the previous day.

___ 3.22 Definitions:

- ◆ **Baseline** - A normal, steady state value for a given plant condition. The RCS Leakrate is the mean and standard deviation value based on one operating quarter. The historical baseline should be recalculated at the end of each quarter for use in the next quarter.
- ◆ **Mean** - Average.
- ◆ **Standard Deviation** - Measure of the degree of dispersion of the data from the mean value.
- ◆ **Action Level 1** - Baseline mean plus two (2) times the standard deviation.
- ◆ **Action Level 2** - Baseline mean plus three (3) times the standard deviation.

4.0 EQUIPMENT/MATERIAL REQUIRED

4.1 Calculator

5.0 **PROCEDURE**5.1 **Plant Computer RCS Water Inventory Balance****NOTE**

Section 5.1 is **NOT** to be performed to satisfy Technical Specification 4.4.6.2.d **OR** 4.0.5 for 1RH21. This Section may only be used for operator trending [Order 80023756 (70031764) to update and validate Plant Computer program].

- ___ 5.1.1 **IF** automatic RCDT pump start appears imminent during test,
THEN PUMP RCDT to minimum level IAW S1.OP-SO.WL-0005(Q),
Reactor Coolant Drain Tank Operation.
- ___ 5.1.2 **IF** makeup to the VCT appears imminent during test,
THEN ADJUST VCT level and pressure IAW S1.OP-SO.CVC-0006(Q),
Boron Concentration Control.
- ___ 5.1.3 **IF** PRT level, pressure, or temperature adjustments are required prior to
the start of the test,
THEN:
 - ___ A. **ADJUST** PRT parameters IAW S1.OP-SO.PZR-0003(Q),
Pressurizer Relief Tank Operations.
 - ___ B. **WAIT** at least 15 minutes for the PRT parameters to stabilize.
- ___ 5.1.4 **ENSURE CLOSED** the following valves:
 - ___ ◆ 1WR80, CONT PRI WATER STOP
 - ___ ◆ 1WR82, PRT WATER SUPPLY
- ___ 5.1.5 **ENSURE** both Primary Water Pumps are **NOT** running.
- ___ 5.1.6 **ENSURE** 1CV134 is selected to FLOW TO VCT position.
- ___ 5.1.7 **ENSURE AT LEAST ONE** of the following conditions exists:
 - ___ ◆ 1CV35 is selected to the MANUAL FLOW TO VCT position.
 - OR**
 - ___ ◆ VCT level is adequate to preclude Automatic High Level Divert of 1CV35
for duration of RCS Water Inventory Balance.

- ___ 5.1.8 **START** the Primary System Leak Rate on the Plant Computer as follows:
 - ___ A. Using the mouse left button, **DOUBLE CLICK-ON** the "PROCESS DIAGRAM *W1" icon.
 - ___ B. Using the mouse left button, **CLICK-ON** "PAGE" from the top menu bar.
 - ___ C. Using the mouse left button, **CLICK-ON** "PRIM SYS LEAK RATE" from the Application Programs screen.
 - ___ D. At the desired test time, **CLICK-ON** "TOGGLE" using the mouse left button to START test.
- ___ 5.1.9 **RECORD** Initial Data on Attachment 1, Sections 2.0 and 4.0.
- ___ 5.1.10 IF the PRT OR RCDT leakrate is to be captured and the system returned for normal operation prior to RCS Water Inventory Balance Test Data completion, THEN:
 - ___ A. **RECORD** Final Data on Attachment 1, Sections 2.0 or 4.0.
 - ___ B. **OPERATE** the Primary Water Pumps as required to adjust the PRT parameters IAW S1.OP-SO.PZR-0003(Q), Pressurizer Relief Tank Operations.
- ___ 5.1.11 IF this test is being performed for routine RCS Water Inventory Balance calculation, THEN OBTAIN most recent Primary to Secondary Leak Rate from Chemistry and **RECORD** on Attachment 3, Step 2.E.
- ___ 5.1.12 IF this test is being performed due to unexpected or unexplained increase in RCS leakage, THEN:
 - ___ ◆ Direct Chemistry to calculate Primary to Secondary Leak Rate and **RECORD** on Attachment 3, Step 2.E.
 - ___ ◆ Direct Radiation Protection to **MONITOR** 1R11A/1R12A and report results to SM/CRS.
 - ___ ◆ **INITIATE** S1.OP-SO.RC-0004(Q), Identifying and Measuring Leakage.
- ___ 5.1.13 When required time has elapsed since initiating RCS Water Inventory Balance, **ENSURE** the following Plant Computer points are available:
 - ___ ◆ L0112N (L0112A OR L0114A as alternates) - VCT Level
 - ___ ◆ T0140N (T0140A as alternate) - VCT Temperature
 - ___ ◆ TRM1101N (TRM1101B as alternate) - Tavg
 - ___ ◆ PRM0601N (PRM0601B as alternate) - Pressurizer Pressure
 - ___ ◆ LRM0501N (LRM0501B as alternate) - Pressurizer Level

___ 5.1.14 When the following conditions exist,

- ◆ Reactor Thermal Power is within 3.4 MW_{th} of initial power as indicated on QPP0004T, Reactor Thermal Output - Ten Minute Average (*preferred*) OR Reactor Power is within 0.5% of initial power as indicated on either NRM0401N PR Nuclear Chan Avg Q 1M Avg, or N41-N44 (*alternate*) [applicable in Modes 1 and 2 only], and
- ◆ Final RCS Tavg is within $\pm 0.5^{\circ}\text{F}$ of initial Tavg, and
- ◆ Pressurizer pressure is between 2225 and 2245 psig, and
- ◆ Pressurizer level is within 0.5% of initial level.

PERFORM the following:

___ A. **CLICK-ON** "TOGGLE", using the mouse left button to STOP test.

___ B. **OBTAIN** the Computer Leak Rate printout from the Sequence of Events printer which will automatically print when the RCS Water Inventory Balance is stopped.

OR

___ C. **PRINT** Test Results by moving cursor to the screens Blue Background Field and press the mouse right button, then **SELECT** Screen Print.

___ 5.1.15 **RECORD** Leak Rate results on Attachment 3, Section 1.0.

___ 5.1.16 IF the PRT AND RCDT are NOT returned to service, THEN **RECORD** Final Data on Attachment 1, Sections 2.0 and 4.0.

