U.S. Nuclear Regulatory Commission
Surry Power Station

SR10301
Administrative Job Performance Measure 2.1.37

Applicant________________________________ Start Time___________________

Examiner_______________________________

Date ___________________________________ Stop Time___________________

Title

COMPLETE A REACTIVITY SUMMARY SHEET

K/A: G2.1.37 – Knowledge of procedures, guidelines, or limitations associated with reactivity management. (4.3/4.6)

Applicability	**Est Completion Time**	**Actual Time**
RO	45 Minutes	___________

Initial Conditions

- Task is to be PERFORMED in the SIMULATOR or CLASSROOM.
- Performance of 1-OP-RX-010, Documentation of Reactivity Parameters during Power Operations, is required.

Standards

- Completes the calculations, within tolerances, that allow for completion of the Reactivity Summary Sheet located in 1-OP-RX-010, Documentation of Reactivity Parameters during Power Operations.

Initiating Cues

- Given simulated plant conditions, perform 1-OP-RX-010, Documentation of Reactivity Parameters during Power Operations and complete Attachment 2 of 1-OP-RX-010, Reactivity Summary Sheet.

Initial Conditions

- It is mid shift on Saturday. Unit 1 power is 100 percent.
- I am the Nuclear Shift Manager. I have assigned you to perform 1-OP-RX-010, Documentation of Reactivity Parameters during Power Operations and complete Attachment 2 of 1-OP-RX-010, Reactivity Summary Sheet.

- The following is reactivity information was supplied by the Reactor Engineer today:
  - Core burnup: 13090 MWD/MTU
  - Isothermal temperature coefficient: -26.48 pcm/°F
  - Target delta flux: -0.5%

- The following are the Unit conditions:
  - Reactor power: 100% and stable for last 7 days
  - RCS boron concentration: 468 ppm
  - Control Bank ‘D’ is at 228 steps
  - ‘A’ BAST is in-service on Unit 1 with a boron concentration of 13952 ppm.
  - A power reduction has not occurred and is not planned.

- Here is a copy of 1-OP-RX-010, Documentation of Reactivity Parameters during Power Operations. I need you to perform 1-OP-RX-010, Documentation of Reactivity Parameters during Power Operations and complete Attachment 2 of 1-OP-RX-010, Reactivity Summary Sheet.

- When you are ready to have your work independently verified, please inform me, as this will end the JPM.

Terminating Cues

- Reactivity Summary Sheet calculations performed and the candidate is ready for their work to be independently verified.

Procedures

- 1-OP-RX-010, Documentation of Reactivity Parameters during Power Operations (Revision 11)

Tools and Equipment

- Calculator

Safety Considerations

- None

Notes

Performance Checklist

Notes to the Evaluator.

- Task critical elements are bolded and noted by the words “Critical Step” at the end of the step.
- **START TIME:**

STEP 1: 3.0 INITIAL CONDITIONS 3.1 Unit is operating at greater than 50% power (see P&L 4.1). 4.0 PRECAUTIONS AND LIMITATIONS 4.1 The Unit should be at steady state conditions, i.e., constant power (+/- 5%) for 48 hours. If the unit is not stable or not above 50% power, then this procedure should be carried daily on the PT schedule until the Unit is at equilibrium condition. 4.2 This procedure should be performed every two weeks as directed by the Operations PT schedule. If RCS boron concentration is less than 200 ppm, this procedure should be done weekly. **STANDARD:** (a) Acknowledges Initial Conditions and Precautions and Limitations. **EVALUATOR’S NOTE:** • None **COMMENTS:**	_______ **SAT** _______ **UNSAT**
STEP 2: Note prior to Step 5.1.1: • The items listed in Step 5.1.1 will be updated every 2 weeks by Reactor Engineering. **STANDARD:** (a) Acknowledges the Note. **EVALUATOR’S NOTE:** • None **COMMENTS:**	_______ **SAT** _______ **UNSAT**

STEP 3:

_______ **SAT**

_______ **UNSAT**

Step 5.1.1

5.1.1 The following items have been provided by Reactor Engineering, and will be used for calculations:

- Core burn-up
- Isothermal Temperature Coefficient (ITC)

STANDARD:

(a) Acknowledges that this information was provided by Reactor Engineering in the initial conditions.

EVALUATOR'S NOTE:

- None.

COMMENTS:

STEP 4:

_______ **SAT**

_______ **UNSAT**

Notes prior to Step 5.2.1:

- The following guidelines should be used when performing calculations:
  - o Do no round numbers until the final value. Then round Boric Acid calculations to the nearest tenth of a gallon and round PG calculations to the nearest gallon. Review Attachment 4 before performing calculations.
  - o Use the last known reported boron from Chemistry. It is not necessary to interpolate or obtain a sample if one has not been taken for the day.
- The following form is located on the Operations network drive in S:/Surry Power Station/3/Data1/OPS/Forms/Reactivity
  - Reactivity1, Unit 1 Form
- Once calculated, this procedure will remain in effect for two weeks if RCS boron concentration is greater than or equal to 200 ppm. If RCS boron concentration is less than 200 ppm, this calculation should be performed weekly.
- The Unit 1 Reactor Operator will have the results of this procedure verified by either the Shift Technical Advisor or another licensed Reactor Operator.

STANDARD:

(a) Acknowledges the Notes.

EVALUATOR'S NOTE:

- None

COMMENTS:

STEP 5:

Step 5.2.1

5.2.1 Perform Attachment 1 to calculate reactivity parameters.

STANDARD:

(a) Proceeds to Attachment 1 to commence reactivity calculations.

EVALUATOR'S NOTE:

- None.

COMMENTS:

_______ **SAT**

_______ **UNSAT**

STEP 6:

Note prior to Step 1 of Attachment 1:

- Unless a specific value is given, the most recent Core Burn-up value from the Reactor Engineers should be used. This value is listed on the bench board. Do not interpolate for daily burn-up.

STANDARD:

(a) Acknowledges the Note.

EVALUATOR'S NOTE:

- None

COMMENTS:

_______ **SAT**

_______ **UNSAT**

STEP 7

_______ **SAT**

_______ **UNSAT**

Attachment 1, Step 1:

1. Using data from Reactor Engineering, the Curve Book, and Chemistry, determine the following parameters:

   a. Core Burn-up: _______________ (MWD/MTU)

   b. ITC: ________________________ (PCM/°F)

   c. Differential Boron Worth (DBW): ______________ (PCM/PPM)

   d. Boron Concentration of in-service BAST (Cb BAST): ____________ppm

STANDARD:

Completes Step 1 as indicated below:

1. Using data from Reactor Engineering, the Curve Book, and Chemistry, determine the following parameters:

   a. Core Burn-up: __**13090**__ (MWD/MTU)

   b. ITC: __**-26.48**__ (PCM/°F)

   c. Differential Boron Worth (DBW): __**-8.30**__ (PCM/PPM)

   d. Boron Concentration of in-service BAST (Cb BAST): __**13952**__ppm

EVALUATOR'S NOTE:

a. Core Burn-up was provided as an initial condition.
b. ITC was provided as an initial condition.
c. Is read from a graph in DRP-0003, Curve Book.
   The curve is located at Section 27 (page 53) of DRP-0003.
   Answer: -8.30 pcm/ppm
   ACCEPTABLE RANGE: [-8.28 to -8.33]

d. BAST Boron Concentration was provided as an initial condition.

COMMENTS:

STEP 8:

Attachment 1, Step 2:

2. Calculate the amount of boron to make a +1 ppm change.

-50813 x LN(1 + 1 / (Current Boron – Step 1d))

-50813 x LN(1 + 1 / (____– ____)) = _____ gal (Reactivity Summary Line 7)

_______ **SAT**

_______ **UNSAT**

STANDARD:

Completes Step 2 as indicated below:

2. Calculate the amount of boron to make a +1 ppm change.

a. -50813 x LN(1 + 1 / (468 – 13952))

b. -50813 x LN(1 + 1 / (-13484))

c. -50813 x LN(1 + (-0.000074162) [may round to -0.00007]

d. -50813 x LN(0.999925838) [based on previous rounding 0.99993]

e. -50813 x -0.000074165 [based on previous rounding -0.00007]

f. 3.768 gals [based on previous rounding 3.55 gals]

g. **Answer: 3.8 gallons [acceptable range: 3.6 – 3.8 gallons]**
This is a critical step.

EVALUATOR'S NOTE:

- Candidate may transfer this value to Attachment 2 (Reactivity Summary Sheet) line #7 at this time (or may wait until all calculations are complete).

COMMENTS:

STEP 9:

Note prior to Step 3 of Attachment 1:

- When RCS Boron Concentration is less than 12 ppm, the equation in Step 3 will yield invalid results. By decreasing the assumed charging line Boron concentration at low RCS Boron Concentration, a value of 35221 gallons of dilution is obtained.

STANDARD:

(a) Acknowledges the Note.

EVALUATOR'S NOTE:

- None

COMMENTS:

_______ **SAT**

_______ **UNSAT**

STEP 10:

Attachment 1, Step 3:

3. IF RCS Boron concentration is greater than or equal to 12 ppm, THEN calculate the amount of dilution to make a -1 ppm change in accordance with the following. Otherwise, enter N/A

-50813 x LN(1 - 1 / (Current Boron – 10))

-50813 x LN(1 - 1 / (_____– 10)) = _____ gal (Reactivity Summary Line 8)

_______ **SAT**

_______ **UNSAT**

STANDARD:

Completes Step 3 as indicated below:

3. Calculate the amount of boron to make a +1 ppm change.

a. -50813 x LN(1 - 1 / (468 – 10))

b. -50813 x LN(1 - 1 / (458))

c. -50813 x LN(1 – (0.002183406)) [may round to 0.00218]

d. -50813 x LN(0.99781659) [based on previous rounding 0.99782]

e. -50813 x -0.002185797 [based on previous rounding -0.00218]

f. 111.07 gals [based on previous rounding 110.77 gals]

g. **Answer: 111 gallons [acceptable range: 110.7-111.1 gallons]**
This is a critical step.

EVALUATOR'S NOTE:

- Candidate may transfer this value to Attachment 2 (Reactivity Summary Sheet) line #8 at this time (or may wait until all calculations are complete).

COMMENTS:

STEP 11:

Attachment 1, Step 4:

4. IF RCS Boron concentration is less than or equal to 12 ppm, THEN the amount of dilution to make a -1 ppm change is calculated by the following. Otherwise, enter N/A

-50813 x LN(1 – (1 / 2)) = 35221 gal (Reactivity Summary Line 8)

STANDARD:

4. Marks Step as Not Applicable (N/A).

EVALUATOR'S NOTE:

- None.

COMMENTS:

_______ **SAT**

_______ **UNSAT**

STEP 12:

Attachment 1, Step 5:

5. Calculate the boron concentration change to cause a 1 °F temperature change.

_______________ / _________________ = ___________ ppm / °F
(ITC, Step 1b) (DBW, Step 1c)

STANDARD:

Completes Step 5 as indicated below:

5. Calculate the boron concentration change to cause a 1 °F temperature change.

-26.48 / -8.3 = 3.190361 ppm / °F
(ITC, Step 1b) (DBW, Step 1c)

a. ITC was provided as an initial condition.
b. DBW was read from a graph in DRP-0003, Curve Book.
c. **Answer: 3.19 ppm/°F**
ACCEPTABLE RANGE: [3.17 to 3.20]
This is a critical step.

EVALUATOR'S NOTE:

- None

COMMENTS:

_______ **SAT**

_______ **UNSAT**

STEP 13: Attachment 1, Step 6: 6. Calculate the amount of boron to make a -1 °F Tave change. -50813 x LN(1 + Step 5 / (Current Boron – Step 1d)) -50813 x LN(1 + _____ / (_______– _________)) = ________ gal (Reactivity Summary Line 4)	_______ **SAT** _______ **UNSAT**

STANDARD:

Completes Step 6 as indicated below:

6. Calculate the amount of boron to make a +1 ppm change.

a. -50813 x LN(1 + 3.19 / (468 – 13952))

b. -50813 x LN(1 + 3.19 / (-13484))

c. -50813 x LN(1 + (-0.000236577) [may round to -0.00024]

d. -50813 x LN(0.999763423) [based on previous rounding 0.99976]

e. -50813 x -0.000236605 [based on previous rounding -0.00024]

f. 12.02 gals [based on previous rounding 12.18 gals]

g. **Answer: 12.0 gallons [acceptable range: 11.7 – 12.2 gallons]**
This is a critical step.

EVALUATOR'S NOTE:

- Candidate may transfer this value to Attachment 2 (Reactivity Summary Sheet) line #4 at this time (or may wait until all calculations are complete).
- Range incorporates rounding and bounding values from previous step.

COMMENTS:

STEP 14: Notes prior to Step 7 of Attachment 1: • When RCS Boron Concentration is less than 16 ppm, the equation in Step 7 will yield invalid results. • When RCS Boron Concentration is less than 16 ppm, the amount of dilution to make a 1 °F Tave change will be greater than 50,000 gallons. **STANDARD:** (a) Acknowledges the Notes. **EVALUATOR'S NOTE:** • None **COMMENTS:**	_______ **SAT** _______ **UNSAT**

STEP 15:

_______ **SAT**

_______ **UNSAT**

Attachment 1, Step 7:

7. IF RCS Boron concentration is greater than or equal to 16 ppm, THEN calculate the amount of dilution to make a +1 °F Tave change. Otherwise, enter N/A for this step and Step 5 on Attachment 2.

   -50813 x LN(1 – Step 5 / (Current Boron – 10))

   -50813 x LN(1 - ____ / (_____– 10)) = _____ gal (Reactivity Summary Line 5)

STANDARD:

Completes Step 7 as indicated below:

7. Calculate the amount of boron to make a +1 ppm change.

   a. -50813 x LN(1 – 3.19 / (468 – 10))

   b. -50813 x LN(1 – 3.19 / (458))

   c. -50813 x LN(1 – (0.006965066)) [may round to 0.00697]

   d. -50813 x LN(0.993034934 [based on previous rounding 0.99303]

   e. -50813 x -0.006986435 [based on previous rounding -0.00699]

   f. 355.1 gals [based on previous rounding 355.4 gals]

   g. **Answer: 355 gallons [acceptable range 353 – 357]**
   This is a critical step.

EVALUATOR'S NOTE:

- Candidate may transfer this value to Attachment 2 (Reactivity Summary Sheet) line #5 at this time (or may wait until all calculations are complete).
- Range incorporates rounding and bounding values from previous steps

COMMENTS:

STEP 16:

_______ **SAT**

_______ **UNSAT**

Notes prior to Step 8 of Attachment 1:

- If the value of ITC is between rod steps listed in the Curve Book, select the rod height with the highest rod worth. Interpolation to an unlisted rod height is not necessary.

STANDARD:

(a) Acknowledges the Notes.

EVALUATOR'S NOTE:

- None

COMMENTS:

STEP 17

_______ **SAT**

_______ **UNSAT**

Attachment 1, Step 8:

8. Determine the number of rod steps from the fully withdrawn position that equates to a 1 °F Tave change by performing the following calculations:

a. Current Rod Height: _________________ Steps

b. Value of ITC: (+)_______________ pcm (record as + value)

c. Rod height associated with b: _________ Steps

d. Subtract a - c: _________________Steps (Reactivity Summary line 6)

STANDARD:

Completes Step 8 as indicated below:

8. Determine the number of rod steps from the fully withdrawn position that equates to a 1 °F Tave change by performing the following calculations:

a. Current Rod Height: ___228___ Steps

b. Value of ITC: (+)_26.48__ pcm (record as + value)

c. Rod height associated with b: ___217___ Steps

d. Subtract a - c: ___11___________Steps

EVALUATOR'S NOTE:

a. Current Rod Height was provided as an initial condition.
b. ITC was provided as an initial condition.
c. Is read from a table in DRP-0003, Curve Book.
The curve is located at Section 29 (page 62) of DRP-0003.
Answer: 217 steps [217 to 218]
d. 228 – 217 = 11 Steps [11 – 10 Steps].
Answer: 11 Steps [10 – 11 steps]
This is a critical step.

Candidate may transfer this value to Attachment 2 (Reactivity Summary Sheet) line #6 at this time (or may wait until all calculations are complete).

The candidate may sign step 5.2.1 as complete at this time.

COMMENTS:

STEP 18

Step 5.2.2 Transfer appropriate values to Attachment 2, Reactivity Summary Sheet.

_______ **SAT**

_______ **UNSAT**

STANDARD:

Transfer appropriate values to Attachment 2, Reactivity Summary Sheet, as indicated below:

1. Reactor Operators will discuss Items 4 – 8 with the Unit SRO following turnover.
2. See Subsection 5.2 for directions to complete Items 4 through 8.
3. Reactor Power 100 %
4. Boron for 1 °F decrease **11.7 – 12.2** GAL BA
5. Dilution for 1 °F increase **353 – 357** GAL PG
6. Rod steps for 1 °F change **10 - 11** Steps
7. Gallons of boric acid for 1 ppm change **3.6 – 3.8** GAL BA
8. Gallons of PG for 1 ppm change **111** GAL PG

EVALUATOR'S NOTE:

This is a summary sheet for easy reference. Critical Steps (4 – 8) are bolded and the details on the calculation are provided earlier in the JPM.

The candidate may sign step 5.2.2 as complete and 5.2.3 as not applicable at this time.

COMMENTS:

STEP 5: Reports completion of 1-OP-RX-010 and that the calculations are ready to be independently verified. **STANDARD:** (a) Verbal or written status report that a 1-OP-RX-010 is ready to be independently verified. **EVALUATOR'S NOTE:** • Acknowledge the completion of the task. **COMMENTS:**	_______ **SAT** _______ **UNSAT**

STOP TIME:

Operator Directions Handout
(TO BE READ TO APPLICANT BY EXAMINER)

Task

- Task is to be PERFORMED in the SIMULATOR or CLASSROOM.
- Performance of 1-OP-RX-010, Documentation of Reactivity Parameters during Power Operations, is required.

Directions

The evaluator will explain the initial conditions of the task to be performed and will provide the initiating cue. Ensure you indicate to the evaluator when you understand your assigned task.

Initial Conditions

- It is mid shift on Saturday. Unit 1 power is 100 percent.
- I am the Nuclear Shift Manager. I have assigned you to perform 1-OP-RX-010, Documentation of Reactivity Parameters during Power Operations and complete Attachment 2 of 1-OP-RX-010, Reactivity Summary Sheet.

- The following is reactivity information was supplied by the Reactor Engineer today:
  - Core burnup: 13090 MWD/MTU
  - Isothermal temperature coefficient: -26.48 pcm/°F
  - Target delta flux: -0.5%

- The following are the Unit conditions:
  - Reactor power: 100% and stable for last 14 days
  - RCS boron concentration: 468 ppm
  - Control Bank 'D' is at 228 steps
  - 'A' BAST is in-service on Unit 1 with a boron concentration of 13952 ppm.
  - A power reduction has not occurred and is not planned.

Initiating Cues:

- Here is a copy of 1-OP-RX-010, Documentation of Reactivity Parameters during Power Operations. I need you to perform 1-OP-RX-010, Documentation of Reactivity Parameters during Power Operations and complete Attachment 2 of 1-OP-RX-010, Reactivity Summary Sheet.

- When you are ready to have your work independently verified, please inform me, as this will end the JPM.

Operator Directions Handout
(TO BE GIVEN TO APPLICANT)

Initial Conditions

Initial Conditions

- It is mid shift on Saturday. Unit 1 power is 100 percent.
- I am the Nuclear Shift Manager. I have assigned you to perform 1-OP-RX-010, Documentation of Reactivity Parameters during Power Operations and complete Attachment 2 of 1-OP-RX-010, Reactivity Summary Sheet.

- The following is reactivity information was supplied by the Reactor Engineer today:
  - Core burnup: 13090 MWD/MTU
  - Isothermal temperature coefficient: -26.48 pcm/°F
  - Target delta flux: -0.5%

- The following are the Unit conditions:
  - Reactor power: 100% and stable for last 14 days
  - RCS boron concentration: 468 ppm
  - Control Bank 'D' is at 228 steps
  - 'A' BAST is in-service on Unit 1 with a boron concentration of 13952 ppm.
  - A power reduction has not occurred and is not planned.

Initiating Cues:

- Here is a copy of 1-OP-RX-010, Documentation of Reactivity Parameters during Power Operations. I need you to perform 1-OP-RX-010, Documentation of Reactivity Parameters during Power Operations and complete Attachment 2 of 1-OP-RX-010, Reactivity Summary Sheet.

- When you are ready to have your work independently verified, please inform me, as this will end the JPM.

Dominion ***SURRY POWER STATION***	PROCEDURE NO: **1-OP-RX-010**
	REVISION NO: **11**
PROCEDURE TYPE: **OPERATING PROCEDURE**	UNIT NO: **1**

PROCEDURE TITLE:
DOCUMENTATION OF REACTIVITY PARAMETERS DURING POWER OPERATION

RX MGT						

REVISION SUMMARY:

Revised in response to Operations Feedback, OP FB 09-0322. Added Step 5.2.7.

PROCEDURE USED:	☐ Entirely	☐ Partially	**Note:** If used partially, note reasons in remarks.
PROBLEMS ENCOUNTERED:	☐ NO	☐ YES	**Note:** If YES, note problems in remarks.

REMARKS: ____

____

____

____

____

____ (Use back for additional remarks.)

SHIFT SUPERVISION:	DATE:

CONTINUOUS USE

TABLE OF CONTENTS

1.0 PURPOSE

1.1 To calculate and document reactivity parameters during power operation. The Unit 1 Reactor Operator will perform the calculations every other Saturday mid-shift.

2.0 REFERENCES

2.1 Source Documents

None

2.2 Technical Specifications Surry Power Station Units 1 and 2

None

2.3 Technical References

2.3.1 OP-AP-0300, Reactivity Management

2.3.2 OPAP-0005, Shift Relief and Turnover

2.4 Commitment Documents

2.4.1 CR096161, 1/2-OP-RX-010 Reactivity Calculation Requires Enhancement

Init **Verif**

3.0 INITIAL CONDITIONS

______ 3.1 Unit 1 is operating at greater than 50% power. (See P&L 4.1)

4.0 PRECAUTIONS AND LIMITATIONS

4.1 The Unit should be at steady state conditions, i.e. constant power (± 5%) for 48 hours. If the unit is not stable or not above 50% power, then this procedure should be carried daily on the PT schedule until the Unit is at equilibrium conditions.

4.2 This procedure should be performed every two weeks as directed by the Operations PT schedule. If RCS boron concentration is less than 200 ppm, this procedure should be performed weekly.

5.0 INSTRUCTIONS

5.1 Work Preparation

NOTE: The items listed in Step 5.1.1 will be updated approximately every 2 weeks by Reactor Engineering.

______ 5.1.1 The following items have been provided by Reactor Engineering, and will be used for calculations:

- Core burnup
- Isothermal Temperature Coefficient (ITC)

5.2 Reactivity Calculation

NOTE: The following guidelines should be used when performing calculations.

- Do not round numbers until the final value. Then round Boric Acid calculations to the nearest tenth of a gallon and round PG calculations to the nearest gallon. Review Attachment 4 before performing calculations.
- Use the last known reported boron from Chemistry. It is not necessary to interpolate or obtain a sample if one has not been taken for the day.

NOTE: The following form is located on the Operations network drive in S:/Surry Power Station/3/Data1/OPS/Forms/Reactivity.

- Reactivity1, Unit 1 form

NOTE: Once calculated, this procedure will remain in effect for two weeks if RCS boron concentration is greater than or equal to 200 ppm. If RCS boron concentration is less than 200 ppm, this calculation should be performed weekly.

NOTE: The Unit 1 Reactor Operator will have the results of this procedure verified by either the Shift Technical Advisor or another licensed Reactor Operator.

______ 5.2.1 Perform Attachment 1 to calculate reactivity parameters.

______ 5.2.2 Transfer appropriate values to Attachment 2, Reactivity Summary Sheet.

______ 5.2.3 Perform Attachment 3 to convert ppm boron to gallons of boric acid. Enter N/A if a power reduction has <u>NOT</u> occurred or is <u>NOT</u> planned.

______ 5.2.4 Perform Attachment 5 if blended flow makeups are to be used to offset small core reactivity changes. Enter N/A if this method is <u>NOT</u> planned OR if core age is greater than 3000 MWD/MTU.

______
STA / RO 5.2.5 Have the STA or another licensed Reactor Operator independently verify the results of this procedure.

______ 5.2.6 Place a copy of the completed procedure in the 1-OP-RX-010 folder.

______ 5.2.7 Stamp the photocopy with a "COPY" stamp on the front cover. |

Performed by: ______________________ ________ ______________________ ________
Signature Initial Print Date

______________________ ________ ______________________ ________
Signature Initial Print Date

______________________ ________ ______________________ ________
Signature Initial Print Date

______________________ ________ ______________________ ________
Signature Initial Print Date

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Attachment 1
CALCULATING REACTIVITY PARAMETERS

NOTE: Unless a specific value is given, the most recent Core Burnup value from the Reactor Engineers should be used. This value is listed on the benchboard. Do not interpolate for daily burnup.

______ 1. Using data from Reactor Engineering, the Curve Book, and Chemistry, determine the following parameters.

a. Core Burnup: _________ (MWD/MTU)

b. ITC: ________________ (PCM/°F)

c. Differential Boron Worth (DBW): _______________ (PCM/PPM)
(From Boron Coefficient vs. Burnup curve)

d. Boron concentration of in-service BAST (C_B BAST)_________ ppm

______ 2. Calculate the amount of boron to make a + 1 ppm change.

$$-50813 \times \ln\left(1 + \frac{1}{\text{Current Boron} - \text{Step 1d}}\right)$$

$$-50813 \times \ln\left(1 + \frac{1}{\_\_\_\_\_\_\_\_ - \_\_\_\_\_\_\_\_}\right) = \_\_\_\_\_\_\_$$ gal (Reactivity Summary Line 7)

NOTE: When RCS Boron concentration is less than 12 ppm, the equation in Step 3 will yield invalid results. By decreasing the assumed charging line Boron concentration at low RCS Boron concentration, a value of 35221 gallons of dilution is obtained. **(Ref. 2.4.1)**

________ 3. IF RCS Boron concentration is greater than or equal to 12 ppm, THEN calculate the amount of dilution to make a - 1 ppm change IAW the following. Otherwise, enter N/A.

$$-50813 \times \ln\left(1 - \frac{1}{\text{Current Boron} - 10}\right)$$

$$-50813 \times \ln\left(1 - \frac{1}{\_\_\_\_\_\_\_\_\_\_\_ - 10}\right) = \_\_\_\_\_\_\_\_\_$$ gal (Reactivity Summary Line 8)

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Attachment 1

CALCULATING REACTIVITY PARAMETERS

______ 4. IF RCS Boron concentration is less than 12 ppm, THEN the amount of dilution needed to make a - 1 ppm change is calculated by the following. Otherwise, enter N/A.

$$-50813 \times \ln\left(1 - \frac{1}{2}\right) = 35221 \text{ gal (Reactivity Summary Line 8)}$$

______ 5. Calculate the boron concentration change to cause a 1°F temperature change.

$$\underset{\text{(ITC, Step 1b)}}{\underline{\qquad\qquad\qquad}} \div \underset{\text{(DBW, Step 1c)}}{\underline{\qquad\qquad\qquad}} = \underline{\qquad\qquad\qquad\qquad} \text{ ppm/°F}$$

______ 6. Calculate the amount of boron to make a -1°F Tave change.

$$-50813 \times \ln\left(1 + \frac{\text{Step 5}}{\text{Current Boron} - \text{Step 1d}}\right)$$

$$-50813 \times \ln\left(1 + \frac{\underline{\qquad\qquad}}{\underline{\qquad\quad} - \underline{\qquad\quad}}\right) = \underline{\qquad} \text{ gal (Reactivity Summary Line 4)}$$

NOTE: When RCS Boron concentration is less than 16 ppm, the equation in Step 7 will yield invalid results. **(Ref. 2.4.1)**

NOTE: When RCS Boron concentration is less than 16 ppm, the amount of dilution to make a 1°F Tave change will be greater than 50,000 gallons.

______ 7. IF RCS Boron concentration is greater than or equal to 16 ppm, THEN calculate the amount of dilution to make a +1°F Tave change. Otherwise, enter N/A for this step and Step 5 on Attachment 2.

$$-50813 \times \ln\left(1 - \frac{\text{Step 5}}{\text{Current Boron} - 10}\right)$$

$$-50813 \times \ln\left(1 - \frac{\underline{\qquad\qquad}}{\underline{\qquad\qquad} - 10}\right) = \underline{\qquad\quad} \text{ gal (Reactivity Summary Line 5)}$$

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Attachment 1
CALCULATING REACTIVITY PARAMETERS

NOTE: If the value of ITC is between rod steps listed in the Curve Book, select the rod height with the highest rod worth. Interpolation to an unlisted rod height is not necessary.

______ 8. Determine the number of rod steps from the fully withdrawn position that equates to a 1°F Tave change by performing the following calculations.

a. Current rod height: _________ Steps

b. Value of ITC (+) _________ pcm (Record as a + value)

c. Rod height associated with b _________ Steps

d. Subtract a - c _________ Steps (Reactivity Summary line 6)

(Page 1 of 1)

Attachment 2

REACTIVITY SUMMARY SHEET

1. Reactor Operators will discuss Items 4-8 with the Unit SRO following turnover.

2. See Subsection 5.2 for directions to complete Items 4 through 8.

3. Reactor Power ______ %

4. Boron for 1°F decrease ______ GAL BA

5. Dilution for 1°F increase ______ GAL PG

6. Rod steps for 1°F change ______ Steps

7. Gallons of boric acid for 1 ppm change ______ GAL BA

8. Gallons of PG for 1 ppm change ______ GAL PG

Completed by: ____ Date: _________
Reactor Operator

Verified by: ____ Date: _________
Reactor Operator or STA

(Page 1 of 1)

Attachment 3

CONVERTING BORON CHANGE FOR RAMPS TO GALLONS OF BORIC ACID

1. Perform the following calculation using the plot in the 1-OP-RX-010 folder.

   a. Record the Boron Change from graph: ____________________ ppm

   b. Use the Boron recorded in Substep a in the following equation to determine amount of Boric Acid required for ramp. Record below.

$$-50813 \times \ln\left(1 + \frac{\text{Boron change from Graph}}{\text{Current Boron} - C_{\text{B}}\text{BAST}}\right)$$

$$-50813 \times \ln\left(1 + \frac{\_\_\_\_\_\_\_\_\_\_}{\_\_\_\_\_\_\_\_ - \_\_\_\_\_\_\_\_\_\_}\right) = \_\_\_\_\_\_\_\_\_\_\ \text{gal of Boric Acid}$$

Completed by: ____ Date: _________

Reviewed by: ____ Date: _________

(Page 1 of 2)

Attachment 4
COMMON CALCULATION ERRORS

1. Rounding off numbers during the calculations can lead to results being out of tolerance.

Example: Determine gal BA for 1 ppm change when RCS is at 300 ppm.

Item 10: Use the following calculation:

Amount of boron to make a 1 ppm change:

$$-50813 \times \ln\left(1 + \frac{1}{\text{Current Boron} - C_B\text{BAST}}\right)$$

Use:

$$\underset{\text{Current } C_B}{\underline{\quad 300 \quad}} - \underset{C_{BAST}}{\underline{13984}} = \underline{\quad -13684 \quad} \quad [5]$$

$$1 \div \underset{[5]}{\underline{\quad -13684 \quad}} = \underline{\quad \mathbf{-0.000073078} \quad} \quad [6]$$

-50813 × ln (1 + ____________) = ____________ gal BA (Rctvy Sum. line 8)

If [6] is rounded off to –0.0001 (4 decimal places) then the answer is 5.1 **gal BA**

If [6] is rounded off to –0.00007 (5 decimal places) then the **answer is 3.6** gal BA

Therefore, Reactor Engineering states that calculations such as this should be kept to at least 5 decimal places to ensure accuracy.

To prevent the error-likely situation in which confusion could exist in remembering which calculations need five decimal places and those that do not; it has been decided that during all calculations keep figures to at least five decimal places. **Consequently, rounding should be performed at the end with boric acid round off to the <u>nearest tenth</u> and PG to the <u>nearest whole</u> gallon.**

(Page 2 of 2)

Attachment 4
COMMON CALCULATION ERRORS

2. Errors when reading the Delta-I Control for Rapid Power Reduction Transients from HFP, ARO graph. (Self Check)
    - The curve is built for a down power. Target power goes from 100% on the left to 50% on the right.
    - Using "D-bank Insertion" line to get data for "Boron Change" and vice-versa.
    - Interpolation errors between times in core life.

3. When determining the amount of reactivity associated with a rapid power reduction, some people only calculated the amount of boric acid.
   The DELTA-I Control for Rapid Power Reduction Transients from HFP, ARO graph should be used to find the amount of Boric Acid and Rod Motion that together should be needed to lower Rx Power and keep Delta Flux in band.
   It should be noted that this curve need not be consulted before the commencement of an 0-AP-23.00 Rapid Load Reduction. However, the curve is used after the plant has been stabilized at the lower power to verify actual plant conditions to be as expected (i.e. Rod Height and Boron PPM).

4. Reading the Boron Coefficient Curve incorrectly. (Self Check)

5. Transferring the wrong information from the calculation pages to Attachment 2.

(Page 1 of 2)

Attachment 5

IFBA CORE BLENDED FLOW MAKEUPS

NOTE: This Attachment is only required to be performed when blended makeups are to be used to offset daily small IFBA core reactivity changes.
This guidance is intended to calculate the required reactivity changes in the region where the boron letdown curve is relatively flat for an IFBA core (approximately 500 to 3000 MWD/MTU).

______ 1. Determine the following parameters:

a. Current Core Burnup: _____________(MWD/MTU)
[From Att. 1 Step 1.a.]

b. Anticipated Average Power in next two weeks: ________(%)

c. Burnup in two weeks: ______+ ((490/_____)*100) = _____(MWD/MTU)
Step 1.a. Step 1.b.

d. Predicted Boron from the Critical Boron Concentration vs. Burnup, Hot Full Power, All Rods Out curve, at burnup in Step 1.a. ______(ppm)

e. Predicted Boron from Critical Boron Concentration vs. Burnup, Hot Full Power, All Rods Out curve, at burnup in Step 1.c. ______(ppm)

f. Predicted Boron Change: _________ - _________ = ___________(ppm)
Step 1.e. Step 1.d.

g. Predicted Daily Boron Change: ________ / 14 = _______ (ppm)
Step 1.f.

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Attachment 5
IFBA CORE BLENDED FLOW MAKEUPS

NOTE: The Controller Pot settings calculated in the following 2 steps assume the blender will be run for exactly one minute for ease of calculation. The blender controllers must be restored to the proper settings based on current boron concentration following the blended makeup so that automatic makeups will not significantly change reactivity.

______ 2. If Step 1.g. is negative, do the following. Otherwise, enter N/A for this step:

a. Record gallons PG for 1 ppm change from Att 2, Step 8: ______ (gal)

b. Determine daily extra PG: (-) ________ * _________ = _________(gal)
Step 1.g. Step 2.a.

c. Current Blended Makeup PG controller pot setting: _______ (turns)

d. Additional PG pot turns required: ________ / 15 = _______ (turns)
Step 2.b.

e. Required PG pot setting to offset burnup: _____ + _____ = _____(turns)
Step 2.c. Step 2.d.

NOTE: The method used to set the Blender Boric Acid pot in 1-OP-CH-007, Blender Operations, can be used to determine a more exact blender setting.

______ 3. If Step 1.g. is positive, do the following. Otherwise, enter N/A for this step:

a. Record gallons BA for 1 ppm change from Att 2, step 7: _______ (gal)

b. Determine daily extra BA: ________ * _________ = _________ (gal)
Step 1.g. Step 3.a.

c. Current Blended Makeup BA controller pot setting: ________ (turns)

d. Additional BA pot turns required: ________/ 2.5 = ________ (turns)
Step 3.b.

e. Required BA pot setting to offset burnup: _____ + _____ = _____(turns)
Step 3.c. Step 3.d.

Dominion

SURRY POWER STATION

PROCEDURE NO:
1-DRP-003

REVISION NO:
92

PROCEDURE TYPE:
DESIGN REFERENCE PROCEDURE

UNIT NO:
1

PROCEDURE TITLE:

CURVE BOOK

REACT MGT						

REVISION SUMMARY:

Revised in accordance with EN FB 10-0045:

- Revised to update Attachments 30 and 32 through 37 to reflect the change in burnup range of the core. These attachments are applicable through 13,500 MWD/T and current projections for the month of May 2010 indicate that the Surry Unit 1 core will exceed this burnup range during the month.
  (Pages 70, and 72 through 78)

INFORMATION USE

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SECTION 1 - ATTACHMENTS - PHYSICS CURVES

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TABLE OF CONTENTS

1.0 PURPOSE

1.1 To provide instructions for the maintenance of the Curve Book, which contains the Physics Curves for Surry Unit 1.

1.2 To provide guidelines for the receipt and generation of curves.

2.0 REFERENCES

2.1 Technical Specifications Surry Power Station Units 1 and 2

2.2 VPAP-0303, Scaling/Setpoint Change and Curve Program

2.3 VPAP-0301, Design Change Process

2.4 CM-AA-CLC-301, Engineering Calculations

2.5 NF-AA-NCD-101, Nuclear Core Design Procedures and Methods: Purpose, Organization and Use

2.6 Calculation Note PM-419, Revision 0, Addendum B

2.7 NE Technical Report No. 908, Revision 0

2.8 CTS 2753, Core Uprate

2.9 CTS 3423, Calorimetric Task Team

2.10 DR S-97-2736, Blender POT Setting Changes

2.11 DR S-98-0496, Containment Sump Wide Range Transmitter Curve

2.12 NAF-980034, Rev. 0, 1/2-DRP-3 Wide Range Sump Level Curve

2.13 DR S-98-1412, 1/2-CN-TK-1 TS Volume

2.14 ET NAF 98-0126, Rev. 0, Loss of Decay Heat Removal Capacity

2.15 PI S-2001-0630, PRT Curves Updated to Address DR

3.0 INITIAL CONDITIONS

None

4.0 PRECAUTIONS AND LIMITATIONS

None

5.0 INSTRUCTIONS

5.1 New curves or revisions to existing curves generated by Nuclear Analysis and Fuel shall be received under transmittal accompanied by the following documentation as a minimum:

- Calculation number
- Justification for new curve or revision to existing curve

5.2 Those curves that require the generation of a DCP will be processed in accordance with VPAP-0301, Design Change Process.

5.3 Upon receipt of new or revised curves, from Nuclear Analysis and Fuel or by generation of a DCP, a revision to this procedure will be initiated.

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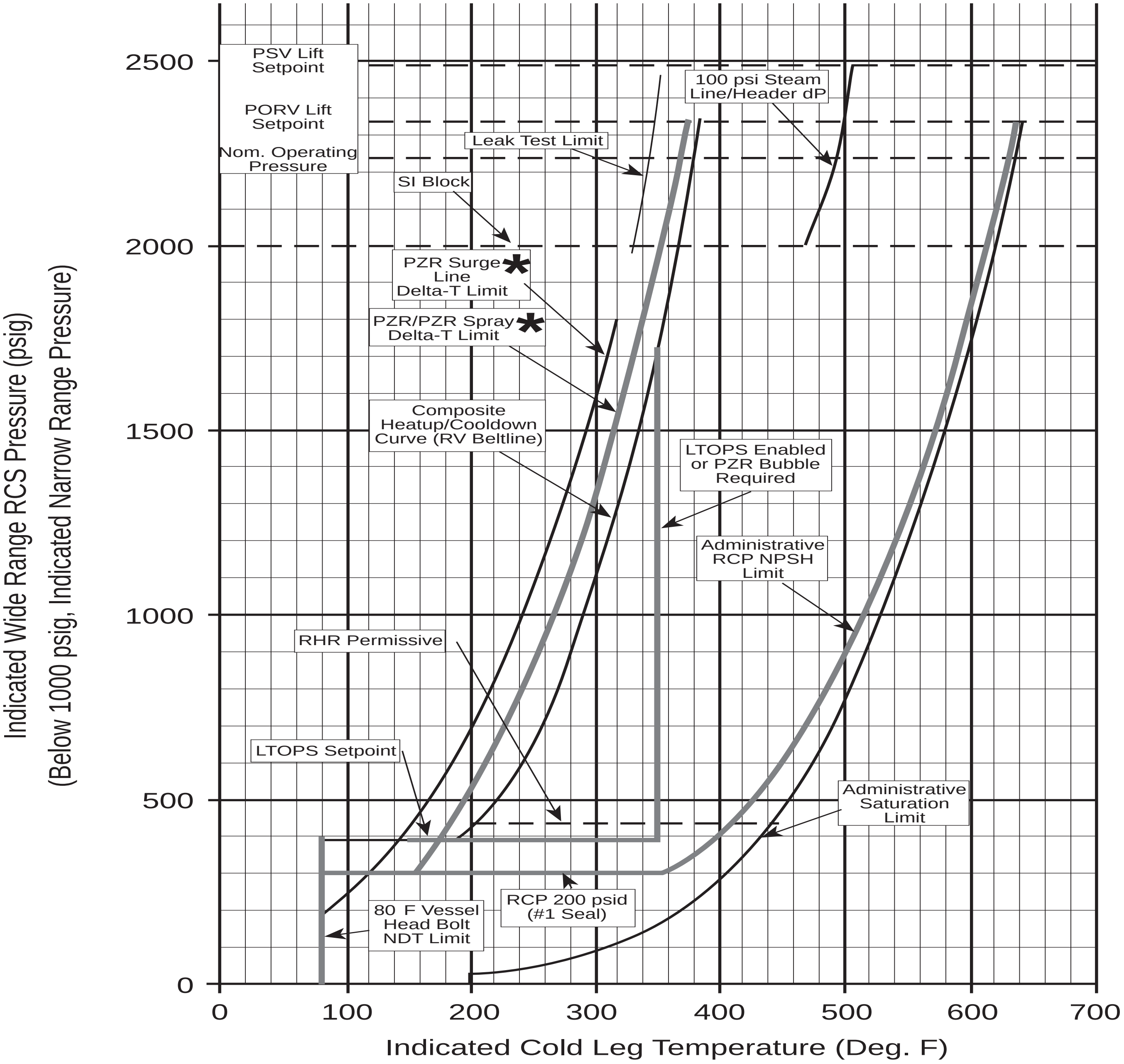
Attachment 1

HEATUP AND COOLDOWN CURVE



Graphics No: PC300

*The PZR Surge Line Delta-T Limit and PZR/PZR Spray Delta-T Limit curves are not applicable during water solid operations.

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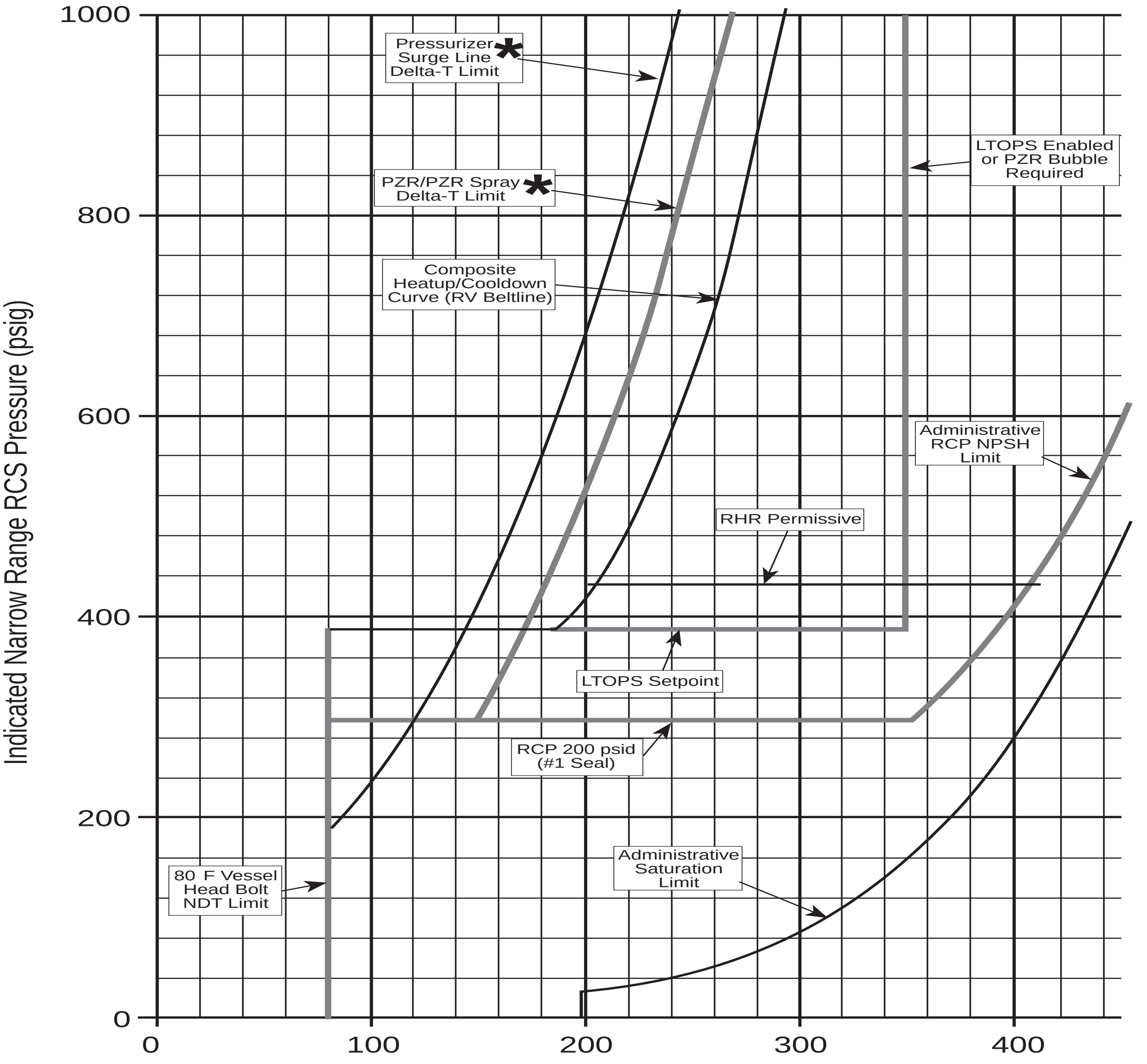
Attachment 1

HEATUP AND COOLDOWN CURVE

(Blowup of 0-1000 PSIG by 0-450 °F)



* The PZR Surge Line Delta-T Limit and PZR/PZR Spray Delta-T Limit curves are not applicable during water solid operations.

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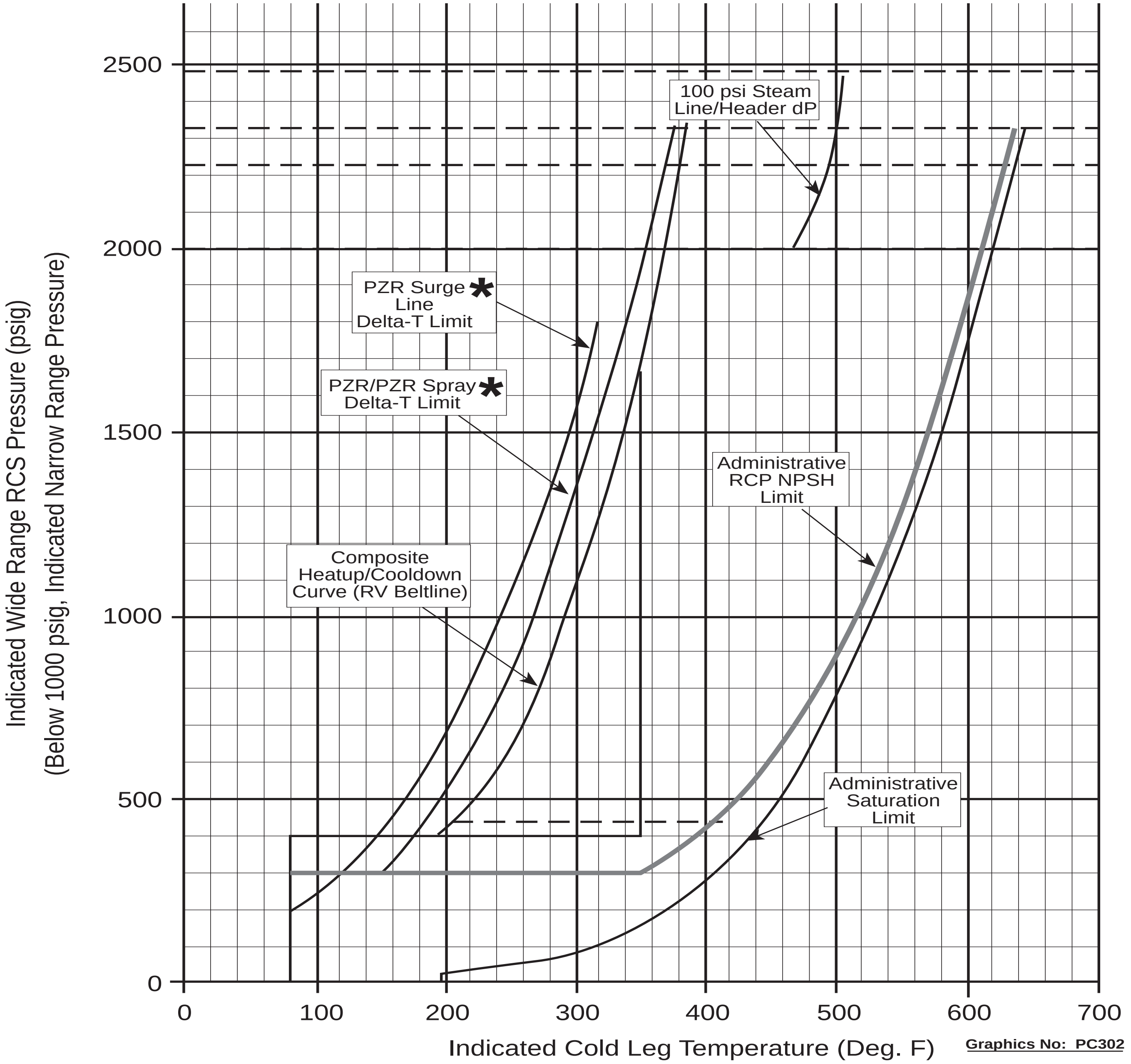
Attachment 1

HEATUP AND COOLDOWN CURVE



*The PZR Surge Line Delta-T Limit and PZR/PZR Spray Delta-T Limit curves are not applicable during water solid operations.

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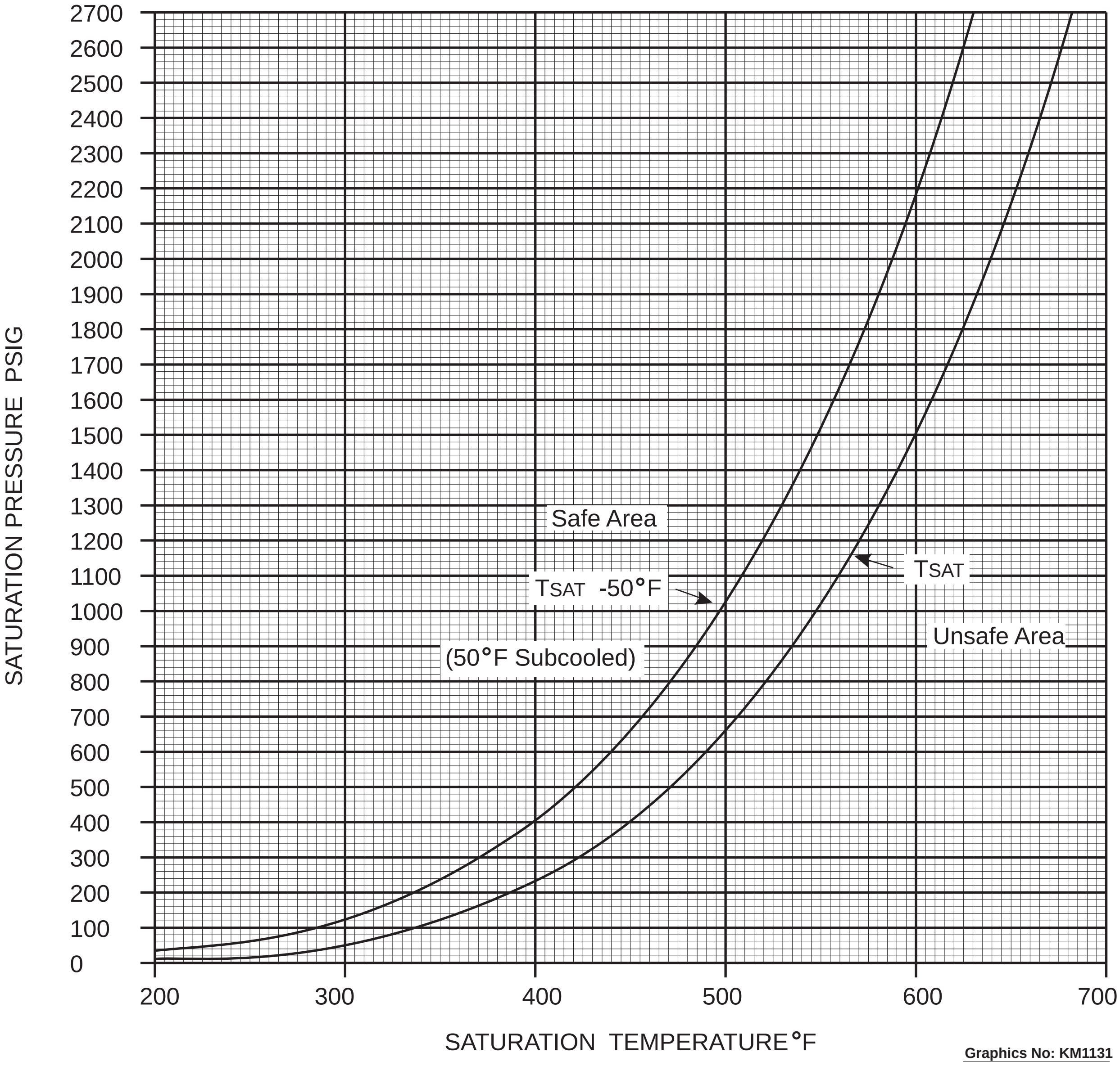
Attachment 2

SATURATION PRESSURE TEMPERATURE CURVE



SATURATION PRESSURE TEMPERATURE CURVE

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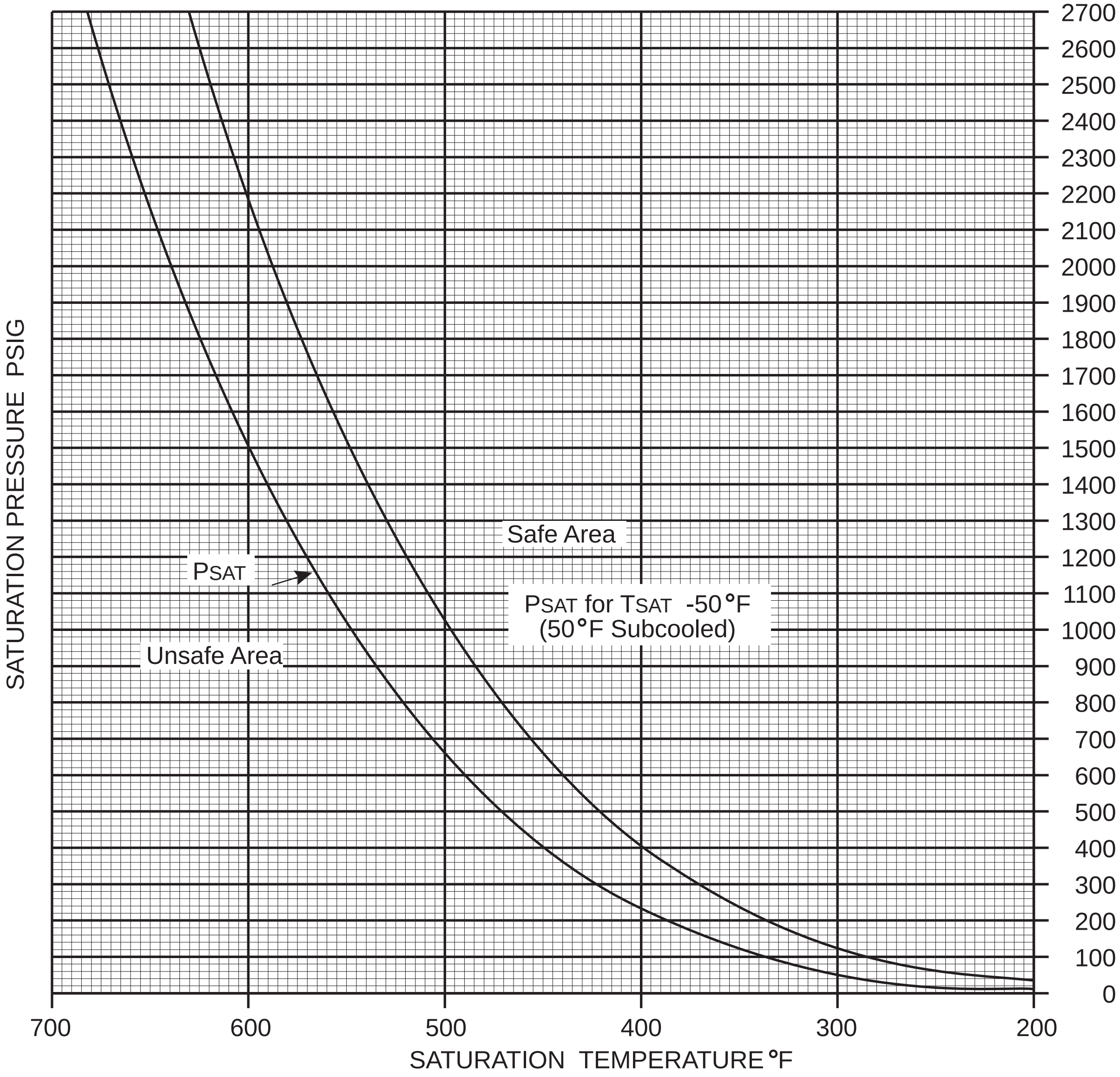
Attachment 3

SATURATION PRESSURE TEMPERATURE CURVE



Graphics No: KM1132

SATURATION PRESSURE TEMPERATURE CURVE

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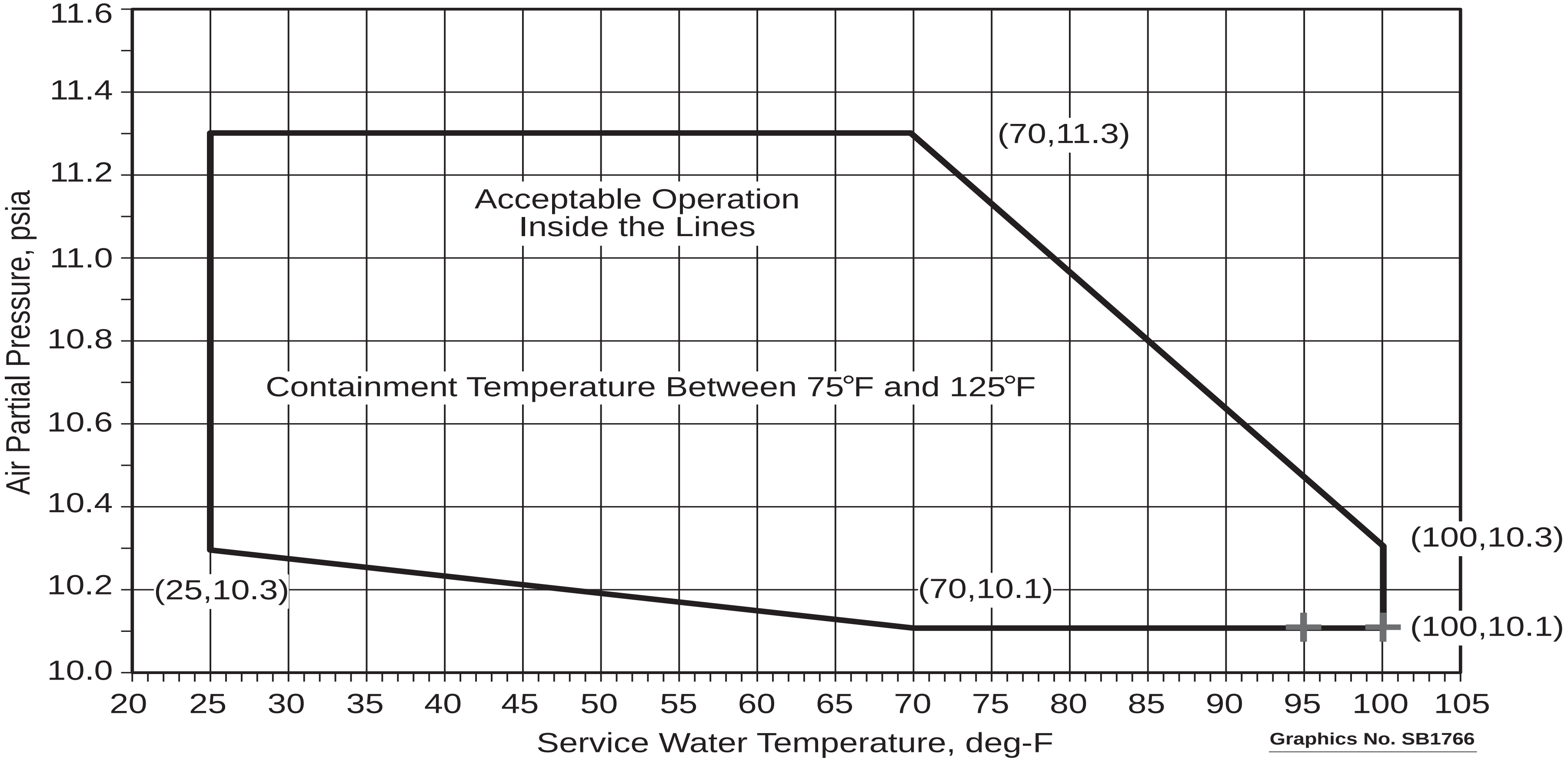
Attachment 4

CONTAINMENT ALLOWABLE AIR PARTIAL PRESSURE INDICATION VS. SERVICE WATER TEMPERATURE



Graphics No. SB1766

Note: Operation On or Outside the Line Requires Entry into TS 3.8.D.1.a

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Attachment 5

ALLOWABLE AIR PARTIAL PRESSURE TABLE

Service Water Temperature (°F)	Maximum Allowable Air Partial Pressure (psia)	Minimum Allowable Air Partial Pressure (psia)	Service Water Temperature (°F)	Maximum Allowable Air Partial Pressure (psia)	Minimum Allowable Air Partial Pressure (psia)
25.0	11.3	10.3000	28.1	11.3	10.2862
25.1	11.3	10.2996	28.2	11.3	10.2858
25.2	11.3	10.2991	28.3	11.3	10.2853
25.3	11.3	10.2987	28.4	11.3	10.2849
25.4	11.3	10.2982	28.5	11.3	10.2844
25.5	11.3	10.2978	28.6	11.3	10.2840
25.6	11.3	10.2973	28.7	11.3	10.2836
25.7	11.3	10.2969	28.8	11.3	10.2831
25.8	11.3	10.2964	28.9	11.3	10.2827
25.9	11.3	10.2960	29.0	11.3	10.2822
26.0	11.3	10.2956	29.1	11.3	10.2818
26.1	11.3	10.2951	29.2	11.3	10.2813
26.2	11.3	10.2947	29.3	11.3	10.2809
26.3	11.3	10.2942	29.4	11.3	10.2804
26.4	11.3	10.2938	29.5	11.3	10.2800
26.5	11.3	10.2933	29.6	11.3	10.2796
26.6	11.3	10.2929	29.7	11.3	10.2791
26.7	11.3	10.2924	29.8	11.3	10.2787
26.8	11.3	10.2920	29.9	11.3	10.2782
26.9	11.3	10.2916	30.0	11.3	10.2778
27.0	11.3	10.2911	30.1	11.3	10.2773
27.1	11.3	10.2907	30.2	11.3	10.2769
27.2	11.3	10.2902	30.3	11.3	10.2764
27.3	11.3	10.2898	30.4	11.3	10.2760
27.4	11.3	10.2893	30.5	11.3	10.2756
27.5	11.3	10.2889	30.6	11.3	10.2751
27.6	11.3	10.2884	30.7	11.3	10.2747
27.7	11.3	10.2880	30.8	11.3	10.2742
27.8	11.3	10.2876	30.9	11.3	10.2738
27.9	11.3	10.2871	31.0	11.3	10.2733
28.0	11.3	10.2867	31.1	11.3	10.2729

Attachment 5

ALLOWABLE AIR PARTIAL PRESSURE TABLE

Service Water Temperature (°F)	Maximum Allowable Air Partial Pressure (psia)	Minimum Allowable Air Partial Pressure (psia)	Service Water Temperature (°F)	Maximum Allowable Air Partial Pressure (psia)	Minimum Allowable Air Partial Pressure (psia)
31.2	11.3	10.2724	34.2	11.3	10.2591
31.3	11.3	10.2720	34.3	11.3	10.2587
31.4	11.3	10.2716	34.4	11.3	10.2582
31.5	11.3	10.2711	34.5	11.3	10.2578
31.6	11.3	10.2707	34.6	11.3	10.2573
31.7	11.3	10.2702	34.7	11.3	10.2569
31.8	11.3	10.2698	34.8	11.3	10.2564
31.9	11.3	10.2693	34.9	11.3	10.2560
32.0	11.3	10.2689	35.0	11.3	10.2556
32.1	11.3	10.2684	35.1	11.3	10.2551
32.2	11.3	10.2680	35.2	11.3	10.2547
32.3	11.3	10.2676	35.3	11.3	10.2542
32.4	11.3	10.2671	35.4	11.3	10.2538
32.5	11.3	10.2667	35.5	11.3	10.2533
32.6	11.3	10.2662	35.6	11.3	10.2529
32.7	11.3	10.2658	35.7	11.3	10.2524
32.8	11.3	10.2653	35.8	11.3	10.2520
32.9	11.3	10.2649	35.9	11.3	10.2516
33.0	11.3	10.2644	36.0	11.3	10.2511
33.1	11.3	10.2640	36.1	11.3	10.2507
33.2	11.3	10.2636	36.2	11.3	10.2502
33.3	11.3	10.2631	36.3	11.3	10.2498
33.4	11.3	10.2627	36.4	11.3	10.2493
33.5	11.3	10.2622	36.5	11.3	10.2489
33.6	11.3	10.2618	36.6	11.3	10.2484
33.7	11.3	10.2613	36.7	11.3	10.2480
33.8	11.3	10.2609	36.8	11.3	10.2476
33.9	11.3	10.2604	36.9	11.3	10.2471
34.0	11.3	10.2600	37.0	11.3	10.2467
34.1	11.3	10.2596	37.1	11.3	10.2462

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Attachment 5

ALLOWABLE AIR PARTIAL PRESSURE TABLE

Service Water Temperature (°F)	Maximum Allowable Air Partial Pressure (psia)	Minimum Allowable Air Partial Pressure (psia)	Service Water Temperature (°F)	Maximum Allowable Air Partial Pressure (psia)	Minimum Allowable Air Partial Pressure (psia)
37.2	11.3	10.2458	40.2	11.3	10.2324
37.3	11.3	10.2453	40.3	11.3	10.2320
37.4	11.3	10.2449	40.4	11.3	10.2316
37.5	11.3	10.2444	40.5	11.3	10.2311
37.6	11.3	10.2440	40.6	11.3	10.2307
37.7	11.3	10.2436	40.7	11.3	10.2302
37.8	11.3	10.2431	40.8	11.3	10.2298
37.9	11.3	10.2427	40.9	11.3	10.2293
38.0	11.3	10.2422	41.0	11.3	10.2289
38.1	11.3	10.2418	41.1	11.3	10.2284
38.2	11.3	10.2413	41.2	11.3	10.2280
38.3	11.3	10.2409	41.3	11.3	10.2276
38.4	11.3	10.2404	41.4	11.3	10.2271
38.5	11.3	10.2400	41.5	11.3	10.2267
38.6	11.3	10.2396	41.6	11.3	10.2262
38.7	11.3	10.2391	41.7	11.3	10.2258
38.8	11.3	10.2387	41.8	11.3	10.2253
38.9	11.3	10.2382	41.9	11.3	10.2249
39.0	11.3	10.2378	42.0	11.3	10.2244
39.1	11.3	10.2373	42.1	11.3	10.2240
39.2	11.3	10.2369	42.2	11.3	10.2236
39.3	11.3	10.2364	42.3	11.3	10.2231
39.4	11.3	10.2360	42.4	11.3	10.2227
39.5	11.3	10.2356	42.5	11.3	10.2222
39.6	11.3	10.2351	42.6	11.3	10.2218
39.7	11.3	10.2347	42.7	11.3	10.2213
39.8	11.3	10.2342	42.8	11.3	10.2209
39.9	11.3	10.2338	42.9	11.3	10.2204
40.0	11.3	10.2333	43.0	11.3	10.2200
40.1	11.3	10.2329	43.1	11.3	10.2196

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Attachment 5

ALLOWABLE AIR PARTIAL PRESSURE TABLE

Service Water Temperature (°F)	Maximum Allowable Air Partial Pressure (psia)	Minimum Allowable Air Partial Pressure (psia)	Service Water Temperature (°F)	Maximum Allowable Air Partial Pressure (psia)	Minimum Allowable Air Partial Pressure (psia)
43.2	11.3	10.2191	46.1	11.3	10.2062
43.3	11.3	10.2187	46.2	11.3	10.2058
43.4	11.3	10.2182	46.3	11.3	10.2053
43.5	11.3	10.2178	46.4	11.3	10.2049
43.6	11.3	10.2173	46.5	11.3	10.2044
43.7	11.3	10.2169	46.6	11.3	10.2040
43.8	11.3	10.2164	46.7	11.3	10.2036
43.9	11.3	10.2160	46.8	11.3	10.2031
44.0	11.3	10.2156	46.9	11.3	10.2027
44.1	11.3	10.2151	47.0	11.3	10.2022
44.2	11.3	10.2147	47.1	11.3	10.2018
44.3	11.3	10.2142	47.2	11.3	10.2013
44.4	11.3	10.2138	47.3	11.3	10.2009
44.5	11.3	10.2133	47.4	11.3	10.2004
44.6	11.3	10.2129	47.5	11.3	10.2000
44.7	11.3	10.2124	47.6	11.3	10.1996
44.8	11.3	10.2120	47.7	11.3	10.1991
44.9	11.3	10.2116	47.8	11.3	10.1987
45.0	11.3	10.2111	47.9	11.3	10.1982
45.1	11.3	10.2107	48.0	11.3	10.1978
45.2	11.3	10.2102	48.1	11.3	10.1973
45.3	11.3	10.2098	48.2	11.3	10.1969
45.4	11.3	10.2093	48.3	11.3	10.1964
45.5	11.3	10.2089	48.4	11.3	10.1960
45.6	11.3	10.2084	48.5	11.3	10.1956
45.7	11.3	10.2080	48.6	11.3	10.1951
45.8	11.3	10.2076	48.7	11.3	10.1947
45.9	11.3	10.2071	48.8	11.3	10.1942
46.0	11.3	10.2067	48.9	11.3	10.1938

(Page 5 of 13)

Attachment 5

ALLOWABLE AIR PARTIAL PRESSURE TABLE

Service Water Temperature (°F)	Maximum Allowable Air Partial Pressure (psia)	Minimum Allowable Air Partial Pressure (psia)	Service Water Temperature (°F)	Maximum Allowable Air Partial Pressure (psia)	Minimum Allowable Air Partial Pressure (psia)
49.0	11.3	10.1933	52.1	11.3	10.1796
49.1	11.3	10.1929	52.2	11.3	10.1791
49.2	11.3	10.1924	52.3	11.3	10.1787
49.3	11.3	10.1920	52.4	11.3	10.1782
49.4	11.3	10.1916	52.5	11.3	10.1778
49.5	11.3	10.1911	52.6	11.3	10.1773
49.6	11.3	10.1907	52.7	11.3	10.1769
49.7	11.3	10.1902	52.8	11.3	10.1764
49.8	11.3	10.1898	52.9	11.3	10.1760
49.9	11.3	10.1893	53.0	11.3	10.1756
50.0	11.3	10.1889	53.1	11.3	10.1751
50.1	11.3	10.1884	53.2	11.3	10.1747
50.2	11.3	10.1880	53.3	11.3	10.1742
50.3	11.3	10.1876	53.4	11.3	10.1738
50.4	11.3	10.1871	53.5	11.3	10.1733
50.5	11.3	10.1867	53.6	11.3	10.1729
50.6	11.3	10.1862	53.7	11.3	10.1724
50.7	11.3	10.1858	53.8	11.3	10.1720
50.8	11.3	10.1853	53.9	11.3	10.1716
50.9	11.3	10.1849	54.0	11.3	10.1711
51.0	11.3	10.1844	54.1	11.3	10.1707
51.1	11.3	10.1840	54.2	11.3	10.1702
51.2	11.3	10.1836	54.3	11.3	10.1698
51.3	11.3	10.1831	54.4	11.3	10.1693
51.4	11.3	10.1827	54.5	11.3	10.1689
51.5	11.3	10.1822	54.6	11.3	10.1684
51.6	11.3	10.1818	54.7	11.3	10.1680
51.7	11.3	10.1813	54.8	11.3	10.1676
51.8	11.3	10.1809	54.9	11.3	10.1671
51.9	11.3	10.1804	55.0	11.3	10.1667
52.0	11.3	10.1800	55.1	11.3	10.1662

Attachment 5

ALLOWABLE AIR PARTIAL PRESSURE TABLE

Service Water Temperature (°F)	Maximum Allowable Air Partial Pressure (psia)	Minimum Allowable Air Partial Pressure (psia)	Service Water Temperature (°F)	Maximum Allowable Air Partial Pressure (psia)	Minimum Allowable Air Partial Pressure (psia)
55.2	11.3	10.1658	58.3	11.3	10.1520
55.3	11.3	10.1653	58.4	11.3	10.1516
55.4	11.3	10.1649	58.5	11.3	10.1511
55.5	11.3	10.1644	58.6	11.3	10.1507
55.6	11.3	10.1640	58.7	11.3	10.1502
55.7	11.3	10.1636	58.8	11.3	10.1498
55.8	11.3	10.1631	58.9	11.3	10.1493
55.9	11.3	10.1627	59.0	11.3	10.1489
56.0	11.3	10.1622	59.1	11.3	10.1484
56.1	11.3	10.1618	59.2	11.3	10.1480
56.2	11.3	10.1613	59.3	11.3	10.1476
56.3	11.3	10.1609	59.4	11.3	10.1471
56.4	11.3	10.1604	59.5	11.3	10.1467
56.5	11.3	10.1600	59.6	11.3	10.1462
56.6	11.3	10.1596	59.7	11.3	10.1458
56.7	11.3	10.1591	59.8	11.3	10.1453
56.8	11.3	10.1587	59.9	11.3	10.1449
56.9	11.3	10.1582	60.0	11.3	10.1444
57.0	11.3	10.1578	60.1	11.3	10.1440
57.1	11.3	10.1573	60.2	11.3	10.1436
57.2	11.3	10.1569	60.3	11.3	10.1431
57.3	11.3	10.1564	60.4	11.3	10.1427
57.4	11.3	10.1560	60.5	11.3	10.1422
57.5	11.3	10.1556	60.6	11.3	10.1418
57.6	11.3	10.1551	60.7	11.3	10.1413
57.7	11.3	10.1547	60.8	11.3	10.1409
57.8	11.3	10.1542	60.9	11.3	10.1404
57.9	11.3	10.1538	61.0	11.3	10.1400
58.0	11.3	10.1533	61.1	11.3	10.1396
58.1	11.3	10.1529	61.2	11.3	10.1391
58.2	11.3	10.1524	61.3	11.3	10.1387

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Attachment 5

ALLOWABLE AIR PARTIAL PRESSURE TABLE

Service Water Temperature (°F)	Maximum Allowable Air Partial Pressure (psia)	Minimum Allowable Air Partial Pressure (psia)	Service Water Temperature (°F)	Maximum Allowable Air Partial Pressure (psia)	Minimum Allowable Air Partial Pressure (psia)
61.4	11.3	10.1382	64.5	11.3	10.1244
61.5	11.3	10.1378	64.6	11.3	10.1240
61.6	11.3	10.1373	64.7	11.3	10.1236
61.7	11.3	10.1369	64.8	11.3	10.1231
61.8	11.3	10.1364	64.9	11.3	10.1227
61.9	11.3	10.1360	65.0	11.3	10.1222
62.0	11.3	10.1356	65.1	11.3	10.1218
62.1	11.3	10.1351	65.2	11.3	10.1213
62.2	11.3	10.1347	65.3	11.3	10.1209
62.3	11.3	10.1342	65.4	11.3	10.1204
62.4	11.3	10.1338	65.5	11.3	10.1200
62.5	11.3	10.1333	65.6	11.3	10.1196
62.6	11.3	10.1329	65.7	11.3	10.1191
62.7	11.3	10.1324	65.8	11.3	10.1187
62.8	11.3	10.1320	65.9	11.3	10.1182
62.9	11.3	10.1316	66.0	11.3	10.1178
63.0	11.3	10.1311	66.1	11.3	10.1173
63.1	11.3	10.1307	66.2	11.3	10.1169
63.2	11.3	10.1302	66.3	11.3	10.1164
63.3	11.3	10.1298	66.4	11.3	10.1160
63.4	11.3	10.1293	66.5	11.3	10.1156
63.5	11.3	10.1289	66.6	11.3	10.1151
63.6	11.3	10.1284	66.7	11.3	10.1147
63.7	11.3	10.1280	66.8	11.3	10.1142
63.8	11.3	10.1276	66.9	11.3	10.1138
63.9	11.3	10.1271	67.0	11.3	10.1133
64.0	11.3	10.1267	67.1	11.3	10.1129
64.1	11.3	10.1262	67.2	11.3	10.1124
64.2	11.3	10.1258	67.3	11.3	10.1120
64.3	11.3	10.1253	67.4	11.3	10.1116
64.4	11.3	10.1249	67.5	11.3	10.1111

Attachment 5

ALLOWABLE AIR PARTIAL PRESSURE TABLE

Service Water Temperature (°F)	Maximum Allowable Air Partial Pressure (psia)	Minimum Allowable Air Partial Pressure (psia)	Service Water Temperature (°F)	Maximum Allowable Air Partial Pressure (psia)	Minimum Allowable Air Partial Pressure (psia)
67.6	11.3	10.1107	70.5	11.283	10.1
67.7	11.3	10.1102	70.6	11.280	10.1
67.8	11.3	10.1098	70.7	11.277	10.1
67.9	11.3	10.1093	70.8	11.273	10.1
68.0	11.3	10.1089	70.9	11.270	10.1
68.1	11.3	10.1084	71.0	11.267	10.1
68.2	11.3	10.1080	71.1	11.263	10.1
68.3	11.3	10.1076	71.2	11.260	10.1
68.4	11.3	10.1071	71.3	11.257	10.1
68.5	11.3	10.1067	71.4	11.253	10.1
68.6	11.3	10.1062	71.5	11.250	10.1
68.7	11.3	10.1058	71.6	11.247	10.1
68.8	11.3	10.1053	71.7	11.243	10.1
68.9	11.3	10.1049	71.8	11.240	10.1
69.0	11.3	10.1044	71.9	11.237	10.1
69.1	11.3	10.1040	72.0	11.233	10.1
69.2	11.3	10.1036	72.1	11.230	10.1
69.3	11.3	10.1031	72.2	11.227	10.1
69.4	11.3	10.1027	72.3	11.223	10.1
69.5	11.3	10.1022	72.4	11.220	10.1
69.6	11.3	10.1018	72.5	11.217	10.1
69.7	11.3	10.1013	72.6	11.213	10.1
69.8	11.3	10.1009	72.7	11.210	10.1
69.9	11.3	10.1004	72.8	11.207	10.1
70.0	11.3	10.1	72.9	11.203	10.1
70.1	11.297	10.1	73.0	11.200	10.1
70.2	11.293	10.1	73.1	11.197	10.1
70.3	11.290	10.1	73.2	11.193	10.1
70.4	11.287	10.1	73.3	11.190	10.1

Attachment 5

ALLOWABLE AIR PARTIAL PRESSURE TABLE

Service Water Temperature (°F)	Maximum Allowable Air Partial Pressure (psia)	Minimum Allowable Air Partial Pressure (psia)	Service Water Temperature (°F)	Maximum Allowable Air Partial Pressure (psia)	Minimum Allowable Air Partial Pressure (psia)
73.4	11.187	10.1	76.5	11.083	10.1
73.5	11.183	10.1	76.6	11.080	10.1
73.6	11.180	10.1	76.7	11.077	10.1
73.7	11.177	10.1	76.8	11.073	10.1
73.8	11.173	10.1	76.9	11.070	10.1
73.9	11.170	10.1	77.0	11.067	10.1
74.0	11.167	10.1	77.1	11.063	10.1
74.1	11.163	10.1	77.2	11.060	10.1
74.2	11.160	10.1	77.3	11.057	10.1
74.3	11.157	10.1	77.4	11.053	10.1
74.4	11.153	10.1	77.5	11.050	10.1
74.5	11.150	10.1	77.6	11.047	10.1
74.6	11.147	10.1	77.7	11.043	10.1
74.7	11.143	10.1	77.8	11.040	10.1
74.8	11.140	10.1	77.9	11.037	10.1
74.9	11.137	10.1	78.0	11.033	10.1
75.0	11.133	10.1	78.1	11.030	10.1
75.1	11.130	10.1	78.2	11.027	10.1
75.2	11.127	10.1	78.3	11.023	10.1
75.3	11.123	10.1	78.4	11.020	10.1
75.4	11.120	10.1	78.5	11.017	10.1
75.5	11.117	10.1	78.6	11.013	10.1
75.6	11.113	10.1	78.7	11.010	10.1
75.7	11.110	10.1	78.8	11.007	10.1
75.8	11.107	10.1	78.9	11.003	10.1
75.9	11.103	10.1	79.0	11.000	10.1
76.0	11.100	10.1	79.1	10.997	10.1
76.1	11.097	10.1	79.2	10.993	10.1
76.2	11.093	10.1	79.3	10.990	10.1
76.3	11.090	10.1	79.4	10.987	10.1
76.4	11.087	10.1	79.5	10.983	10.1

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Attachment 5

ALLOWABLE AIR PARTIAL PRESSURE TABLE

Service Water Temperature (°F)	Maximum Allowable Air Partial Pressure (psia)	Minimum Allowable Air Partial Pressure (psia)	Service Water Temperature (°F)	Maximum Allowable Air Partial Pressure (psia)	Minimum Allowable Air Partial Pressure (psia)
79.6	10.980	10.1	82.6	10.880	10.1
79.7	10.977	10.1	82.7	10.877	10.1
79.8	10.973	10.1	82.8	10.873	10.1
79.9	10.970	10.1	82.9	10.870	10.1
80.0	10.967	10.1	83.0	10.867	10.1
80.1	10.963	10.1	83.1	10.863	10.1
80.2	10.960	10.1	83.2	10.860	10.1
80.3	10.957	10.1	83.3	10.857	10.1
80.4	10.953	10.1	83.4	10.853	10.1
80.5	10.950	10.1	83.5	10.850	10.1
80.6	10.947	10.1	83.6	10.847	10.1
80.7	10.943	10.1	83.7	10.843	10.1
80.8	10.940	10.1	83.8	10.840	10.1
80.9	10.937	10.1	83.9	10.837	10.1
81.0	10.933	10.1	84.0	10.833	10.1
81.1	10.930	10.1	84.1	10.830	10.1
81.2	10.927	10.1	84.2	10.827	10.1
81.3	10.923	10.1	84.3	10.823	10.1
81.4	10.920	10.1	84.4	10.820	10.1
81.5	10.917	10.1	84.5	10.817	10.1
81.6	10.913	10.1	84.6	10.813	10.1
81.7	10.910	10.1	84.7	10.810	10.1
81.8	10.907	10.1	84.8	10.807	10.1
81.9	10.903	10.1	84.9	10.803	10.1
82.0	10.900	10.1	85.0	10.800	10.1
82.1	10.897	10.1	85.1	10.797	10.1
82.2	10.893	10.1	85.2	10.793	10.1
82.3	10.890	10.1	85.3	10.790	10.1
82.4	10.887	10.1	85.4	10.787	10.1
82.5	10.883	10.1	85.5	10.783	10.1

