

Facility: Palisades

Task No: PL-342 026 03 03

Task Title: Review a PCS Leakrate CalculationJob Performance Measure No: 2017 Remediation
Admin 1A

K/A Reference: 2.1.20, Ability to interpret and execute procedure steps.

Examinee: _____

NRC Examiner: _____

Facility Evaluator: _____

Date: _____

Method of testing:

Simulated Performance _____

Actual Performance X _____Classroom X _____

Simulator _____

Plant _____

Read to the examinee:

I will explain the initial conditions, which steps to simulate or discuss, and provide initiating cues. When you complete the task successfully, the objective for this job performance measure will be satisfied.

Initial Conditions:

1. The reactor is at full power
2. DWO-1, Attachment 8, PCS Inventory Form, has been completed
3. A 25.1 gallon PMW addition was made to the PCS
4. No Boric Acid Additions were made
5. Zinc addition is 2.36 liters/day (from the Shift Manager's log)
6. Charging Pump Seal leakage (total) is 105 ml/min
7. CRDM Seal leakage is 10 ml/min
8. No known leakage sources outside the PCPB
9. No known leakage sources inside the PCPB

Task Standard: Review and Approve a Primary System Leakage Calculation (DWO-1, Attachment 8, PCS Inventory Form)

Required Materials: DWO-1, Attachment 8, PCS Inventory Form completed by NCO-R

General References: DWO-1, OPERATOR'S DAILY/WEEKLY ITEMS MODES 1, 2, 3, AND 4

Initiating Cue: The NCO-R has just completed a PCS Leak Rate, DWO-1, Attachment 8, PCS Inventory Form, and requests that you review and approve it per DWO-1, Section 5.1.5

Time Critical Task: No

Validation Time: 30 minutes

Performance Information

Denote critical steps with a check mark

_____ Performance step: 1,

Obtain completed DWO-1, Attachment 8, PCS Inventory Form

Standard: SRO obtains completed Working Copy of DWO-1, Attachment 8 and determines time of leakrate was 180 minutes for blank 1a.

Note: Blanks 1b through 1e are given parameters on the data sheet handout and no verification is required.

Comment: Evaluator provides candidate with the completed PCS Inventory Form (Attachment 8) Working Copy.

_____ Performance step: 2,

IF MODE 1, 2 or 3 AND Pressure is between 2055 and 2065 psia (inclusive), THEN **RECORD** 0.18021 ft³ for Pressurizer Vapor Space specific volume on Att. 8, Step 1.f.

Standard: SRO ensures 0.18021 entered in Att. 8, Step 1.f

Comment:

_____ Performance step: 3,
IF MODE 1, 2 or 3 AND Pressure is between 2055 and 2065 psia (inclusive), THEN **RECORD** 0.02595 ft³/lbm for Pressurizer Liquid Space specific volume on Att. 8, Step 1.g

Standard: SRO ensures 0.02595 entered in Att. 8, Step 1.g

Comment:

Performance Information***Denote critical steps with a check mark***

_____ Performance step: 4

RECORD 0.01616 ft³/lbm for Volume Control Tank specific volume on Att. 8, Step 1.h

Standard: SRO ensures 0.01616 entered in Att. 8, Step 1.h

Comment:

_____ Performance step: 5

DETERMINE Primary Coolant System specific volume from Steam Tables or DWO-1 Basis Document AND **RECORD** on Att. 8, Step 1.i

Standard: SRO ensures .021733 entered in Att. 8, Step 1.i

Comment: Provide candidate with DWO-1 Basis when asked.