___ 5.1.17 **PLACE** 1CV35, VCT 3 WAY INLET VALVE, in AUTO.

___ 5.1.18 **OPERATE** the Primary Water Pumps as required to support current plant evolutions.

___ 5.1.19 **NOTIFY** Chemistry that all sampling may resume.

___ 5.1.20 **COMPLETE** Attachment 1, PRT and RCDT Data.

___ 5.1.21 **COMPLETE** Attachment 3, RCS Water Inventory Balance Calculation Sheet.

___ 5.1.22 **ATTACH** the completed RCS Water Inventory Balance test printout to this procedure.

___ 5.1.23 **DIRECT** a second Operator to perform Independent Verification of all calculations performed in this procedure.

[C0284]

5.2 **Manually Calculated RCS Water Inventory Balance**

- ___ 5.2.1 **IF** Automatic RCDT pump start appears imminent during test,
THEN **PUMP** RCDT to minimum level IAW S1.OP-SO.WL-0005(Q),
Reactor Coolant Drain Tank Operation.

- ___ 5.2.2 **IF** makeup to the VCT appears imminent during test,
THEN **ADJUST** VCT level and pressure IAW S1.OP-SO.CVC-0006(Q),
Boron Concentration Control.

- ___ 5.2.3 **IF** PRT level, pressure, or temperature adjustments are required prior to
the start of the test,
THEN:
 - ___ A. **ADJUST** PRT parameters IAW S1.OP-SO.PZR-0003(Q),
Pressurizer Relief Tank Operations.

 - ___ B. **WAIT** at least 15 minutes for the PRT parameters to stabilize.

- ___ 5.2.4 **ENSURE** CLOSED the following valves:
 - ___ ◆ 1WR80, CONT PRI WATER STOP

 - ___ ◆ 1WR82, PRT WATER SUPPLY

- ___ 5.2.5 **ENSURE** both Primary Water Pumps are stopped.

- ___ 5.2.6 **ENSURE** 1CV134 is selected to FLOW TO VCT position.

- ___ 5.2.7 **ENSURE** AT LEAST ONE of the following conditions exists:
 - ___ ◆ 1CV35 is selected to the MANUAL FLOW TO VCT position.

 - OR

 - ___ ◆ VCT level is adequate to preclude Automatic High Level Divert of 1CV35
for duration of RCS Water Inventory Balance.

- ___ 5.2.8 **RECORD** Initial Data on Attachment 1, Sections 2.0 and 4.0, and Attachment 2.

- ___ 5.2.9 **IF** the PRT OR RCDT leakrate is to be captured and the system returned for
normal operation prior to RCS Water Inventory Balance Test Data completion,
THEN:
 - ___ A. **RECORD** Final Data on Attachment 1, Sections 2.0 or 4.0.

 - ___ B. **OPERATE** the Primary Water Pumps as required to adjust the PRT
parameters IAW S1.OP-SO.PZR-0003(Q), Pressurizer Relief
Tank Operations.

- ___ 5.2.10 IF this test is being performed for routine RCS Water Inventory Balance calculation, THEN **OBTAIN** most recent Primary to Secondary Leak Rate from Chemistry AND **RECORD** on Attachment 3, Step 2.E.
- ___ 5.2.11 IF this test is being performed due to unexpected or unexplained increase in RCS leakage, THEN:
- ___ ♦ Direct Chemistry to calculate Primary to Secondary Leak Rate and **RECORD** on Attachment 3, Step 2.E.
- ___ ♦ **INITIATE** S1.OP-SO.RC-0004(Q), Identifying and Measuring Leakage.
- ___ 5.2.12 When required time has elapsed, AND the following conditions exist,
- ___ ♦ Reactor Thermal Power is within 3.4 MW_{th} of initial power as indicated on QPP0004T, Reactor Thermal Output - Ten Minute Average (*preferred*) OR Reactor Power is within 0.5% of initial power as indicated on either NRM0401N PR Nuclear Chan Avg Q 1M Avg, or N41-N44 (*alternate*) [applicable in Modes 1 and 2 only], and
- ___ ♦ Final RCS Tav_g is within ±0.5°F of initial Tav_g, and
- ___ ♦ Pressurizer pressure is within 10 psig of initial pressure, and
- ___ ♦ Pressurizer level is within 0.5% of initial level.
- RECORD** Final Data on Attachment 2.
- ___ 5.2.13 IF the PRT AND RCDT are NOT returned to service, THEN **RECORD** Final Data on Attachment 1, Sections 2.0 and 4.0.
- ___ 5.2.14 **PLACE** 1CV35, VCT 3 WAY INLET VALVE, in AUTO.
- ___ 5.2.15 **OPERATE** the Primary Water Pumps as required to support current plant evolutions.
- ___ 5.2.16 **NOTIFY** Chemistry that all sampling may resume.
- ___ 5.2.17 **COMPLETE** Attachments 1, 2, 3, and 4 or 5 as applicable.
- ___ 5.2.18 IF Attachment 5 was used, THEN **ATTACH** the completed Desktop Mass Leak Rate Correction printout to this procedure.
- ___ 5.2.19 **DIRECT** a second Operator to perform Independent Verification of all calculations performed in this procedure. [C0284]

5.3 **Acceptance Criteria**

____ § 5.3.1 This surveillance is satisfactory when applicable sections of Attachment 3 are completed with all equipment listed meeting Acceptance Criteria stated in Attachment 3.

OR

____ 5.3.2 This surveillance is unsatisfactory.

____ A. **INITIATE** Notification(s) to correct the unsatisfactory condition(s).

____ B. **RECORD** Notification number(s), AND reason for unsatisfactory completion on Attachment 8 in the Comments section.

5.4 **Completion and Review**

- ___ 5.4.1 **COMPLETE** Attachment 8, Sections 1.0 and 2.0, **AND FORWARD** this procedure to the SM/CRS for review.
- ___ 5.4.2 **PERFORM** the following to trend the Reactor Coolant System Leak Rate:
- ___ A. **RECORD** the following on the Attachment 6 located in the “*Salem 1 Monthly RCS Leakrate*” binder:
- ◆ Date
 - ◆ Identified Leak Rate from Attachment 3, Line 3.0
 - ◆ Unidentified Leakrate from Attachment 3, Line 4.C
 - ◆ RCDT Inleakage from Attachment 3, Line 5.0

NOTE

The following guidance should be utilized when calculating the RCS Unidentified Leakrate Seven (7) Day Rolling Average: **[WCAP-16465-NP]**

- ◆ ANY negative RCS Unidentified Leakrate values should be set to 0.0 gpm prior to performing the average.
- ◆ ANY missing RCS Unidentified Leakrate values for a specific day should be set to the value recorded for the previous day.