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Attachment 5

ALLOWABLE AIR PARTIAL PRESSURE TABLE

Service Water Temperature (°F)	Maximum Allowable Air Partial Pressure (psia)	Minimum Allowable Air Partial Pressure (psia)	Service Water Temperature (°F)	Maximum Allowable Air Partial Pressure (psia)	Minimum Allowable Air Partial Pressure (psia)
85.6	10.780	10.1	88.6	10.680	10.1
85.7	10.777	10.1	88.7	10.677	10.1
85.8	10.773	10.1	88.8	10.673	10.1
85.9	10.770	10.1	88.9	10.670	10.1
86.0	10.767	10.1	89.0	10.667	10.1
86.1	10.763	10.1	89.1	10.663	10.1
86.2	10.760	10.1	89.2	10.660	10.1
86.3	10.757	10.1	89.3	10.657	10.1
86.4	10.753	10.1	89.4	10.653	10.1
86.5	10.750	10.1	89.5	10.650	10.1
86.6	10.747	10.1	89.6	10.647	10.1
86.7	10.743	10.1	89.7	10.643	10.1
86.8	10.740	10.1	89.8	10.640	10.1
86.9	10.737	10.1	89.9	10.637	10.1
87.0	10.733	10.1	90.0	10.633	10.1
87.1	10.730	10.1	90.1	10.630	10.1
87.2	10.727	10.1	90.2	10.627	10.1
87.3	10.723	10.1	90.3	10.623	10.1
87.4	10.720	10.1	90.4	10.620	10.1
87.5	10.717	10.1	90.5	10.617	10.1
87.6	10.713	10.1	90.6	10.613	10.1
87.7	10.710	10.1	90.7	10.610	10.1
87.8	10.707	10.1	90.8	10.607	10.1
87.9	10.703	10.1	90.9	10.603	10.1
88.0	10.700	10.1	91.0	10.600	10.1
88.1	10.697	10.1	91.1	10.597	10.1
88.2	10.693	10.1	91.2	10.593	10.1
88.3	10.690	10.1	91.3	10.590	10.1
88.4	10.687	10.1	91.4	10.587	10.1
88.5	10.683	10.1	91.5	10.583	10.1

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Attachment 5

ALLOWABLE AIR PARTIAL PRESSURE TABLE

Service Water Temperature (°F)	Maximum Allowable Air Partial Pressure (psia)	Minimum Allowable Air Partial Pressure (psia)	Service Water Temperature (°F)	Maximum Allowable Air Partial Pressure (psia)	Minimum Allowable Air Partial Pressure (psia)
91.6	10.580	10.1	94.6	10.480	10.1
91.7	10.577	10.1	94.7	10.477	10.1
91.8	10.573	10.1	94.8	10.473	10.1
91.9	10.570	10.1	94.9	10.470	10.1
92.0	10.567	10.1	95.0	10.467	10.1
92.1	10.563	10.1	95.1	10.463	10.1
92.2	10.560	10.1	95.2	10.460	10.1
92.3	10.557	10.1	95.3	10.457	10.1
92.4	10.553	10.1	95.4	10.453	10.1
92.5	10.550	10.1	95.5	10.450	10.1
92.6	10.547	10.1	95.6	10.447	10.1
92.7	10.543	10.1	95.7	10.443	10.1
92.8	10.540	10.1	95.8	10.440	10.1
92.9	10.537	10.1	95.9	10.437	10.1
93.0	10.533	10.1	96.0	10.433	10.1
93.1	10.530	10.1	96.1	10.430	10.1
93.2	10.527	10.1	96.2	10.427	10.1
93.3	10.523	10.1	96.3	10.423	10.1
93.4	10.520	10.1	96.4	10.420	10.1
93.5	10.517	10.1	96.5	10.417	10.1
93.6	10.513	10.1	96.6	10.413	10.1
93.7	10.510	10.1	96.7	10.410	10.1
93.8	10.507	10.1	96.8	10.407	10.1
93.9	10.503	10.1	96.9	10.403	10.1
94.0	10.500	10.1	97.0	10.400	10.1
94.1	10.497	10.1	97.1	10.397	10.1
94.2	10.493	10.1	97.2	10.393	10.1
94.3	10.490	10.1	97.3	10.390	10.1
94.4	10.487	10.1	97.4	10.387	10.1
94.5	10.483	10.1	97.5	10.383	10.1

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Attachment 5

ALLOWABLE AIR PARTIAL PRESSURE TABLE

Service Water Temperature (°F)	Maximum Allowable Air Partial Pressure (psia)	Minimum Allowable Air Partial Pressure (psia)	Service Water Temperature (°F)	Maximum Allowable Air Partial Pressure (psia)	Minimum Allowable Air Partial Pressure (psia)
97.6	10.380	10.1			
97.7	10.377	10.1			
97.8	10.373	10.1			
97.9	10.370	10.1			
98.0	10.367	10.1			
98.1	10.363	10.1			
98.2	10.360	10.1			
98.3	10.357	10.1			
98.4	10.353	10.1			
98.5	10.350	10.1			
98.6	10.347	10.1			
98.7	10.343	10.1			
98.8	10.340	10.1			
98.9	10.337	10.1			
99.0	10.333	10.1			
99.1	10.330	10.1			
99.2	10.327	10.1			
99.3	10.323	10.1			
99.4	10.320	10.1			
99.5	10.317	10.1			
99.6	10.313	10.1			
99.7	10.310	10.1			
99.8	10.307	10.1			
99.9	10.303	10.1			
100.0	10.300	10.1			

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Attachment 6

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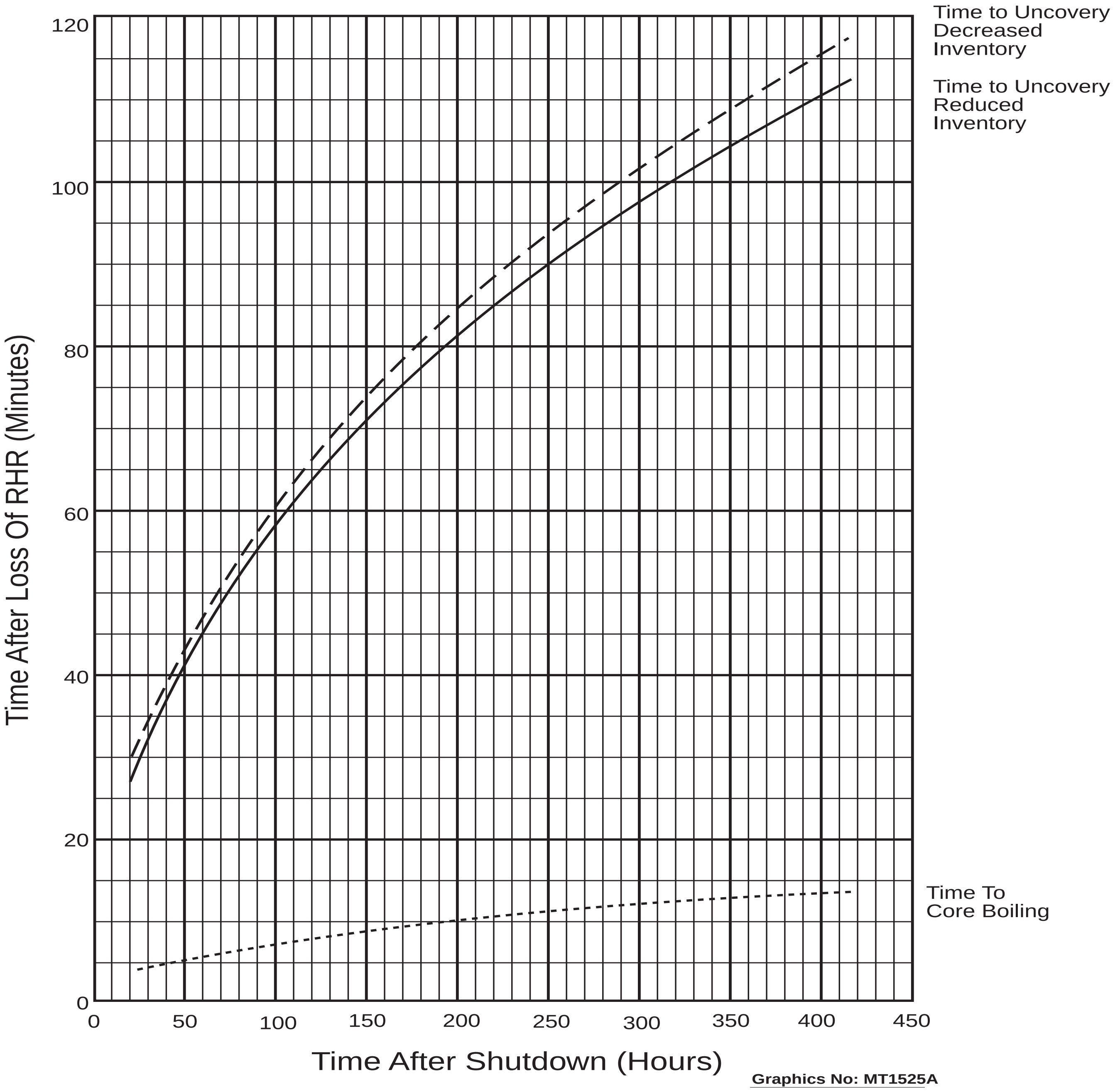
Attachment 7

CORE HEATUP TIMES FOR SURRY



CORE HEATUP TIMES

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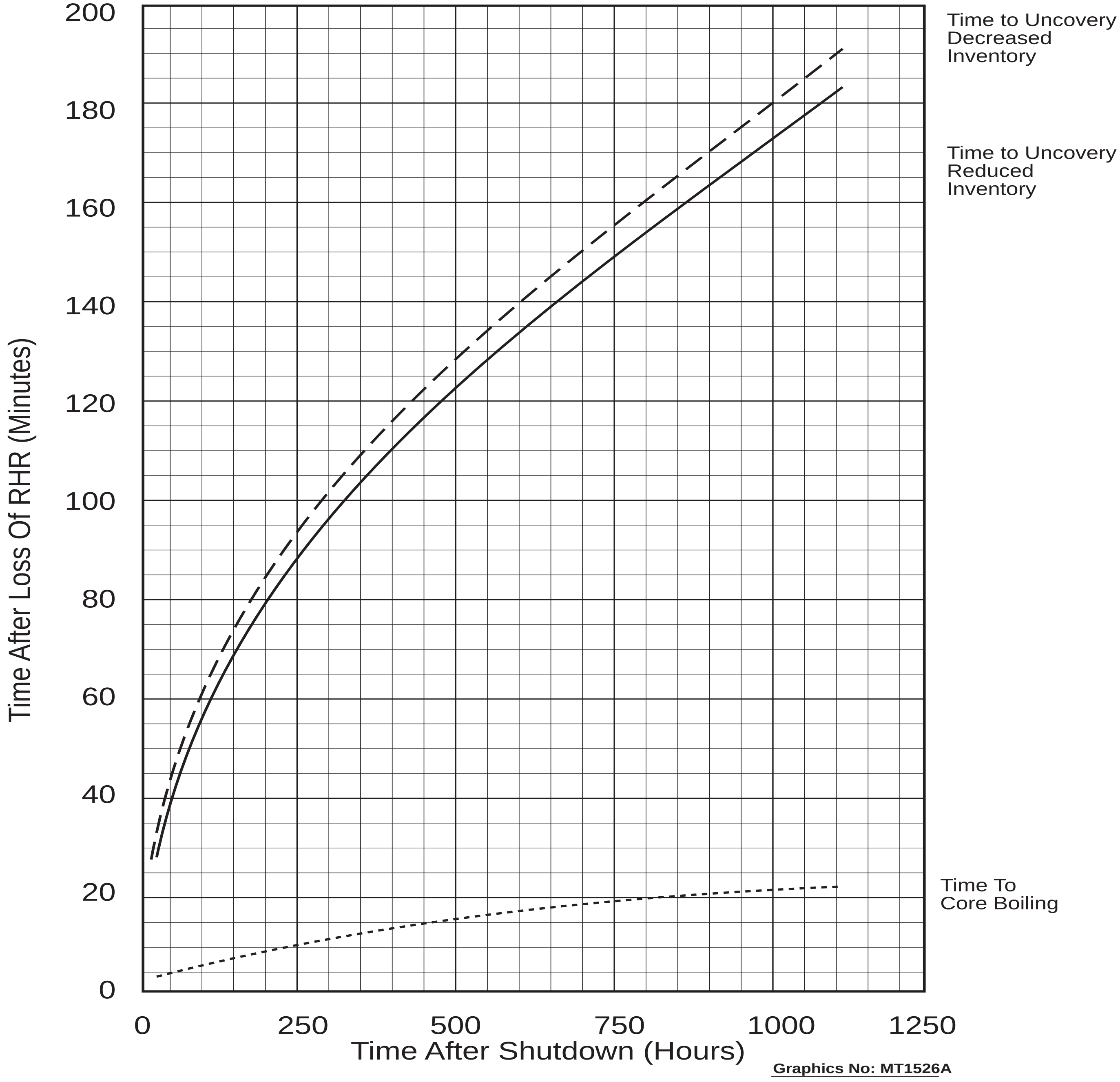
Attachment 7

CORE HEATUP TIMES FOR SURRY



CORE HEATUP TIMES

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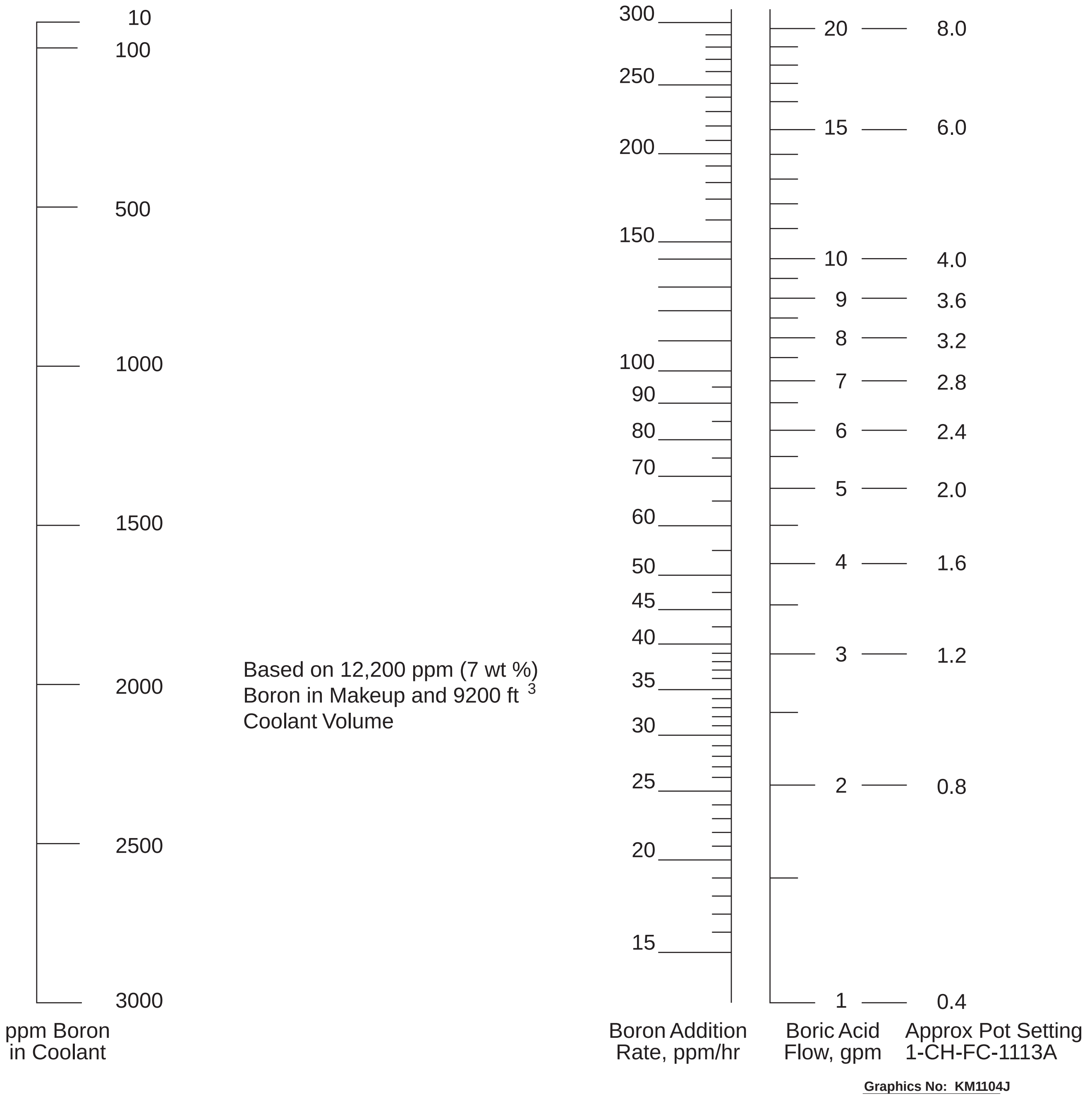
Attachment 8

BORON ADDITION RATE - COOLANT HOT



Based on 12,200 ppm (7 wt %) Boron in Makeup and 9200 ft^3 Coolant Volume

BORON ADDITION RATE - COOLANT HOT (~ 580°F)
FIGURE S-3.1-1 (UNIT 1)

NOTE: DO NOT set pot setting above 8.0 (20 GPM) on 1-CH-FC-1113A.

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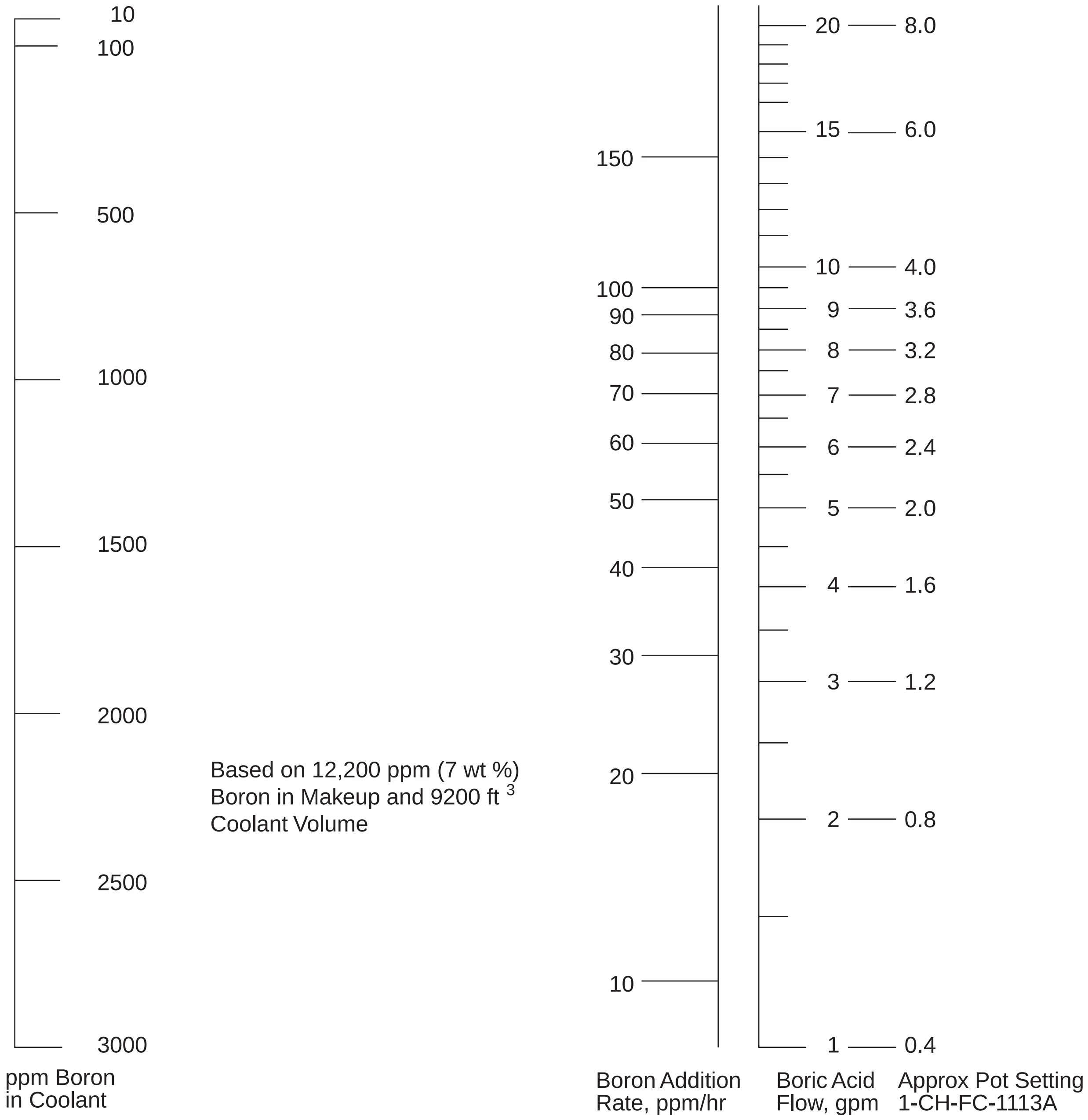
Attachment 9

BORON ADDITION RATE - COOLANT COLD



Based on 12,200 ppm (7 wt %) Boron in Makeup and 9200 ft^3 Coolant Volume

Graphics No: KM1104M

BORON ADDITION RATE - COOLANT COLD (~ 100°F)
FIGURE S-3.1-2 (UNIT 1)

NOTE: DO NOT set pot setting above 8.0 (20 GPM) on 1-CH-FC-1113A.

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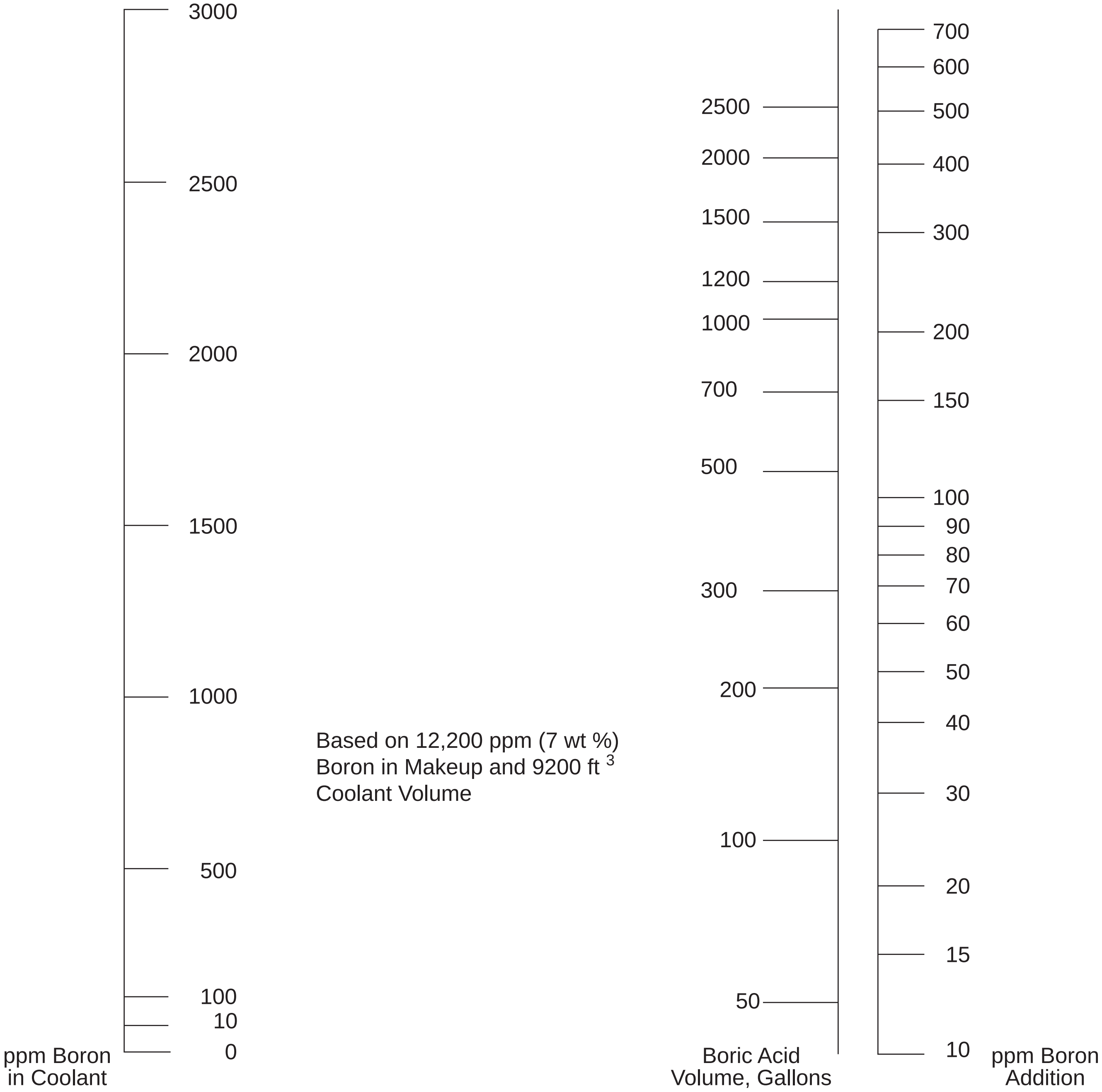
Attachment 10

BORON ADDITION - COOLANT HOT



Based on 12,200 ppm (7 wt %) Boron in Makeup and 9200 ft^3 Coolant Volume

BORON ADDITION RATE - COOLANT HOT (~ 580°F)
FIGURE S-3.1-3

Graphics No: KM1104B

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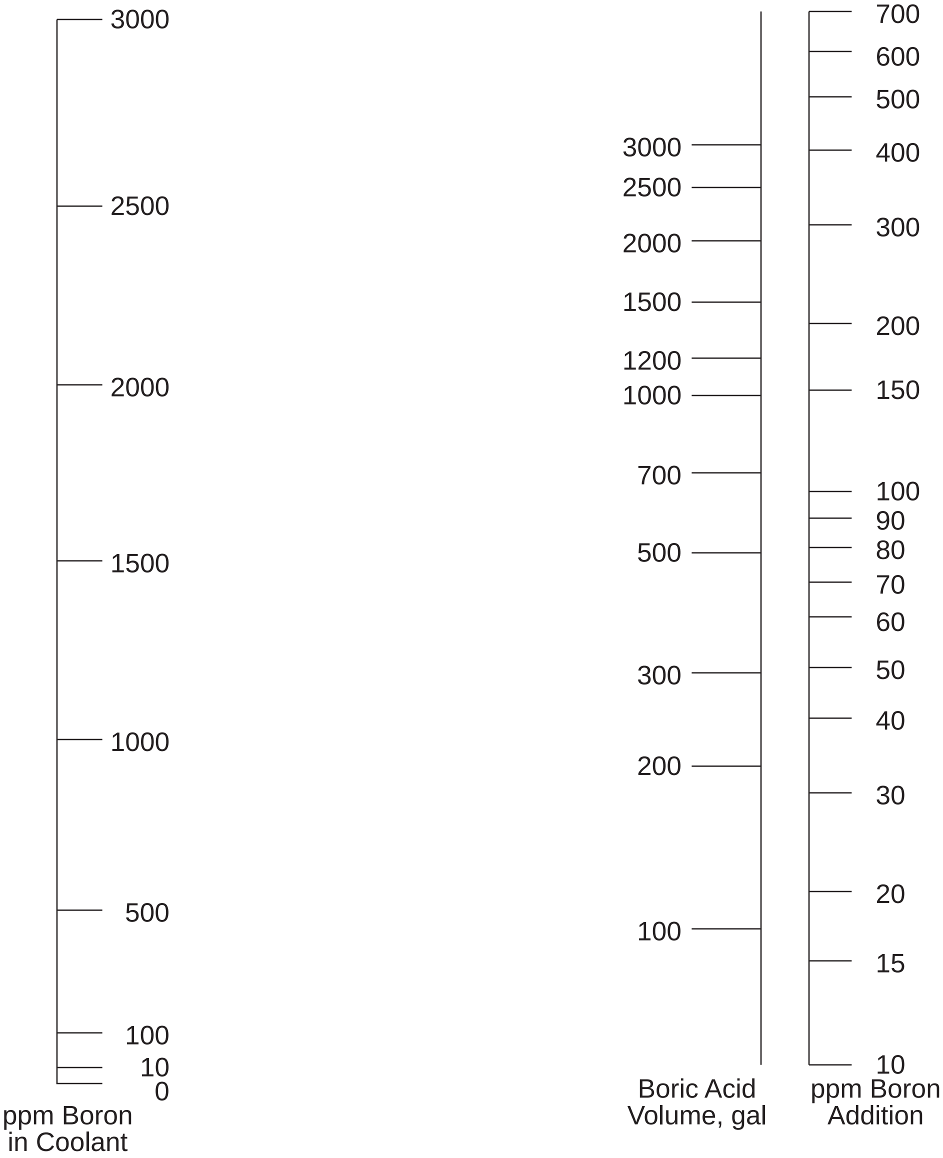
Attachment 11

BORON ADDITION - COOLANT COLD



Graphics No: CB1420

BORON ADDITION - COOLANT COLD (~ 100°F)
FIGURE S-3.1-4

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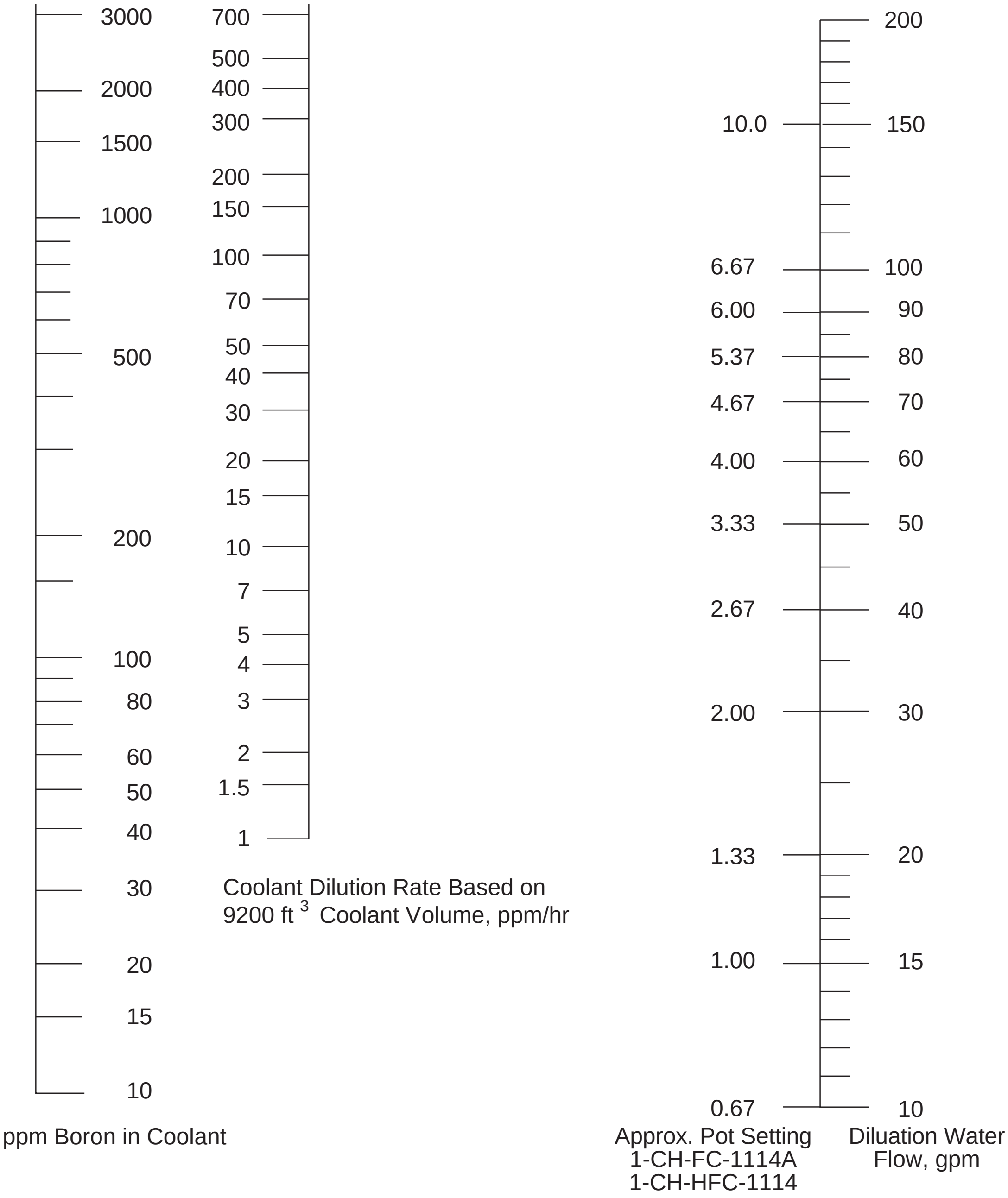
Attachment 12

DILUTION RATE - COOLANT HOT



Graphics No: KM1105D

DILUTION RATE - COOLANT HOT (~ 580°F)
FIGURE S-3.1-5 (UNIT 1)

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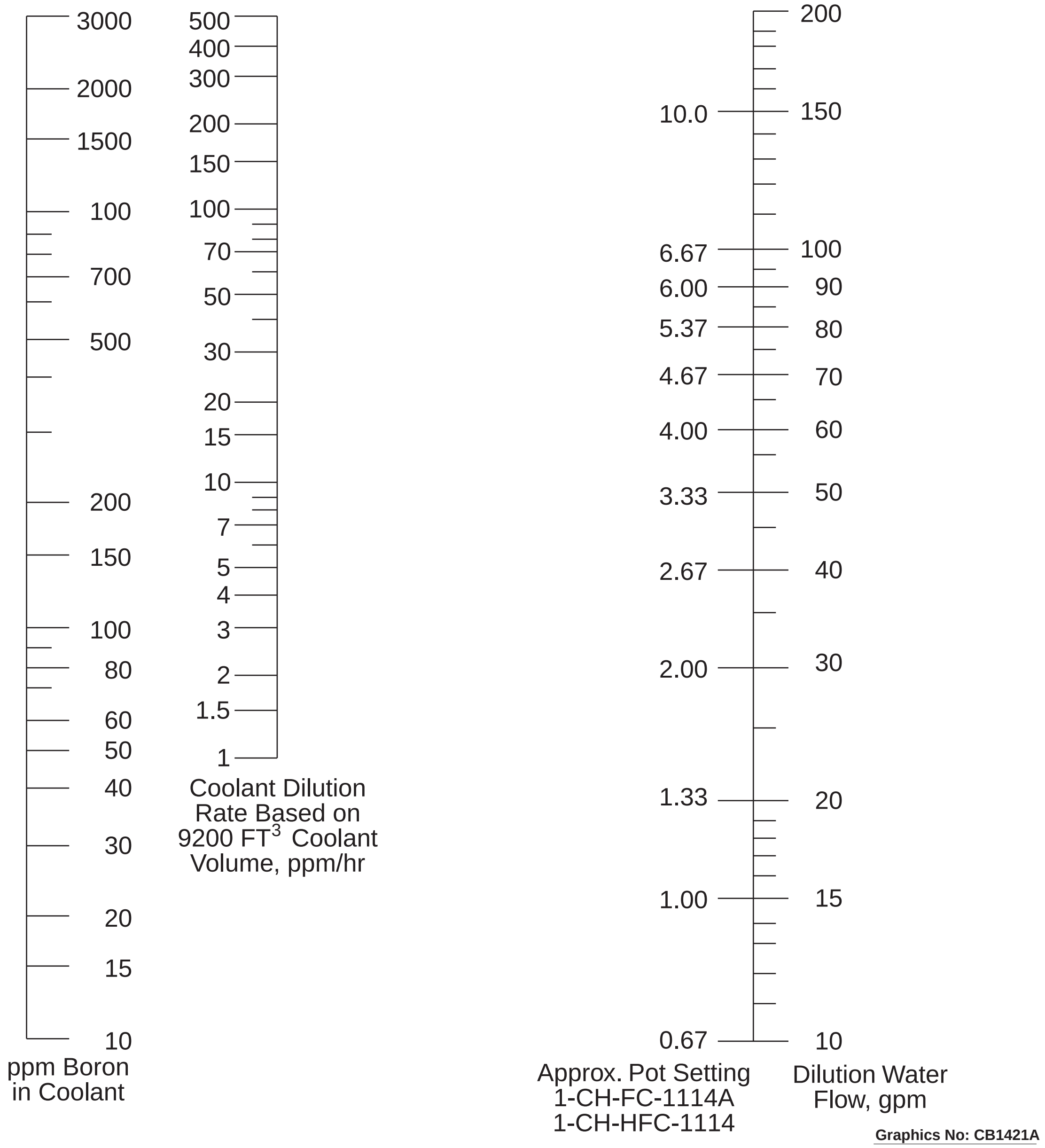
Attachment 13

DILUTION RATE - COOLANT COLD



DILUTION RATE - COOLANT COLD (~ 100°F)
FIGURE S-3.1-6

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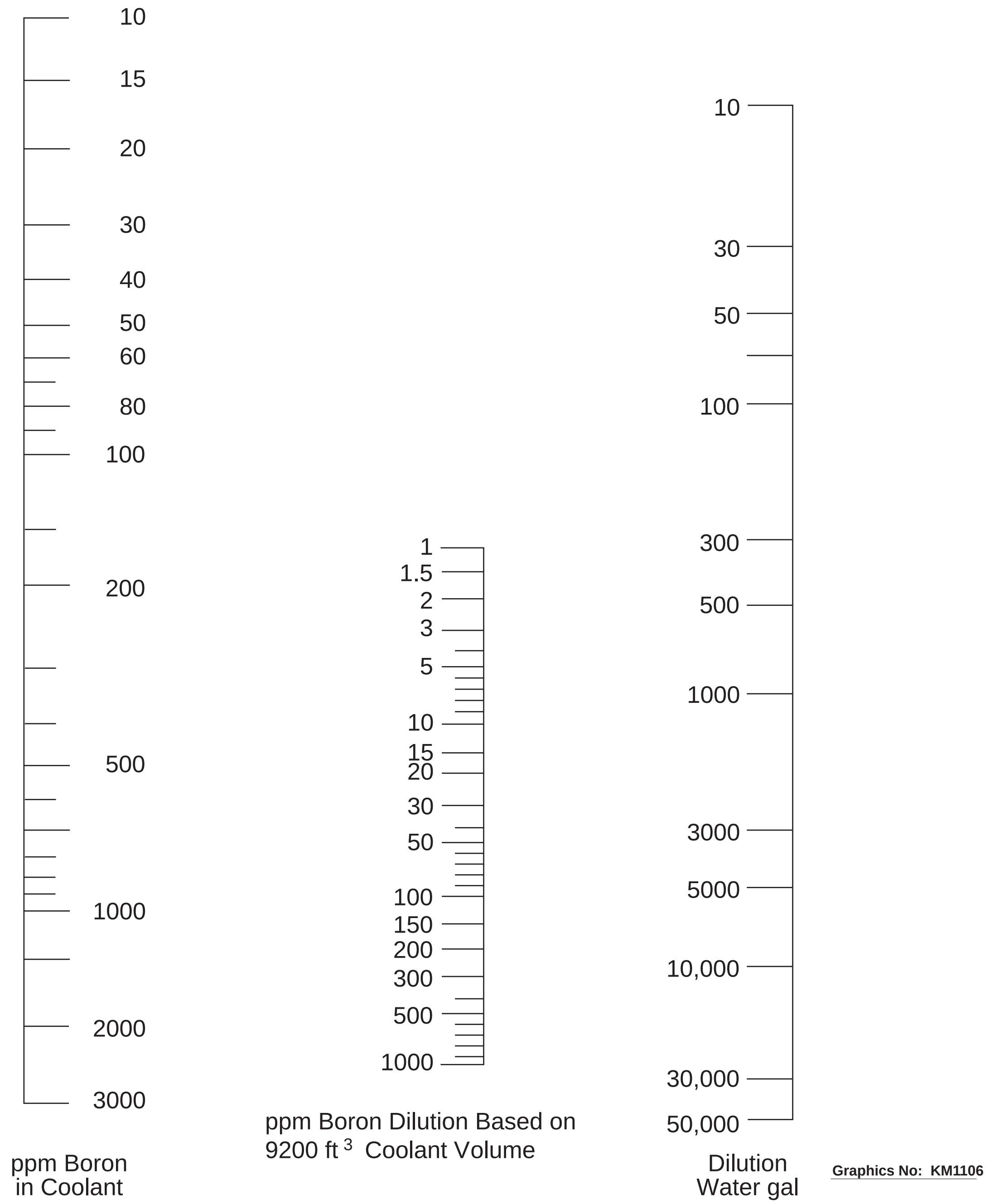
Attachment 14

DILUTION NOMOGRAPH - COOLANT HOT



DILUTION VOLUME NOMOGRAPH - COOLANT HOT (~ 580°F)
FIGURE S-3.1-7

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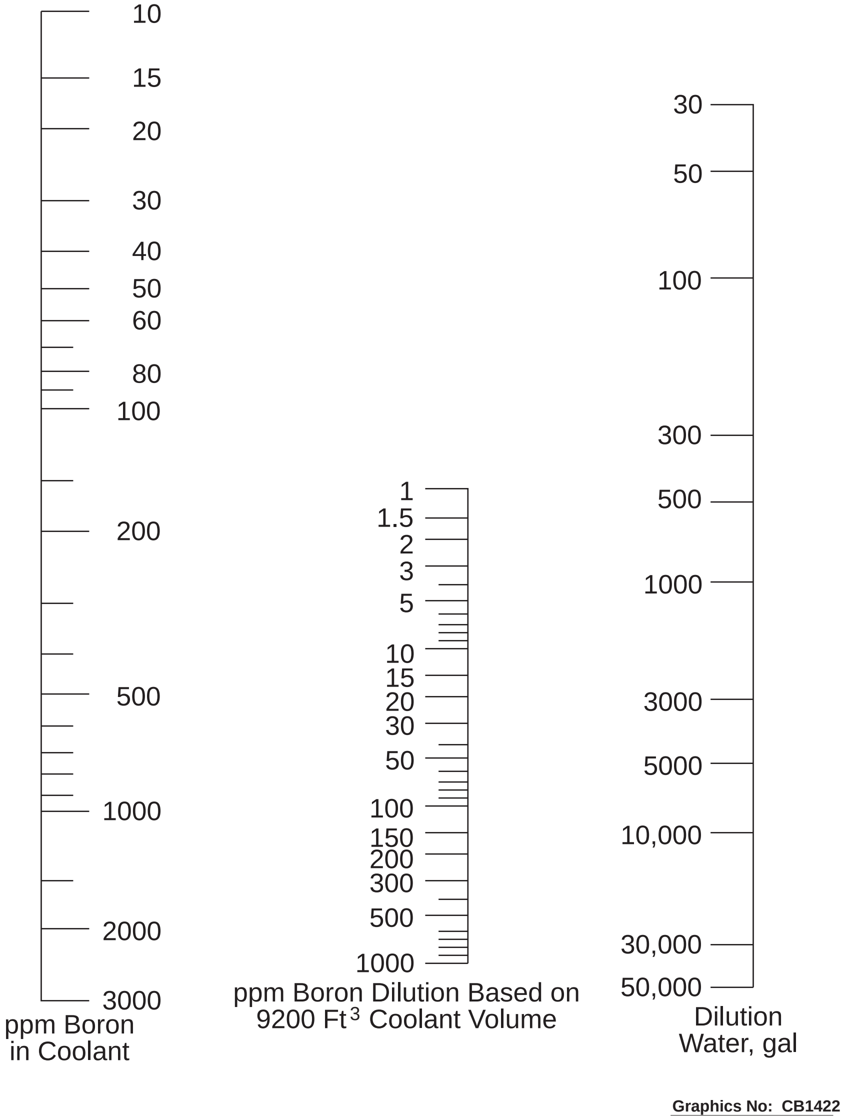
Attachment 15

DILUTION NOMOGRAPH - COOLANT COLD



DILUTION VOLUME NOMOGRAPH - COOLANT COLD (~100° F)
FIGURE S-3.1-8

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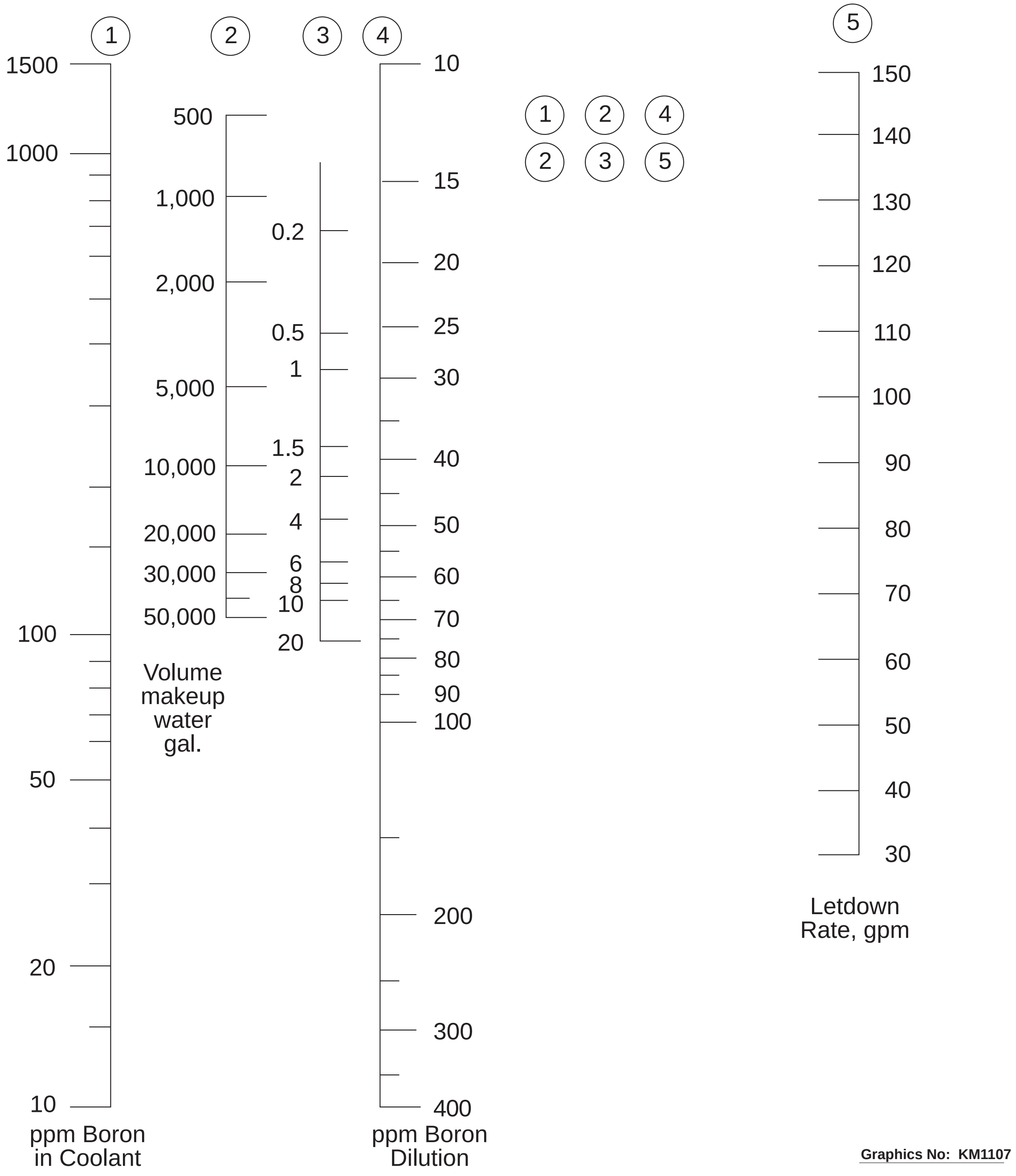
Attachment 16

DILUTION AND LETDOWN RATE NOMOGRAPH - COOLANT HOT



DILUTION AND LETDOWN RATE NOMOGRAPH - COOLANT HOT (~ 580°F)
FIGURE S-3.1-9

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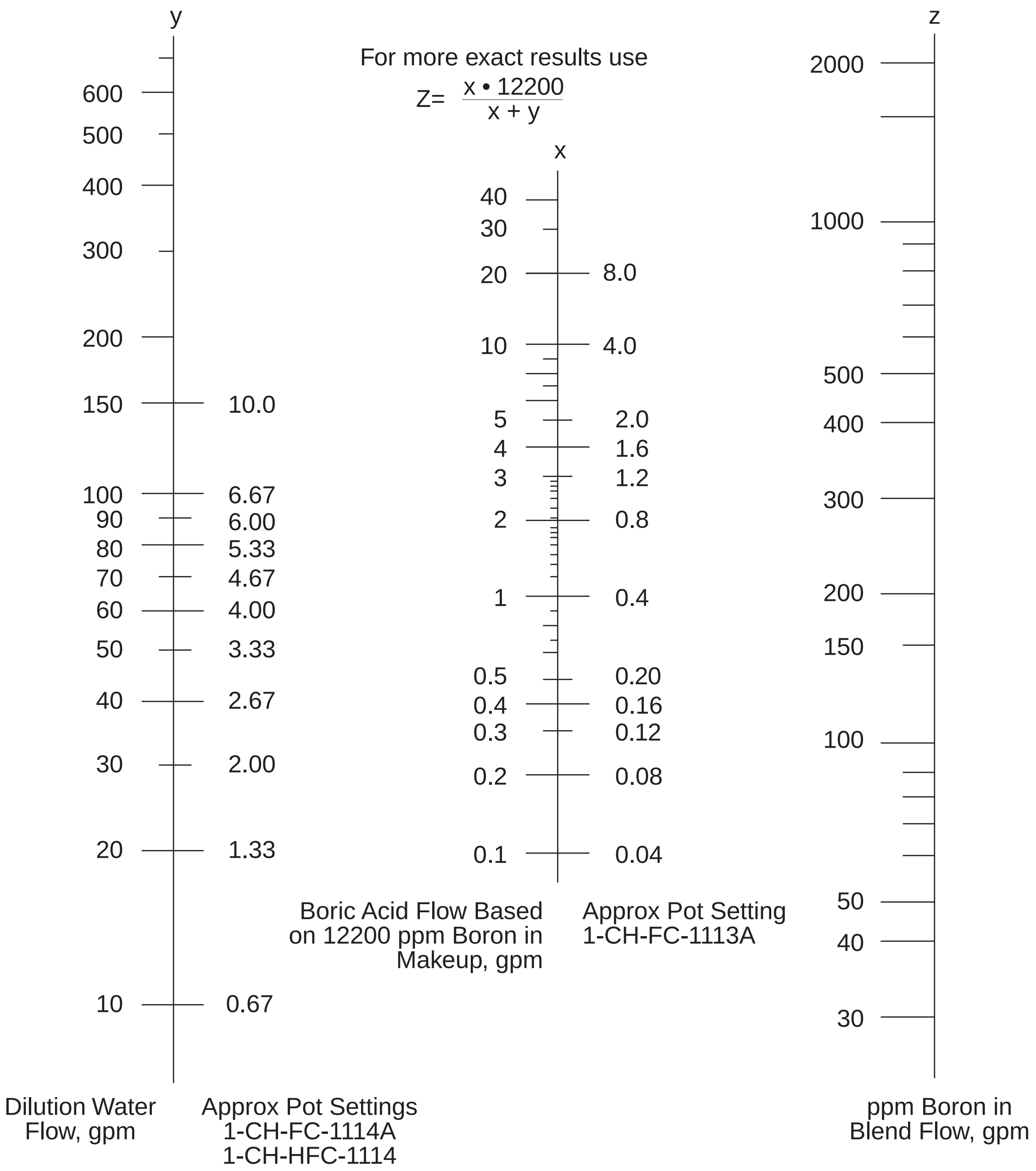
Attachment 17

BLENDED FLOW NOMOGRAPH



BLENDED FLOW NOMOGRAPH
FIGURE S-3.1-10 (UNIT 1)

NOTE: DO NOT set pot setting above 8.0 (20 GPM) on 1-CH-FC-1113A.

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Attachment 18

BLENDED FLOW NOMOGRAPH

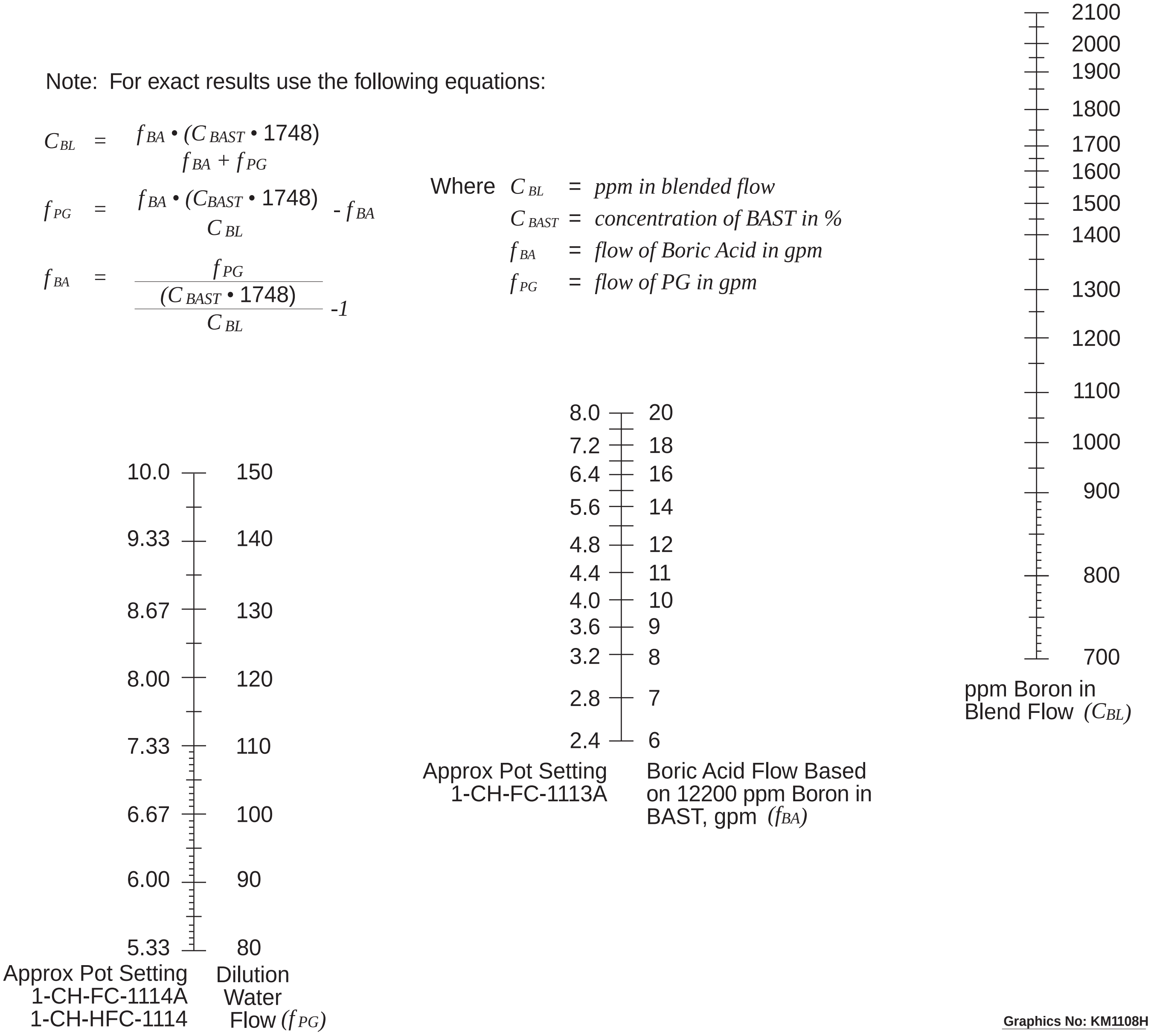
Note: For exact results use the following equations:

$$C_{BL} = \frac{f_{BA} \bullet (C_{BAST} \bullet 1748)}{f_{BA} + f_{PG}}$$

$$f_{PG} = \frac{f_{BA} \bullet (C_{BAST} \bullet 1748)}{C_{BL}} - f_{BA}$$

$$f_{BA} = \frac{f_{PG}}{\frac{(C_{BAST} \bullet 1748)}{C_{BL}} - 1}$$

Where C_{BL} = *ppm in blended flow*
C_{BAST} = *concentration of BAST in %*
f_{BA} = *flow of Boric Acid in gpm*
f_{PG} = *flow of PG in gpm*



BLENDED FLOW NOMOGRAPH
FIGURE S-3.1-10 (UNIT 1)

NOTE: DO NOT set pot setting above 8.0 (20 GPM) on 1-CH-FC-1113A.

(Page 1 of 1)

Attachment 19

BLENDED FLOW TABLE FOR 9.5 GPM FROM BAST

BLEND	BAST 7.0	BAST 7.3	BAST 7.5	BAST 7.8	BAST 8.0	BAST 8.2	BAST 8.5
1000	106.7	111.7	115.0	120.0	123.3	126.7	131.7
1100	96.2	100.7	103.7	108.3	111.3	114.3	118.8
1200	87.4	91.5	94.3	98.4	101.2	104.0	108.1
1300	79.9	83.7	86.3	90.1	92.7	95.2	99.1
1400	73.5	77.1	79.5	83.0	85.4	87.8	91.3
1500	68.0	71.3	73.5	76.9	79.1	81.3	84.6
1600	63.2	66.3	68.3	71.5	73.5	75.6	78.7
1700	58.9	61.8	63.8	66.7	68.6	70.6	73.5
1800	55.1	57.8	59.7	62.5	64.3	66.1	68.9
1900	51.7	54.3	56.1	58.7	60.4	62.2	64.8
2000	48.6	51.1	52.8	55.3	56.9	58.6	61.1
2100	45.9	48.2	49.8	52.2	53.8	55.3	57.7
2200	43.3	45.6	47.1	49.4	50.9	52.4	54.7
2300	41.0	43.2	44.7	46.8	48.3	49.7	51.9
2400	38.9	41.0	42.4	44.5	45.9	47.2	49.3
2500	37.0	39.0	40.3	42.3	43.6	45.0	47.0

*****Select the column corresponding to the BAST concentration.

This table shows the PG flowrate needed to obtain the blended flow shown in the far left column.

(Page 1 of 1)

Attachment 20

BLENDED FLOW TABLE FOR 7.0 GPM FROM BAST

BLEND	BAST 7.0	BAST 7.3	BAST 7.5	BAST 7.8	BAST 8.0	BAST 8.2	BAST 8.5
1000	78.7	82.3	84.4	88.4	90.9	93.3	97.0
1100	70.9	74.2	76.4	79.8	82.0	84.2	87.6
1200	64.4	67.4	69.5	72.5	74.6	76.6	79.7
1300	58.9	61.7	63.6	66.4	68.3	70.2	73.0
1400	54.2	56.8	58.6	61.2	62.9	64.7	67.3
1500	50.1	52.5	54.2	56.6	58.3	59.9	62.3
1600	46.5	48.8	50.4	52.7	54.2	55.7	58.0
1700	43.4	45.5	47.0	49.1	50.6	52.0	54.2
1800	40.6	42.6	44.0	46.0	47.4	48.7	50.8
1900	38.1	40.0	41.3	43.2	44.5	45.8	47.7
2000	35.8	37.7	38.9	40.7	41.9	43.2	45.0
2100	33.8	35.5	36.7	38.4	39.6	40.8	42.5
2200	31.9	33.6	34.7	36.4	37.5	38.6	40.3
2300	30.2	31.8	32.9	34.5	35.6	36.6	38.2
2400	28.7	30.2	31.2	32.8	33.8	34.8	36.3
2500	27.3	28.7	29.7	31.2	32.2	33.1	34.6

*****Select the column corresponding to the BAST concentration.

This table shows the PG flowrate needed to obtain the blended flow shown in the far left column.

(Page 1 of 1)

Attachment 21

BLENDED FLOW TABLE FOR 5.0 GPM FROM BAST

BLEND	BAST 7.0	BAST 7.3	BAST 7.5	BAST 7.8	BAST 8.0	BAST 8.2	BAST 8.5
1000	56.2	58.8	60.6	63.2	64.9	66.7	69.3
1100	50.6	53.0	54.6	57.0	58.6	60.2	62.5
1200	46.0	48.2	49.6	51.8	53.3	54.7	56.9
1300	42.1	44.1	45.4	47.4	48.8	50.1	52.1
1400	38.7	40.6	41.8	43.7	44.9	46.2	48.1
1500	35.8	37.5	38.7	40.4	41.6	42.8	44.5
1600	33.2	34.9	36.0	37.6	38.7	39.8	41.4
1700	31.0	32.5	33.6	35.1	36.1	37.2	38.7
1800	29.0	30.4	31.4	32.9	33.8	34.8	36.3
1900	27.2	28.6	29.5	30.9	31.8	32.7	34.1
2000	25.6	26.9	27.8	29.1	30.0	30.8	32.1
2100	24.1	25.4	26.2	27.5	28.3	29.1	30.4
2200	22.8	24.0	24.8	26.0	26.8	27.6	28.8
2300	21.6	22.7	23.5	24.6	25.4	26.2	27.3
2400	20.5	21.6	22.3	23.4	24.1	24.9	26.0
2500	19.5	20.5	21.2	22.3	23.0	23.7	24.7

*****Select the column corresponding to the BAST concentration.

This table shows the PG flowrate needed to obtain the blended flow shown in the far left column.

(Page 1 of 1)

Attachment 22

VCT BATCH MIX TABLE

(* Gallons of acid to add to 100 gallons of PG)

VCT PPM	BAST 7.0	BAST 7.3	BAST 7.5	BAST 7.8	BAST 8.0	BAST 8.2	BAST 8.5
100	0.8	0.8	0.8	0.7	0.7	0.7	0.7
200	1.7	1.6	1.5	1.5	1.5	1.4	1.4
300	2.5	2.4	2.3	2.2	2.2	2.1	2.1
400	3.4	3.2	3.1	3.0	2.9	2.9	2.8
500	4.3	4.1	4.0	3.8	3.7	3.6	3.5
600	5.2	4.9	4.8	4.6	4.5	4.4	4.2
700	6.1	5.8	5.6	5.4	5.3	5.1	4.9
800	7.0	6.7	6.5	6.2	6.1	5.9	5.7
900	7.9	7.6	7.4	7.1	6.9	6.7	6.4
1000	8.9	8.5	8.3	7.9	7.7	7.5	7.2
1100	9.9	9.4	9.2	8.8	8.5	8.3	8.0
1200	10.9	10.4	10.1	9.7	9.4	9.1	8.8
1300	11.9	11.3	11.0	10.5	10.2	10.0	9.6
1400	12.9	12.3	12.0	11.4	11.1	10.8	10.4
1500	14.0	13.3	12.9	12.4	12.0	11.7	11.2
1600	15.0	14.3	13.9	13.3	12.9	12.6	12.1
1700	16.1	15.4	14.9	14.2	13.8	13.5	12.9
1800	17.2	16.4	15.9	15.2	14.8	14.4	13.8
1900	18.4	17.5	16.9	16.2	15.7	15.3	14.7
2000	19.5	18.6	18.0	17.2	16.7	16.2	15.6
2100	20.7	19.7	19.1	18.2	17.7	17.2	16.5
2200	21.9	20.8	20.2	19.2	18.7	18.1	17.4
2300	23.1	22.0	21.3	20.3	19.7	19.1	18.3
2400	24.4	23.2	22.4	21.4	20.7	20.1	19.3
2500	25.7	24.4	23.6	22.5	21.8	21.1	20.2

1. Select the column corresponding to the BAST concentration.

   This table shows the number of gallons from the BAST needed to make a VCT Batch of the concentration shown in the far left column, assuming 100 gallons of PG water are in the VCT.
2. For other batch sizes, ratio the gallons of acid.
3. This table may also be used for flow rates. For example, a 1400 ppm mix can be made by combining 100 gpm of PG water with 12.0 gpm from the BAST (at 7.5 w/o).

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Attachment 23

GALLONS OF BORIC ACID NEEDED TO INCREASE RCS BY 1 PPM

(2235 PSIG, 550 °F, RCS VOLUME=9200 CUBIC FEET)

CURRENT RCS PPM	BAST 7.0	BAST 7.3	BAST 7.5	BAST 7.8	BAST 8.0	BAST 8.2	BAST 8.5
0	4.3	4.1	4.0	3.9	3.8	3.7	3.5
250	4.4	4.2	4.1	3.9	3.8	3.7	3.6
500	4.5	4.3	4.2	4.0	3.9	3.8	3.7
750	4.6	4.4	4.3	4.1	4.0	3.9	3.7
1000	4.7	4.5	4.3	4.2	4.1	3.9	3.8
1250	4.8	4.6	4.4	4.2	4.1	4.0	3.9
1500	4.9	4.7	4.5	4.3	4.2	4.1	3.9
1750	5.0	4.8	4.6	4.4	4.3	4.2	4.0
2000	5.1	4.9	4.7	4.5	4.4	4.3	4.1
2250	5.3	5.0	4.8	4.6	4.5	4.4	4.2

(450 PSIG, 350 °F, RCS VOLUME=9200 CUBIC FEET)

CURRENT RCS PPM	BAST 7.0	BAST 7.3	BAST 7.5	BAST 7.8	BAST 8.0	BAST 8.2	BAST 8.5
0	5.1	4.9	4.8	4.6	4.5	4.4	4.2
250	5.2	5.0	4.9	4.7	4.6	4.4	4.3
500	5.3	5.1	5.0	4.8	4.6	4.5	4.4
750	5.4	5.2	5.1	4.9	4.7	4.6	4.4
1000	5.6	5.3	5.2	4.9	4.8	4.7	4.5
1250	5.7	5.4	5.3	5.0	4.9	4.8	4.6
1500	5.8	5.6	5.4	5.2	5.0	4.9	4.7
1750	6.0	5.7	5.5	5.3	5.1	5.0	4.8
2000	6.1	5.8	5.6	5.4	5.2	5.1	4.9
2250	6.3	5.9	5.8	5.5	5.3	5.2	5.0

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Attachment 23

GALLONS OF BORIC ACID NEEDED TO INCREASE RCS BY 1 PPM

(0 PSIG, 100 °F, RCS VOLUME=9200 CUBIC FEET)

CURRENT RCS PPM	BAST 7.0	BAST 7.3	BAST 7.5	BAST 7.8	BAST 8.0	BAST 8.2	BAST 8.5
0	5.7	5.5	5.3	5.1	5.0	4.9	4.7
250	5.8	5.6	5.4	5.2	5.1	4.9	4.8
500	5.9	5.7	5.5	5.3	5.2	5.0	4.8
750	6.1	5.8	5.6	5.4	5.3	5.1	4.9
1000	6.2	5.9	5.7	5.5	5.4	5.2	5.0
1250	6.3	6.0	5.9	5.6	5.5	5.3	5.1
1500	6.5	6.2	6.0	5.7	5.6	5.4	5.2
1750	6.6	6.3	6.1	5.9	5.7	5.5	5.3
2000	6.8	6.5	6.3	6.0	5.8	5.6	5.4
2250	7.0	6.6	6.4	6.1	5.9	5.8	5.5

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Attachment 24

RCS DILUTION TABLE

RCS PPM	0 PSIG/70 °F	450 PSIG/350 °F	2235 PSIG/547 °F
50	1766	1581	1336
100	779	698	590
200	368	330	279
300	241	216	182
400	179	160	136
500	142	128	108
600	118	106	90
700	101	91	77
800	88	79	67
900	78	70	59
1000	70	63	53
1100	64	57	48
1200	59	53	44
1300	54	48	41
1400	50	45	38
1500	47	42	35
1600	44	39	33
1700	41	37	31
1800	39	35	29
1900	37	33	28
2000	35	31	27
2100	33	30	25
2200	32	29	24
2300	30	27	23
2400	29	26	22
2500	28	25	21

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Attachment 24

RCS DILUTION TABLE

NOTES:

1. The table shows gallons of primary grade water needed to dilute the RCS 1 ppm.
2. For temperatures significantly different than those shown, interpolate.

3. Examples:
   (a) If the RCS is at 2235 psig/547°F with a boron concentration of 1100 ppm, how much primary grade water is needed to dilute to 1050 ppm?
   (1100 - 1050) x 48 = 2400 gallons

   (b) In example (a) if the RCS is to be diluted a large amount, for example to 500 ppm, select the table value midway between the two boron concentrations. In this example (b) the dilution value at 800 ppm would be chosen.
   (1100 - 500) x 67 = 40, 200 gallons
   The results will always be slightly conservative (will not result in overdilution).

4. For more precise dilution volumes, use the following formulas:

At 0 psig/70°F $$W= -69751 \times \ln\left(1+\frac{B2-B1}{B1-10}\right)$$

At 350 psig/450°F $$W= -62462 \times \ln\left(1+\frac{B2-B1}{B1-10}\right)$$

At 2235 psig/547°F $$W= -52784 \times \ln\left(1+\frac{B2-B1}{B1-10}\right)$$

Where W= gallons of PG water to add
B1 = initial boron concentration
B2 = final boron concentration
and ln is the natural log.
DO NOT use the base 10 log, which will yield conservative but very inaccurate results.

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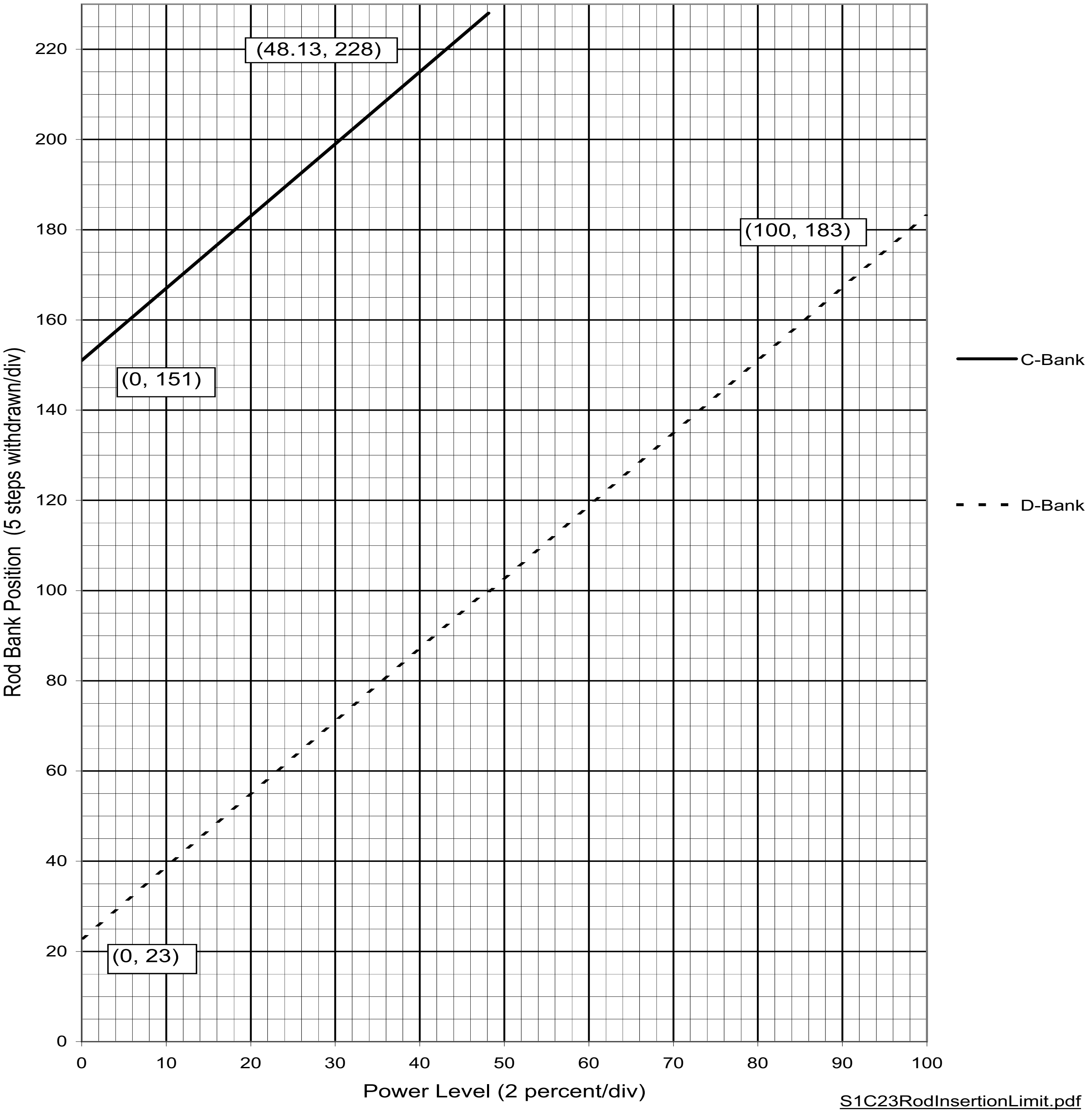
Attachment 25

CONTROL ROD INSERTION LIMITS VS POWER LEVEL (FOR 3 LOOP NORMAL OPERATION)

NOTE: ARO EQUALS 228 STEPS
OVERLAP EQUALS 100 STEPS



S1C23RodInsertionLimit.pdf

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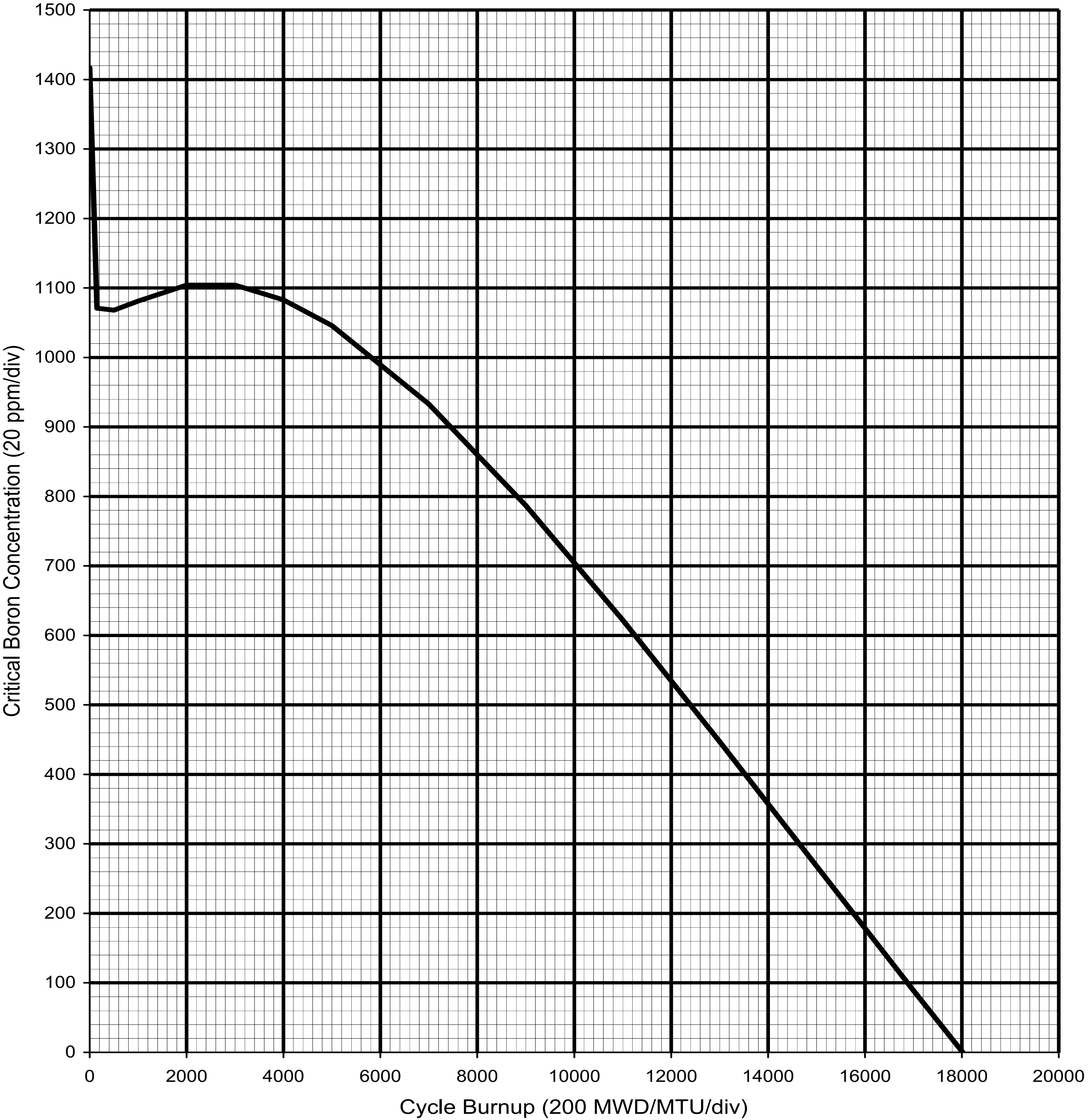
Attachment 26

SURRY UNIT 1 - CYCLE 23 CRITICAL BORON CONCENTRATION VS. BURNUP HOT FULL POWER, ALL RODS OUT

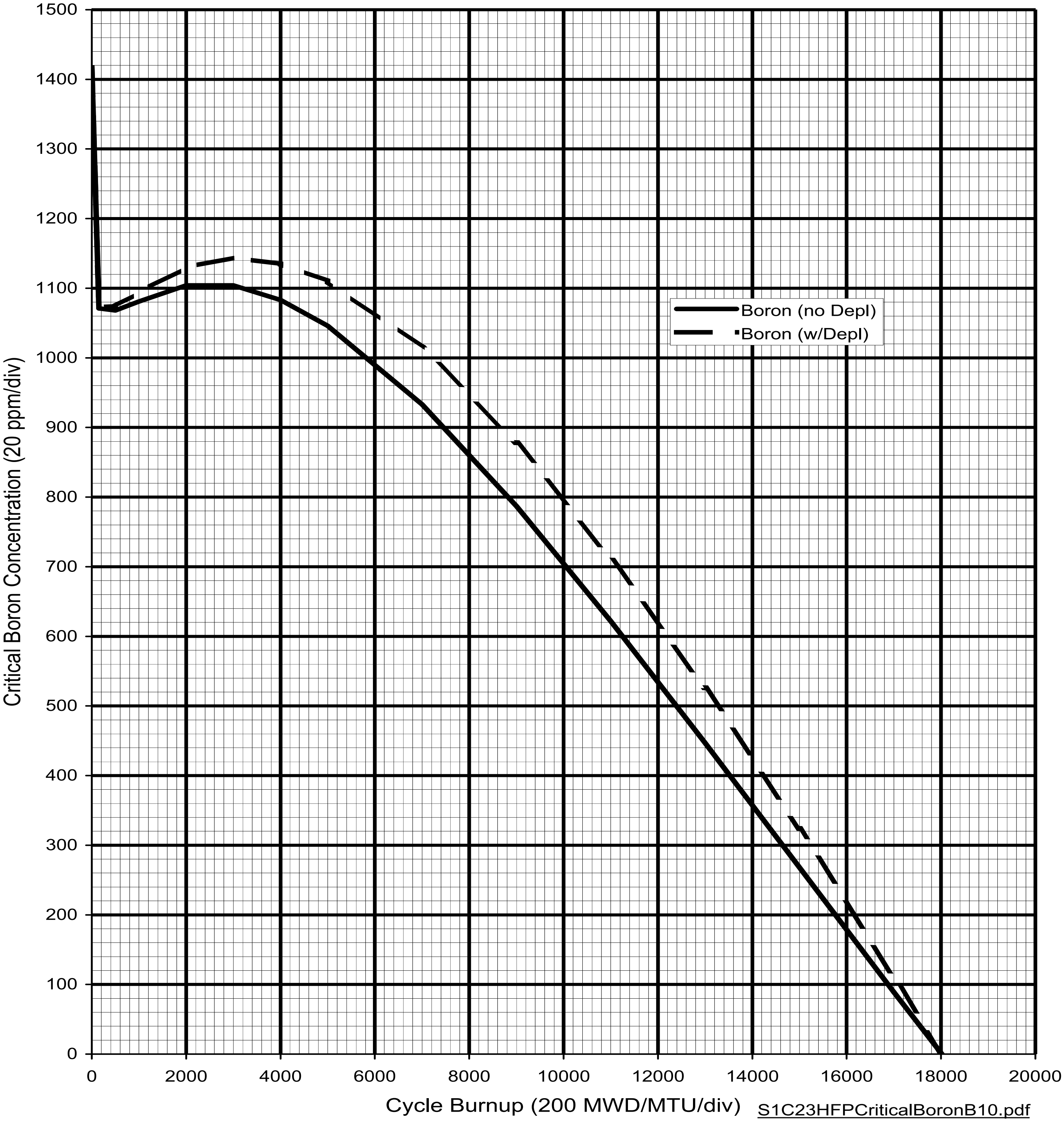


S1C23HFPCriticalBoron.pdf

(Page 2 of 2)

Attachment 26

SURRY UNIT 1 - CYCLE 23 CRITICAL BORON CONCENTRATION VS. BURNUP HOT FULL POWER, ALL RODS OUT

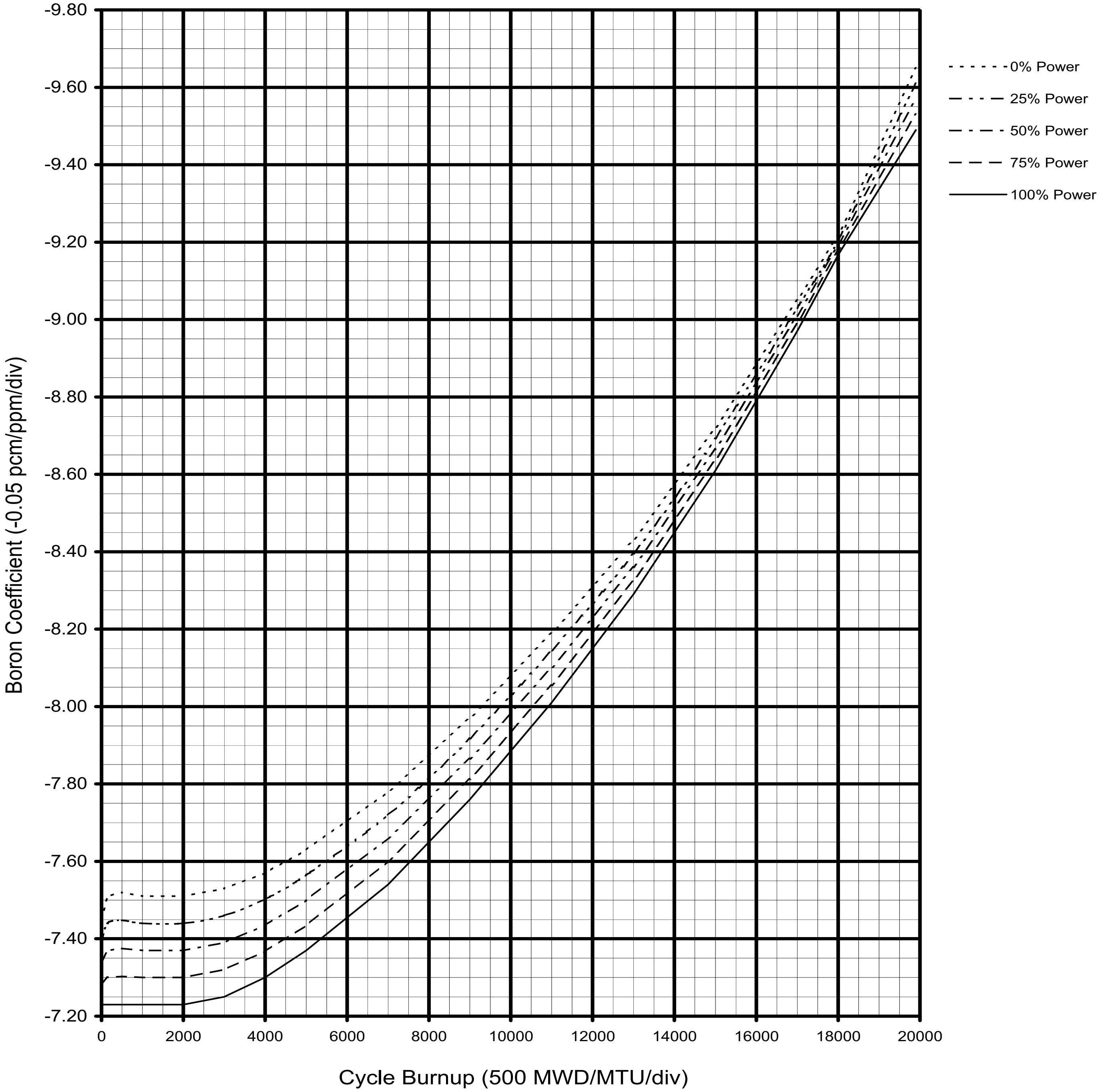


S1C23HFPCriticalBoronB10.pdf

(Page 1 of 1)