_____ Performance step: 6

CALCULATE Pressurizer Vapor Space Volume (VGPZR) to the nearest 0.1 ft³ AND **RECORD** on Att.8, Step 1.j

$$V_{GPZR} = (94.3\% - L_{PZR}) (14.370 \text{ ft}^3/\%) + 182.20 \text{ ft}^3$$

Standard: SRO ensures 703.7 entered in Att. 8, Step 1.j

Comment: Using given Pressurizer Level of 58.01 for L_{PZR} from 1b on datasheet

Performance Information***Denote critical steps with a check mark***

_____ Performance step: 7

CALCULATE Pressurizer Liquid Space Volume (V_{FPZR}) to the nearest 0.1 ft³
AND **RECORD** on Att.8, Step 1.k

$$V_{FPZR} = 1547 - V_{GPZR}$$

Standard: SRO ensures 843.3 ft³ entered in Att. 8, Step 1.k

Comment:

✓_____ Performance step: 8

IF Primary Makeup Water was added during performance of the test THEN:
1. DETERMINE the total ... AND **RECORD**on Att. 8, Step 1.m.1
2. **CALCULATE** mass added AND RECORD on Att. 8, Step 1.m.3

Standard: SRO ensures:
25.1 entered in Att. 8, Step 1.m.1
209.1 entered in Att. 8, Step 1.m.3

Comment: 25.1 is given as the volume of makeup water added.
209.1 is the mass conversion calculated in this step

_____ Performance step: 9

IF Boric Acid was added during performance of the test THEN:

Standard: SRO ensures:
0 entered in Att. 8, Step 1.n.1
0 entered in Att. 8, Step 1.n.3

Comment: **Note: No Boric Acid Added**

Performance Information

Denote critical steps with a check mark

✓ Performance step: 10
Calculate Zinc injection Rate

Standard: SRO ensures:
2.36 entered in Att. 8, Step 1.o.1 (Zinc Injection Rate)
0 entered in Att. 8, Step 1.o.1 due to rounding to nearest .001 gpm
180 entered in Att. 8, Step 1.o.2
0 entered in Att. 8, Step 1.o.4

Comment: **Note: 2.36 liters/day given in Initial Conditions from Shift Manager's Log**
Per procedural step 0 is entered due to rounding to the nearest 0.001 gpm
180 is the time in minutes for the leakrate
The calculation is multiplied by 9 due to 1.o.1 entry

✓ Performance step: 11
CALCULATE Total Mass added AND **RECORD** on Att. 8, Step 1.p Total Mass added = 1.m.3 + 1.n.3 + 1.o.4

Standard: SRO ensures 209.1 entered in Att. 8, Step 1.p

Comment:

✓ Performance step: 12
CALCULATE Total Uncorrected Leakage AND **RECORD** to the nearest 0.001 gpm per Att. 8, Step 1.q

Standard: SRO identifies **ERROR** as decimal error/miscalculation and enters .083 entered in Att. 8, Step 1.q instead of 0.83

Comment: ***EVALUATOR: If candidate directs NCO to reperform calculation, instruct the candidate that the NCO is busy and that they should perform the corrections.***

Performance Information**Denote critical steps with a check mark**

✓ Performance step: 13

RECORD Charging Pump seal leakage in ml/min on Att. 8, Step 2.a

Standard: SRO identifies and corrects to 105 entered in Att. 8, Step 2.a

Comment: **Note: Candidate discovers that 10 ml/min has been entered for Charging Pump Seal Leakage in Att. 8, Step 2.a.**

EVALUATOR: If candidate directs NCO to reperform calculation, instruct the candidate that the NCO is busy and that they should perform the corrections.

✓ Performance step: 14

CONVERT Charging Pump seal leakage to gpm AND **RECORD** to the nearest 0.001 gpm per Att. 8, Step 2.a

Standard: SRO identifies error and corrects to .028 gpm entered in Att. 8, Step 2.a

Comment:

✓ Performance step: 15

IF any primary coolant leakage sources outside of Primary Coolant Pressure Boundary

Standard: SRO verifies 0 entered in Att. 8, Step 2.b for rate

Comment: **Note: No other leakage sources outside the PCPB given in Initial Conditions.**

Performance Information**Denote critical steps with a check mark**

_____ Performance step: 16

CONVERT primary coolant leakage sources outside of the Primary Coolant Pressure Boundary ...