- ___ B. **RECORD** the following on Attachment 7, RCS Unidentified Leakrate Seven (7) Day Rolling Average Calculation Data Sheet:
- ◆ The previous six (6) days of RCS Unidentified Leakrates from Attachment 6, Reactor Coolant System Leak Rate Trending Data Sheet **AND** associated date(s).
 - ◆ Unidentified Leakrate from Attachment 3, Line 4.C
- ___ C. **CALCULATE** the Seven (7) Day Rolling Average for the RCS Unidentified Leakrate IAW Attachment 7, RCS Unidentified Leakrate Seven (7) Day Rolling Average Calculation Data Sheet.
- ___ D. **PERFORM** Independent Verification of the Seven (7) Day Rolling Average RCS Unidentified Leakrate calculation IAW Attachment 7, RCS Unidentified Leakrate Seven (7) Day Rolling Average Calculation Data Sheet.
- ___ E. **RECORD** the Seven (7) Day Rolling Average RCS Unidentified Leakrate on the Attachment 6 located in the “*Salem 1 Monthly RCS Leakrate*” binder:

(continued on next page)

5.4.2 (continued)

NOTE

- ◆ The indicated criteria is to be utilized for trending purposes only. Exceeding ANY of the indicated parameters or action levels does NOT impact Reactor Coolant System Operational Leakage as delineated in Technical Specification 3.4.6.2. Based on the severity of the elevated RCS Leakrate condition, System Engineering will determine any additional corrective actions, if applicable.
- ◆ When a notification was previously submitted documenting a similar elevated RCS leakrate condition, then initiation of an additional notification is NOT required, however, the Notification number(s) of the previously identified condition should be recorded on Attachment 8 in the Comments Section.

- F. IF ANY of the following conditions are met (referring to Attachment 6), THEN ENSURE a notification to System Engineering documenting the elevated RCS Leakrate condition is initiated:

Absolute Action Levels:

- ◆ Any seven (7) day rolling average of Unidentified RCS Leakrate exceeds 0.10 gpm, or
- ◆ Any two (2) of three (3) consecutive RCS Unidentified leakrates exceed 0.15 gpm, or
- ◆ Any RCS Unidentified leakrate exceeds 0.30 gpm, or
- ◆ Any unexpected measurable, confirmed rise in RCS Unidentified leakrate as determined by the SM/CRS.

Deviation from Baseline Mean (Monthly Average) Action Levels:

- ◆ Any nine (9) consecutive RCS Unidentified leakrates exceed the Monthly Average, or
- ◆ Any two (2) of three (3) consecutive RCS Unidentified leakrates exceed the Action Level I value, or
- ◆ Any RCS Unidentified leakrate exceeds the Action Level II value.

(continued on next page)

5.4.2 (continued)

___ G. IF a notification is initiated to document ANY of the above conditions,
THEN

___ 1. **RECORD** Notification number(s) on Attachment 8
in the Comments Section.

___ 2. **EVALUATE** performance of S1.OP-SO.RC-0004(Q), Identifying
and Measuring Leakage, based on review of the following parameters:

___ ♦ Changes in RCDT Inleakage, or

___ ♦ Recent Plant Manipulations (e.g., shifting to Excess Letdown,
shifting CVC Pumps which results in VCT and CVC
temperature changes , etc.), or

___ ♦ Fluctuations in CCW temperature or river temperatures.

___ 5.4.3 IF plant transient conditions required performance of an abbreviated
Reactor Coolant System Water Inventory Balance (i.e., less than two hours),
THEN **RECORD** the following on Attachment 8 in the Comments Section:

___ ♦ Date and Test Results of the last performed S1.OP-ST.RC-0008(Q)

___ ♦ Description of Transient Condition and an Expected Time establishment
of steady state conditions achieved allowing performance of a RCS Leakrate.

___ ♦ Any additional pertinent information as deemed appropriate by
the SM/CRS (e.g., status of RCS leakrate instrumentation as identified
in Technical Specification 3.4.6.1, recent S1.OP-PT.CAN-0001(Q)
Containment Walkdown results, Results of the Plant Computer RCS
Water Inventory Balance, etc.).

- ___ 5.4.4 SM/CRS **PERFORM** the following:
- ___ A. **REVIEW** this procedure with Attachments 1- 8 for completeness and accuracy.
- ___ B. IF ANY Evaluation Result is UNSAT for applicable Mode, THEN ENTER applicable Technical Specification Action Statement(s).
- ___ C. **COMPLETE** Attachment 8, Section 3.0.
- ___ D. IF 1RH21 Leak Rate is performed, THEN PLACE this procedure in the IST IMPLEMENTATION ENGINEER REVIEW REQUIRED mail slot.
- ___ E. IF 1RH21 Leak Rate is NOT performed, THEN:
- ___ 1. **RECORD** N/A on Attachment 8, Section 4.0.
- ___ 2. **FORWARD** completed procedure to Operations Staff.

END OF PROCEDURE SECTION

6.0 **RECORDS**

6.1 Retain the following IAW RM-AA-101, Records Management Program:

- Attachment 1
- Attachment 2 (as applicable)
- Attachment 3
- Attachment 4
- Attachment 5
- Attachment 7
- Attachment 8
- Primary System Leak Rate Hard Copy (as applicable)

7.0 **REFERENCES**

7.1 **Updated Final Safety Analysis Report:**

- 7.1.1 Section 15.2.12, Accidental Depressurization of the RCS
- 7.1.2 Section 15.3.1, Loss of Reactor Coolant
- 7.1.3 Appendix A, TMI Lessons Learned, 2.1.6.a, Leakage Outside Containment

7.2 **Technical Specifications - Unit 1:**

- 7.2.1 3.4.6.1, Leakage Detection Systems
- 7.2.2 3.4.6.2, Operational Leakage
- 7.2.3 4.0.5, Inservice Testing and Inspection

7.3 **Procedures:**

- 7.3.1 ER-AA-321, Administrative Requirements for Inservice Testing
- 7.3.2 S1.OP-AB.RC-0001(Q), Reactor Coolant System Leak
- 7.3.3 S1.OP-AB.SG-0001(Q), Steam Generator Tube Leak
- 7.3.4 S1.OP-SO.WL-0005(Q), Reactor Coolant Drain Tank Operation

7.4 **Drawings:**

- 7.4.1 205228, No. 1 Unit Chemical and Volume Control System P&ID
- 7.4.2 205201, No. 1 Unit Reactor Coolant System P&ID
- 7.4.3 220403, No. 1 and No. 2 Units CVCS

7.5 **Others:**

- 7.5.1 Event Classification Guide:
 - A. Section 1, Primary Leakage/SG Tube Leakage
 - B. Attachment 1, Unusual Event
- 7.5.2 NRC GL 88-05, Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants
- 7.5.3 USNRC Regulatory Guide 1.45, Reactor Coolant Pressure Boundary Leakage Detection Systems