Attachment 27

SURRY UNIT 1 - CYCLE 23 BORON COEFFICIENT VS BURNUP



S1C23BoronCoeff.pdf

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Attachment 28

SURRY UNIT 1 - CYCLE 23 HZP INTEGRAL ROD WORTH TABLE FOR CONTROL BANKS C AND D IN OVERLAP

		CYCLE BURNUP RANGE (MWD/MTU)					
D-BANK POS STEPS	C-BANK POS STEPS	8000.1 TO 10000.0	10000.1 TO 12000.0	12000.1 TO 14000.0	14000.1 TO 16000.0	16000.1 TO 17500.0	17500.1 TO 18500.0
228	228	0.0	0.0	0.0	0.0	0.0	0.0
225	228	0.0	0.0	0.0	0.0	0.0	0.0
223	228	2.1	2.8	3.4	4.1	4.9	5.2
221	228	7.4	9.6	11.9	14.2	16.6	18.0
219	228	14.2	18.2	22.5	27.1	31.5	33.8
217	228	22.9	29.4	36.4	43.2	49.9	53.4
215	228	33.2	42.3	52.0	61.1	70.0	74.5
213	228	44.5	56.8	69.0	80.6	91.9	97.5
211	228	56.8	72.3	87.3	101.7	115.4	122.1
209	228	70.5	89.3	107.4	124.5	140.5	148.4
207	228	84.8	107.0	128.1	147.7	166.0	174.8
205	228	100.0	125.7	150.0	172.3	192.9	202.7
203	228	117.3	146.9	174.8	200.0	223.1	234.0
201	228	133.0	166.0	196.6	224.2	249.0	260.7
199	228	149.6	186.1	219.7	249.6	276.2	288.7
197	228	166.3	206.3	242.8	275.0	303.4	316.7
195	228	184.9	228.6	268.4	302.9	333.3	347.3
193	228	201.7	248.5	290.8	327.2	358.9	373.5
191	228	218.8	268.9	313.7	352.0	385.1	400.3
189	228	236.1	289.3	336.7	377.0	411.5	427.2
187	228	253.5	309.9	359.8	401.7	437.5	453.7
185	228	269.8	328.8	380.9	424.3	461.0	477.7
183	228	286.4	348.2	402.5	447.5	485.3	502.4

S1C23RodWorthHZPMOL.pdf

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Attachment 28

SURRY UNIT 1 - CYCLE 23 HZP INTEGRAL ROD WORTH TABLE FOR CONTROL BANKS C AND D IN OVERLAP

		CYCLE BURNUP RANGE (MWD/MTU)					
D-BANK POS STEPS	C-BANK POS STEPS	8000.1 TO 10000.0	10000.1 TO 12000.0	12000.1 TO 14000.0	14000.1 TO 16000.0	16000.1 TO 17500.0	17500.1 TO 18500.0
181	228	303.6	368.4	425.0	471.6	510.5	528.1
179	228	318.8	385.8	444.2	491.9	531.7	549.5
177	228	334.1	403.5	463.7	512.7	553.2	571.4
175	228	349.5	421.3	483.4	533.6	575.0	593.5
173	228	364.8	438.6	502.7	554.1	596.3	615.1
171	228	378.9	454.9	520.3	572.7	615.5	634.5
169	228	393.3	471.4	538.3	591.7	635.2	654.5
167	228	408.9	489.1	557.8	612.4	656.6	676.3
165	228	421.5	503.2	573.3	628.6	673.3	693.1
163	228	434.5	517.7	589.1	645.3	690.4	710.4
161	228	447.3	532.1	604.8	661.8	707.5	727.7
159	228	461.4	547.8	621.9	679.7	725.9	746.3
157	228	473.5	561.3	636.2	694.8	741.3	761.8
155	228	485.9	575.0	650.8	710.1	757.0	777.5
153	228	498.2	588.7	665.5	725.3	772.6	793.3
151	228	510.6	602.2	680.0	740.2	787.7	808.5
149	228	521.9	614.5	693.0	753.6	801.2	822.0
147	228	533.5	627.2	706.4	767.4	815.1	836.0
145	228	545.7	640.3	720.3	781.6	829.5	850.3
143	228	556.1	651.4	731.9	793.3	841.1	861.9
141	228	566.9	662.8	743.8	805.3	852.9	873.6
139	228	577.7	674.3	755.7	817.3	864.8	885.4
137	228	588.5	685.6	767.3	828.9	876.2	896.7

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Attachment 28

SURRY UNIT 1 - CYCLE 23 HZP INTEGRAL ROD WORTH TABLE FOR CONTROL BANKS C AND D IN OVERLAP

		CYCLE BURNUP RANGE (MWD/MTU)					
D-BANK POS STEPS	C-BANK POS STEPS	8000.1 TO 10000.0	10000.1 TO 12000.0	12000.1 TO 14000.0	14000.1 TO 16000.0	16000.1 TO 17500.0	17500.1 TO 18500.0
135	228	598.6	696.0	777.8	839.2	886.2	906.5
133	228	608.9	706.7	788.6	849.9	896.4	916.6
131	228	620.2	718.3	800.3	861.3	907.5	927.4
129	228	629.6	727.8	809.6	870.1	915.8	935.4
127	228	639.4	737.5	819.2	879.2	924.2	943.6
125	228	649.1	747.3	828.6	888.1	932.6	951.7
123	228	659.8	757.8	838.8	897.6	941.3	960.1
121	228	668.9	766.6	847.0	905.0	947.9	966.4
119	228	678.4	775.7	855.4	912.6	954.8	972.9
117	228	688.0	784.9	863.9	920.1	961.5	979.3
115	228	697.9	794.2	872.2	927.4	967.8	985.3
113	228	707.1	802.6	879.6	933.7	973.2	990.3
111	228	716.6	811.4	887.2	940.1	978.7	995.4
109	228	726.7	820.5	895.1	946.6	984.3	1000.0
107	228	735.5	828.2	901.4	951.6	988.3	1004.0
105	228	744.6	836.1	907.8	956.7	992.4	1008.0
103	228	753.9	844.1	914.2	961.7	996.5	1011.1
101	228	763.2	852.0	920.3	966.4	999.6	1014.9
99	227	772.0	859.1	925.6	970.3	1003.0	1017.7
97	225	781.0	866.5	931.1	974.3	1006.2	1020.0
96	224	785.6	870.1	933.5	976.0	1007.6	1021.6
95	223	791.9	875.9	939.0	981.5	1013.5	1027.9
94	222	797.2	881.0	944.2	987.1	1019.8	1034.6

S1C23RodWorthHZPMOL.pdf

Attachment 28

SURRY UNIT 1 - CYCLE 23 HZP INTEGRAL ROD WORTH TABLE FOR CONTROL BANKS C AND D IN OVERLAP

		CYCLE BURNUP RANGE (MWD/MTU)					
D-BANK POS STEPS	C-BANK POS STEPS	8000.1 TO 10000.0	10000.1 TO 12000.0	12000.1 TO 14000.0	14000.1 TO 16000.0	16000.1 TO 17500.0	17500.1 TO 18500.0
93	221	802.6	886.5	950.0	993.7	1027.4	1042.7
92	220	808.5	892.4	956.4	1000.9	1035.4	1051.3
91	219	814.4	898.6	963.4	1008.9	1044.6	1061.0
90	218	820.7	905.3	970.8	1017.3	1054.1	1071.1
89	217	827.0	912.3	979.2	1027.2	1065.4	1083.2
88	216	835.5	921.1	988.8	1037.8	1077.1	1095.4
87	215	841.5	928.1	997.2	1047.8	1088.5	1107.5
86	214	848.0	935.4	1005.9	1058.0	1100.0	1119.6
85	213	855.2	943.6	1015.7	1069.3	1112.9	1133.1
84	212	862.2	951.5	1025.1	1080.4	1125.4	1146.3
83	211	869.9	960.2	1035.5	1092.5	1139.0	1160.6
82	210	877.6	969.3	1046.5	1105.4	1153.7	1176.1
81	209	885.4	978.0	1056.7	1117.3	1166.8	1189.8
80	208	893.8	987.5	1067.9	1130.2	1181.2	1204.8
79	207	901.4	996.2	1078.3	1142.2	1194.6	1218.8
78	206	909.3	1005.3	1089.4	1155.2	1209.2	1234.1
77	205	917.4	1014.5	1100.4	1168.0	1223.5	1249.0
76	204	925.4	1023.7	1111.4	1180.9	1237.9	1264.1
75	203	934.8	1034.7	1124.8	1196.7	1255.6	1283.0
74	202	942.9	1043.9	1135.8	1209.3	1269.7	1297.5
73	201	952.2	1054.1	1147.4	1222.5	1284.0	1312.1
72	200	960.7	1063.6	1158.8	1235.6	1298.6	1327.2
71	199	969.3	1073.3	1170.0	1248.5	1312.7	1341.9

S1C23RodWorthHZPMOL.pdf

Attachment 28

SURRY UNIT 1 - CYCLE 23 HZP INTEGRAL ROD WORTH TABLE FOR CONTROL BANKS C AND D IN OVERLAP

		CYCLE BURNUP RANGE (MWD/MTU)					
D-BANK POS STEPS	C-BANK POS STEPS	8000.1 TO 10000.0	10000.1 TO 12000.0	12000.1 TO 14000.0	14000.1 TO 16000.0	16000.1 TO 17500.0	17500.1 TO 18500.0
70	198	978.1	1083.2	1181.8	1262.1	1327.9	1357.7
69	197	986.9	1092.8	1192.8	1274.7	1341.7	1372.0
68	196	997.4	1105.0	1207.5	1291.9	1361.0	1392.6
67	195	1005.8	1113.9	1217.6	1303.2	1373.2	1405.0
66	194	1015.4	1124.1	1228.9	1315.7	1386.7	1418.7
65	193	1024.4	1133.9	1240.0	1328.3	1400.4	1432.8
64	192	1033.5	1143.7	1251.0	1340.5	1413.8	1446.6
63	191	1042.8	1153.8	1262.4	1353.5	1428.0	1461.3
62	190	1052.4	1164.0	1273.8	1366.2	1441.8	1475.6
61	189	1061.9	1174.3	1285.4	1379.2	1455.9	1490.2
60	188	1071.8	1185.0	1297.3	1392.6	1470.6	1505.4
59	187	1082.7	1196.3	1309.3	1405.4	1484.2	1519.2
58	186	1092.0	1205.9	1319.7	1416.7	1496.2	1531.6
57	185	1101.4	1215.9	1330.6	1428.7	1509.1	1544.8
56	184	1111.2	1226.1	1341.5	1440.5	1521.6	1557.7
55	183	1121.1	1236.6	1352.9	1452.9	1535.0	1571.5
54	182	1131.3	1247.1	1364.0	1464.8	1547.6	1584.4
53	181	1141.6	1258.1	1376.0	1478.0	1561.9	1599.2
52	180	1153.8	1270.3	1388.3	1490.5	1574.6	1611.9
51	179	1162.8	1279.7	1398.3	1501.2	1585.9	1623.5
50	178	1172.4	1289.6	1408.6	1512.0	1597.3	1635.0
49	177	1182.9	1300.4	1419.9	1523.9	1609.7	1647.7
48	176	1192.8	1310.7	1430.7	1535.2	1621.5	1659.7

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Attachment 28

SURRY UNIT 1 - CYCLE 23 HZP INTEGRAL ROD WORTH TABLE FOR CONTROL BANKS C AND D IN OVERLAP

		CYCLE BURNUP RANGE (MWD/MTU)					
D-BANK POS STEPS	C-BANK POS STEPS	8000.1 TO 10000.0	10000.1 TO 12000.0	12000.1 TO 14000.0	14000.1 TO 16000.0	16000.1 TO 17500.0	17500.1 TO 18500.0
47	175	1203.7	1322.0	1442.3	1547.2	1634.0	1672.5
46	174	1214.7	1333.3	1454.1	1559.7	1647.1	1685.8
45	173	1225.2	1344.0	1464.9	1570.7	1658.2	1697.0
44	172	1236.4	1355.4	1476.4	1582.2	1669.9	1708.8
43	171	1246.7	1365.9	1487.0	1592.9	1680.7	1719.6
42	170	1257.0	1376.5	1497.9	1604.1	1692.1	1731.2
41	169	1267.7	1387.5	1508.9	1615.2	1703.5	1742.6
40	168	1278.2	1398.2	1519.9	1626.4	1714.8	1754.1
39	167	1290.3	1410.8	1532.8	1639.6	1728.3	1767.7
38	166	1300.4	1421.2	1543.2	1650.0	1738.7	1778.1
37	165	1312.0	1432.8	1554.6	1661.0	1749.4	1788.7
36	164	1322.1	1443.2	1565.0	1671.4	1759.7	1799.0
35	163	1332.4	1453.8	1575.6	1681.7	1770.0	1809.2
34	162	1342.9	1464.6	1586.4	1692.6	1780.9	1820.1
33	161	1353.3	1475.2	1597.0	1703.0	1791.0	1830.2
32	160	1365.6	1488.1	1610.3	1716.5	1804.8	1844.1
31	159	1375.4	1498.1	1620.0	1725.9	1813.8	1853.0
30	158	1386.4	1509.2	1630.9	1736.2	1823.7	1862.7
29	157	1396.5	1519.7	1641.2	1746.4	1833.6	1872.5
28	156	1406.7	1530.1	1651.5	1756.3	1843.3	1882.1
27	155	1416.9	1540.7	1662.1	1766.7	1853.5	1892.2
26	154	1427.3	1551.4	1672.8	1777.1	1863.6	1902.2
25	153	1437.7	1562.1	1683.5	1787.6	1873.8	1912.3

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Attachment 28

SURRY UNIT 1 - CYCLE 23 HZP INTEGRAL ROD WORTH TABLE FOR CONTROL BANKS C AND D IN OVERLAP

		CYCLE BURNUP RANGE (MWD/MTU)					
D-BANK POS STEPS	C-BANK POS STEPS	8000.1 TO 10000.0	10000.1 TO 12000.0	12000.1 TO 14000.0	14000.1 TO 16000.0	16000.1 TO 17500.0	17500.1 TO 18500.0
24	152	1448.4	1573.2	1694.5	1798.4	1884.3	1922.7
23	151	1459.5	1584.5	1705.5	1808.8	1894.1	1932.3
22	150	1468.9	1594.0	1714.8	1817.7	1902.6	1940.5
21	149	1478.2	1603.7	1724.5	1827.0	1911.6	1949.4
20	148	1487.7	1613.4	1734.1	1836.2	1920.4	1958.1
19	147	1497.3	1623.4	1744.0	1845.9	1929.8	1967.3
18	146	1506.8	1633.2	1753.6	1855.1	1938.6	1975.9
17	145	1516.8	1643.6	1764.1	1865.3	1948.6	1985.8
16	144	1527.1	1654.0	1774.1	1874.6	1957.0	1993.9
15	143	1535.3	1662.4	1782.4	1882.5	1964.6	2001.3
14	142	1543.4	1670.7	1790.5	1890.3	1972.0	2008.6
13	141	1552.1	1679.7	1799.4	1898.9	1980.2	2016.5
12	140	1560.3	1688.1	1807.8	1906.9	1987.8	2024.0
11	139	1569.0	1697.1	1816.6	1915.4	1995.8	2031.8
10	138	1577.9	1706.3	1825.7	1924.2	2004.2	2040.0
9	137	1585.7	1714.2	1833.5	1931.4	2010.9	2046.5
8	136	1593.9	1722.6	1841.5	1939.0	2017.9	2053.2
7	135	1601.0	1729.7	1848.6	1945.6	2024.1	2059.2
6	134	1608.4	1737.3	1856.0	1952.8	2030.9	2065.8
5	133	1615.5	1744.6	1863.3	1959.6	2037.3	2072.0
4	132	1622.6	1751.9	1870.5	1966.5	2043.8	2078.3
3	131	1631.1	1760.5	1879.0	1974.7	2051.5	2085.8
2	130	1637.6	1767.2	1885.5	1980.7	2057.0	2091.1

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Attachment 28

SURRY UNIT 1 - CYCLE 23 HZP INTEGRAL ROD WORTH TABLE FOR CONTROL BANKS C AND D IN OVERLAP

		CYCLE BURNUP RANGE (MWD/MTU)					
D-BANK POS STEPS	C-BANK POS STEPS	8000.1 TO 10000.0	10000.1 TO 12000.0	12000.1 TO 14000.0	14000.1 TO 16000.0	16000.1 TO 17500.0	17500.1 TO 18500.0
1	129	1644.3	1773.9	1891.9	1986.6	2062.4	2096.2
0	128	1650.6	1780.2	1898.1	1992.4	2067.8	2101.4
0	126	1661.4	1791.2	1909.2	2003.3	2078.1	2111.5
0	124	1673.8	1803.8	1921.8	2015.6	2089.9	2122.9
0	122	1682.6	1812.6	1930.6	2023.8	2097.3	2129.9
0	120	1692.7	1822.7	1940.4	2033.0	2105.6	2137.9
0	118	1703.3	1833.1	1950.6	2042.5	2114.2	2146.0
0	116	1714.4	1844.1	1961.1	2052.1	2122.8	2154.1
0	114	1724.5	1853.8	1970.2	2060.1	2129.6	2160.4
0	112	1735.0	1863.8	1979.5	2068.2	2136.4	2166.7
0	110	1745.7	1874.0	1988.8	2076.2	2143.2	2173.0
0	108	1756.8	1884.5	1998.2	2084.0	2149.6	2178.2
0	106	1767.1	1893.9	2006.4	2090.6	2154.8	2183.3
0	104	1777.9	1903.8	2014.8	2097.3	2160.1	2187.6
0	102	1789.4	1914.2	2023.7	2104.2	2164.5	2191.9
0	100	1799.8	1923.4	2031.0	2109.6	2169.1	2196.1
0	98	1810.5	1932.7	2038.4	2114.9	2173.3	2199.3

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Attachment 29

SURRY UNIT 1 - CYCLE 23 AT POWER INTEGRAL ROD WORTH TABLE FOR CONTROL BANKS C AND D IN OVERLAP

Note: Worth At Nominal HFP Conditions

		CYCLE BURNUP RANGE (MWD/MTU)					
D-BANK POS STEPS	C-BANK POS STEPS	8000.1 TO 10000.0	10000.1 TO 12000.0	12000.1 TO 14000.0	14000.1 TO 16000.0	16000.1 TO 17500.0	17500.1 TO 18500.0
228	228	0.0	0.0	0.0	0.0	0.0	0.0
225	228	0.0	0.0	0.0	0.0	0.0	0.0
223	228	2.1	2.4	2.9	3.4	4.0	4.3
221	228	6.9	8.2	9.7	11.3	13.3	14.4
219	228	12.6	15.0	17.7	20.7	24.1	25.6
217	228	19.6	23.2	27.3	31.8	36.4	39.3
215	228	27.1	31.9	37.2	43.0	48.9	52.4
213	228	35.3	41.3	47.9	55.1	62.3	66.6
211	228	43.3	50.7	58.7	67.2	76.5	81.5
209	228	52.9	61.6	70.9	80.8	91.6	97.3
207	228	62.7	72.7	83.4	94.6	106.6	112.9
205	228	73.1	84.5	96.6	109.1	122.1	129.3
203	228	84.9	97.9	111.4	125.4	139.8	147.5
201	228	95.7	109.9	124.7	139.7	155.5	163.6
199	228	107.3	122.7	138.7	154.9	171.7	180.4
197	228	118.8	135.5	152.7	170.1	187.9	197.1
195	228	131.9	150.0	168.5	187.0	205.7	215.7
193	228	143.8	163.0	182.5	202.2	221.8	231.9
191	228	156.1	176.4	197.0	217.4	238.1	248.6
189	228	168.5	190.0	211.5	232.9	254.5	265.4
187	228	181.5	204.0	226.5	248.8	271.1	282.5
185	228	193.6	217.0	240.4	263.7	286.5	298.2
183	228	206.2	230.5	254.8	278.8	302.4	314.4

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Attachment 29

SURRY UNIT 1 - CYCLE 23 AT POWER INTEGRAL ROD WORTH TABLE FOR CONTROL BANKS C AND D IN OVERLAP

Note: Worth At Nominal HFP Conditions

		CYCLE BURNUP RANGE (MWD/MTU)					
D-BANK POS STEPS	C-BANK POS STEPS	8000.1 TO 10000.0	10000.1 TO 12000.0	12000.1 TO 14000.0	14000.1 TO 16000.0	16000.1 TO 17500.0	17500.1 TO 18500.0
181	228	219.4	244.7	269.9	294.7	319.0	331.4
179	228	231.4	257.4	284.0	308.8	333.6	346.3
177	228	243.6	270.4	297.7	323.1	348.6	361.6
175	228	256.0	283.6	311.6	338.1	363.8	377.1
173	228	268.6	296.9	325.6	352.8	379.1	392.7
171	228	280.6	310.2	338.7	366.4	393.3	407.2
169	228	292.9	323.1	352.2	380.6	408.0	422.2
167	228	306.2	336.5	367.0	396.0	424.1	438.6
165	228	318.2	348.9	379.2	408.8	437.6	452.0
163	228	329.9	361.1	392.0	422.0	451.4	466.0
161	228	341.6	373.3	404.7	435.2	465.1	480.3
159	228	354.0	387.0	418.9	450.0	480.5	495.9
157	228	366.3	399.0	431.4	463.0	493.9	509.6
155	228	378.3	411.5	444.3	476.4	507.8	523.8
153	228	390.4	424.0	457.3	489.9	521.8	538.0
151	228	402.9	436.9	470.7	503.8	536.2	552.7
149	228	414.5	448.8	483.0	516.6	549.5	566.2
147	228	426.6	461.2	495.8	529.8	563.2	580.1
145	228	439.2	474.2	509.2	543.7	577.6	594.8
143	228	450.6	485.9	521.2	556.1	590.4	607.9
141	228	462.2	497.8	533.5	568.8	603.6	621.3
139	228	474.0	509.9	545.9	581.7	616.9	634.8
137	228	486.0	522.1	558.5	594.7	630.3	648.5

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Attachment 29

SURRY UNIT 1 - CYCLE 23 AT POWER INTEGRAL ROD WORTH TABLE FOR CONTROL BANKS C AND D IN OVERLAP

Note: Worth At Nominal HFP Conditions

		CYCLE BURNUP RANGE (MWD/MTU)					
D-BANK POS STEPS	C-BANK POS STEPS	8000.1 TO 10000.0	10000.1 TO 12000.0	12000.1 TO 14000.0	14000.1 TO 16000.0	16000.1 TO 17500.0	17500.1 TO 18500.0
135	228	497.4	533.7	570.4	606.9	642.9	661.3
133	228	509.1	545.6	582.6	619.5	655.9	674.5
131	228	521.8	558.5	595.9	633.2	670.1	688.9
129	228	532.8	569.7	607.3	644.9	682.2	701.2
127	228	544.1	581.2	619.0	657.0	694.6	713.8
125	228	555.4	592.6	630.7	668.9	707.0	726.3
123	228	567.8	605.1	643.5	682.2	720.6	740.2
121	228	578.6	616.0	654.6	693.5	732.3	752.0
119	228	589.8	627.3	666.0	705.2	744.3	764.2
117	228	600.9	638.4	677.4	716.9	756.3	776.4
115	228	612.7	650.3	689.4	729.2	768.9	789.2
113	228	623.8	661.4	700.6	740.6	780.6	801.0
111	228	635.1	672.7	712.1	752.3	792.6	813.2
109	228	647.0	684.6	724.1	764.5	805.1	825.8
107	228	657.7	695.3	734.9	775.5	816.3	837.1
105	228	668.7	706.1	745.8	786.6	827.6	848.5
103	228	679.7	717.1	756.8	797.7	838.9	860.0
101	228	690.9	728.2	767.9	809.0	850.4	871.6
99	227	701.4	738.6	778.4	819.6	861.1	882.4
97	225	712.3	749.3	789.1	830.4	872.1	893.4
96	224	717.8	754.8	794.6	835.9	877.7	899.1
95	223	725.7	763.0	803.2	845.1	887.5	909.3
94	222	732.7	770.3	810.9	853.3	896.4	918.5

S1C23RodWorthAtPowerMOL.pdf

Attachment 29

SURRY UNIT 1 - CYCLE 23 AT POWER INTEGRAL ROD WORTH TABLE FOR CONTROL BANKS C AND D IN OVERLAP

Note: Worth At Nominal HFP Conditions

		CYCLE BURNUP RANGE (MWD/MTU)					
D-BANK POS STEPS	C-BANK POS STEPS	8000.1 TO 10000.0	10000.1 TO 12000.0	12000.1 TO 14000.0	14000.1 TO 16000.0	16000.1 TO 17500.0	17500.1 TO 18500.0
93	221	739.8	777.8	818.9	862.0	905.8	928.3
92	220	747.4	785.8	827.4	871.2	915.7	938.7
91	219	755.1	793.9	836.2	880.7	926.1	949.5
90	218	763.2	802.5	845.4	890.5	936.7	960.5
89	217	771.4	811.3	854.9	900.9	948.1	972.4
88	216	781.7	822.1	866.2	913.0	960.8	985.5
87	215	789.5	830.4	875.2	922.5	971.1	996.2
86	214	797.7	839.1	884.5	932.6	981.8	1007.3
85	213	806.9	848.8	894.9	943.7	993.7	1019.6
84	212	815.5	858.1	904.8	954.3	1005.0	1031.2
83	211	825.1	868.2	915.6	965.9	1017.4	1044.0
82	210	834.7	878.5	926.7	977.8	1030.1	1057.1
81	209	844.1	888.5	937.2	988.9	1041.9	1069.2
80	208	854.4	899.3	948.7	1001.1	1054.7	1082.4
79	207	863.9	909.3	959.4	1012.3	1066.6	1094.6
78	206	873.5	919.6	970.3	1024.0	1078.9	1107.2
77	205	883.4	930.1	981.4	1035.8	1091.3	1119.9
76	204	893.2	940.4	992.4	1047.4	1103.6	1132.5
75	203	904.7	952.8	1005.6	1061.3	1118.3	1147.6
74	202	914.5	963.0	1016.4	1072.8	1130.2	1159.8
73	201	925.6	974.6	1028.5	1085.4	1143.4	1173.3
72	200	936.0	985.6	1040.1	1097.5	1156.1	1186.2
71	199	946.5	996.6	1051.6	1109.6	1168.7	1199.0

S1C23RodWorthAtPowerMOL.pdf

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Attachment 29

SURRY UNIT 1 - CYCLE 23 AT POWER INTEGRAL ROD WORTH TABLE FOR CONTROL BANKS C AND D IN OVERLAP

Note: Worth At Nominal HFP Conditions

		CYCLE BURNUP RANGE (MWD/MTU)					
D-BANK POS STEPS	C-BANK POS STEPS	8000.1 TO 10000.0	10000.1 TO 12000.0	12000.1 TO 14000.0	14000.1 TO 16000.0	16000.1 TO 17500.0	17500.1 TO 18500.0
70	198	957.2	1007.9	1063.6	1122.1	1181.7	1212.3
69	197	967.7	1018.9	1075.0	1134.0	1194.1	1224.9
68	196	980.7	1032.7	1089.6	1149.4	1210.2	1241.3
67	195	990.4	1042.8	1100.1	1160.3	1221.4	1252.8
66	194	1001.7	1054.4	1112.2	1172.7	1234.2	1265.8
65	193	1012.6	1065.8	1124.0	1185.0	1246.9	1278.6
64	192	1023.4	1077.0	1135.7	1197.1	1259.3	1291.2
63	191	1034.5	1088.6	1147.7	1209.5	1272.2	1304.3
62	190	1045.8	1100.3	1159.8	1222.1	1285.1	1317.4
61	189	1057.1	1112.1	1172.0	1234.6	1298.1	1330.5
60	188	1068.8	1124.3	1184.7	1247.7	1311.6	1344.2
59	187	1081.2	1137.0	1197.7	1261.1	1325.2	1358.0
58	186	1092.0	1148.1	1209.1	1272.7	1337.1	1370.0
57	185	1103.2	1159.6	1220.9	1284.9	1349.5	1382.6
56	184	1114.4	1171.2	1232.8	1297.0	1361.9	1395.1
55	183	1126.0	1183.1	1245.1	1309.7	1374.8	1408.2
54	182	1137.5	1194.9	1257.1	1321.9	1387.4	1420.8
53	181	1149.7	1207.5	1270.1	1335.3	1401.0	1434.6
52	180	1162.8	1220.8	1283.6	1348.9	1414.8	1448.5
51	179	1173.4	1231.7	1294.7	1360.2	1426.3	1460.1
50	178	1184.3	1242.8	1306.0	1371.7	1438.0	1471.9
49	177	1196.2	1255.0	1318.5	1384.4	1450.9	1484.9
48	176	1207.5	1266.5	1330.2	1396.3	1463.0	1497.1

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Attachment 29

SURRY UNIT 1 - CYCLE 23 AT POWER INTEGRAL ROD WORTH TABLE FOR CONTROL BANKS C AND D IN OVERLAP

Note: Worth At Nominal HFP Conditions

		CYCLE BURNUP RANGE (MWD/MTU)					
D-BANK POS STEPS	C-BANK POS STEPS	8000.1 TO 10000.0	10000.1 TO 12000.0	12000.1 TO 14000.0	14000.1 TO 16000.0	16000.1 TO 17500.0	17500.1 TO 18500.0
47	175	1219.7	1278.9	1342.8	1409.1	1476.0	1510.2
46	174	1232.0	1291.5	1355.7	1422.2	1489.3	1523.6
45	173	1243.6	1303.3	1367.6	1434.2	1501.4	1535.8
44	172	1256.0	1315.8	1380.2	1447.0	1514.3	1548.8
43	171	1267.4	1327.4	1392.0	1458.8	1526.3	1560.8
42	170	1279.1	1339.3	1404.0	1471.0	1538.6	1573.1
41	169	1290.9	1351.3	1416.2	1483.3	1551.0	1585.6
40	168	1302.6	1363.1	1428.2	1495.4	1563.2	1597.9
39	167	1316.2	1377.0	1442.2	1509.7	1577.5	1612.3
38	166	1328.1	1389.0	1454.3	1521.9	1589.2	1624.1
37	165	1340.5	1401.6	1467.0	1534.5	1601.9	1636.8
36	164	1351.4	1413.2	1478.7	1546.3	1613.9	1648.8
35	163	1363.6	1424.9	1490.5	1558.3	1625.8	1660.8
34	162	1375.5	1437.0	1502.8	1570.6	1638.2	1673.2
33	161	1387.0	1448.7	1514.5	1582.4	1650.1	1685.1
32	160	1400.7	1462.6	1528.5	1596.6	1665.3	1700.4
31	159	1412.2	1474.3	1539.6	1607.7	1676.4	1711.6
30	158	1424.6	1486.7	1552.1	1620.2	1689.0	1724.1
29	157	1436.5	1498.8	1564.2	1632.4	1701.2	1736.5
28	156	1448.2	1510.7	1576.3	1644.6	1713.4	1748.7
27	155	1460.3	1523.0	1588.6	1657.0	1726.0	1761.3
26	154	1472.5	1535.4	1601.1	1669.6	1738.6	1773.8
25	153	1484.7	1547.8	1613.7	1682.2	1751.4	1786.6

Attachment 29

SURRY UNIT 1 - CYCLE 23 AT POWER INTEGRAL ROD WORTH TABLE FOR CONTROL BANKS C AND D IN OVERLAP

Note: Worth At Nominal HFP Conditions

		CYCLE BURNUP RANGE (MWD/MTU)					
D-BANK POS STEPS	C-BANK POS STEPS	8000.1 TO 10000.0	10000.1 TO 12000.0	12000.1 TO 14000.0	14000.1 TO 16000.0	16000.1 TO 17500.0	17500.1 TO 18500.0
24	152	1497.5	1560.7	1626.7	1695.4	1764.5	1799.9
23	151	1510.7	1573.3	1640.3	1708.9	1778.1	1813.6
22	150	1521.9	1585.5	1651.8	1720.6	1790.0	1825.5
21	149	1533.5	1597.3	1663.7	1732.7	1802.1	1837.5
20	148	1545.1	1609.1	1675.7	1744.7	1814.1	1849.7
19	147	1556.4	1621.3	1688.0	1757.2	1826.7	1862.4
18	146	1568.7	1633.2	1700.1	1769.4	1839.0	1874.8
17	145	1580.6	1645.2	1713.1	1782.6	1852.4	1888.2
16	144	1594.3	1658.4	1726.5	1796.0	1866.0	1901.9
15	143	1604.1	1669.2	1738.1	1807.8	1877.3	1913.2
14	142	1614.4	1680.3	1748.8	1818.7	1888.3	1924.3
13	141	1625.7	1691.2	1760.6	1830.7	1900.4	1936.3
12	140	1636.2	1702.7	1771.6	1841.9	1911.8	1948.0
11	139	1647.4	1714.2	1783.3	1853.9	1924.0	1960.0
10	138	1658.9	1725.2	1794.5	1866.1	1936.4	1972.6
9	137	1669.2	1736.4	1806.0	1877.0	1947.6	1983.8
8	136	1680.0	1746.8	1817.3	1888.4	1959.2	1995.8
7	135	1689.3	1756.4	1826.3	1897.6	1970.0	2006.6
6	134	1698.9	1766.2	1836.4	1907.9	1979.8	2016.5
5	133	1708.3	1775.9	1846.3	1918.0	1990.8	2027.7
4	132	1717.6	1785.3	1856.0	1928.0	2000.3	2037.3
3	131	1728.4	1796.4	1867.4	1939.6	2012.3	2049.4
2	130	1737.1	1805.3	1876.4	1948.9	2021.8	2059.0

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Attachment 29

SURRY UNIT 1 - CYCLE 23 AT POWER INTEGRAL ROD WORTH TABLE FOR CONTROL BANKS C AND D IN OVERLAP

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Note: Worth At Nominal HFP Conditions

		CYCLE BURNUP RANGE (MWD/MTU)					
D-BANK POS STEPS	C-BANK POS STEPS	8000.1 TO 10000.0	10000.1 TO 12000.0	12000.1 TO 14000.0	14000.1 TO 16000.0	16000.1 TO 17500.0	17500.1 TO 18500.0
1	129	1746.0	1814.4	1885.7	1958.4	2032.2	2069.5
0	128	1754.0	1822.6	1894.2	1967.1	2040.4	2077.8
0	126	1767.3	1836.0	1907.8	1981.0	2054.7	2092.3
0	124	1781.9	1850.8	1922.9	1996.6	2070.7	2108.6
0	122	1793.1	1862.1	1934.3	2008.2	2082.5	2120.5
0	120	1805.3	1874.4	1946.9	2021.0	2095.7	2133.8
0	118	1818.2	1887.3	1959.9	2034.4	2109.3	2147.7
0	116	1831.6	1900.8	1973.6	2048.3	2123.6	2162.2
0	114	1844.1	1913.3	1986.2	2061.1	2136.7	2175.3
0	112	1856.8	1926.0	1999.0	2074.1	2149.9	2188.7
0	110	1869.6	1938.7	2011.9	2087.2	2163.2	2202.1
0	108	1883.0	1952.0	2025.2	2100.7	2177.0	2216.0
0	106	1895.2	1964.2	2037.4	2113.0	2189.5	2228.6
0	104	1907.9	1976.7	2050.0	2125.7	2202.3	2241.6
0	102	1921.1	1989.9	2063.1	2139.0	2215.8	2255.2
0	100	1933.3	2001.9	2075.1	2150.9	2227.9	2267.3
0	98	1945.5	2013.9	2087.0	2162.9	2240.0	2279.4

S1C23RodWorthAtPowerMOL.pdf

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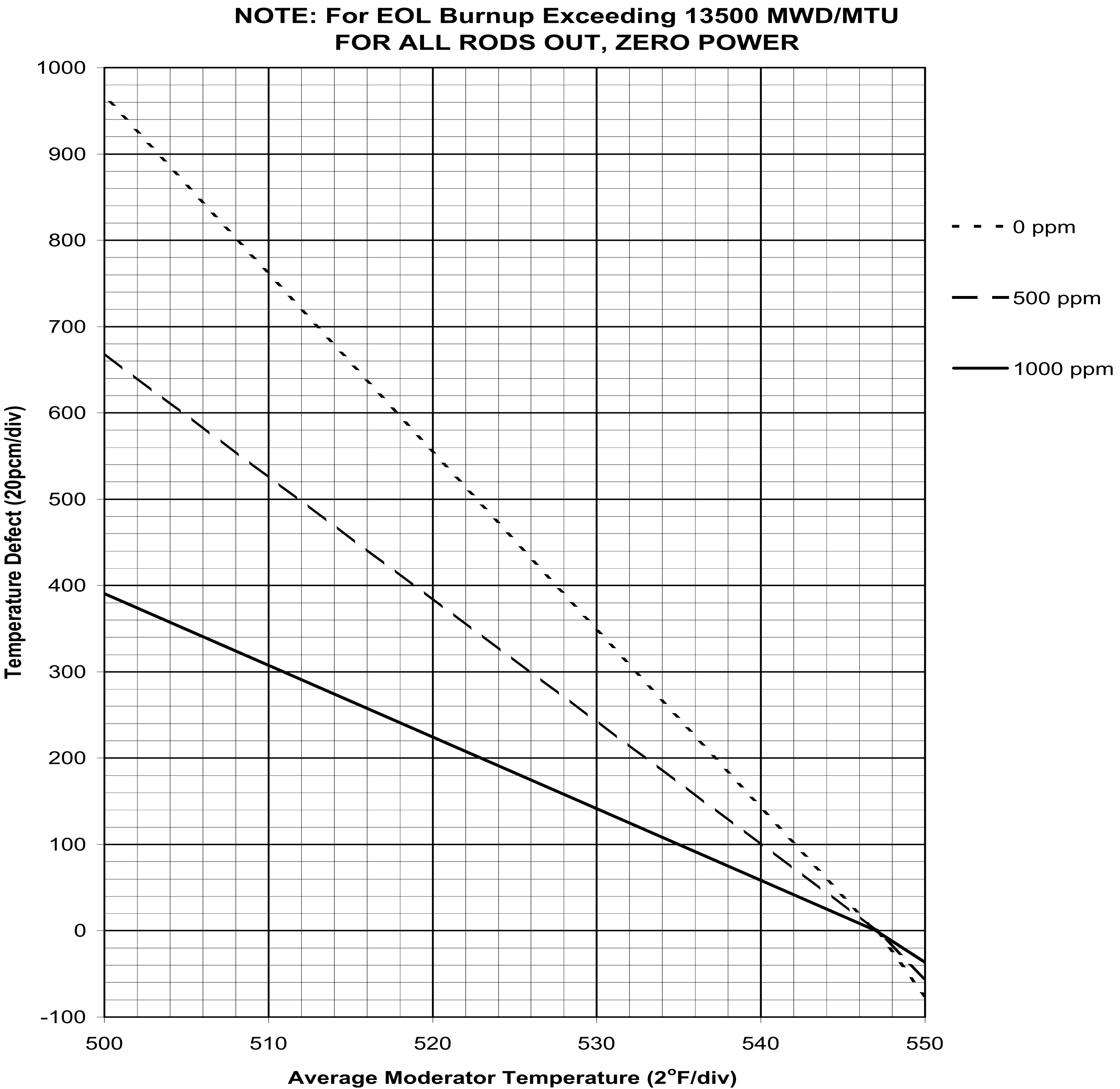
Attachment 30

SURRY UNIT 1 - CYCLE 23 ISOTHERMAL TEMPERATURE DEFECT VS. AVERAGE MODERATOR TEMPERATURE



S1C23IsothermalTempDefectEOL.pdf

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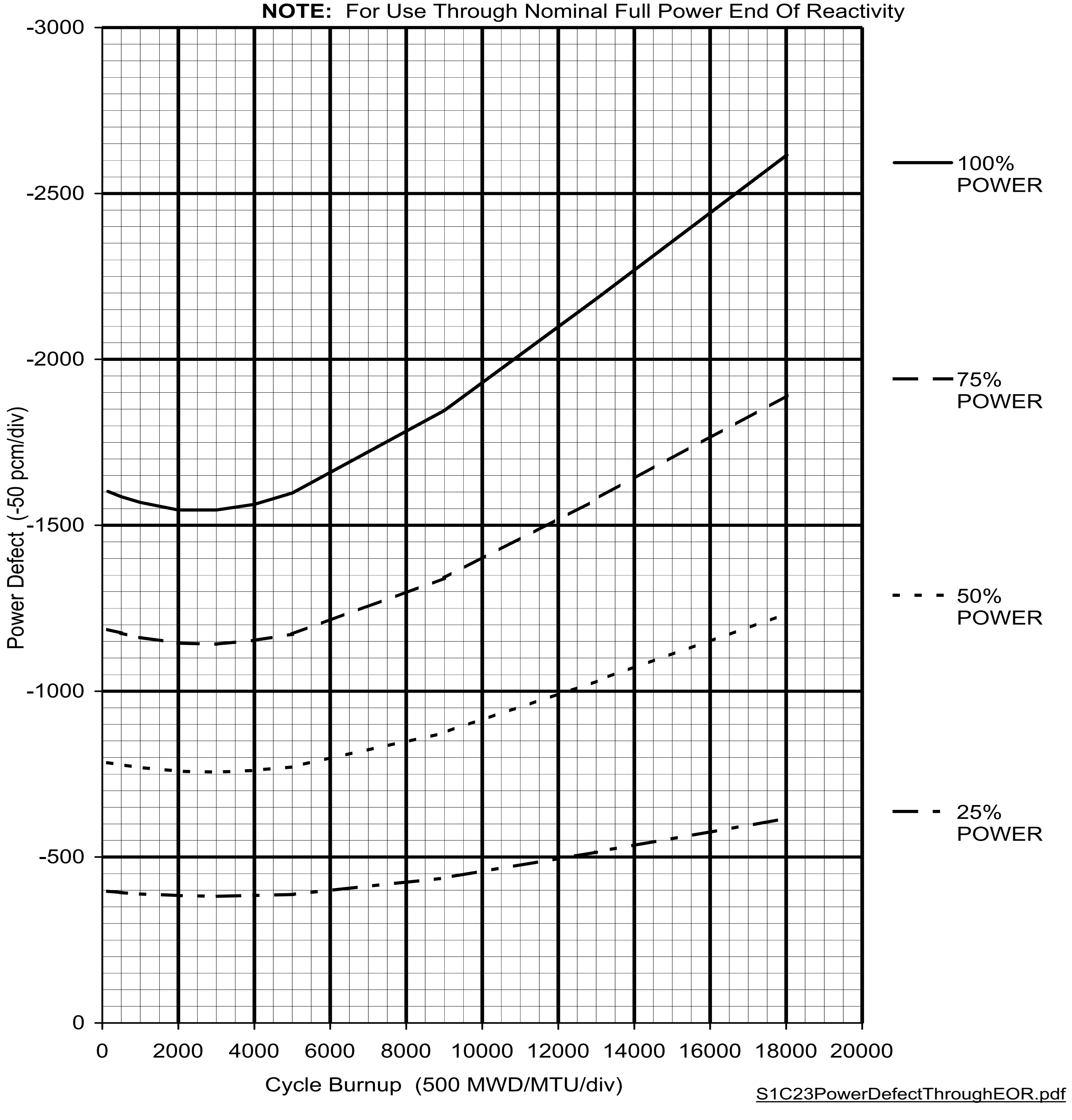
Attachment 31

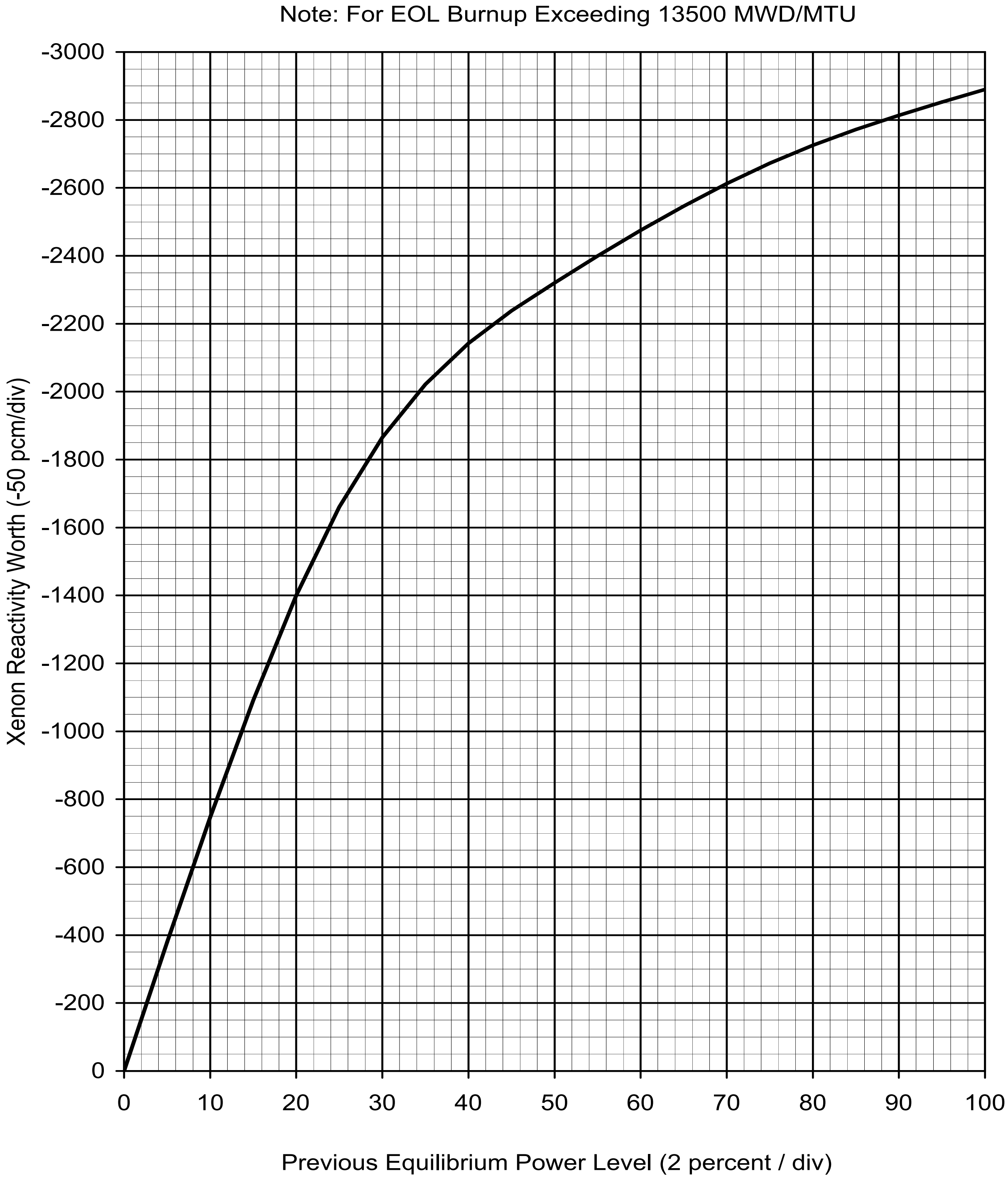
SURRY UNIT 1 - CYCLE 23 POWER DEFECT



(Page 1 of 1)

Attachment 32

SURRY UNIT 1 - CYCLE 23 XENON REACTIVITY WORTH AT HZP VS. PREVIOUS EQUILIBRIUM POWER LEVEL



S1C23XenonHZPvsPrevEOL.pdf

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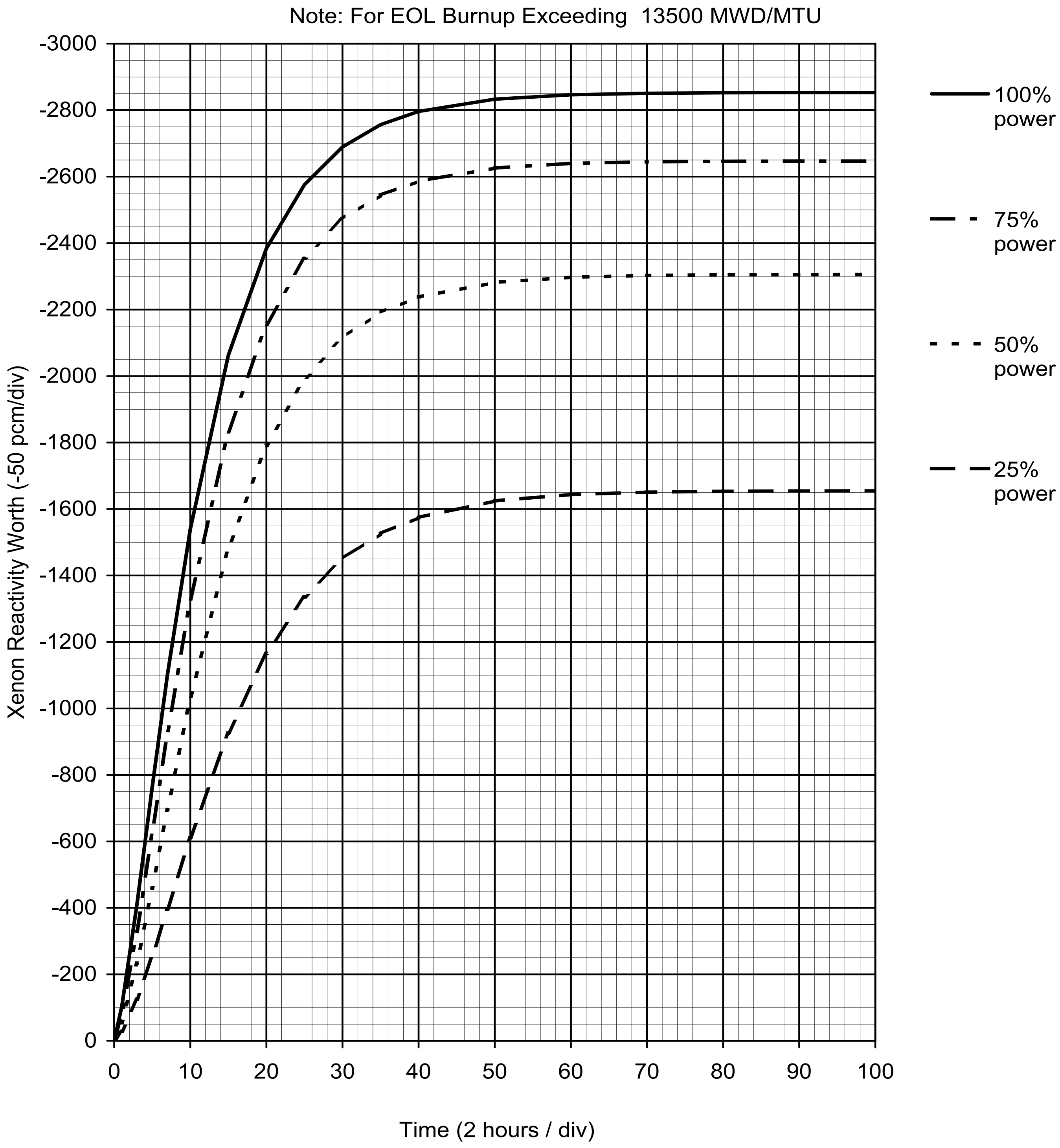
Attachment 33

SURRY UNIT 1 - CYCLE 23 XENON REACTIVITY WORTH FOLLOWING STARTUP



S1C23XenonStartupEOL.pdf

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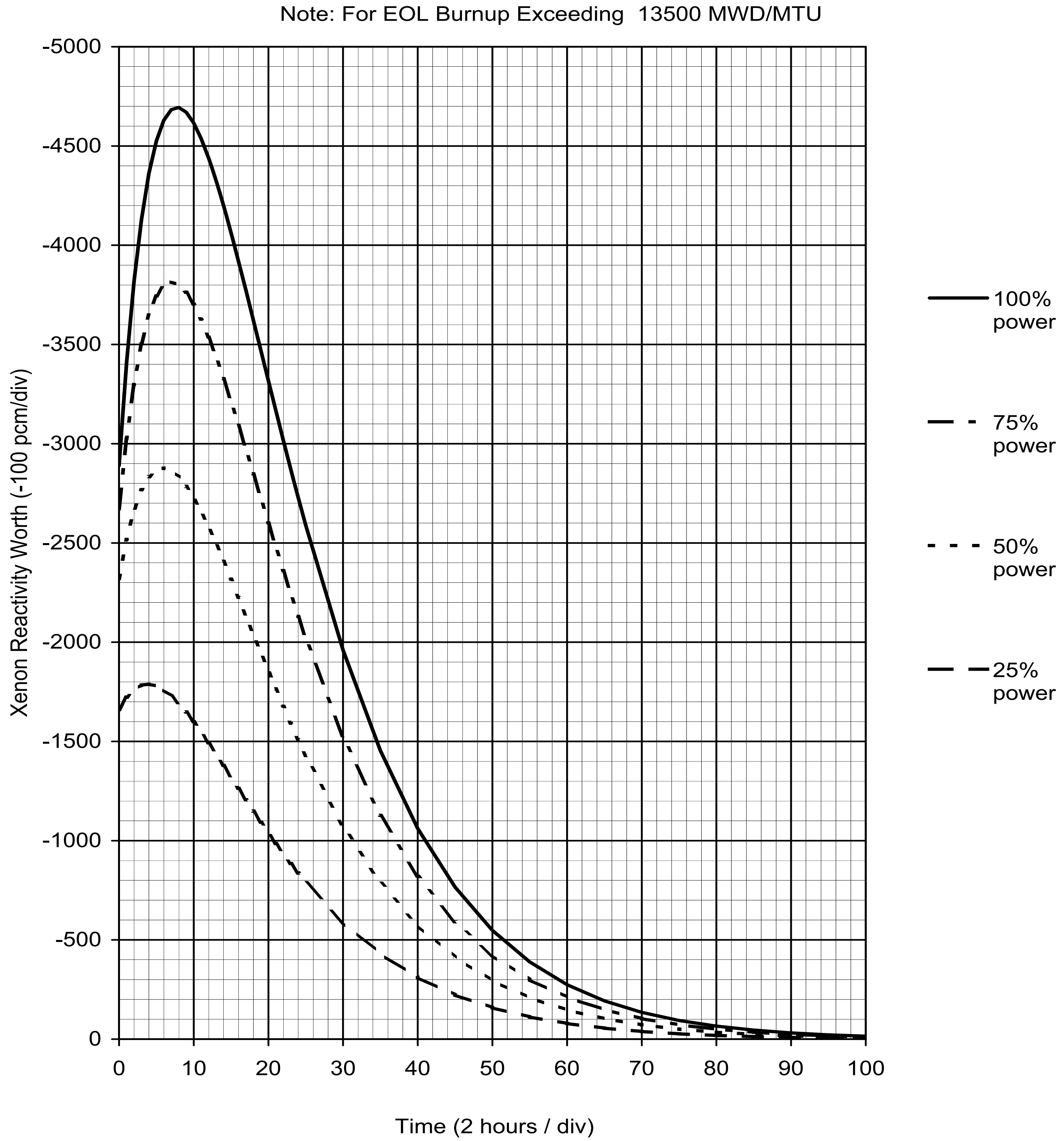
Attachment 34

SURRY UNIT 1 - CYCLE 23 XENON REACTIVITY WORTH FOLLOWING REACTOR TRIP (100 HOURS)



S1C23XenonTripEOL100.pdf

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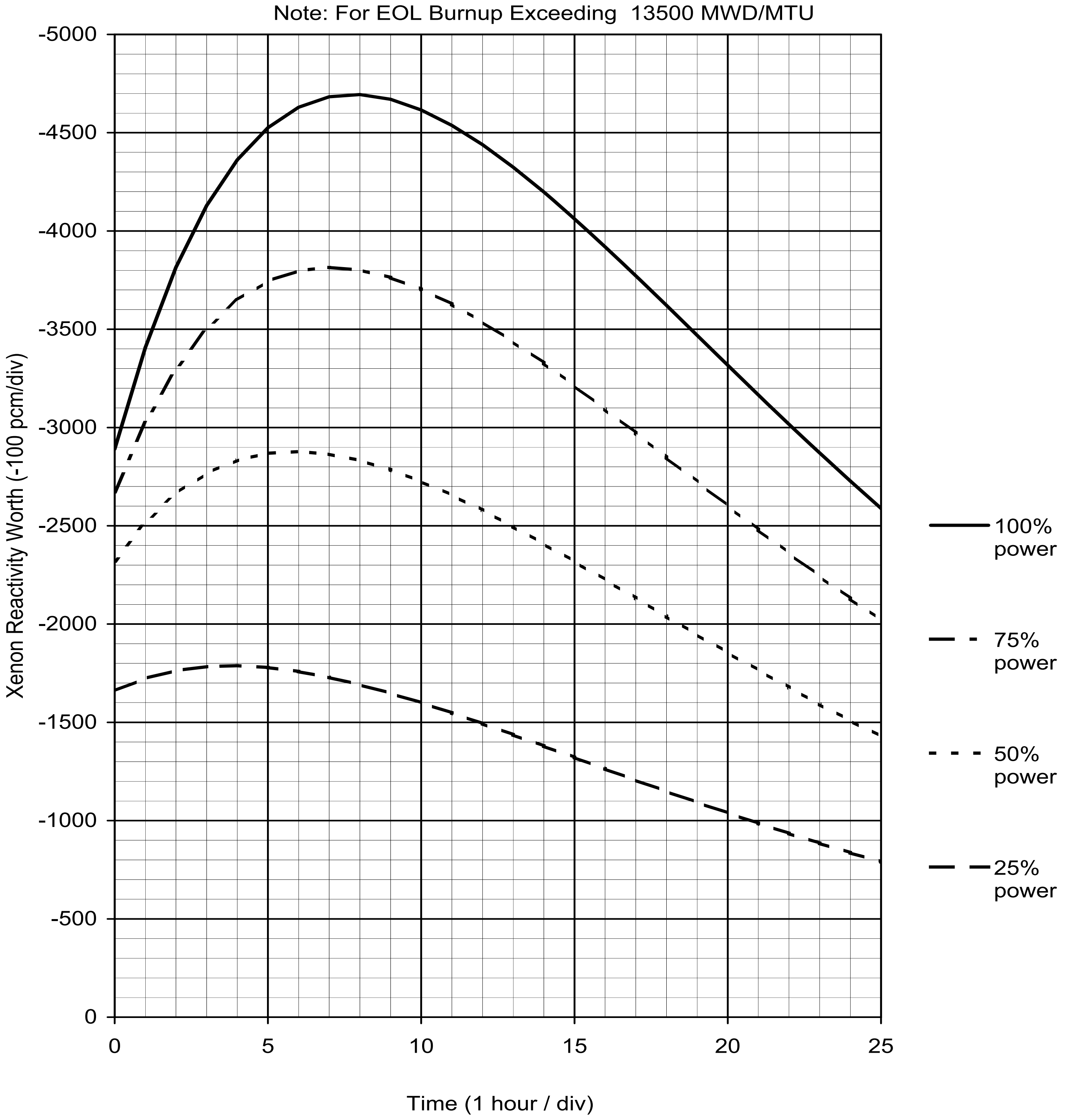
Attachment 35

SURRY UNIT 1 - CYCLE 23 XENON REACTIVITY WORTH FOLLOWING REACTOR TRIP (25 HOURS)



S1C23XenonTripEOL25.pdf

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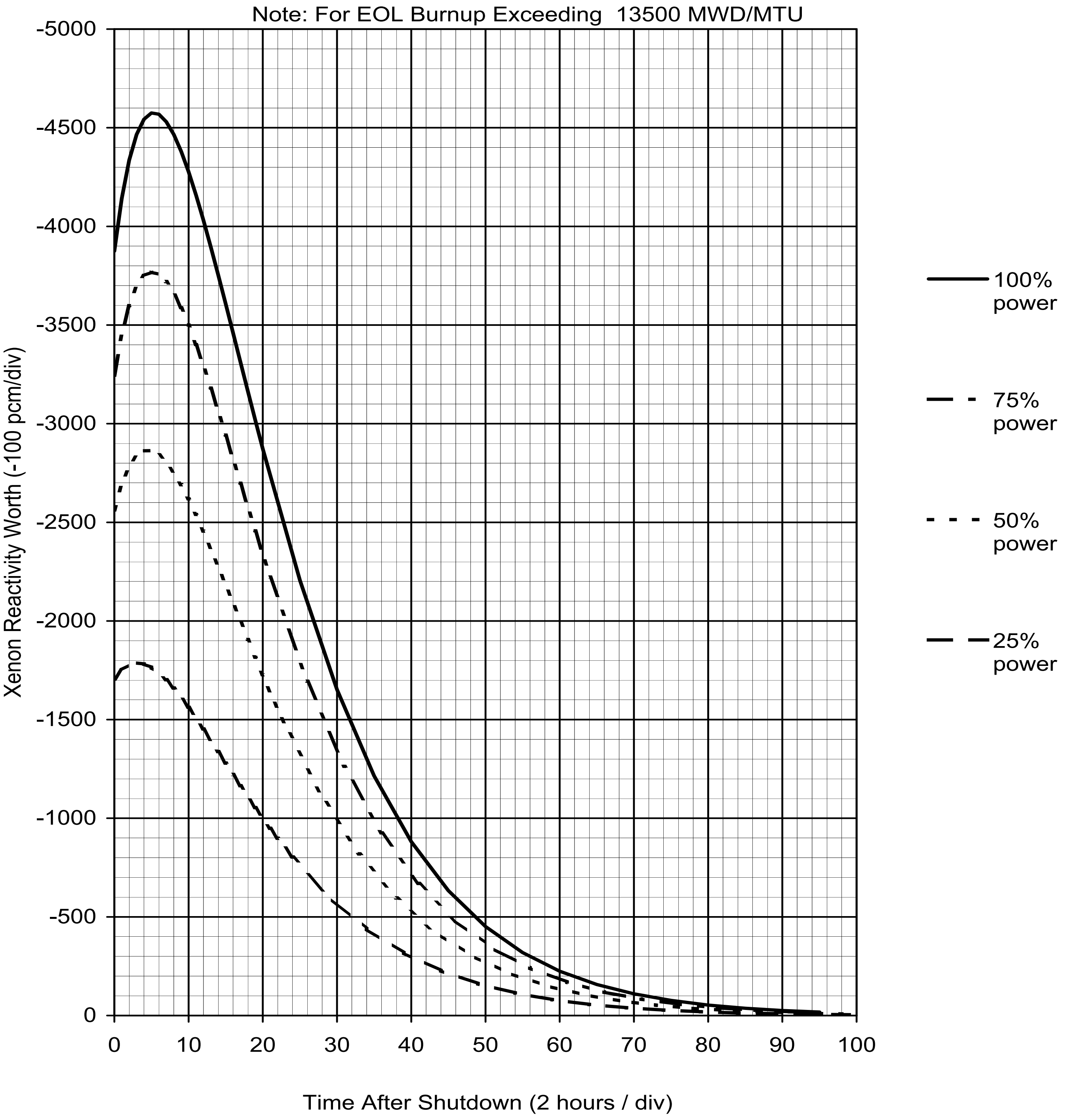
Attachment 36

SURRY UNIT 1 - CYCLE 23 XENON REACTIVITY WORTH FOLLOWING ORDERLY SHUTDOWN



S1C23XenonShutEOL.pdf

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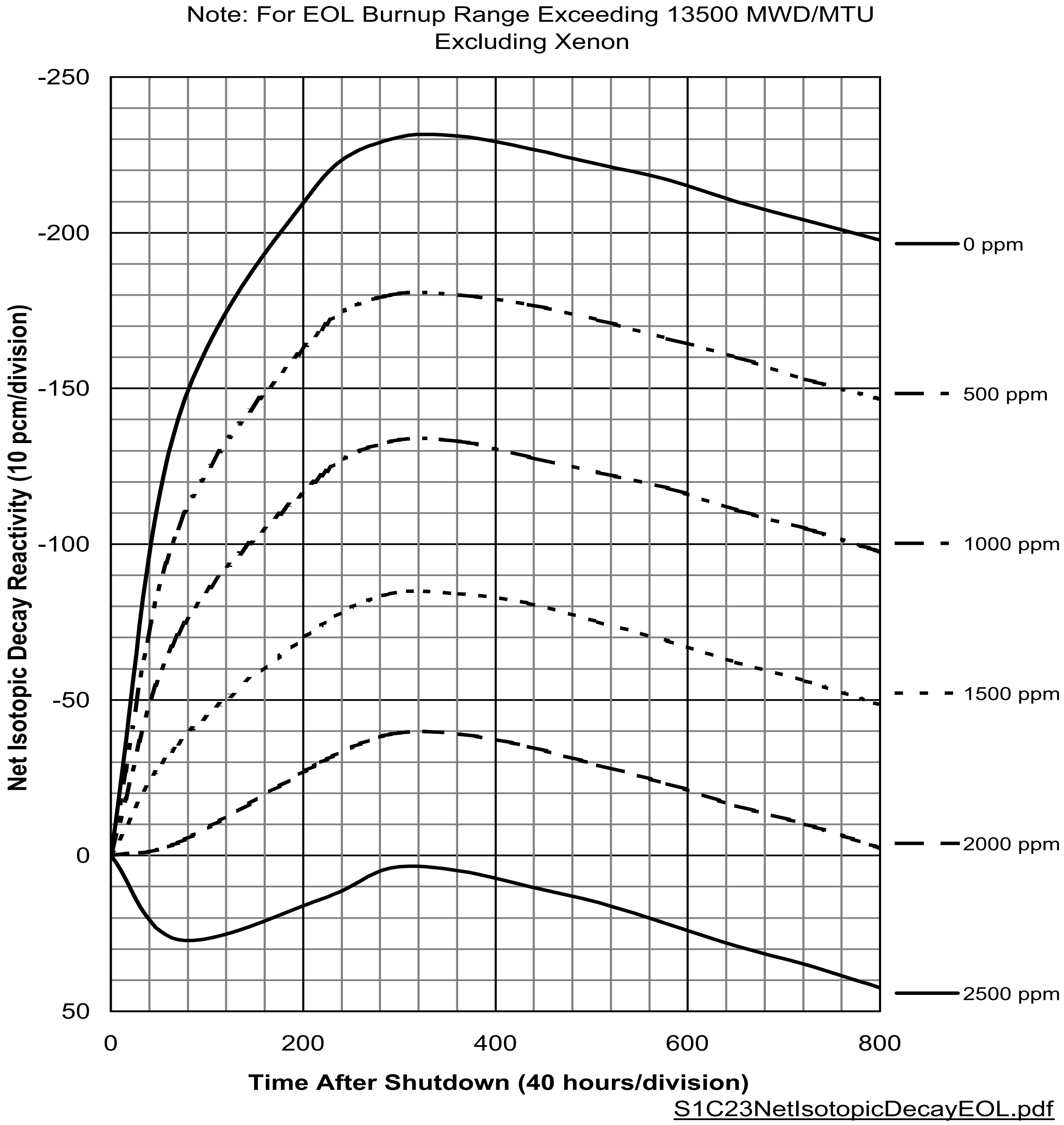
Attachment 37

SURRY UNIT 1 - CYCLE 23 NET ISOTOPIC DECAY REACTIVITY AFTER SHUTDOWN FROM HFP



S1C23NetIsotopicDecayEOL.pdf

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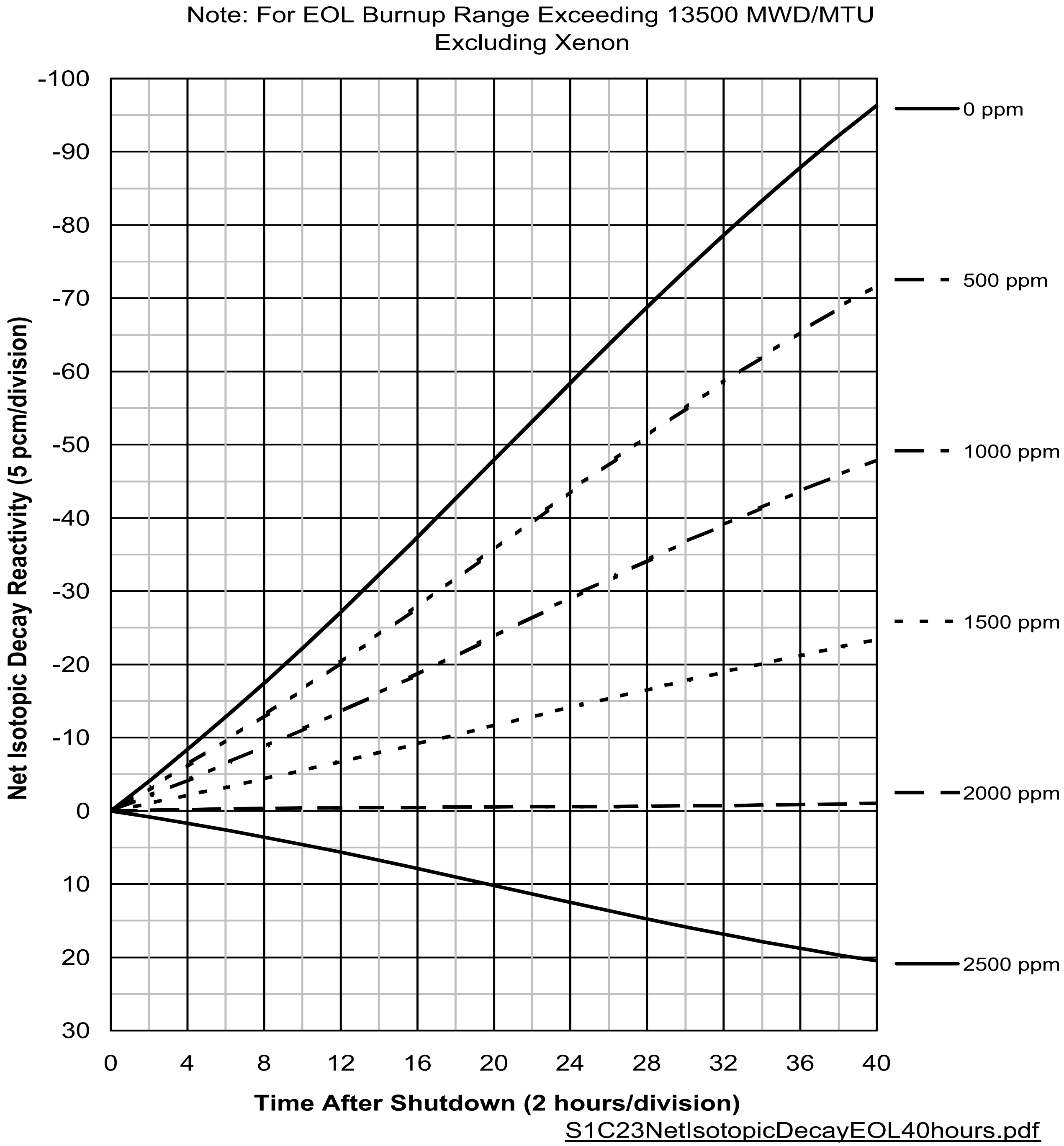
Attachment 37

SURRY UNIT 1 - CYCLE 23 NET ISOTOPIC DECAY REACTIVITY AFTER SHUTDOWN FROM HFP



S1C23NetIsotopicDecayEOL40hours.pdf

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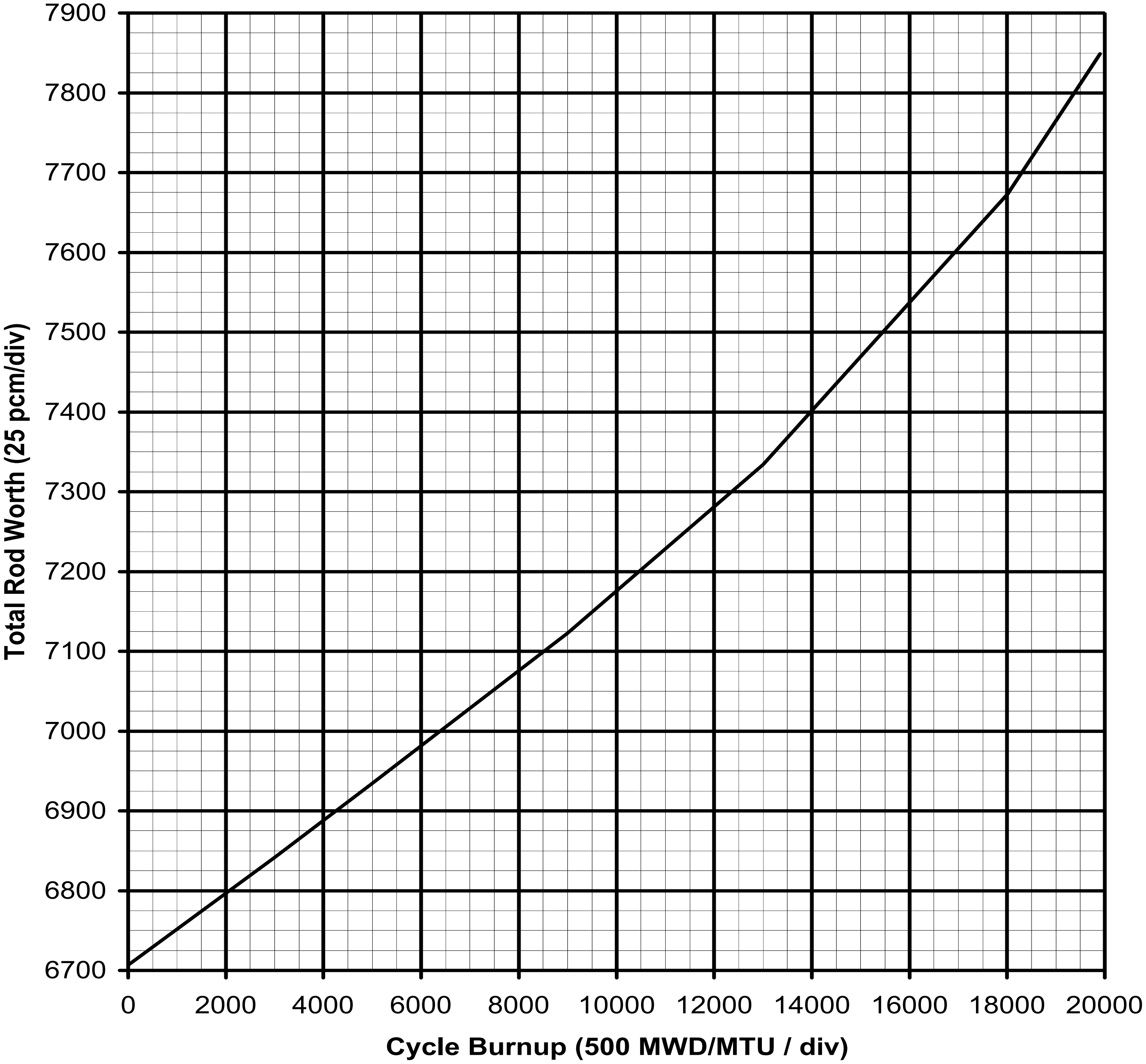
Attachment 38

SURRY UNIT 1 - CYCLE 23 TOTAL ROD WORTH VS. BURNUP

Note: For Use In Shutdown Margin Calculations Only



S1C23TotalRodWorth.pdf

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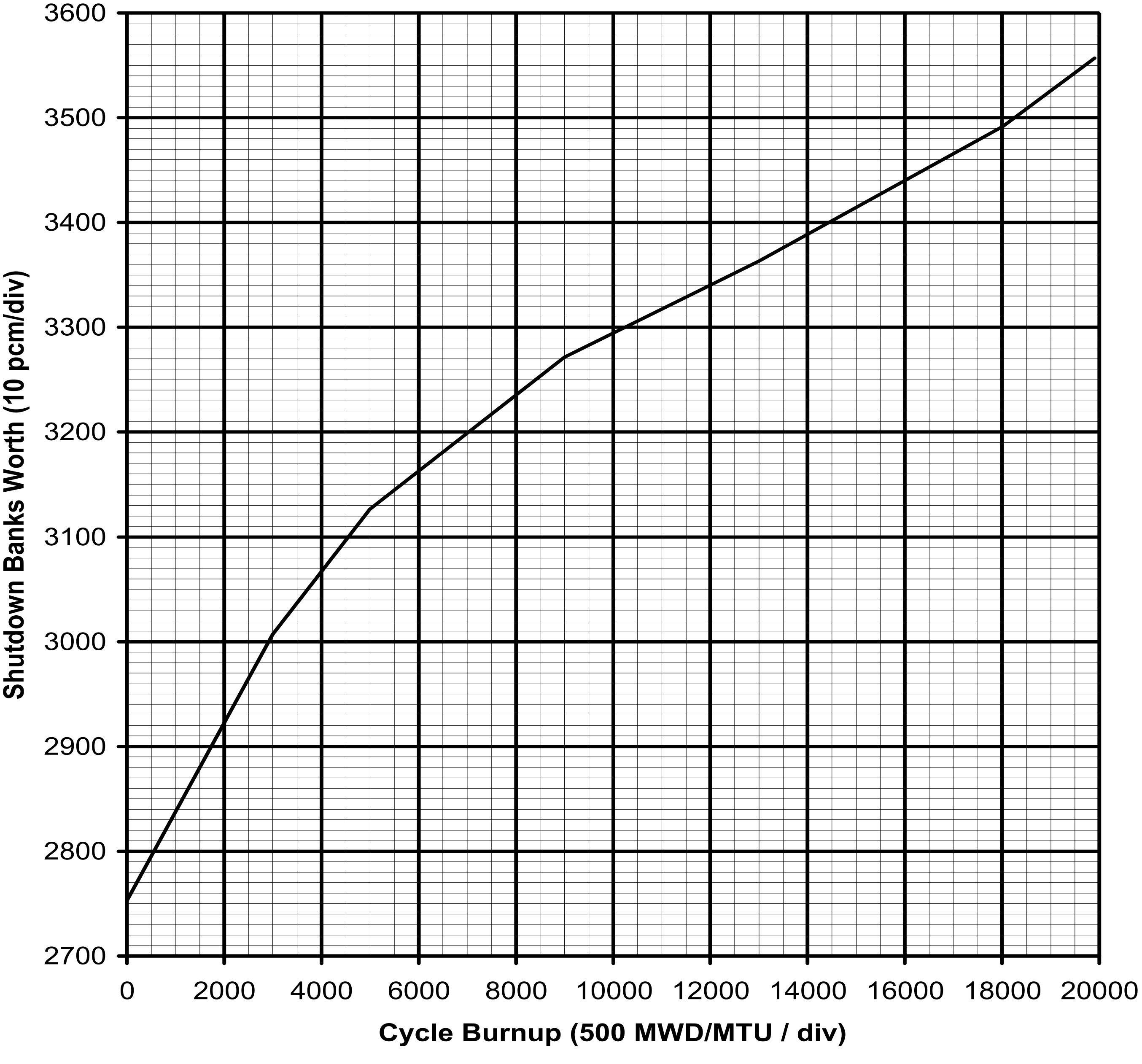
Attachment 39

SURRY UNIT 1 - CYCLE 23 SHUTDOWN BANKS WORTH VS. BURNUP

Note: For Use In Shutdown Margin Calculations Only



S1C23ShutdownBanksWorth.pdf

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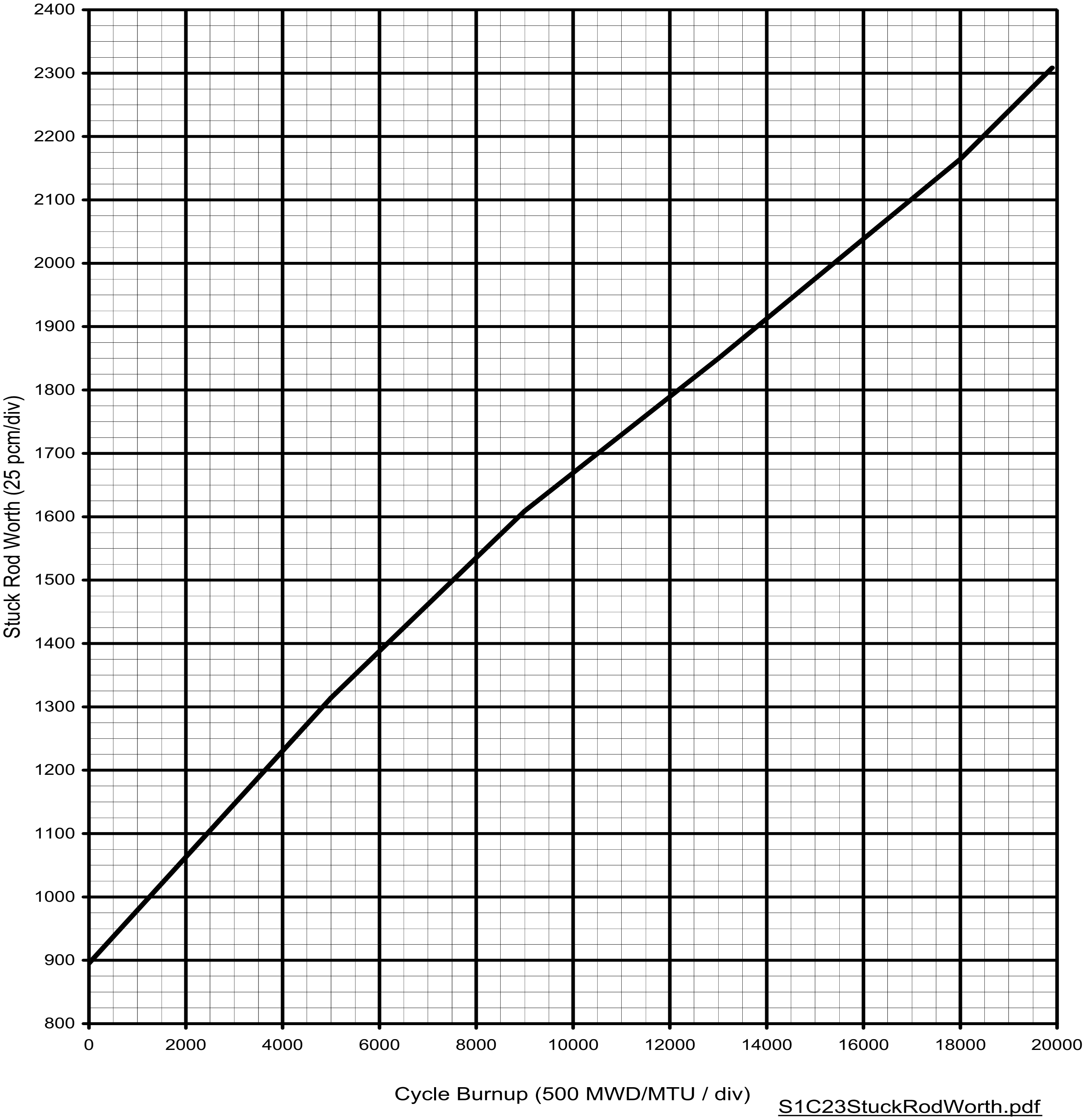
Attachment 40

SURRY UNIT 1 - CYCLE 23 STUCK ROD WORTH VS. BURNUP

Note: For Use In Shutdown Margin Calculations Only



S1C23StuckRodWorth.pdf

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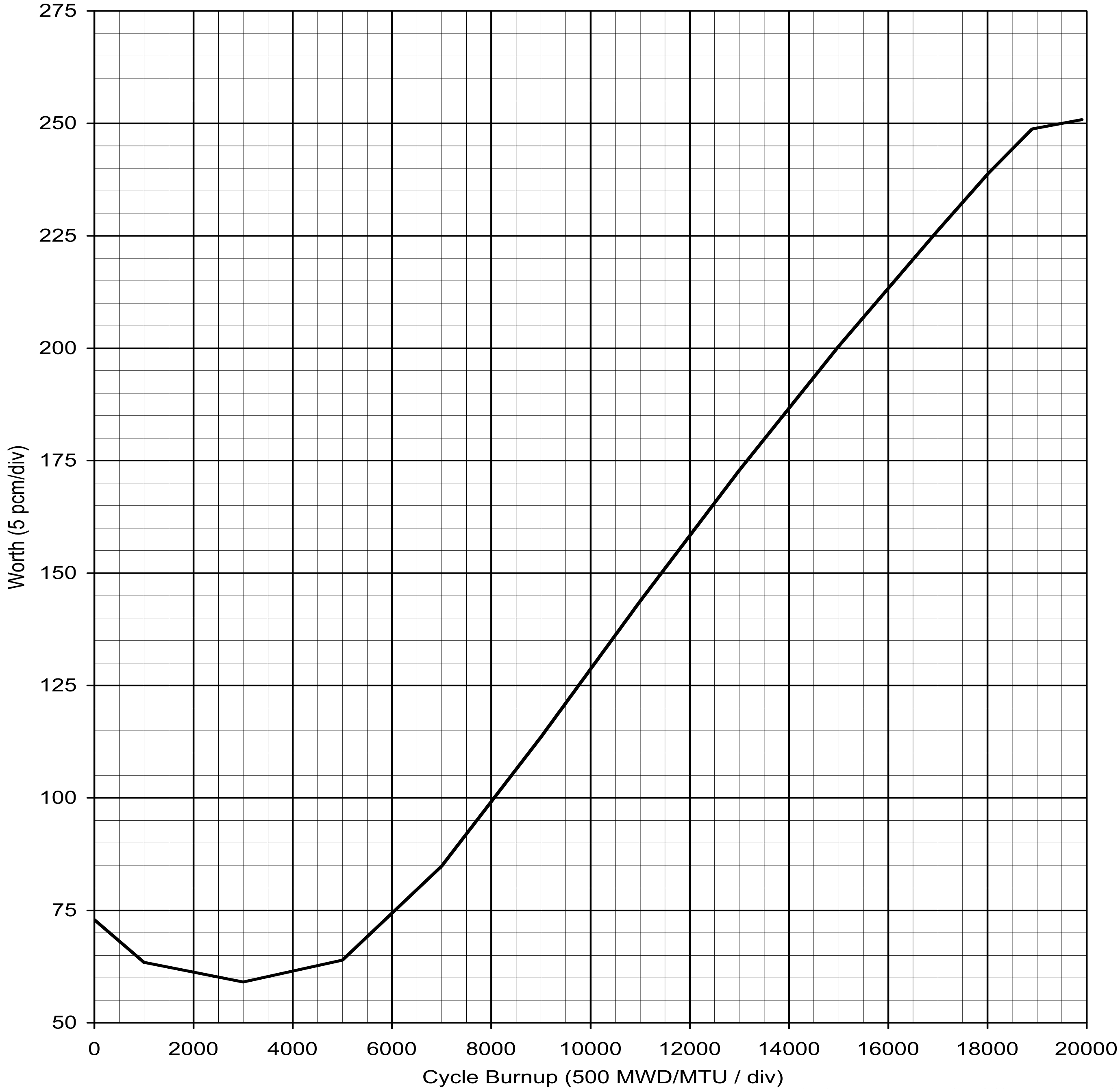
Attachment 41