Standard: SRO ensures 0 entered in Att. 8, Step 2.b

Comment:

✓ Performance step: 17

CALCULATE leakage which affects PCS leakrate calculations and is outside of the Primary Coolant Pressure Boundary AND **RECORD** to the nearest 0.001 gpm per Att. 8, Step 2.c

Standard: SRO identifies **ERROR** and corrects value to .028 in Att. 8, Step 2.c

Comment: **NOTE: Charging seal leakage and CRDM seal leakage have been incorrectly switched causing this calculation error.**

✓ Performance step: 18

CALCULATE Corrected PCS Leakage AND **RECORD** to the nearest 0.001 gpm per Att.8, Step 2.d
(Att. 8, Step 1.q – Att. 8, Step 2.c)

Standard: SRO identifies error and corrects .055 entered in Att. 8, Step 2.d

Comment:

Performance Information**Denote critical steps with a check mark**

✓ Performance step: 19

RECORD the most recent CRDM seal leakage measurement in ml/min on Att. 8, Step 3.a.

Standard: SRO ensures 10 entered in Att. 8, Step 3.a calculation

Comment: **Note: Candidate discovers that 105 ml/min has been entered for CRDM seal leakage. Candidate corrects this by entering 10 on Att. 8, step 3.a.**

EVALUATOR: If candidate directs NCO to reperform calculation, instruct the candidate that the NCO is busy and that they should perform the corrections.

✓ Performance step: 20

COVERT CRDM seal leakage to gpm AND **RECORD** to the nearest 0.001 gpm per Att. 8, Step 3.a

Standard: SRO ensures .003 entered in Att. 8, Step 3.a

Comment: **Note: Candidate discovers that .028 gpm has been entered for CRDM seal leakage. Candidate corrects this by entering .003 gpm on Att. 8, step 3.a. Charging seal leakage and CRDM seal leakage have been incorrectly switched causing this calculation error.**

Performance step: 21

IF any primary coolant leakage sources inside the Primary Coolant Pressure Boundary

Standard: SRO ensures 0 entered in Att. 8, Step 3.b

Comment: **Note: No known leakage sources inside the PCPB given in Initial Conditions.**

Performance Information**Denote critical steps with a check mark**

_____ Performance step: 22

CONVERT primary coolant leakage sources inside of the Primary Coolant Pressure Boundary ...AND record to the nearest 0.001 gpm per Att. 8, Step 3b

Standard: SRO ensures 0 entered in Att. 8, Step 3.b

Comment:

✓ Performance step:23

CALCULATE Identified PCS Leakage AND **RECORD** to the nearest 0.001 gpm per Att. 8, Step 3.c
(Att. 8, Step 3.a + Att. 8, Step 3.b)

Standard: SRO ensures .003 entered in Att. 8, Step 3.c

Comment: **Note: Candidate discovers ERROR that .028 gpm has been entered for Identified leakage. Candidate corrects this by entering .003 gpm on Att. 8, step 3.c.**

✓ Performance step:24

CALCULATE Unidentified PCS Leakage AND **RECORD** to the nearest 0.001 gpm per Att. 8, Step 4.a
(Att. 8, Step 2.d – Att. 8, Step 3.c)

Standard: SRO ensures .052 entered in Att. 8, Step 4.a

Comment: **Note: Candidate discovers that .7994 gpm has been entered for Identified leakage. Candidate corrects this by entering .052 gpm on Att. 8, step 4.a.**

Terminating cue:

EVALUATOR QUE: When candidate completes PCS leakrate calculation, end the JPM.

Verification of CompletionJob Performance Measure No. ADMIN JPM 1

Examinee's Name:

Examiner's Name:

Date Performed:

Facility Evaluator:

Number of Attempts:

Time to Complete:

Question Documentation:

Question: _____

Response: _____

Result: Satisfactory/Unsatisfactory

Examiner's signature and date: _____

CANDIDATE CUE SHEET

(TO BE RETURNED TO EXAMINER TO UPON COMPLETION OF TASK)

INITIAL CONDITIONS:

- DWO-1, Attachment 8, PCS Inventory Form, has been completed
- A 25.1 gallon PMW addition was made to the PCS
- No Boric Acid Additions were made
- Zinc addition is 2.36 liters/day (from the Shift Manager's log)
- Charging Pump Seal leakage (total) is 105 ml/min
- CRDM Seal leakage is 10 ml/min
- No known leakage sources outside the PCPB
- No known leakage sources inside the PCPB

INITIATING CUES:

The NCO-R has just completed a PCS Leak Rate, DWO-1, Attachment 8, PCS Inventory Form, and requests that you review and approve it.