- 7.5.4 USNRC NUREG 0737, Clarification of TMI Action Plan Requirements
- 7.5.5 S-C-RH-SEE-0922, Dose Assessment for Potential RHR Valve Leakage to RWST Vented to Atmosphere.
- 7.5.6 S-C-RC-MEE-1067, Non-conservative Reactor Coolant System Leakage Calculation.
- 7.5.7 Salem Generating Station IST Manual.
- 7.5.8 PR #951220233, 1RH21 & 2RH21 Seat Leak Testing
- 7.5.9 DCP 1EC-3389, P-250 Plant Computer Replacement
- 7.5.10 S-C-R200-MDC-080, Revision 2, Equation for Error Corrections in the RCS Leakage Calculations Induced by Changes in Pressurizer Level and Reactor Coolant System Temperature.
- 7.5.11 S-C-RCS-ECS-0178, RCS Water Inventory Balance Software for the Salem Control Room
- 7.5.12 Minor Modification S97-174, Rerouting of Non RCS Leakage to Containment Sump Instead of the PRT
- 7.5.13 AR980311093, Reactivity - Accumulator Purge Returns to VCT
- 7.5.14 NRC Inspection Manual 2515D
- 7.5.15 WCAP-16423, "Standard Process and Methods for Calculating RCS Leak Rate for Pressurized Water Reactors"
- 7.5.16 WCAP-16465, "Standard RCS Leakage Action Levels and Response Guidelines for Pressurized Water Reactors"

7.6 Cross-References:

- 7.6.1 Technical Specifications - Unit 1:
 - A. 3.4.6.2, Operational Leakage
- 7.6.2 Procedures:
 - A. RM-AA-101, Records Management Program
 - B. NC.NA-AP.ZZ-0064(Q), Software Quality Assurance (Digital Systems)
 - C. SC.OP-DL.ZZ-0010(Q), Control Room Instrumentation and Alarms
 - D. S1.OP-SO.CVC-0001(Q), Charging, Letdown, and Seal Injection
 - E. S1.OP-SO.CVC-0006(Q), Boron Concentration Control
 - F. S1.OP-SO.PZR-0003(Q), Pressurizer Relief Tank Operation
 - G. S1.OP-SO.RC-0004(Q), Identifying and Measuring Leakage
 - H. S1.OP-TM.ZZ-0002(Q), Tank Capacity Data

7.7 Commitments:

- 7.7.1 C0265 - NSO LER 311/89-015-00
- 7.7.2 C0283 - NRC VIOL 311/87-018-01
- 7.7.3 C0284 - NRC VIOL 272/90-014-00
- 7.7.4 C0611 - NRC INFO 91-56
- 7.7.5 CM-SC-2008-122, Implement RCS Leak Rate Guidance Recommendations by December 31, 2008

ATTACHMENT 1
(Page 1 of 4)

PRT AND RCDT DATA

1.0 PRT DATA

Indicator Range	% Level Change	Volume for 1% Change	Volume Change
0 - 3.0%	%	73.1 gal/%	gal
>3.0 - 5.0%	%	82.8 gal/%	gal
>5.0 - 7.0%	%	91.3 gal/%	gal
>7.0 - 10.0%	%	98.9 gal/%	gal
>10.0 - 12.0%	%	105.7 gal/%	gal
>12.0 - 14.0%	%	111.8 gal/%	gal
>14.0 - 16.0%	%	117.4 gal/%	gal
>16.0 - 19.0%	%	122.4 gal/%	gal
>19.0 - 21.0%	%	126.9 gal/%	gal
>21.0 - 23.0%	%	131.1 gal/%	gal
>23.0 - 25.0%	%	134.9 gal/%	gal
>25.0 - 28.0%	%	138.2 gal/%	gal
>28.0 - 30.0%	%	141.5 gal/%	gal
>30.0 - 32.0%	%	143.5 gal/%	gal
>32.0 - 35.0%	%	146.0 gal/%	gal
>35.0 - 37.0%	%	148.3 gal/%	gal
>37.0 - 39.0%	%	150.4 gal/%	gal
>39.0 - 41.0%	%	151.5 gal/%	gal
>41.0 - 44.0%	%	152.3 gal/%	gal
>44.0 - 46.0%	%	153.7 gal/%	gal
>46.0 - 48.0%	%	154.1 gal/%	gal
>48.0 - 50.0%	%	154.3 gal/%	gal
>50.0 - 53.0%	%	154.3 gal/%	gal
>53.0 - 55.0%	%	154.1 gal/%	gal
>55.0 - 57.0%	%	153.7 gal/%	gal
>57.0 - 60.0%	%	152.3 gal/%	gal
>60.0 - 62.0%	%	151.5 gal/%	gal
>62.0 - 64.0%	%	150.4 gal/%	gal
>64.0 - 66.0%	%	148.3 gal/%	gal
>66.0 - 69.0%	%	146.0 gal/%	gal
>69.0 - 71.0%	%	143.5 gal/%	gal
>71.0 - 73.0%	%	141.5 gal/%	gal
>73.0 - 75.0%	%	138.2 gal/%	gal
>75.0 - 78.0%	%	134.9 gal/%	gal
>78.0 - 80.0%	%	131.1 gal/%	gal
>80.0 - 82.0%	%	126.9 gal/%	gal
>82.0 - 85.0%	%	122.4 gal/%	gal
>85.0 - 87.0%	%	117.4 gal/%	gal
>87.0 - 89.0%	%	111.8 gal/%	gal
>89.0 - 91.0%	%	105.7 gal/%	gal
>91.0 - 94.0%	%	98.9 gal/%	gal
>94.0 - 96.0%	%	91.3 gal/%	gal
>96.0 - 98.0%	%	82.8 gal/%	gal
>98.0 - 100.0%	%	73.1 gal/%	gal
		TOTAL	gal

ATTACHMENT 1
(Page 2 of 4)

PRT AND RCDT DATA

2.0 PRT LEAK RATE

Parameter	Initial Data (A)	Final Data (B)	Difference (B - A)
PRT LEVEL	%	%	gal (2.4)
TIME			min

___ 2.1 **RECORD** INDICATOR USED FOR DATA:

___ Plant Computer point L0485A (preferred)

___ Console Indicator 1LI470 (alternate)

___ 2.2 **CONVERT** the PRT % level change to gallons by multiplying the % level change X Volume Change for 1% for the applicable Indicator Range. IF the PRT level change spans two or more Indicator Ranges, THEN volume changes are to be calculated in each of the applicable Indicator Ranges [e.g., a PRT level increase from 69.2% to 71.6% is to be calculated as (1.8% X 143.5 gal/%) and (0.6% X 141.5 gal/%)].