SURRY UNIT 1 - CYCLE 23 WORTH OF A SINGLE ROD BANK OUT OF SEQUENCE UP TO 18 STEPS

Note: For Use In Shutdown Margin Calculations Only



S1C23BankWorthOutOfSequence.pdf

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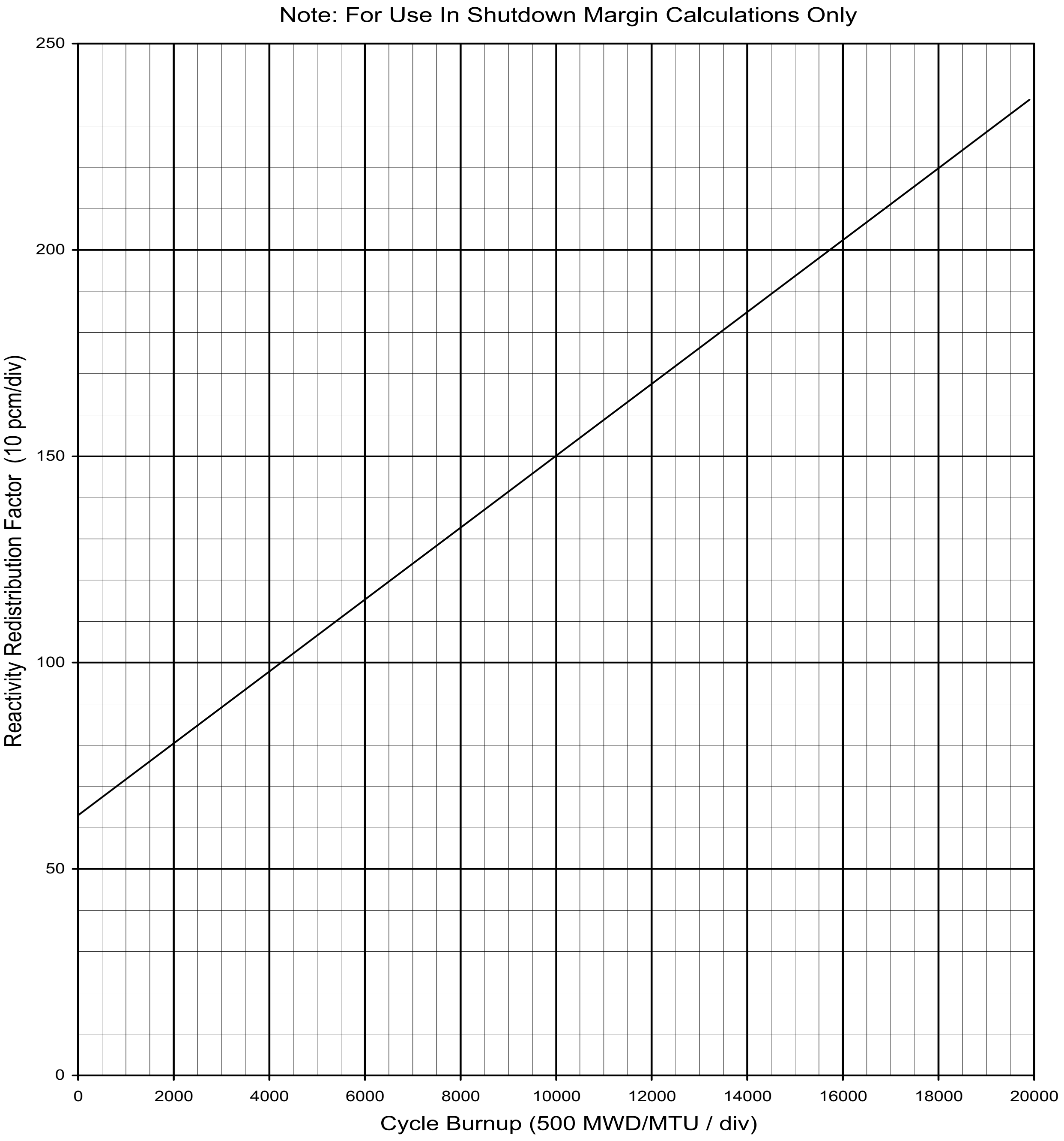
Attachment 42

SURRY UNIT 1 - CYCLE 23 REACTIVITY REDISTRIBUTION FACTOR VS. BURNUP



S1C23ReactRedistFactor.pdf

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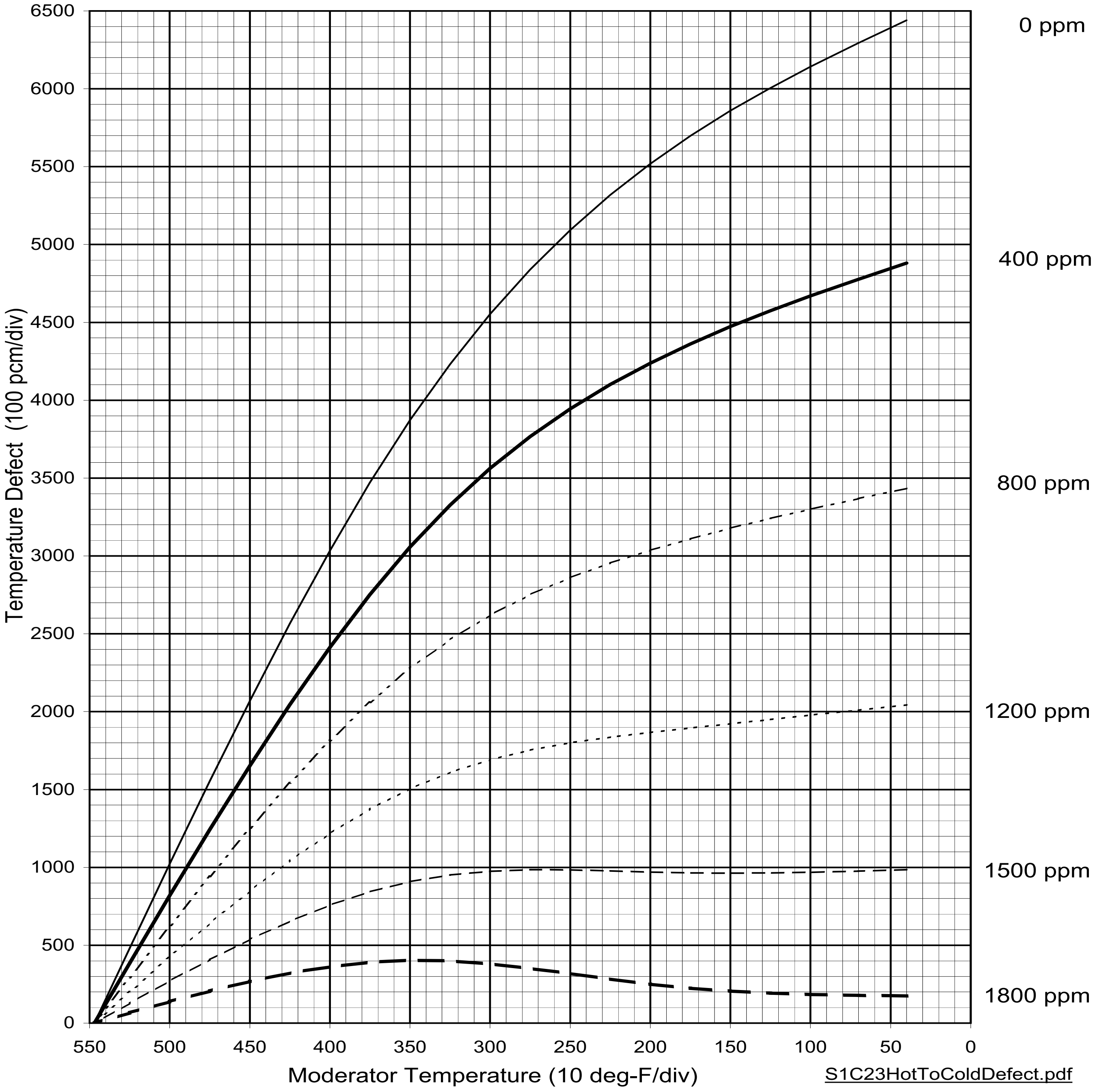
Attachment 43

SURRY UNIT 1 - CYCLE 23 HOT TO COLD TEMPERATURE DEFECT VS. AVERAGE MODERATOR TEMPERATURE

NOTE: For Boron Concentrations Greater Than 1800 PPM, The 1800 PPM Curve Should Be Used



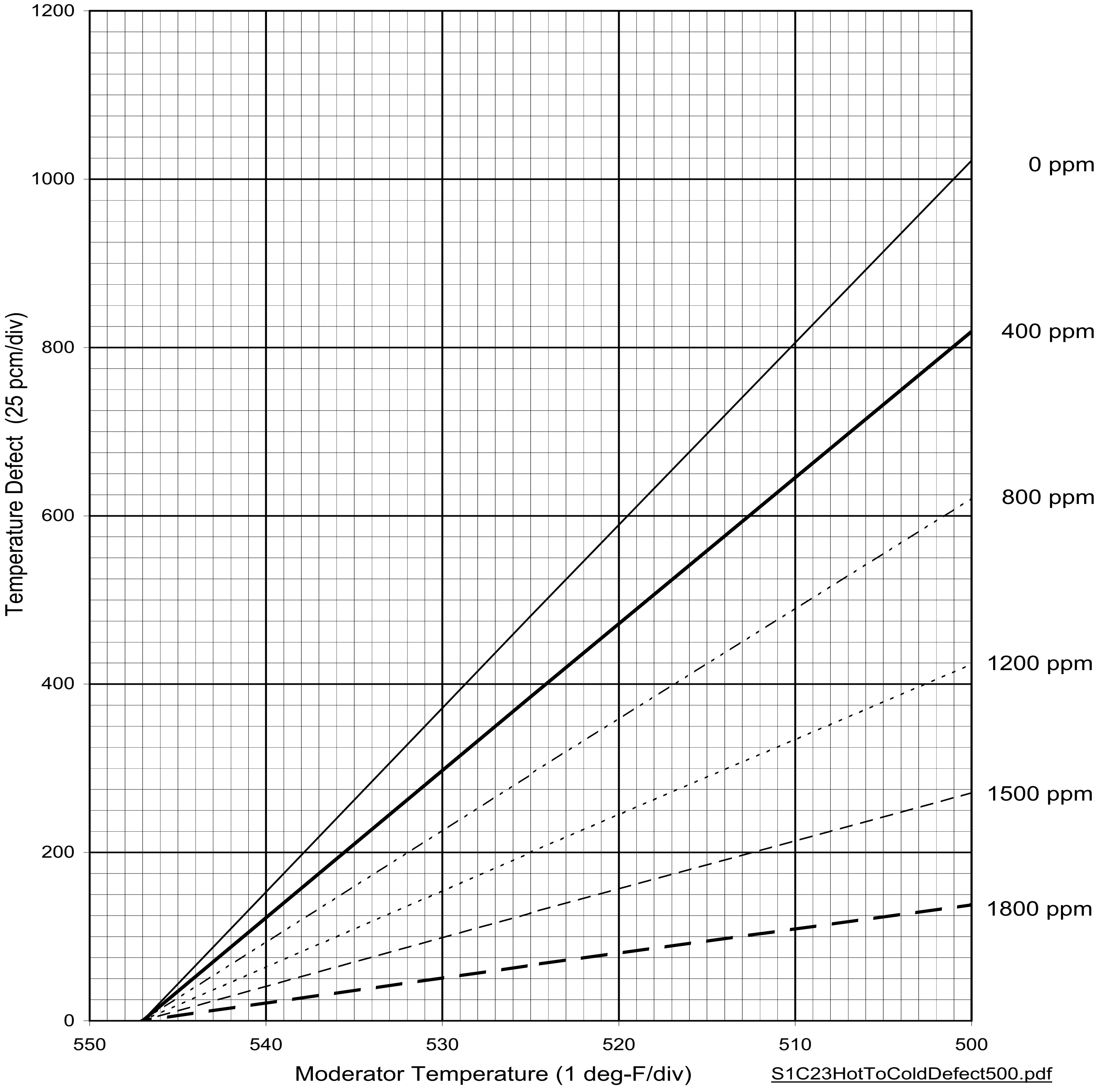
S1C23HotToColdDefect.pdf

(Page 2 of 2)

Attachment 43

SURRY UNIT 1 - CYCLE 23 HOT TO COLD TEMPERATURE DEFECT VS. AVERAGE MODERATOR TEMPERATURE

NOTE: For Boron Concentrations Greater Than 1800 PPM, The 1800 PPM Curve Should Be Used



S1C23HotToColdDefect500.pdf

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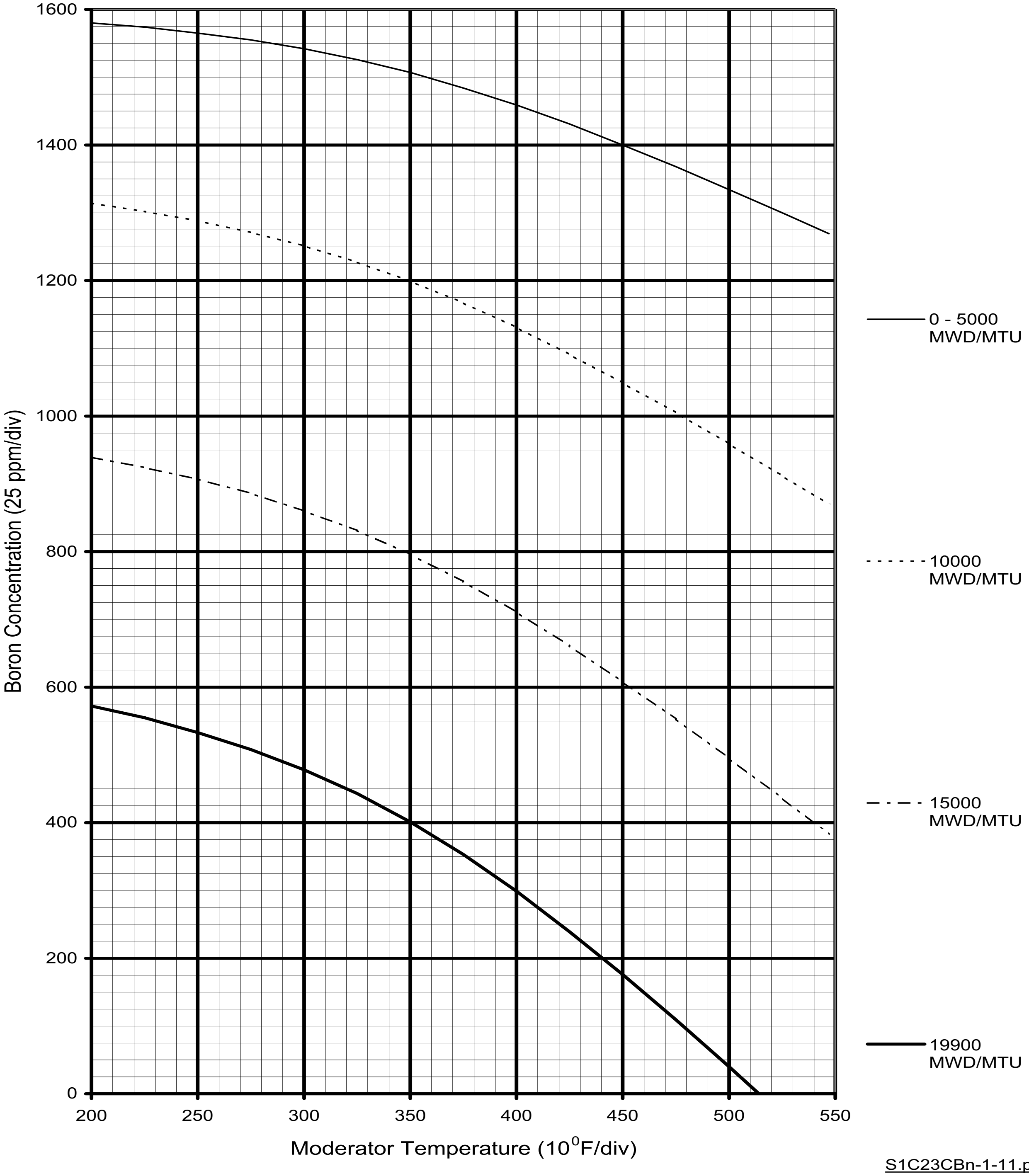
Attachment 44

SURRY UNIT 1 - CYCLE 23 1.1 X Cb(N-1) VS. TEMPERATURE AT VARIOUS BURNUPS

The 0-5000 MWD/MTU curve is bounding for all burnups through 5000 MWD/MTU. Interpolation is acceptable greater than 5000 MWD/MTU.



S1C23CBn-1-11.pdf

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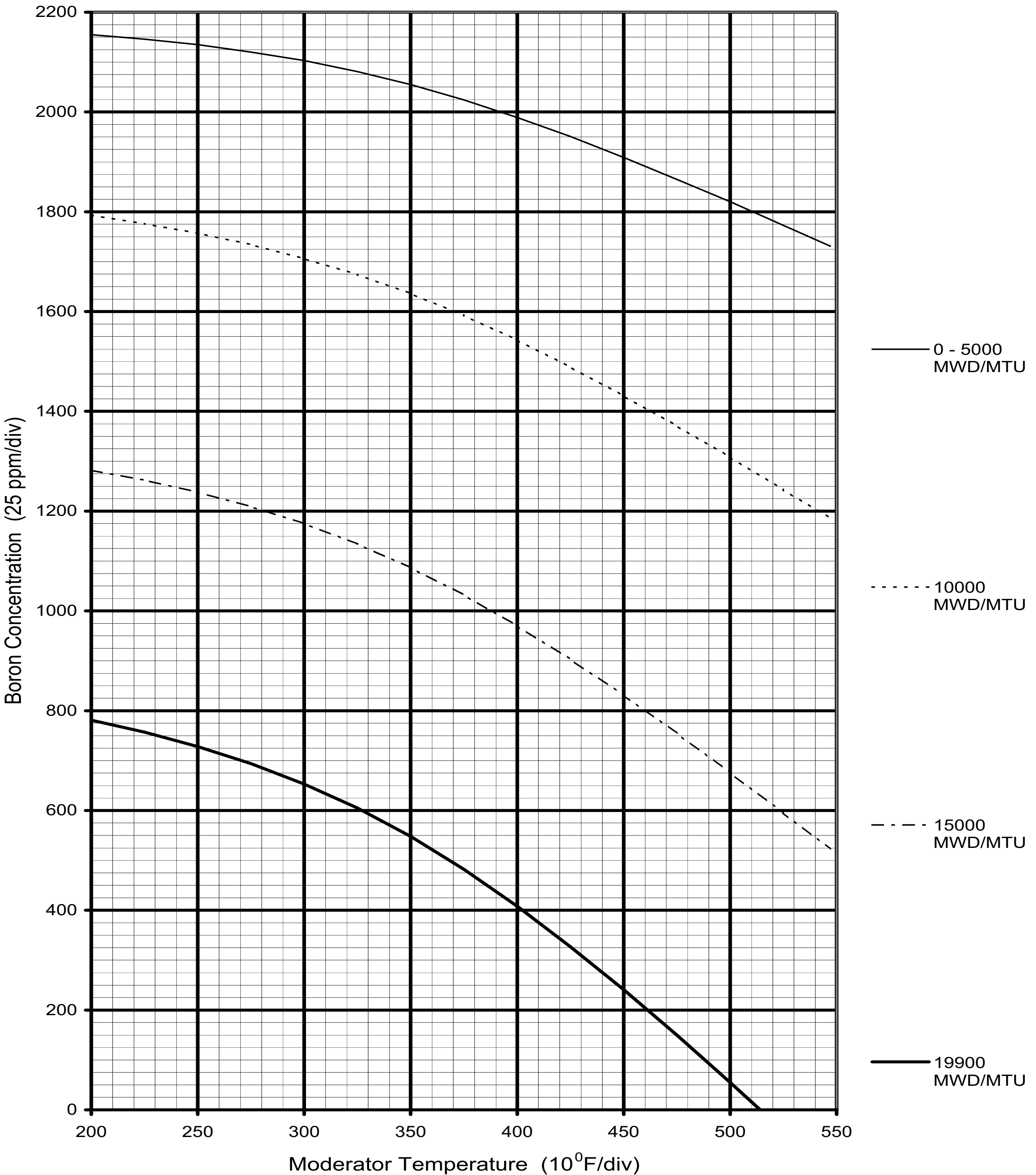
Attachment 45

SURRY UNIT 1 - CYCLE 23 1.5 X Cb(N-1) VS. TEMPERATURE AT VARIOUS BURNUPS

The 0-5000 MWD/MTU curve is bounding for all burnups through 5000 MWD/MTU. Interpolation is acceptable greater than 5000 MWD/MTU.



S1C23CBn-1-15.pdf

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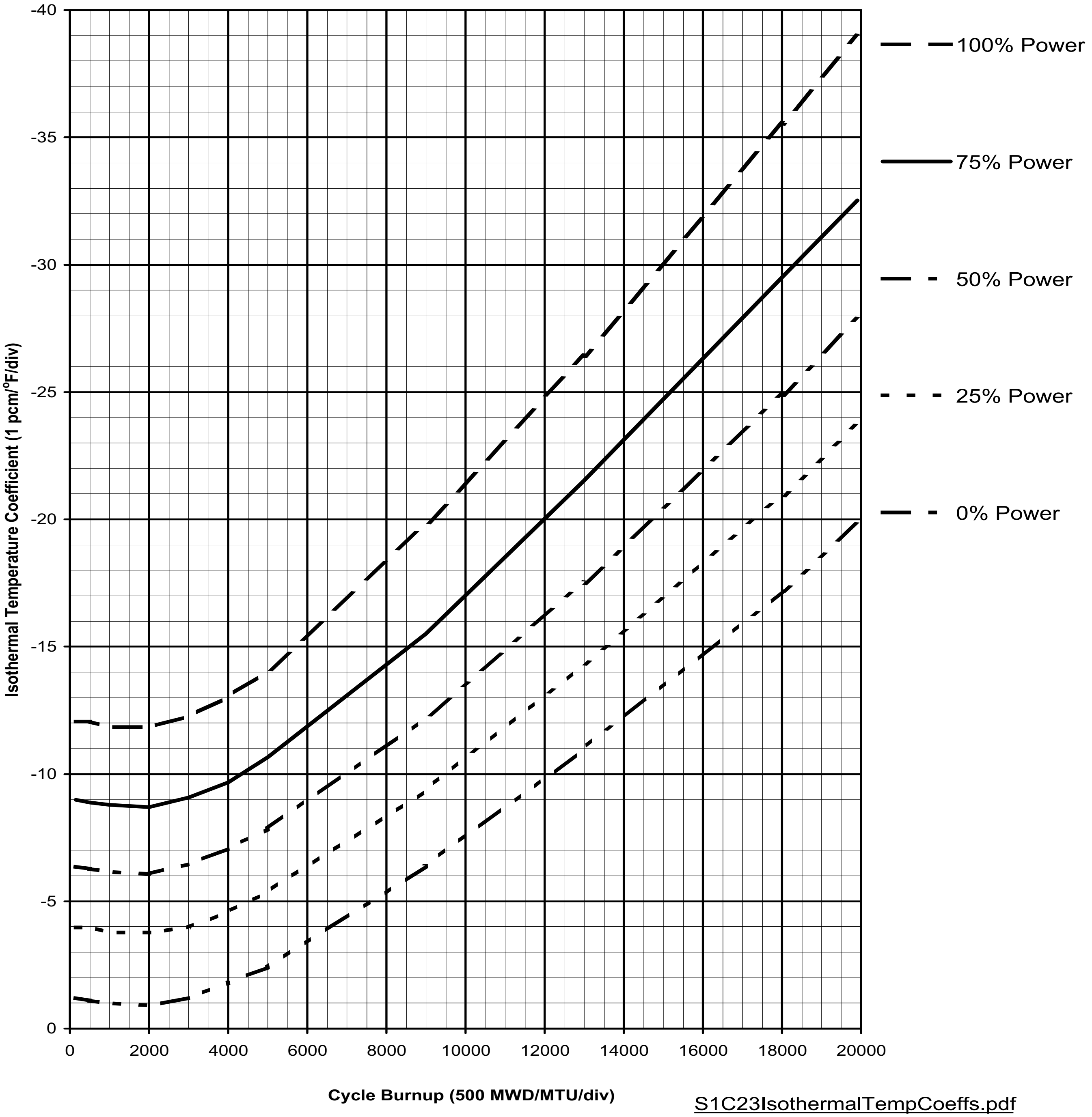
Attachment 46

SURRY UNIT 1 - CYCLE 23 ISOTHERMAL TEMPERATURE COEFFICIENT AT VARIOUS POWER LEVELS VS. BURNUP WITH ALL RODS OUT



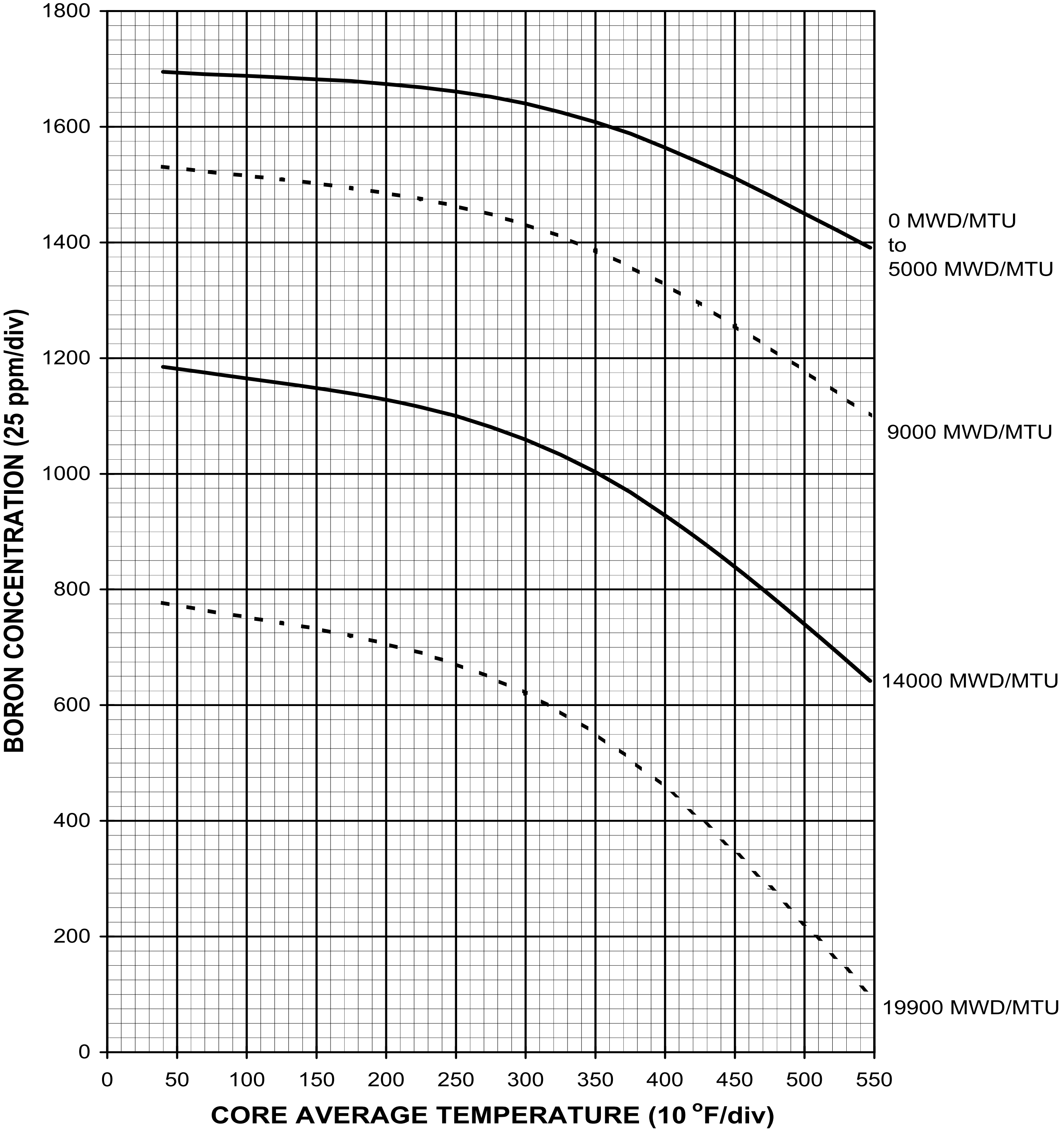
S1C23IsothermalTempCoeffs.pdf

(Page 1 of 1)

Attachment 47

SURRY UNIT 1 - CYCLE 23 MINIMUM BORON CONCENTRATION REQUIRED TO MEET 1770 PCM SHUTDOWN

The 0-5000 MWD/MTU curve is bounding for all burnups through 5000 MWD/MTU. Interpolation is acceptable greater than 5000 MWD/MTU.



S1C23MinShutdownBoron.pdf

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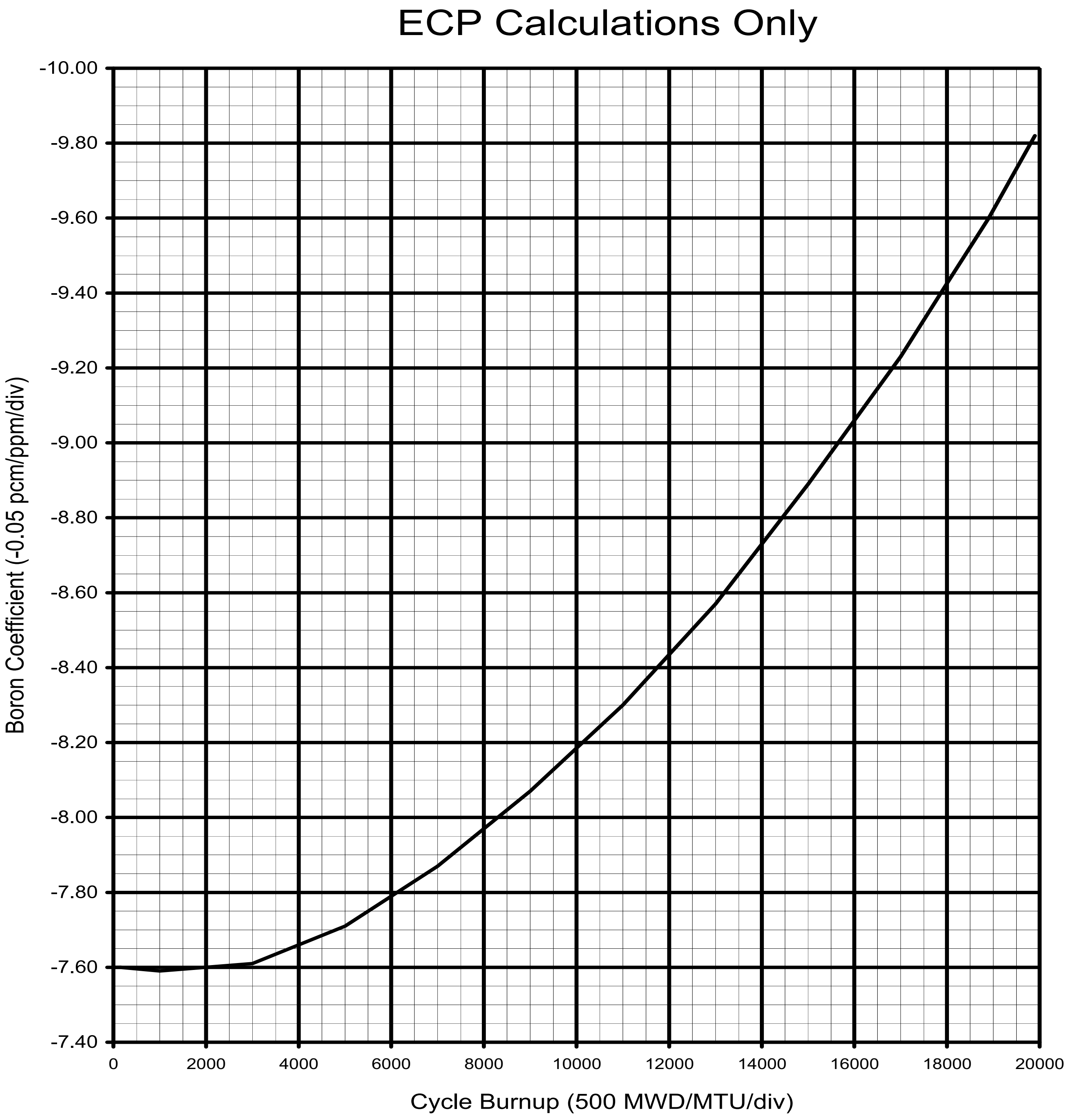
Attachment 48

SURRY UNIT 1 - CYCLE 23 BORON COEFFICIENT VS. BURNUP FOR ZERO PERCENT POWER



S1C23BoronCoeffECPOnly.pdf

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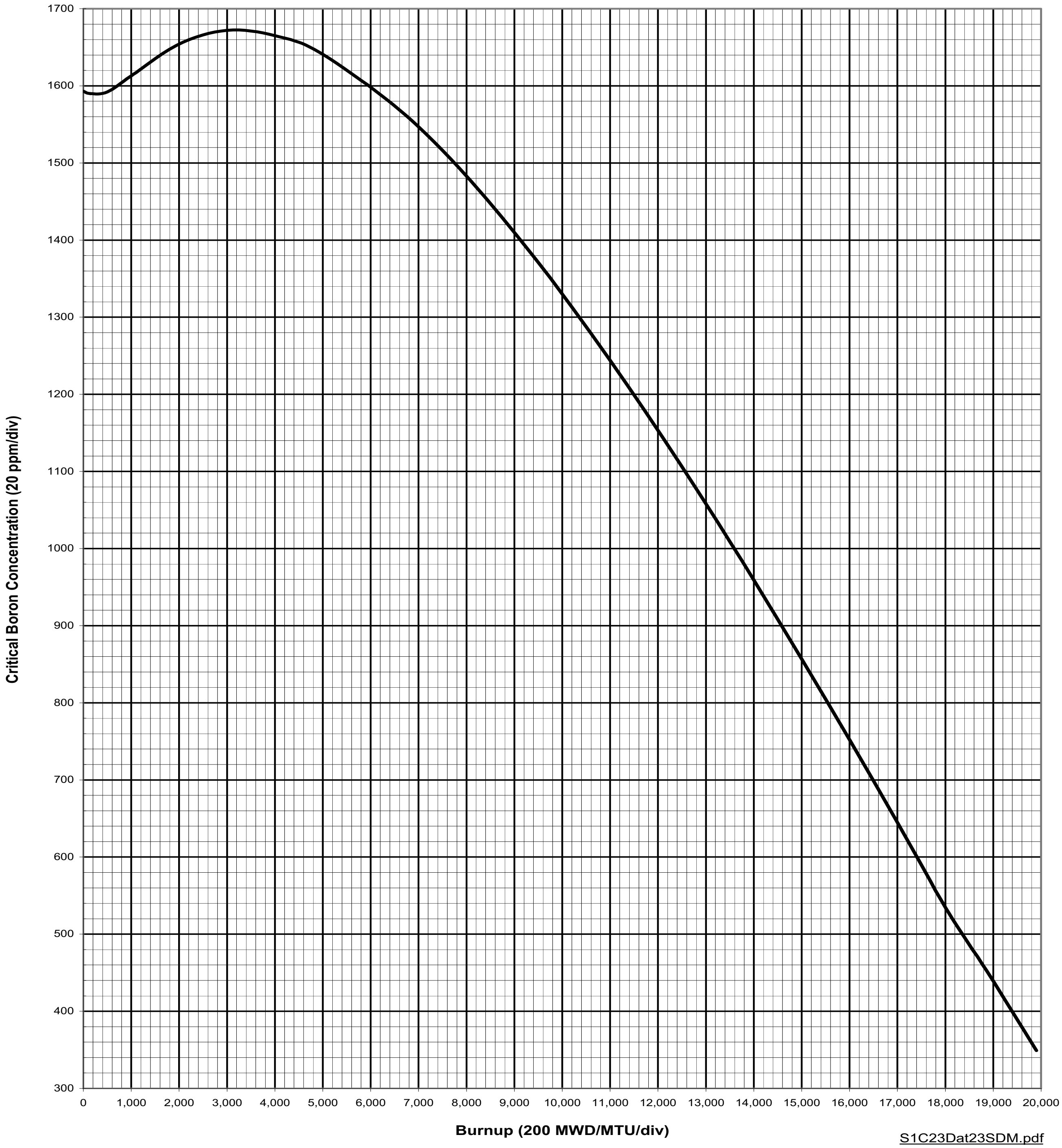
Attachment 49

SURRY UNIT 1 - CYCLE 23 CONSERVATIVE ZERO POWER MINIMUM INSERTION LIMIT SHUTDOWN MARGIN DATA

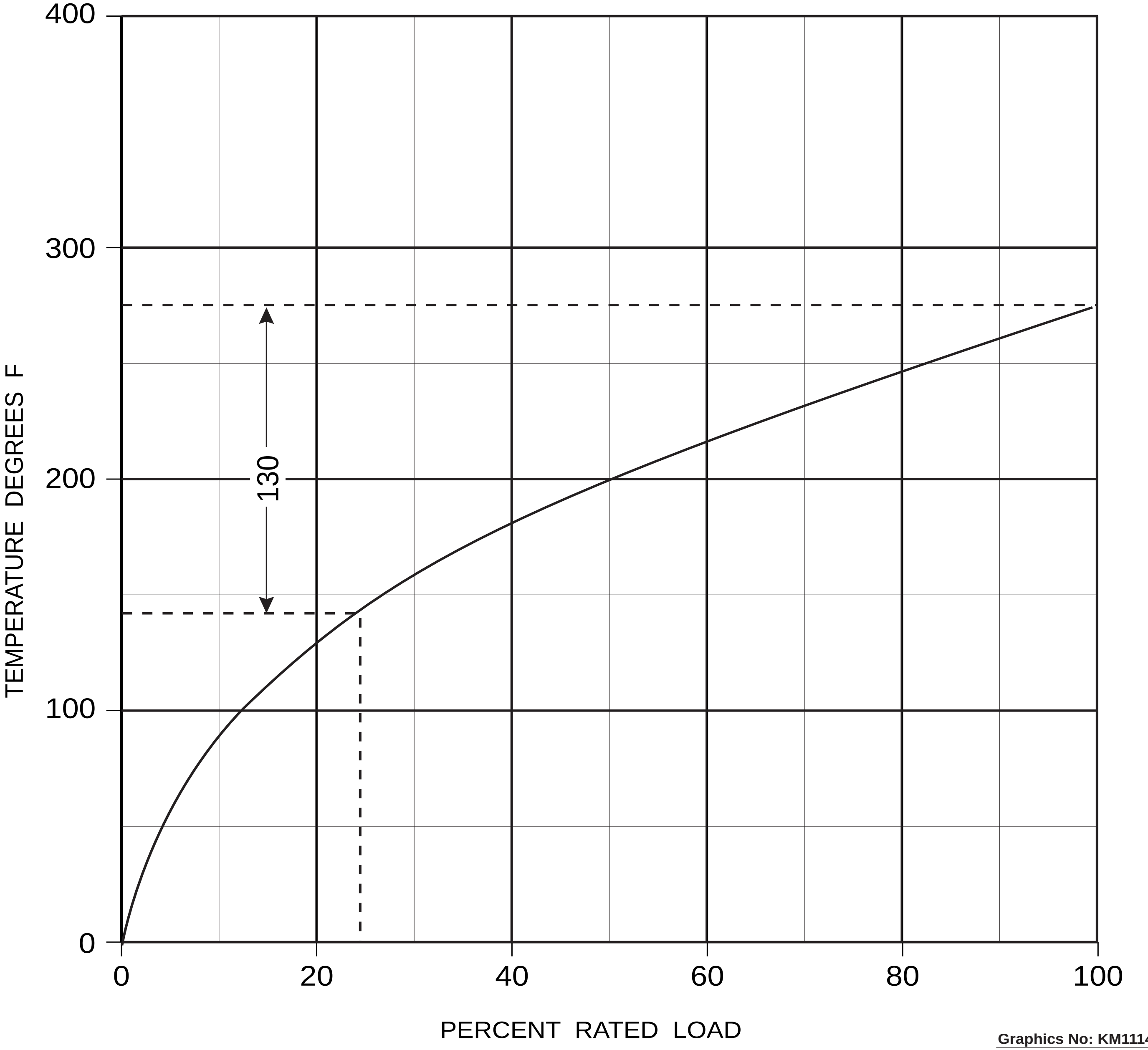


S1C23Dat23SDM.pdf

(Page 1 of 3)

Attachment 50

LOAD CHANGE CHARTS

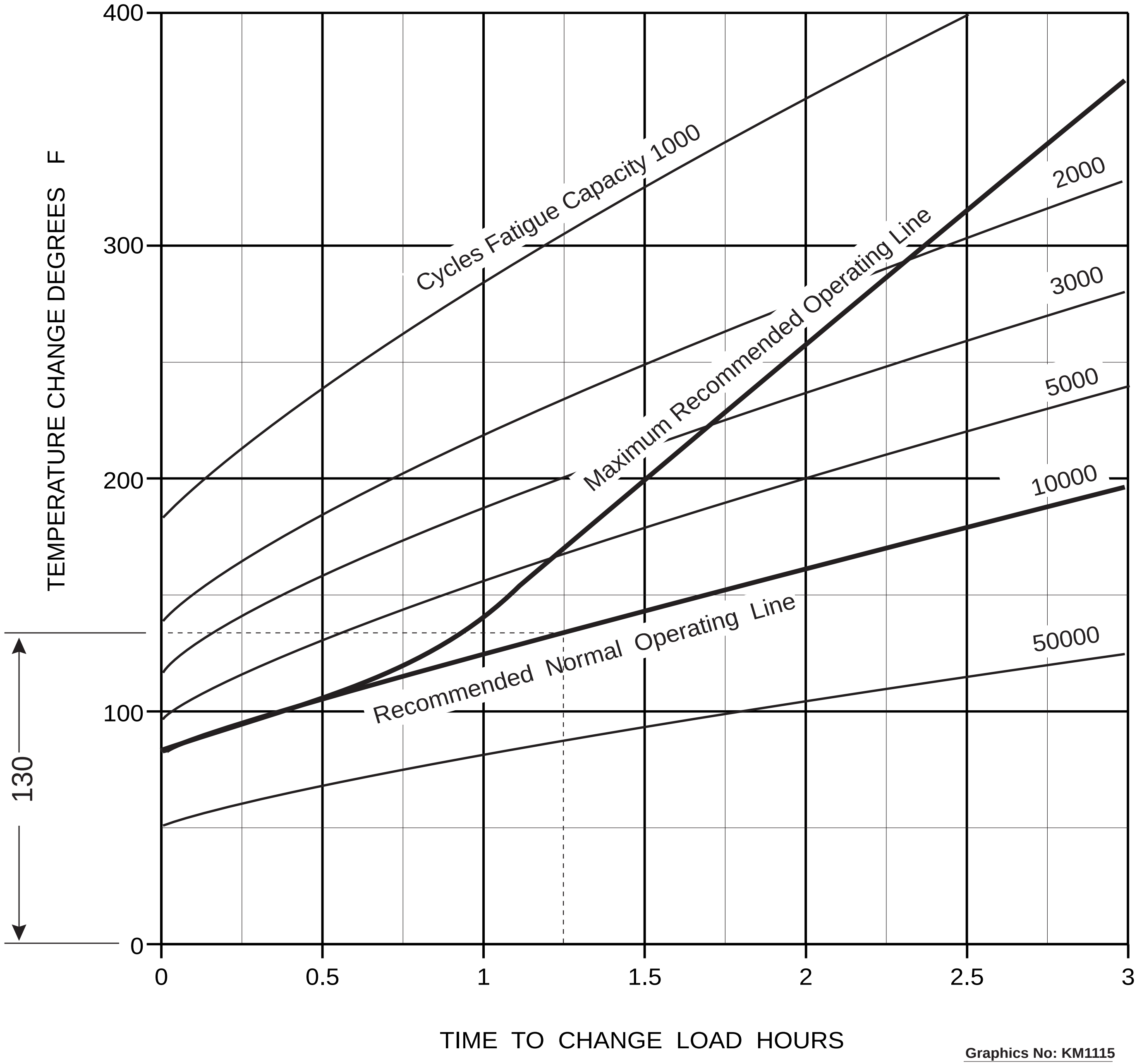


FIRST - STAGE TEMPERATURE
CHANGE ABOVE ZERO LOAD

FIGURE 1

Attachment 50

LOAD CHANGE CHARTS



LOAD CHANGE

FIGURE 2

(Page 3 of 3)

Attachment 50

LOAD CHANGE CHARTS

USE OF CHARTS

All load changes are assumed to take place from initially steady-state rotor temperatures at the first stage zone, and to be accomplished at a uniform rate.

(a) Load-Change Charts, Figures 1 and 2:

EXAMPLE: Find the recommended time to change load from 25% to 100% of rated load.

PROCEDURE

From Figure 1, find the change in first-stage temperature between 25% and 100% load. Enter Figure 2 with this valuerature change and read the recommended time of 1.25 hours determined by the intersection with the 10,000 cycle guide line.

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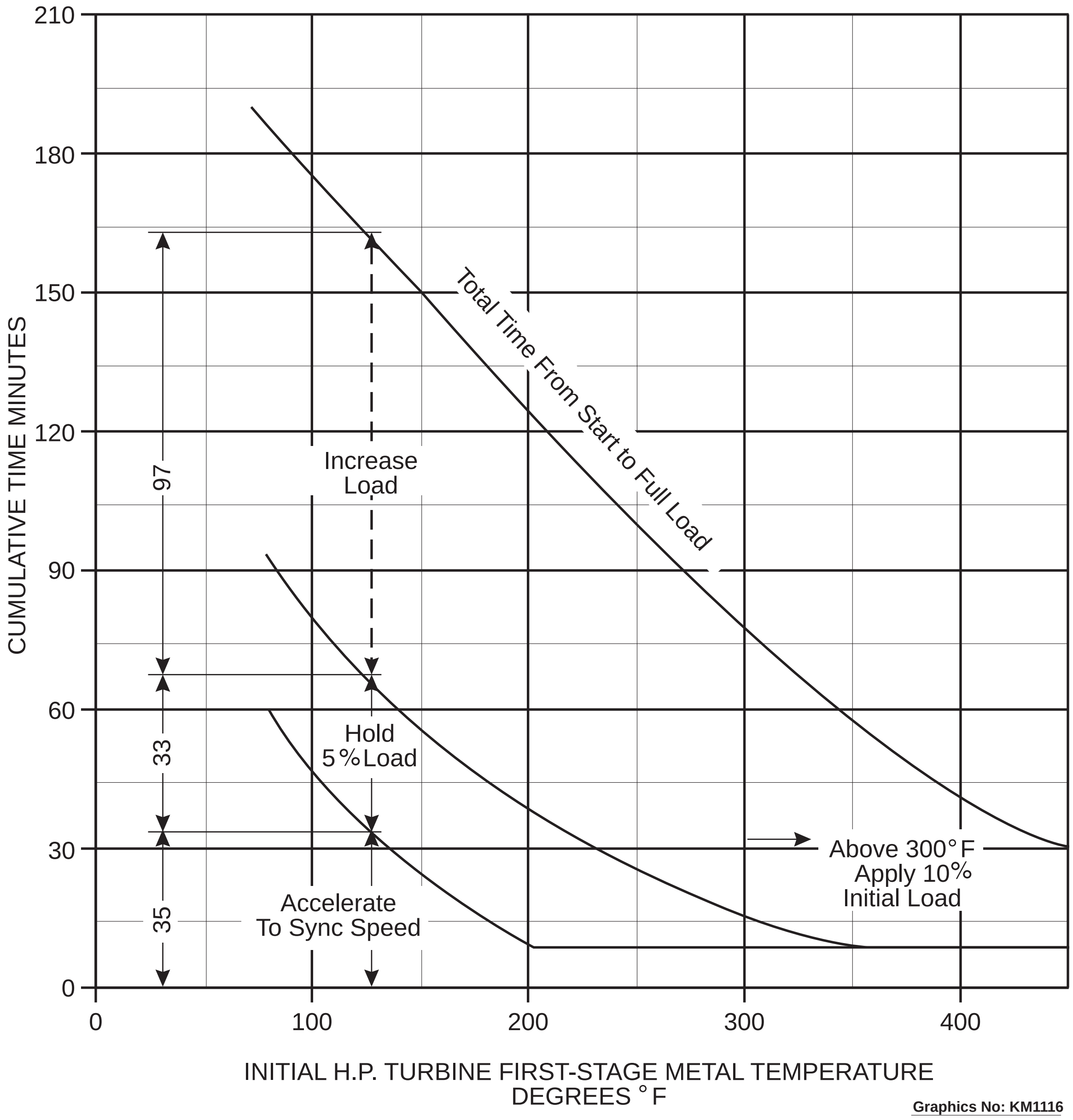
Attachment 51

STARTUP AND LOADING TIMES



RECOMMENDED START-UP AND LOADING TIMES
NUCLEAR STEAM SYSTEM UNITS

FIGURE 3

Attachment 51

STARTUP AND LOADING TIMES

Figure 3 is designed to limit the maximum rotor stress during the entire program of acceleration, synchronizing, holding at minimum load, followed by increasing load to full capability. The recommended time per each phase of the program are determined by the measured first-stage temperature at the time of starting. The curves on the chart give the cumulative times for the sequence of events. The dotted lines illustrate the following example:

If the measured first stage metal temperature is 125 °F at starting:

1) Accelerate uniformly to synchronous speed in 35 minutes, as determined from the bottom curve.

2) Synchronize, apply 5% load and hold for 33 minutes, as determined from the difference between the bottom and middle curves. The total elapsed time from starting is 68 minutes, given by the middle curve.

3) Apply load at a uniform rate, reaching full load in 97 minutes, as determined by the difference between the middle and top curves. The total elapsed time of 2 hours 45 minutes is given by the top curve.

4) After reaching full load, perform subsequent load changes in accordance with Figures 1 and 2.

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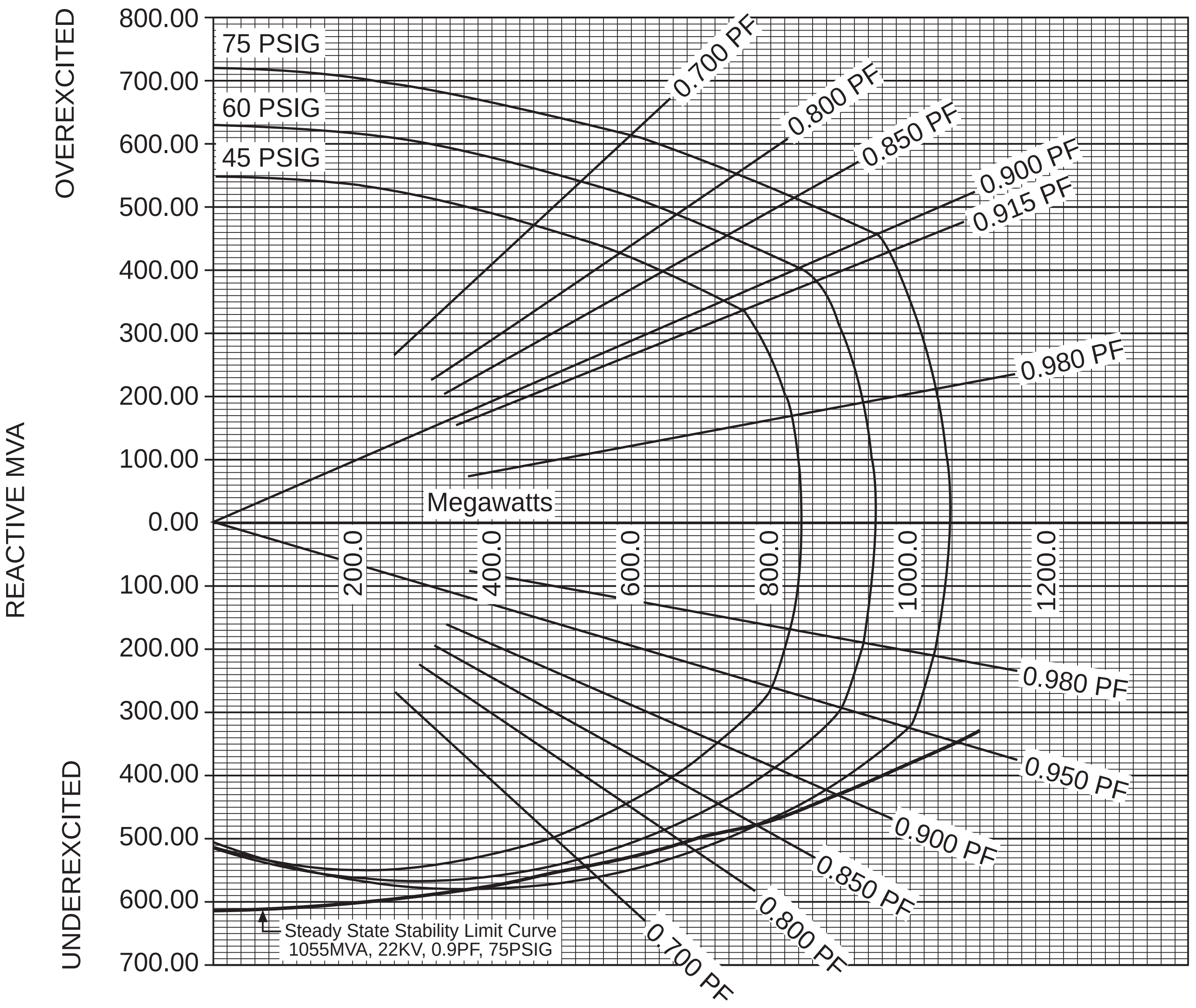
Attachment 52

CAPABILITY CURVES



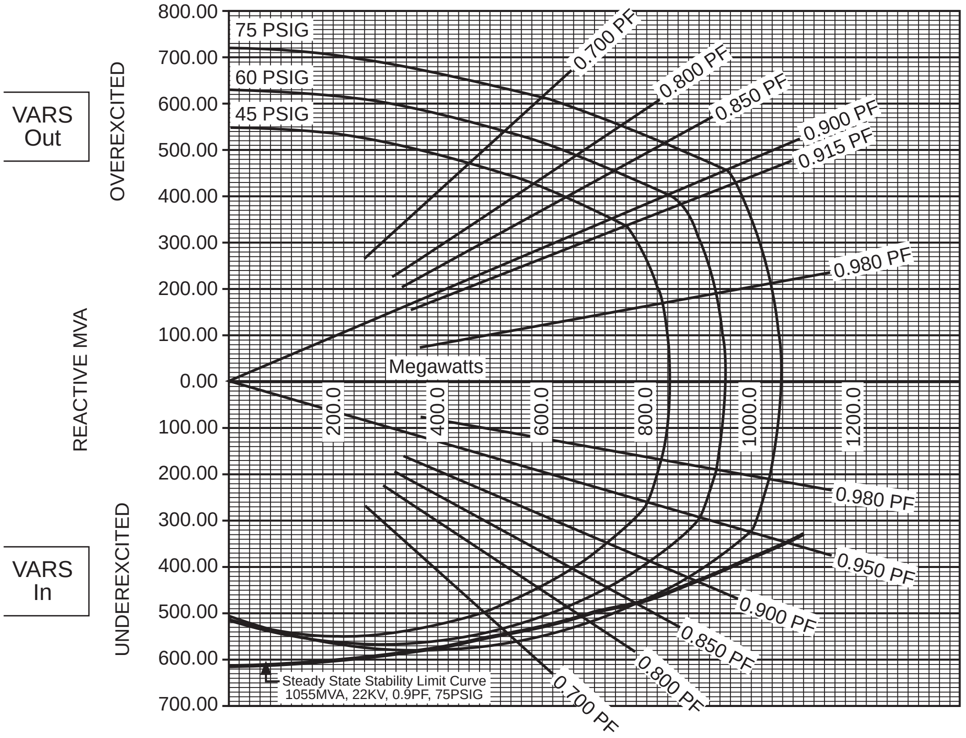
1055.0 MVA 0.900 PF 22.0 kV 27686 AMPERES
3 PHASE 60 HERTZ 1800 RPM 0.54 SCR
COLD GAS 46°C

Graphics No. CS4665

(Page 2 of 2)

Attachment 52

CAPABILITY CURVES



In the Overexcited Region, the limiting factor is the Field Windings on the Generator Rotor due to the required high current flow and subsequent I^{2}R heating.

The (3) D-Shaped Curves represent Hydrogen Pressure. Since the Generator cooling medium is Hydrogen, the higher the pressure the more load you can carry.

In the Underexcited Region, the limiting factor is the heating of the laminated iron at the ends of the stator core.

Graphics No. CS3324A

The Generator Manufacturer, Westinghouse, provides the Main Generator Capability Curve. A few things to consider when using the Curves are as follows:

- At unity Power Factor, ‘O’ MVAR, you would directly read the Horizontal Axis for the MW value and plot the Operating point.
- When you Boost or Buck the Grid, the Generator is carrying Inductive Load and this is indicated on the MVAR Meter as VARS ‘OUT’ or VARS ‘IN’.
- When the Generator Terminal Voltage is increased above the Grid Voltage, we are Boosting the Grid Voltage, we are Overexcited, producing VARS, have a lagging Power Factor, and indicate VARS ‘OUT’. To plot the Operating Point, you would again plot the MW value on the horizontal axis and also the MVAR value on the vertical axis. Since we were VARS ‘OUT’, Overexcited, we plot above the origin. This now defines the Operating Point.
- When the Generator Terminal Voltage is decreased below the Grid Voltage, we are Bucking the Grid Voltage, we are Underexcited, absorbing VARS, have a leading Power Factor, and indicate VARS ‘IN’. To plot the Operating Point, you would again plot the MW value on the horizontal axis and also the MVAR value on the vertical axis. Since we were VARS ‘IN’, Underexcited, we plot below the origin. This now defines the Operating Point.

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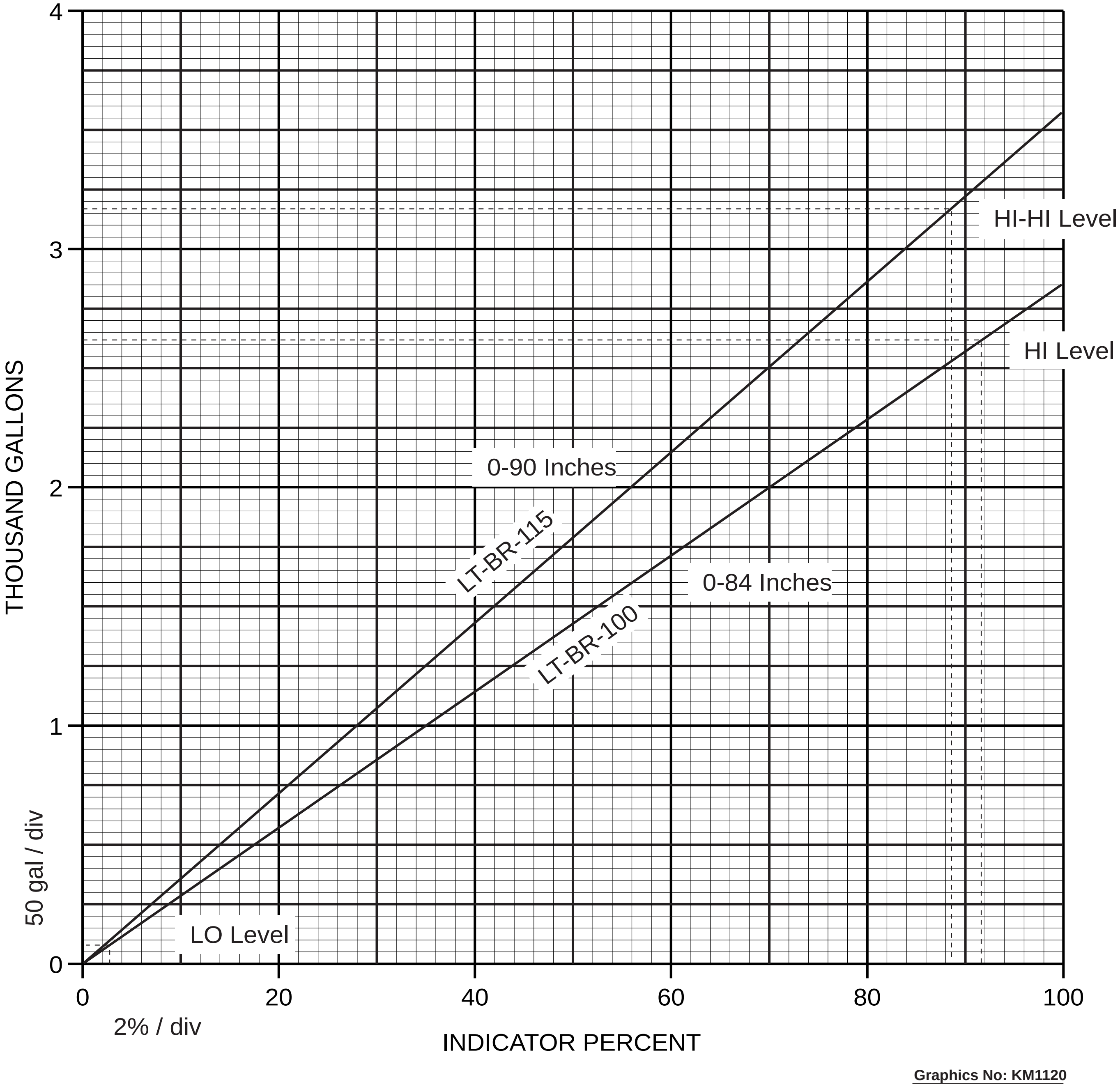
Attachment 53

PRIMARY DRAINS TANK

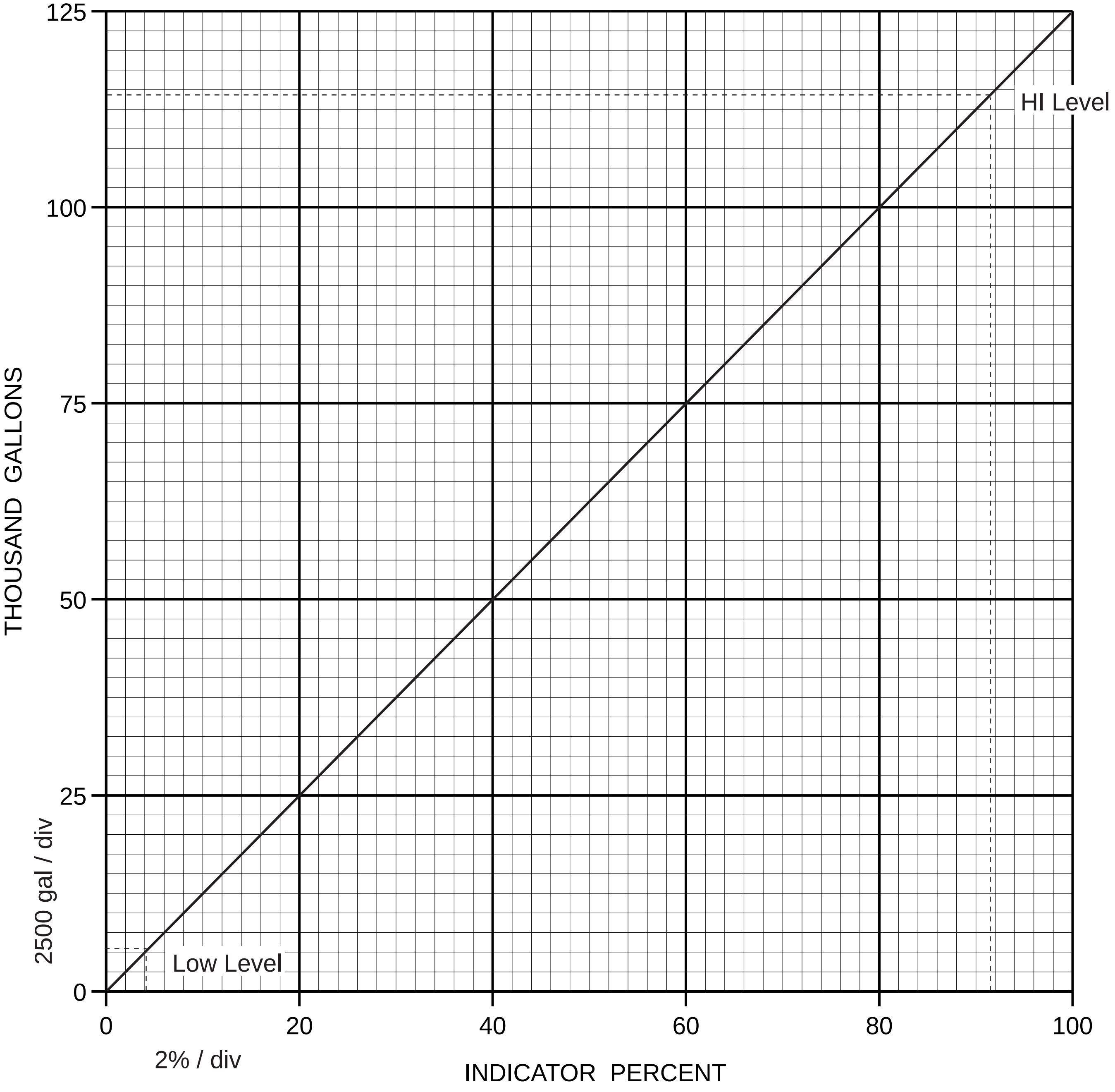


PRIMARY DRAINS TANK

(Page 1 of 1)

Attachment 54

BORON RECOVERY TANK



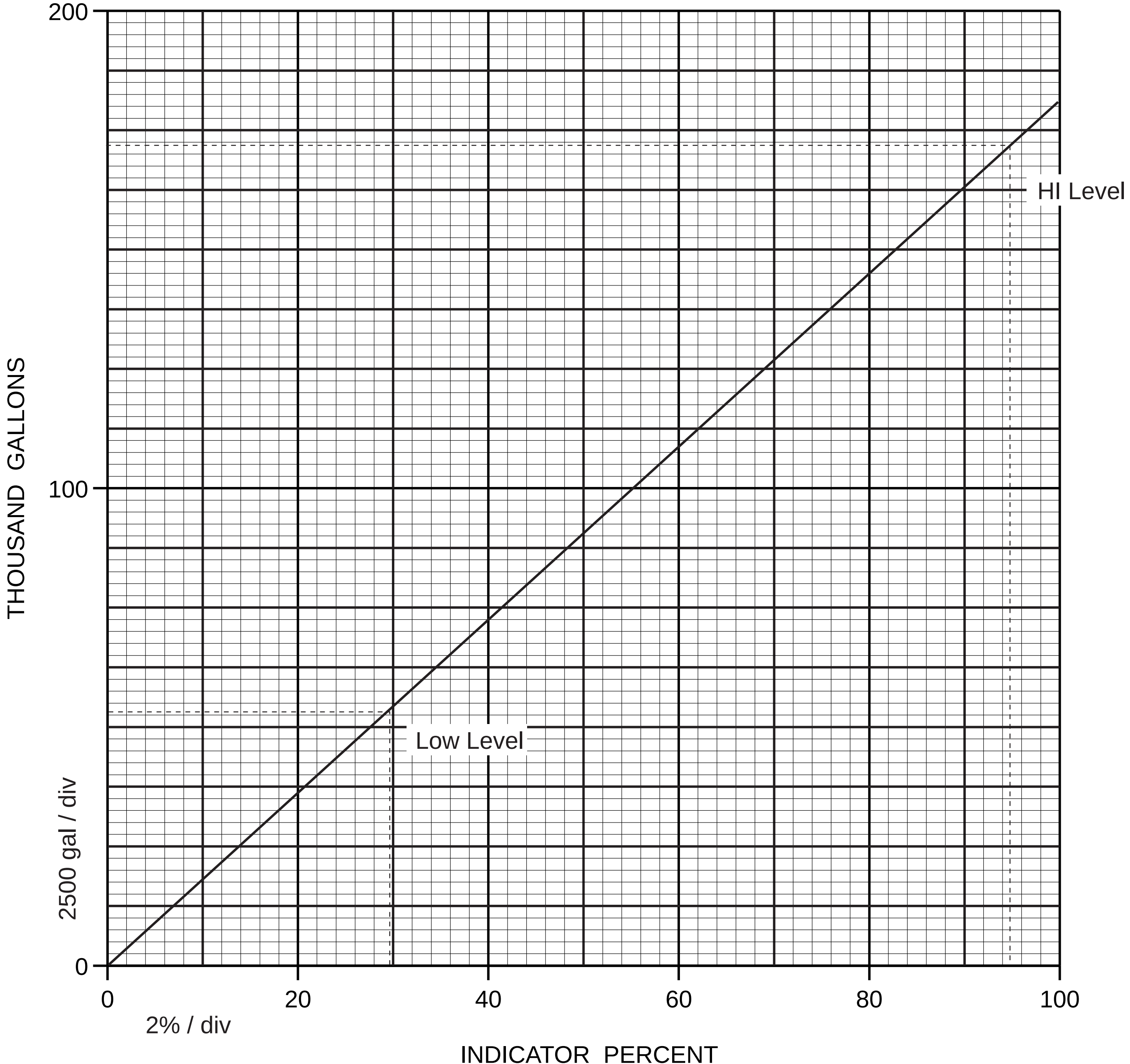
Graphics No: KM1121

BORON RECOVERY TANK

(Page 1 of 1)

Attachment 55

PRIMARY GRADE WATER TANK

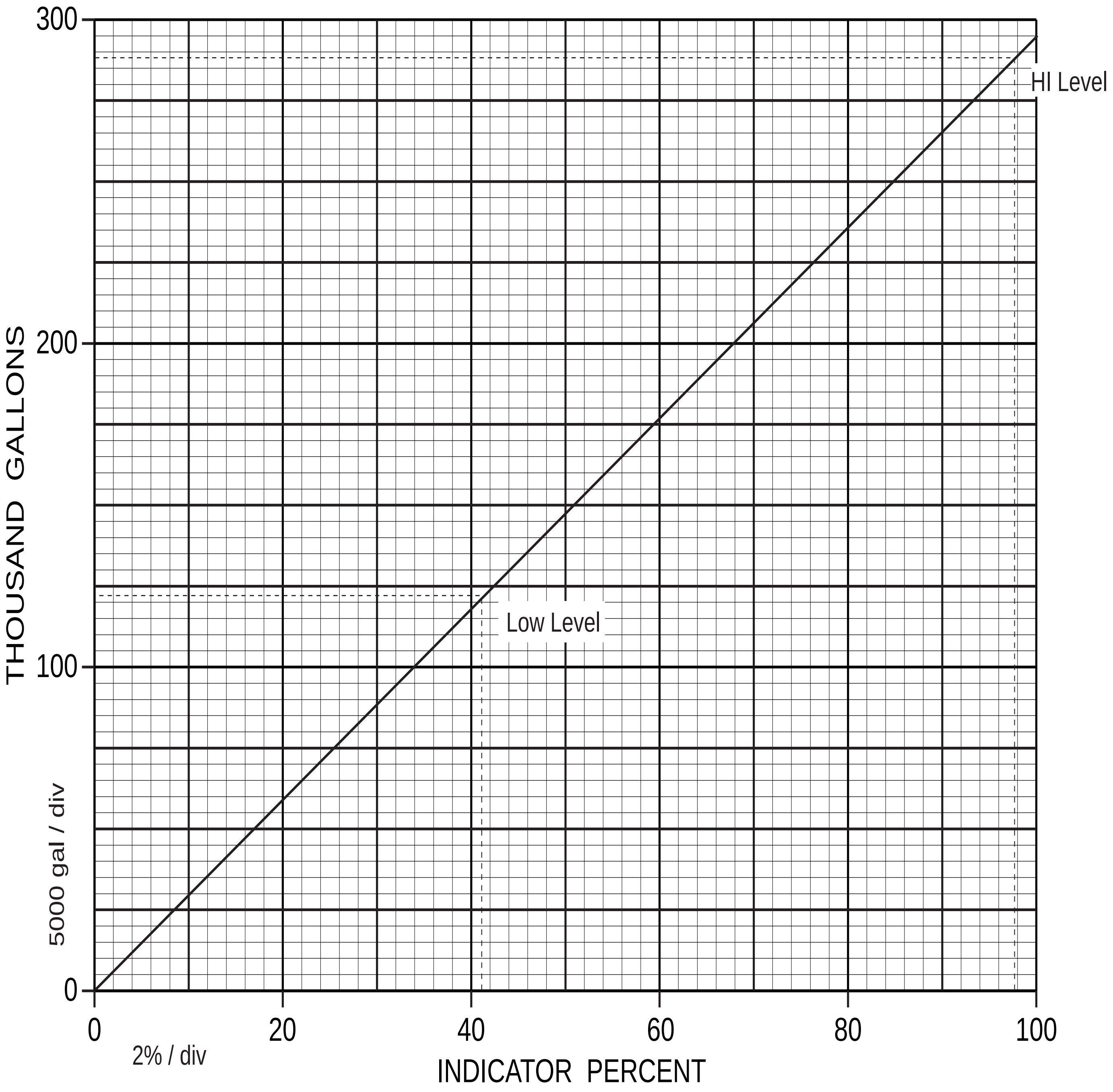


PRIMARY GRADE WATER TANK

(Page 1 of 1)

Attachment 56

300,000 GALLON CONDENSATE STORAGE TANK

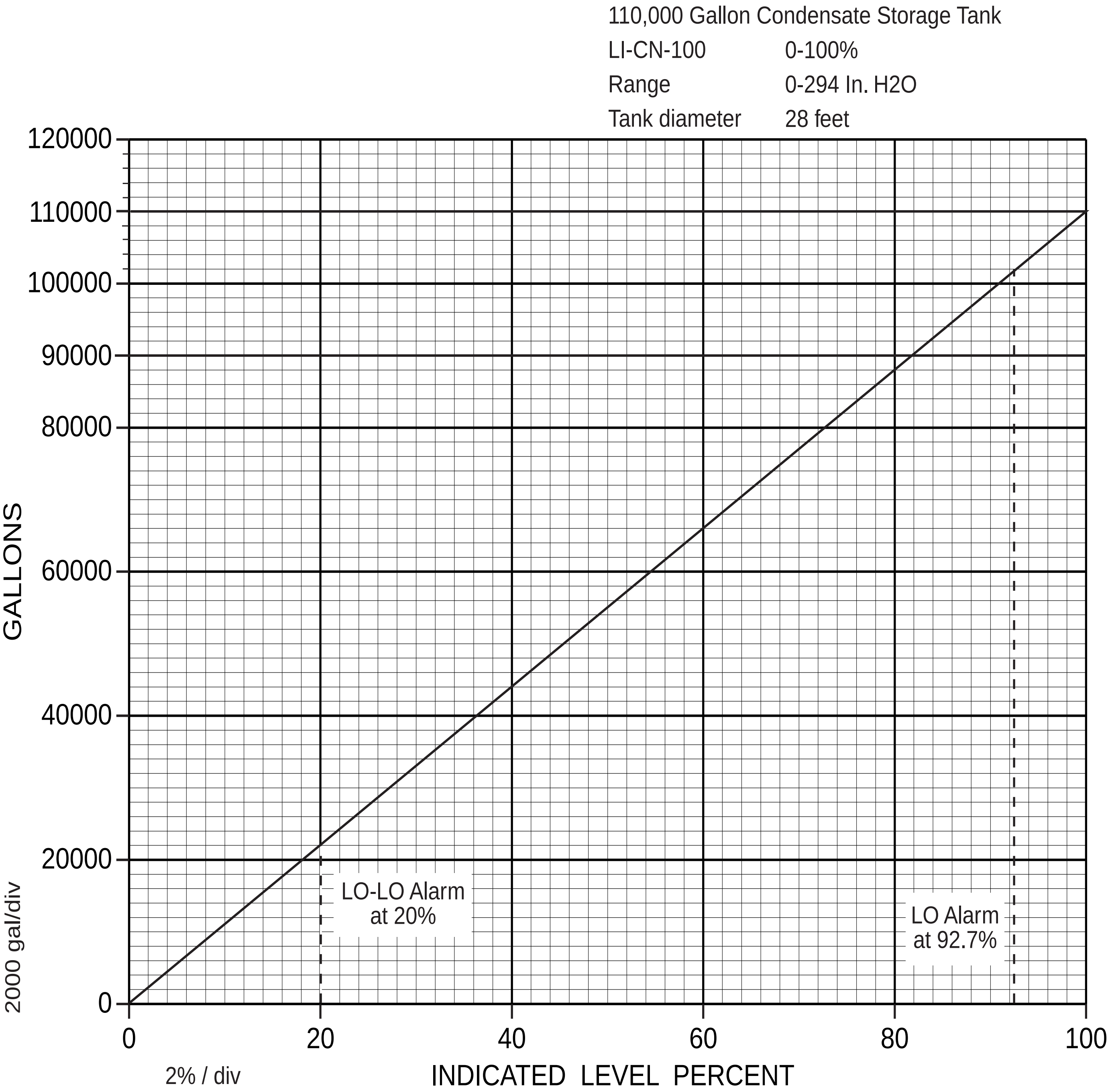


Graphics No: KM1126

(Page 1 of 1)

Attachment 57

110,000 GALLON CONDENSATE STORAGE TANK



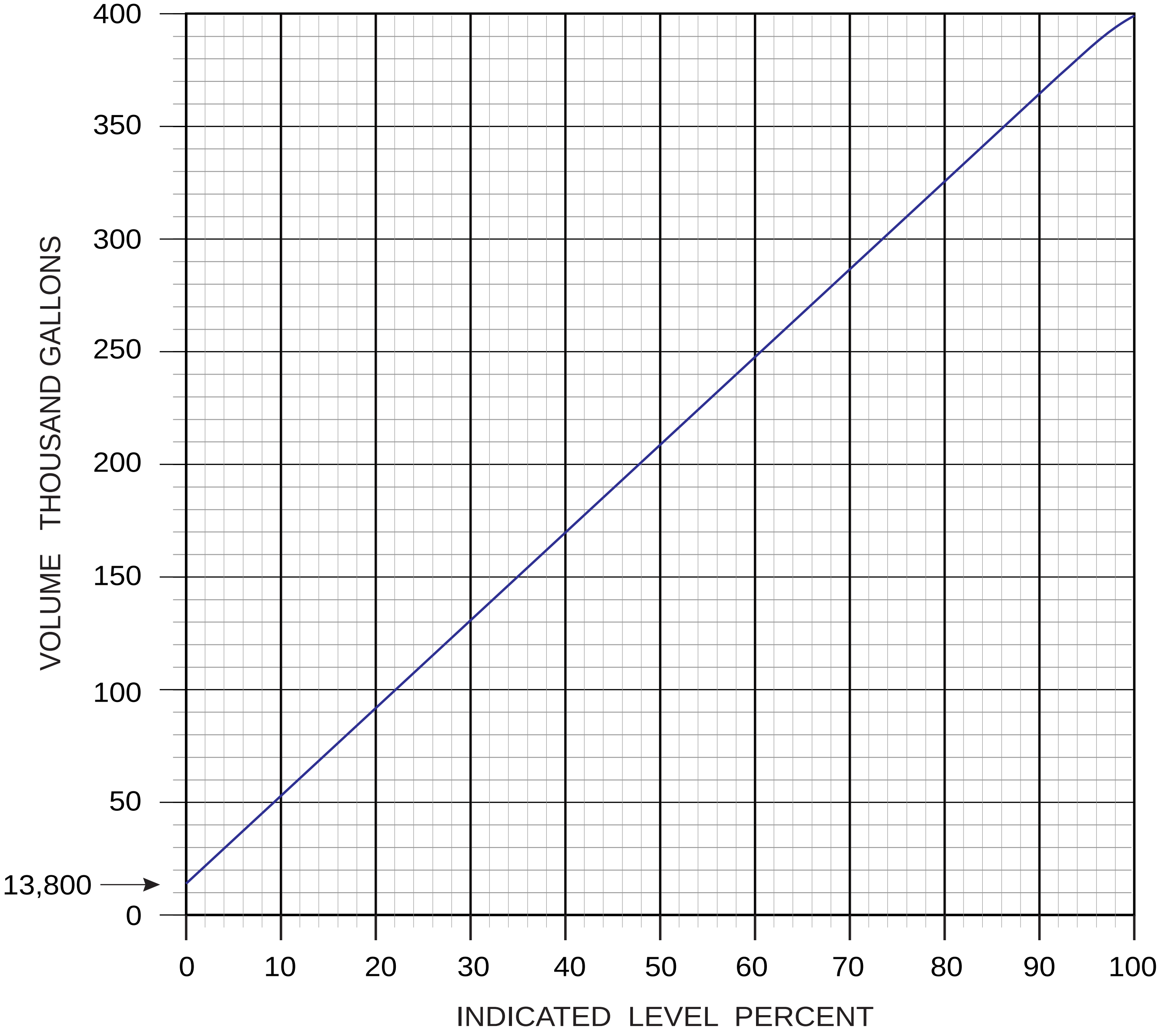
Graphics No: KM1127

(Page 1 of 3)

Attachment 58
RWST

UNIT 1 VOLUME VS WIDE RANGE LEVEL

NOTE: Linear Region 3895 Gal/% to 92.1%
Volume at 0% = 13,800 gallons



Graphics No: KM1781

UNIT 1 VOLUME VS WIDE RANGE LEVEL

(Page 2 of 3)

Attachment 58

RWST

UNIT 1 VOLUME VS NARROW RANGE LEVEL

	NARROW RANGE LEVEL %	TOTAL VOLUME (GALLONS)	NARROW RANGE LEVEL%	TOTAL VOLUME (GALLONS)
	90.0	364366	92.6	374493
	90.1	364756	92.7	374882
	90.2	365145	92.8	375271
	90.3	365535	92.9	375659
	90.4	365924	93.0	376047
	90.5	366314	93.1	376435
	90.6	366703	93.2	376822
	90.7	367093	93.3	377209
	90.8	367482	93.4	377595
	90.9	367872	93.5	377981
	91.0	368262	93.6	378366
	91.1	368651	93.7	378750
	91.2	369041	93.8	379134
	91.3	369430	93.9	379516
	91.4	369820	94.0	379898
	91.5	370209	94.1	380280
	91.6	370599	94.2	380660
	91.7	370988	94.3	381039
	91.8	371378	94.4	381418
	91.9	371767	94.5	381795
	92.0	372157	94.6	382171
END OF LINEAR REGION	92.1	372546	94.7	382546
	92.2	372936	94.8	382920
	92.3	373325	94.9	383293
	92.4	373715	95.0	383665
	92.5	374104		

(Page 3 of 3)

Attachment 58

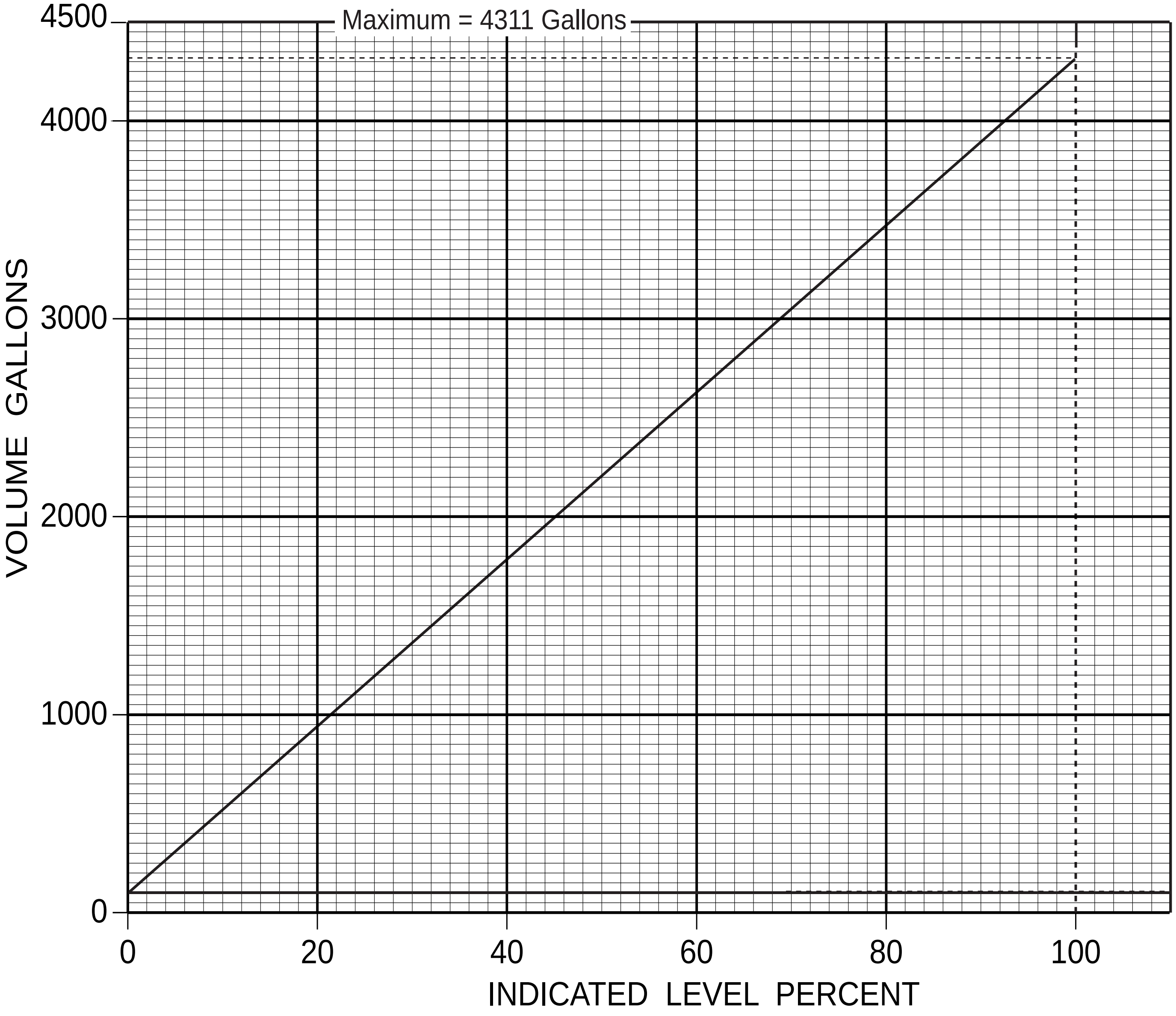
RWST

UNIT 1 VOLUME VS NARROW RANGE LEVEL

NARROW RANGE LEVEL%	TOTAL VOLUME (GALLONS)
95.1	384035
95.2	384404
95.3	384771
95.4	385137
95.5	385501
95.6	385864
95.7	386225
95.8	386585
95.9	386943
96.0	387299
96.1	387653
96.2	388005
96.3	388356
96.4	388704
96.5	389050
96.6	389394
96.7	389734
96.8	390071
96.9	390404
97.0	390734
97.1	391061
97.2	391384
97.3	391704
97.4	392021
97.5	392334
97.6	392644
97.7	392950
97.8	393253
97.9	393553
98.0	393849
98.1	394142
98.2	394432
98.3	394718
98.4	395001
98.5	395280
98.6	395556
98.7	395828
98.8	396097
98.9	396363
99.0	396625
99.1	396884
99.2	397139
99.3	397391
99.4	397639
99.5	397884
99.6	398126
99.7	398364
99.8	398599
99.9	398830
100.0	399057

(Page 1 of 2)

Attachment 59
CHEMICAL ADDITION TANK



REFUELING WATER CHEMICAL ADDITION TANK - UNIT 1

NOTE: 100% indicates a fluid level of 430 inches above the level transmitter tap for 18% NaOH solution at 68°F.