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PCS INVENTORY FORM

Date: Today

☒ TECHNICAL SPECIFICATION REQUIRED

☐ INFORMATION ONLY

1. TOTAL UNCORRECTED LEAKAGE CALCULATION (Section 5.1.5)

| PARAMETER | | TIME 1 | TIME 2 | DELTA TIME |
|-----------|---|------------------------------|------------------------------|------------|
| a. | Leakrate Duration | 0000 | + 0300 | = 180 min |
| b. | Pressurizer Level (L_{PRZ}) PPC PT LPRZC_AVG or LPRZC or LT_0101A_D; LIC-0101A or LIC-0101B | 58.01% | 58.01% | |
| c. | Pressurizer Pressure (P_{PRZ}) PPC PT PRZBE; LPIR-0101A/B | 2061 psia | 2061 psia | |
| d. | Volume Control Tank Level (L_{VCT}) PPC Point LTC0205_AVG or LTC0205; LIC-0205 | 71.09 % | 71.39 % | |
| e. | PCS Avg Coolant Temperature (T_{AVE}) PPC PT TAVG_AVG or TAVG or TYT_0100 or TYT_0200A; TI-0110 Reactor Reg #____ | 560.62 °F | 560.62°F | |
| f. | Pressurizer Vapor Space Specific Volume $V_{g_{PZR}} @ P_{PRZ}$ | 0.18021 ft³/lb _m | 0.18021 ft³/lb _m | |
| g. | Pressurizer Liquid Space Specific Volume $V_{f_{PZR}} @ P_{PRZ}$ | 0.02595 ft³/lb _m | 0.02595 ft³/lb _m | |
| h. | Volume Control Tank Specific Volume $V_{f_{VCT}}$ | 0.01616 ft³/lb _m | 0.01616 ft³/lb _m | |
| i. | Primary Coolant System Specific Volume $V_{f_{PCS}} @ P_{PRZ} \text{ \& } T_{AVE}$ | 0.021733 ft³/lb _m | 0.021733 ft³/lb _m | |
| j. | Pressurizer Vapor Space Volume (V_{GPZR}) $V_{GPZR} = (94.3\% - L_{PRZ}) (14.370 \text{ ft}^3/\%) + 182.20 \text{ ft}^3$ | 703.7 ft³ | 703.7 ft³ | |
| k. | Pressurizer Liquid Space Volume (V_{FPZR}) $V_{FPZR} = 1547 \text{ ft}^3 - V_{GPZR}$ | 843.3 ft³ | 843.3 ft³ | |
| l. | Repeat data at the end of the time period | | | |

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m. Primary Makeup Water Addition

| | | |
|----|---|--|
| 1. | Volume (FIC-0210A) | 25.1 gal |
| 2. | Specific Volume of water at room temperature | 0.01605 ft ³ /lb _m |
| 3. | Mass added = volume (gal) x 0.13368 ft ³ /gal ÷ 0.01605 ft ³ /lb _m | 209.1 lb _m |

n. Boric Acid Solution Addition

| | | |
|----|---|--|
| 1. | Volume (FIC-0210B) | 0 gal |
| 2. | Specific Volume of water at 160°F | 0.01639 ft ³ /lb _m |
| 3. | Mass added = volume (gal) x 0.13368 ft ³ /gal ÷ 0.01639 ft ³ /lb _m | 0 lb _m |