___ 2.3 **ADD** all volume changes to obtain total gallons, as applicable.

___ 2.4 **RECORD** total volume change in Section 2.0 of this attachment.

___ 2.5 **DIVIDE** total gallons volume change by elapsed time (minutes) to determine leak rate:

TOTAL VOLUME CHANGE _____ gal ÷ ELAPSED TIME _____ min =
LEAK RATE _____ GPM

ATTACHMENT 1
(Page 3 of 4)

PRT AND RCDT DATA

3.0 RCDT DATA

Indicator Range	% Level Change	Volume for 1% Change	Volume Change
0 - 3.0%	%	4.6 gal/%	gal
>3.0 - 6.0%	%	4.7 gal/%	gal
>6.0 - 9.0%	%	4.8 gal/%	gal
>9.0 - 12.0%	%	4.8 gal/%	gal
>12.0 - 15.0%	%	4.8 gal/%	gal
>15.0 - 18.0%	%	4.9 gal/%	gal
>18.0 - 21.0%	%	4.9 gal/%	gal
>21.0 - 24.0%	%	4.9 gal/%	gal
>24.0 - 27.0%	%	4.9 gal/%	gal
>27.0 - 30.0%	%	4.9 gal/%	gal
>30.0 - 33.0%	%	4.9 gal/%	gal
>33.0 - 36.0%	%	4.8 gal/%	gal
>36.0 - 39.0%	%	4.8 gal/%	gal
>39.0 - 42.0%	%	4.8 gal/%	gal
>42.0 - 45.0%	%	4.7 gal/%	gal
>45.0 - 48.0%	%	4.6 gal/%	gal
>48.0 - 51.0%	%	4.6 gal/%	gal
>51.0 - 54.0%	%	4.5 gal/%	gal
>54.0 - 57.0%	%	4.4 gal/%	gal
>57.0 - 60.0%	%	4.3 gal/%	gal
>60.0 - 63.0%	%	4.2 gal/%	gal
>63.0 - 66.0%	%	4.0 gal/%	gal
>66.0 - 69.0%	%	3.9 gal/%	gal
>69.0 - 72.0%	%	3.7 gal/%	gal
>72.0 - 75.0%	%	3.6 gal/%	gal
>75.0 - 78.0%	%	3.4 gal/%	gal
>78.0 - 81.0%	%	3.2 gal/%	gal
>81.0 - 84.0%	%	2.9 gal/%	gal
>84.0 - 87.0%	%	2.7 gal/%	gal
>87.0 - 90.0%	%	2.4 gal/%	gal
>90.0 - 93.0%	%	2.0 gal/%	gal
>93.0 - 96.0%	%	1.5 gal/%	gal
>96.0 - 100.0%	%	0.8 gal/%	gal
		TOTAL	gal

ATTACHMENT 1
(Page 4 of 4)

PRT AND RCDT DATA

4.0 RCDT LEAK RATE

Parameter	Initial Data (A)	Final Data (B)	Difference (B - A)
RCDT LEVEL	%	%	gal (4.4)
TIME			min

___ 4.1 **RECORD** INDICATOR USED FOR DATA:

___ LA-4144RB Recorder Channel A on 1RP1 (preferred)

___ 1LT1003 on Panel 104 (alternate)

___ 4.2 **CONVERT** the RCDT % level change to gallons by multiplying the % level change X Volume Change for 1% for the applicable Indicator Range. IF the RCDT level change spans two or more Indicator Ranges, THEN volume changes are to be calculated in each of the applicable Indicator Ranges [e.g., a RCDT level increase from 69.2% to 72.6% is to be calculated as (2.8% X 3.7 gal/%) and (0.6% X 3.6 gal/%)].

___ 4.3 **ADD** all volume changes to obtain total gallons, as applicable.

___ 4.4 **RECORD** total volume change in Section 4.0 of this attachment.

___ 4.5 **DIVIDE** total gallons volume change by elapsed time (minutes) to determine leak rate:

TOTAL VOLUME CHANGE _____ gal ÷ ELAPSED TIME _____ min =

LEAK RATE _____ GPM

Performed By _____ Date _____

Independent Verification _____ Date _____

ATTACHMENT 2
(Page 1 of 2)

MANUAL RCS WATER INVENTORY BALANCE TEST DATA

1.0 DATA COLLECTION

NOTE

- ◆ Available Plant Computer points should be used when possible.
- ◆ Record console VCT and Pressurizer levels, and RCS Tavg to the nearest tenth.
- ◆ Indications used shall be circled.
- ◆ Initial data and final data shall be obtained from the same indicators.
- ◆ Attachment 4 or 5 is to be used to calculate Mass Leak Rate Correction.

Parameter	Start	Finish	Difference
TIME			min.

Parameter	Initial Data (A)	Final Data (B)	Difference or Average
REACTOR POWER ($MW_{th} / \%$) Computer: QPP0004T (10 Minute Avg) NRM0401N (PR 1M Avg) Console/NI Racks: Avg of N41-N44			(A-B) ($\pm 3.4 MW_{th}$) ($\pm 0.5\% PR$)
VCT LEVEL Computer: L0112N or L0112A or L0114A Console: 1LT112 Panel 116: 1LT114A			(A-B) %
VCT TEMPERATURE Computer: T0140N or T0140A Console: 1TI130A			(A+B)/2 °F
RCS TEMPERATURE TAVG Computer: TRM1101N or TRM1101B (Valid only when Tav _g $\geq 547^{\circ}F$) Console: 1TI412, 1TI422, 1TI432, 1TI442 (Valid only when RCP I/S)			(A-B) ($\pm 0.5^{\circ}F$) °F
RHR HX INLET TEMP (Valid only on operating RHR loop w/RCP O/S) Computer: T0630A or T0631A			
WR HOT LEG TEMP (Valid w/RCPs I/S & Tav _g $< 547^{\circ}F$) Computer: T0419A, T0439A, T0459A, T0479A Console: TA-14, TA-16, TA-36, TA-38			

ATTACHMENT 2
(Page 2 of 2)

MANUAL RCS WATER INVENTORY BALANCE TEST DATA

Parameter	Initial Data (A)	Final Data (B)	Difference or Average
PRESSURIZER PRESSURE Computer: PRM0601N or PRM0601B (* P0499A, P2752A, PRM2027B) Console: 1PI455A, 1PI456, 1PI457, 1PI474A, (* 1PI405) (* Valid only with pressure <1700 psig)			(A+B)/2 (A-B) PSIG (±10)
PRESSURIZER LEVEL Computer: LRM0501N or LRM0501B Console: 1LI459A, 1LI460A, 1LI461A Console: COLD CAL 1LI462 (Valid in Mode 4 or 5 with a bubble in the Pressurizer)			(A-B) % (±0.5)
BORIC ACID TOTALIZER			(A-B) gal (must be zero)
PRIMARY WATER TOTALIZER			(A-B) gal (must be zero)

___ 1.1 **TRANSFER** Difference or Average to Attachment 4 or 5 for Mass Leak Rate Correction.

Performed By _____ Date _____

Independent Verification _____ Date _____

ATTACHMENT 3
(Page 1 of 3)

RCS WATER INVENTORY BALANCE CALCULATION SHEET

___ 1.0 TOTAL CORRECTED VOLUME LEAK RATE
(from Attachment 4, Attachment 5 or Step 5.1.15, as applicable) _____ GPM

NOTE

If the following (2A, 2B, 2C & 2D) Identified RCS Leak Rates are to be used in the Total Identified RCS Leak Rate, then identified leakage data must be obtained during performance of this procedure. If current leakrate is unavailable, a value of "0" shall be used.