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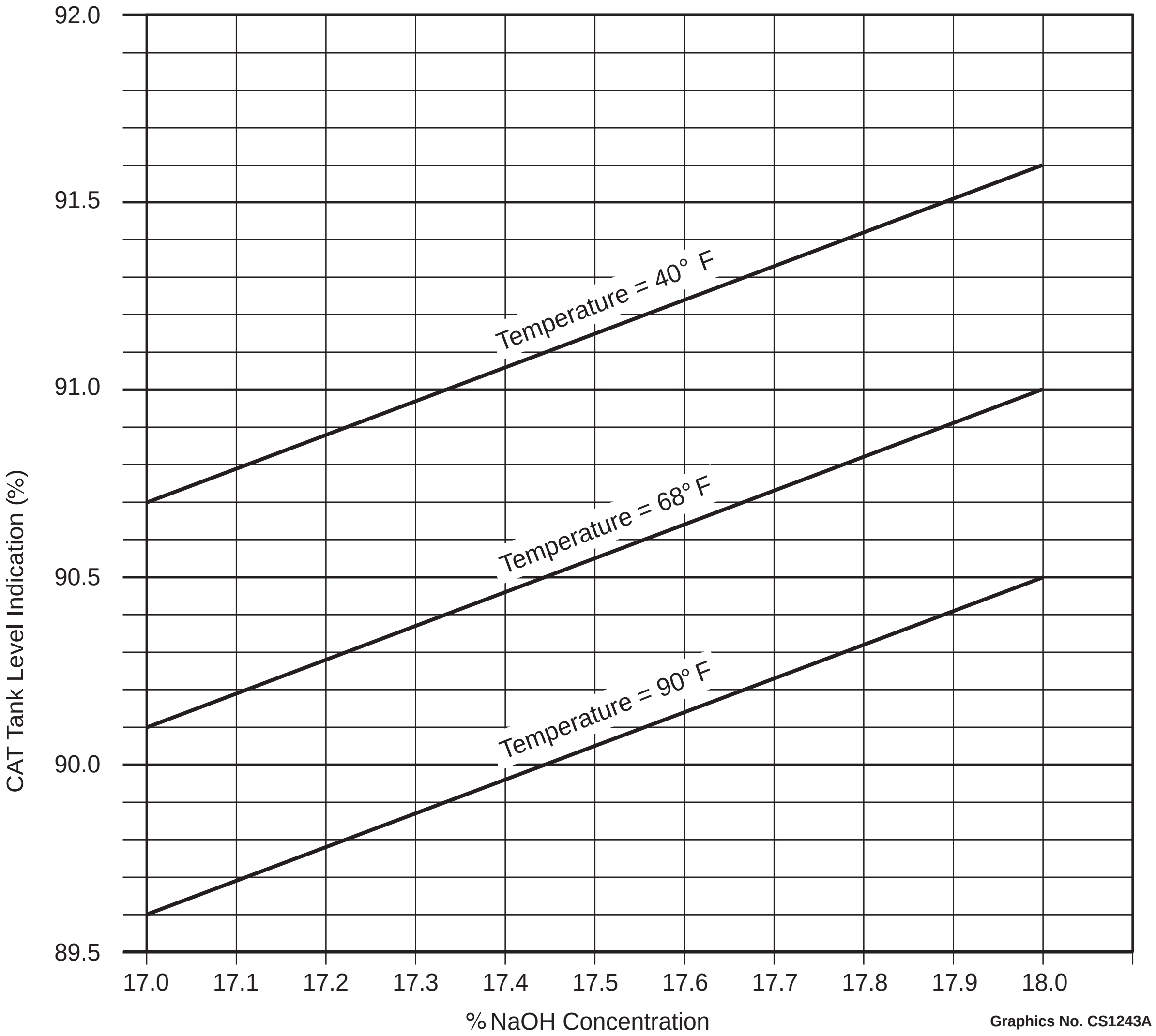
Attachment 59

CHEMICAL ADDITION TANK



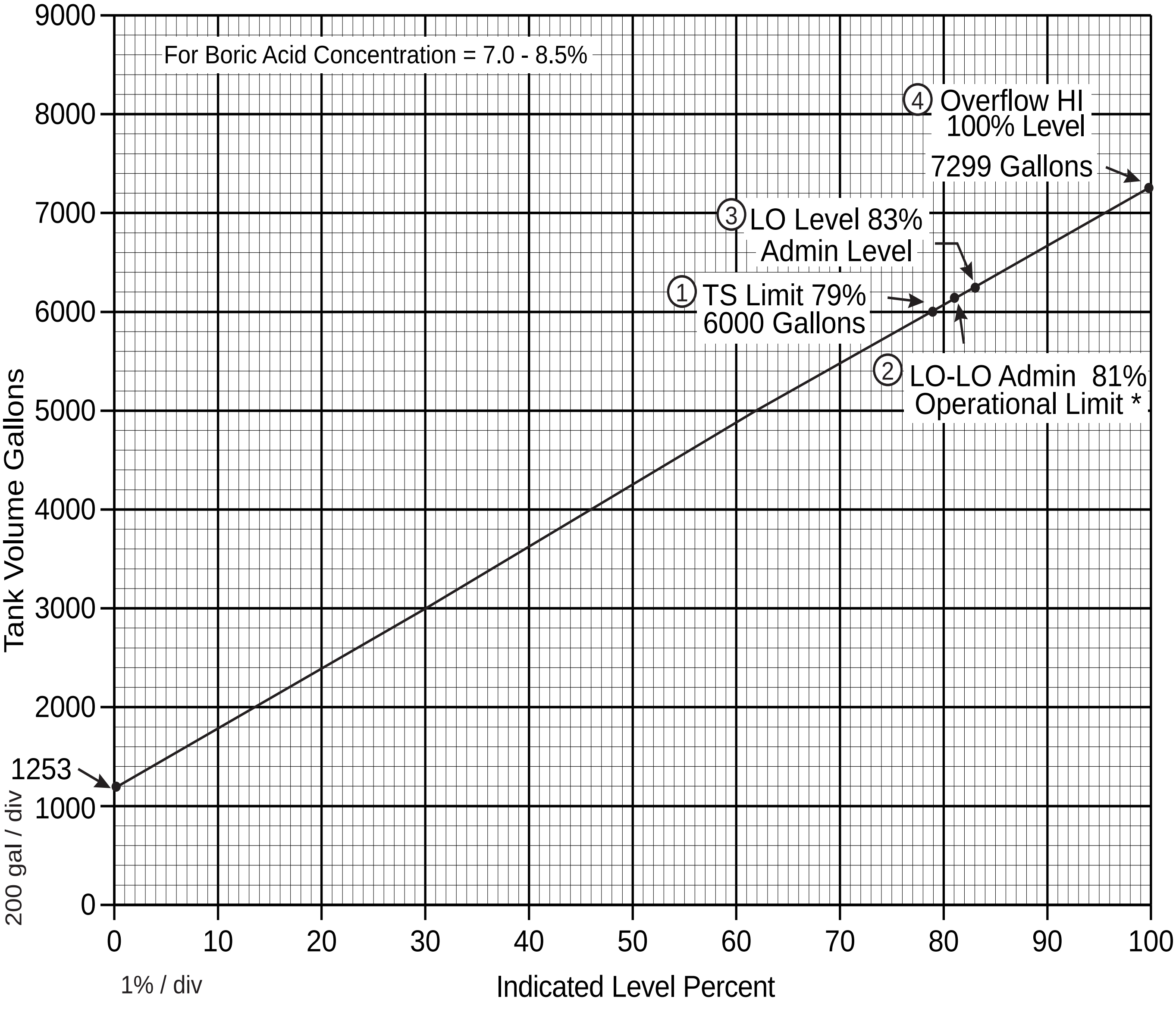
Graphics No. CS1243A

MINIMUM T.S. LEVEL (3930 GALLONS) VS NaOH CONCENTRATION AT VARIOUS SOLUTION TEMPERATURES

(Page 1 of 1)

Attachment 60

BORIC ACID STORAGE TANKS



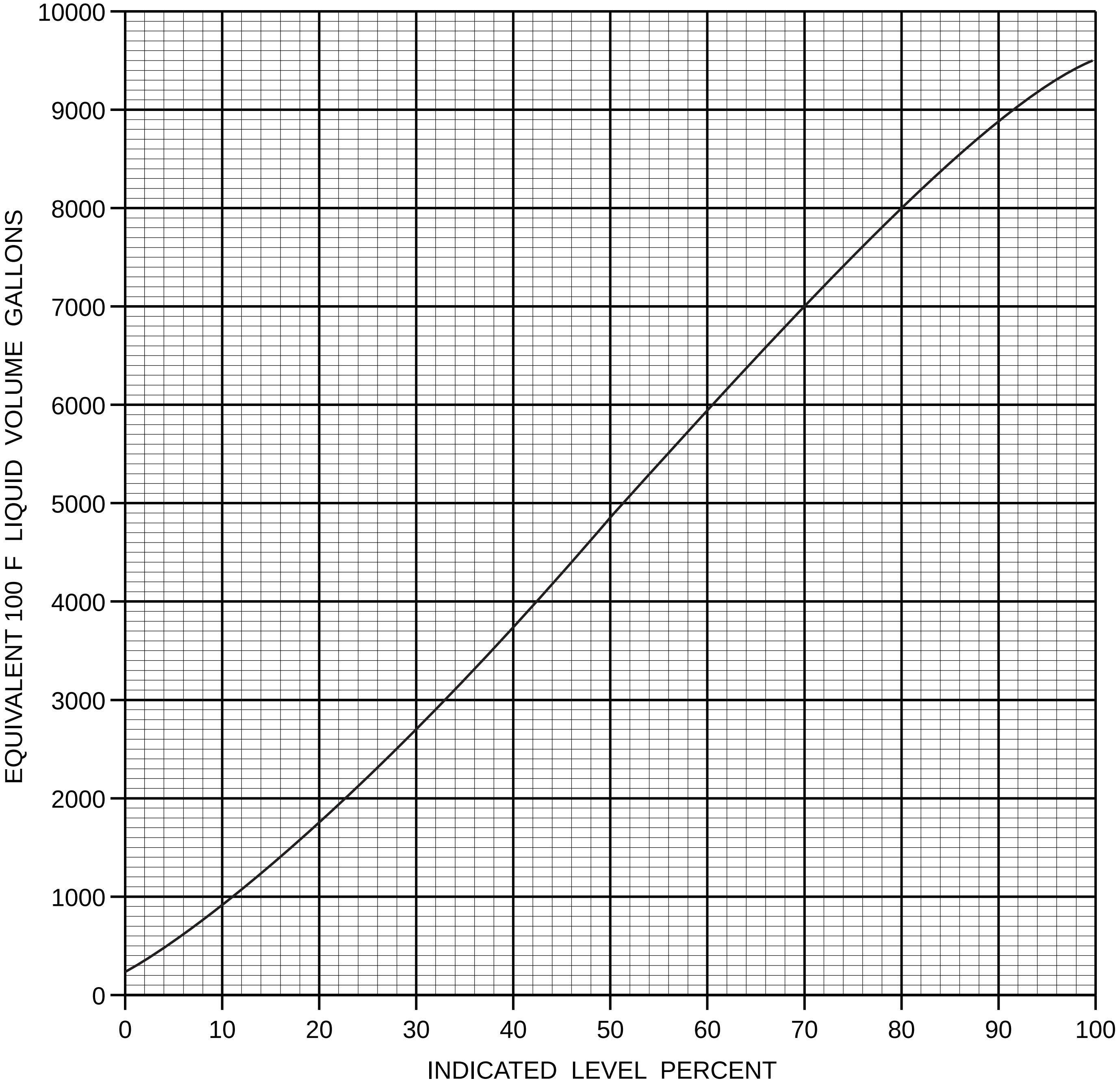
① TS Limit (6000 gallons)	79%
② LO-LO Admin Operational Limit	81%
③ LO Level Admin Limit	83%
④ Overflow High Level	100%

* 81% ~ TS Limit with Gauge
Inaccuracy Minimum Operational Limit

(Page 1 of 1)

Attachment 61

PRESSURIZER RELIEF TANK



Graphics No: KM1135

PRESSURIZER RELIEF TANK

Attachment 62

PRESSURIZER RELIEF TANK MASS VERSUS INDICATED LEVEL

Indicated Level (Percent)	PRT Water Mass (lbm)
59.0	48801.12
59.1	48893.33
59.2	48985.51
59.3	49077.65
59.4	49169.76
59.5	49261.83
59.6	49353.87
59.7	49445.88
59.8	49537.86
59.9	49629.79
60.0	49721.70
60.1	49813.56
60.2	49905.40
60.3	49997.19
60.4	50088.95
60.5	50180.67
60.6	50272.36
60.7	50364.00
60.8	50455.61
60.9	50547.18
61.0	50638.71

Indicated Level (Percent)	PRT Water Mass (lbm)
61.1	50730.20
61.2	50821.65
61.3	50913.07
61.4	51004.44
61.5	51095.77
61.6	51187.06
61.7	51278.31
61.8	51369.51
61.9	51460.68
62.0	51551.80
62.1	51642.88
62.2	51733.91
62.3	51824.91
62.4	51915.85
62.5	52006.76
62.6	52097.62
62.7	52188.43
62.8	52279.20
62.9	52369.92
63.0	52460.60
63.1	52551.23

Attachment 62

PRESSURIZER RELIEF TANK MASS VERSUS INDICATED LEVEL

Indicated Level (Percent)	PRT Water Mass (lbm)
63.2	52641.81
63.3	52732.34
63.4	52822.83
63.5	52913.27
63.6	53003.66
63.7	53094.00
63.8	53184.30
63.9	53274.54
64.0	53364.73
64.1	53454.88
64.2	53544.97
64.3	53635.01
64.4	53725.00
64.5	53814.94
64.6	53904.82
64.7	53994.66
64.8	54084.44
64.9	54174.16
65.0	54263.84
65.1	54353.45
65.2	54443.02

Indicated Level (Percent)	PRT Water Mass (lbm)
65.3	54532.53
65.4	54621.98
65.5	54711.38
65.6	54800.72
65.7	54890.01
65.8	54979.24
65.9	55068.41
66.0	55157.53
66.1	55246.58
66.2	55335.58
66.3	55424.52
66.4	55513.40
66.5	55602.22
66.6	55690.99
66.7	55779.69
66.8	55868.33
66.9	55956.91
67.0	56045.43
67.1	56133.88
67.2	56222.28
67.3	56310.61

Attachment 62

PRESSURIZER RELIEF TANK MASS VERSUS INDICATED LEVEL

Indicated Level (Percent)	PRT Water Mass (lbm)	Indicated Level (Percent)	PRT Water Mass (lbm)
67.4	56398.88	69.5	58237.31
67.5	56487.09	69.6	58324.09
67.6	56575.23	69.7	58410.81
67.7	56663.31	69.8	58497.45
67.8	56751.32	69.9	58584.02
67.9	56839.27	70.0	58670.51
68.0	56927.15	70.1	58756.94
68.1	57014.97	70.2	58843.28
68.2	57102.72	70.3	58929.56
68.3	57190.41	70.4	59015.76
68.4	57278.03	70.5	59101.88
68.5	57368.58	70.6	59187.93
68.6	57453.06	70.7	59273.90
68.7	57540.48	70.8	59359.80
68.8	57627.82	70.9	59445.62
68.9	57715.10	71.0	59531.36
69.0	57802.31	71.1	59617.02
69.1	57889.45	71.2	59702.61
69.2	57976.52	71.3	59788.11
69.3	58063.52	71.4	59873.54
69.4	58150.45	71.5	59958.89

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Attachment 62

PRESSURIZER RELIEF TANK MASS VERSUS INDICATED LEVEL

Indicated Level (Percent)	PRT Water Mass (lbm)
71.6	60044.16
71.7	60129.35
71.8	60214.46
71.9	60299.49
72.0	60384.44
72.1	60469.30
72.2	60554.09
72.3	60638.79
72.4	60723.40
72.5	60807.94
72.6	60892.39
72.7	60976.76
72.8	61061.04
72.9	61145.23
73.0	61229.34
73.1	61313.37
73.2	61397.31
73.3	61481.16
73.4	61564.92
73.5	61648.60
73.6	+1732.19

Indicated Level (Percent)	PRT Water Mass (lbm)
73.7	61815.69
73.8	61899.10
73.9	61982.42
74.0	62065.66
74.1	62148.80
74.2	62231.85
74.3	62314.81
74.4	62397.68
74.5	62480.46
74.6	62563.14
74.7	62645.74
74.8	62728.23
74.9	62810.64
75.0	62892.95
75.1	62975.17
75.2	63057.29
75.3	63139.32
75.4	63221.25
75.5	63303.08
75.6	63384.82
75.7	63466.46

Attachment 62

PRESSURIZER RELIEF TANK MASS VERSUS INDICATED LEVEL

Indicated Level (Percent)	PRT Water Mass (lbm)
75.8	63548.00
75.9	63629.44
76.0	63710.79
76.1	63792.04
76.2	63873.19
76.3	63954.23
76.4	64035.18
76.5	64116.03
76.6	64196.77
76.7	64277.42
76.8	64357.96
76.9	64438.40
77.0	64518.73
77.1	64598.97
77.2	64679.09
77.3	64759.12
77.4	64839.04
77.5	64918.85
77.6	64998.56
77.7	65078.16
77.8	65157.66
77.9	65237.05
78.0	65316.33
78.1	65395.50
78.2	65474.56
78.3	65553.52
78.4	65632.36
78.5	65711.10
78.6	65789.72
78.7	65868.23
78.8	65946.64
78.9	66024.93
79.0	66103.10
79.1	66181.17
79.2	66259.12
79.3	66336.96
79.4	66414.68
79.5	66492.29
79.6	66569.78
79.7	66647.16
79.8	66724.42
79.9	66801.56

(Page 6 of 6)

Attachment 62

PRESSURIZER RELIEF TANK MASS VERSUS INDICATED LEVEL

Indicated Level (Percent)	PRT Water Mass (lbm)
80.0	66878.59
80.1	66955.50
80.2	67032.29
80.3	67108.96
80.4	67185.51
80.5	67261.95
80.6	67338.26
80.7	67414.45
80.8	67490.52
80.9	67566.47
81.0	67642.30
81.1	67718.00
81.2	67793.58
81.3	67869.04
81.4	67944.37
81.5	68019.58
81.6	68094.66
81.7	68169.61
81.8	68244.44
81.9	68319.15
82.0	68393.72

Indicated Level (Percent)	PRT Water Mass (lbm)
82.1	68468.17
82.2	68542.49
82.3	68616.68
82.4	68690.73
82.5	68764.66
82.6	68838.46
82.7	68912.13
82.8	68985.67
82.9	69059.07
83.0	69132.34

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Attachment 63

PRESSURIZER RELIEF TANK VOLUME VERSUS INDICATED LEVEL

LEVEL TRAN REF LEG CAL TEMP 70.0 DEGREES F
DENSITY 62.305 LBM/FT^3

ACTUAL TANK WATER TEMP 85.0 DEGREES F
DENSITY 62.172 LBM/FT^3

INDICATED LEVEL (PERCENT)	EQUIVALENT 110 °F VOLUME (GALLONS)
0.0	223.19
0.5	247.91
1.0	273.50
1.5	299.93
2.0	327.17
2.5	355.20
3.0	383.98
3.5	413.51
4.0	443.76
4.5	474.71
5.0	506.34
5.5	538.64
6.0	571.58
6.5	605.16
7.0	639.36
7.5	674.17
8.0	709.56
8.5	745.53
9.0	782.06
9.5	819.15

Attachment 63

PRESSURIZER RELIEF TANK VOLUME VERSUS INDICATED LEVEL

LEVEL TRAN REF LEG CAL TEMP 70.0 DEGREES F
DENSITY 62.305 LBM/FT^3

ACTUAL TANK WATER TEMP 85.0 DEGREES F
DENSITY 62.172 LBM/FT^3

INDICATED LEVEL (PERCENT)	EQUIVALENT 110 °F VOLUME (GALLONS)
10.0	856.78
10.5	894.93
11.0	933.60
11.5	972.78
12.0	1012.45
12.5	1052.61
13.0	1093.25
13.5	1134.35
14.0	1175.91
14.5	1217.91
15.0	1260.35
15.5	1303.22
16.0	1346.52
16.5	1390.22
17.0	1434.32
17.5	1478.82
18.0	1523.71
18.5	1568.98
19.0	1614.62
19.5	1660.62
20.0	1706.97
20.5	1753.68

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Attachment 63

PRESSURIZER RELIEF TANK VOLUME VERSUS INDICATED LEVEL

LEVEL TRAN REF LEG CAL TEMP 70.0 DEGREES F
DENSITY 62.305 LBM/FT^3

ACTUAL TANK WATER TEMP 85.0 DEGREES F
DENSITY 62.172 LBM/FT^3

INDICATED LEVEL (PERCENT)	EQUIVALENT 110 °F VOLUME (GALLONS)
21.0	1800.0
21.5	1848.11
22.0	1895.81
22.5	1943.84
23.0	1992.18
23.5	2040.83
24.0	2089.77
24.5	2139. 01
25.0	2188.53
25.5	2238.33
26.0	2288.41
26.5	2338.75
27.0	2389.35
27.5	2440.20
28.0	2491.30
28.5	2542.65
29.0	2594.22
29.5	2646.03
30.0	2698.06
30.5	2750.30
31.0	2802.76
31.5	2855.42

Attachment 63

PRESSURIZER RELIEF TANK VOLUME VERSUS INDICATED LEVEL

LEVEL TRAN REF LEG CAL TEMP 70.0 DEGREES F
DENSITY 62.305 LBM/FT^3

ACTUAL TANK WATER TEMP 85.0 DEGREES F
DENSITY 62.172 LBM/FT^3

INDICATED LEVEL (PERCENT)	EQUIVALENT 110 °F VOLUME (GALLONS)
32.0	2908.28
32.5	2961.34
33.0	3014.58
33.5	3068.00
34.0	3121.60
34.5	3175.37
35.0	3229.31
35.5	3283.40
36.0	3337.65
36.5	3392.05
370	3446.58
37.5	3501.26
38.0	3556.06
38.5	3611.00
39.0	3666.05
39.5	3721.22
40.0	3776.49
40.5	3831.87
41.0	3887.35
41.5	3942.93
42.0	3998.59
42.5	4054.34

Attachment 63

PRESSURIZER RELIEF TANK VOLUME VERSUS INDICATED LEVEL

LEVEL TRAN REF LEG CAL TEMP 70.0 DEGREES F
DENSITY 62.305 LBM/FT^3

ACTUAL TANK WATER TEMP 85.0 DEGREES F
DENSITY 62.172 LBM/FT^3

INDICATED LEVEL (PERCENT)	EQUIVALENT 110 °F VOLUME (GALLONS)
43.0	4110.16
43.5	4166.05
44.0	4222.01
44.5	4278.04
45.0	4334.12
45.5	4390.25
46.0	4446.42
46.5	4502.64
47.0	4558.89
47.5	4615.18
48.0	4671.49
48.5	4727.81
49.0	4784.16
49.5	4840.51
50.0	4896.86
50.5	4953.22
51.0	5009.57
51.5	5065.90
52.0	5122.22
52.5	5178.52
53.0	5234.79
53.5	5291.03

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Attachment 63

PRESSURIZER RELIEF TANK VOLUME VERSUS INDICATED LEVEL

LEVEL TRAN REF LEG CAL TEMP 70.0 DEGREES F
DENSITY 62.305 LBM/FT^3

ACTUAL TANK WATER TEMP 85.0 DEGREES F
DENSITY 62.172 LBM/FT^3

INDICATED LEVEL (PERCENT)	EQUIVALENT 110 °F VOLUME (GALLONS)
54.0	5347.23
54.5	5403.39
55.0	5459.50
55.5	5515.55
56.0	5571.55
56.5	5627.49
57.0	5683.35
57.5	5739.14
58.0	5794.85
58.5	5850.48
59.0	5906.01
59.5	5961.45
60.0	6016.79
60.5	6072.02
61.0	6127.14
61.5	6182.14
62.0	6237.02
62.5	6291.77
63.0	6346.38
63.5	6400.86
64.0	6455.19
64.5	6509.38

Attachment 63

PRESSURIZER RELIEF TANK VOLUME VERSUS INDICATED LEVEL

LEVEL TRAN REF LEG CAL TEMP 70.0 DEGREES F
DENSITY 62.305 LBM/FT^3

ACTUAL TANK WATER TEMP 85.0 DEGREES F
DENSITY 62.172 LBM/FT^3

INDICATED LEVEL (PERCENT)	EQUIVALENT 110 °F VOLUME (GALLONS)
65.0	6563.40
65.5	6617.27
66.0	6670.97
66.5	6724.49
67.0	6777.84
67.5	6831.00
68.0	6883.97
68.5	6936.75
69.0	6989.33
69.5	7041.69
70.0	7093.85
70.5	7145.78
71.0	7197.49
71.5	7248.97
72.0	7300.21
72.5	7351.21
73.0	7401.95
73.5	7452.44
74.0	7502.67
74.5	7552.63
75.0	7602.31
75.5	7651.71
76.0	7700.83
76.5	7749.64
77.0	7798.16

Attachment 63

PRESSURIZER RELIEF TANK VOLUME VERSUS INDICATED LEVEL

LEVEL TRAN REF LEG CAL TEMP 70.0 DEGREES F
DENSITY 62.305 LBM/FT^3

ACTUAL TANK WATER TEMP 85.0 DEGREES F
DENSITY 62.172 LBM/FT^3

INDICATED LEVEL (PERCENT)	EQUIVALENT 110 °F VOLUME (GALLONS)
77.5	7846. 37
78.0	7894.26
78.5	7941.83
79.0	7989.07
79.5	8035.97
80.0	8082.53
80.5	8128.73
81.0	8220.06
82.0	8265.16
82.5	8309.89
83.0	8354.22
83.5	8398.16
84.0	8441.68
84.5	8484.80
85.0	8527.49
85.5	8569.74
86.0	8611.56
86.5	8652.92
87.0	8693.82
87.5	8734.26
88.0	8774.21
88.5	8813.67
89.0	8852.64
89.5	8891.09
90.0	8929.02

Attachment 63

PRESSURIZER RELIEF TANK VOLUME VERSUS INDICATED LEVEL

LEVEL TRAN REF LEG CAL TEMP 70.0 DEGREES F
DENSITY 62.305 LBM/FT^3

ACTUAL TANK WATER TEMP 85.0 DEGREES F
DENSITY 62.172 LBM/FT^3

INDICATED LEVEL (PERCENT)	EQUIVALENT 110 °F VOLUME (GALLONS)
90.5	8966.42
91.0	9003.27
91.5	9039.56
92.0	9075.29
92.5	9110.43
93.0	9144.98
93.5	9178.92
94.0	9212.23
94.5	9244.90
95.0	9276.91
95.5	9308.25
96.0	9338.91
96.5	9368.85
97.0	9398.06
97.5	9426.53
98.0	9454.22
98.5	9481.12
99.0	9507.19
99.5	9532.42

NOTE: The transmitter will no longer increase with increase level after 99.5% indication.

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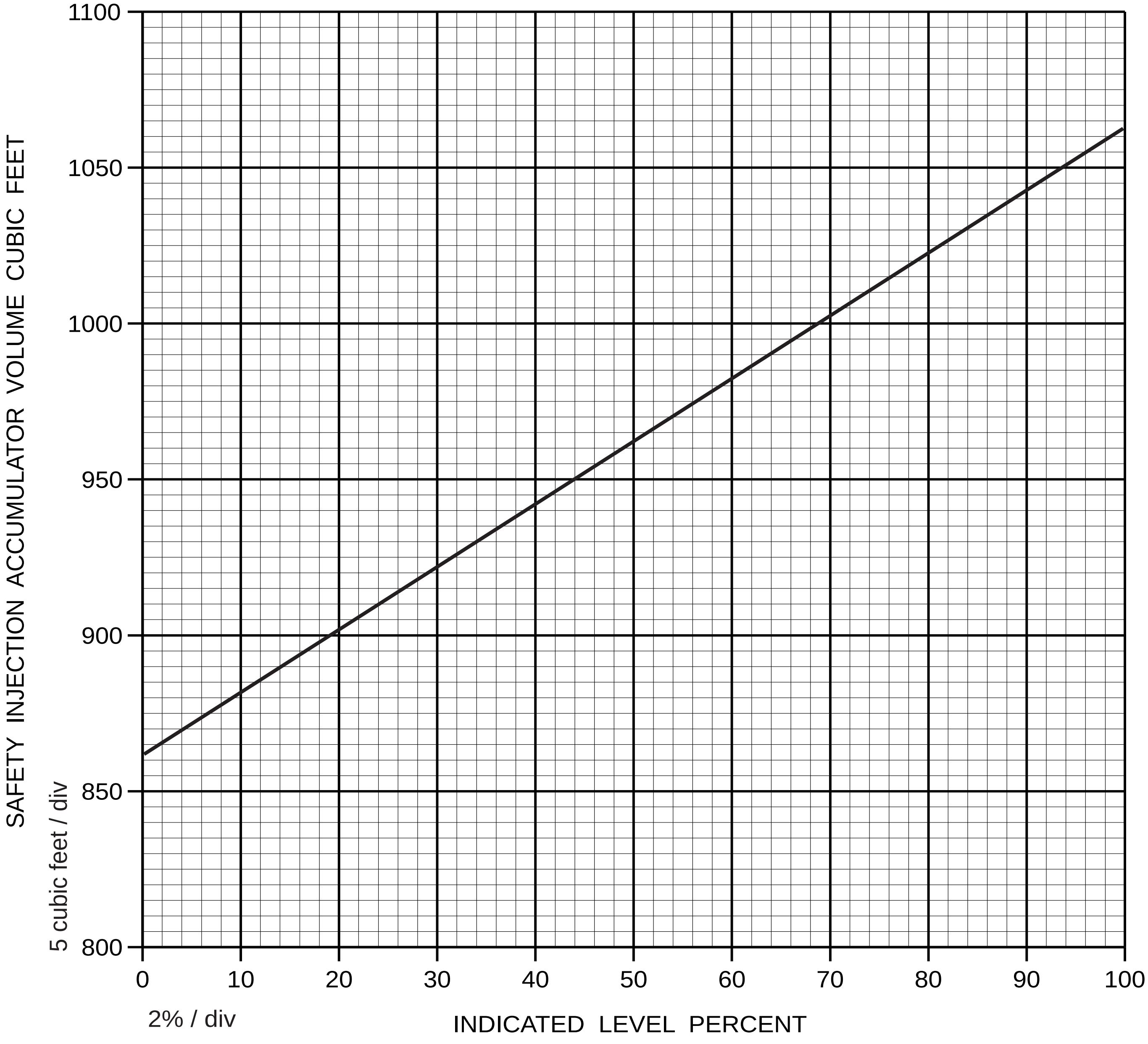
Attachment 64

SAFETY INJECTION ACCUMULATOR LEVEL

NOTE: For Operating Limits refer to 1-PT-36.



SAFETY INJECTION ACCUMULATOR LEVEL

Reference: 1) Surry Power Station SCR No. 88-02, Safety Injection Accumulator Levels Surry 1 & 2

2) Calculation EE-0376 dated 5/9/91

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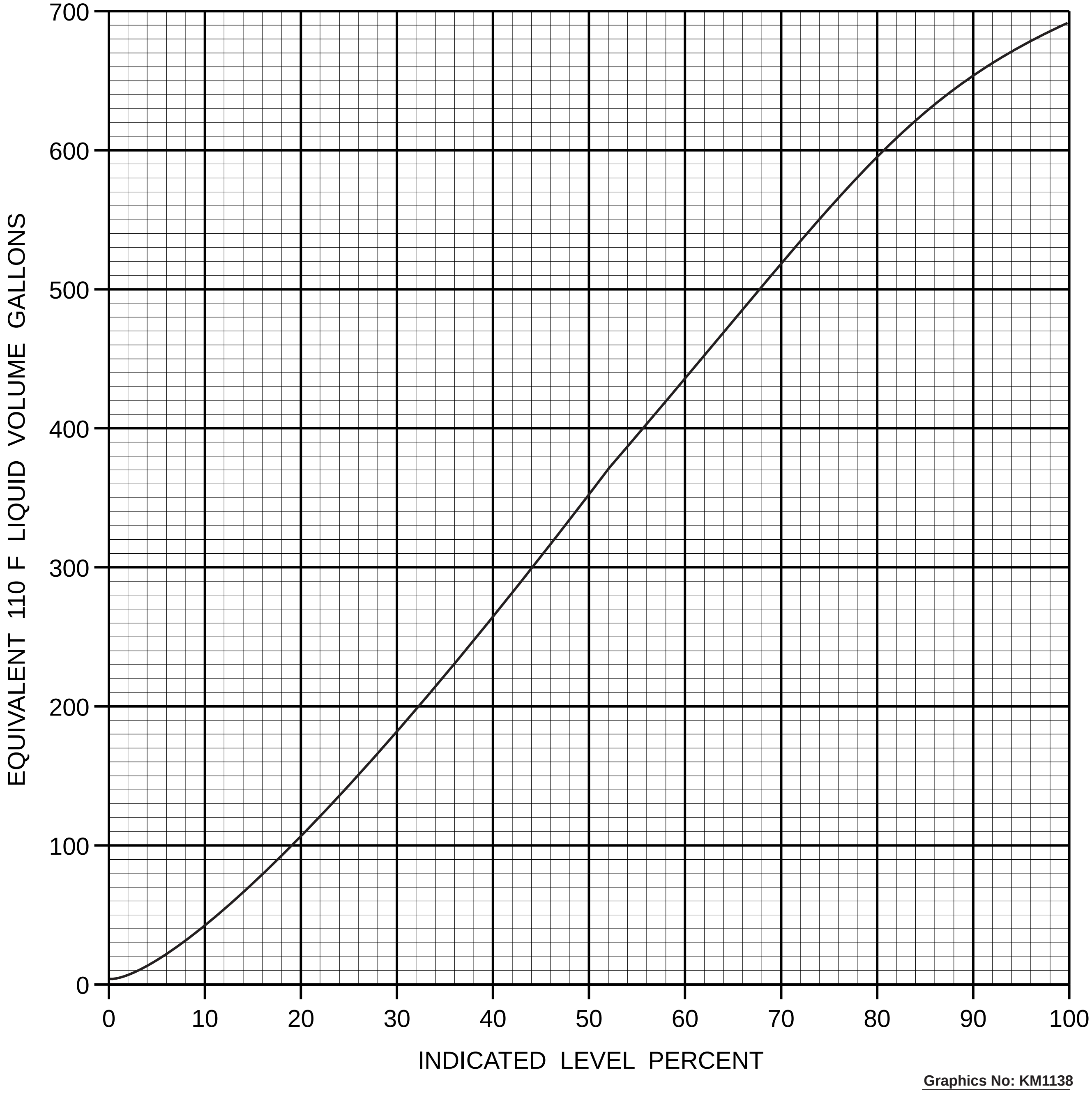
Attachment 65

PRIMARY DRAIN TRANSFER TANK



PRIMARY DRAIN TRANSFER TANK

Attachment 66

PRIMARY DRAIN TRANSFER TANK VOLUME VERSUS INDICATED LEVEL

LEVEL TRANSMITTER REFERENCE LEG TEMP 100.0 DEGREES F, DENSITY 61.996 LBM/^TANK LEVEL COLUMN TEMP 100.0 DEGREES F, DENSITY 61.996 LBM/FT^3

WATER HEIGHT (FEET)	INDICATED LEVEL (PERCENT)	ACTUAL TANK VOLUME (GALLONS)	EQUIVALENT 100°F VOLUME (GALLONS)
0.094	0.0	3.63	3.64
0.113	0.5	4.82	4.83
0.133	1.0	6.13	6.14
0.152	1.5	7.54	7.55
0.171	2.0	9.04	9.06
0.191	2.5	10.64	10.67
0.210	3.0	12.33	12.36
0.229	3.5	14.10	14.13
0.249	4.0	15.95	15.98
0.268	4.5	17.87	17.91
0.287	5.0	19.87	19.91
0.307	5.5	21.94	21.98
0.326	6.0	24.07	24.13
0.345	7.0	28.54	28.60
0.384	7.5	30.87	30.94
0.403	8.0	33.26	33.33
0.423	8.5	35.71	35.78
0.461	9.5	40.77	40.86
0.480	10.0	43.38	43.48
0.500	10.5	46.05	46.15
0.519	11.0	48.77	48.87
0.538	11.5	51.53	51.65
0.558	12.0	54.35	54.47

Attachment 66

PRIMARY DRAIN TRANSFER TANK VOLUME VERSUS INDICATED LEVEL

LEVEL TRANSMITTER REFERENCE LEG TEMP 100.0 DEGREES F, DENSITY 61.996 LBM/^TANK LEVEL COLUMN TEMP 100.0 DEGREES F, DENSITY 61.996 LBM/FT^3

WATER HEIGHT (FEET)	INDICATED LEVEL (PERCENT)	ACTUAL TANK VOLUME (GALLONS)	EQUIVALENT 100°F VOLUME (GALLONS)
0.577	12.5	57.21	57.34
0.596	13.0	60.12	60.25
0.616	13.5	63.08	63.21
0.635	14.0	66.08	66.22
0.654	14.5	69.12	69.27
0.674	15.0	72.20	72.36
0.712	16.0	78.50	78.67
0.732	16.5	81.70	81.88
0.751	17.0	84.95	85.13
0.770	17.5	88.23	88.42
0.790	18.0	91.55	91.75
0.809	18.5	94.91	95.11
0.828	19.0	98.30	98.51
0.848	19.5	101.72	101.94
0.867	20.0	105.18	105.41
0.886	20.5	108.67	108.91
0.906	21.0	112.20	112.44
0.925	21.5	115.75	116.00
0.944	22.0	119.34	119.60
0.964	22.5	122.96	123.22
0.983	23.0	126.60	126.88
1.002	23.5	130.28	130.56
1.022	24.0	133.98	134.27

Attachment 66

PRIMARY DRAIN TRANSFER TANK VOLUME VERSUS INDICATED LEVEL

LEVEL TRANSMITTER REFERENCE LEG TEMP 100.0 DEGREES F, DENSITY 61.996 LBM/^TANK LEVEL COLUMN TEMP 100.0 DEGREES F, DENSITY 61.996 LBM/FT^3

WATER HEIGHT (FEET)	INDICATED LEVEL (PERCENT)	ACTUAL TANK VOLUME (GALLONS)	EQUIVALENT 100°F VOLUME (GALLONS)
1.041	24.5	137.70	138.00
1.060	25.0	141.46	141.76
1.080	25.5	145.24	145.55
1.099	26.0	149.04	149.36
1.118	26.5	152.87	153.20
1.138	27.0	156.72	157.06
1.157	27.5	160.60	160.94
1.176	28.0	164.49	164.85
1.195	28.5	168.41	168.77
1.215	29.0	172.35	172.72
1.234	29.5	176.31	176.69
1.253	30.0	180.29	180.68
1.273	30.5	184.28	184.68
1.292	31.0	188.30	188.71
1.311	31.5	192.34	192.75
1.331	32.0	196.39	196.81
1.350	32.5	200.47	200.90
1.369	33.0	204.56	205.01
1.389	33.5	208.68	209.13
1.408	34.0	212.81	213.27
1.427	34.5	216.96	217.43
1.447	35.0	221.13	221.61
1.466	35.5	225.31	225.80

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Attachment 66

PRIMARY DRAIN TRANSFER TANK VOLUME VERSUS INDICATED LEVEL

LEVEL TRANSMITTER REFERENCE LEG TEMP 100.0 DEGREES F, DENSITY 61.996 LBM/^TANK LEVEL COLUMN TEMP 100.0 DEGREES F, DENSITY 61.996 LBM/FT^3

WATER HEIGHT (FEET)	INDICATED LEVEL (PERCENT)	ACTUAL TANK VOLUME (GALLONS)	EQUIVALENT 100°F VOLUME (GALLONS)
1.485	36.0	229.50	230.00
1.505	36.5	233.71	234.22
1.524	37.0	237.94	238.45
1.543	37.5	242.17	242.70
1.563	38.0	246.42	246.95
1.582	38.5	250.68	251.22
1.601	39.0	254.95	255.50
1.621	39.5	259.23	259.79
1.640	40.0	263.52	264.09
1.659	40.5	267.82	268.40
1.679	41.0	272.13	272.72
1.698	41.5	276.45	277.05
1.717	42.0	280.77	281.38
1.737	42.5	285.11	285.72
1.756	43.0	289.45	290.07
1.775	43.5	293.79	294.43
1.795	44.0	298.14	298.79
1.814	44.5	302.50	303.16
1.833	45.0	306.86	307.53
1.853	45.5	311.23	311.90
1.872	46.0	315.60	316.28
1.891	46.5	319.97	320.66
1.910	47.0	324.35	325.05

Attachment 66

PRIMARY DRAIN TRANSFER TANK VOLUME VERSUS INDICATED LEVEL

LEVEL TRANSMITTER REFERENCE LEG TEMP 100.0 DEGREES F, DENSITY 61.996 LBM/^TANK LEVEL COLUMN TEMP 100.0 DEGREES F, DENSITY 61.996 LBM/FT^3

WATER HEIGHT (FEET)	INDICATED LEVEL (PERCENT)	ACTUAL TANK VOLUME (GALLONS)	EQUIVALENT 100°F VOLUME (GALLONS)
1.930	47.5	328.73	329.44
1.949	48.0	333.11	333.83
1.968	48.5	337.49	338.22
1.988	49.0	341.87	342.61
2.007	49.5	346.25	347.00
2.026	50.0	350.63	351.39
2.046	50.5	355.02	355.78
2.065	51.0	359.40	360.17
2.084	51.5	363.77	364.56
2.104	52.0	368.15	368.95
2.123	52.5	372.53	373.33
2.142	53.0	376.90	377.71
2.162	53.5	381.26	382.09
2.181	54.0	385.63	386.46
2.200	54.5	389.98	390.83
2.220	55.0	394.34	395.19
2.239	55.5	398.69	399.55
2.258	56.0	403.03	403.90
2.278	56.5	407.36	408.24
2.297	57.0	411.69	412.58
2.316	57.5	416.01	416.91
2.336	58.0	420.32	421.23
2.355	58.5	424.62	425.54

Attachment 66

PRIMARY DRAIN TRANSFER TANK VOLUME VERSUS INDICATED LEVEL

LEVEL TRANSMITTER REFERENCE LEG TEMP 100.0 DEGREES F, DENSITY 61.996 LBM/^TANK LEVEL COLUMN TEMP 100.0 DEGREES F, DENSITY 61.996 LBM/FT^3

WATER HEIGHT (FEET)	INDICATED LEVEL (PERCENT)	ACTUAL TANK VOLUME (GALLONS)	EQUIVALENT 100°F VOLUME (GALLONS)
2.374	59.0	428.92	429.84
2.394	59.5	433.20	434.14
2.413	60.0	437.47	438.42
2.432	60.5	441.74	442.69
2.452	61.0	445.99	446.95
2.471	61.5	450.23	451.20
2.490	62.0	454.45	455.44
2.510	62.5	458.67	459.66
2.529	63.0	462.86	463.87
2.548	63.5	467.05	468.06
2.568	64.0	471.22	472.24
2.587	64.5	475.37	476.40
2.606	65.0	479.51	480.55
2.625	65.5	483.63	484.68
2.645	66.0	487.73	488.79
2.664	66.5	491.82	492.88
2.683	67.0	495.87	496.95
2.703	67.5	499.91	500.99
2.722	68.0	503.93	505.02
2.741	68.5	507.94	509.04
2.761	69.0	511.92	513.03
2.780	69.5	515.88	517.00
2.799	70.0	519.83	520.95

Attachment 66

PRIMARY DRAIN TRANSFER TANK VOLUME VERSUS INDICATED LEVEL

LEVEL TRANSMITTER REFERENCE LEG TEMP 100.0 DEGREES F,
DENSITY 61.996 LBM/^TANK LEVEL
COLUMN TEMP 100.0 DEGREES F, DENSITY 61.996 LBM/FT^3

WATER HEIGHT (FEET)	INDICATED LEVEL (PERCENT)	ACTUAL TANK VOLUME (GALLONS)	EQUIVALENT 100°F VOLUME (GALLONS)
2.819	71.0	527.65	528.80
2.857	71.5	531.53	532.68
2.877	72.0	535.39	536.55
2.896	72.5	539.23	540.39
2.915	73.0	543.04	544.21
2.935	73.5	546.82	548.01
2.954	74.0	550.58	551.78
2.973	74.5	554.32	555.52
2.993	75.0	558.03	559.23
3.012	75.5	561.71	562.92
3.031	76.0	565.36	566.58
3.051	76.5	568.98	570.22
3.070	77.0	572.58	573.82
3.089	77.5	576.14	577.39
3.109	78.0	579.68	580.93
3.128	78.5	583.18	584.44
3.147	79.0	585.64	587.91
3.167	79.5	590.08	591.36
3.186	80.0	593.48	594.76
3.205	80.5	596.84	598.14
3.225	81.0	600.17	601.47
3.244	81.5	603.47	604.77

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Attachment 66

PRIMARY DRAIN TRANSFER TANK VOLUME VERSUS INDICATED LEVEL

LEVEL TRANSMITTER REFERENCE LEG TEMP 100.0 DEGREES F,
DENSITY 61.996 LBM/^TANK LEVEL
COLUMN TEMP 100.0 DEGREES F, DENSITY 61.996 LBM/FT^3

WATER HEIGHT (FEET)	INDICATED LEVEL (PERCENT)	ACTUAL TANK VOLUME (GALLONS)	EQUIVALENT 100°F VOLUME (GALLONS)
3.263	82.0	606.72	608.03
3.283	82.5	609.94	611.26
3.302	83.0	613.11	614.44
3.321	83.5	616.25	617.58
3.341	84.0	619.35	620.69
3.360	84.5	622.40	623.75
3.379	85.0	625.41	626.77
3.398	85.5	628.38	629.74
3.418	86.0	631.30	632.67
3.437	86.5	634.17	635.55
3.456	87.0	637.00	638.38
3.476	87.5	639.78	641.17
3.495	88.0	642.51	643.90
3.514	88.5	645.19	646.59
3.534	89.0	647.82	649.22
3.553	89.5	650.39	651.80
3.572	90.0	652.91	654.33
3.592	90.5	655.37	656.79
3.611	91.0	657.78	659.20
3.630	91.5	660.12	661.55
3.650	92.0	662.41	663.84
3.669	92.5	664.63	666.07
3.688	93.0	666.78	668.22

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Attachment 66

PRIMARY DRAIN TRANSFER TANK VOLUME VERSUS INDICATED LEVEL

LEVEL TRANSMITTER REFERENCE LEG TEMP 100.0 DEGREES F, DENSITY 61.996 LBM/^TANK LEVEL COLUMN TEMP 100.0 DEGREES F, DENSITY 61.996 LBM/FT^3

WATER HEIGHT (FEET)	INDICATED LEVEL (PERCENT)	ACTUAL TANK VOLUME (GALLONS)	EQUIVALENT 100°F VOLUME (GALLONS)
3.708	93.5	668.87	670.32
3.727	94.0	670.88	672.34
3.746	94.5	672.83	674.29
3.766	95.0	674.70	676.16
3.785	95.5	676.49	677.95
3.804	96.0	678.20	679.66
3.824	96.5	679.82	681.29
3.843	97.0	681.35	682.82
3.862	97.5	682.79	684.26
3.882	98.0	684.12	685.60
3.901	98.5	685.34	686.83
3.920	99.0	686.45	687.93
3.940	99.5	687.42	688.91
3.959	100.0	688.24	689.73

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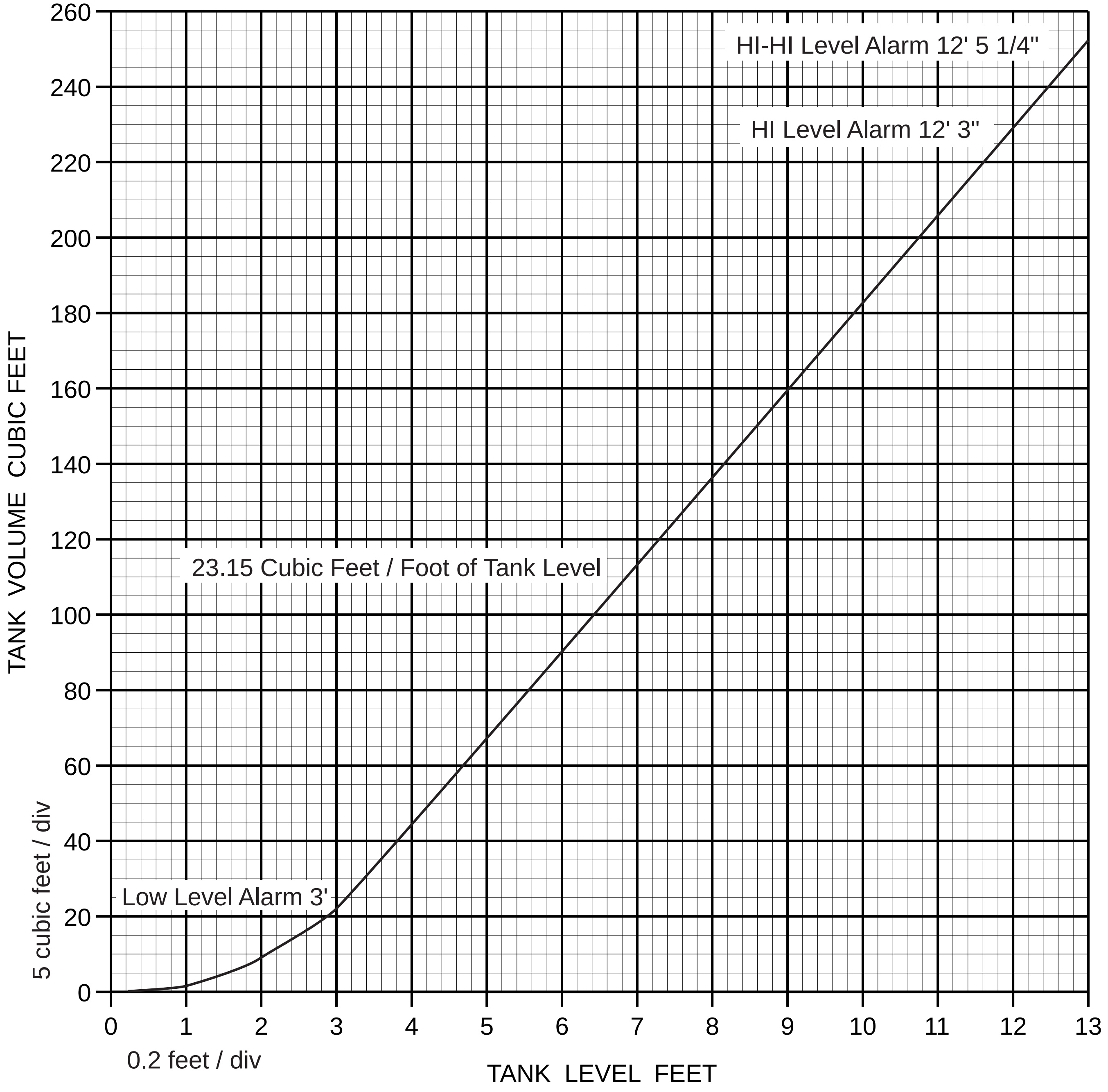
Attachment 67
LIQUID WASTE TANK



Graphics No: KM1140

1-LW-TK-14, 1-LW-TK-15

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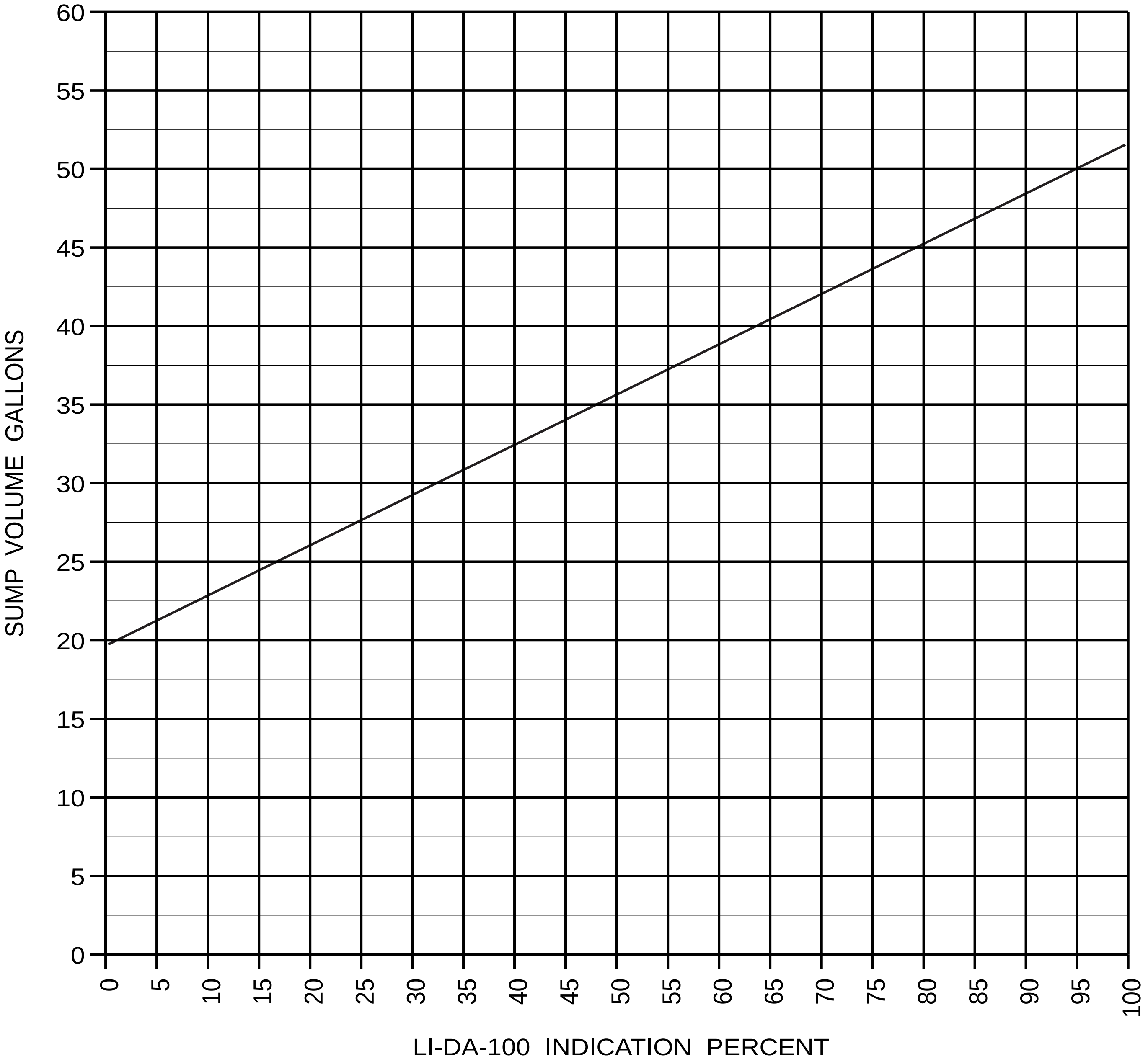
Attachment 68

CONTAINMENT SUMP VOLUME



Graphics No: KM1142A

CONTAINMENT SUMP VOLUME UNIT 1

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Attachment 68

CONTAINMENT SUMP VOLUME

Level (%)	Gallons	Level (%)	Gallons	Level (%)	Gallons	Level (%)	Gallons
0	19.63	17.5	25.22125	35	30.8125	52.5	36.40375
0.5	19.78975	18	25.381	35.5	30.97225	53	36.5635
1	19.9495	18.5	25.54075	36	31.132	53.5	36.72325
1.5	20.10925	19	25.7005	36.5	31.29175	54	36.883
2	20.269	19.5	25.86025	37	31.4515	54.5	37.04275
2.5	20.42875	20	26.02	37.5	31.61125	55	37.2025
3	20.5885	20.5	26.17975	38	31.771	55.5	37.36225
3.5	20.74825	21	26.3395	38.5	31.93075	56	37.522
4	20.908	21.5	26.49925	39	32.0905	56.5	37.68175
4.5	21.06775	22	26.659	39.5	32.25025	57	37.8415
5	21.2275	22.5	26.81875	40	32.41	57.5	38.00125
5.5	21.38725	23	26.9785	40.5	32.56975	58	38.161
6	21.547	23.5	27.13825	41	32.7295	58.5	38.32075
6.5	21.70675	24	27.298	41.5	32.88925	59	38.4805
7	21.8665	24.5	27.45775	42	33.049	59.5	38.64025
7.5	22.02625	25	27.6175	42.5	33.20875	60	38.8
8	22.186	25.5	27.77725	43	33.3685	60.5	38.95975
8.5	22.34575	26	27.937	43.5	33.52825	61	39.1195
9	22.5055	26.5	28.09675	44	33.688	61.5	39.27925
9.5	22.66525	27	28.2565	44.5	33.84775	62	39.439
10	22.825	27.5	28.41625	45	34.0075	62.5	39.59875
10.5	22.98475	28	28.576	45.5	34.16725	63	39.7585
11	23.1445	28.5	28.73575	46	34.327	63.5	39.91825
11.5	23.30425	29	28.8955	46.5	34.48675	64	40.078
12	23.464	29.5	29.05525	47	34.6465	64.5	40.23775
12.5	23.62375	30	29.215	47.5	34.80625	65	40.3975
13	23.7835	30.5	29.37475	48	34.966	65.5	40.55725
13.5	23.94325	31	29.5345	48.5	35.12575	66	40.717
14	24.103	31.5	29.69425	49	35.2855	66.5	40.87675
14.5	24.26275	32	29.854	49.5	35.44525	67	41.0365
15	24.4225	32.5	30.01375	50	35.605	67.5	41.19625
15.5	24.58225	33	30.1735	50.5	35.76475	68	41.356
16	24.742	33.5	30.33325	51	35.9245	68.5	41.51575
16.5	24.90175	34	30.493	51.5	36.08425	69	41.6755
17	25.0615	34.5	30.65275	52	36.244	69.5	41.83525

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Attachment 68

CONTAINMENT SUMP VOLUME

Level (%)	Gallons	Level (%)	Gallons	Level (%)	Gallons	Level (%)	Gallons
70	41.995	79	44.8705	88	47.746	97	50.6215
70.5	42.15475	79.5	45.03025	88.5	47.90575	97.5	50.78125
71	42.3145	80	45.19	89	48.0655	98	50.941
71.5	42.47425	80.5	45.34975	89.5	48.22525	98.5	51.10075
72	42.634	81	45.5095	90	48.385	99	51.2605
72.5	42.79375	81.5	45.66925	90.5	48.54475	99.5	51.42025
73	42.9535	82	45.829	91	48.7045	100	51.58
73.5	43.11325	82.5	45.98875	91.5	48.86425		
74	43.273	83	46.1485	92	49.024		
74.5	43.43275	83.5	46.30825	92.5	49.18375		
75	43.5925	84	46.468	93	49.3435		
75.5	43.75225	84.5	46.62775	93.5	49.50325		
76	43.912	85	46.7875	94	49.663		
76.5	44.07175	85.5	46.94725	94.5	49.82275		
77	44.2315	86	47.107	95	49.9825		
77.5	44.39125	86.5	47.26675	95.5	50.14225		
78	44.551	87	47.4265	96	50.302		
78.5	44.71075	87.5	47.58625	96.5	50.46175		

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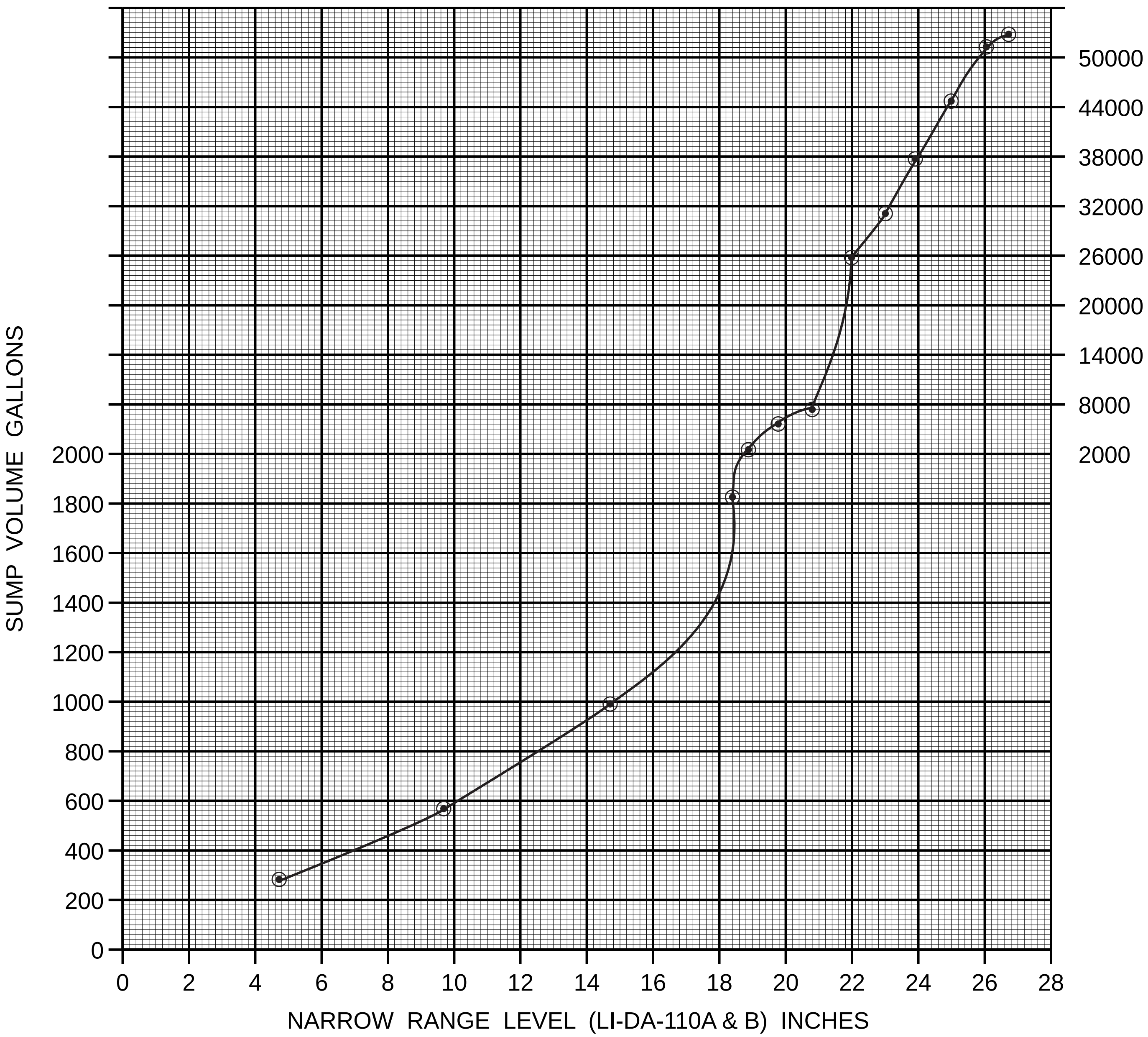
Attachment 69

CONTAINMENT SUMP VOLUME - NARROW RANGE LEVEL



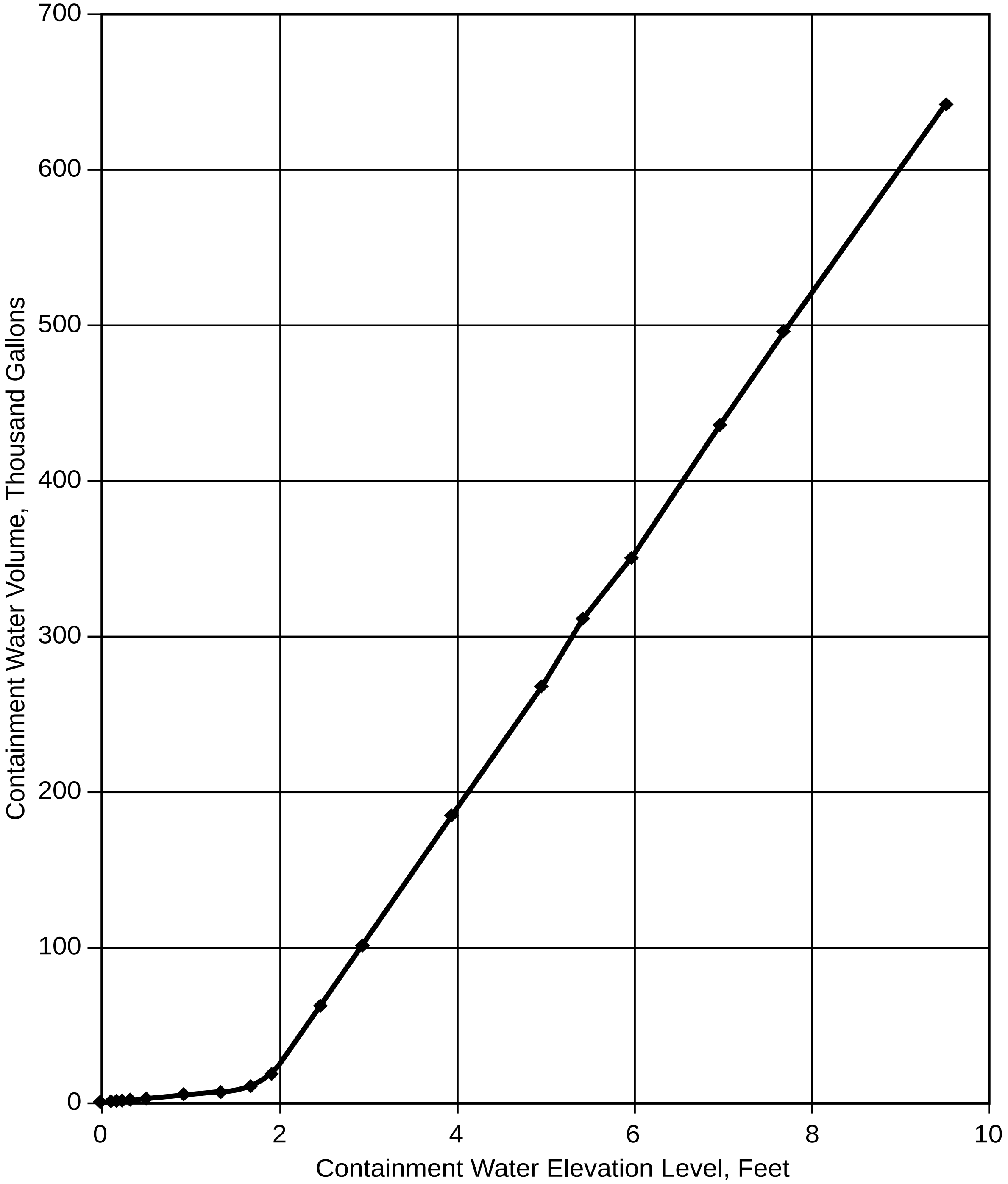
Graphics No: KM1143A

CONTAINMENT SUMP VOLUME
VS NARROW RANGE LEVEL
(LI-DA-110A & B)

(Page 1 of 2)

Attachment 70

CONTAINMENT WATER VOLUME VS. WATER LEVEL ELEVATION



Graphics No. CS5426

CONTAINMENT WATER VOLUME VS WATER LEVEL ELEVATION

(Page 2 of 2)

Attachment 70

CONTAINMENT WATER VOLUME VS. WATER LEVEL ELEVATION

Level (Feet)	Water Volume (Gallons) x 1000
0	0
0.114	0.51
0.18	0.93
0.27	1.36
0.353	1.78
0.52	2.69
0.937	4.91
1.353	7.21
1.69	9.65
1.937	18.09
2.468	62.42
2.937	101.35
3.937	184.35
4.937	267.36
5.385	311.43
5.937	350.63
6.937	435.63
7.645	495.81
9.437	642.88

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Attachment 71

COMPONENT COOLING SURGE TANK

FLUID HEIGHT PERCENT	TOTAL VOLUME GALLONS
1	4
2	12
3	21
4	33
5	47
6	62
7	78
8	96
9	114
10	134
11	155
12	177
13	200
14	223
15	248
16	273
17	299
18	325
19	352
20	380
21	409
22	438
23	468
24	498
25	529
26	560
27	592
28	624
29	657
30	690
31	723
32	757

FLUID HEIGHT PERCENT	TOTAL VOLUME GALLONS
33	791
34	826
35	860
36	895
37	930
38	966
39	1001
40	1037
41	1073
42	1109
43	1145
44	1182
45	1219
46	1255
47	1291
48	1329
49	1365
50	1403
51	1439
52	1476
53	1513
54	1549
55	1586
56	1623
57	1659
58	1695
59	1731
60	1767
61	1803
62	1839
63	1874
64	1910

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Attachment 71

COMPONENT COOLING SURGE TANK

FLUID HEIGHT PERCENT	TOTAL VOLUME GALLONS
65	1945
66	1979
67	2014
68	2047
69	2082
70	2115
71	2148
72	2180
73	2212
74	2244
75	2275
76	2306
77	2336
78	2366
79	2395
80	2424
81	2452
82	2479

FLUID HEIGHT PERCENT	TOTAL VOLUME GALLONS
83	2506
84	2531
85	2557
86	2581
87	2605
88	2628
89	2650
90	2670
91	2690
92	2709
93	2726
94	2743
95	2757
96	2771
97	2783
98	2792
99	2800
100	2804

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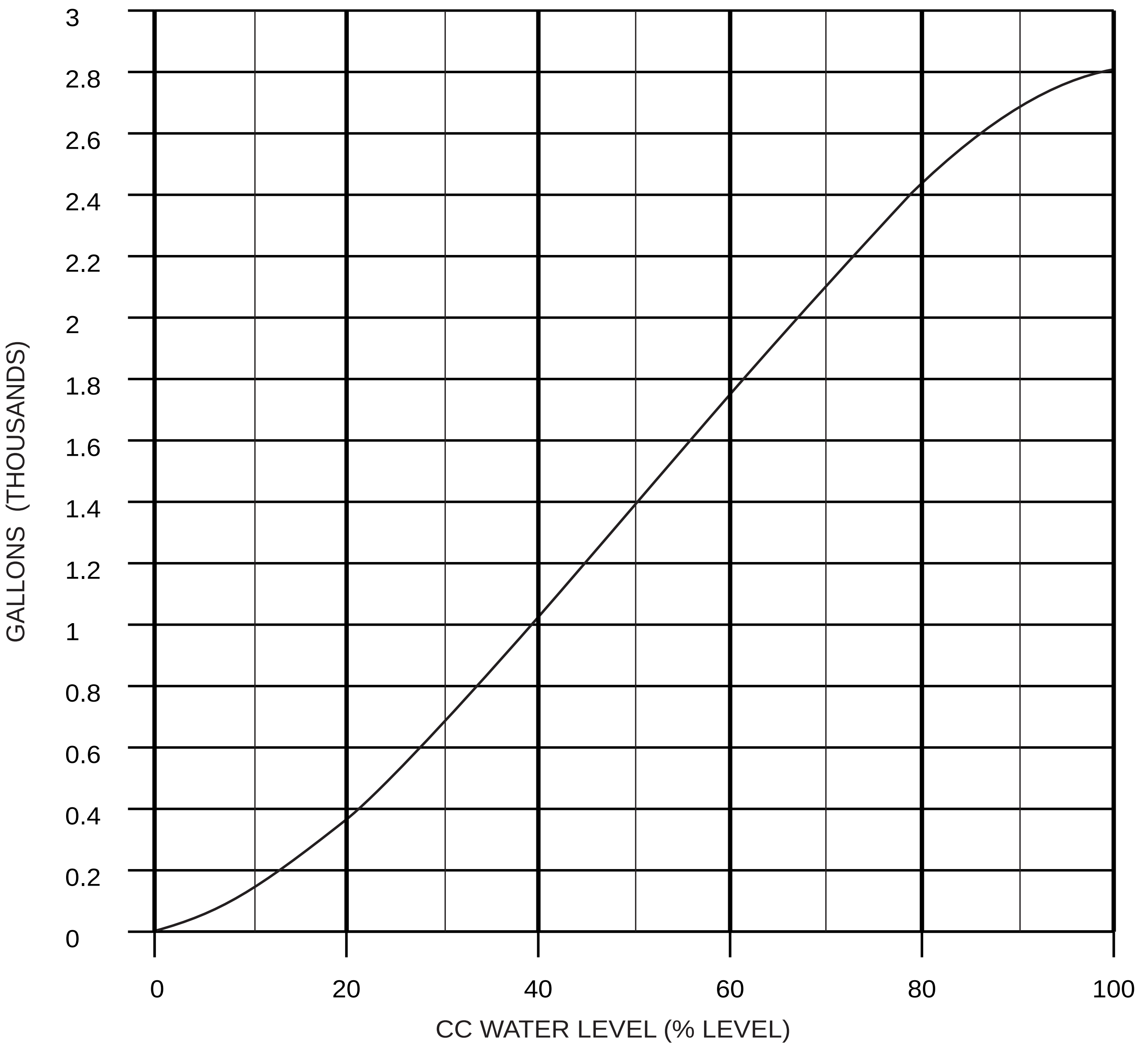
Attachment 71

COMPONENT COOLING SURGE TANK



Graphics No: KM1733

1-CC-TK-1
VOLUME VS. WATER LEVEL

(Page 1 of 1)

Attachment 72

ENTHALPY STEAM TABLE (100% QUALITY)

ABSOL PRSR (PSIA)	0	1	2	3	4	5	6	7	8	9
750	1200.69	1200.66	1200.64	1200.61	1200.59	1200.56	1200.54	1200.51	1200.49	1200.46
760	1200.44	1200.41	1200.39	1200.36	1200.34	1200.31	1200.29	1200.26	1200.23	1200.21
770	1200.18	1200.16	1200.13	1200.11	1200.08	1200.05	1200.03	1200.00	1199.98	1199.95
780	1199.92	1199.90	1199.87	1199.84	1199.82	1199.79	1199.76	1199.74	1199.71	1199.68
790	1199.66	1199.63	1199.60	1199.58	1199.55	1199.52	1199.50	1199.47	1199.44	1199.41
800	1199.39	1199.36	1199.33	1199.30	1199.28	1199.25	1199.22	1199.19	1199.17	1199.14
810	1199.11	1199.08	1199.05	1199.03	1199.00	1198.97	1198.94	1198.91	1198.89	1198.86
820	1198.83	1198.80	1198.77	1198.74	1198.71	1198.69	1198.66	1198.63	1198.60	1198.57
830	1198.54	1198.51	1198.48	1198.45	1198.43	1198.40	1198.37	1198.34	1198.31	1198.28
840	1198.25	1198.22	1198.19	1198.16	1198.13	1198.10	1198.07	1198.04	1198.01	1197.98
850	1197.95	1197.92	1197.89	1197.86	1197.83	1197.80	1197.77	1197.74	1197.71	1197.68
860	1197.65	1197.62	1197.59	1197.56	1197.53	1197.50	1197.47	1197.44	1197.41	1197.37
870	1197.34	1197.31	1197.28	1197.25	1197.22	1197.19	1197.16	1197.13	1197.10	1197.06
880	1197.03	1197.00	1196.97	1196.94	1196.91	1196.87	1196.84	1196.81	1196.78	1196.75
890	1196.72	1196.68	1196.65	1196.62	1196.59	1196.56	1196.52	1196.49	1196.46	1196.43
900	1196.39	1196.36	1196.33	1196.30	1196.26	1196.23	1196.20	1196.17	1196.13	1196.10
910	1196.07	1196.04	1196.00	1195.97	1195.94	1195.90	1195.87	1195.84	1195.80	1195.77
920	1195.74	1195.71	1195.67	1195.64	1195.61	1195.57	1195.54	1195.50	1195.47	1195.44
930	1195.40	1195.37	1195.34	1195.30	1195.27	1195.23	1195.20	1195.17	1195.13	1195.10
940	1195.06	1195.03	1195.00	1194.96	1194.93	1194.89	1194.86	1194.82	1194.79	1194.75
950	1194.72	1194.69	1194.65	1194.62	1194.58	1194.55	1194.51	1194.48	1194.44	1194.41
960	1194.37	1194.34	1194.30	1194.27	1194.23	1194.20	1194.16	1194.13	1194.09	1194.05
970	1194.02	1193.98	1193.95	1193.91	1193.88	1193.84	1193.81	1193.77	1193.73	1193.70
980	1193.66	1193.63	1193.59	1193.55	1193.52	1193.48	1193.45	1193.41	1193.37	1193.34
990	1193.30	1193.27	1193.23	1193.19	1193.16	1193.12	1193.08	1193.05	1193.01	1192.97
1000	1192.94	1192.90	1192.86	1192.83	1192.79	1192.75	1192.71	1192.68	1192.64	1192.60

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Attachment 73

ENTHALPY SATURATED LIQUID TABLE

ABSOL PRSR (PSIA)	0	1	2	3	4	5	6	7	8	9
750	500.89	501.07	501.26	501.44	501.62	501.80	501.98	502.16	502.34	502.52
760	502.70	502.88	503.06	503.24	503.42	503.60	503.78	503.96	504.14	504.32
770	504.50	504.68	504.86	505.04	505.22	505.40	505.57	505.75	505.93	506.11
780	506.29	506.46	506.64	506.82	506.99	507.17	507.35	507.53	507.70	507.88
790	508.05	508.23	508.41	508.58	508.76	508.93	509.11	509.29	509.46	509.64
800	509.81	509.99	510.16	510.34	510.51	510.68	510.86	511.03	511.21	511.38
810	511.55	511.73	511.90	512.08	512.25	512.42	512.59	512.77	512.94	513.11
820	513.29	513.46	513.63	513.80	513.97	514.15	514.32	514.49	514.66	514.83
830	515.00	515.17	515.35	515.52	515.69	515.86	516.03	516.20	516.37	516.54
840	516.71	516.88	517.05	517.22	517.39	517.56	517.73	517.90	518.07	518.23
850	518.40	518.57	518.74	518.91	519.08	519.25	519.41	519.58	519.75	519.92
860	520.09	520.25	520.42	520.59	520.76	520.92	521.09	521.26	521.42	521.59
870	521.76	521.92	522.09	522.26	522.42	522.59	522.75	522.92	523.09	523.25
880	523.42	523.58	523.75	523.91	524.08	524.24	524.41	524.57	524.74	524.90
890	525.07	525.23	525.39	525.56	525.72	525.89	526.05	526.21	526.38	526.54
900	526.70	526.87	527.03	527.19	527.36	527.52	527.68	527.84	528.01	528.17
910	528.33	528.49	528.66	528.82	528.98	529.14	529.30	529.47	529.63	529.79
920	529.95	530.11	530.27	530.43	530.59	530.76	530.92	531.08	531.24	531.40
930	531.56	531.72	531.88	532.04	532.20	532.36	532.52	532.68	532.84	533.00
940	533.16	533.32	533.47	533.63	533.79	533.95	534.11	534.27	534.43	534.59
950	534.74	534.90	535.06	535.22	535.38	535.54	535.69	535.85	536.01	536.17
960	536.32	536.48	536.64	536.80	536.95	537.11	537.27	537.42	537.58	537.74
970	537.89	538.05	538.21	538.36	538.52	538.68	538.83	538.99	539.14	539.30
980	539.45	539.61	539.77	539.92	540.08	540.23	540.39	540.54	540.70	540.85
990	541.01	541.16	541.32	541.47	541.63	541.78	541.93	542.09	542.24	542.40
1000	542.55	542.70	542.86	543.01	543.17	543.32	543.47	543.63	543.78	543.93

Attachment 74

ENTHALPY COMPRESSED LIQUID TABLE (800 PSIA)