o. Zinc Addition

| | | |
|----|---|--|
| 1. | Zinc Injection Rate: (2.36 liters/day x 0.000183) [conversion units are gal day/liter min] | 0 gpm |
| 2. | Leak rate duration from 1.a | 180 min |
| 3. | Specific Volume of water at room temperature | 0.01605 ft ³ /lb _m |
| 4. | Mass added = injection rate (gpm) x leakrate duration (min) x 0.13368 ft ³ /gal ÷ 0.01605 ft ³ /lb _m | 0 lb _m |

p. Total Mass added = 1.m.3 + 1.n.3 + 1.o.4 209.1 lb_m

q. Total Uncorrected Leakage Calculation 0.83 gpm

$$\left(\frac{\text{Total_PCS}}{\text{Leak_Rate}} \right) = \frac{0.1201}{\text{Time}} \left[\left(-9136.8 \left(\frac{1}{Vf_{PCS2}} - \frac{1}{Vf_{PCS1}} \right) \right) - \left[\left(\frac{V_{GPZR2}}{V_{gPZR2}} + \frac{V_{FPZR2}}{V_{fPZR2}} \right) - \left(\frac{V_{GPZR1}}{V_{gPZR1}} + \frac{V_{FPZR1}}{V_{fPZR1}} \right) \right] - 4.588 \left(\frac{L_{VCT2}}{Vf_{VCT}} - \frac{L_{VCT1}}{Vf_{VCT}} \right) \right] + \text{Total Mass Added}$$

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$$\left(\frac{Total_PCS}{Leak_Rate} \right) = \frac{0.1201}{a} \left[\left(-9136.8 \left(\frac{1}{i_2} - \frac{1}{i_1} \right) \right) - \left[\left(\frac{j_2}{f_2} + \frac{k_2}{g_2} \right) - \left(\frac{j_1}{f_1} + \frac{k_1}{g_1} \right) \right] - 4.588 \left(\frac{d_2}{0.01616} - \frac{d_1}{0.01616} \right) + p \right]$$

$$\left(\frac{Total_PCS}{Leak_Rate} \right) = \frac{0.1201}{180} \left[\left(-9136.8 \left(\frac{1}{.021733} - \frac{1}{.021733} \right) \right) - \left[\left(\frac{703.7}{.18021} + \frac{843.3}{.02595} \right) - \left(\frac{703.7}{.18021} + \frac{843.3}{.02595} \right) \right] - 4.588 \left(\frac{71.39}{0.01616} - \frac{71.09}{0.01616} \right) \right]$$

+ 209.1

= 0.083

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2. LEAKAGE CORRECTION CALCULATION (Section 5.1.7)

| | | |
|----|---|----------|
| a. | Charging Pump Seal Leakage: (10 ml/min x 0.0002642 gal/ml) | .003 gpm |
| b. | Other known leakage sources outside the PCPB; list source and rate: Source: Rate: (0 ml/min x 0.0002642 gal/ml) | 0 gpm |
| c. | Leakage outside the PCPB which affects the PCS leakrate calculation: (2.a + 2.b) | .003 gpm |
| d. | Corrected PCS Leakage: (1.q - 2.c) | .827 gpm |

3. IDENTIFIED PCS LEAKAGE CALCULATION (Section 5.1.8)

| | | |
|----|--|---|
| a. | CRDM Seal Leakage: (105 ml/min x 0.0002642 gal/ml) | .028 gpm |
| b. | Other known leakage sources inside the PCPB; list source and rate: Source: Rate: (0 ml/min x 0.0002642 gal/ml) | 0 gpm |
| c. | Identified PCS Leakage: (3.a + 3.b) | .028 gpm (If >10.0 gpm - refer to Step 5.1.10d) |

4. UNIDENTIFIED PCS LEAKAGE CALCULATION (Section 5.1.9)

| | | |
|----|--|--|
| a. | Unidentified PCS Leakage: (2.d - 3.c) | .799 gpm (If ≥ 0.15 gpm, refer to Step 5.1.10b) (If >1.0 gpm - refer to Step 5.1.10d) |
|----|--|--|

5. PCS LEAKAGE CALCULATION COMPLETION (Section 5.1.10)

- a.1 Record positive values (≥ 0 gpm) as calculated on Attachment 1, Step 5.1.
- a.2 Record negative values (< 0 gpm) as 0 gpm on Attachment 1, Step 5.1.