___ 2.0 IDENTIFIED RCS LEAK RATE:

___ A. IDENTIFIED RCS LEAKAGE INSIDE CONTAINMENT
[from S1.OP-SO.RC-0004(Q), Attachment 9] _____ GPM

___ B. IDENTIFIED RCS LEAKAGE OUTSIDE CONTAINMENT
[from S1.OP-SO.RC-0004(Q), Attachment 10] _____ GPM

___ C. IDENTIFIED RCS LEAKAGE TO ACCUMULATORS
[from S1.OP-SO.RC-0004(Q), Attachment 6] _____ GPM

◆ IF value is a negative number,
THEN **RECORD** "0" gpm.

___ D. PRT INLEAKAGE (from Attachment 1, Section 2.0) _____ GPM

___ E. PRIMARY TO SECONDARY LEAK RATE
(from Chemistry) _____ GPM

◆ IF Leak Rate is ≥ 1 GPD,
THEN **RECORD** the number: _____ GPD
AND **DIVIDE** by 1440.

◆ IF RCS Leak Rate < 1 GPD,
THEN **RECORD** "0" GPM.

___ 3.0 TOTAL IDENTIFIED RCS LEAK RATE = 2A+2B+2C+2D+2E _____ GPM

ATTACHMENT 3
(Page 2 of 3)

RCS WATER INVENTORY BALANCE CALCULATION SHEET

NOTE

Unidentified Leakage >0.85 gpm requires performance of S1.OP-SO.RC-0004(Q), Identifying and Measuring Leakage.

___ 4.0 UNIDENTIFIED LEAK RATE:

___ A. **SUBTRACT** Line 3.0 from Line 1.0 _____ GPM

B. 1WR80 inleakage (*) 0.001 GPM

___ C. **ADD** 4A and 4B to obtain UNIDENTIFIED LEAK RATE _____ GPM

(*) Latest IST leakage for 1WR80 (4.0 sccm x 2.6417 E⁻⁴ gal/cm³).

NOTE

Since the RCDT collects both RCS and Non-RCS inleakage, it is considered unidentified leakage. The RCDT inleakage is recorded for trending purposes only.

___ 5.0 RCDT INLEAKAGE (from Attachment 1, Section 4.0) _____ GPM

___ 6.0 IF UNIDENTIFIED LEAK RATE (Line 4C) is >1.0 GPM,
THEN ENTER Tech Spec 3.4.6.2 AND **EVALUATE** RCS LEAKAGE IAW Attachment 1 of this procedure, AND S1.OP-SO.RC-0004(Q), Identifying and Measuring Leakage.

7.0 **MODES 1-4 ACCEPTANCE CRITERIA:**

Parameter	Technical Specification	Leak Rate	Test Results	
			SAT	UNSAT
IDENTIFIED LEAK RATE Line 3	10 GPM 3.4.6.2d			
UNIDENTIFIED LEAK RATE Line 4C	1 GPM 3.4.6.2b			
PRIMARY TO SECONDARY LEAK RATE Line 2E	150 GPD through any one SG (ADMIN LIMIT 140 GPD) 3.4.6.2.c			

ATTACHMENT 3
(Page 3 of 3)

RCS WATER INVENTORY BALANCE CALCULATION SHEET

NOTE

The following step is required to perform the Inservice Inspection and Testing of 1RH21, RHR TO RWST STOP VALVE, IAW Technical Specification 4.0.5. This requirement is applicable in Modes 1-4, and is performed at least once per 24 months while in Mode 4 OR 5 with a pressurizer bubble established. (M/I S1102265).

___ 8.0 **1RH21 LEAK RATE ACCEPTANCE CRITERIA:** **[C0611]**

◆ **Test Required Yes ___ No ___**

Parameter	Technical Specification	Leak Rate	Test Results	
			SAT	UNSAT
UNIDENTIFIED LEAK RATE Line 4C	IST PROGRAM <2.0 GPM 4.0.5	*		

* Performed with an RHR Pump in service and the respective RH19 valve OPEN.
 An RCS Unidentified Leakrate of <2.0 GPM satisfies the 1RH21 seat leakage limit.

Performed By _____ Date _____

Independent Verification _____ Date _____

ATTACHMENT 4
(Page 1 of 5)

MANUAL MASS LEAK RATE CORRECTION

1.0 Mass Leak Rate Correction for Changes in VCT Level

___ 1.1 **CALCULATE** VCT level change (ΔL) during the test as follows: (observe +/- sign)

$$\Delta L = \text{Initial Level} - \text{Final Level}$$

$$\Delta L = \text{_____ \%} - \text{_____ \%}$$

$$\Delta L = \text{_____ \%}$$

___ 1.2 **CONVERT** the % level change (ΔL) to volume rate of change (ΔV) as follows:

$$\Delta V = [\Delta L \times (2.57 \text{ ft}^3/\%)] / \text{test duration in minutes}$$

$$\Delta V = [(\text{_____}) \% \times (2.57 \text{ ft}^3/\%)] / (\text{_____}) \text{ minutes}$$

$$\Delta V = \text{_____ ft}^3/\text{minute}$$

___ 1.3 Using the Saturated Steam: Temperature table,
DETERMINE the specific volume of the water corresponding to the VCT average temperature.

$$v_f = \text{_____ ft}^3/\text{lbm}$$

___ 1.4 **CALCULATE** the mass leak rate (ΔM) of water from the VCT as follows:

$$\Delta M = \Delta V / v_f$$

$$\Delta M = (\text{_____}) \text{ ft}^3/\text{minute} / (\text{_____}) \text{ ft}^3/\text{lbm}$$

$$\Delta M = \text{_____ lbm}/\text{minute}$$

___ 1.5 **RECORD** mass leak rate from VCT in Step 4.1.

ATTACHMENT 4
(Page 2 of 5)