FW TEMP (°F)	0	1	2	3	4	5	6	7	8	9
300	271.07	271.17	271.28	271.38	271.48	271.58	271.69	271.79	271.89	271.99
301	272.10	272.20	272.30	272.40	272.51	272.61	272.71	272.81	272.92	273.02
302	273.12	273.22	273.33	273.43	273.53	273.64	273.74	273.84	273.94	274.05
303	274.15	274.25	274.35	274.46	274.56	274.66	274.76	274.87	274.97	275.07
304	275.17	275.28	275.38	275.48	275.58	275.69	275.79	275.89	276.00	276.10
305	276.20	276.30	276.41	276.51	276.61	276.71	276.82	276.92	277.02	277.12
306	277.23	277.33	277.43	277.54	277.64	277.74	277.84	277.95	278.05	278.15
307	278.25	278.36	278.46	278.56	278.67	278.77	278.87	278.97	279.08	279.18
308	279.28	279.39	279.49	279.59	279.69	279.80	279.90	280.00	280.10	280.21
309	280.31	280.41	280.52	280.62	280.72	280.82	280.93	281.03	281.13	281.24
310	281.34	281.44	281.54	281.65	281.75	281.85	281.96	282.06	282.16	282.26
311	282.37	282.47	282.57	282.68	282.78	282.88	282.98	283.09	283.19	283.29
312	283.40	283.50	283.60	283.70	283.81	283.91	284.01	284.12	284.22	284.32
313	284.43	284.53	284.63	284.73	284.84	284.94	285.04	285.15	285.25	285.35
314	285.46	285.56	285.66	285.76	285.87	285.97	286.07	286.18	286.28	286.38
315	286.49	286.59	286.69	286.79	286.90	287.00	287.10	287.21	287.31	287.41
316	287.52	287.62	287.72	287.83	287.93	288.03	288.13	288.24	288.34	288.44
317	288.55	288.65	288.75	288.86	288.96	289.06	289.17	289.27	289.37	289.47
318	289.58	289.68	289.78	289.89	289.99	290.09	290.20	290.30	290.40	290.51
319	290.61	290.71	290.82	290.92	291.02	291.13	291.23	291.33	291.44	291.54
320	291.64	291.74	291.85	291.95	292.05	292.16	292.26	292.36	292.47	292.57
321	292.67	292.78	292.88	292.98	293.09	293.19	293.29	293.40	293.50	293.60
322	293.71	293.81	293.91	294.02	294.12	294.22	294.33	294.43	294.53	294.64
323	294.74	294.84	294.95	295.05	295.15	295.26	295.36	295.46	295.57	295.67
324	295.77	295.88	295.98	296.08	296.19	296.29	296.39	296.50	296.60	296.70
325	296.81	296.91	297.01	297.12	297.22	297.32	297.43	297.53	297.63	297.74

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Attachment 74

ENTHALPY COMPRESSED LIQUID TABLE (800 PSIA)

FW TEMP (°F)	0	1	2	3	4	5	6	7	8	9
326	297.84	297.95	298.05	298.15	298.26	298.36	298.46	298.57	298.67	298.77
327	298.88	298.98	299.08	299.19	299.29	299.39	299.50	299.60	299.70	299.81
328	299.91	300.02	300.12	300.22	300.33	300.43	300.53	300.64	300.74	300.84
329	300.95	301.05	301.15	301.26	301.36	301.47	301.57	301.67	301.78	301.88
330	301.98	302.09	302.19	302.29	302.40	302.50	302.60	302.71	302.81	302.92
331	303.02	303.12	303.23	303.33	303.43	303.54	303.64	303.75	303.85	303.95
332	304.06	304.16	304.26	304.37	304.47	304.57	304.68	304.78	304.89	304.99
333	305.09	305.20	305.30	305.40	305.51	305.61	305.72	305.82	305.92	306.03
334	306.13	306.24	306.34	306.44	306.55	306.65	306.75	306.86	306.96	307.07
335	307.17	307.27	307.38	307.48	307.58	307.69	307.79	307.90	308.00	308.10
336	308.21	308.31	308.42	308.52	308.62	308.73	308.83	308.94	309.04	309.14
337	309.25	309.35	309.45	309.56	309.66	309.77	309.87	309.97	310.08	310.18
338	310.29	310.39	310.49	310.60	310.70	310.81	310.91	311.01	311.12	311.22
339	311.33	311.43	311.53	311.64	311.74	311.85	311.95	312.05	312.16	312.26
340	312.37	312.47	312.57	312.68	312.78	312.89	312.99	313.09	313.20	313.30
341	313.41	313.51	313.62	313.72	313.82	313.93	314.03	314.14	314.24	314.34
342	314.45	314.55	314.66	314.76	314.86	314.97	315.07	315.18	315.28	315.39
343	315.49	315.59	315.70	315.80	315.91	316.01	316.12	316.22	316.32	316.43
344	316.53	316.64	316.74	316.84	316.95	317.05	317.16	317.26	317.37	317.47
345	317.57	317.68	317.78	317.89	317.99	318.10	318.20	318.30	318.41	318.51
346	318.62	318.72	318.83	318.93	319.03	319.14	319.24	319.35	319.45	319.56
347	319.66	319.77	319.87	319.97	320.08	320.18	320.29	320.39	320.50	320.60
348	320.70	320.81	320.91	321.02	321.12	321.23	321.33	321.44	321.54	321.64
349	321.75	321.85	321.96	322.06	322.17	322.27	322.38	322.48	322.59	322.69

Attachment 74

ENTHALPY COMPRESSED LIQUID TABLE (800 PSIA)

FW TEMP (°F)	0	1	2	3	4	5	6	7	8	9
350	322.79	322.90	323.00	323.11	323.21	323.32	323.42	323.53	323.63	323.73
351	323.84	323.94	324.05	324.15	324.26	324.36	324.47	324.57	324.68	324.78
352	324.89	324.99	325.09	325.20	325.30	325.41	325.51	325.62	325.72	325.83
353	325.93	326.04	326.14	326.25	326.35	326.45	326.56	326.66	326.77	326.87
354	326.98	327.08	327.19	327.29	327.40	327.50	327.61	327.71	327.82	327.92
355	328.03	328.13	328.24	328.34	328.44	328.55	328.65	328.76	328.86	328.97
356	329.07	329.18	329.28	329.39	329.49	329.60	329.70	329.81	329.91	330.02
357	330.12	330.23	330.33	330.44	330.54	330.65	330.75	330.86	330.96	331.07
358	331.17	331.28	331.38	331.49	331.59	331.70	331.80	331.90	332.01	332.11
359	332.22	332.32	332.43	332.53	332.64	332.74	332.85	332.95	333.06	333.16
360	333.27	333.37	333.48	333.58	333.69	333.79	333.90	334.00	334.11	334.21
361	334.32	334.43	334.53	334.64	334.74	334.85	334.95	335.06	335.16	335.27
362	335.37	335.48	335.58	335.69	335.79	335.90	336.00	336.11	336.21	336.32
363	336.42	336.53	336.63	336.74	336.84	336.95	337.05	337.16	337.26	337.37
364	337.47	337.58	337.68	337.79	337.89	338.00	338.11	338.21	338.32	338.42
365	338.53	338.63	338.74	338.84	338.95	339.05	339.16	339.26	339.37	339.47
366	339.58	339.68	339.79	339.90	340.00	340.11	340.21	340.32	340.42	340.53
367	340.63	340.74	340.84	340.95	341.05	341.16	341.27	341.37	341.48	341.58
368	341.69	341.79	341.90	342.00	342.11	342.21	342.32	342.43	342.53	342.64
369	342.74	342.85	342.95	343.06	343.16	343.27	343.37	343.48	343.59	343.69
370	343.80	343.90	344.01	344.11	344.22	344.32	344.43	344.54	344.64	344.75
371	344.85	344.96	345.06	345.17	345.27	345.38	345.49	345.59	345.70	345.80
372	345.91	346.01	346.12	346.23	346.33	346.44	346.54	346.65	346.75	346.86
373	346.97	347.07	347.18	347.28	347.39	347.49	347.60	347.71	347.81	347.92
374	348.02	348.13	348.23	348.34	348.45	348.55	348.66	348.76	348.87	348.97

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Attachment 74

ENTHALPY COMPRESSED LIQUID TABLE (800 PSIA)

FW TEMP (°F)	0	1	2	3	4	5	6	7	8	9
375	349.08	349.19	349.29	349.40	349.50	349.61	349.72	349.82	349.93	350.03
376	350.14	350.24	350.35	350.46	350.56	350.67	350.77	350.88	350.99	351.09
377	351.20	351.30	351.41	351.52	351.62	351.73	351.83	351.94	352.05	352.15
378	352.26	352.36	352.47	352.58	352.68	352.79	352.89	353.00	353.11	353.21
379	353.32	353.42	353.53	353.64	353.74	353.85	353.95	354.06	354.17	354.27
380	354.38	354.49	354.59	354.70	354.80	354.91	355.02	355.12	355.23	355.33
381	355.44	355.55	355.65	355.76	355.87	355.97	356.08	356.18	356.29	356.40
382	356.50	356.61	356.71	356.82	356.93	357.03	357.14	357.25	357.35	357.46
383	357.57	357.67	357.78	357.88	357.99	358.10	358.20	358.31	358.42	358.52
384	358.63	358.73	358.84	358.95	359.05	359.16	359.27	359.37	359.48	359.59
385	359.69	359.80	359.91	360.01	360.12	360.22	360.33	360.44	360.54	360.65
386	360.76	360.86	360.97	361.08	361.18	361.29	361.40	361.50	361.61	361.72
387	361.82	361.93	362.03	362.14	362.25	362.35	362.46	362.57	362.67	362.78
388	362.89	362.99	363.10	363.21	363.31	363.42	363.53	363.63	363.74	363.85
389	363.95	364.06	364.17	364.27	364.38	364.49	364.59	364.70	364.81	364.91
390	365.02	365.13	365.23	365.34	365.45	365.55	365.66	365.77	365.87	365.98
391	366.09	366.20	366.30	366.41	366.52	366.62	366.73	366.84	366.94	367.05
392	367.16	367.26	367.37	367.48	367.58	367.69	367.80	367.91	368.01	368.12
393	368.23	368.33	368.44	368.55	368.65	368.76	368.87	368.97	369.08	369.19
394	369.30	369.40	369.51	369.62	369.72	369.83	369.94	370.04	370.15	370.26
395	370.37	370.47	370.58	370.69	370.79	370.90	371.01	371.12	371.22	371.33
396	371.44	371.54	371.65	371.76	371.87	371.97	372.08	372.19	372.29	372.40
397	372.51	372.62	372.72	372.83	372.94	373.04	373.15	373.26	373.37	373.47
398	373.58	373.69	373.80	373.90	374.01	374.12	374.22	374.33	374.44	374.55
399	374.65	374.76	374.87	374.98	375.08	375.19	375.30	375.40	375.51	375.62

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Attachment 74

ENTHALPY COMPRESSED LIQUID TABLE (800 PSIA)

FW TEMP (°F)	0	1	2	3	4	5	6	7	8	9
400	375.73	375.83	375.94	376.05	376.16	376.26	376.37	376.48	376.59	376.69
401	376.80	376.91	377.02	377.12	377.23	377.34	377.45	377.55	377.66	377.77
402	377.88	377.98	378.09	378.20	378.31	378.41	378.52	378.63	378.74	378.84
403	378.95	379.06	379.17	379.28	379.38	379.49	379.60	379.71	379.81	379.92
404	380.03	380.14	380.24	380.35	380.46	380.57	380.68	380.78	380.89	381.00
405	381.11	381.21	381.32	381.43	381.54	381.64	381.75	381.86	381.97	382.08
406	382.18	382.29	382.40	382.51	382.62	382.72	382.83	382.94	383.05	383.15
407	383.26	383.37	383.48	383.59	383.69	383.80	383.91	384.02	384.13	384.23
408	384.34	384.45	384.56	384.67	384.77	384.88	384.99	385.10	385.21	385.31
409	385.42	385.53	385.64	385.75	385.85	385.96	386.07	386.18	386.29	386.39
410	386.50	386.61	386.72	386.83	386.94	387.04	387.15	387.26	387.37	387.48
411	387.58	387.69	387.80	387.91	388.02	388.13	388.23	388.34	388.45	388.56
412	388.67	388.78	388.88	388.99	389.10	389.21	389.32	389.43	389.53	389.64
413	389.75	389.86	389.97	390.08	390.18	390.29	390.40	390.51	390.62	390.73
414	390.83	390.94	391.05	391.16	391.27	391.38	391.48	391.59	391.70	391.81
415	391.92	392.03	392.14	392.24	392.35	392.46	392.57	392.68	392.79	392.90
416	393.00	393.11	393.22	393.33	393.44	393.55	393.66	393.76	393.87	393.98
417	394.09	394.20	394.31	394.42	394.53	394.63	394.74	394.85	394.96	395.07
418	395.18	395.29	395.40	395.50	395.61	395.72	395.83	395.94	396.05	396.16
419	396.27	396.37	396.48	396.59	396.70	396.81	396.92	397.03	397.14	397.25
420	397.35	397.46	397.57	397.68	397.79	397.90	398.01	398.12	398.23	398.34
421	398.44	398.55	398.66	398.77	398.88	398.99	399.10	399.21	399.32	399.43
422	399.53	399.64	399.75	399.86	399.97	400.08	400.19	400.30	400.41	400.52
423	400.63	400.73	400.84	400.95	401.06	401.17	401.28	401.39	401.50	401.61
424	401.72	401.83	401.94	402.05	402.15	402.26	402.37	402.48	402.59	402.70

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Attachment 74

ENTHALPY COMPRESSED LIQUID TABLE (800 PSIA)

FW TEMP (°F)	0	1	2	3	4	5	6	7	8	9
425	402.81	402.92	403.03	403.14	403.25	403.36	403.47	403.58	403.69	403.79
426	403.90	404.01	404.12	404.23	404.34	404.45	404.56	404.67	404.78	404.89
427	405.00	405.11	405.22	405.33	405.44	405.55	405.66	405.77	405.88	405.98
428	406.09	406.20	406.31	406.42	406.53	406.64	406.75	406.86	406.97	407.08
429	407.19	407.30	407.41	407.52	407.63	407.74	407.85	407.96	408.07	408.18
430	408.29	408.40	408.51	408.62	408.73	408.84	408.95	409.06	409.17	409.28
431	409.39	409.50	409.61	409.72	409.83	409.94	410.05	410.16	410.27	410.38
432	410.49	410.59	410.70	410.81	410.92	411.03	411.14	411.25	411.36	411.47
433	411.58	411.69	411.81	411.92	412.03	412.14	412.25	412.36	412.47	412.58
434	412.69	412.80	412.91	413.02	413.13	413.24	413.35	413.46	413.57	413.68
435	413.79	413.90	414.01	414.12	414.23	414.34	414.45	414.56	414.67	414.78
436	414.89	415.00	415.11	415.22	415.33	415.44	415.55	415.66	415.77	415.88
437	415.99	416.10	416.21	416.33	416.44	416.55	416.66	416.77	416.88	416.99
438	417.10	417.21	417.32	417.43	417.54	417.65	417.76	417.87	417.98	418.09
439	418.20	418.31	418.43	418.54	418.65	418.76	418.87	418.98	419.09	419.20
440	419.31	419.42	419.53	419.64	419.75	419.86	419.97	420.09	420.20	420.31
441	420.42	420.53	420.64	420.75	420.86	420.97	421.08	421.19	421.30	421.42
442	421.53	421.64	421.75	421.86	421.97	422.08	422.19	422.30	422.41	422.53
443	422.64	422.75	422.86	422.97	423.08	423.19	423.30	423.41	423.52	423.64
444	423.75	423.86	423.97	424.08	424.19	424.30	424.41	424.52	424.64	424.75
445	424.86	424.97	425.08	425.19	425.30	425.41	425.53	425.64	425.75	425.86
446	425.97	426.08	426.19	426.30	426.42	426.53	426.64	426.75	426.86	426.97
447	427.08	427.20	427.31	427.42	427.53	427.64	427.75	427.86	427.98	428.09
448	428.20	428.31	428.42	428.53	428.64	428.76	428.87	428.98	429.09	429.20
449	429.31	429.43	429.54	429.65	429.76	429.87	429.98	430.10	430.21	430.32
450	430.43	430.54	430.65	430.77	430.88	430.99	431.10	431.21	431.33	431.44

Attachment 75

DENSITY COMPRESSED LIQUID TABLE (800 PSIA)

TEMP (°F)	Specific Volume	Density	SQRT Density
300	0.017397785	57.47858	7.5815
301	0.017407461	57.44663	7.5794
302	0.017417172	57.41460	7.5772
303	0.017426920	57.38249	7.5751
304	0.017436703	57.35029	7.5730
305	0.017446522	57.31801	7.5709
306	0.017456378	57.28565	7.5687
307	0.017466270	57.25321	7.5666
308	0.017476198	57.22068	7.5644
309	0.017486163	57.18807	7.5623
310	0.017496165	57.15538	7.5601
311	0.017506204	57.12261	7.5579
312	0.017516280	57.08975	7.5558
313	0.017526393	57.05681	7.5536
314	0.017536543	57.02378	7.5514
315	0.017546732	56.99067	7.5492
316	0.017556957	56.95748	7.5470
317	0.017567221	56.92420	7.5448
318	0.017577523	56.89084	7.5426
319	0.017587863	56.85739	7.5404
320	0.017598242	56.82386	7.5382
321	0.017608659	56.79024	7.5359
322	0.017619115	56.75654	7.5337
323	0.017629610	56.72275	7.5315
324	0.017640144	56.68888	7.5292
325	0.017650718	56.65492	7.5269

Attachment 75
DENSITY COMPRESSED LIQUID TABLE (800 PSIA)

TEMP (°F)	Specific Volume	Density	SQRT Density
326	0.017661331	56.62088	7.5247
327	0.017671983	56.58675	7.5224
328	0.017682675	56.55253	7.5201
329	0.017693408	56.51822	7.5179
330	0.017704180	56.48383	7.5156
331	0.017714994	56.44936	7.5133
332	0.017725847	56.41479	7.5110
333	0.017736742	56.38014	7.5087
334	0.017747677	56.34540	7.5064
335	0.017758654	56.31057	7.5040
336	0.017769672	56.27566	7.5017
337	0.017780732	56.24065	7.4994
338	0.017791834	56.20556	7.4970
339	0.017802978	56.17038	7.4947
340	0.017814164	56.13511	7.4923
341	0.017825392	56.09975	7.4900
342	0.017836663	56.06430	7.4876
343	0.017847977	56.02876	7.4852
344	0.017859334	55.99313	7.4829
345	0.017870735	55.95741	7.4805
346	0.017882179	55.92160	7.4781
347	0.017893667	55.88569	7.4757
348	0.017905199	55.84970	7.4733
349	0.017916775	55.81361	7.4709

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Attachment 75

DENSITY COMPRESSED LIQUID TABLE (800 PSIA)

TEMP (°F)	Specific Volume	Density	SQRT Density
350	0.017928396	55.77744	7.4684
351	0.017940062	55.74117	7.4660
352	0.017951772	55.70481	7.4636
353	0.017963528	55.66835	7.4611
354	0.017975330	55.63180	7.4587
355	0.017987177	55.59516	7.4562
356	0.01799907	55.55843	7.4538
357	0.018011009	55.52160	7.4513
358	0.018022995	55.48467	7.4488
359	0.018035028	55.44766	7.4463
360	0.018047107	55.41054	7.4438
361	0.018059234	55.37333	7.4413
362	0.018071409	55.33603	7.4388
363	0.018083632	55.29863	7.4363
364	0.018095902	55.26113	7.4338
365	0.018108221	55.22354	7.4313
366	0.018120589	55.18584	7.4287
367	0.018133006	55.14805	7.4262
368	0.018145472	55.11017	7.4236
369	0.018157988	55.07218	7.4211
370	0.01870553	55.03410	7.4185
371	0.018183169	54.99592	7.4159
372	0.018195835	54.95763	7.4133
373	0.018208552	54.91925	7.4108
374	0.01822132	54.88077	7.4082
375	0.018234139	54.84218	7.4056

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Attachment 75

DENSITY COMPRESSED LIQUID TABLE (800 PSIA)

TEMP (°F)	Specific Volume	Density	SQRT Density
376	0.018247010	54.80350	7.4029
377	0.018259934	54.76471	7.4003
378	0.018272909	54.72582	7.3977
379	0.018285938	54.68683	7.3951
380	0.018299019	54.64774	7.3924
381	0.018312154	54.60854	7.3898
382	0.018325342	54.56924	7.3871
383	0.018338585	54.52984	7.3844
384	0.018351881	54.49033	7.3818
385	0.018365233	54.45071	7.3791
386	0.018378640	54.41099	7.3764
387	0.018392102	54.37116	7.3737
388	0.018405620	54.33123	7.3710
389	0.018419195	54.29119	7.3683
390	0.018432826	54.25104	7.3655
391	0.018446513	54.21079	7.3628
392	0.018460259	54.17042	7.3601
393	0.018474062	54.12995	7.3573
394	0.018487923	54.08937	7.3545
395	0.018501842	54.04867	7.3518
396	0.018515821	54.00787	7.3490
397	0.018529859	53.96695	7.3462
398	0.018543956	53.92593	7.3434
399	0.018558114	53.88479	7.3406
400	0.018572332	53.84353	7.3378
401	0.018586612	53.80217	7.3350

Attachment 75

DENSITY COMPRESSED LIQUID TABLE (800 PSIA)

TEMP (°F)	Specific Volume	Density	SQRT Density
402	0.018600953	53.76069	7.3322
403	0.018615355	53.71909	7.3293
404	0.018629820	53.67738	7.3265
405	0.018644348	53.63556	7.3236
406	0.018658939	53.59362	7.3208
407	0.018673594	53.55156	7.3179
408	0.018688312	53.50938	7.3150
409	0.018703096	53.46708	7.3121
410	0.018717944	53.42467	7.3092
411	0.018732859	53.38214	7.3063
412	0.018747839	53.33948	7.3034
413	0.018762885	53.29671	7.3005
414	0.018777999	53.25381	7.2975
415	0.018793181	53.21079	7.2946
416	0.018808430	53.16765	7.2916
417	0.018823748	53.12438	7.2886
418	0.018839135	53.08099	7.2857
419	0.018854592	53.03748	7.2827
420	0.018870119	52.99384	7.2797
421	0.018885717	52.95007	7.2767
422	0.018901386	52.90617	7.2737
423	0.018917127	52.86215	7.2706
424	0.018932941	52.81800	7.2676
425	0.018948827	52.77371	7.2646
426	0.018964787	52.72930	7.2615
427	0.018980822	52.68476	7.2584

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Attachment 75

DENSITY COMPRESSED LIQUID TABLE (800 PSIA)

TEMP (°F)	Specific Volume	Density	SQRT Density
428	0.018996931	52.64008	7.2553
429	0.019013116	52.59527	7.2523
430	0.019029376	52.55033	7.2492
431	0.019045713	52.50525	7.2461
432	0.019062128	52.46004	7.2429
433	0.019078621	52.41469	7.2398
434	0.019095192	52.36920	7.2367
435	0.019111842	52.32358	7.2335
436	0.019128572	52.27782	7.2303
437	0.019145383	52.23191	7.2272
438	0.019162275	52.18587	7.2240
439	0.019179250	52.13968	7.2208
440	0.019196307	52.09335	7.2176
441	0.019213447	52.04688	7.2144
442	0.019230672	52.00026	7.2111
443	0.019247981	51.95350	7.2079
444	0.019265376	51.90659	7.2046
445	0.019282858	51.85953	7.2014
446	0.019300426	51.81233	7.1981
447	0.019318083	51.76497	7.1948
448	0.019335829	51.71746	7.1915
449	0.019353664	51.66980	7.1882
450	0.019371589	51.62199	7.1848

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Attachment 76

ENTHALPY THERMODYNAMIC PROPERTIES OF COMPRESSED LIQUID TABLE (2250 PSIA)

ENTHALPHY (BTU/LBM)

TEMP (°F)	0	1	2	3	4	5	6	7	8	9
500	487.51	488.66	489.81	490.97	492.13	493.28	494.44	495.60	496.77	497.93
510	499.10	500.26	501.43	502.60	503.77	504.95	506.12	507.30	508.48	509.65
520	510.84	512.02	513.20	514.39	515.58	516.77	517.96	519.15	520.35	521.55
530	522.75	523.95	525.15	526.35	527.56	528.77	529.98	531.19	532.41	533.63
540	534.84	536.07	537.29	538.51	539.74	540.97	542.20	543.44	544.68	545.92
550	547.16	548.40	549.65	550.90	552.15	553.40	554.66	555.92	557.18	558.44
560	559.71	560.98	562.26	563.53	564.81	566.09	567.38	568.66	569.95	571.25
570	572.55	573.85	575.15	576.46	577.77	579.08	580.40	581.72	583.04	584.37
580	585.70	587.04	588.38	589.72	591.07	592.42	593.77	595.13	596.50	597.87
590	599.24	600.62	602.00	603.38	604.78	606.17	607.57	608.98	610.39	611.81
600	613.23	614.66	616.09	617.53	618.97	620.42	621.88	623.34	624.81	626.29

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Attachment 77

DENSITY THERMODYNAMIC PROPERTIES OF COMPRESSED LIQUID TABLE (400 PSIA)

Letdown Temp (°F)	Specific Volume	Density (lbm/cubic feet)
60	0.016012822	62.45
61	0.016014275	62.44
62	0.016015785	62.44
63	0.016017354	62.43
64	0.016018979	62.43
65	0.016020660	62.42
66	0.016022397	62.41
67	0.016024188	62.41
68	0.016026033	62.40
69	0.016027932	62.39
70	0.016029883	62.38
71	0.016031886	62.38
72	0.016033941	62.37
73	0.016036046	62.36
74	0.016038202	62.35
75	0.016040408	62.34
76	0.016042663	62.33
77	0.016044966	62.32
78	0.016047318	62.32
79	0.016049717	62.31
80	0.016052164	62.30
81	0.016054657	62.29
82	0.016057196	62.28
83	0.016059782	62.27
84	0.016062413	62.26
85	0.016065088	62.25

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Attachment 77

DENSITY THERMODYNAMIC PROPERTIES OF COMPRESSED LIQUID TABLE (400 PSIA)

Letdown Temp (°F)	Specific Volume	Density (lbm/cubic feet)
86	0.016067809	62.24
87	0.016070574	62.23
88	0.016073382	62.21
89	0.016076234	62.20
90	0.016079129	62.19
91	0.016082067	62.18
92	0.016085047	62.17
93	0.016088070	62.16
94	0.016091134	62.15
95	0.016094240	62.13
96	0.016097387	62.12
97	0.016100574	62.11
98	0.016103802	62.10
99	0.016107071	62.08
100	0.016110380	62.07
101	0.016113728	62.06
102	0.016117116	62.05
103	0.016120543	62.03
104	0.016124009	62.02
105	0.016127514	62.01
106	0.016131057	61.99
107	0.016134639	61.98
108	0.016138259	61.96
109	0.016141916	61.95
110	0.016145612	61.94

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Attachment 77

DENSITY THERMODYNAMIC PROPERTIES OF COMPRESSED LIQUID TABLE (400 PSIA)

Letdown Temp (°F)	Specific Volume	Density (lbm/cubic feet)
111	0.016149345	61.92
112	0.016153115	61.91
113	0.016156922	61.89
114	0.016160766	61.88
115	0.016164646	61.86
116	0.016168563	61.85
117	0.016172517	61.83
118	0.016176506	61.82
119	0.016180532	61.80
120	0.016184593	61.79
121	0.016188690	61.77
122	0.016192822	61.76
123	0.016196990	61.74
124	0.016201193	61.72
125	0.016205431	61.71
126	0.016209703	61.69
127	0.016214011	61.68
128	0.016218353	61.66
129	0.016222729	61.64
130	0.016227139	61.63
131	0.016231584	61.61
132	0.016236063	61.59
133	0.016240575	61.57
134	0.016245122	61.56
135	0.016249702	61.54

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Attachment 77

DENSITY THERMODYNAMIC PROPERTIES OF COMPRESSED LIQUID TABLE (400 PSIA)

Letdown Temp (°F)	Specific Volume	Density (lbm/cubic feet)
136	0.016254315	61.52
137	0.016258962	61.50
138	0.016263642	61.49
139	0.016268355	61.47
140	0.016273101	61.45
141	0.016277880	61.43
142	0.016282692	61.41
143	0.016287536	61.40
144	0.016292413	61.38
145	0.016297322	61.36
146	0.016302264	61.34
147	0.016307238	61.32
148	0.016312244	61.30
149	0.016317283	61.28
150	0.016322353	61.27
151	0.016327455	61.25
152	0.016332588	61.23
153	0.016337754	61.21
154	0.016342951	61.19
155	0.016348179	61.17
156	0.016353439	61.15
157	0.016358730	61.13
158	0.016364053	61.11
159	0.016369407	61.09
160	0.016374791	61.07

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Attachment 78

ENTHALPY THERMODYNAMIC PROPERTIES OF COMPRESSED LIQUID TABLE (2500 PSIA)

TEMP (°F)	0	1	2	3	4	5	6	7	8	9
300	274.27	275.29	276.30	277.32	278.34	279.36	280.38	281.40	282.41	283.43
310	284.45	285.47	286.49	287.52	288.54	289.56	290.58	291.60	292.62	293.65
320	294.67	295.69	296.72	297.74	298.76	299.79	300.81	301.84	302.87	303.89
330	304.92	305.95	306.97	308.00	309.03	310.06	311.09	312.11	313.14	314.17
340	315.20	316.23	317.27	318.30	319.33	320.36	321.39	322.43	323.46	324.49
350	325.53	326.56	327.60	328.63	329.67	330.70	331.74	332.78	333.82	334.85
360	335.89	336.93	337.97	339.01	340.05	341.09	342.13	343.17	344.22	345.26
370	346.30	347.34	348.39	349.43	350.48	351.52	352.57	353.61	354.66	355.71
380	356.76	357.80	358.85	359.90	360.95	362.00	363.05	364.11	365.16	366.21
390	367.26	368.32	369.37	370.42	371.48	372.54	373.59	374.65	375.71	376.76
400	377.82	378.88	379.94	381.00	382.06	383.12	384.19	385.25	386.31	387.38
410	388.44	389.50	390.57	391.64	392.70	393.77	394.84	395.91	396.98	398.05
420	399.12	400.19	401.26	402.34	403.41	404.48	405.56	406.64	407.71	408.79
430	409.87	410.95	412.02	413.10	414.19	415.27	416.35	417.43	418.52	419.60
440	420.69	421.77	422.86	423.95	425.03	426.12	427.21	428.31	429.40	430.49
450	431.58	432.68	433.77	434.87	435.97	437.06	438.16	439.26	440.36	441.46
460	442.56	443.67	444.77	445.88	446.98	448.09	449.20	450.31	451.42	452.53
470	453.64	454.75	455.87	456.98	458.10	459.21	460.33	461.45	462.57	463.69
480	464.81	465.94	467.06	468.19	469.31	470.44	471.57	472.70	473.83	474.96
490	476.10	477.23	478.37	479.50	480.64	481.78	482.92	484.06	485.21	486.35
500	487.50	488.65	489.79	490.94	492.10	493.25	494.40	495.56	496.71	497.87
510	499.03	500.19	501.36	502.52	503.69	504.85	506.02	507.19	508.36	509.54
520	510.71	511.89	513.07	514.25	515.43	516.61	517.80	518.98	520.17	521.36
530	522.55	523.75	524.94	526.14	527.34	528.54	529.74	530.95	532.15	533.36
540	534.57	535.78	537.00	538.22	539.43	540.66	541.88	543.10	544.33	545.56
550	546.79	548.03	549.26	550.50	551.74	552.99	554.23	555.48	556.73	557.99

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Attachment 78

ENTHALPY THERMODYNAMIC PROPERTIES OF COMPRESSED LIQUID TABLE (2500 PSIA)

TEMP (°F)	0	1	2	3	4	5	6	7	8	9
560	559.24	560.50	561.76	563.03	564.29	565.56	566.83	568.11	569.39	570.67
570	571.95	573.24	574.53	575.82	577.11	578.41	579.72	581.02	582.33	583.64
580	584.96	586.28	587.60	588.93	590.26	591.59	592.93	594.27	595.61	596.96
590	598.31	599.67	601.03	602.40	603.77	605.14	606.52	607.90	609.29	610.69
600	612.08	613.49	614.89	616.31	617.72	619.15	620.57	622.01	623.45	624.89

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Attachment 79

DENSITY THERMODYNAMIC PROPERTIES OF COMPRESSED LIQUID TABLE (2500 PSIA)

Seal Water Injection and Charging Temp (°F)	Specific Volume	Density (lbm/cubic feet)
60	0.015908506	62.86
61	0.015910173	62.85
62	0.015911891	62.85
63	0.015913660	62.84
64	0.01591548	62.83
65	0.015917349	62.82
66	0.015919267	62.82
67	0.015921234	62.81
68	0.015923248	62.80
69	0.015925309	62.79
70	0.015927417	62.78
71	0.015929571	62.78
72	0.015931770	62.77
73	0.015934015	62.76
74	0.015936304	62.75
75	0.015938637	62.74
76	0.015941014	62.73
77	0.015943435	62.72
78	0.015945898	62.71
79	0.015948403	62.70
80	0.015950951	62.69
81	0.015953540	62.68
82	0.01595617	62.67
83	0.015958842	62.66
84	0.015961553	62.65
85	0.015964305	62.64
86	0.015967097	62.63
87	0.015969928	62.62

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Attachment 79

DENSITY THERMODYNAMIC PROPERTIES OF COMPRESSED LIQUID TABLE (2500 PSIA)

Seal Water Injection and Charging Temp (°F)	Specific Volume	Density (lbm/cubic feet)
88	0.015972799	62.61
89	0.015975708	62.60
90	0.015978657	62.58
91	0.015981643	62.57
92	0.015984667	62.56
93	0.015987730	62.55
94	0.015990829	62.54
95	0.015993966	62.52
96	0.015997140	62.51
97	0.016000351	62.50
98	0.016003598	62.49
99	0.016006882	62.47
100	0.016010202	62.46
101	0.016013557	62.45
102	0.016016949	62.43
103	0.016020375	62.42
104	0.016023837	62.41
105	0.016027334	62.39
106	0.016030866	62.38
107	0.016034433	62.37
108	0.016038034	62.35
109	0.016041670	62.34
110	0.016045339	62.32
111	0.016049043	62.31
112	0.016052781	62.29
113	0.016056552	62.28
114	0.016060357	62.27

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Attachment 79

DENSITY THERMODYNAMIC PROPERTIES OF COMPRESSED LIQUID TABLE (2500 PSIA)

Seal Water Injection and Charging Temp (°F)	Specific Volume	Density (lbm/cubic feet)
115	0.016064195	62.25
116	0.016068067	62.24
117	0.016071971	62.22
118	0.016075909	62.20
119	0.016079879	62.19
120	0.016083882	62.17
121	0.016087918	62.16
122	0.016091986	62.14
123	0.016096086	62.13
124	0.016100218	62.11
125	0.016104383	62.09
126	0.016108579	62.08
127	0.016112807	62.06
128	0.016117067	62.05
129	0.016121359	62.03
130	0.016125681	62.01
131	0.016130036	62.00
132	0.016134421	61.98
133	0.016138837	61.96
134	0.016143285	61.95
135	0.016147763	61.93
136	0.016152273	61.91
137	0.016156813	61.89
138	0.016161383	61.88
139	0.016165984	61.86
140	0.016170615	61.84
141	0.016175277	61.82

Attachment 79

DENSITY THERMODYNAMIC PROPERTIES OF COMPRESSED LIQUID TABLE (2500 PSIA)

Seal Water Injection and Charging Temp (°F)	Specific Volume	Density (lbm/cubic feet)
142	0.016179969	61.80
143	0.016184691	61.79
144	0.016189443	61.77
145	0.016194225	61.75
146	0.016199037	61.73
147	0.016203878	61.71
148	0.016208749	61.70
149	0.016213650	61.68
150	0.016218581	61.66
151	0.016223540	61.64
152	0.016228529	61.62
153	0.016233548	61.60
154	0.016238595	61.58
155	0.016243672	61.56
156	0.016248778	61.54
157	0.016253912	61.52
158	0.016259076	61.50
159	0.016264268	61.48
160	0.016269489	61.46

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Attachment 80

ENTHALPY SEAL WATER INJECTION TABLE (2500 PSIA)

TEMP (°F)	0	1	2	3	4	5	6	7	8	9
60	35.08	36.07	37.06	38.04	39.03	40.02	41.00	41.99	42.97	43.96
70	44.95	45.93	46.92	47.91	48.89	49.88	50.87	51.85	52.84	53.83
80	54.82	55.80	56.79	57.78	58.76	59.75	60.74	61.73	62.71	63.70
90	64.69	65.68	66.66	67.65	68.64	69.63	70.62	71.60	72.59	73.58
100	74.57	75.56	76.54	77.53	78.52	79.51	80.50	81.49	82.48	83.46
110	84.45	85.44	86.43	87.42	88.41	89.40	90.39	91.38	92.36	93.35
120	94.34	95.33	96.32	97.31	98.30	99.29	100.28	101.27	102.26	103.25
130	104.24	105.23	106.22	107.21	108.20	109.19	110.18	111.17	112.16	113.15
140	114.14	115.13	116.13	117.12	118.11	119.10	120.09	121.08	122.07	123.06
150	124.05	125.05	126.04	127.03	128.02	129.01	130.00	131.00	131.99	132.98
160	133.97	134.97	135.96	136.95	137.94	138.94	139.93	140.92	141.91	142.91

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Attachment 81

DIESEL DRIVEN FIRE PUMP FUEL OIL TANK LEVEL

	INCHES	GALLONS
	51.0	347
	50.5	345
	50.0	342
	49.5	340
	49.0	337
	48.5	334
	48.0	331
	47.5	328
MAX FILL	47.0	325
	46.5	322
	46.0	319
	45.5	315
	45.0	312
	44.5	309
	44.0	305
	43.5	301
	43.0	298
	42.5	294
	42.0	291
	41.5	287
	41.0	283
	40.5	279
	40.0	276

INCHES	GALLONS
39.5	272
39.0	268
38.5	265
38.0	261
37.5	257
37.0	253
36.5	250
36.0	246
35.5	242
35.0	239
34.5	235
34.0	231
33.5	227
33.0	224
32.5	220
32.0	216
31.5	213
31.0	209
30.5	205
30.0	201
29.5	198
29.0	194
28.5	190

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Attachment 82

EDG NO. 1 AND EDG NO. 3 AUXILIARY FUEL OIL TANK LEVEL

HEIGHT OF FUEL IN INCHES	TOTAL GALLONS OF FUEL	USABLE GALLONS OF FUEL
0.00	0.0	0.0
0.25	0.4	0.0
0.50	1.1	0.0
0.75	2.1	0.0
1.00	3.2	0.0
1.25	4.5	0.0
1.50	5.9	0.0
1.75	7.4	1.5
2.00	9.0	3.1
2.25	10.7	4.9
2.50	12.5	6.7
2.75	14.4	8.6
3.00	16.5	10.6
3.25	18.6	12.7
3.50	20.7	14.8
3.75	23.0	17.1
4.00	25.3	19.4
4.25	27.6	21.8
4.50	30.0	24.2
4.75	32.6	26.7
5.00	35.2	29.3
5.25	37.8	32.0
5.50	40.5	34.7
5.75	43.3	37.4
6.00	46.1	40.2
6.25	48.9	43.1

Attachment 82

EDG NO. 1 AND EDG NO. 3 AUXILIARY FUEL OIL TANK LEVEL

HEIGHT OF FUEL IN INCHES	TOTAL GALLONS OF FUEL	USABLE GALLONS OF FUEL
6.50	51.9	46.0
6.75	54.9	49.0
7.00	57.9	52.1
7.25	61.0	55.1
7.50	64.0	58.1
7.75	67.1	61.2
8.00	70.3	64.5
8.25	73.6	67.7
8.50	74.9	69.0
8.75	80.3	74.4
9.00	83.7	77.8
9.25	87.1	81.3
9.50	90.6	84.7
9.75	93.9	88.0
10.00	97.4	91.5
10.25	100.9	95.0
10.50	105.1	99.2
10.75	108.7	102.8
11.00	112.4	106.5
11.25	116.1	110.3
11.50	119.9	114.0
11.75	123.6	117.8
12.00	127.4	121.5
12.25	131.3	125.4
12.50	135.1	129.2

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Attachment 82

EDG NO. 1 AND EDG NO. 3 AUXILIARY FUEL OIL TANK LEVEL

HEIGHT OF FUEL IN INCHES	TOTAL GALLONS OF FUEL	USABLE GALLONS OF FUEL
12.75	138.9	133.1
13.00	142.7	136.9
13.25	146.6	140.7
13.50	150.5	144.6
13.75	154.3	148.5
14.00	158.2	152.4
14.25	162.2	156.3
14.50	166.2	160.3
14.75	170.3	164.4
15.00	174.2	168.4
15.25	178.2	172.4
15.50	182.3	176.4
15.75	186.3	180.4
16.00	190.5	184.7
16.25	194.7	188.8
16.50	198.8	193.0
16.75	202.9	197.0
17.00	207.0	201.1
17.25	211.1	205.3
17.50	215.3	209.5
17.75	219.5	213.6
18.00	223.7	217.9
18.25	227.9	222.1
18.50	232.1	226.3
18.75	236.3	230.4

Attachment 82

EDG NO. 1 AND EDG NO. 3 AUXILIARY FUEL OIL TANK LEVEL

HEIGHT OF FUEL IN INCHES	TOTAL GALLONS OF FUEL	USABLE GALLONS OF FUEL
19.00	240.5	234.6
19.25	244.7	238.8
19.50	248.8	243.0
19.75	251.9	246.0
20.00	257.3	251.5
20.25	261.6	255.7
20.50	265.9	260.0
20.75	270.8	264.9
21.00	275.1	269.2
21.25	279.4	273.5
21.50	283.6	277.8
21.75	287.9	282.0
22.00	292.1	286.2
22.25	296.3	290.4
22.50	300.5	294.6
22.75	304.7	298.8
23.00	308.8	303.0
23.25	313.0	307.2
23.50	317.2	311.3
23.75	321.4	315.6
24.00	325.6	319.8
24.25	329.8	323.9
24.50	334.0	328.1
24.75	338.1	332.2
25.00	342.2	336.3

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Attachment 82

EDG NO. 1 AND EDG NO. 3 AUXILIARY FUEL OIL TANK LEVEL

HEIGHT OF FUEL IN INCHES	TOTAL GALLONS OF FUEL	USABLE GALLONS OF FUEL
25.25	346.3	340.4
25.50	350.4	344.5
25.75	354.6	348.7
26.00	358.7	352.8
26.25	362.8	356.9
26.50	366.9	361.0
26.75	370.7	364.9
27.00	374.7	368.8
27.25	378.7	372.8
27.50	382.8	376.9
27.75	386.7	380.9
28.00	390.6	384.7
28.25	394.4	388.5
28.50	398.3	392.4
28.75	402.1	396.2
29.00	405.9	400.1
29.25	409.7	403.9
29.50	413.5	407.7
29.75	417.3	411.4
30.00	421.2	415.3
30.25	425.0	419.1
30.50	428.6	422.7
30.75	432.3	426.5
31.00	436.0	430.1
31.25	440.1	434.2

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Attachment 82

EDG NO. 1 AND EDG NO. 3 AUXILIARY FUEL OIL TANK LEVEL

HEIGHT OF FUEL IN INCHES	TOTAL GALLONS OF FUEL	USABLE GALLONS OF FUEL
31.50	443.7	437.8
31.75	447.2	441.3
32.00	450.6	444.7
32.25	454.0	448.1
32.50	457.3	451.5
32.75	460.7	454.8
33.00	464.1	458.3
33.25	467.4	461.6
33.50	470.7	464.9
33.75	474.0	468.1
34.00	480.1	474.3
34.25	483.1	477.3
34.50	486.1	480.2
34.75	489.0	483.1
35.00	491.0	485.1
35.25	494.9	489.0
35.50	497.8	491.9
35.75	500.5	494.7
36.00	503.3	497.4
36.25	505.9	500.0
36.50	508.5	502.6
36.75	508.6	502.7
37.00	511.1	505.3
37.25	513.6	507.7
37.50	516.0	510.1

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Attachment 82

EDG NO. 1 AND EDG NO. 3 AUXILIARY FUEL OIL TANK LEVEL

HEIGHT OF FUEL IN INCHES	TOTAL GALLONS OF FUEL	USABLE GALLONS OF FUEL
37.75	518.3	512.4
38.00	520.5	514.7
38.25	522.7	516.8
38.50	524.8	518.9
38.75	526.8	520.9
39.00	528.7	522.9
39.25	530.6	524.7
39.50	532.3	526.4
39.75	533.9	528.1
40.00	535.5	529.6
40.25	536.9	531.0
40.50	538.2	532.3
40.75	539.2	533.4
41.00	540.3	534.5
41.25	541.0	535.1
41.50	541.6	535.7

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Attachment 83

EDG NO. 1 AND EDG NO. 3 BASE FUEL OIL TANK LEVEL

HEIGHT OF FUEL IN INCHES	TOTAL GALLONS OF FUEL	USABLE GALLONS OF FUEL
0.000	0.000	0.000
0.250	7.212	0.000
0.500	14.424	0.000
0.750	21.636	0.000
1.000	28.848	0.000
1.250	36.061	0.000
1.500	43.273	0.000
1.750	50.485	7.212
2.000	57.697	14.424
2.250	64.909	21.636
2.500	72.121	28.848
2.750	79.333	36.060
3.000	86.545	43.272
3.250	93.758	50.485
3.500	100.970	57.697
3.750	108.182	64.909
4.000	115.394	71.121
4.250	122.606	79.333
4.500	129.818	86.545
4.750	137.030	93.757
5.000	144.242	100.969
5.250	151.455	108.182
5.500	158.667	115.394
5.750	165.879	122.606
6.000	173.091	129.818
6.250	180.303	137.030
6.500	187.515	144.242
6.750	194.727	151.454
7.000	201.939	158.666

(Page 2 of 3)

Attachment 83

EDG NO. 1 AND EDG NO. 3 BASE FUEL OIL TANK LEVEL

HEIGHT OF FUEL IN INCHES	TOTAL GALLONS OF FUEL	USABLE GALLONS OF FUEL
7.250	209.152	165.879
7.500	216.364	173.091
7.750	223.576	180.303
8.000	230.788	187.515
8.250	238.000	194.727
8.500	245.212	201.939
8.750	252.424	209.151
9.000	259.636	216.363
9.250	266.848	223.575
9.500	274.061	230.788
9.750	281.273	238.000
10.000	288.485	245.212
10.250	295.697	252.424
10.500	302.909	259.636
10.750	310.121	266.848
11.000	317.333	274.060
11.250	324.545	281.272
11.500	331.758	288.485
11.750	338.970	295.697
12.000	346.182	302.909
12.250	353.394	310.121
12.500	360.606	317.333
12.750	367.818	324.545
13.000	375.030	331.757
13.250	382.242	338.969
13.500	389.455	346.182
13.750	396.667	353.394
14.000	403.879	360.606

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Attachment 83

EDG NO. 1 AND EDG NO. 3 BASE FUEL OIL TANK LEVEL

HEIGHT OF FUEL IN INCHES	TOTAL GALLONS OF FUEL	USABLE GALLONS OF FUEL
14.250	411.091	367.818
14.500	418.303	375.030
14.750	425.515	382.242
15.000	432.727	389.454
15.250	439.939	396.666
15.500	447.152	403.879
15.750	454.364	411.091
16.000	461.576	418.303
16.250	468.788	425.515
16.500	476.000	432.727
16.750	483.212	439.939
17.000	490.424	447.151
17.250	497.636	454.363
17.500	504.848	461.575
17.750	512.061	468.788
18.000	519.273	476.000
18.250	526.485	483.212
18.500	533.697	490.424
18.750	540.909	497.636
19.000	548.121	504.848
19.063	549.924	506.651

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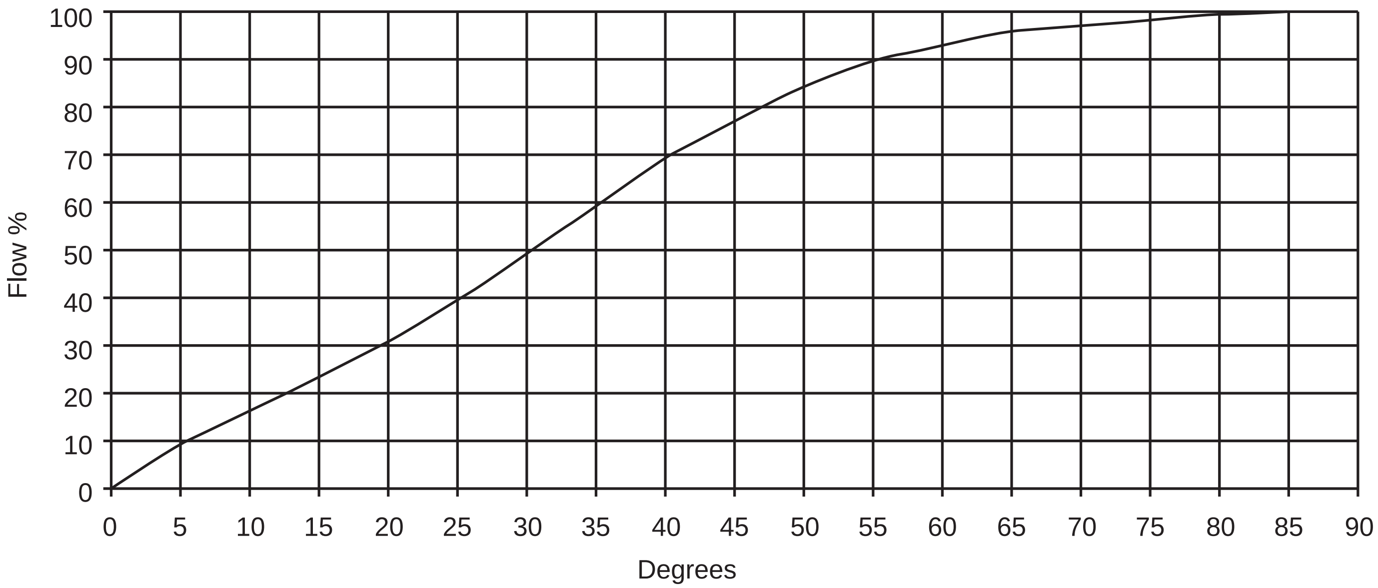
Attachment 84

MAIN CONDENSER

Circ Flowrate Vs. Valve Opening



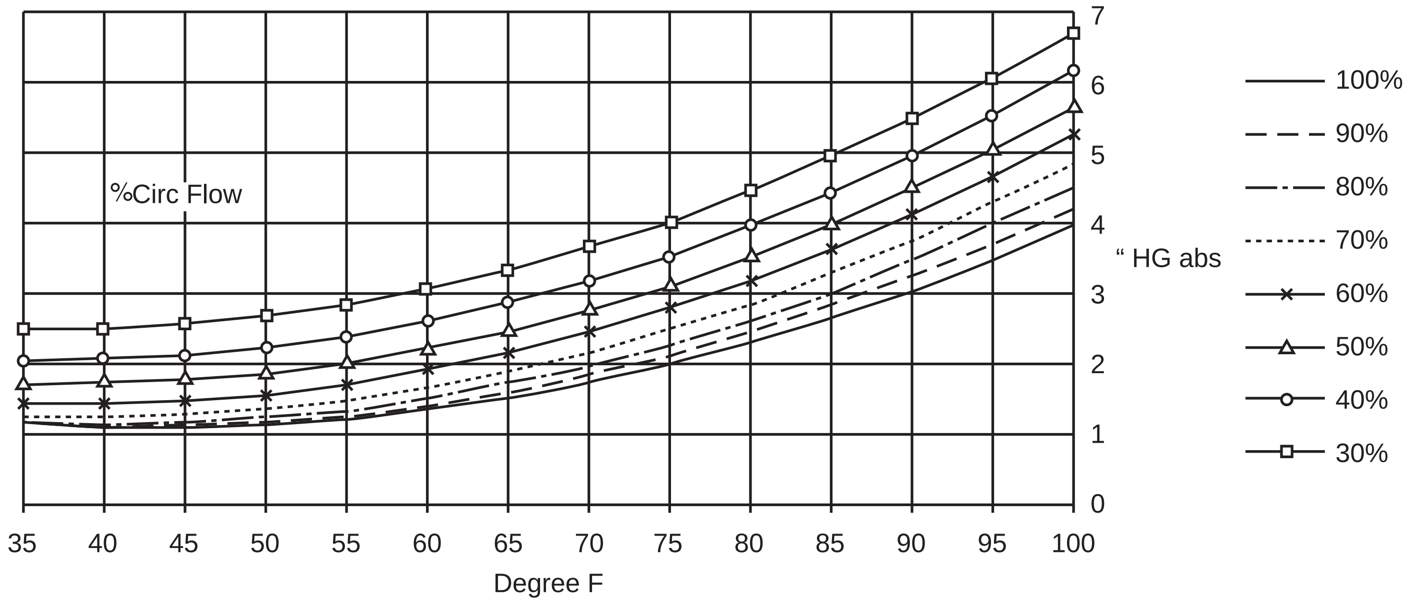
Graphics No: LD2502

(Page 2 of 3)

Attachment 84

MAIN CONDENSER

Expected Cond Press Vs. Circ Inlet Temp



Graphics No: LD2503

(Page 3 of 3)

Attachment 84

MAIN CONDENSER

NOTE:

1. From the local positions indicators for the four (4) Main Condenser Circulating Water Outlet Valves, determine the average degrees open.
2. From Page 1 of 3 of this attachment, determine the percent circulating water flow based on the average degrees open.
3. From Page 2 of 3 of this attachment, determine the expected Main Condenser pressure in inches of HG absolute based on circulating water inlet temperature (river water temperature) and the percent circulating water flow.
4. Convert Main Condenser absolute pressure to gauge pressure to compare with control board indications as follows:

- Pressure (inches HG vacuum) = 29.92 inches HG - inches HG absolute

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Attachment 85

RCS INVENTORY VS PLANT ELEVATION

PERCENT PRESSURIZER LEVEL	PLANT ELEVATION (FEET)	RCS INVENTORY 3 LOOPS ISOLATED (GALLONS)
100	58.2	40788
95	56.6	40346
90	55.1	39905
85	53.6	39463
80	52.0	39022
75	50.5	38580
70	49.0	38139
65	47.4	37697
60	45.9	37256
55	44.4	36815
50	42.8	36373
45	41.3	35932
40	39.8	35490
35	38.2	35049
30	36.7	34607
25	35.2	34166
20	33.6	33724
15	32.1	33283
10	30.6	32841
5	29.0	32400
0	27.5	31959

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Attachment 85

RCS INVENTORY VS PLANT ELEVATION

DESCRIPTION OF SIGNIFICANT RCS LEVELS	PLANT ELEVATION (FEET)	RCS INVENTORY 3 LOOPS ISOLATED (GALLONS)
	27.4	31930
	27.3	31901
	27.2	31873
	27.1	31845
	27.0	31818
	26.9	31791
	26.8	31765
	26.7	31739
	26.6	31714
	26.5	31689
	26.4	31666
	26.3	31643
	26.2	31620
	26.1	31599
	26.0	31578
	25.9	31559
	25.8	31540
	25.7	31523
	25.6	31506
	25.5	31491
	25.4	31477
	25.3	31464
	25.2	31452
	25.1	31442

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Attachment 85

RCS INVENTORY VS PLANT ELEVATION

DESCRIPTION OF SIGNIFICANT RCS LEVELS	PLANT ELEVATION (FEET)	RCS INVENTORY 3 LOOPS ISOLATED (GALLONS)
	25.0	31433
	24.9	31425
	24.8	31419
	24.7	31414
	24.6	31411
TOP RX VESSEL	24.5	31410
PRZR SURGE LINE	24.4	31408
	24.3	31405
	24.2	31400
	24.1	31393
	24.0	31385
	23.9	31379
	23.8	31371
	23.7	31360
	23.6	31346
	23.5	31330
	23.4	31310
	23.3	31289
	23.2	31264
	23.1	31238
	23.0	31209
	22.9	31177
	22.8	31143

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Attachment 85

RCS INVENTORY VS PLANT ELEVATION

DESCRIPTION OF SIGNIFICANT RCS LEVELS	PLANT ELEVATION (FEET)	RCS INVENTORY 3 LOOPS ISOLATED (GALLONS)
	22.7	31107
	22.6	31068
	22.5	31028
	22.4	30985
	22.3	30940
	22.2	30893
	22.1	30844
	22.0	30793
	21.9	30740
	21.8	30685
	21.7	30628
	21.6	30570
	21.5	30510
	21.4	30448
	21.3	30385
	21.2	30320
	21.1	30253
	21.0	30184
	20.9	30115
	20.8	30044
	20.7	29972
	20.6	29898
	20.5	29823

Attachment 85

RCS INVENTORY VS PLANT ELEVATION

DESCRIPTION OF SIGNIFICANT RCS LEVELS	PLANT ELEVATION (FEET)	RCS INVENTORY 3 LOOPS ISOLATED (GALLONS)
	20.4	29818
	20.3	29814
	20.2	29743
	20.1	29670
	20.0	29597
	19.9	29523
	19.8	29448
	19.7	29373
	19.6	29297
	19.5	29220
	19.4	29142
	19.3	29064
	19.2	28986
	19.1	28907
	19.0	28828
	18.9	28748
	18.8	28668
	18.7	28588
	18.6	28498
	18.5	28408
	18.4	28318
	18.3	28229
	18.2	28139

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Attachment 85

RCS INVENTORY VS PLANT ELEVATION

DESCRIPTION OF SIGNIFICANT RCS LEVELS	PLANT ELEVATION (FEET)	RCS INVENTORY 3 LOOPS ISOLATED (GALLONS)
	18.1	28049
	18.0	27959
	17.9	27870
	17.8	27780
	17.7	27690
	17.6	27600
	17.5	27510
	17.4	27421
	17.3	27331
	17.2	27241
	17.1	27151
	17.0	27062
	16.9	26972
	16.8	26882
	16.7	26791
	16.6	26701
	16.5	26611
	16.4	26521
	16.3	26431
	16.2	26341
	16.1	26250
	16.0	26160
	15.9	26070

Attachment 85

RCS INVENTORY VS PLANT ELEVATION

DESCRIPTION OF SIGNIFICANT RCS LEVELS	PLANT ELEVATION (FEET)	RCS INVENTORY 3 LOOPS ISOLATED (GALLONS)
	15.8	25980
Reduced Inventory	15.7	25890
	15.6	25800
	15.5	25709
	15.4	25619
	15.3	25529
	15.2	25439
	15.1	25349
	15.0	25259
	14.9	25168
	14.8	25078
	14.7	24988
	14.6	24898
	14.5	24808
	14.4	24717
	14.3	24627
	14.2	24537
	14.1	24447
	14.0	24357
	13.9	24267
	13.8	24176
	13.7	24086
	13.6	23996

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Attachment 85

RCS INVENTORY VS PLANT ELEVATION

DESCRIPTION OF SIGNIFICANT RCS LEVELS	PLANT ELEVATION (FEET)	RCS INVENTORY 3 LOOPS ISOLATED (GALLONS)
TOP CL NOZZLE	13.5	23906
	13.4	23816
	13.3	23726
	13.2	23635
	13.1	23545
TOP HOT LEG	13.0	23455
TOP COLD LEG	12.9	23329
	12.8	23157
	12.7	22946
ADMIN. LIMIT	**12.6**	**22716**
	12.5	22470
	12.4	22211
	12.3	21930
	12.2	21630
	12.1	21319
	12.0	21001
	11.9	20677
	11.8	20352
	11.7	20020
	11.6	19699
	11.5	19385
BOT SURGE LINE	11.4	19086
	11.3	18804

Attachment 85

RCS INVENTORY VS PLANT ELEVATION

DESCRIPTION OF SIGNIFICANT RCS LEVELS	PLANT ELEVATION (FEET)	RCS INVENTORY 3 LOOPS ISOLATED (GALLONS)
	11.2	18530
	11.1	18265
	11.0	18012
	10.9	17774
	10.8	17555
BOT COLD LEG	10.7	17361
BOT HOT LEG	10.6	17214

U.S. Nuclear Regulatory Commission
Surry Power Station

SR10301
Administrative Job Performance Measure 2.1.23

Applicant________________________________ Start Time___________________

Examiner_______________________________

Date ___________________________________ Stop Time___________________

Title

COMPLETE 1-OPT-RC-10.0, REACTOR COOLANT LEAKAGE – COMPUTER CALCULATED

K/A: G2.1.23 – Ability to perform specific system and integrated plant procedure during all modes of plant operation. (4.3/4.4)

Applicability	**Est Completion Time**	**Actual Time**
RO	30 Minutes	___________

Initial Conditions

- Task is to be PERFORMED in the SIMULATOR or CLASSROOM.
- Performance of 1-OPT-RC-10.0, Reactor Coolant Leakage – Computer Calculated, is required.

Standards

- Completes the remaining portions of 1-OPT-RC-10.0, Reactor Coolant Leakage – Computer Calculated, and determines that the procedure was unsatisfactory.

Initiating Cues

- Given simulated plant conditions, perform the remainder of 1-OPT-RC-10.0, Reactor Coolant Leakage – Computer Calculated, and submitted the procedure for review by the Unit Supervisor.

Initial Conditions

- It is mid-shift on May 22, 2010. Unit 1 power is 100 percent.
- I am the Nuclear Shift Manager. I have assigned you to complete the normal daily 1-OPT-RC-10.0, Reactor Coolant Leakage – Computer Calculated. The procedure is complete up through Step 6.2.11 and the computer generated leak rate data sheet has just been printed out, the leak rate ran for 125 minutes. You are to complete 1-OPT-RC-10.0, Reactor Coolant Leakage – Computer Calculated in its entirety and when done turn the procedure in for review.

- The following are the Unit conditions:
  - Reactor power: 100%
  - Charging flow control is in automatic.
  - One PDTT pump was placed in automatic after the PCS computer leak rate program results were printed.
  - Containment Sump Data:
    - Initial containment sump level was 47% as indicated on 1-DA-LI-100 (CTMT SUMP LEVEL).
    - Final containment sump level was 62% as indicated on 1-DA-LI-100 (CTMT SUMP LEVEL).
    - Containment Sump leak rate elapsed time – 60 minutes.
    - After this data was recorded, one containment sump pump was placed back in automatic

  Primary to Secondary Leakage exists and is known and has been indicating in the 15 – 25 gpd range per steam generator for the past week. Today the N-16 monitors are slightly elevated and indicate the following:
  SG A: 24.4 gpd
  SG B: 22.1 gpd
  SG C: 25.6 gpd

  The Leakrate spreadsheet is located at folder S:\SURRY PWR STA\3\Ops\Leakrate on the desktop of your laptop computer.

- Here is a partially completed copy of 1-OPT-RC-10.0, Reactor Coolant Leakage – Computer Calculated. I need you to complete 1-OPT-RC-10.0, Reactor Coolant Leakage – Computer Calculated it is entirety and when done turn the procedure in for review.

- When you are ready to have your work reviewed, please inform me, as this will end the JPM.

Terminating Cues

- 1-OPT-RC-10.0 has been completed and is ready to be reviewed.

Procedures

- 1-OPT-RC-10.0, Reactor Coolant Leakage – Computer Calculated (Revision 33)

Tools and Equipment

- Calculator
- RCS Leakrate Spreadsheet
- Large Stapler

Safety Considerations

- None

Notes

Performance Checklist

Notes to the Evaluator.

- Task critical elements are bolded and noted by the words "Critical Step" at the end of the step.
- **START TIME:**

STEP 1: 3.0 INITIAL CONDITIONS Notes prior to Step 3.1 • Reactor Coolant System (RCS) temperature and pressure stability for the purposes of this procedure shall be determined by Shift Supervision. • An RCS water inventory balance must be performed once every 24 hours. Surveillance requirement specified time intervals may be adjusted plus or minus 25% to accommodate normal test schedules. • If required RCS pressure conditions cannot be met, 1-OPT-RC-10.01, Reactor Coolant Leakage – Manually Calculated, must be performed. 3.1 Verify that the Reactor Coolant System is being maintained at stable temperature and pressure. 3.2 Verify that Reactor Coolant System Pressure is greater than 2100 psig and less than 2500 psig. **STANDARD:** (a) Acknowledges/Reviews the Initial Conditions. **EVALUATOR'S NOTE:** • None **COMMENTS:**	_______ **SAT** _______ **UNSAT**

STEP 2:

_______ **SAT**

_______ **UNSAT**

4.0 PRECAUTIONS AND LIMITATIONS

4.1 The RCS leak rate program on the PCS plant computer will halt if VCT level increases by 2.0%, if PDTT level decreases by 1.0%, or if PRZR level changes (increases or decreases) by 2.0% during the performance of the program.

4.2 Routine daily leak rate determinations should be performed over a minimum time period of two hours, when a computer calculation of the RCS leak rate is performed.

4.3 Reactor Coolant System sampling should **not** take place during the performance of this procedure.

4.4 RCS temperature and pressure should be maintained as stable as possible when a RCS leak rate calculation is being performed during a pause in a Reactor Coolant System (RCS) heat up or cool down.

4.5 A leak rate based on an RCS water inventory balance is required once every 24 hours, but is not required to be completed until 12 hours after establishment of steady state operation. (stable pressure, temperature, power level, Pressurizer and makeup tank levels, makeup and letdown, and RCP seal injection and return flow) Refer to Tech Spec 4.13, SR 4.13.A.

4.6 The initials identification block in Subsection 7.3 must be completed before this procedure is closed out.

4.7 If any one data point from the leakrate printout or the final leakrate results are marked with POOR or BAD, or has any reason code, (for example, L, H, or S) the leakrate should be considered unreliable.

4.8 The RCS leak rate calculation should not be performed until 10 minutes have passed following pumping the PDTT.

4.9 The RCS must be maintained at steady state during the performance of the leak rate. Steady state is defined as:

- Power change less than one percent of rated Thermal Power
- RCS temperature change less than 2°F
- RCS pressure change less than 5 psig
- No change in letdown or makeup systems
- PRZR level change less than 2%
- No RCP standpipe fills

4.10 Any evolution that changes level in the PDTT (for example, draining the PRT, making up to the RCP Vapor Seal Tank, or cycling of the Gas Stripper) may negate the validity of this OPT.

STANDARD:

(a) Acknowledges/Reviews the Precautions and Limitations.

EVALUATOR'S NOTE:

- None

COMMENTS:

STEP 3:

_______ **SAT**

_______ **UNSAT**

Reviews completed procedure Section 6.1 and procedure Section 6.12 up to Step 6.2.12.

STANDARD:

(a) Acknowledges procedure status up to Step 6.2.12.

EVALUATOR'S NOTE:

- None

COMMENTS:

STEP 4:

_______ **SAT**

_______ **UNSAT**

Step 6.2.12:

6.2.12 Evaluate unidentified RCS leak rate result and perform the actions indicated in the table below. Enter N/A for the condition that does not exist, or if the unidentified RCS leak rate is positive

Evaluation of RCS Leakrate

Unidentified RCS Leakrate:	**Actions to be taken:**	**Initials**
With a negative Unidentified leakrate greater than -0.08 gpm	a. REPEAT steps 6.2.7 through 6.2.12 to obtain valid unidentified RCS Leak Rate Calculation. b. IF a valid Unidentified RCS Leak Rate calculation cannot be obtained, THEN perform a manual leak rate IAW 1-OPT-RC-10.0	_________ _________
With a negative Unidentified leakrate less than or equal to -0.08 gpm	a. Enter zero for unidentified RCS leak rate. b. Adjust total leak rate fto equal to the identified leak rate. c. Make a comment in the Operator Comments in Subsection 7.3.	_________ _________ _________

STANDARD:

(a) Marks the Initial Column Lines as "N/A".

EVALUATOR'S NOTE:

- None.

COMMENTS:

STEP 5:

Step 6.2.13

6.2.13 Record the Total, Unidentified, and Identified RCS leak rates (gpm) in Attachment 1. Use results from Step 6.2.12 if performed, otherwise use computer printout results.

STANDARD:

(a) Proceeds to Attachment 1 to record data from RCS Leak Rate Printout.

EVALUATOR'S NOTE:

Summary of Reactor Coolant Leak Rate Test Results

RCS Leak Rate Data	Identified leakage from the LAST (most recent previously calculated leak rate data) performance of 1-OPT-RC-10.0 or 1-OPT-RC-10.1, as appropriate	Current values:	
Total OTHER Identified Leakage:	0 (gpm)	0 (gpm)	
Total Unidentified RCS Leak Rate:		0.13 (gpm)	
Identified RCS Leak Rate:		0.15 (gpm)	
Total RCS Leak Rate:		0.28 (gpm)	

COMMENTS:

_______ **SAT**

_______ **UNSAT**

STEP 6: Step 6.2.14 6.2.14 Print and attach the PCS computer printout leak rate program results to this procedure as a permanent record of the derivation of the RCS Leak rates recorded in Step 6.2.13. **STANDARD:** (a) Acknowledges and signs this Step. **EVALUATOR'S NOTE:** • None **COMMENTS:**	_______ **SAT** _______ **UNSAT**
STEP 7: Step 6.2.15 6.2.15 Verify one PDTT pump is in AUTO. **STANDARD:** (a) Recalls from initial conditions that one PDTT pump is in Automatic. **EVALUATOR'S NOTE:** • None **COMMENTS:**	_______ **SAT** _______ **UNSAT**

STEP 8:

_______ **SAT**

_______ **UNSAT**

Step 6.2.16

6.2.16 IF charging flow control was placed in Manual in Step 6.2.4, THEN do the following. Otherwise, enter N/A.

a. Verify or adjust CHG flow to maintain PRZR level at programmed setpoint.

b. Place 1-CH-FCV-1122, CHG FLOW CNTRL, in Auto.

STANDARD:

(a) Recalls from initial conditions that charging flow control is in Automatic and marks this step as N/A.

EVALUATOR'S NOTE:

- Candidate will proceed to Section 6.3.

COMMENTS:

STEP 9:

_______ **SAT**

_______ **UNSAT**

Reviews procedure Section 6.3 up to Step 6.3.2.

STANDARD:

(a) Acknowledges procedure status up to Step 6.3.2 and that these steps have been signed off as completed.

EVALUATOR'S NOTE:

- None

COMMENTS:

STEP 10:

_______ **SAT**

_______ **UNSAT**

Step 6.3.3

6.3.3 Record the required initial data for calculating the Containment Sump in-leakage rate (Attachment 4, Table 1 – Containment Sump In Leakage Rate, Column 3).

STANDARD:

(a) Recalls from initial conditions that initial containment sump level was 47%.
(b) Records initial containment sump level in Attachment 4.

EVALUATOR'S NOTE:

Table 1 – Containment Sump In Leakage Rate

Parameter being analyzed	Column 2	Column 3	
	Final Value of Parameter at END of Time	Initial Value of Parameter at START of Time	** Change in Parameter (+ or -) (final value – initial value)
Elapsed Time	65 minutes ago	125 minutes ago	60 (Minutes)
CTMT Sump Level instrument used: 1-DA-LI-100, 1-DA-LI-110A, or 1-DA-LI-110B	Circle instrument used 1-DA-LI-100, 1-DA-LI-110A, or 1-DA-LI-110B	Circle instrument used [✓ 1-DA-LI-100,] 1-DA-LI-110A, or 1-DA-LI-110B	N/A
CTMT Sump Level	(% or IN)	47 (% or IN)	N/A
CTMT Sump Volume from curve in 1-DRP-003	(gallons)	(gallons) 34.6465	(gallons)

Elapsed time will be filled in as an initial condition.
If candidate uses chart to determine containment volume:
Answer: 34.6465 [range 34.6465 – 35 gallons]

If candidate uses graph to determine containment volume:
Answer: 35 gallons [range 34 – 36 gallons]

COMMENTS:

STEP 11:

_______ **SAT**

_______ **UNSAT**

Step 6.3.4

6.3.4 Record the required final data for calculating the Containment Sump in-leakage rate (Attachment 4, Table 1 – Containment Sump In Leakage Rate, Column 2).

STANDARD:

(a) Recalls from initial conditions that final containment sump level was 62%.
(b) Records final containment sump level in Attachment 4.

EVALUATOR'S NOTE:

Table 1 – Containment Sump In Leakage Rate

Parameter being analyzed	Column 2	Column 3	
	Final Value of Parameter at END of Time	Initial Value of Parameter at START of Time	** Change in Parameter (+ or -) (final value – initial value)
Elapsed Time	65 minutes ago	125 minutes ago	60 (Minutes)
CTMT Sump Level instrument used: 1-DA-LI-100, 1-DA-LI-110A, or 1-DA-LI-110B	Circle instrument used [✓ 1-DA-LI-100,] 1-DA-LI-110A, or 1-DA-LI-110B	Circle instrument used [✓ 1-DA-LI-100,] 1-DA-LI-110A, or 1-DA-LI-110B	N/A
CTMT Sump Level	62 (% or IN)	47 (% or IN)	N/A
CTMT Sump Volume from curve in 1-DRP-003	(gallons) 39.439	(gallons) 34.6465	(gallons)

Elapsed time will be filled in as an initial condition.
If candidate uses chart to determine containment volume:
Answer: 39.439 [range 39 – 39.439 gallons]

If candidate uses graph to determine containment volume:
Answer: 39 gallons [range 38 – 40 gallons]

COMMENTS:

STEP 12:

Step 6.3.5

_______ SAT

_______ UNSAT

6.3.5 Calculate the change in parameter from the initial start conditions to the final end conditions and record the elapsed time in Table 2 – Containment Sump In-leakage Rate. (Attachment 4).

STANDARD:

(a) Calculated the difference in containment sump volume. This is a critical step.

(b) Records difference in containment sump level in Attachment 4.

EVALUATOR'S NOTE:

Table 1 – Containment Sump In Leakage Rate

Parameter being analyzed	Column 2	Column 3	
	Final Value of Parameter at END of Time	Initial Value of Parameter at START of Time	** Change in Parameter (+ or -) (final value – initial value)
Elapsed Time	65 minutes ago	125 minutes ago	60 (Minutes)
CTMT Sump Level instrument used: 1-DA-LI-100, 1-DA-LI-110A, or 1-DA-LI-110B	Circle instrument used [✓ 1-DA-LI-100,] 1-DA-LI-110A, or 1-DA-LI-110B	Circle instrument used [✓ 1-DA-LI-100,] 1-DA-LI-110A, or 1-DA-LI-110B	N/A
CTMT Sump Level	62 (% or IN)	47 (% or IN)	N/A
CTMT Sump Volume from curve in 1-DRP-003	(gallons) 39.439	(gallons) 34.6465	(gallons) 4.7925

Elapsed time will be filled in as an initial condition.

If candidate uses chart to determine containment volume:

Answer: 4.7925 [range 4 – 5 gallons]

If candidate uses graph to determine containment volume:

Answer: 4 gallons [range 2 – 6 gallons]

Table 2 – Containment Sump In Leakage rate

Change in Parameter (+/-) (final value – initial value)	Divided by Elapsed Time	Sump In Leakage rate
CTMT Sump Volume Change 4.7925 (gallons)	(minutes) 60	(gpm)

Elapsed time will be filled in as an initial condition.

COMMENTS:

STEP 13:

Step 6.3.6

6.3.6 Calculate the total Containment Sump In Leakage Rate in gallons per minute. (Attachment 4, Table 2 – Containment Sump In Leakage Rate).

STANDARD:

(a) Calculates the containment sump in leakage rate in gallons per minute. This is a critical step.

(b) Records containment sump in leakage rate in Attachment 4.

EVALUATOR'S NOTE:

Table 2 – Containment Sump In Leakage rate

Change in Parameter (+/-) (final value – initial value)	Divided by Elapsed Time	Sump In Leakage rate
CTMT Sump Volume Change 4.7925 (gallons)	(minutes) 60	(gpm) 0.08

If candidate uses chart to determine containment volume:

Answer: 0.0798754 gpm [range 0.06 – 0.083 gpm]

If candidate uses graph to determine containment volume:

Answer: 0.06667 gpm [range 0.03 – 0.1 gallons]

COMMENTS:

_______ **SAT**

_______ **UNSAT**

STEP 14:

Step 6.3.7

6.3.7 Transfer the Containment Sump In Leakage Rate from Attachment 4, Table 2 – Containment Sump In Leakage Rate, to Attachment 1.

_______ **SAT**

_______ **UNSAT**

STANDARD:

(a) Records containment sump in leakage rate on Attachment 1.

EVALUATOR'S NOTE:

Summary of Reactor Coolant Leak Rate Test Results			
RCS Leak Rate Data	Identified leakage from the LAST (most recent previously calculated leak rate data) performance of 1-OPT-RC-10.0 or 1-OPT-RC-10.1, as appropriate	Current values:	
Total OTHER Identified Leakage:	0 (gpm)	0 (gpm)	
Total Unidentified RCS Leak Rate:		0.13 (gpm)	
Identified RCS Leak Rate:		0.15 (gpm)	
Total RCS Leak Rate:		0.28 (gpm)	

CTMT Sump In Leakage
CTMT Sump In Leakage Rate: 0.08 (gpm)

If candidate uses chart to determine containment volume:

Answer: 0.0798754 gpm [range 0.06 – 0.083 gpm]

If candidate uses graph to determine containment volume:

Answer: 0.06667 gpm [range 0.03 – 0.1 gallons]

COMMENTS:

STEP 15: Step 6.3.8 6.3.8 Verify or place one CTMT sump pump is in AUTO. **STANDARD:** (a) Recalls from initial conditions that one CTMT sump pump is in Automatic. **EVALUATOR’S NOTE:** • None **COMMENTS:**	_______ **SAT** _______ **UNSAT**
STEP 16: Step 6.4 Note prior to Step 6.4.1: • This Subsection is not required if performing a backup leak rate. **STANDARD:** (a) Acknowledges the note. **EVALUATOR’S NOTE:** • None **COMMENTS:**	_______ **SAT** _______ **UNSAT**

STEP 17:

Step 6.4.1

_______ SAT

_______ UNSAT

6.4.1 Verify primary to secondary leakage through SG A and SG C is less than or equal to 100 gallons per day AND less than or equal to 20 gallons per day through SG B IAW either of the following. Enter N/A for this subsection if RCS temperature is less than 200 °F.

_______ If Reactor power is greater than 25%, all N-16 Radiation Monitors are operable.

_______ If Reactor power is less than or equal to 25%, OR any N-16 Radiation Monitor is inoperable, Chemistry has verified leakage IAW 0-CPT-SG-003, Steam Generator Primary to Secondary Leakage, if stable RCS conditions exist.

STANDARD:

(a) Acknowledges that reactor power is greater than 25% and that SG B is greater than 20 gallons per day.

EVALUATOR'S NOTE:

- None

COMMENTS:

STEP 18:

_______ SAT

_______ UNSAT

Note prior to Step 6.4.2:

- Primary to secondary leakage determination through each SG is required every 72 hours. If an SG N-16 Radiation Monitor is inoperable, sampling will be used to determine this leak rate.

STANDARD:

(a) Acknowledges the note.

EVALUATOR'S NOTE:

- None

COMMENTS:

STEP 19:

Step 6.4.2

6.4.2 Record primary to secondary leakage from each SG below. Enter N/A for SG(s) if N-16 monitor inoperable.

- SG A ___________ gpd
- SG B ___________ gpd
- SG C ___________ gpd

STANDARD:

(a) Records the values from the initial conditions as indicated below

- SG A 24.4 gpd
- SG B 22.1 gpd
- SG C 25.6 gpd

EVALUATOR'S NOTE:

- None

COMMENTS:

_______ **SAT**

_______ **UNSAT**

STEP 20:

Step 6.4.3

6.4.3 If any N-16 inoperable, AND RCS is in a stable condition to perform leakrate, THEN notify Chemistry AND record person notified and date/time below. Otherwise, enter N/A.

STANDARD:

(a) Records N/A for this step.

EVALUATOR'S NOTE:

- None

COMMENTS:

_______ **SAT**

_______ **UNSAT**

STEP 21: Step 6.5 Notes prior to Step 6.5.1: • The Leakrate spreadsheet is located at S:\SURRY PWR STA\3\Data1\OPS\Leakrate\1-OPT-RC-10.0. Backup leakrates are to be entered in “Backup Statistics” tab of spreadsheet, if applicable. **STANDARD:** (a) Acknowledges the notes. **EVALUATOR’S NOTE:** • None **COMMENTS:**	_______ **SAT** _______ **UNSAT**

STEP 22:

Step 6.5.1

6.5.1 Update 1-OPT-RC-10.0 Data Entry tab in 1-OPT-RC-10.0 spreadsheet with Daily primary leak rate, primary to secondary leak rate, and sump in-leakage information.

_______ **SAT**

_______ **UNSAT**

STANDARD:

(a) Opens the leakrate spreadsheet and enters the required data.

EVALUATOR’S NOTE:

- Pre-data Entry

Date	Total (gpm)	Identified (gpm)	Unidentified (gpm)	Sump (gpm)	'A' (gpd)	'B' (gpd)	'C' (gpd)
05/15/10	0.240	0.150	0.090	0.140	24.200	15.200	25.400
05/16/10	0.220	0.120	0.110	0.130	24.400	15.300	25.400
05/17/10	0.250	0.150	0.100	0.130	24.200	14.800	25.600
05/18/10	0.230	0.130	0.090	0.130	24.300	14.900	25.100
05/19/10	0.230	0.140	0.100	0.130	24.500	15.200	25.300
05/20/10	0.250	0.160	0.090	0.130	24.200	15.300	25.700
05/21/10	0.250	0.160	0.090	0.130	24.400	15.200	25.400

		Action Level 1		Action Level 2		Action Level 3	
Date	Unident. Leakage (gpm)	7 Day Average Unidentified Leak Rate > .1 gpm	9 last Consecutive Unidentified Leak Rates > baseline mean	2 Consecutive Unidentified Leak Rates >.15 gpm	2 of 3 consecutive Unidentified Leak Rates > baseline mean + 2 standard deviations	Unident. Leak Rate > baseline mean + 3 standard deviations	Unident. Leak Rate >.3 gpm
05/21/10	0.090	0	0	0	0	0	0
05/20/10	0.090	0	0	0	0	0	0
05/19/10	0.100	0	0	0	0	0	0
05/18/10	0.090	0	0	0	0	0	0
05/17/10	0.100	0	0	0	0	0	0
05/16/10	0.110	0	0	0	0	0	0
05/15/10	0.090	0	0	0	0	0	0

COMMENTS:

STEP 23:

Step 6.5.2

6.5.2 Review leakage trends in 1-OPT-RC-10.0 spreadsheet.

STANDARD:

(a) Reviews the trends for 5/22/10 and notes that B SG primary to secondary leakage is elevated and that the plant is in action level 1 for RCS leakage.

EVALUATOR'S NOTE:

- Post-data Entry

Date	Total (gpm)	Identified (gpm)	Unidentified (gpm)	Sump (gpm)	'A' (gpd)	'B' (gpd)	'C' (gpd)
05/15/10	0.240	0.150	0.090	0.140	24.200	15.200	25.400
05/16/10	0.220	0.120	0.110	0.130	24.400	15.300	25.400
05/17/10	0.250	0.150	0.100	0.130	24.200	14.800	25.600
05/18/10	0.230	0.130	0.090	0.130	24.300	14.900	25.100
05/19/10	0.230	0.140	0.100	0.130	24.500	15.200	25.300
05/20/10	0.250	0.160	0.090	0.130	24.200	15.300	25.700
05/21/10	0.250	0.160	0.090	0.130	24.400	15.200	25.400
05/22/10	**0.280**	**0.150**	**0.130**	**0.080**	**24.400**	**22.100**	**25.600**

	Action Level 1			Action Level 2		Action Level 3	
Date	Unident. Leakage (gpm)	7 Day Average Unidentified Leak Rate > .1 gpm	9 last Consecutive Unidentified Leak Rates > baseline mean	2 Consecutive Unidentified Leak Rates >.15 gpm	2 of 3 consecutive Unidentified Leak Rates > baseline mean + 2 standard deviations	Unident. Leak Rate > baseline mean + 3 standard deviations	Unident. Leak Rate >.3 gpm
5/22/10	**0.13**	**1**	**0**	**0**	**0**	**0**	**0**
05/21/10	0.090	0	0	0	0	0	0
05/20/10	0.090	0	0	0	0	0	0
05/19/10	0.100	0	0	0	0	0	0
05/18/10	0.090	0	0	0	0	0	0
05/17/10	0.100	0	0	0	0	0	0
05/16/10	0.110	0	0	0	0	0	0
05/15/10	0.090	0	0	0	0	0	0

COMMENTS:

________ **SAT**

________ **UNSAT**

STEP 24:

Notes prior to Step 6.5.3:

- The following information is determined by 1-OPT-RC-10.0 spreadsheet in “Daily Statistics” tab with Yellow representing Action Level 1, Orange representing Action Level 2, and Red representing Action Level 3. If all Action levels are Green, then all criteria is satisfied.
- The OPT-RC-10.0 spreadsheet Action Level criteria are not subject to change and do not need to have the revision number verified. Changes will be made to the baseline mean unidentified leak rate and baseline standard deviation of unidentified leak rate by Engineering following Refueling Outages and as required.

STANDARD:

(a) Acknowledges the Notes.

EVALUATOR’S NOTE:

- None

COMMENTS:

_______ **SAT**

_______ **UNSAT**

STEP 25:

Step 6.5.3

_______ **SAT**

_______ **UNSAT**

6.5.3 IF any of the following criteria apply to the unidentified leakage, THEN initiate 1-OP-RC-014. Otherwise, enter N/A.