Nate C Operator/ Today
Calculated By Date

/
Reviewed By Date

PCS INVENTORY FORMDate: Today☒ TECHNICAL SPECIFICATION REQUIRED☐ INFORMATION ONLY**1. TOTAL UNCORRECTED LEAKAGE CALCULATION**
(Section 5.1.5)

| PARAMETER | | TIME 1 | TIME 2 | DELTA TIME |
|-----------|---|------------------------------|------------------------------|------------|
| a. | Leakrate Duration | 0000 | + 0300 | = 180 min |
| b. | Pressurizer Level (L_{PRZ}) PPC PT LPRZC_AVG or LPRZC or LT_0101A_D; LIC-0101A or LIC-0101B | 58.01% | 58.01% | |
| c. | Pressurizer Pressure (P_{PRZ}) PPC PT PRZBE; LPIR-0101A/B | 2061 psia | 2061 psia | |
| d. | Volume Control Tank Level (L_{VCT}) PPC Point LTC0205_AVG or LTC0205; LIC-0205 | 71.09 % | 71.39 % | |
| e. | PCS Avg Coolant Temperature (T_{AVE}) PPC PT TAVG_AVG or TAVG or TYT_0100 or TYT_0200A; TI-0110 Reactor Reg #____ | 560.62 °F | 560.62°F | |
| f. | Pressurizer Vapor Space Specific Volume $V_{g_{PZR}} @ P_{PRZ}$ | 0.18021 ft³/lb _m | 0.18021 ft³/lb _m | |
| g. | Pressurizer Liquid Space Specific Volume $V_{f_{PZR}} @ P_{PRZ}$ | 0.02595 ft³/lb _m | 0.02595 ft³/lb _m | |
| h. | Volume Control Tank Specific Volume $V_{f_{VCT}}$ | 0.01616 ft³/lb _m | 0.01616 ft³/lb _m | |
| i. | Primary Coolant System Specific Volume $V_{f_{PCS}} @ P_{PRZ} \text{ \& } T_{AVE}$ | 0.021733 ft³/lb _m | 0.021733 ft³/lb _m | |
| j. | Pressurizer Vapor Space Volume (V_{GPZR}) $V_{GPZR} = (94.3\% - L_{PRZ}) (14.370 \text{ ft}^3/\%) + 182.20 \text{ ft}^3$ | 703.7 ft³ | 703.7 ft³ | |
| k. | Pressurizer Liquid Space Volume (V_{FPZR}) $V_{FPZR} = 1547 \text{ ft}^3 - V_{GPZR}$ | 843.3 ft³ | 843.3 ft³ | |
| l. | Repeat data at the end of the time period | | | |

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m. Primary Makeup Water Addition

| | | |
|----|---|--|
| 1. | Volume (FIC-0210A) | 25.1 gal |
| 2. | Specific Volume of water at room temperature | 0.01605 ft ³ /lb _m |
| 3. | Mass added = volume (gal) x 0.13368 ft ³ /gal ÷ 0.01605 ft ³ /lb _m | 209.1 lb _m |

n. Boric Acid Solution Addition

| | | |
|----|---|--|
| 1. | Volume (FIC-0210B) | 0 gal |
| 2. | Specific Volume of water at 160°F | 0.01639 ft ³ /lb _m |
| 3. | Mass added = volume (gal) x 0.13368 ft ³ /gal ÷ 0.01639 ft ³ /lb _m | 0 lb _m |

o. Zinc Addition

| | | |
|----|---|--|
| 1. | Zinc Injection Rate: (2.36 liters/day x 0.000183) [conversion units are gal day/liter min] | 0 gpm |
| 2. | Leak rate duration from 1.a | 180 min |
| 3. | Specific Volume of water at room temperature | 0.01605 ft ³ /lb _m |
| 4. | Mass added = injection rate (gpm) x leakrate duration (min) x 0.13368 ft ³ /gal ÷ 0.01605 ft ³ /lb _m | 0 lb _m |