MANUAL MASS LEAK RATE CORRECTION

2.0 Mass Leak Rate Correction for Changes in RCS Tavg

___ 2.1 **RECORD** Initial and Final RCS Tavg and Pressurizer Pressure.

Initial RCS Tavg = (_____ °F) Pressurizer Pressure = (_____ psig)

Final RCS Tavg = (_____ °F) Pressurizer Pressure = (_____ psig)

___ 2.2 **CALCULATE** Initial and Final Absolute Pressurizer Pressure as follows:

Absolute Pressurizer Pressure = Pressurizer Pressure + 14.7 psi

Initial Absolute Pressurizer Pressure = (_____ psig) + 14.7 psi

Initial Absolute Pressurizer Pressure = (_____ psi)

Final Absolute Pressurizer Pressure = (_____ psig) + 14.7 psi

Final Absolute Pressurizer Pressure = (_____ psi)

NOTE

The specific volume correction is based on a RCS volume of 11072 ft³.

___ 2.3 Using the Subcooled Liquid tables, **DETERMINE** the specific volume change (ν) of the RCS corresponding to Initial and Final RCS Tavg and Absolute Pressurizer Pressure.

ν Initial = (_____ ft³/lbm)

ν Final = (_____ ft³/lbm)

ATTACHMENT 4
(Page 3 of 5)

MANUAL MASS LEAK RATE CORRECTION

- ___ 2.4 **CALCULATE** the RCS mass change (ΔMass) due to the change in specific volume (v).
(observe +/- sign)

$$\Delta\text{Mass} = 11072\text{ft}^3 \times [1/(v \text{ Initial}) - 1/(v \text{ Final})]$$

$$\Delta\text{Mass} = 11072\text{ft}^3 \times [\text{_____} - \text{_____}]$$

$$\Delta\text{Mass} = 11072\text{ft}^3 \times \text{_____} (\text{lbm}/\text{ft}^3)$$

$$\Delta\text{Mass} = \text{_____} \text{lbm}$$

- ___ 2.5 **CALCULATE** the mass leak rate (ΔM) due to changes in RCS Tavg as follows:

$$\Delta\text{M RCS Tavg} = \Delta\text{Mass} / \text{test duration in minutes}$$

$$\Delta\text{M RCS Tavg} = \text{_____} \text{lbm} / \text{_____} \text{minutes}$$

$$\Delta\text{M RCS Tavg} = \text{_____} \text{lbm/minute}$$

- ___ 2.6 **RECORD** mass leak rate from the RCS due to changes in RCS Tavg in Step 4.2.

3.0 Mass Leak Rate Correction for Changes in Pressurizer Level

- ___ 3.1 **CALCULATE** Pressurizer level change (ΔL) during the test as follows:
(observe +/- sign)

$$\Delta\text{L} = \text{Initial Level} - \text{Final Level}$$

$$\Delta\text{L} = \text{_____} \% - \text{_____} \%$$

$$\Delta\text{L} = \text{_____} \%$$

- ___ 3.2 **CONVERT** the % level change (ΔL) to volume rate of change (ΔV) as follows:

$$\Delta\text{V} = [\Delta\text{L} \times (16.85 \text{ ft}^3/\%)] / \text{test duration in minutes}$$

$$\Delta\text{V} = [(\text{_____}) \% \times (16.85 \text{ ft}^3/\%)] / (\text{_____}) \text{minutes}$$

$$\Delta\text{V} = \text{_____} \text{ft}^3/\text{minute}$$

ATTACHMENT 4
(Page 4 of 5)

MANUAL MASS LEAK RATE CORRECTION

___ 3.3 **CALCULATE** Average Absolute Pressurizer Pressure as follows:

$$\text{Average Absolute Pressurizer Pressure} = \text{Average Pressurizer Pressure} + 14.7 \text{ psi}$$

$$\text{Average Absolute Pressurizer Pressure} = (\text{_____} \text{ psig}) + 14.7 \text{ psi}$$

$$\text{Average Absolute Pressurizer Pressure} = (\text{_____} \text{ psi})$$

___ 3.4 Using the Saturated Steam: Pressure table, **DETERMINE** the specific volume of the water for saturated liquid and vapor corresponding to the Average Absolute Pressurizer Pressure.

$$v_f = \text{_____} \text{ ft}^3/\text{lbm}$$

$$v_g = \text{_____} \text{ ft}^3/\text{lbm}$$

___ 3.5 **CALCULATE** the mass leak rate (ΔM) of water from the Pressurizer as follows:

$$\Delta M = \Delta V \times (1/v_f - 1/v_g)$$

$$\Delta M = (\text{_____}) \text{ ft}^3/\text{minute} \times [(1/\text{_____} \text{ ft}^3/\text{lbm}) - (1/\text{_____} \text{ ft}^3/\text{lbm})]$$

$$\Delta M = (\text{_____}) \text{ ft}^3/\text{minute} \times [\text{_____} \text{ lbm}/\text{ft}^3 - (\text{_____} \text{ lbm}/\text{ft}^3)]$$

$$\Delta M = \text{_____} \text{ lbm}/\text{minute}$$

___ 3.6 **RECORD** mass leak rate from Pressurizer in Step 4.3.

ATTACHMENT 4
(Page 5 of 5)

MANUAL MASS LEAK RATE CORRECTION

4.0 Calculate Corrected RCS Mass Leak Rate as Follows:

___ 4.1 **RECORD** the Mass Leak Rate correction for changes in VCT level. (Section 1.0) _____ lbm/minute

___ 4.2 **RECORD** the Mass Leak Rate Correction for Changes in RCS Tav. (Section 2.0) _____ lbm/minute

___ 4.3 **RECORD** the Mass Leak Rate Correction for Changes in Pressurizer Level. (Section 3.0) _____ lbm/minute

___ 4.4 **CALCULATE** the Corrected Mass Leak Rate (CMLR) as follows:

$$\text{CMLR} = (\text{Step 4.1}) + (\text{Step 4.2}) + (\text{Step 4.3})$$

$$\text{CMLR} = (\quad) + (\quad) + (\quad)$$

$$\text{CMLR} = \quad \text{lbm/minute}$$

___ 4.5 **CALCULATE** the Corrected Volume Leak Rate (CVLR) as follows:

$$\text{CVLR} = \text{CMLR} \times 0.121 \text{ gal/lbm}$$

$$\text{CVLR} = (\quad) \text{ lbm/minute} \times 0.121 \text{ gal/lbm}$$

$$\text{CVLR} = \quad \text{gpm}$$

___ 4.6 **TRANSFER** Corrected Volume Leak Rate (CVLR) to Attachment 3, Step 1.0.

Performed By _____ Date _____

Independent Verification _____ Date _____

ATTACHMENT 5
(Page 1 of 1)

DESKTOP MASS LEAK RATE CORRECTION

1.0 Desktop CRT Calculation:

NOTE

The following information provides guidance on the use a desktop CRT to perform the required Mass Leakrate Calculation. An approved LAN based EXCEL program developed IAW NC.NA-AP.ZZ-0064(Q), Software Quality Assurance (Digital Systems), is being used to automatically determine the specific volume of water based on the algorithms used to create the ASME Steam Tables. Reactor Engineering Department maintains control of the program.