Action Level 1

_______ One seven day rolling average of Unified RCS Leak Rate greater than 0.1 gpm.

_______ Nine consecutive daily Unidentified RCS Leakrates greater than baseline mean.

Action Level 2

_______ Two consecutive daily Unidentified RCS leakrates greater than 0.15 gpm.

_______ Two of Three consecutive daily Unidentified RCS Leakrates greater than mean +2 standard deviations.

Action Level 3

_______ One Unidentified RCS leakrates greater than 0.3 gpm.

_______ One Unidentified RCS Leakrate greater than mean +3 standard deviations.

STANDARD:

(a) Marks the step as follows:.

Action Level 1:

___X___ One seven day rolling average of Unified RCS Leak Rate greater than 0.1 gpm.

_______ Nine consecutive daily Unidentified RCS Leakrates greater than baseline mean.

This is a critical step.

EVALUATOR'S NOTE:

- If asked, acknowledge the need to perform 1-OP-RC-014. State another operator will perform this procedure and to continue on with 1-OPT-RC-10.0

COMMENTS:

STEP 26:

_______ **SAT**

_______ **UNSAT**

7.1 Acceptance Criteria.

7.1.1 Evaluate the test results by reviewing the following acceptance criteria.

_______ The Unidentified Leakage Rate is less than or equal to 1.0 gpm.
_______ The Total Identified Leakage Rate is less than or equal to 10.0 gpm.
_______ Primary to secondary leakage through each Steam Generator is being monitored IAW 0-CPT-SG-003, OR is less than or equal to 100 gallons per day through SG A and SG C AND less than or equal to 20 gallons per day through SG B as determined by N-16 Radiation Monitors

7.1.2 Document the test results.

_______ Satisfactory _______ Unsatisfactory

STANDARD:
(a) Completes this section as follows:

7.1.1 Evaluate the test results by reviewing the following acceptance criteria.

___X___ The Unidentified Leakage Rate is less than or equal to 1.0 gpm.
___X___ The Total Identified Leakage Rate is less than or equal to 10.0 gpm.
_______ Primary to secondary leakage through each Steam Generator is being monitored IAW 0-CPT-SG-003, OR is less than or equal to 100 gallons per day through SG A and SG C AND less than or equal to 20 gallons per day through SG B as determined by N-16 Radiation Monitors

7.1.2 Document the test results.

_______ Satisfactory ___X___ Unsatisfactory

This is a critical step.

EVALUATOR'S NOTE:

- Acknowledge the completion of the task.

COMMENTS:

STEP 27:

_______ **SAT**

_______ **UNSAT**

7.2 Follow on Tasks.

7.2.1 If the test was unsatisfactory, THEN perform the following actions. Otherwise, enter N/A.

a. Document the reason for the unsatisfactory test in Operator Comments.

b. Notify System Engineering of unsatisfactory conditions and record the name of the person notified.

c. The system engineer will initiate an evaluation for license renewal of potential aging effects such as material or cracking.

d. Initiate a Condition Report and record the number below.

e. Initiate the use of 1-AP-16.00, Excessive RCS Leakage.

7.2.2 IF a partial operability test was performed, THEN document the reason for the partial test in Operator Comments. Otherwise, enter N/A.

STANDARD:

(a) The candidate will document that the test was performed unsat in the Operator Comments due to the primary to secondary leakage. May also note that the plant is in action level 1 and 1-OP-RC-014 is required. Words to the effect follow: “This PT was completed unsat due to primary to secondary leakage greater than 20 gpd on B SG.”
(b) Will inform the evaluator that system engineering needs to be notified, a CR will be required and that AP-16 will need to be evaluated.
(c) STA has initiated a CR and the number is CR123456

EVALUATOR’S NOTE:

- System Engineer: Karlie F. Irwine

COMMENTS:

STEP 28:

_______ **SAT**

_______ **UNSAT**

7.3 Notification, Documentation and Procedure Closeout.

7.3.1 Notify Shift Supervision that the test is complete.

7.3.2 Document Leak Rate results in Unit 1 Narrative Logs.

STANDARD:

(a) Will inform the evaluator that the test is complete.
(b) Will inform the evaluator that the leak rate needs to be documented.

EVALUATOR'S NOTE:

- None.

COMMENTS:

STOP TIME:

Operator Directions Handout
(TO BE READ TO APPLICANT BY EXAMINER)

Task

- Task is to be PERFORMED in the SIMULATOR or CLASSROOM.
- Given simulated plant conditions, perform the remainder of 1-OPT-RC-10.0, Reactor Coolant Leakage – Computer Calculated, and submitted the procedure for review by the Unit Supervisor.

Directions

The evaluator will explain the initial conditions of the task to be performed and will provide the initiating cue. Ensure you indicate to the evaluator when you understand your assigned task.

Initial Conditions

- It is mid-shift on May 22, 2010. Unit 1 power is 100 percent.
- I am the Nuclear Shift Manager. I have assigned you to complete the normal daily 1-OPT-RC-10.0, Reactor Coolant Leakage – Computer Calculated. The procedure is complete up through Step 6.2.11 and the computer generated leak rate data sheet has just been printed out, the leak rate ran for 125 minutes. You are to complete 1-OPT-RC-10.0, Reactor Coolant Leakage – Computer Calculated in its entirety and when done turn the procedure in for review.

- The following are the Unit conditions:
  - Reactor power: 100%
  - Charging flow control is in automatic.
  - One PDTT pump was placed in automatic after the PCS computer leak rate program results were printed.
  - Containment Sump Data:
    - Initial containment sump level was 47% as indicated on 1-DA-LI-100 (CTMT SUMP LEVEL).
    - Final containment sump level was 62% as indicated on 1-DA-LI-100 (CTMT SUMP LEVEL).
    - Containment Sump leak rate elapsed time – 60 minutes.
    - After this data was recorded, one containment sump pump was placed back in automatic

  Primary to Secondary Leakage exists and is known and has been indicating in the 15 – 25 gpd range per steam generator for the past week. Today the N-16 monitors are slightly elevated and indicate the following:
  SG A: 24.4 gpd
  SG B: 22.1 gpd
  SG C: 25.6 gpd

  The Leakrate spreadsheet is located at folder S:\SURRY PWR STA\3\Ops\Leakrate on the desktop of your laptop computer.

Initiating Cues:

- Here is a partially completed copy of 1-OPT-RC-10.0, Reactor Coolant Leakage – Computer Calculated. I need you to complete 1-OPT-RC-10.0, Reactor Coolant Leakage – Computer Calculated it is entirety and when done turn the procedure in for review.

- When you are ready to have your work reviewed, please inform me, as this will end the JPM.

Operator Directions Handout
(TO BE GIVEN TO APPLICANT)

Initial Conditions

- It is mid-shift on May 22, 2010. Unit 1 power is 100 percent.
- I am the Nuclear Shift Manager. I have assigned you to complete the normal daily 1-OPT-RC-10.0, Reactor Coolant Leakage – Computer Calculated. The procedure is complete up through Step 6.2.11 and the computer generated leak rate data sheet has just been printed out, the leak rate ran for 125 minutes. You are to complete 1-OPT-RC-10.0, Reactor Coolant Leakage – Computer Calculated in its entirety and when done turn the procedure in for review.

- The following are the Unit conditions:
  - Reactor power: 100%
  - Charging flow control is in automatic.
  - One PDTT pump was placed in automatic after the PCS computer leak rate program results were printed.
  - Containment Sump Data:
    - Initial containment sump level was 47% as indicated on 1-DA-LI-100 (CTMT SUMP LEVEL).
    - Final containment sump level was 62% as indicated on 1-DA-LI-100 (CTMT SUMP LEVEL).
    - Containment Sump leak rate elapsed time – 60 minutes.
    - After this data was recorded, one containment sump pump was placed back in automatic

Primary to Secondary Leakage exists and is known and has been indicating in the 15 – 25 gpd range per steam generator for the past week. Today the N-16 monitors are slightly elevated and indicate the following:
SG A: 24.4 gpd
SG B: 22.1 gpd
SG C: 25.6 gpd

The Leakrate spreadsheet is located at folder S:\SURRY PWR STA\3\Ops\Leakrate on the desktop of your laptop computer.

Initiating Cues:

- Here is a partially completed copy of 1-OPT-RC-10.0, Reactor Coolant Leakage – Computer Calculated. I need you to complete 1-OPT-RC-10.0, Reactor Coolant Leakage – Computer Calculated it is entirety and when done turn the procedure in for review.

- When you are ready to have your work reviewed, please inform me, as this will end the JPM.

REACTOR COOLANT SYSTEM LEAK RATE

DATE: 5/22/10
START TIME: 125 Minutes ago
DURATION REQUESTED: 125
ESTIMATED STOP TIME: Now

OPERATOR ENTERED PARAMETERS:
YLR0001K, OP ENTERED MINUTES TO RUN = 125 MIN
YLR0002K, OP ENTERED IDENT LEAKAGE   = 0   GPM
U9130, ROLLING PRT LEAKRATE   = 0.00 GPM

REACTOR COOLANT SYSTEM LEAK RATE

DATE: 5/22/10
START TIME: 125 Minutes ago
DURATION REQUESTED: 125
ESTIMATED STOP TIME: Now

OPERATOR ENTERED PARAMETERS:
YLR0001K, OP ENTERED MINUTES TO RUN = 125 MIN
YLR0002K, OP ENTERED IDENT LEAKAGE   = 0   GPM
U9130, ROLLING PRT LEAKRATE   = 0.00 GPM

```
CALCULATION OF LEAK RATES
1)    RAW DATA OF PDTT LEVEL –                 START:          40.70                     END:          42.91

2)    SAMPLE DATA:
      RCS TEMPERATURE AVERAGE                  ((T0400A + T0420A + T0440A)/3:
          573.36    573.38    573.37    573.39    573.32    573.38    573.31    573.28    573.40    573.32    573.43    573.32
          573.40    573.34    573.35    573.30    573.32    573.34    573.33    573.30    573.33    573.38    573.32    573.35
          573.30    573.32    573.37    573.33    573.32    573.32    573.34    573.36    573.34    573.34    573.32    573.32
          573.30    573.34    573.31    573.31    573.30

      PRESSURIZER LEVEL AVERAGE                ((L0480A + L0481A + L0482A)/3):
          56.67     56.79     56.77     56.82     56.77     56.77     56.76     56.71     56.77     56.76     56.77     56.75
          56.72     56.69     56.70     56.70     56.69     56.70     56.70     56.71     56.72     56.77     56.75     56.76
          56.74     56.76     56.77     56.72     56.65     56.72     56.73     56.76     56.74     56.76     56.72     56.72
          56.73     56.70     56.73     56.70     56.73

      VCT LEVEL         (L0112A):
          42.90     42.81     42.63     42.60     42.50     42.44     42.35     42.38     42.35     42.32     42.26     42.20
          42.14     42.14     42.14     42.05     41.93     41.83     41.74     41.65     41.56     41.44     41.41     41.31
          41.19     41.25     41.13     41.07     41.01     40.95     40.95     40.77     40.80     40.67     40.61     40.58
          40.52     40.49     40.40     40.40     40.34

      RCS PRESSURE AVERAGE              ((P0480A + P0481A + P0482A)/3):
          2243.38   2243.62   2243.38   2243.87   2243.30   2243.54   2243.22   2243.13   2243.22   2243.54   2243.79   2243.87
          2242.89   2242.81   2243.22   2242.73   2243.05   2243.54   2243.54   2242.73   2243.70   2243.95   2244.11   2243.79
          2243.54   2244.44   2243.22   2243.46   2243.30   2242.97   2243.70   2244.44   2244.03   2243.54   2244.03   2243.54
          2243.30   2242.65   2243.46   2243.22   2243.70
```

```
3)   LINEAR REGRESSION STATISTICS:
     PARAMETER                                         SLOPE                         START VALUE                   END VALUE
     ------------------------------                    -------------                 -------------------           -----------------
     TEMPERATURE                             -0.00037                      573.36                        573.31
     PRESSURIZER LEVEL                                 -0.00026                      56.75                         56.71
     VCT LEVEL                                         -0.02070                      42.86                         40.27

4)   MASS CHANGE DATA (A NEGATIVE RATE IMPLIES MASS TRANSFER OUT OF THE VOLUME):
     RCS:      -0.00037 DEGF/MIN  *          -0.07 LBM/CU FT(DEGF)  *            82.08.8 CU FT                                                 =         0.22 LBM/MIN
     PRZR:     -0.00026 PCT/MIN    *         74.0  GAL/PCT   *                   0.13368 CU FT/GAL   *         37.12 LBM/CU FT     =    -0.10 LBM/MIN
     VCT:      -0.02070 PCT/MIN    *         14.1 GAL/PCT    *                   0.13368CU FT/GAL    *         61.87 LBM/CU FT     =    -2.41 LBM/MIN

5)   CONVERSIONS FOR PDTT, PRT AND IDENTIFIED LEAKAGE TO LBM:
     PDTT CHANGE:                  42.91 PCT  -                  40.70 PCV                                                         =    2.21 PCT
     PDTT:                         2.21 PCT   *                  71.16 LBM/PCT   /             125 MIN                             =    1.26 LBM/MIN
     PRT:                          0.00 GAL/MIN    *             0.13368 CU FT/GAL    *        61.856 LBM/CU FT                    =    0.00 LBM.MIN
     IDENTIFIED LEAKAGE:                     0.00 GAL/MIN    *             0.13368 CU FT/GAL    *        62.310 LBM/CU FT               =         0.00 LBM.MIN

6)   TOTAL LEAKAGES IN LBM/MIN:
     RCS:      (-1.0)  *           0.22 LBM/MIN    +             -0.10 LBM/MIN         +       -2.41 LBM/MIN                       =    2.29 LBM/MIN
     IDENTIFIED:                             1.26 LBM/MIN    +             0.00 LBM/MIN         +        0.00 LBM/MIN                   =         1.26 LBM/MIN
     UNIDENTIFIED:                 2.29 LBM/MIN    -             1.26 LBM/MIN                                                      =    1.03 LBM/MIN

7)   TOTAL LEAKAGES IN GALLONS/MINUTE:
     RCS:                          2.29 LBM/MIN    *             7.48052 GAL/CU FT    /        61.856 LBM/CU FT                    =    0.28 GAL/MIN
     IDENTIFIED:                             1.26 LBM/MIN    *             7.48052 GAL/CU FT    /        61.856 LBM/CU FT               =         0.15 GAL/MIN
     UNIDENTIFIED:                 0.28 GAL/MIN    -             0.15 GAL/MIN                                                      =    0.13 GAL/MIN


     NOTE:     VALUES WITH A QUALITY OF “B” ARE UNRELIABLE


                                                             REACTOR COOLANT SYSTEM LEAK RATE
                                                             --------------------------------------------------------------
                                                             DATE:  5/22/10
                                                             START TIME:  Now
```

Dominion

OPERATIONS PERIODIC TEST

PROCEDURE NO: **1-OPT-RC-10.0**

REVISION NO: **33**

PROCEDURE TYPE: **OPERATIONS PERIODIC TEST**

UNIT NO: **1**

PROCEDURE TITLE:

REACTOR COOLANT LEAKAGE - COMPUTER CALCULATED

LR						

REVISION SUMMARY:

Revised in response to Operations Feedback, OP FB 10-0221 for CR379270. Added P&L 4.10 and revised second note before Step 6.2.10.

CONTINUOUS USE

TABLE OF CONTENTS

1.0 PURPOSE

1.1 To provide instructions for performing a computer generated daily leak rate test of the Reactor Coolant System by using a mass balance method of Reactor Coolant System Inventory analysis, once every 24 hours, when RCS temperature is greater than 200°F. **(Reference 2.4.1)**

2.0 REFERENCES

2.1 Source Documents

2.1.1 UFSAR Section 4.2, RCS Design and Operation

2.1.2 UFSAR Section 5.3.2, Containment Leakage Monitoring System

2.1.3 UFSAR Section 9.1, Chemical Volume and Control System

2.1.4 UFSAR Section 9.3, Residual Heat Removal System

2.1.5 EWR 91-011, RCS Leakage Calculation Revisions / Surry / 1&2

2.2 Technical Specifications Surry Power Station Units 1 and 2

2.2.1 Technical Specification 3.1.C, RCS Operational Leakage

2.2.2 Technical Specification 4.13, RCS Operational Leakage

2.3 Technical References

2.3.1 1-DRP-003, The Curve Book

2.3.2 1-AP-16.00, Excessive RCS Leakage

2.3.3 1-OPT-RC-10.01, Reactor Coolant Leakage - Manually Calculated

2.3.4 RCS Leakage Program (LR), NABU-FS-00101-VPA, Rev. 1.3, January 2003

2.3.5 Technical Report NE-1381, Rev. 0, Evaluation of Surry Power Station Reactor Coolant System Leak Rate Program

2.3.6 ET NAF-98-0069 REV 1.

2.3.7 Technical Report NE-1270, Rev. 0, Evaluation of Surry Power Station RCS Leak Rate Calculation.

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

2.3.9 ER-AA-AMP-101, Implementation of Activities Performed by License Renewal Aging Management Coordinators

2.3.10 ODM000122, 1-RC-P-1B #2 Seal Degrading Trend

2.4 Commitment Documents

2.4.1 CTS 50114, Revise RCS leakage calculation procedure to use mass balance method

2.4.2 Section XI Relief Request (Serial #91-269): Inform management of leakage trends which could be indicative of underside reactor vessel and instrumentation weld leakage.

2.4.3 CTS 2406, Safety Injection accumulator leakage to the PDTT

2.4.4 NUREG-1766, Safety Evaluation Report Related to the License Renewal of North Anna Power Station Units 1 and 2, and Surry Power Station Units 1 and 2, January 28, 2003.

2.4.5 PI S-2004-1855, PSIRV CAS Recommendations

2.4.6 WCAP-16423-NP, Rev. 0, PWR Owners Group Standard Process and Methods for Calculating RCS Leak Rate

2.4.7 LC000307/LA001424 - LBDCR/TSCR 417, Emergency TS Change for Modified IARC/Revised Reporting Requirements and 20 gpd Primary to Secondary Leakage for Unit 1 B SG

2.4.8 PWROG 07-387 Recommendations for Implementation of Guidelines for PWROG RCS Leak Rate Programs with Respect to NEI-03-08

Init **Verif**

3.0 INITIAL CONDITIONS

NOTE:

- Reactor Coolant System (RCS) temperature and pressure stability for the purposes of this procedure shall be determined by Shift Supervision.
- An RCS water inventory balance must be performed once every 24 hours. Surveillance requirement specified time intervals may be adjusted plus or minus 25% to accomodate normal test schedules.
- If required RCS pressure conditions cannot be met, 1-OPT-RC-10.01, Reactor Coolant Leakage - Manually Calculated, must be performed.

SI ______ 3.1 Verify that the Reactor Coolant System is being maintained at stable temperature and pressure.

SI ______ 3.2 Verify that Reactor Coolant System Pressure is greater than 2100 psig and less than 2500 psig.

4.0 PRECAUTIONS AND LIMITATIONS

4.1 The RCS leak rate program on the PCS plant computer will halt if VCT level increases by 2.0%, if PDTT level decreases by 1.0%, or if PRZR level changes (increases or decreases) by 2.0% during the performance of the program.

4.2 Routine daily leak rate determinations should be performed over a minimum time period of two hours, when a computer calculation of the RCS leak rate is performed.

4.3 Reactor Coolant System sampling should **not** take place during the performance of this procedure.

4.4 RCS temperature and pressure should be maintained as stable as possible when a RCS leak rate calculation is being performed during a pause in a Reactor Coolant System (RCS) heat up or cool down.

4.5 A leak rate based on an RCS water inventory balance is required once every 24 hours, but is not required to be completed until 12 hours after establishment of steady state operation. (stable pressure, temperature, power level, Pressurizer and makeup tank levels, makeup and letdown, and RCP seal injection and return flow) Refer to Tech Spec 4.13, SR 4.13.A.

4.6 The initials identification block in Subsection 7.3 must be completed before this procedure is closed out.

4.7 If any one data point from the leakrate printout or the final leakrate results are marked with POOR or BAD, or has any reason code, (for example, L, H, or S) the leakrate should be considered unreliable.

4.8 The RCS leak rate calculation should not be performed until 10 minutes have passed following pumping the PDTT.

4.9 The RCS must be maintained at steady state during the performance of the leak rate. Steady state is defined as:

- Power change less than one percent of rated Thermal Power
- RCS temperature change less than 2°F
- RCS pressure change less than 5 psig
- No change in letdown or makeup systems
- PRZR level change less than 2%
- No RCP standpipe fills

4.10 Any evolution that changes level in the PDTT (for example, draining the PRT, making up to the RCP Vapor Seal Tank, or cycling of the Gas Stripper) may negate the validity of this OPT.

5.0 SPECIAL TOOLS AND EQUIPMENT

None

Init **Verif**

6.0 INSTRUCTIONS

6.1 General Instructions

NOTE:

- Summary of all RCS Leakage results will be recorded on Attachment 1.
- If RCS pressure and temperature are too unstable for an accurate computer calculation of RCS Leak Rate, a leak rate must be performed within 12 hours after establishment of steady state operation.
- Subsections 6.2, 6.3, and 6.4 may be performed simultaneously.

SI ______ 6.1.1 Notify Chemistry Department that calculation of RCS leak rate will be in progress and that all sampling operations will be stopped unless authorized by Shift Supervision.

SI ______ 6.1.2 Check VCT controller 1-CH-LCV-1115A, VCT LEVEL DIVERT, and verify that no RCS letdown flow is being diverted to the PDT.

SI ______ 6.1.3 Stop all makeup to the VCT.

SI ______ 6.1.4 Record the Total Other Identified Leakage Excluding PRT and PDTT from the last (most recent previously calculated leak rate data) performance of 1-OPT-RC-10.0, Reactor Coolant Leakage - Computer Calculated, or 1-OPT-RC-10.01, Reactor Coolant Leakage - Manually Calculated, or from Computer Point YLR0002K, on Attachment 1.

6.1.5 Calculate the current Total Other Identified Leakage (excluding the PRT and the PDTT).

SI a. Identify and list current Other Identified Leakage (excluding PRT and PDTT) on Attachment 2.

SI b. Add the other identified leakage (excluding PRT and PDTT) and record the current Total Other Identified Leakage in Attachment 2 and Attachment 1.

SI 6.1.6 Compare values of Total Other Identified Leakage (excluding PRT and PDTT) for last and present performance of 1-OPT-RC-10.0 or 1-OPT-RC-10.01.

N/A SI 6.1.7 IF the amount of Total Other Identified Leakage (excluding PRT and PDTT) recorded in Attachment 1 has changed from the value recorded from last (most recent previously calculated leak rate data) performance of 1-OPT-RC-10.0 or 1-OPT-RC-10.01, THEN notify the Operations Manager on Call before continuing this procedure. Otherwise, enter N/A.

6.2 Computer Calculation of RCS Leak Rate

NOTE: The RCS leak rate calculation should not be performed until 10 minutes have passed following pumping the PDTT.

SI 6.2.1 Verify that the PDTT level is between 40% and 46%. (Reference 2.3.10)

SI 6.2.2 Verify that RCS Pressure is greater than 2100 psig and less than 2500 psig.

SI 6.2.3 Verify that Pressurizer level is between 20% and 75%.

N/A SI 6.2.4 IF necessary to stabilize charging flow, THEN place 1-CH-FCV-1122, CHG FLOW CNTRL, in Manual, and control PRZR level at programmed setpoint. Otherwise, enter N/A.

6.2.5 Determine the Pressurizer Relief Tank (PRT) Inleakage by performing the following. **(Reference 2.4.3)**

SI a. IF a previously calculated value of PRT inleakage is to be used for the PCS calculation, THEN enter N/A for Substep 6.2.5.b below. IF the previously calculated value of PRT inleakage is NOT being used, THEN enter N/A for this substep.

b. Perform the following Substeps for the manual calculation of the PRT leakrate.

N/A SI 1. Verify no makeups to the PRT, draining of the PRT, or pressurizer PORV openings will be performed during the trending of the PRT Level (L0485A) on the PCS plant computer or by reviewing the Control Room Operator Logs.

2. Place PRT Level (L0485A) on trend.

3. Record the start time and PRT Level at the start of the addressable point L0485A trend in Attachment 3,Table 1: Calculation of PRT Level Change.

N/A SI ______ 4. Record the final time and PRT Level at the end of the addressable point L0485A trend in Attachment 3, Table 1: Calculation of PRT Level Change.

______ 5. Calculate Elapsed Time in Attachment 3, Table 1: Calculation of PRT Level Change.

______ 6. Using 1-DRP-003, convert PRT levels(%) to lbm and record in Attachment 3, Table 1: Calculation of PRT Level Change. (Using closest table entry to indicated level is acceptable.) Calculate the change in PRT level (lbm) and record in Attachment 3, Table 1: Calculation of PRT Level Change.

______ 7. IF the PRT inleakage is less than zero, THEN record zero for the PRT Level Change.

______ 8. Determine the PRT inleakage in lbm/min by performing Attachment 3, Table 2, PRT Leak Rate Calculation (lbm/minute) for the PRT.

______ 9. Convert the PRT inleakage in lbm/min to gpm by performing Attachment 3, Table 3, Conversion to gpm.

SI ______ 6.2.6 Open the Leak Rate Program on the PCS plant computer.

NOTE: Routine daily leak rate determinations should be performed over a minimum time period of two hours. Backup leak rate should be performed over a minimum time period of 30 minutes.

SI ______ 6.2.7 Enter a value from 5 minutes to 480 minutes to indicate how long the leak rate computer program will run, and record the amount below.

Time entered = 125 minutes.

SI ______ 6.2.8 Enter the amount of Total Other Identified Leakage from Attachment 2 into Identified Leak Rate field, and record the amount below.

Total Other Identified Leakage entered (YLR0002K) = 0 gpm

SI 6.2.9 Verify entered or enter the calculated PRT leakrate (U9130).

PRT leakrate entered 0 gpm

NOTE:
- The PCS plant computer will automatically display the leak rate program results at the end of the selected time period noted in Step 6.2.7.
- Any evolution that changes level in the PDTT (for example, draining the PRT, making up to the RCP Vapor Seal Tank, or cycling of the Gas Stripper) may negate the validity of this OPT.

SI 6.2.10 Depress the START button on the Leak Rate Display to activate the leak rate program on the PCS computer.

N/A SI 6.2.11 IF at any time the PCS RCS Leak Rate program needs to be halted by the operator, THEN click the STOP button. Otherwise enter N/A.

______ 6.2.12 Evaluate unidentified RCS leak rate result and perform the actions indicated in the table below. Enter N/A for the condition that does not exist, or if the unidentified RCS leak rate is positive.

Evaluation of RCS Leakrate

Unidentified RCS Leakrate:	**Actions to be taken:**	**Initials**
With a negative Unidentified leakrate greater than -0.08 gpm	a. REPEAT Steps 6.2.7 through 6.2.12 to obtain valid unidentified RCS Leak Rate Calculation. b. IF a valid Unidentified RCS Leak Rate calculation can not be obtained, THEN perform a manual Leak Rate IAW 1-OPT-RC-10.01. (Reference 2.3.6)	______ ______
With a negative Unidentified leakrate less than or equal to -0.08 gpm.	a. Enter zero for unidentified RCS Leakrate. b. Adjust the Total Leak Rate to equal to the Identified Leak Rate. c. Make a comment in the Operator Comments in Subsection 7.3.	______ ______ ______

______ 6.2.13 Record the Total, Unidentified, and Identified RCS leak rates (gpm) in Attachment 1. Use results from Step 6.2.12 if performed, otherwise use computer printout results.

______ 6.2.14 Print and attach the PCS computer printout leak rate program results to this procedure as a permanent record of the derivation of the RCS Leak rates recorded in Step 6.2.13.

______ 6.2.15 Verify one PDTT pump is in AUTO.

6.2.16 IF charging flow control was placed in Manual in Step 6.2.4, THEN do the following. Otherwise, enter N/A.

______ a. Verify or adjust CHG flow to maintain PRZR level at programmed setpoint.

______ b. Place 1-CH-FCV-1122, CHG FLOW CNTRL, in Auto.

6.3 Calculation of the Containment Sump Inleakage Rate

NOTE:

- The Containment Sump Inleakage Rate is not required by the Surry Technical Specifications and is being determined for information only.
- The same Containment sump level instrument should be used to determine both the initial and final Containment sump indicated levels.
- CTMT Sump inleakage rate will be calculated using Attachment 4.
- This Subsection is not required if performing a backup leak rate.

SI______ 6.3.1 IF it is desired to pump down the Containment Sump, THEN place one of the following sump pumps in HAND and verify pump starts. Otherwise, enter N/A.

X____ 1-DA-P-4A, CTMT Sump Pump 4A

____ 1-DA-P-4B, CTMT Sump Pump 4B

SI______ 6.3.2 IF desired, THEN place control switches for 1-DA-P-4A and 1-DA-P-4B, CTMT SUMP PUMPs, in OFF. Otherwise, enter N/A.

______ 6.3.3 Record the required initial data for calculating the Containment sump inleakage rate. (Attachment 4, Table 1 - Containment Sump Inleakage Rate, Column 3)

______ 6.3.4 Record the required final data for calculating the Containment sump inleakage rate. (Attachment 4, Table 1 - Containment Sump Inleakage Rate, Column 2)

______ 6.3.5 Calculate the change in parameter from the initial start conditions to the final end conditions and record elapsed time in Table 2 - Containment Sump Inleakage Rate. (Attachment 4)

______ 6.3.6 Calculate the total Containment Sump Inleakage Rate in gallons per minute. (Attachment 4, Table 2 - Containment Sump Inleakage Rate)

______ 6.3.7 Transfer the Containment Sump Inleakage Rate from Attachment 4, Table 2 - Containment Sump Inleakage Rate, to Attachment 1.

______ 6.3.8 Verify or place one CTMT sump pump in AUTO.

6.4 **Primary to Secondary Leak Rate Verification**

NOTE: This Subsection is not required if performing a backup leak rate.

______ 6.4.1 Verify primary to secondary leakage through SG A and SG C is less than or equal to 100 gallons per day AND less than or equal to 20 gallons per day through SG B IAW either of the following. (✓) Enter N/A for this Subsection if RCS temperature is less than 200°F. **(Ref. 2.4.7)**

____ If Reactor power is greater than 25%, all N-16 Radiation Monitors are operable

____ If Reactor power is less than or equal to 25%, OR any N-16 Radiation Monitor is inoperable, Chemistry has verified leakage IAW 0-CPT-SG-003, Steam Generator Primary to Secondary Leakage, if stable RCS conditions exist.

NOTE: Primary to secondary leakage determination through each SG is required every 72 hours. If an SG N-16 Radiation Monitor is inoperable, sampling will be used to determine this leak rate.

______ 6.4.2 Record primary to secondary leakage from each SG below. Enter N/A for SG(s) if N-16 monitor inoperable.

- SG A _________ gpd
- SG B _________ gpd
- SG C _________ gpd

______ 6.4.3 IF any N-16 monitor inoperable, AND RCS is in a stable condition to perform leakrate, THEN notify Chemistry AND record person notified and date/time below. Otherwise, enter N/A.

____ ___________

6.5 Leak Rate Evaluation and Trending

NOTE:
- The Leakrate spreadsheet is located at S:\SURRY PWR STA\3\Data1\Ops\Leakrate\1-OPT-RC-10.0.xls. Backup leakrates are to be entered in “Backup Statistics” tab of spreadsheet, if applicable.
- This Subsection is not required if performing a backup leak rate.

______ 6.5.1 Update 1-OPT-RC-10.0 Data Entry tab in 1-OPT-RC-10.0 spreadsheet with DAILY primary leak rate, primary to secondary leak rate, and sump in-leakage information.

NOTE: The ‘Daily Leakage Graphs” provides trends for all parameters.

______ 6.5.2 Review leakage trends in 1-OPT-RC-10.0 spreadsheet.

NOTE:
- The following information is determined by 1-OPT-RC-10.0 spreadsheet in "Daily Statistics" tab with Yellow representing Action Level 1, Orange representing Action Level 2, and Red representing Action Level 3. If all Action Level cells are Green, then all criteria is satisfactory.
- The OPT-RC-10.0 spreadsheet Action Level criteria is not subject to change and does not need to have the revision number verified. Changes will be made to the baseline mean unidentified leak rate and baseline standard deviation of unidentified leak rate by Engineering following Refueling outages and as required.

______ 6.5.3 IF any of the following criteria apply to the unidentified leakage, THEN initiate 1-OP-RC-014. Otherwise, enter N/A.

Action Level 1

____ One seven day rolling average of Unidentified RCS Leak Rate greater than 0.1 gpm

____ Nine consecutive daily Unidentified RCS Leakrates greater than baseline mean

Action Level 2

____ Two consecutive daily Unidentified RCS Leakrates greater than 0.15 gpm.

____ Two of Three consecutive daily Unidentified RCS Leakrates greater than mean + 2 standard deviations

Action Level 3

____ One Unidentified RCS Leak rate greater than 0.3 gpm

____ One Unidentified RCS Leak rate greater than mean + 3 standard deviations

7.0 FOLLOW-ON

7.1 Acceptance Criteria

_____ 7.1.1 Evaluate the test results by reviewing the following Acceptance Criteria. (✓)

_____ The Unidentified Leakage Rate is less than or equal to 1.0 gpm.

_____ The Total Identified Leakage Rate is less than or equal to 10.0 gpm.

_____ Primary to secondary leakage through each Steam Generator is being monitored IAW 0-CPT-SG-003, OR is less than or equal to 100 gallons per day through SG A and SG C AND less than or equal to 20 gallons per day through SG B as determined by N-16 Radiation Monitors **(Ref. 2.4.7)**

_____ 7.1.2 Document the test results. (✓)

___ Satisfactory ___ Unsatisfactory

7.2 Follow-On Tasks

7.2.1 IF the test was unsatisfactory, THEN perform the following actions. Otherwise, enter N/A.

_____ a. Document the reason for the unsatisfactory test in Operator Comments.

_____ b. Notify System Engineering of unsatisfactory conditions and record the name of the person notified.

____ ____________
System Engineer

_____ c. The system engineer will initiate an evaluation for license renewal of potential aging effects such as loss of material or cracking. **(Reference 2.4.4)**

_______ d. Initiate a Condition Report and record the number below.

CR No. ____

_______ e. Initiate the use of 1-AP-16.00, Excessive RCS Leakage.

_______ 7.2.2 IF a partial operability test was performed, THEN document the reason for the partial test in Operator Comments. Otherwise, enter N/A.

7.3 Notification, Documentation, and Procedure Closeout

_______ 7.3.1 Notify Shift Supervision that the test is complete.

_______ 7.3.2 Document Leak Rate results in Unit 1 Narrative Logs.

The Initials in this procedure will be identified by the Printed Name.

Initials	Printed Name
SI	Skip Irwin

Operator Comments: ____

Completed by: ______________________________ Date: __________

7.4 **Review**

Comments: ____

Reviewed by: ____ Date: __________
Shift Supervision

Forward original procedure to Station Records.

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Attachment 1

SUMMARY OF REACTOR COOLANT LEAK RATE TEST RESULTS AND CONTAINMENT SUMP INLEAKAGE

Summary of Reactor Coolant Leak Rate Test Results

RCS Leak Rate Data	Identified leakage from the LAST (most recent previously calculated leak rate data) performance of 1-OPT-RC-10.0 or 1-OPT-RC-10.1, as appropriate	**Current** values:	
Total <u>OTHER</u> Identified Leakage:	0 (gpm)	0 (gpm)	
Total <u>Unidentified</u> RCS Leak Rate:		(gpm)	
<u>Identified</u> RCS Leak Rate:		(gpm)	
<u>Total</u> RCS Leak Rate:		(gpm)	

CTMT Sump Inleakage

CTMT Sump Inleakage Rate: _____________ (gpm)

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Attachment 2

DETERMINATION OF TOTAL OTHER IDENTIFIED LEAKAGE EXCLUDING PRT AND PDTT

NOTE: The date column corresponds to the date on which the leak was discovered.

NOTE: Leakage from Safety Injection Accumulators to the PDTT may result in a lower than actual unidentified leak rate.

Total Other Identified Leakage
(excluding PRT and PDTT)

Source	Leak Rate (gpm)	Date

Add all the leak rates recorded above in the leak rate column and record the total below as the RCS Total Other Identified Leak Rate.

RCS Total Other Identified Leak Rate = 0 **GPM**

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Attachment 3

CALCULATION OF PRT LEAKAGE RATE

Table 1: Calculation of PRT Level Change			
Parameter	Final Value of Parameter at End Time	Initial Value of Parameter at Start Time	Change in Parameter (+ or -) (Final Value - Initial Value)
Elapsed Time	End Time:	Start Time:	Minutes:
PRT Level % (L0485A)			▨
PRT Level (lbm) use 1-DRP-003			(± lbm)

Table 2, PRT Leak Rate Calculation (lbm/minute)		
PRT Level Change (lbm)	Divide by Change in Time (minutes)	Equals Leak rate (lbm / minute)

Table 3, Conversion to gpm		
Parameter	Conversion Factors *	Leak Rate (gpm)
PRT Leak Rate (lb_m / minute)	Multiply leak rate by: 7.48052 gallons / ft^3 Divided by 61.856 lb_m / ft^3 (VCT Conditions)	

* VCT conditions for Makeup Water to RCS: Density = 61.856 lb_m/ft^3 @ 110°F and 15 psia.

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Attachment 4

CALCULATION OF THE CONTAINMENT SUMP INLEAKAGE RATE

Table 1 - Containment Sump Inleakage Rate			
Parameter being analyzed	Column 2 Final Value of Parameter at End of Time	Column 3 Initial Value of Parameter at Start of Time	**Change in Parameter (+ or -) (final value − initial value)
Elapsed Time	65 minutes ago	125 minutes ago	60 (MINUTES)
CTMT Sump Level instrument used: 1-DA-LI-100, 1-DA-LI-110A or 1-DA-LI-110B	Circle instrument used 1-DA-LI-100, 1-DA-LI-110A or 1-DA-LI-110B	Circle instrument used: 1-DA-LI-100, 1-DA-LI-110A or 1-DA-LI-110B	N / A
CTMT Sump Level	(% or IN)	(% or IN)	N / A
CTMT Sump Volume from curve in 1-DRP-003	(gallons)	(gallons)	(gallons)

**A ± value in the change in parameter column indicates an increase or decrease in the respective parameter.

Table 2 - Containment Sump Inleakage Rate		
Change in Parameter (±) (final value − initial value)	Divide by Elapsed Time	Sump Inleakage Rate
CTMT Sump Volume Change ___________ (gallons)	60 (Minutes)	(gpm)

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Attachment 5
COMPUTER POINTS ASSOCIATED WITH LEAK RATE

PCS Computer Pt ID	Description
K2051	Atmospheric Pressure
L0112A	Volume Control Tank Level
L0480A	Pressurizer Level CH1 (L459)
L0481A	Pressurizer Level CH2 (L460)
L0482A	Pressurizer Level CH3 (L461)
P0480A	PZR Pressure CH1 (P455)
P0481A	PZR Pressure CH2 (P456)
P0482A	PZR Pressure CH3 (P457)
T0400A	RC Loop A TAVE CH1 (T412)
T0420A	RC Loop B TAVE CH2 (T422)
T0440A	RC Loop C TAVE CH3 (T432)
Y4020A	Primary Drains Tank Level
U9130	Rolling PRT Leak Rate (gpm)
U9133	Unidentified Leak Rate (gpm)
U9134	Identified Leak Rate (gpm)
U9135	RCS Total Leak Rate (gpm)
U9136	Unidentified Leak Rate (lbm/min)
U9137	Identified Leak Rate (lbm/min)
U9138	RCS Total Leak Rate (lbm/min)
YLR0002K	Op Entered Ident Leakage

U.S. Nuclear Regulatory Commission
Surry Power Station

SR10301
Administrative Job Performance Measure 2.2.13

Applicant________________________________ Start Time___________________

Examiner_______________________________

Date ___________________________________ Stop Time___________________

Title

Determine Tagout Boundaries

K/A: G2.2.13 – Knowledge of Tagging and Clearance Procedures. (4.1/4.3)

Applicability	**Est Completion Time**	**Actual Time**
RO	30 Minutes	___________

Initial Conditions

- Task is to be PERFORMED in the CLASSROOM.

Standards

- Correctly determine the tagging boundary to allow for maintenance on 1-RT-P-1B.

Initiating Cues

- Unit One is shutdown and chemical cleaning of the "B" Steam Generator is scheduled for tomorrow. To facilitate this work, a temporary suction blank needs to be installed on the "B" RT pump (1-RT-P-1B). This blank flange will be installed in place of the normal suction valve, such that the normal suction valve (1-RT-27) will be removed.
- I am the Nuclear Shift Manager. I need you to determine the electrical and mechanical tagging boundaries that will allow maintenance to safely install the temporary blank flange on 1-RT-P-1B.

Initial Conditions

- Unit One is shutdown and chemical cleaning of the “B” Steam Generator is scheduled for tomorrow. To facilitate this work, a temporary suction blank needs to be installed on the “B” RT pump (1-RT-P-1B). This blank flange will be installed in place of the normal suction valve, such that the normal suction valve (1-RT-27) will be removed.
- I am the Nuclear Shift Manager. I need you to determine the electrical and mechanical tagging boundaries that will allow maintenance to safely install the temporary blank flange on 1-RT-P-1B.
- Use the attached table to identify all components and their required positions. The number of blanks on this table does not indicate the number of steps in the tagout or the number of components to be tagged.
- The order in which tags should be placed is not necessary.
- When you finish identifying the tagging boundary, inform an examiner.
- The computerized Tagging Systems are not operational and may not be used for this task.

Terminating Cues

- Applicant informs examiner that the task has been completed.

Tools, Equipment, and Procedures

- Applicants may request administrative procedures and plant drawings.

Procedures

- OP-AA-200, EQUIPMENT CLEARANCE
- 11448-FM-124A SH 2
- 11448-FE-1K

Tools and Equipment

- Computer only connected to Webtop

Safety Considerations

- None

Notes

Performance Checklist

Notes to the Evaluator.

- Task critical elements are bolded and noted by the words “Critical Step” at the end of the step.
- **START TIME:**

STEP 1: Reviews the initial conditions of the JPM and uses Webtop to identify the drawings associated with the Recirc and Transfer System that will be used to generate a safe working boundary. **STANDARD:** (a) Utilizes Webtop and identifies that the following drawings are applicable: 11448-FM-124A SH 2 and 11448-FE-1K. **EVALUATOR’S NOTE:** • **If asked**, provide candidate with system to drawing number summary sheet. **COMMENTS:**	_______ **SAT** _______ **UNSAT**

STEP 2:

_______ **SAT**

_______ **UNSAT**

Reviews mechanical drawing 11448-FM-124A SH2 and identifies the mechanical boundaries (suction, discharge, vent, and drain)

NOTE TO EVALUATOR:

There are two possible safe working boundaries for this component. They are listed below as Boundary "A" and Boundary "B". All components for one choice are required for a safe working boundary.

STANDARD:

Boundary "A"	Boundary "B"
- 1-RT-25 – Suction Isol – CLOSED	- 1-RT-25 – Suction Isol – CLOSED
- 1-RT-36 – Pump ALT suction – CLOSED	- 1-RT-37(38) – Suction Isol – CLOSED
- 1-RT-88 – Chem injection Isol – CLOSED	- 1-RT-88 – Chem injection Isol – CLOSED
- 1-RT-59 – Discharge isol – CLOSED	- 1-RT-59 – Discharge isol – CLOSED
- 1-RT-32 – Discharge isol – CLOSED	- 1-RT-27 – Pump Suction – OPEN (Not CS)
- 1-RT-27 – Pump Suction – OPEN (Not CS)	

Vents/Drains – Numerous Vents/drains exists – at least one of the following drains and at least one of the following vents shall be open.

Boundary "A"	Boundary "B"
- 1-RT-92 – Suction drain – OPEN	- 1-RT-92 – Suction drain – OPEN
- 1-RT-28 – Suction drain – OPEN	- 1-RT-28 – Suction drain - OPEN
- 1-RT-31 – Discharge drain – OPEN	- 1-RT-31 – Discharge drain - OPEN
- 1-RT-70 – Suction Vent – OPEN	- 1-RT-70 – Suction Vent – OPEN
- 1-RT-29 – Disch Vent – OPEN with PI removed	- 1-RT-29 – Disch Vent – OPEN with PI Removed
	- 1-RT-33 – Loop Drain – OPEN
	- 1-RT-67 – Suction Vent – OPEN – if 1-RT-38 used instead of 1-RT-37.

This is a critical step.

EVALUATOR NOTES:

- Component and component position are both critical.
- If asked – 1-RT-S-1B will not be removed from the system.

COMMENTS:

STEP 3: Reviews electrical drawing 11448-FE-1K and identifies the electrical boundary (480V supply breaker) **STANDARD:** **(a) Notes that 1-EP-BKR-1A2-1-4B will need to be opened This is a critical step.** **EVALUATOR NOTES:** • Candidate may also no tag the control switch in OFF. • Component and component position are both critical. **COMMENTS:**	_______ **SAT** _______ **UNSAT**

STEP 4 (Boundary “A”):

Completes the attached table and reports that the task is complete.

_______ **SAT**

_______ **UNSAT**

STANDARD:
Table is completed as follows:

Boundary “A”

	Component ID Number / Name	Position	Danger Tag Required
1	1-RT-P-1B Control Switch	OFF	No
2	**1-EP-BKR-1A2-1-4B (‘B’ RT Pump Supply Breaker)**	**OFF**	Yes
3	**1-RT-25 – Pump Suction Isolation**	**CLOSED**	YES
4	**1-RT-36 – Pump ALT Suction**	**CLOSED**	YES
5	**1-RT-88 – Chem Injection Isol**	**CLOSED**	YES
6	**1-RT-59 – Pump Discharge Isol**	**CLOSED**	YES
7	**1-RT-32 – Pump Discharge Isol**	**CLOSED**	YES
8	1-RT-27 – Pump Suction	OPEN	NO
	At least one of the following Drains		
9	**1-RT-92 – Suction Drain**	**OPEN**	Either is acceptable
9	**1-RT-28 – Suction Drain**	**OPEN**	Either is acceptable
9	**1-RT-31 – Discharge Drain**	**OPEN**	Either is acceptable
	At least one of the following Vents		
10	**1-RT-70 – Suction Vent**	**OPEN**	Either is acceptable
10	**1-RT-29 – Discharge Vent**	**OPEN w/PI Removed**	Either is acceptable

EVALUATOR’S NOTE:

- **Minimum of 1 vent and 1 drain required. Additional vents/drains may be utilized and tags not required to be placed on additional vents/drains.**

COMMENTS:

STEP 4 (Boundary “B”):

Completes the attached table and reports that the task is complete.

_______ **SAT**

_______ **UNSAT**

STANDARD:
Table is completed as follows:

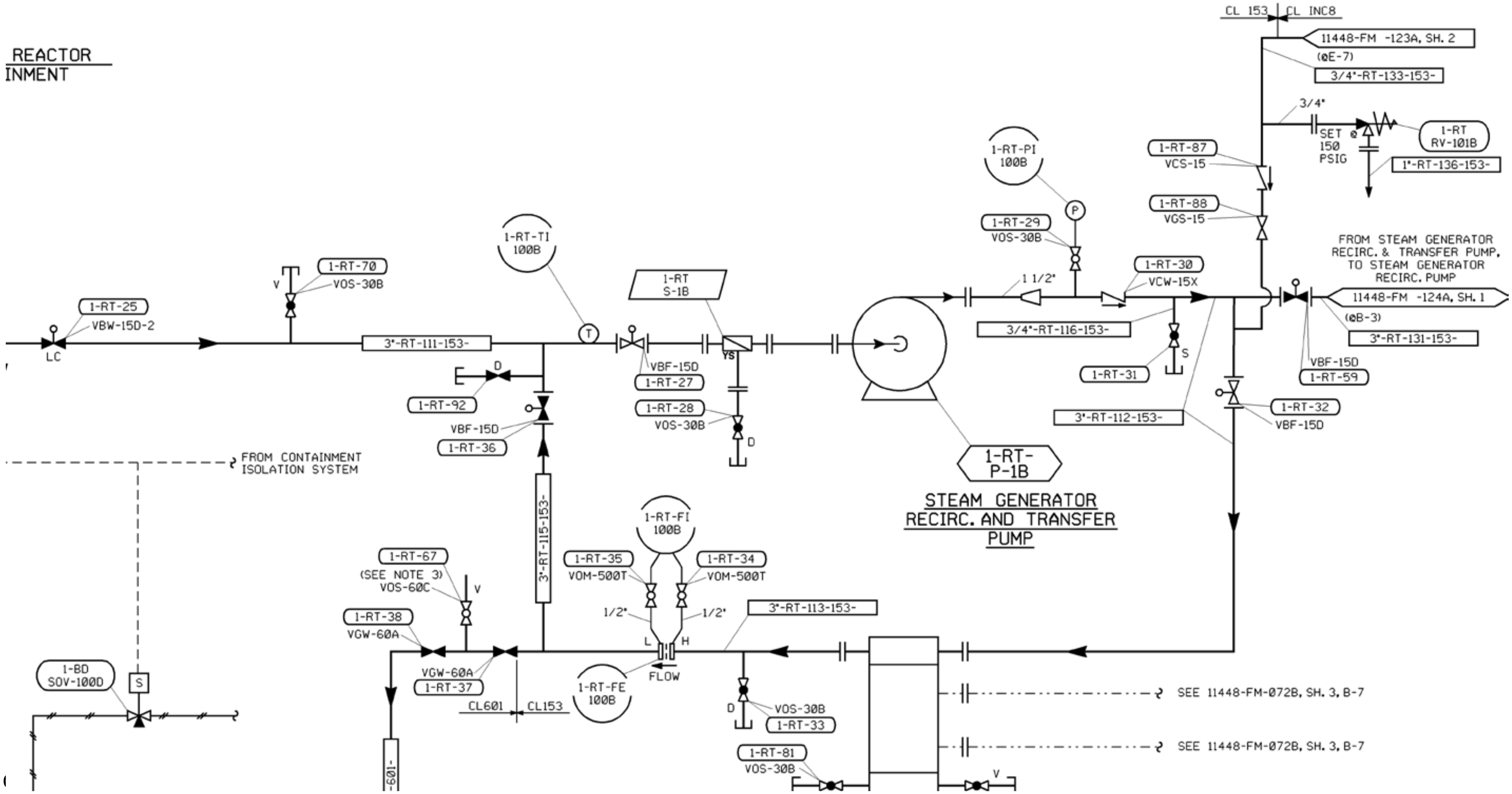
Boundary “B”

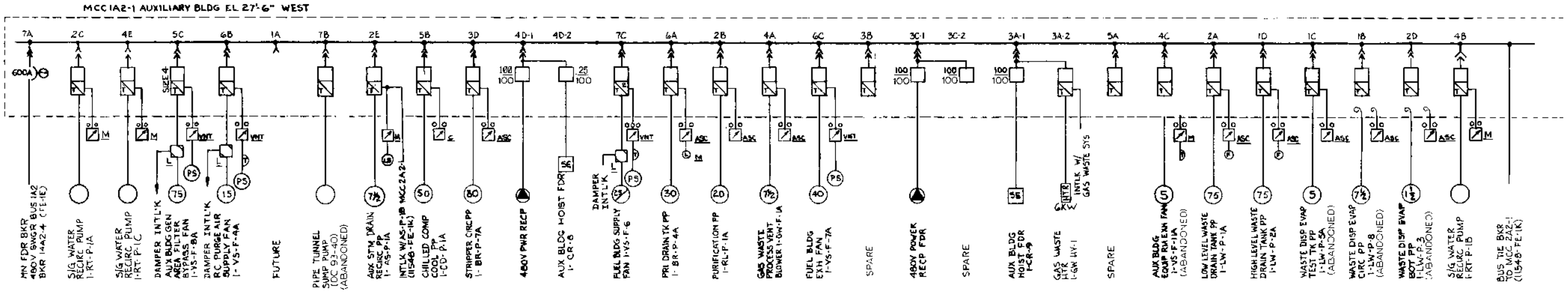
	Component ID Number / Name	Position	Danger Tag Required
1	1-RT-P-1B Control Switch	OFF	No
2	**1-EP-BKR-1A2-1-4B (‘B’ RT Pump Supply Breaker)**	**OFF**	Yes
3	**1-RT-25 – Pump Suction Isolation**	**CLOSED**	Yes
4	**1-RT-37/38 – Pump Suction Isol**	**CLOSED**	Yes
5	**1-RT-88 – Chem Injection Isol**	**CLOSED**	Yes
6	**1-RT-59 – Pump Discharge Isol**	**CLOSED**	Yes
7	1-RT-27 – Pump Suction	OPEN	No
	At least one of the following Drains		
8	**1-RT-92 – Suction Drain**	**OPEN**	Either is acceptable
8	**1-RT-28 – Suction Drain**	**OPEN**	Either is acceptable
8	**1-RT-31 – Discharge Drain**	**OPEN**	Either is acceptable
8	**1-RT-33 – Loop Drain**	**OPEN**	Either is acceptable
	At least one of the following Vents		
9	**1-RT-70 – Suction Vent**	**OPEN**	Either is acceptable
9	**1-RT-29 – Discharge Vent**	**OPEN w/PI Removed**	Either is acceptable
9	**1-RT-67 – Suction Vent** **EVALUATOR’s NOTE – ONLY IF 1-RT-38 used vs. 1-RT-37**	**OPEN**	Either is acceptable

EVALUATOR’S NOTE: Minimum of 1 vent and 1 drain required. Additional vents/drains may be utilized and tags not required to be placed on additional vents/drains.

COMMENTS:

STOP TIME:


REACTOR
INMENT
CL 153
CL INC8
11448-FM -123A, SH. 2
(@E-7)
3/4"-RT-133-153-
3/4"
SET @ 150 PSIG
1-RT RV-101B
1"-RT-136-153-
1-RT-87
VCS-15
1-RT-88
VGS-15
1-RT-PI 100B
1-RT-29
VOS-30B
1-RT-30
VCW-15X
1 1/2"
FROM STEAM GENERATOR RECIRC. & TRANSFER PUMP, TO STEAM GENERATOR RECIRC. PUMP
11448-FM -124A, SH. 1
(@B-3)
3"-RT-131-153-
VBF-15D
1-RT-59
3/4"-RT-116-153-
1-RT-31
S
1-RT-32
VBF-15D
3"-RT-112-153-
1-RT-TI 100B
1-RT-70
VOS-30B
V
1-RT-25
VBW-15D-2
LC
3"-RT-111-153-
T
1-RT S-1B
YS
VBF-15D
1-RT-27
1-RT-28
VOS-30B
D
D
1-RT-92
VBF-15D
1-RT-36
1-RT- P-1B
STEAM GENERATOR RECIRC. AND TRANSFER PUMP
FROM CONTAINMENT ISOLATION SYSTEM
3"-RT-115-153-
1-RT-FI 100B
1-RT-35
VOM-500T
1-RT-34
VOM-500T
1/2"
1/2"
3"-RT-113-153-
L
H
FLOW
1-RT-67
(SEE NOTE 3)
VOS-60C
V
1-RT-38
VGW-60A
VGW-60A
1-RT-37
CL601
CL153
1-RT-FE 100B
D
VOS-30B
1-RT-33
1-RT-81
VOS-30B
V
SEE 11448-FM-072B, SH. 3, B-7
SEE 11448-FM-072B, SH. 3, B-7
1-BD SOV-100D
S
-601-


MCC 1A2-1 AUXILIARY BLDG EL 27'-6" WEST
7A
600A
MN FDR BKR 480V SWGR BUS 1A2 BKR 14A2-4 (FE-1E)
2C
M
S/G WATER RECIRC PUMP 1-RT-P-1A
4E
M
S/G WATER RECIRC PUMP 1-RT-P-1C
5C
SIZE 4
VNT
PS
75
DAMPER INTL'K
AUX BLDG GEN AREA FILTER BYPASS FAN 1-VS-F-8A
6B
VNT
PS
15
DAMPER INTL'K
RC PURGE AIR SUPPLY FAN 1-VS-F-4A
1A
FUTURE
7B
PIPE TUNNEL SUMP PUMP (DC 93-40) (ABANDONED)
2E
M
7½
AUX STM DRAIN RECIRC PP 1-AS-P-1A
INTLK W/AS-P-1B MCC 2A2-1 (11548-FE-1K)
5B
C
50
CHILLED COMP COOL PP 1-CD-P-1A
3D
ASC
80
STRIPPER CIRC PP 1-BR-P-7A
4D-1
100/100
480V PWR RECP
4D-2
.25/100
SE
AUX BLDG HOIST FDR 1-CR-8
7C
VNT
PS
25
DAMPER INTL'K
FUEL BLDG SUPPLY FAN 1-VS-F-6
6A
ASC
M
30
PRI DRAIN TK PP 1-BR-P-4A
2B
ASC
20
PURIFICATION PP 1-RL-P-1A
4A
ASC
7½
GAS WASTE PROCESS VENT BLOWER 1-GW-F-1A
6C
VNT
PS
40
FUEL BLDG EXH FAN 1-VS-F-7A
3B
SPARE
3C-1
100/100
480V POWER RECP FDR
3C-2
100/100
SPARE
3A-1
100/100
SE
AUX BLDG HOIST FDR 1-CR-9
3A-2
HTR
6KW
INTLK W/ GAS WASTE SYS
GAS WASTE HTR 1-GW HY-1
5A
SPARE
4C
M
5
AUX BLDG EQUIP RM EXH FAN 1-VS-F-1A (ABANDONED)
2A
ASC
F
75
LOW LEVEL WASTE DRAIN TANK PP 1-LW-P-1A
1D
ASC
F
75
HIGH LEVEL WASTE DRAIN TANK PP 1-LW-P-2A
1C
ASC
5
WASTE DISP EVAP TEST TK PP 1-LW-P-5A (ABANDONED)
1B
ASC
7½
WASTE DISP EVAP CIRC PP 1-LW-P-8 (ABANDONED)
2D
ASC
1½
WASTE DISP EVAP BOT PP 1-LW-P-3 (ABANDONED)
4B
M
S/G WATER RECIRC PUMP 1-RT-P-1B
BUS TIE BKR TO MCC 2A2-1 (11548-FE-1K)

Operator Directions Handout
(TO BE READ TO APPLICANT BY EXAMINER)

Task

- Task may be PERFORMED in the classroom.

Directions

The evaluator will explain the initial conditions of the task to be performed and will provide the initiating cue. Ensure you indicate to the evaluator when you understand your assigned task.

Initial Conditions

- Unit One is shutdown and chemical cleaning of the “B” Steam Generator is scheduled for tomorrow. To facilitate this work, a temporary suction blank needs to be installed on the “B” RT pump (1-RT-P-1B). This blank flange will be installed in place of the normal suction valve, such that the normal suction valve (1-RT-27) will be removed.

- I am the Nuclear Shift Manager. I need you to determine the electrical and mechanical tagging boundaries that will allow maintenance to safely install the temporary blank flange on 1-RT-P-1B.

- Use the attached table to identify all components and their required positions. The number of blanks on this table does not indicate the number of steps in the tagout or the number of components to be tagged.

- The order in which tags should be placed is not necessary.

- When you finish identifying the tagging boundary, inform an examiner.

- The computerized Tagging Systems are not operational and may not be used for this task.

Initiating Cues

- Unit One is shutdown and chemical cleaning of the “B” Steam Generator is scheduled for tomorrow. To facilitate this work, a temporary suction blank needs to be installed on the “B” RT pump (1-RT-P-1B).

- I am the Nuclear Shift Manager. I need you to determine the electrical and mechanical tagging boundaries that will allow maintenance to safely install the temporary blank flange on 1-RT-P-1B.

Operator Directions Handout
(TO BE GIVEN TO APPLICANT)

Initial Conditions

- Unit One is shutdown and chemical cleaning of the “B” Steam Generator is scheduled for tomorrow. To facilitate this work, a temporary suction blank needs to be installed on the “B” RT pump (1-RT-P-1B). This blank flange will be installed in place of the normal suction valve, such that the normal suction valve (1-RT-27) will be removed.

- I am the Nuclear Shift Manager. I need you to determine the electrical and mechanical tagging boundaries that will allow maintenance to safely install the temporary blank flange on 1-RT-P-1B.

- Use the attached table to identify all components and their required positions. The number of blanks on this table does not indicate the number of steps in the tagout or the number of components to be tagged.

- The order in which tags should be placed is not necessary.

- When you finish identifying the tagging boundary, inform an examiner.

- The computerized Tagging Systems are not operational and may not be used for this task.

Initiating Cues

- Unit One is shutdown and chemical cleaning of the “B” Steam Generator is scheduled for tomorrow. To facilitate this work, a temporary suction blank needs to be installed on the “B” RT pump (1-RT-P-1B).

- I am the Nuclear Shift Manager. I need you to determine the electrical and mechanical tagging boundaries that will allow maintenance to safely install the temporary blank flange on 1-RT-P-1B.

(TO BE GIVEN TO APPLICANT)

	Component ID Number / Name	Position	Danger Tag Required? (Yes / No)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			

	FM-11448	FM-11548	FB-11448
AAC			8A/B,46D(1-4),47,7
Air Ejectors	66A	66A	
Annunciators---ESK 6821, 10AC & 10C			RE-25C
Aux Steam	66A,B	66A,B	
Bearing Cooling	73A,B	73A,B	
Blowdown	124A-C	124A-C	
Boron Recovery	79A-E		
Cardox			17D,FE-51Q
CC (Chg Pump)	71B	71B	
CC (general)	72A-G	72A-G	
Chem Feed	123A	123A	
Chilled CC (CD system)	72D(5)	72D(5)	
Chillers (555)	72C,H	72C,D	
Chillers (Front Office)			41A
Chillers (MCR)			41A
Circ & Service Water incl LoLvl	71A,136A	71A	
Condensate	67A-C	67A-C	
Containment Hogger	85A	85A	
Containment Leakage Monitoring	85A	85A	
Containment Spray	84A	84A	
Containment Vacuum	85A	85A	
Control Rm Bottled Air			27A,B,41B
CVCS	88A-C	88A-C	
Decon Bldg Sump Pumps	129A		
Demin Regen	77F		
Demin, condensate		77D	
Domestic Water			47A, 47D
Domestic Water (Laundry)			47D(4)
Domestic Water (1-WT-P-20)	77G		
Drains, EDG			27C
Drains, MER 1 & 2			27E
Drains, MER 3			27F
Drains, TSC			27E
Ductline Sump		(FE 32B, H; FB 39A)	
EDG #1			46A
EDG #2			46B
EDG #3			46C
EDG Fuel Oil Lines			38A
EHC	91B	91B	
Electrical Dist (SWYD)			FE-1A2
Enthalpy Diagram	59M		
Extraction Steam	65A	65A	
Feedwater	68A	68A	
Fire Protection, Aux Bldg			10B,C
Fire Protection, Cable Tunnels & Vaults			17C
Fire Protection, General			2A
Fire Protection, Svc Bldg			27E
Fire Protection, Yard Lines			3A-G, FBC-47B

FOR REFERENCE ONLY

Fire Protection---45A,47A-B
Fish Spray-------------------------136A
Floor Drains (Aux Bldg)---9A-C
Floor Drains (Decon Bldg)---------129A
Floor Drains (Turb Bldg)--15A,B
Fuel Bldg structure---------------9A
Fuel Oil (ESW Pump)---------------71E
Fuel Oil--38A
Fuel Pit---------------------------81A
Gaseous Waste----------------------90A,B
Gland Steam------------------------117A 117A
Heating Steam-------------------------------FB20&21,27Q,36A,37A-E
Heating, MER 1--26A
Heating, MER 2, EDG 1-3---26B
Hydrogen gas (Generator)---------151A,152A 151A
ICV (Instrument Control Valves): Use FK series
Inst Air (Low Level Intake)------75K
Instrument Air (Containment)-----75J/G 75J/G
Instrument Air (general)---------75A-K 75A-K
Iron Horse 76B -----------76B
Laundry Bldg (Pipes & Drains FB 49A; Domestic water FB 47D)
Liquid Waste-----------------------80A-D
Low Level Intake-------------------136A
Lube Oil---------------------------91A,76A,B 91A,76A(76B for Iron Horse)
Main Steam-------------------------64A 64A
MCR Board Diagrams--RE series
Nitrogen, Steam Generators-------64B 64B
Personnel Air Lock Hydraulics------------------91C
Plumbing (sewage tanks, HP rest rooms)--------------------------34B
Plumbing, Service Bldg--27C,H
Post Accident Vents and Drains---83C
Primary Grade Water--------------79C,D
Rad Monitor Particulate System, Containment---------------------SPP 14A
Rad Monitors (Kaman)-------------142A
Rad Monitors (RS SW)-------------130A 130A
Reactor Cavity Purification------118A 118A
Reactor Coolant------------------86A,B 86A,B
Recirc Spray Service Water-------71C 71C
Recirc Spray----------------------84B 84B
Refurb Bldg---SPS 22R
RHR (Residual Heat Removal)------87A 87A
RM 259/260--SPS 14B
RT (Recirc and Transfer)---------124A 124A
Safety Injection------------------89A,B 89A,B
Sampling System------------------82A-F 82A-E
Seal Oil 76B-----------76B
Secondary Drains (HP)------------69A 69A
Secondary Drains (LP)------------70A 70A
Secondary Drains (Misc)----------78A 78A
Secondary Drains (MSR's)---------69A 69A

Service Air-----------------------75A

Service Water (Chg Pump)----------71B 71B

Service Water (MER 3)-------------71D(1)

Service Water (MER 5)-------------71D(2)

Service Water (RS)----------------71A(3) 71A(3)

Spent Fuel Pit--------------------81A

Steam Generator Vac Priming------64B 64B

Subsurface Drains, Main Xformer--75B

Symbols & Abbreviations-------------------------------------SPS21A

Transformer drains (main/RSST - FB 1B; Low Level FB 39A)

Turbine Bldg sumps--15B

Vacuum Priming, Station----------74A 74A

Ventilation (AAC)---54B

Ventilation (Aux Bldg)---------------------------6D,11A-G,24A-25V

Ventilation (Black battery Bldg)----------------------------25Q

Ventilation (Front Office)----------------------------------24C,D

Ventilation (Fuel Bldg)--------------------------24A-G,25A,P,S,T

Ventilation (MCR)---24A, 25C

Ventilation (Primary)---------------------------------------6C

Ventilation (Svc Bldg Roof)---------------------------------25P

Vents & Drains (Post Accident)---83C

Vents & Drains-------------------83A,B 83A,B

Waste Oil Storage Facility----------------------------------SPS 12A

FK-8D TYPICAL PI/FI/FE etc

FOR REFERENCE ONLY

		UNIT 1					UNIT 2		
MCC	1A1-2	TURBINE BASEMENT WEST	FE-1H		MCC	2A1-2	TURBINE BASEMENT WEST	FE-	H
MCC	1B1-3	TURBINE BASEMENT WEST	FE-1H		MCC	2B1-3	TURBINE BASEMENT EAST	FE-	H
MCC	1A2-2	TURBINE MEZZ	FE-1H		MCC	2A2-2	TURBINE MEZZ	FE-	H
MCC	1C2-2	TURBINE MEZZ	FE-1H		MCC	2C2-2	TURBINE MEZZ	FE-	H
MCC	1A1-2A	FIRE PUMP HOUSE	FE-1H		MCC	2A2-3	TURBINE BASEMENT EAST	FE-	J
MCC	1B1-3A	FIRE PUMP HOUSE	FE-1J		MCC	2B2-2	TURBINE BASEMENT WEST	FE-	J
MCC	1A2-3	TURBINE BASEMENT EAST	FE-1J		MCC	2B1-1	FUEL BUILDING	FE-	J
MCC	1B2-2	TURBINE BASEMENT EAST	FE-1J		MCC	2B1-1B	DISCH. VACUUM PRIMING	FE-	J
MCC	1B1-1	FUEL BUILDING	FE-1J		MCC	2A2-1	AUX BUILDING WEST	FE-	K
MCC	1B1-1A	PG PUMP HOUSE	FE-1J		MCC	2C2-1	AUX BUILDING EAST	FE-	K
MCC	1B1-1B	VACUUM PRIMING DISCH	FE-1J		MCC	2G1-1	LL INTAKE STRUCTURE	FE-	K
MCC	1A2-1	AUX BUILDING WEST	FE-1K		MCC	2G1-1	LL INTAKE STRUCTURE	FE-	K
MCC	1C2-1	AUX BIUILDING EAST	FE-1K		MCC	2B1-3A	HIGH LEVEL INTAKE	FE-	K
MCC	1G1-1	LL INTAKE STRUCTURE	FE-1K		MCC	2A1-2A	HIGH LEVEL INTAKE	FE-	K
MCC	1G1-1	LL INTAKE STRUCTURE	FE-1K		MCC	2H1-1	ESGR	FE-	L
MCC	1B2-2A	HIGH LEVEL INTAKE	FE-1K		MCC	2H1-2N	CABLE VAULT	FE-	L
MCC	1H1-1	ESGR	FE-1L		MCC	2J1-1	ESGR	FE-	M
MCC	1H1-2N	CABLE VAULT	FE-1L		MCC	2J1-2E	CABLE VAULT	FE-	M
MCC	1H1-2S	CABLE VAULT	FE-1L		MCC	2J1-2W	CABLE VAULT	FE-	M
MCC	1J1-1	ESGR	FE-1M		MCC	2A1-1E	UPPER CABLE VAULT	FE-	N
MCC	1J1-2E	CABLE VAULT	FE-1M		MCC	2A1-1W	UPPER CABLE VAULT	FE-	N
MCC	1J1-2W	CABLE VAULT	FE-1M		MCC	2B1-2E	UPPER CABLE VAULT	FE-	N
MCC	1A1-1E	UPPER CABLE VAULT	FE-1N		MCC	2B1-2W	UPPER CABLE VAULT	FE-	N
MCC	1A1-1W	UPPER CABLE VAULT	FE-1N		MCC	2C1-1E	UPPER CABLE VAULT	FE-	N
MCC	1B1-2E	UPPER CABLE VAULT	FE-1N		MCC	2C1-1	UPPER CABLE VAULT	FE-	N
MCC	1B1-2W	UPPER CABLE VAULT	FE-1N		MCC	2B2-1	SWITCHGEAR ROOM	FE-	P
MCC	1C1-1E	UPPER CABLE VAULT	FE-1N		MCC	2G1-1A	INTAKE VACUUM PRIMING	FE-	P
MCC	1C1-1W	UPPER CABLE VAULT	FE-1N		MCC	2C1-2	SWITCHGEAR ROOM	FE-	P
MCC	1B1-1C	DECON BUILDING	FE-1N		MCC	2G1-1B	EMER. SW PUMP HOUSE	FE-	P
MCC	1A1-2B	DISCH. VACUUM PRIMING	FE-1P		MCC	2H1-1A	#2 EDG	FE-	P
MCC	1B1-3B	DISCH. VACUUM PRIMING	FE-1P						
MCC	1G1-1A	INATKE VACUUM PRIMING	FE-1P				COND. POLISHING BLDG		
MCC	1B2-1	SWITCHGEAR ROOM WEST	FE-1P		MCC	1C3-1	13058 SERIES	FE-	
MCC	1G1-1B	EMER. SW PUMP HOUSE	FE-1P		MCC	2C3-1	13058 SERIES	FE-	
MCC	1C1-2	SWITCHGEAR ROOM EAST	FE-1P		MCC	1C3-2	13058 SERIES	FE-1	
MCC	1H1-1A	#1 EDG ROOM	FE-1P		MCC	2C3-2	13058 SERIES	FE-1	
MCC	1J1-1A	#3 EDG ROOM	FE-1P1		C3	480V	13058 SERIES	FE-1	
A	4160 V	SWITCHGEAR ROOM	FE-1B						
B	4160 V	SWITCHGEAR ROOM	FE-1B						
C	4160 V	SWITCHGEAR ROOM	FE-1C						
G	4160 V	LL SWITCHGEAR ROOM	FE-1C						
H	4160 V	ESGR	FE-1D						
J	4160 V	ESGR	FE-1D						
A1	480 V	SWITCHGEAR ROOM	FE-1E						
A2	480 V	SWITCHGEAR ROOM	FE-1E						
B1	480 V	SWITCHGEAR ROOM	FE-1E						
B2	480 V	SWITCHGEAR ROOM	FE-1F						
C1	480 V	SWITCHGEAR ROOM	FE-1F						
C2	480 V	SWITCHGEAR ROOM	FE-1E						
H	480 V	ESGR	FE-1F						
J	480 V	ESGR	FE-1F						

FOR REFERENCE ONLY

U.S. Nuclear Regulatory Commission
Surry Power Station

SR10301
Administrative Job Performance Measure 2.1.20

Applicant_______________________________ Start Time__________________

Examiner______________________________

Date __________________________________ Stop Time__________________

Title

Determine Partial Pressure following a Loss of Containment Cooling

K/A: G2.1.20 – Ability to interpret and execute procedure steps. (4.6/4.6)

Applicability	**Est Completion Time**	**Actual Time**
SRO(I)	30 Minutes	___________

Initial Conditions

- Task is to be PERFORMED in the SIMULATOR or CLASSROOM.

Standards

- Correctly determine partial pressure in accordance with ARP-1B-A6 and verifies Tech Spec compliance.

Initiating Cues

- Given simulated plant conditions, perform Attachment 2 of Annunciator Response Procedure (ARP) 1B-A6, Containment Pressure -0.1 PSI Channel 1, to calculate Containment Partial Pressure and Technical Specification Compliance.

Initial Conditions

- I am the Nuclear Shift Manager. I have assigned you to perform Attachment 2 of Annunciator Response Procedure (ARP) 1B-A6, Containment Pressure -0.1 PSI Channel 1, to calculate Containment Partial Pressure and Technical Specification Compliance.

- Approximately 2 hours ago Unit 1 was at 100% power when the operating chilled water system chiller tripped. As a result, annunciators 1B-A6 (CTMT PART PRESS -0.1 PSI CH 1) and 1B-B6 (CTMT PART PRESS -0.1 PSI CH 2) were received.
- The operating team has implemented ARP-1B-A6 up to the point of implementing Attachment 2.
- Maintenance has determined that the chiller will not be returned to service until tomorrow.

Applicable Plant conditions are located below and as attachments to this JPM:

Previous PT-36.00 data:

Date:	Today
Time:	0000
CTMT Air Partial Pressure:	10.41 psia

- Here is a copy of Attachment 2 of Annunciator Response Procedure (ARP) 1B-A6, Containment Pressure -0.1 PSI Channel 1. I need you to perform Attachment 2 of Annunciator Response Procedure (ARP) 1B-A6, Containment Pressure -0.1 PSI Channel 1, to calculate Containment Partial Pressure and Technical Specification Compliance.

- When you have completed this task please inform me of the results.

Terminating Cues

- Steps 1-13 of Attachment 2 of ARP 1B-A6 are complete.

Procedures

- Attachment 2 of procedure 1B-A6, CTMT PRESS –0.1 PSI CH 1
- Tech Spec 3.8

Tools and Equipment

- Calculator
- Steam Tables
- Tech Specs
- DRP-003

Safety Considerations

- None

Notes

PCS Screen Shots are provide to facilitate classroom performance.

Performance Checklist

Notes to the Evaluator.

- Task critical elements are bolded and noted by the words "Critical Step" at the end of the step.
- **START TIME:**

STEP 1: Notes prior to Step 1 of Attachment 2: • This calculation is required at a minimum of every 12 hours to satisfy Tech Spec 3.8. However, if CTMT cooling conditions change adversely, this calculation should be performed more frequently, at the discretion of Shift Supervision. • Performance of this calculation immediately after loss of CTMT cooling is not required; however, it must be performed within 12 hours of the last satisfactory surveillance. (typically within 12 hours of the last valid 1-PT-36 log reading) • Air partial pressure (P air) is obtained from the formula Ptot - Psat = Pair • Ptot is CTMT pressure from one of the following: o The highest of 1-CV-PI-101A or 1-CV-PI-101B o The highest of Unit 1 PCS points P1LM002A, P1LM003A, P1LM001A, or P1LM004A • Psat is the saturation pressure of the minimum CTMT temperature obtained in Step 3 (using steam tables). This conservatively assumes that the lowest CTMT ambient temperature is at the CTMT saturation temperature. A more precise determination of Psat is allowed in Step 8. This alternative relies on measurement of relative humidity, since the actual saturation temperature is a function of both dry-bulb temperature and relative humidity. **STANDARD:** (a) Acknowledges the notes **EVALUATOR'S NOTE:** • **If asked**, it is desired to perform this calculation now. **COMMENTS:**	_______ **SAT** _______ **UNSAT**

STEP 2:

_______ **SAT**

_______ **UNSAT**

Step 1 of Attachment 2:

1. Record the Date, Time, and CTMT Air Partial Pressure from the last valid 1-PT-36 log reading in the first row of the CTMT Pressure Data Table at the end of this attachment.

STANDARD:

a) Obtains required data from supplied PT-36 and records it on LINE 1 of CTMT PRESSURE DATA TABLE of Attachment 2.

EVALUATOR NOTES:

Page 3 of Attachment 2 will be filled out as follows:

Date/Time	Tmin	Ptot	Psat	Pair	Initials
Today/0000	N/A	N/A	N/A	10.41	

COMMENTS:

STEP 3:

_______ **SAT**

_______ **UNSAT**

Step 2 of Attachment 2:

2. Record the Date and Time in the CTMT Pressure Data Table.

STANDARD:

a) Records the current Date and Time on Line 2 of CTMT PRESSURE DATA TABLE of attachment 2.

EVALUATOR NOTES:

Page 3 of Attachment 2 will be filled out as follows:

Date/Time	Tmin	Ptot	Psat	Pair	Initials
Today/0000	N/A	N/A	N/A	10.41	
Today/Now					

COMMENTS:

STEP 4:

Step 3 of Attachment 2:

3. Obtain the minimum CTMT air temperature from Unit 1 PCS Containment Temperatures (Elev) and record in the Tmin column in the CTMT Pressure Data Table.

STANDARD:

a) Utilizing the PCS Screen Shot for CTMT Air Temperatures – chooses the reading of 89 °F
This is a critical step.

EVALUATOR NOTES:

This PCS Screen Shot is located at the end of this JPM.

Page 3 of Attachment 2 will be filled out as follows:

Date/Time	Tmin	Ptot	Psat	Pair	Initials
Today/0000	N/A	N/A	N/A	10.41	
Today/Now	89 °F				

COMMENTS:

_______ **SAT**

_______ **UNSAT**

STEP 5:

Step 4 of Attachment 2:

4. Obtain Ptot from one of the following sources and record in the Ptot column in the CTMT Pressure Data Table.
   - o The highest of 1-CV-PI-101A or 1-CV-PI-101B

STANDARD:

a) Utilizing the highest (in accordance with note prior to step 1) of either 1-CV-PI-101A/B
This is a critical step.

EVALUATOR NOTES:

This PCS Screen Shot is located at the end of this JPM.

Page 3 of Attachment 2 will be filled out as follows (using PCS data):

Date/Time	Tmin	Ptot	Psat	Pair	Initials
Today/0000	N/A	N/A	N/A	10.41	
Today/Now	89 °F	11.21 (11.17-11.25 range)			

Answer:

- CV-PI-101A/B– highest reading should be 11.21 psia [range 11.17 – 11.25]
- If asked, PCS points are as they appear on printout.

COMMENTS:

STEP 6:

_______ **SAT**

_______ **UNSAT**

Step 5 of Attachment 2

5. Use Steam Tables to determine Psat corresponding to the minimum CTMT temperature obtained in Step 3 and record in the Psat column in the CTMT Pressure Data Table.

STANDARD:

a) Utilizing minimum temperature obtained in Step 3, determines Psat and records on Line 2 of CTMT PRESSURE DATA TABLE of Attachment 2-Psat data field.
This is a critical step.

EVALUATOR NOTES:

- Should determine Psat to be 0.67682 [0.67 – 0.68]

Page 3 of Attachment 2 will be filled out as follows (using PCS data):

Date/Time	Tmin	Ptot	Psat	Pair	Initials
Today/0000	N/A	N/A	N/A	10.41	
Today/Now	89 °F	11.21 (11.17-11.25 range)	0.67682 (0.67–0.68 range)		

Answer: 0.67682 [Acceptable Range 0.67 – 0.68]

COMMENTS:

STEP 7:

Step 6 of Attachment 2:

6. Calculate Pair by subtracting Psat from Ptot and record in the Pair column in the CTMT Pressure Data Table.

STANDARD:

a) Determines Pair by subtracting Psat from Ptot.

EVALUATOR NOTES:

Page 3 of Attachment 2 will be filled out as follows (using PCS data):

Date/Time	Tmin	Ptot	Psat	Pair	Initials
Today/0000	N/A	N/A	N/A	10.41	
Today/Now	89 °F	11.21 (11.17-11.25 range)	0.67682 (0.67–0.68 range)	10.53 (10.49 – 10.58 range)	

Answer:
- Candidate should calculate Pair to be 10.53 [range 10.49 – 10.58]

COMMENTS:

_______ **SAT**

_______ **UNSAT**

STEP 8:

Note prior to step 7:
- A more precise measurement of Pair may be obtained by performing the following steps with STA or System Engineering assistance.

STANDARD:

(a) Acknowledges the notes

EVALUATOR NOTES:
- If asked, it is NOT desired to perform this calculation

COMMENTS:

_______ **SAT**

_______ **UNSAT**

STEP 9:

Step 7 of Attachment 2:

7. IF a more precise measurement of Pair is required, THEN perform the remainder of this attachment with STA or Engineering assistance. Otherwise, enter N/A for Steps 8 through 12, AND GO TO Step 13.

STANDARD:

a) Enters N/A on steps 8 through 12 and goes to step 12.

EVALUATOR NOTES:

- If asked, it is NOT desired to perform this calculation

COMMENTS:

_______ **SAT**

_______ **UNSAT**

STEP 10:

Step 13 of Attachment 2

13. Verify CTMT Air Partial Pressure is within Tech Spec 3.8-1 limits.

STANDARD:

a) Obtains a copy of Tech Specs and refers to table 3.8-1 and determines that partial pressure is NOT within acceptable Tech Spec limits.
This is a critical step.

EVALUATOR NOTES:

- Trainee to obtain CW temperature from PCS Screen Shots located at the end of this JPM – CW inlet temp will be 96˚F.
- If report is given that partial pressure is outside of Table 3.8-1 limits, ask the trainee to determine and report applicable LCO limits and actions required.
    - o Should determine 1 hour clock to restore to within limits or be in HSD in next 6 hours and CSD in following 30 hours.

COMMENTS:

STEP 11: Reports task is complete. **STANDARD:** **a) Verbal or written status report that the task is complete and that Partial Pressure is outside the limits of TS Table 3.8-1. This is a Critical Step if not already performed.** **EVALUATOR'S NOTE:** - Acknowledge the completion of the task. **COMMENTS:**	_______ **SAT** _______ **UNSAT**

STOP TIME:

Operator Directions Handout
(TO BE READ TO APPLICANT BY EXAMINER)

Task

- Task may be PERFORMED in the simulator or classroom.
- Correctly determine partial pressure in accordance with ARP-1B-A6 and verifies Tech Spec compliance.

Directions

The evaluator will explain the initial conditions of the task to be performed and will provide the initiating cue. Ensure you indicate to the evaluator when you understand your assigned task.

Initial Conditions:

- I am the Nuclear Shift Manager. I have assigned you to perform Attachment 2 of Annunciator Response Procedure (ARP) 1B-A6, Containment Pressure -0.1 PSI Channel 1, to calculate Containment Partial Pressure and Technical Specification Compliance.

- Approximately 2 hours ago Unit 1 was at 100% power when the operating chilled water system chiller tripped. As a result, annunciators 1B-A6 (CTMT PART PRESS -0.1 PSI CH 1) and 1B-B6 (CTMT PART PRESS -0.1 PSI CH 2) were received.
- The operating team has implemented ARP-1B-A6 up to the point of implementing Attachment 2.
- Maintenance has determined that the chiller will not be returned to service until tomorrow.

Applicable Plant conditions are located below and as attachments to this JPM:

Previous PT-36.00 data:

Date:	Today
Time:	0000
CTMT Air Partial Pressure:	10.41 psia

Initiating Cues:

- Here is a copy of Attachment 2 of Annunciator Response Procedure (ARP) 1B-A6, Containment Pressure -0.1 PSI Channel 1. I need you to perform Attachment 2 of Annunciator Response Procedure (ARP) 1B-A6, Containment Pressure -0.1 PSI Channel 1, to calculate Containment Partial Pressure and Technical Specification Compliance.

- When you have completed this task please inform me of the results.

Operator Directions Handout
(TO BE GIVEN TO APPLICANT)

Initial Conditions:

- I am the Nuclear Shift Manager. I have assigned you to perform Attachment 2 of Annunciator Response Procedure (ARP) 1B-A6, Containment Pressure -0.1 PSI Channel 1, to calculate Containment Partial Pressure and Technical Specification Compliance.