p. Total Mass added = 1.m.3 + 1.n.3 + 1.o.4 209.1 lb_mq. Total Uncorrected Leakage Calculation 0.083 gpm

$$\left(\frac{Total_PCS}{Leak_Rate} \right) = \frac{0.1201}{Time} \left[\left(-9136.8 \left(\frac{1}{Vf_{PCS2}} - \frac{1}{Vf_{PCS1}} \right) \right) - \left[\left(\frac{V_{GPZR2}}{V_{gPZR2}} + \frac{V_{FPZR2}}{V_{fPZR2}} \right) - \left(\frac{V_{GPZR1}}{V_{gPZR1}} + \frac{V_{FPZR1}}{V_{fPZR1}} \right) \right] - 4.588 \left(\frac{L_{VCT2}}{Vf_{VCT}} - \frac{L_{VCT1}}{Vf_{VCT}} \right) \right] + Total\ Mass\ Added$$

KEY

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$$\left(\begin{array}{l} Total_PCS \\ Leak_Rate \end{array} \right) = \frac{0.1201}{a} \left[\left(-9136.8 \left(\frac{1}{i_2} - \frac{1}{i_1} \right) \right) - \left[\left(\frac{j_2}{f_2} + \frac{k_2}{g_2} \right) - \left(\frac{j_1}{f_1} + \frac{k_1}{g_1} \right) \right] - 4.588 \left(\frac{d_2}{0.01616} - \frac{d_1}{0.01616} \right) + p \right]$$

$$\left(\begin{array}{l} Total_PCS \\ Leak_Rate \end{array} \right) = \frac{0.1201}{180} \left[\left(-9136.8 \left(\frac{1}{.021733} - \frac{1}{.021733} \right) \right) - \left[\left(\frac{703.7}{.18021} + \frac{843.3}{.02595} \right) - \left(\frac{703.7}{.18021} + \frac{843.3}{.02595} \right) \right] - 4.588 \left(\frac{71.39}{0.01616} - \frac{71.09}{0.01616} \right) \right]$$

+ 209.1

= 0.083

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2. LEAKAGE CORRECTION CALCULATION
(Section 5.1.7)

| | | |
|----|---|----------|
| a. | Charging Pump Seal Leakage: (105 ml/min x 0.0002642 gal/ml) | .028 gpm |
| b. | Other known leakage sources outside the PCPB; list source and rate: Source: Rate: (0 ml/min x 0.0002642 gal/ml) | 0 gpm |
| c. | Leakage outside the PCPB which affects the PCS leakrate calculation: (2.a + 2.b) | .028 gpm |
| d. | Corrected PCS Leakage: (1.q - 2.c) | .055 gpm |

3. IDENTIFIED PCS LEAKAGE CALCULATION
(Section 5.1.8)

| | | |
|----|--|---|
| a. | CRDM Seal Leakage: (10 ml/min x 0.0002642 gal/ml) | .003 gpm |
| b. | Other known leakage sources inside the PCPB; list source and rate: Source: Rate: (0 ml/min x 0.0002642 gal/ml) | 0 gpm |
| c. | Identified PCS Leakage: (3.a + 3.b) | .003 gpm (If >10.0 gpm - refer to Step 5.1.10d) |

4. UNIDENTIFIED PCS LEAKAGE CALCULATION
(Section 5.1.9)

| | | |
|----|--|--|
| a. | Unidentified PCS Leakage: (2.d - 3.c) | .052 gpm (If ≥ 0.15 gpm, refer to Step 5.1.10b) (If >1.0 gpm - refer to Step 5.1.10d) |
|----|--|--|

5. PCS LEAKAGE CALCULATION COMPLETION
(Section 5.1.10)

- a.1 Record positive values (≥ 0 gpm) as calculated on Attachment 1, Step 5.1.
- a.2 Record negative values (< 0 gpm) as 0 gpm on Attachment 1, Step 5.1.

Nate C Operator/ Today
Calculated By Date

/ Date
Reviewed By Date