___ 1.1 **PERFORM** the following:

___ 1.1.1 IF the system desktop RCS "LEAKRATE" Icon is available,
THEN OPEN the RCS "LEAKRATE" Program.

___ 1.1.2 IF the system desktop RCS "LEAKRATE" Icon is NOT available,
THEN OPEN the RCS "LEAKRATE" Program utilizing the following link:

K:\EXCEL5\EXCEL.EXE K:\LEAKRATE\LEAKRATE.XLS

___ 1.1.3 Using the left mouse button, **CLICK ON** "AUTO FILL WITH TEST DATA" to perform a sample calculation.

___ 1.1.4 IF "PROGRAM POSSIBLY CORRUPTED-RESULTS NOT RELIABLE" appears,
THEN PERFORM a Mass Leak Rate Correction IAW Attachment 4.

___ 1.1.5 IF "SAMPLE DATA RESULTS VERIFIED PLEASE CONTINUE" appears,
THEN SELECT "CLEAR INPUTS".

___ 1.1.6 **ENTER** DATA from Attachment 2.

___ 1.1.7 When the data has been entered and the calculation completed,
Using the left mouse button, **SELECT** "PRINT" to print the results
AND SIGN the printout.

___ 1.1.8 **TRANSFER** the Corrected Volume Leak Rate (CVLR) to Attachment 3, Step 1.0.

Performed By _____ Date _____

Independent Verification _____ Date _____

ATTACHMENT 6
(Page 1 of 2)

REACTOR COOLANT SYSTEM LEAKRATE TRENDING DATA SHEET

[illegible]

- (1) The Quarterly Average, Action Level I and Action Level II values are developed by Engineering utilizing leak rate historical data and are typically updated on the first of each quarter. In instances where new quarterly values have not been updated, utilize the previous quarter's values and inform Engineering.
- (2) IF ANY of the following conditions are met,
THEN ENSURE a notification to System Engineering is initiated IAW Completion and Review Step 5.4.2:
 - ◆ Any seven (7) day rolling average of Unidentified RCS Leakrate (ULR) exceeds 0.10 gpm, or
 - ◆ Any two (2) of three (3) consecutive RCS Unidentified leakrates exceed 0.15 gpm, or
 - ◆ Any RCS Unidentified leakrate exceeds 0.30 gpm, or
 - ◆ Any unexpected measurable, confirmed rise in RCS Unidentified Leakrate as determined by the SM/CRS, or
 - ◆ Any nine (9) consecutive RCS Unidentified Leakrates exceed the Quarterly Average, or
 - ◆ Any two (2) of three (3) consecutive RCS Unidentified Leakrates exceed the Action Level I value, or
 - ◆ Any RCS Unidentified Leakrate exceeds the Action Level II value.

ATTACHMENT 6
(Page 2 of 2)

REACTOR COOLANT SYSTEM LEAKRATE TRENDING DATA SHEET

[illegible]

- (1) The Quarterly Average, Action Level I and Action Level II values are developed by Engineering utilizing leak rate historical data and are typically updated on the first of each quarter. In instances where new quarterly values have not been updated, utilize the previous quarter's values and inform Engineering.
- 2) IF ANY of the following conditions are met,
THEN ENSURE a notification to System Engineering is initiated IAW Completion and Review Step 5.4.2:
- ◆ Any seven (7) day rolling average of Unidentified RCS Leakrate (ULR) exceeds 0.10 gpm, or
 - ◆ Any two (2) of three (3) consecutive RCS Unidentified leakrates exceed 0.15 gpm, or
 - ◆ Any RCS Unidentified leakrate exceeds 0.30 gpm, or
 - ◆ Any unexpected measurable, confirmed rise in RCS Unidentified Leakrate as determined by the SM/CRS, or
 - ◆ Any nine (9) consecutive RCS Unidentified Leakrates exceed the Quarterly Average, or
 - ◆ Any two (2) of three (3) consecutive RCS Unidentified Leakrates exceed the Action Level I value, or
 - ◆ Any RCS Unidentified Leakrate exceeds the Action Level II value.

ATTACHMENT 7
(Page 1 of 1)

RCS UNIDENTIFIED LEAKRATE SEVEN (7) DAY
ROLLING AVERAGE CALCULATION DATA SHEET

NOTE

The following guidance should be utilized when calculating the RCS Unidentified Leakrate Seven (7) Day Rolling Average: **[WCAP-16465-NP]**

- ◆ ANY negative RCS Unidentified Leakrate (ULR) values should be set to 0.0 gpm prior to performing the average.
- ◆ ANY missing RCS Unidentified Leakrate (ULR) values for a specific day should be set to the value recorded for the previous day.

Date (mm/dd/yy)	RCS ULR (gpm)	Seven (7) Day Rolling Average
T-6		
T-5	+	
T-4	+	
T-3	+	
T-2	+	
T-1	+	
Current RCS ULR from Attachment 3, Line 4.C	+	
Total	= ÷ 7 =	gpm
Independent Verification of Calculation Performed By:		

ATTACHMENT 8
(Page 1 of 2)

COMPLETION SIGN-OFF SHEET

1.0 **COMMENTS:**

(Include procedure/test deficiencies and corrective actions.)

[illegible]

ATTACHMENT 8
(Page 2 of 2)

COMPLETION SIGN-OFF SHEET

2.0 SIGNATURES:

Print	Initials	Signature	Date
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

INDEPENDENT VERIFICATION:

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

3.0 SM/CRS FINAL REVIEW AND APPROVAL:

[C0283]

This procedure with Attachments 1-8 is reviewed for completeness and accuracy. All deficiencies, including corrective actions, are clearly recorded in the COMMENTS Section of this attachment. Technical Specification compliance, procedure compliance, and Acceptance Criteria are evaluated.

Signature: _____ Date/Time: _____
SM/CRS

4.0 IST IMPLEMENTATION ENGINEER REVIEW:

Test Results are reviewed for acceptability. Forward completed procedure to Operations Staff.

Signature: _____ Date/Time: _____
IST Program Engineer