- Approximately 2 hours ago Unit 1 was at 100% power when the operating chilled water system chiller tripped. As a result, annunciators 1B-A6 (CTMT PART PRESS -0.1 PSI CH 1) and 1B-B6 (CTMT PART PRESS -0.1 PSI CH 2) were received.
- The operating team has implemented ARP-1B-A6 up to the point of implementing Attachment 2.
- Maintenance has determined that the chiller will not be returned to service until tomorrow.

Applicable Plant conditions are located below and as attachments to this JPM:

Previous PT-36.00 data:

Date:	Today
Time:	0000
CTMT Air Partial Pressure:	10.41 psia

Initiating Cues:

- Here is a copy of Attachment 2 of Annunciator Response Procedure (ARP) 1B-A6, Containment Pressure -0.1 PSI Channel 1. I need you to perform Attachment 2 of Annunciator Response Procedure (ARP) 1B-A6, Containment Pressure -0.1 PSI Channel 1, to calculate Containment Partial Pressure and Technical Specification Compliance.

- When you have completed this task please inform me of the results.

NOTE:

- This calculation is required at a minimum of every 12 hours to satisfy Tech Spec 3.8. However, if CTMT cooling conditions change adversely, this calculation should be performed more frequently, at the discretion of Shift Supervision.
- Performance of this calculation immediately after loss of CTMT cooling is not required, however, it must be performed within 12 hours of the last satisfactory surveillance. (typically within 12 hours of the last valid 1-PT-36 log reading)
- Air partial pressure (P_{air}) is obtained from the formula $P_{tot} - P_{sat} = P_{air}$
- P_{tot} is CTMT pressure from one of the following:
  - The highest of 1-CV-PI-101A or 1-CV-PI-101B
  - The highest of Unit 1 PCS points P1LM002A, P1LM003A, P1LM001A, or P1LM004A
- P_{sat} is the saturation pressure of the lowest CTMT temperature obtained in Step 3 (using steam tables). This conservatively assumes that the lowest CTMT ambient temperature is at the CTMT saturation temperature. A more precise determination of P_{sat} is allowed in Step 7. This alternative relies on measurement of relative humidity, since the actual saturation temperature is a function of both dry-bulb temperature and relative humidity.

1. ___ Record the Date, Time, and CTMT Air Partial Pressure in the P_{air} column from the last valid 1-PT-36 log reading in the first row of the CTMT Pressure Data Table at the end of this attachment.

2. ___ Record the current Date and Time in the CTMT Pressure Data Table in the next available row.

3. ___ Obtain and record the lowest CTMT air temperature from Unit 1 PCS Containment Temperatures (Elev) and record in the T_{min} column in the CTMT Pressure Data Table.

4. ___ Obtain P_{tot} from one of the following sources and record in the P_{tot} column in the CTMT Pressure Data Table.

   ☐ • The highest of 1-CV-PI-101A or 1-CV-PI-101B

   ☐ • The highest of Unit 1 PCS points P1LM002A, P1LM003A, P1LM001A, or P1LM004A

5. ___ Use Steam Tables to determine P_{sat} corresponding to the lowest CTMT temperature obtained in Step 3 and record in the P_{sat} column in the CTMT Pressure Data Table.

6. ___ Calculate P_{air} by subtracting P_{sat} from P_{tot} and record in the P_{air} column in the CTMT Pressure Data Table.

NOTE: A more precise measurement of P_{air} may be obtained by performing the following steps with STA or System Engineering assistance.

7. ___ IF a more precise measurement of P_{air} is required, THEN perform the remainder of this attachment with STA or System Engineering assistance. Otherwise, enter N/A for Steps 8 through 12, AND GO TO Step 13.

8. ___ Obtain an instrument for measuring relative humidity or dewpoint.

9. ___ Request HP assistance.

10. ___ Obtain a sample of the CTMT atmosphere from the CTMT Particulate and Gas Radiation monitor or from CTMT entry.

11. ___ Determine the relative humidity or dewpoint of the CTMT atmosphere sample.

12. ___ Determine P_{sat} IAW the following:

    ☐ a) IF a measured value for CTMT air dewpoint (t_d) is obtained, THEN use Steam Tables to determine P_{sat} corresponding to t_d.

    ☐ b) IF measured values for CTMT relative humidity (RH) and temperature (dry-bulb) are obtained, THEN use Steam Tables to determine P_{sat} corresponding to the dry-bulb temperature.

    - Calculate P_{sat} = RH x (P_{sat} corresponding to the dry-bulb temperature)

    ☐ c) Calculate P_{air} by subtracting P_{sat} from P_{tot}.

13. ___ Verify current CTMT Air Partial Pressure (P_{air}) is within Tech Spec 3.8-1 limits.

14. ___ Perform calculations and log results every four hours in the CTMT Pressure Data Table starting at Step 2 of this attachment.

15. ___ WHEN Chiller has been restarted, THEN RETURN TO procedure Step 10.

NOTE: P_{air} must be calculated every 12 hours to satisfy compliance with Tech Spec 3.8.

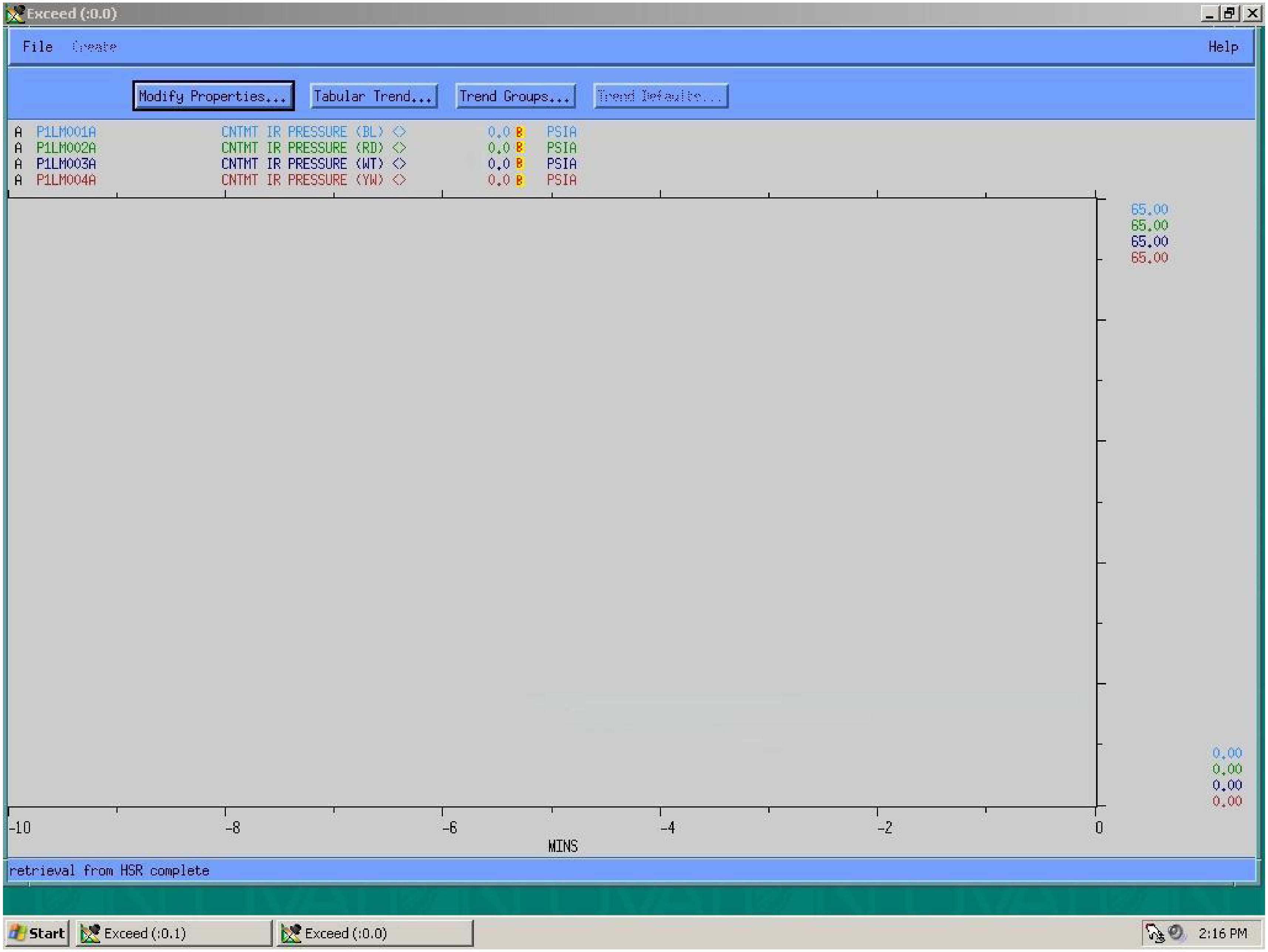
CTMT PRESSURE DATA TABLE

Date/Time	T_{min}	P_{tot}	P_{sat}	P_{air}	Initials

Attachment 1 – Screen Shots

Attachment 1 – Screen Shots

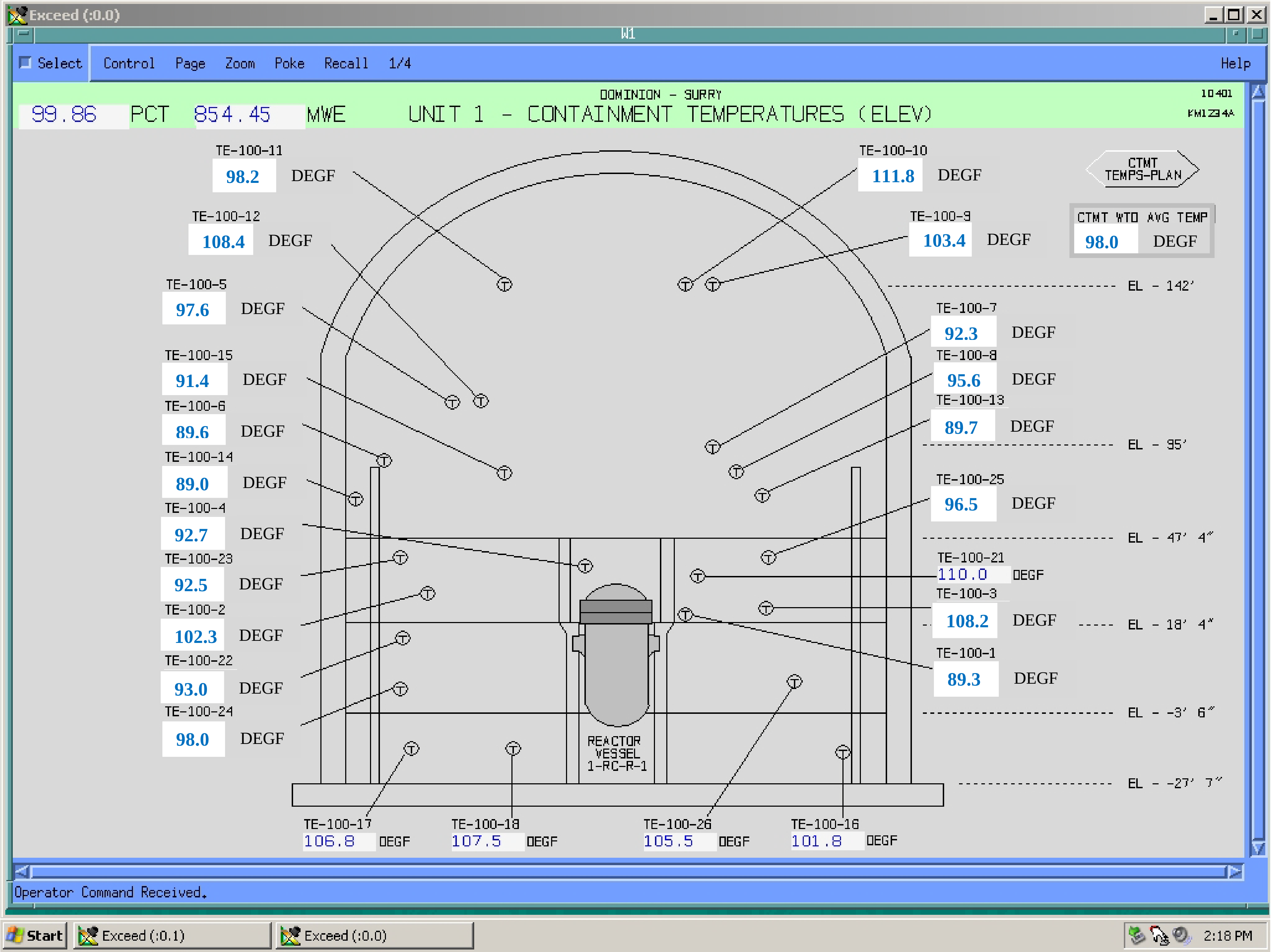
Attachment 1 – Screen Shots



A	P1LM001A	CNTMT IR PRESSURE (BL) <>	0.0	B	PSIA
A	P1LM002A	CNTMT IR PRESSURE (RD) <>	0.0	B	PSIA
A	P1LM003A	CNTMT IR PRESSURE (WT) <>	0.0	B	PSIA
A	P1LM004A	CNTMT IR PRESSURE (YW) <>	0.0	B	PSIA

retrieval from HSR complete

Attachment 1 – Screen Shots



DOMINION – SURRY

99.86 PCT 854.45 MWE UNIT 1 – CONTAINMENT TEMPERATURES (ELEV)

TE-100-11 98.2 DEGF

TE-100-10 111.8 DEGF

TE-100-12 108.4 DEGF

TE-100-9 103.4 DEGF

CTMT WTD AVG TEMP 98.0 DEGF

TE-100-5 97.6 DEGF

TE-100-7 92.3 DEGF

TE-100-15 91.4 DEGF

TE-100-8 95.6 DEGF

TE-100-6 89.6 DEGF

TE-100-13 89.7 DEGF

TE-100-14 89.0 DEGF

TE-100-25 96.5 DEGF

TE-100-4 92.7 DEGF

TE-100-21 110.0 DEGF

TE-100-23 92.5 DEGF

TE-100-3 108.2 DEGF

TE-100-2 102.3 DEGF

TE-100-1 89.3 DEGF

TE-100-22 93.0 DEGF

TE-100-24 98.0 DEGF

TE-100-17 106.8 DEGF

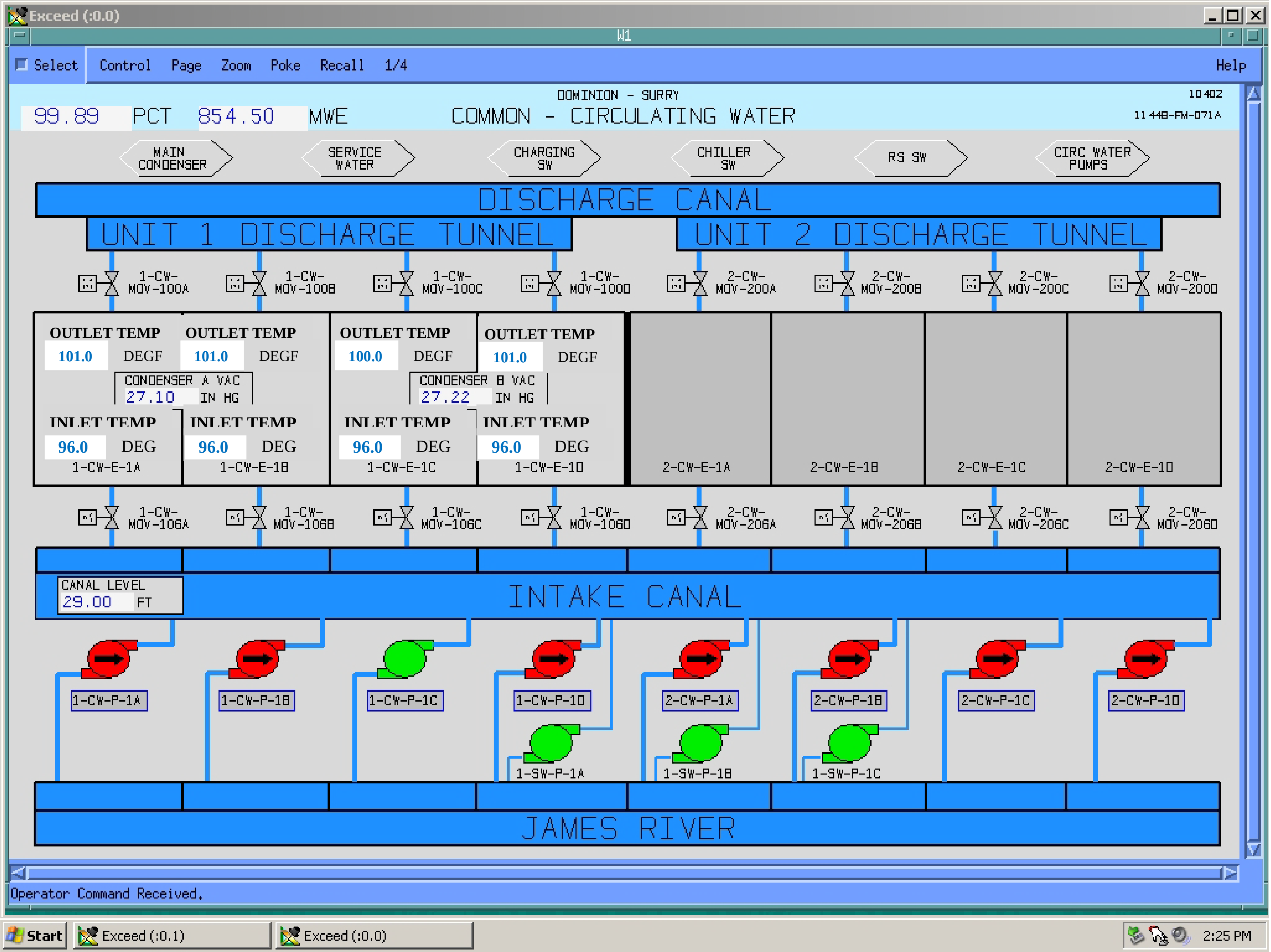
TE-100-18 107.5 DEGF

TE-100-26 105.5 DEGF

TE-100-16 101.8 DEGF

Operator Command Received.

Attachment 1 – Screen Shots



99.89 PCT 854.50 MWE

1-CW-E-1A: OUTLET TEMP 101.0 DEGF; INLET TEMP 96.0 DEG

1-CW-E-1B: OUTLET TEMP 101.0 DEGF; INLET TEMP 96.0 DEG

CONDENSER A VAC 27.10 IN HG

1-CW-E-1C: OUTLET TEMP 100.0 DEGF; INLET TEMP 96.0 DEG

1-CW-E-1D: OUTLET TEMP 101.0 DEGF; INLET TEMP 96.0 DEG

CONDENSER B VAC 27.22 IN HG

CANAL LEVEL 29.00 FT

Operator Command Received.

U.S. Nuclear Regulatory Commission
Surry Power Station

SR10301
Administrative Job Performance Measure GEN2.2.37 (3.6/4.6)

Applicant________________________________ Start Time___________________

Examiner_______________________________

Date ___________________________________ Stop Time___________________

Title

Periodic Test Review 1-OPT-CH-002 (REV 47), CHARGING PUMP OPERABILITY AND PERFORMANCE TEST FOR 1-CH-P-1B

K/A: GEN2.2.37 Ability to determine operability and/or availability of safety related equipment.

Applicability	**Estimated Time**	**Actual Time**
SRO(I)	45 Minutes	

Initial Conditions

- Task is to be PERFORMED in the classroom.

Standards

- Reviews completed 1-OPT-CH-002 (REV 47), CHARGING PUMP OPERABILITY AND PERFORMANCE TEST FOR 1-CH-P-1B, for accuracy and determines operability.

Initiating Cues

- I am the Shift Manager and you are the Unit Supervisor. Here is a copy of 1-OPT-CH-002 (REV 47), CHARGING PUMP OPERABILITY AND PERFORMANCE TEST FOR 1-CH-P-1B, which has just been completed.
- No maintenance has been performed on the Charging system.
-
- This was a quarterly test.
- Review 1-OPT-CH-002 (REV 47), CHARGING PUMP OPERABILITY AND PERFORMANCE TEST FOR 1-CH-P-1B, for completeness and accuracy.
- List ALL discrepancies noted on the ANSWER SHEET provided.
- When you are finished, inform your examiner of ALL problems noted in the procedure and any Technical Specification operability concerns if applicable.

Terminating Cues

- Applicant has completed the procedure review and discussed problems with examiner.

Tools and Equipment

- Calculator
- Copy of completed 1-OPT-CH-002 (REV 47), CHARGING PUMP OPERABILITY AND PERFORMANCE TEST FOR 1-CH-P-1B.

Safety Considerations

- None

Notes

PERFORMANCE CHECKLIST

Notes to the Evaluator

- Task critical elements are bolded and noted at the end of the step as CRITICAL STEP.
- **START TIME:**

STEP 1: ***STEP 1 -*** Review the purpose of the procedure (Section 1.0) **STANDARD:** • Reviews purpose of procedure steps 1.1 - 1.9. **EVALUATOR'S NOTE: N/A** **COMMENTS:**	_______ **SAT** _______ **UNSAT**
STEP 2: ***STEP 2*** - Review the References section (Section 2.0) **STANDARD:** • Reviews section 2.1, Source Documents, 2.2 Technical Specifications, 2.3 Technical References, and 2.4 Commitment Documents. **EVALUATOR'S NOTE: N/A** **COMMENTS:**	_______ **SAT** _______ **UNSAT**

STEP 3:

STEP 3 - Reviews the Initial Conditions section (Section 3.0)

STANDARD:

- Reviews Initial Conditions steps 3.1 - 3.4.

EVALUATOR'S NOTE: N/A

COMMENTS:

_______ **SAT**

_______ **UNSAT**

STEP 4:

STEP 4 - Reviews the Precautions and Limitations section (Section 4.0)

STANDARD:

- Reviews precautions and limitations steps 4.1 - 4.15.

EVALUATOR'S NOTE: N/A

COMMENTS:

_______ **SAT**

_______ **UNSAT**

STEP 5:

STEP 5 - Reviews the Special Tools and Equipment section (Section 5.0)

STANDARD:

- Reviews Special Tools and Equipment section steps 5.1 - 5.8.

EVALUATOR'S NOTE: N/A

COMMENTS:

_______ **SAT**

_______ **UNSAT**

STEP 6:

STEP 6.1 - Reviews Work Preparation section (Section 6.1).

STANDARD:

- Verifies proper placekeeping on all steps, notes, and cautions.
- Verifies step 6.1.1 is N/A'd.
- Verifies step 6.1.2 substeps a and b are initialed and Attachment 9 is properly filled out.
- Verifies step 6.1.3 is initialed and SQC numbers and Cal Due Dates are recorded on Attachment 1. **CANDIDATE IDENTIFIES THAT ONE STOPWATCH USED IS NOT IN CAL – THIS IS A CRITICAL STEP**
- Verifies step 6.1.4 is initialed.
- Verifies step 6.1.5 is initialed and blocks are correctly checked off. The 6th block should be checked off which is "1-CH-P-1B needs the Quarterly Test (1-CH-P-1B must be stopped), Perform Subsection 6.5 and Subsection 6.6"
- Goes to subsection 6.5.

EVALUATOR'S NOTE: N/A

COMMENTS:

_______ **SAT**

_______ **UNSAT**

STEP 7:

STEPS 6.2-6.4 **-** Reviews Steps 6.2 - 6.4 of 1-OPT-CH-002

STANDARD:

- Verifies all steps in 6.2 - 6.4 are N/A'd.

EVALUATOR'S NOTE: N/A

COMMENTS:

_______ **SAT**

_______ **UNSAT**

STEP 8:

STEP 6.5- Reviews Discharge Check Valve Close Test, MOV Timing, Lube Oil TCV Timing and Starting 1-CH-P-1B section of procedure (Section 6.5.1 - 6.5.20).

STANDARD:

- Verifies proper placekeeping on all steps, notes, and cautions.
- Verifies step 6.5.1 – 6.5.20 are properly initialed.
- Verifies open and close stroke times are recorded on Attachment 4 for 1-CH-MOV-1286B, 1287B and 1275B.
- Verifies discharge pressure recorded on Attachment 1 IAW step 6.5.1.e, 6.5.1.f, 6.5.1.g and that differential is < 7.5 psid IAW 6.5.1.g.
- Verifies box checked in step 6.5.2 indicating that 1-SW-TCV-108B was closed and goes to step 6.5.3.
- Verifies step 6.5.4 is N/A'd.
- Verifies step 6.5.6.a is N/A'd.
- Verifies step 6.5.7 is N/A'd.
- Verifies the open and closed stroke times, test position, and the as left position for 1-SW-TCV-108B are recorded on Attachment 4.
- Verifies lube oil temperature recorded in step 6.5.6.d is between 60-120 °F.
- Verifies step 6.5.10.b is N/A'd.
- Verifies step 6.5.12 is N/A'd.
- Verifies lube oil pressure recorded in step 6.5.16 is between 8-35 psig.
- Verifies step 6.5.17 N/A'd.
- Verifies pump and damper checks were sat IAW step 6.5.20 on non-running charging pumps.

EVALUATOR'S NOTE: N/A

COMMENTS:

_______ **SAT**

_______ **UNSAT**

STEP 9:

_______ **SAT**

_______ **UNSAT**

STEP 6.6- Reviews 1-CH-P-1B Performance Test section of procedure (Section 6.6.1 - 6.6.26).

STANDARD:

- Verifies proper placekeeping on all steps, notes, and cautions.
- Verifies step 6.6.1 – 6.6.26 are properly initialed.
- Verifies step 6.6.3 is N/A'd.
- Verifies data is recorded in step 6.6.5 - 6.6.7.
- Verifies step 6.6.10.b is N/A'd.
- Verifies data recorded on Attachments 1 and 2 IAW steps 6.6.12 - 6.6.16.
- Verifies step 6.6.17 and step 6.6.18 are N/A'd.
- Verifies data is recorded in step 6.6.22.
- Verifies step 6.6.26 N/A'd.

EVALUATOR'S NOTE: N/A

COMMENTS:

STEP 10:

_______ **SAT**

_______ **UNSAT**

STEPS 6.7-6.8 - Reviews Steps 6.7 - 6.8 of 1-OPT-CH-002

STANDARD:

- Verifies all steps in 6.7 - 6.8 are N/A'd.

EVALUATOR'S NOTE: N/A

COMMENTS:

STEP 11:

_______ **SAT**

_______ **UNSAT**

STEP 6.9- Reviews Obtaining Oil Samples section of procedure Section 6.9.1-6.9.2).

STANDARD:

- Verifies proper placekeeping on all steps, notes, and cautions.
- Verifies steps in 6.9.1 are properly initialed and steps in 6.9.2 are N/A'd.

EVALUATOR'S NOTE: N/A

COMMENTS:

STEP 12:

STEP 6.10 - Reviews Step 6.10 of 1-OPT-CH-002.

_______ **SAT**

_______ **UNSAT**

STANDARD:

- Verifies all steps of 6.10 are N/A'd.

EVALUATOR'S NOTE: N/A

COMMENTS:

STEP 12:

STEP 7.0- Reviews Follow-On section of procedure (Section 7.1 – 7.4).

_______ **SAT**

_______ **UNSAT**

STANDARD:

- Verifies proper placekeeping on all steps, notes, and cautions.
- Evaluates the acceptance criteria in step 7.1.1 by reviewing attachment data referenced for each bulleted item.

EVALUATOR'S NOTE: N/A

COMMENTS:

STEP 13:

Attachment 1- Reviews Attachment 1 Data.

_______ **SAT**

_______ **UNSAT**

STANDARD:

- Review attachment 1 data and verifies all are within the acceptance criteria.
- Step 6.1.3 - **CANDIDATE IDENTIFIES THAT ONE STOPWATCH USED IS NOT IN CAL – THIS IS A CRITICAL STEP**

EVALUATOR'S NOTE: N/A

COMMENTS:

STEP 14: ***Attachment 2***- Reviews Attachment 2 Data. **STANDARD:** • Review attachment 2 data and verifies all are within the acceptance criteria. • **Notes that the outboard horizontal vibration (pt 22) on the pump bearing is in the INOPERABLE RANGE and that OPT was checked as SAT.** • **This is a critical step.** **EVALUATOR’S NOTE: N/A** **COMMENTS:**	_______ **SAT** _______ **UNSAT**
STEP 15: ***Attachment 4***- Reviews Attachment 4 Data. **STANDARD:** • Review attachment 4 data and verifies all are within the acceptance criteria. • **Notes that 1-CH-MOV-1287B OPEN stroke test time is not in the ACCEPTABLE range and that OPT was checked as SAT.** • **This is a critical step.** **EVALUATOR’S NOTE: N/A** **COMMENTS:**	_______ **SAT** _______ **UNSAT**
STEP 16: ***Attachment 9***- Reviews Attachment 9. **STANDARD:** • Verifies proper placekeeping on all steps, notes, and cautions. • Verifies all steps in attachment 9 are properly initialed or N/A’d as applicable. **EVALUATOR’S NOTE: N/A** **COMMENTS:**	_______ **SAT** _______ **UNSAT**

STOP TIME:

ANSWER KEY
1-OPT-CH-002 REVIEW

1. **Attachment 1, Step 6.1.3 – Listed stopwatch is out of CAL. (CRITICAL TASK)**

2. **Attachment 2, outboard horizontal vibration (pt 22) on the pump exceeds the inoperable range limit given. (CRITICAL TASK)**

3. **Attachment 4, 1-CH-MOV-1287B exceeds open stroke time limits. (CRITICAL TASK)**

4. Step 7.1.1, Charging pump delta-p and vibration status determinations are checked as NOT being inoperable. 1-CH-MOV-1287B is checked as meeting the acceptance criteria.

5. **7.1.2, PT is marked as SAT versus UNSAT. (CRITICAL TASK)**

6. Step 7.2.1, step marked N/A when notifications to engineering should be made and Condition Reports/Work Requests should be submitted.

7. No comments made in the Operator Comments section.

8. **They are in violation of Tech Spec 3.2 because they do not have two boron injection subsystems due to 1-CH-P-1B being inoperable. They are in a 72 hour clock to be in at least HOT SHUTDOWN within the next 6 hours. (CRITICAL TASK)**

9. **They are in violation of Tech Spec 3.3 because they do not have two operable Safety Injection subsystems due to 1-CH-P-1B being inoperable. They are in a 72 hour clock to be in at least HOT SHUTDOWN within the next 6 hours. (CRITICAL TASK)**

Operator Directions Handout
(TO BE READ TO APPLICANT BY EXAMINER)

Task

- Task is to be performed in the classroom.
- Review 1-OPT-CH-002 (REV 47), CHARGING PUMP OPERABILITY AND PERFORMANCE TEST FOR 1-CH-P-1B, for completeness and accuracy.

Directions

The evaluator will explain the initial conditions of the task to be performed and will provide the initiating cue. Ensure you indicate to the evaluator when you understand your assigned task.

Initial Conditions:

- Unit 1 is at 100% power.

- 1-OPT-CH-002 (REV 47), CHARGING PUMP OPERABILITY AND PERFORMANCE TEST FOR 1-CH-P-1B, has just been completed.

Initiating Cues

- I am the Shift Manager and you are the Unit Supervisor. Here is a copy of 1-OPT-CH-002 (REV 47), CHARGING PUMP OPERABILITY AND PERFORMANCE TEST FOR 1-CH-P-1B, which has just been completed.

- No maintenance has been performed on the Charging system.

- This was a quarterly test.

- Review 1-OPT-CH-002 (REV 47), CHARGING PUMP OPERABILITY AND PERFORMANCE TEST FOR 1-CH-P-1B, for completeness and accuracy.

- List ALL discrepancies noted on the ANSWER SHEET provided.

- When you are finished, inform your examiner of ALL problems noted in the procedure and any Technical Specification operability concerns if applicable.

Operator Directions Handout
(TO BE GIVEN TO APPLICANT)

Initial Conditions:

- Unit 1 is at 100% power.
- 1-OPT-CH-002 (REV 47), CHARGING PUMP OPERABILITY AND PERFORMANCE TEST FOR 1-CH-P-1B, has just been completed..

Initiating Cues

- I am the Shift Manager and you are the Unit Supervisor. Here is a copy of 1-OPT-CH-002 (REV 47), CHARGING PUMP OPERABILITY AND PERFORMANCE TEST FOR 1-CH-P-1B, which has just been completed.
- No maintenance has been performed on the Charging system.
- This was a quarterly test.
- Review 1-OPT-CH-002 (REV 47), CHARGING PUMP OPERABILITY AND PERFORMANCE TEST FOR 1-CH-P-1B, for completeness and accuracy.
- List ALL discrepancies noted on the ANSWER SHEET provided.
- When you are finished, inform your examiner of ALL problems noted in the procedure and any Technical Specification operability concerns if applicable.

ANSWER SHEET
1-OPT-CH-002 REVIEW

Dominion *SURRY POWER STATION*	PROCEDURE NO: 1-OPT-CH-002 REVISION NO: 47
PROCEDURE TYPE: OPERATIONS PERIODIC TEST	UNIT NO: 1

PROCEDURE TITLE:

CHARGING PUMP OPERABILITY AND PERFORMANCE TEST FOR 1-CH-P-1B

IST	PMT	PSA	REACT MGT			

REVISION SUMMARY:

Revised in response to Operations Feedback, OP FB 09-0122.

- Added Steps 6.6.8 and 6.6.9 to place controllers in Manual.
- Revised Step 6.6.10 to delete substeps for placing controllers in Manual.

Revised in response to Operations Feedback, OP FB 09-0191.

- Revised Steps 6.3.3, 6.4.3, 6.5.6.a, 6.7.4, and Step 9 on Attachment 8 to allow pump flush even if RCS to pump differential boron is less than 360 ppm
- Reordered Attachment 8, Step 10 substeps

Administrative Correction.

- Incorporate ET-CME-09-0027 to update ME-0771 to Revision 3 at Step 2.3.30

CONTINUOUS USE

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1.0 PURPOSE

1.1 To demonstrate and document satisfactory performance of 1-CH-P-1B, CHARGING PUMP, once each quarter. **(Reference 2.4.7)**

1.2 To demonstrate and document satisfactory performance of 1-CH-P-1B, CHARGING PUMP, for Return To Service after maintenance.

1.3 To document that the System External Leakage is within limits once each quarter.

1.4 To test 1-CH-267, Charging Pump Discharge Check Valve, in the closed and open position once each quarter, or to determine backleakage as required.

1.5 To test 1-CH-265, Charging Pump Miniflow Recirc Check Valve, in the open position once each quarter, or to determine backleakage as required.

1.6 To test 1-CH-230, VCT Supply Discharge Check Valve, in the open position once each quarter.

1.7 To demonstrate and document satisfactory stroke once each quarter of the following:

- 1-CH-MOV-1275B, CHG PUMP MINIFLOW RECIRC VALVES PUMP B
- 1-CH-MOV-1286B, CHG PUMP B DISCH NORM
- 1-CH-MOV-1287B, CHG PUMP B DISCH ALT

1.8 To demonstrate and document satisfactory stroke of 1-SW-TCV-108B once each quarter.

1.9 Performance of this procedure satisfies the requirements of Technical Specifications listed in Subsection 2.2 and the Inservice Testing Program Plan for Pumps and Valves.

2.0 REFERENCES

2.1 Source Documents

2.1.1 UFSAR Section 9.1, Chemical and Volume Control System

2.2 Technical Specifications Surry Power Station Units 1 and 2

2.2.1 Technical Specifications, Section 3.2.B.1.a.2, Charging Pump Operability

2.2.2 Technical Specifications, Section 3.2.B.1.b.2, Charging Pump Operability

2.2.3 Technical Specifications, Section 3.2.B.2, Unit 2 Charging Pump Availability

2.2.4 Technical Specifications, Section 3.3.A.3.a, Safety Injection Subsystem Operability

2.2.5 Technical Specification, Section 6.4.I, Inservice Testing Program

2.2.6 Technical Specification 4.11.C.2

2.2.7 Technical Specifications, Section 6.4.K, Systems Integrity

2.3 Technical References

2.3.1 Inservice Testing Program Plan for Pumps and Valves

2.3.2 EWR 93-064, MI Pumps Acceptance Criteria OMa-1988 Part 6 Code

2.3.3 1-NPT-ZZ-001, Quantification of External System Leakage

2.3.4 11448-FM-88B, Sheet 2, Chemical and Volume Control System

2.3.5 11448-FM-71B, Sheet 1 and 2, Circulating and Service Water System

2.3.6 11448-FM-075C, Sheet 1, Compressed Air System

2.3.7 Deviation Report S-92-0948, 2-SW-124 Blockage

2.3.8 DCP 88-037-1, ASME Section XI Instrumentation

2.3.9 EWR 89-442, Evaluate CH Pump Lube Oil System

2.3.10 1-OPT-CH-001, Charging Pump Operability and Performance Test for 1-CH-P-1A

2.3.11 1-OPT-CH-003, Charging Pump Operability and Performance Test for 1-CH-P-1C

2.3.12 DCP 92-064, Charging Pump Logic Modifications

2.3.13 EWR 94-013, CH Pumps Acceptance Criteria during Shutdown

2.3.14 EWR 94-015, IST Valves Acceptance Criteria Stroke Time

2.3.15 DCP 92-27-3, Installation of stroke timing valve 1-IA-1601

2.3.16 Deviation Report S-95-1877, Charging Pump 2C recirc flow rate

2.3.17 Memo from BW/IP International, Inc. to Terri Stahl, Virginia Electric Power Co., June 30, 1988

2.3.18 DCP 95-006, Charging Pump Service Water Pipe Replacement

2.3.19 Engineering Transmittal (ET) No. S-96-0263, Rev. 0, Stroke Time Acceptance Criteria for 1-SW-TCV-108A, B, C and 2-SW-TCV-208A, B, C

2.3.20 DCP 94-006, Charging Pump Seal Replacement

2.3.21 Engineering Transmittal (ET) No. S-97-0280, CH Pump IST Reference Value Change

2.3.22 ET S-00-0127, Revision to IST Parameters for 1-CH-P-1B

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

2.3.24 ET S-03-0090, Rev. 2, IST Acceptance Criteria for 1-CH-P-1B Following Pump Replacement

2.3.25 ET S-04-0037, Revised IST Acceptance Criteria for 1-CH-P-1B and 1-CH-P-1C

2.3.26 ET S-04-0068, Effect of Starting an Idle Charging Pump on RCS Boron Concentration

2.3.27 ET-S-05-0008, Rereferencing of Unit 1 Motor Operated Valve Stroke Time, 1-CH-MOV-1287B

2.3.28 ASME OM Code, Section IST, Rules for Inservice Testing of Light-Water Reactor Nuclear Power Plants

2.3.29 ET-CME-07-0012, Evaluation of CH Pump Discharge Check Valve Backleakage

2.3.30 Calculation ME-0771, Rev. 3, Minimum Delivered HHSI Flow for LOCA and MSLB Analyses and CH/HHSI Pump Flow Test Acceptance Criteria, Surry 1 & 2

2.4 Commitment Documents

2.4.1 Station Commitment Action Request Form (SCARF) 88-5188, Hydrogen Buildup in a Confined Area

2.4.2 CTS 1317, Charging Pump Operation

2.4.3 CTS 1801, Charging Pump Temperature Control Valve

2.4.4 QA Audit 87-01, Finding 2, Recording Work Order Number and Mark Number after maintenance

2.4.5 CTS 635, Verify damper operation and testing

2.4.6 Safety Evaluation 91-238

2.4.7 CTS 1809, CH Pump Configuration Outside Design Basis

2.4.8 Station Deviation S-92-1515

2.4.9 CTS 2646, Technical Specification Amendment #199

2.4.10 CTS 3368, Revise procedures that quantify external loop leakage to add 7-day Administrative Clock in the event of unsatisfactory leakage levels

2.4.11 Station Deviation S-96-0803

2.4.12 NAF 99-0035 Rev 54, Risk Assessment Guidelines for MRule

2.4.13 DR S-2000-0532, External Leakage Quantification

2.4.14 PI S-2001-0466, Maintenance activity, was performed with no prior PSA evaluation

2.4.15 PI S-2002-0044, Add OPs requirement for oil sampling

2.4.16 PI S-2002-3606, Procedural inconsistencies with venting CHG pumps

2.4.17 PI S-2003-0707, Wrong Oil Sample Volume

2.4.18 PI S-2003-2106, Pumps in PTL When Sampling Oil

2.4.19 PI S-2004-1773, No oil flow to pump bearings

2.4.20 PI S-2004-0495 (OE 17609), Reactivity Excursion when starting CHG Pump

2.4.21 PI S-2005-4176, ITC-SA-05-18 In-Service Testing (IST) Program for Pumps

2.4.22 CR 9110, Evaluate Charging Pump Discharge Check Valve Criteria

2.4.23 ACE356, Determining Recirc Check Valve Backleakage

2.4.24 CR010705, High Aux Lube Oil Pump Discharge Pressure

Init **Verif**

3.0 INITIAL CONDITIONS

N/A 3.1 This procedure has PSA significance. IF this procedure is being performed on a day other than its POD scheduled date, THEN notify Shift Supervision that a PSA evaluation is required for the performance of this procedure. **(Reference 2.4.14)**

3.2 Unit 1 is at stable conditions and no power changes are anticipated.

3.3 The Volume Control Tank (VCT) pressure is within the normal operating band. (greater than 15 psig)

3.4 With the Reactor critical, at least two boron injection subsystems shall be operable for performance of this procedure IAW Technical Specification 3.2. Performance with less than two pumps operable may result in entry into a six hour LCO IAW Technical Specification 3.0.1 and will require FSRC approval before a procedure change is implemented.

4.0 PRECAUTIONS AND LIMITATIONS

4.1 No more than one Charging Pump may be tested at a time.

4.2 This procedure assumes at least two Charging Pumps are operable when the Reactor is Critical. Other conditions may require re-evaluation of applicable LCOs to determine the most Limiting Condition.

4.3 The Charging Pump Miniflow Recirc Valves, 1-CH-MOV-1275B and 1-CH-MOV-1373, must remain open during pump operation to prevent pump damage during the performance of this test.

4.4 To prevent damage to the pump, a Charging Pump should not be operated more than three hours with both discharge valves closed.

4.5 The Charging Pump should be shut down as soon as possible if any of the following temperature limits is exceeded.

- Oil Cooler outlet oil temperature upper operating limit is 160°F.
- Oil Cooler outlet oil temperature lower operating limit is 28°F. Oil misting has been observed with temperature less than 60°F. Misting is expected to stop as lube oil temperature increases. Routine pump starts should be avoided until the temperature is above 60°F and preferably in the normal operating band between 80°F and 120°F.
- The upper administrative limit for the Charging Pump bearings is 180°F.

4.6 The undervoltage trip of Charging Pump A is automatically enabled when Charging Pump C, NORM FEED, is Racked In <u>and</u> Charging Pump C, NORM FEED, breaker closed. The undervoltage trip of Charging Pump A is automatically disabled when Charging Pump C, NORM FEED, is Racked Out <u>or</u> Charging Pump C, NORM FEED, breaker open.

4.7 Simultaneous operation of two Charging Pumps below 350°F shall be limited to the time required to swap from one Charging Pump to another.

4.8 Shifting of Charging Pumps shall <u>not</u> be performed when the RCS is solid.

4.9 This OPT may be performed with either RHR in service <u>or</u> the Unit at normal RCS operating pressure with approximately 105 gpm letdown.

4.10 The following Charging Pump Motor starting limitations must be observed to prevent motor damage:

- With the motor cold, TWO consecutive starts are allowed.
- With the motor hot, ONE stop and an immediate restart is allowed.

After either of the above conditions has occurred:

- Subsequent motor stop/start cycles may NOT be performed until the motor has been run for at least 15 minutes.

OR

- If the motor is stopped before the 15 minute run is complete, the motor shall stand idle for at least 60 minutes.

4.11 Shift Supervision shall be notified immediately if any malfunctions or abnormal conditions occur.

4.12 A dedicated Operator will be required to obtain oil samples in Subsection 6.9.

4.13 If the difference between RCS boron and Charging pump boron is greater than 360 ppm, the pump must be flushed before it is started to equalize boron concentration. This requirement ensures that the change in RCS temperature will be less than .2°F when the Charging pump is started. **(Ref. 2.4.20)**

4.14 The initials identification block in Subsection 7.3 must be completed before the procedure is closed out.

4.15 A Charging Pump may be started if Aux Lube Oil Pump discharge pressure is greater than 8 psig. In this case, a Condition Report shall be submitted. **(Ref. 2.4.24)**

5.0 SPECIAL TOOLS AND EQUIPMENT

5.1 Microlog Data Collector for vibration

5.2 Stopwatch, for leakage collection timing, stroke timing of MOVs and Lube Oil TCV

5.3 AirCet connection test fitting (only required if 1-SW-TCV-108B will be stroke tested)

5.4 HP approved catch container (for venting 1-CH-FT-1182)

5.5 Three oil sample bottles of 120 mls

5.6 Two 120 ml bottles of motor replacement oil

5.7 One clean container of approximately 500 mls to purge drain line oil sample

5.8 Accu-cal precision test gauge, Model No. 75514-35B55, or equivalent (if required for high accuracy measurement of discharge check valve backleakage in Subsection 6.5 or 6.10)

6.0 INSTRUCTIONS

6.1 Work Preparation

N/A

6.1.1 IF this procedure is used to prove operability of equipment after maintenance, THEN record the Work Order Number and the Equipment Location on Attachment 1, 1-CH-P-1B Performance Test Data Sheet, OR attach a copy of the Work Order Tracking sheet to the completed procedure for multiple Work Orders and note in Operator Comments, Subsection 7.3. Otherwise, enter N/A. **(Reference 2.4.4)**

6.1.2 IF check valve backleakage testing in Subsection 6.5 or 6.10 required, THEN perform the following. Otherwise, enter N/A.

a. Notify I&C of which Charging Pump will be running during test.

b. Have I&C perform Attachment 9 for installation and setup.

6.1.3 Record the SQC Number and Cal Due Date for the Instrumentation and Test Equipment to be used on Attachment 1.

NOTE: This test may be performed at normal RCS operating pressure or with RHR in operation.

6.1.4 Check the RCS/RHR applicability block on Attachment 1.

6.1.5 Verify Plant Conditions with Shift Supervision AND perform all the associated actions. (✓) Enter N/A for the actions not taken.

Status (✓)	**Present Conditions**	**Actions to be Performed**
N/A	• 1-CH-P-1B needs to be filled and vented **OR** Maintenance has been performed	Perform Subsection 6.2
↓	• Stop 1-CH-P-1B and start 1-CH-P-1A (so 1-CH-P-1B may be stopped for testing)	Perform Subsection 6.3
	• Stop 1-CH-P-1B and start 1-CH-P-1C, NORM FEED (so 1-CH-P-1B may be stopped for testing)	Perform Subsection 6.4
	• Check Valve test or Stroke test MOVs and Lube Oil TCV (1-CH-P-1B must be stopped)	Perform Subsection 6.5 or Subsection 6.8 (MOV stroke only)
✓	• Performance test of 1-CH-P-1B only (1-CH-P-1B already running)	Perform Subsection 6.6
✓	• 1-CH-P-1B needs the Quarterly Test (1-CH-P-1B must be stopped)	Perform Subsection 6.5 and Subsection 6.6.
N/A	• 1-CH-P-1B needs Return to Service PT performed with 1-CH-P-1C, ALT FEED, in service	Perform Subsection 6.7, then Subsections 6.5 and 6.6
↓	• Check backleakage on non-running Charging Pump discharge check valve	Perform Subsection 6.10

6.2 Fill, Vent, and Return to Service Valve Alignment for 1-CH-P-1B

N/A ______ 6.2.1 Have the Mechanics remove the blank flange and install the pump vent rig on the 1-CH-P-1B casing vent flange. IF pump casing was NOT drained, THEN enter N/A for Steps 6.2.1 through 6.2.30.

______ 6.2.2 Close or verify closed 1-CH-ICV-3522, CH Pump 1B Suct PI-1188 Vent.

______ ______ IV 6.2.3 Close 1-CH-246, Chg Pump B Disch Casing Drain.

______ ______ IV 6.2.4 Close 1-CH-247, Chg Pump B Suct Casing Drain.

______ ______ IV 6.2.5 Close 1-CH-402, Chg Pump B Casing Common Drain.

______ 6.2.6 Verify closed 1-CH-261, Chg Pump B Disch Casing Vent.

______ 6.2.7 Verify closed 1-CH-262, Chg Pump B Suct Casing Vent.

______ 6.2.8 Verify that the pump vent rig is installed.

NOTE: The Aux Lube Oil Pump may be started without SW aligned to allow pump shaft rotation during venting.

______ 6.2.9 Verify that the Charging Pump B gearbox oil level is in the operating range. (Gearbox oil level should be greater than $\frac{1}{4}$).

______ ______ IV 6.2.10 Verify closed or close 1J1-1, Bkr 6D, 1-CH-P-110B, Aux Lube Oil Pump.

______ 6.2.11 Verify or place Aux Lube Oil Pump in AUTO.

N/Aa

6.2.12 Verify that 1-CH-PI-110B, Aux Lube Oil Pump Discharge Pressure, is between 4 psig and 8 psig. Record Lube Oil Pressure. Submit a Condition Report if Lube Oil Pressure is greater than 8 psig.

Lube Oil Pressure _________ psig

NOTE: A Charging Pump may be started if oil flow can not be verified to bearing(s). Contingency actions for monitoring bearing temperature are in place as a compensatory measure if pump will be started without oil flow to bearing(s).

_____ 6.2.13 Verify oil flow to the pump bearings. Enter N/A if flow can not be verified to bearing(s).

WARNING

Explosion or fire could result if hydrogen from venting is allowed to build up in a confined area. **(Reference 2.4.1)**

Radioactive gases present during venting will not be removed by the vent rig. Pump venting must be done slowly to prevent a buildup of high radioactive gas concentrations.

_____ 6.2.14 Notify Health Physics that Charging Pump venting will be performed.

_____ 6.2.15 IF 0-MCM-0109-01 will be used to fill and vent the CHG pump, THEN enter N/A for steps 6.2.16 through 6.2.26. Otherwise, enter N/A for this step.

_____ 6.2.16 Verify open or open 1J1-2W, Bkr 1C, 1-CH-MOV-1269A, CHG PUMP B SUCT NORM.

NOTE: Continuous communication shall be established with the Control Room during the performance of the following three steps to prevent the loss of VCT level.

_____ 6.2.17 Manually throttle open (ten turns) 1-CH-MOV-1269A, CHG PUMP B SUCT NORM.

NOTE: If the Charging Pump seal was replaced while the pump was out of service, some seal leakage may occur until the seal becomes seated. A small amount of leakage should be considered normal.

N/Ane

6.2.18 Check the pump shaft seals and other valve and piping boundaries for leakage. IF leakage is identified, THEN isolate the leak, if possible, AND notify Shift Supervision.

NOTE: Be prepared to vent 1-CH-PI-1188 as soon as the casing has been vented.

6.2.19 Vent the Charging Pump B casing by performing the following.

a. Vent the Charging Pump B casing by slowly opening the vents until water issues from the vent.

1. 1-CH-261

2. 1-CH-262

b. WHEN water issues from the vent, THEN close the vent valves.

1. 1-CH-261 IV

2. 1-CH-262 IV

6.2.20 Vent 1-CH-PI-1188 by throttling open 1-CH-ICV-3522.
WHEN 1-CH-ICV-3522 is air free, THEN close 1-CH-ICV-3522.

6.2.21 Verify closed or close 1J1-2W, Bkr 1C, 1-CH-MOV-1269A, CHG PUMP B SUCT NORM.

6.2.22 Verify closed or close 1J1-2W, Bkr 2C, 1-CH-MOV-1269B, CHG PUMP B SUCT ALT.

✓ 6.2.23 Electrically open 1-CH-MOV-1269A.

N/A 6.2.24 Electrically open 1-CH-MOV-1269B.

6.2.25 Verify electrical operability of 1-CH-MOV-1269A by cycling suction valve twice.

______ a. Stroke 1-CH-MOV-1269A closed and return to OPEN.

______ b. Stroke 1-CH-MOV-1269A closed and return to OPEN.

NOTE: Be prepared to vent 1-CH-PI-1188 as soon as the casing has been vented.

6.2.26 Vent the Charging Pump B casing by performing the following.

a. Vent the Charging Pump B casing by slowly opening the vents until water issues from the vent.

______ 1. 1-CH-261

______ 2. 1-CH-262

b. WHEN water issues from the vent, THEN close the vent valves.

______ ______ IV 1. 1-CH-261

______ ______ IV 2. 1-CH-262

______ 6.2.27 IF 0-MCM-0109-01 was used to fill and vent the CHG pump, THEN verify that the Mechanics have completed fill and vent. Otherwise, enter N/A.

______ ______ IV 6.2.28 Vent 1-CH-PI-1188 by throttling open 1-CH-ICV-3522.
WHEN 1-CH-ICV-3522 is air free, THEN close 1-CH-ICV-3522 AND install vent cap.

______ 6.2.29 Have the Mechanics remove the pump vent rig and install the blank flange on the Charging Pump B casing vent flange.

N/A 6.2.30 Have the Mechanics do Attachment 7 for venting of Charging Pump seals. IF Mechanical Maintenance determines that seal venting is NOT required, THEN enter N/A for this step and have Mechanical Maintenance sign below, indicating concurrence that seal venting is NOT required.

____
Mechanical Maintenance

______ ______ IV 6.2.31 Verify open or open 1-CH-263, Chg Pump B Disch Hdr Sample Isol.

6.2.32 Perform the following breaker manipulations

______ ______ IV a. Verify closed or close 1J1-2W, Bkr 1C, 1-CH-MOV-1269A, CHG PUMP B SUCT NORM.

______ ______ IV b. Verify closed or close 1J1-2W, Bkr 2C, 1-CH-MOV-1269B, CHG PUMP B SUCT ALT.

______ ______ IV c. Verify closed or close 1J1-2W, Bkr 4C, 1-CH-MOV-1286B, CHG PUMP B DISCH NORM

______ ______ IV d. Verify closed or close 1J1-2W, Bkr 5B, 1-CH-MOV-1287B, CHG PUMP B DISCH ALT

______ ______ IV e. Verify closed or close 1H1-2S, Bkr 7B, 1-CH-MOV-1275B, CHG PUMP MINIFLOW RECIRC VALVES PUMP B

6.2.33 Perform the following.

______ a. Verify open or open 1-CH-MOV-1269A.

______ b. Verify open or open 1-CH-MOV-1269B.

______ c. Verify open or open 1-CH-MOV-1286B.

______ d. Verify open or open 1-CH-MOV-1287B.

N/ABG e. Verify open or open 1-CH-MOV-1275B.

IV 6.2.34 Verify open or open 1-CC-706, CH Pump Seal Clrs 7C/D CC Inlet Isol.

IV 6.2.35 Verify open or open 1-CC-695, CH Pump Seal Clrs 7C/D CC Otlt FI-118B Inlet Isol.

IV 6.2.36 Throttle 1-CC-773, CH Pump Seal Clrs 7C/D CC Otlt FI-118B Otlt Isol, to greater than or equal to 7.5 gpm. (Charging Pump CC flow should be throttled to balance total flow approximately equally between pumps)

IV 6.2.37 Verify closed or close 1-SW-183, CHG Pump LO Clr 5B SW Outlet Drain. IF pump Service Water was NOT tagged out, THEN enter N/A for Step 6.2.37 through Step 6.2.44.

6.2.38 Verify removed or remove the hose from 1-SW-183.

IV 6.2.39 Verify closed or close 1-SW-185, CHG Pump LO Clr 5B SW Inlet Vent.

IV 6.2.40 Verify closed or close 1-SW-184, CHG Pump LO Clr 5B SW Inlet Drain.

IV 6.2.41 Verify closed or close 1-SW-186, CHG Pump LO Clr 5B SW Outlet Vent.

IV 6.2.42 Verify open or open 1-SW-122, CHG Pump LO Clr 5B SW Inlet.

6.2.43 Vent air from the LO Clr Service Water System by opening and then closing the following vents until water issues from the vent. IF Service Water Cooling Water was not drained, THEN enter N/A.

a. 1-SW-185

b. 1-SW-186

N/A ______ IV

6.2.44 Verify open or open 1-SW-898, Chg Pump LO Clr 5B SW Outlet.

______

6.2.45 Verify that the Charging Pump B gearbox oil level is in the operating range. (Gearbox oil level should be greater than $\frac{1}{4}$). Enter N/A for Steps 6.2.45 through 6.2.49 if Aux Lube Oil Pump already running.

______ ______ IV

6.2.46 Verify closed or close 1J1-1, Bkr 6D, 1-CH-P-110B, Aux Lube Oil Pump.

______

6.2.47 Verify or place Aux Lube Oil Pump in AUTO.

______

6.2.48 Verify that 1-CH-PI-110B, Aux Lube Oil Pump Discharge Pressure, is between 4 psig and 8 psig. Record Lube Oil Pressure. Submit a Condition Report if Lube Oil Pressure is greater than 8 psig.

Lube Oil Pressure ______ psig

NOTE: A Charging Pump may be started if oil flow can not be verified to bearing(s). Contingency actions for monitoring bearing temperature are in place as a compensatory measure if pump will be started without oil flow to bearing(s).

______

6.2.49 Verify oil flow to the pump bearings. Enter N/A if flow can not be verified to bearing(s).

______

6.2.50 IF 1-CH-P-1B is already connected to the Bus, THEN enter N/A for Steps 6.2.51 and 6.2.52. IF 1-CH-P-1B is being returned to service with 1-CH-P-1C, ALT FEED, running, THEN enter N/A for Steps 6.2.51 and 6.2.52 AND perform Subsection 6.7.

______

6.2.51 Verify or place 1-CH-P-1B in PTL.

6.2.52 Verify racked in or rack in Breaker 15J5, 1-CH-P-1B, CHARGING PUMP, to the CONNECT position IAW the following substeps.

N/A ______ IV

a. Verify that the ground straps for Breaker 15J5 have been removed.

______ ______ IV

b. Verify that the charging spring motor toggle switch for Breaker 15J5 is ON.

______ ______ IV

c. Rack Breaker 15J5, 1-CH-P-1B, to CONNECT.

6.3 Placing 1-CH-P-1A in Service and Stopping 1-CH-P-1B

6.3.1 Verify that the following isolation valves are open.

N/A ______ IV
a. 1-CH-MOV-1267A, CHG PUMP A SUCT NORM

______ ______ IV
b. 1-CH-MOV-1267B, CHG PUMP A SUCT ALT

______ ______ IV
c. 1-CH-MOV-1286A, CHG PUMP A DISCH NORM

______ ______ IV
d. 1-CH-MOV-1287A, CHG PUMP A DISCH ALT

______ ______ IV
e. 1-CH-MOV-1275A, CHG PUMP MINIFLOW RECIRC VALVES PUMP A

______ ______ IV
f. 1-CH-MOV-1373, CHG MINIFLOW RECIRC

______
6.3.2 Verify proper gear box and motor oil levels. (Oil levels should be greater than $\frac{1}{4}$).

______
6.3.3 IF the difference between RCS boron and Charging pump boron is greater than 360 ppm, OR it is desired to flush to further reduce boron differential, THEN initiate Attachment 8. Otherwise, enter N/A. **(Ref. 2.4.20)**

______
6.3.4 Verify that Aux Lube Oil Pump Discharge Pressure is between 4 psig and 8 psig as indicated on 1-CH-PI-110A. Record Lube Oil Pressure. Submit a Condition Report if Lube Oil Pressure is greater than 8 psig.

Lube Oil Pressure________ psig

NOTE: A Charging Pump may be started if oil flow can not be verified to bearing(s). Contingency actions for monitoring bearing temperature are in place as a compensatory measure if pump will be started without oil flow to bearing(s).

N/A ______ 6.3.5 Verify oil flow to the pump bearings. Enter N/A if flow can not be verified to bearing(s).

______ 6.3.6 Record Lube Oil Temperature from 1-CH-TI-110A. Submit a Condition Report if Lube Oil Temperature is less than 60°F or greater than 120°F.

Lube Oil Temperature ____________________ °F

______ 6.3.7 Verify that the Auxiliary Building Operator has determined that 1-CH-P-1A is ready to start and that all personnel are clear of the shaft.

CAUTION

Simultaneous operation of two Charging Pumps below 350°F shall be limited to the time required to swap from one Charging Pump to another. **(Reference 2.4.2)**

If pump bearing oil flow can NOT be verified, bearing temperature must be monitored closely upon pump start. If temperature rise greater than 30°F is observed during first minute of pump operation, the pump must be secured immediately.

______ 6.3.8 Start 1-CH-P-1A.

______ 6.3.9 Verify Chg Pump AMPS stabilize between 50 amps and 65 amps.

6.3.10 IF pump started with no bearing oil flow observed prior to start, THEN do the following. Otherwise, enter N/A.

______ a. Immediately after pump start, have Aux Building operator verify oil flow.

______ b. IF no oil flow observed, THEN immediately secure pump.

______ 6.3.11 Stop 1-CH-P-1B (if < 350°F and 450 psig, then place the Control Switch in PTL).

N/A

6.3.12 Monitor 1-CH-P-1A bearing temperatures on the PCS computer.

6.3.13 IF either of the following temperature limits is exceeded when the Charging Pump is operating, THEN the pump should be monitored for degradation as soon as possible by performance of 1-OPT-CH-001, Charging Pump Operability and Performance Test for 1-CH-P-1A.

- Oil Cooler outlet oil temperature - 160°F
- Charging Pump bearing temperature - 180°F

6.3.14 Verify that 1-VS-MOD-101A, Charging Pump Ventilation Suction Motor Operated Damper, is open.

6.3.15 Check that the Aux Lube Oil Pump is stopped.

6.3.16 Verify that Lube Oil Pump Discharge Pressure is between 8 psig and 25 psig as indicated on 1-CH-PI-110A. Record Lube Oil Pressure.

Lube Oil Pressure ________ psig

6.3.17 WHEN Charging Pump Lube Oil temperatures have stabilized, THEN verify that the TCV is controlling Lube Oil temperature between 100°F and 120°F. **(Reference 2.4.3)**

6.3.18 Verify that the Aux Lube Oil Pump for 1-CH-P-1B is running with a Lube Oil Pump Discharge Pressure between 4 psig and 8 psig. Record Lube Oil Pressure. Submit a Condition Report if Lube Oil Pressure is greater than 8 psig.

Lube Oil Pressure ________ psig (1-CH-PI-110B)

6.3.19 Check that 1-VS-MOD-101B, 1-CH-P-1B Charging Pump Ventilation Suction Motor Operated Damper, is closed.

6.4 Placing 1-CH-P-1C NORM FEED in Service and Stopping 1-CH-P-1B

6.4.1 Verify that the following isolation valves are open.

N/A ______ ______ IV a. 1-CH-MOV-1270A, CHG PUMP C SUCT NORM

______ ______ IV b. 1-CH-MOV-1270B, CHG PUMP C SUCT ALT

______ ______ IV c. 1-CH-MOV-1286C, CHG PUMP C DISCH NORM

______ ______ IV d. 1-CH-MOV-1287C, CHG PUMP C DISCH ALT

______ ______ IV e. 1-CH-MOV-1275C, CHG PUMP MINIFLOW RECIRC VALVES PUMP C

______ ______ IV f. 1-CH-MOV-1373, CHG MINIFLOW RECIRC

______ 6.4.2 Verify proper gear box and motor oil levels. (Oil levels should be greater than $\frac{1}{4}$).

______ 6.4.3 <u>IF</u> the difference between RCS boron and Charging pump boron is greater than 360 ppm, <u>OR</u> it is desired to flush to further reduce boron differential, <u>THEN</u> initiate Attachment 8. Otherwise, enter N/A. **(Ref. 2.4.20)**

______ 6.4.4 Verify that Aux Lube Oil Pump Discharge Pressure is between 4 psig and 8 psig as indicated on 1-CH-PI-110C. Record Lube Oil Pressure. Submit a Condition Report if Lube Oil Pressure is greater than 8 psig.

Lube Oil Pressure ____________ psig (1-CH-PI-110C)

NOTE: A Charging Pump may be started if oil flow can not be verified to bearing(s). Contingency actions for monitoring bearing temperature are in place as a compensatory measure if pump will be started without oil flow to bearing(s).

N/A ______ 6.4.5 Verify oil flow to the pump bearings. Enter N/A if flow can not be verified to bearing(s).

______ 6.4.6 Record Lube Oil Temperature from 1-CH-TI-110C. Submit a Condition Report if Lube Oil Temperature is less than 60°F or greater than 120°F.

Lube Oil Temperature ____________________ °F

______ 6.4.7 Verify that the Auxiliary Building Operator has determined that Charging Pump C is ready to start and that all personnel are clear of the shaft.

CAUTION

Simultaneous operation of two Charging Pumps below 350°F shall be limited to the time required to swap from one Charging Pump to another. **(Reference 2.4.2)**

If pump bearing oil flow can NOT be verified, bearing temperature must be monitored closely upon pump start. If temperature rise greater than 30°F is observed during first minute of pump operation, the pump must be secured immediately.

______ 6.4.8 Start 1-CH-P-1C.

______ 6.4.9 Verify Chg Pump AMPS stabilize between 50 amps and 65 amps.

6.4.10 IF pump started with no bearing oil flow observed prior to start, THEN do the following. Otherwise, enter N/A.

______ a. Immediately after pump start, have Aux Building operator verify oil flow.

______ b. IF no oil flow observed, THEN immediately secure pump.

______ 6.4.11 Stop 1-CH-P-1B (if < 350°F and 450 psig, then place the Control Switch in PTL).

N/A

6.4.12 Monitor Charging Pump C bearing temperatures on the PCS computer.

6.4.13 IF either of the following temperature limits is exceeded when the Charging Pump is operating, THEN the pump should be monitored for degradation as soon as possible by performance of 1-OPT-CH-003, Charging Pump Operability and Performance Test for 1-CH-P-1C.

- Oil Cooler outlet oil temperature - 160°F
- Charging Pump bearing temperature - 180°F

6.4.14 Verify that 1-VS-MOD-101C, Charging Pump Ventilation Suction Motor Operated Damper, is open.

6.4.15 Check that the Aux Lube Oil Pump is stopped.

6.4.16 Verify that Lube Oil Pump discharge pressure is between 8 psig and 25 psig as indicated on 1-CH-PI-110C. Record Lube Oil Pressure.

Lube Oil Pressure ________ psig

6.4.17 WHEN Charging Pump Lube Oil temperatures have stabilized, THEN verify that the TCV is controlling Lube Oil temperature between 100°F and 120°F. **(Reference 2.4.3)**

6.4.18 Verify that the Aux Lube Oil Pump for 1-CH-P-1B is running with a Lube Oil Pump Discharge Pressure between 4 psig and 8 psig. Record Lube Oil Pressure. Submit a Condition Report if Lube Oil Pressure is greater than 8 psig.

Lube Oil Pressure ___________ psig (1-CH-PI-110B)

6.4.19 Check that 1-VS-MOD-101B, 1-CH-P-1B Charging Pump Ventilation Suction Motor Operated Damper, is closed.

6.5 Discharge Check Valve Close Test, MOV Timing, Lube Oil TCV Timing and Starting 1-CH-P-1B

NOTE: Steps 6.5.1 through 6.5.4 may be performed simultaneously.

6.5.1 Test the charging pump discharge check valve, stroke time MOVs and Lube Oil TCV by performing the following. IF Check Valve testing, MOV stroke time testing and Lube Oil TCV stroke time testing do NOT have to be performed, THEN enter N/A for steps in this subsection.

NOTE: If individual MOV(s) being returned to service, Subsection 6.8 may be used, if desired.

a. IF the Reactor is critical, THEN start a LCO clock IAW Tech Spec 3.2 and Tech Spec 3.3. Otherwise, enter N/A.

b. Verify 1-CH-P-1B stopped and place pump in PTL.

c. Verify open the following isolation valves.

IV 1. 1-CH-MOV-1269A, CHG PUMP B SUCT NORM

IV 2. 1-CH-MOV-1269B, CHG PUMP B SUCT ALT

IV 3. 1-CH-MOV-1286B, CHG PUMP B DISCH NORM

IV 4. 1-CH-MOV-1287B, CHG PUMP B DISCH ALT

IV 5. 1-CH-MOV-1275B, CHG PUMP MINIFLOW RECIRC VALVE PUMP B

IV 6. 1-CH-MOV-1373, CHG MINIFLOW RECIRC

NOTE: Full stroke time is defined as the interval from initiation of the actuating signal (initiation of manual actuation of the control panel switch) to the end of the actuating cycle (final control panel light extinguished).

d. From the Control Room, close the following. Using Control Room indication, verify each valve travels from full open to full closed. Record time required for each valve to travel closed on Attachment 4.

1. 1-CH-MOV-1286B, CHG PUMP B DISCH NORM
2. 1-CH-MOV-1287B, CHG PUMP B DISCH ALT
3. 1-CH-MOV-1275B, CHG PUMP MINIFLOW RECIRC VALVE PUMP B
4. 1-CH-MOV-1269A, CHG PUMP B SUCT NORM (Valve exercise only. Do not record the stroke time on Attachment 4.)

NOTE: The Accu-cal plus precision test gauge saves power by turning off after 30 minutes. The gauge may need to be energized by holding the power button for 2 - 3 seconds.

The Accu-cal plus precision test gauge is the preferred instrument for use in Substeps 6.5.1.e and 6.5.1.f. If the Accu-cal plus precision test gauge is not available, the normal discharge pressure gauge is acceptable.

e. Record discharge pressure of running Charging pump from Accu-cal plus precision test gauge or the normal discharge gauge on Attachment 1. (Remain at location until Substep 6.5.1.f)

f. From the Control Room, open the following. Using Control Room indication, verify each valve travels from full closed to full open. Record time required for each valve to travel open on Attachment 4.

1. Open 1-CH-MOV-1269A, CHG PUMP B SUCT NORM. (Valve exercise only. Do not record the stroke time on Attachment 4.)

2. Open 1-CH-MOV-1275B, CHG PUMP MINIFLOW RECIRC VALVE PUMP B.

3. Open 1-CH-MOV-1286B, CHG PUMP B DISCH NORM. <u>WHEN</u> 1-CH-MOV-1286B is opened, <u>THEN</u> verify the following parameters indicate no charging pump discharge check valve leakage. (✓)

   ✓ Record discharge pressure of running pump on Attachment 1 using the instrument used in Substep 6.5.1.e.

NOTE: The following are additional parameters to assist the System Engineer in determining the magnitude of check valve leakage, however the acceptance criteria is not based on these parameters.

   ✓ 1D-E5, CHRG PP TO REGEN HX HI-LO FLOW <u>NOT</u> <u>LIT</u>.

   ✓ 1D-F5, CHRG PP TO REGEN HX LO PRESS <u>NOT</u> <u>LIT</u>.

   ✓ CHG PUMP AMPS do not increase.

   ✓ <u>IF</u> PCS point F0128A, Charging Header Flow is being plotted on strip chart, <u>THEN</u> verify charging flow does not decrease.

4. Open 1-CH-MOV-1287B, CHG PUMP B DISCH ALT.

g. Calculate the Discharge Pressure Differential on Attachment 1. (If the differential is less than or equal to 7.5 psid, the close test for 1-CH-267, Charging Pump B Discharge Check Valve, is satisfactory, and 1-CH-265 backleakage is acceptable)

NOTE: For a Charging Pump which has just been shut down, the respective TCV will normally remain open or throttled until the oil temperature has been reduced below the operating range of 100°F to 120°F.

6.5.2 Evaluate status of 1-SW-TCV-108B and perform the corresponding actions. (✓) Enter N/A for actions not taken.

Status	Criteria	Actions	Initials
✓	1-SW-TCV-108B Closed	a) Continue with Step 6.5.3.	BC
N/ABC	1-SW-TCV-108B not full closed	a) IF 1-CH-P-1B was recently shut down AND 1-SW-TCV-108B remains partially open, THEN wait until 1-SW-TCV-108B goes full closed AND continue with Step 6.5.3. b) IF 1-CH-P-1B was NOT recently shutdown, THEN adjust controller until 1-SW-TCV-108B closes AND continue with Step 6.5.3. c) IF 1-SW-TCV-108B can NOT be closed by adjusting controller, THEN write WO AND do NOT continue until 1-SW-TCV-108B is operational.	N/ABC

6.5.3 Stroke test 1-SW-TCV-108B by performing the following.

BC a. Obtain the AirCet test fitting.

BC b. Verify 1-CH-P-1B stopped.

BC c. Close or verify closed the valve on the AirCet test fitting.

CAUTION

The test fitting must be connected at the proper disconnect fitting. If the AirCet test fitting is connected to the wrong disconnect, then the valve will close, however, the stroke time will be significantly longer. **(Reference 2.4.11)**

d. Connect the AirCet test fitting to the quick disconnect fitting on the air supply tubing leading to 1-SW-TCV-108B actuator dome.

e. Verify closed 1-SW-TCV-108B.

f. Station an operator to track the stroke time of 1-SW-TCV-108B.

g. Close 1-IA-1601, Chg Pump B 1-SW-TCV-108B Positioner IA Isol.

NOTE: Stroke time is defined as the time required for the valve local position indicator to travel to the opposite extreme. Stroke timing will start when stem starts to move.

h. Quickly open the isolation valve on the AirCet test fitting and begin timing.

NOTE: The TCV is open at greater than or equal to 90.0%. (9/10 on position indicator)

i. Verify 1-SW-TCV-108B opens, as indicated on the local position indicator. Record the stroke time and Test position on Attachment 4.

j. Close the isolation valve on the AirCet test fitting.

k. Remove the AirCet test fitting from 1-SW-TCV-108B.

l. Open 1-IA-1601.

IV

m. Verify 1-SW-TCV-108B strokes fully closed and record the As Left position on Attachment 4. <u>IF</u> 1-SW-TCV-108B does <u>NOT</u> fully close, <u>THEN</u> initiate a Condition Report to check the operation of the controller.

N/A

6.5.4 <u>IF</u> the controller for 1-SW-TCV-108B was adjusted in Step 6.5.2, <u>THEN</u> perform 1-IPM-SW-TCV-108B to adjust controller setpoint. Otherwise, enter N/A.

6.5.5 Verify that the Charging Pump gearbox oil level is in the operating range.

6.5.6 Verify the following before starting 1-CH-P-1B.

N/A

a. <u>IF</u> the difference between RCS boron and Charging pump boron is greater than 360 ppm, <u>OR</u> it is desired to flush to further reduce boron differential, <u>THEN</u> initiate Attachment 8. Otherwise, enter N/A. **(Ref. 2.4.20)**

b. Verify that 1-CH-PI-110B, Aux Lube Oil Pump Discharge Pressure, is between 4 psig and 8 psig. Submit a Condition Report if Lube Oil Pressure is greater than 8 psig.

c. Verify that LO temperature is greater than 28°F and preferably in the normal operating band between 80°F and 120°F.

d. Record Lube Oil Temperature from 1-CH-TI-110B. Submit a Condition Report if Lube Oil Temperature is less than 60°F or greater than 120°F.

Lube Oil Temperature 102 °F

e. Verify that MOD-VS-101B, Charging Pump Ventilation Suction Damper, is closed by noting no significant airflow through the duct.

NOTE: If any of the following temperature limits are exceeded on the Charging Pump being tested, the pump should be immediately shutdown.

- Oil Cooler outlet oil temperature upper operating limit is 160°F.
- Oil Cooler outlet oil temperature lower operating limit is 28°F.
- The upper administrative limit for the Charging Pump bearings is 180°F.

N/AAR

6.5.7 IF only valve stroke timing is to be performed, THEN place 1-CH-P-1B in AUTO and enter N/A for the remaining steps in Subsection 6.5.

CAUTION

If pump bearing oil flow can NOT be verified, bearing temperature must be monitored closely upon pump start. If temperature rise greater than 30°F is observed during first minute of pump operation, the pump must be secured immediately.

NOTE: Performance of the next step may remove the unit from the LCO clock entered in Step 6.5.1.b.

BL

6.5.8 Start 1-CH-P-1B.

BL

6.5.9 Verify Chg Pump AMPS stabilize between 50 amps and 65 amps.

6.5.10 IF pump started with no bearing oil flow observed prior to start, THEN do the following. Otherwise, enter N/A.

BL

a. Immediately after pump start, have Aux Building operator verify oil flow.

N/AAM

b. IF no oil flow observed, THEN immediately secure pump.

BL

6.5.11 IF the RCS is greater than 350°F and 450 psig, THEN stop the operating pump (1-CH-P-1A or 1-CH-P-1C, NORM FEED) and place in AUTO. Otherwise, enter N/A.

N/A

6.5.12 IF the RCS is less than 350°F and 450 psig, THEN stop the operating pump (1-CH-P-1A or 1-CH-P-1C) and place in PTL. Otherwise, enter N/A.

NOTE: Subsection 6.9 should be performed as soon as possible after pump stop.

6.5.13 Initiate oil sampling IAW Subsection 6.9.

6.5.14 Monitor Charging Pump B bearing temperatures on the PCS computer.

6.5.15 Check that the Aux Lube Oil Pump is stopped.

6.5.16 Verify that Lube Oil Pump Discharge Pressure is between 8 psig and 35 psig as indicated on 1-CH-PI-110B. Record Lube Oil Pressure.

Lube Oil Pressure 17.5 psig

CAUTION

Oil temperatures MUST NOT be allowed to exceed 160°F.

Setpoint adjustments MUST NOT be made during a pump start.

N/A

6.5.17 Monitor oil pressure and temperature. IF it is anticipated that Lube Oil Pump Discharge Pressure will drop below 8 psig OR Lube Oil temperature will reach 160°F, THEN start the operable standby pump AND secure 1-CH-P-1B. Otherwise, enter N/A.

NOTE: During hot weather a TCV may be full open with temperature above 120°F.

6.5.18 WHEN Charging Pump Lube Oil temperatures have stabilized, THEN verify that the TCV is controlling Lube Oil temperature between 100°F and 120°F. **(Reference 2.4.3)**

- IF oil temperature is greater than 120°F, AND the TCV is full open, THEN submit a Condition Report and inform System Engineering. N/A
- IF oil temperature is greater than 120°F, AND the TCV is not full open, THEN write a CR for I & C to adjust the setpoint. N/A
- IF oil temperature is less than 100°F, THEN write a CR for I & C to adjust the setpoint. N/A

6.5.19 Verify MOD-VS-101B is open by noting airflow through the duct. **(Reference 2.4.5)**

6.5.20 Verify the following pump and damper checks.

Pump	Aux LO Pump Running	Aux LO Pump Pressure (psig)	Ventilation Damper Closed	Initials
1-CH-P-1A	[✓ Yes]	4 psig to 8 psig 7 psig	[✓ Closed]	
1-CH-P-1C	[✓ Yes]	4 psig to 8 psig 5.25 psig	[✓ Closed]	

6.6 1-CH-P-1B Performance Test

NOTE: Charging flow may require manual adjustment to maintain Przr level at normal operating level.

BL 6.6.1 Verify Pressurizer level is at the desired Program band level AND stable.

NOTE: When Charging flow is adjusted, Pressurizer level may deviate from program level. RCS pressure should be closely monitored.

BL 6.6.2 Close 1-CH-MOV-1269B, CHG PUMP B SUCT ALT.

6.6.3 IF the RCS is less than 350°F and 450 psig, THEN adjust the total Charging Flow between 157 gpm to 173 gpm as follows. Otherwise, enter N/A.

N/A BL a. Verify or place 1-CH-FC-1122C, CHG FLOW CNTRL, in MANUAL.

↓ b. Using 1-CH-FC-1122C and 1-RH-HCV-1142, RHR LETDOWN FLOW, adjust the flow through the Charging Pump until 1-CH-FI-1182, 1-CH-P-1B Suction Flow, indicates between 157 gpm and 173 gpm.

BL 6.6.4 IF the RCS is greater than 350°F and 450 psig, THEN verify or place 1-CH-FC-1122C, CHG FLOW CNTRL, in AUTO. Otherwise, enter N/A.

CAUTION

Adjustment of charging flow will affect Przr level, letdown temperature, and letdown pressure. These parameters must be continuously monitored to prevent flashing in the letdown line, relief valve lifting, and excessive temperature changes to the letdown flowstream.

6.6.5 Record the following indications.

- Przr Level 54.2 %
- VCT Level 40.4 %
- LTDN Relief Line Temperature (1-CH-TI-1141) 106 °F
- Non-Regen Hx Temperature (1-CH-TI-1144) 101 °F
- Letdown Line Pressure (1-CH-PI-1145) 362 psi

6.6.6 Record charging flow. (PCS Point F1CH003A)

85 gpm

6.6.7 Record suction flow. (1-CH-FI-1182 from local indicator) 167 gpm
If suction flow is oscillating excessively, vent 1-CH-FT-1182 IAW Attachment 6.

NOTE:
- Pump performance test takes approximately 20 minutes. Przr Level Program band should be maintained.
- In order to remain within the Przr level program band of +/- 5% for the duration of the test, adjustment must <u>not</u> exceed 7 gpm. Inability to obtain the required target flowrate with a +/- 7 gpm adjustment does not affect pump operability.

6.6.8 Verify or place 1-CH-LC-1459G, PRZR LEVEL CNTRL, in Manual.

6.6.9 Verify or place 1-CH-FC-1122C, CHG FLOW CONTROL, in Manual.

6.6.10 Adjust total charging flow:

a. Adjust 1-CH-FC-1122C until 1-CH-FI-1182 indicates a target range of between 149.0 and 163.0.

N/A b. IF required adjustment exceeds +/- 7 gpm of the flow recorded in Step 6.6.7, THEN adjust to not more than +/- 7 gpm AND note in Operator Comments, Subsection 7.3. Otherwise, enter N/A.

NOTE: 1-CH-P-1B must run for at least 2 minutes to stabilize parameters before recording data.

6.6.11 Record the following information on Attachment 1, 1-CH-P-1B Performance Test Data Sheet.

- VCT Level
- VCT Pressure
- RCP A Seal Flow (1-CH-FT-1130) (PCS Computer Point U0983)
- RCP B Seal Flow (1-CH-FT-1127) (PCS Computer Point U0982)
- RCP C Seal Flow (1-CH-FT-1124) (PCS Computer Point U0981)
- 1-CH-P-1B discharge pressure (1-CH-PI-1152)
- 1-CH-P-1B suction pressure (1-CH-PI-1188)
- 1-CH-P-1B Suction Flow (1-CH-FI-1182) from Local Indicator
- Charging Flow (1-CH-FT-1122) (PCS Computer point F1CH003A)

NOTE: Attachment 2 is to be used for plant conditions greater than 350°F and Attachment 3 for plant conditions less than 350°F.

6.6.12 Calculate the Pump Differential Pressure (ΔP) on Attachment 1 and record the calculated value on Attachment 2 or Attachment 3. (If the ΔP is in the acceptable range, the partially open test for 1-CH-267 is satisfactory.)

6.6.13 Check 1-CH-PI-110B, Lube Oil Pump Discharge Pressure, and record Lube Oil Pressure on Attachment 1. (Reference pressure range is 8 psig to 35 psig.)

NOTE: Points measured but not recorded on Attachment 2 or Attachment 3 will be used by the Predictive Analysis Group.

NOTE: The specified flow rate must be maintained while suction pressure, discharge pressure, and vibration points 19 through 24 are recorded. Flow adjustments may be made after these data points are collected.

6.6.14 Using the Microlog Data Collector, measure the bearing vibration of the pump, driver, and speed increaser at points 1 through 24 of Attachment 2 or Attachment 3. Record the measured data for points 19 through 24 on Attachment 2 or Attachment 3.

6.6.15 Calculate the Charging Pump Miniflow Recirc flow rate on Attachment 1 and record the calculated value on Attachment 2 or Attachment 3. (If the flow rate is in acceptable range, the open test for 1-CH-265, Charging Pump Mini-flow Check Valve, and 1-CH-230, VCT Supply Discharge Check Valve, is satisfactory.)

6.6.16 Call up the 1-CH-P-1B Inboard, Outboard, and Thrust Bearing temperatures on the PCS Computer and record on Attachment 1.

N/A

6.6.17 IF any bearing temperature is above 170°F, THEN notify System Engineering within 24 hours AND record name of person notified on Attachment 1. Monitor bearing temperature closely while the pump is operating. IF bearing temperatures are below 170°F, THEN enter N/A.

N/A

6.6.18 IF the RCS is less than 350°F and 450 psig, THEN, using 1-CH-FC-1122C and 1-RH-HCV-1142, return the RHR Letdown Flow to a value specified by Shift Supervision. Otherwise, enter N/A.

6.6.19 IF the RCS is greater than 350°F and 450 psig, THEN, using 1-CH-FC-1122C, adjust charging flow AND establish Przr level to within Program band. Otherwise, enter N/A.

6.6.20 Place 1-CH-LC-1459G in Auto.

6.6.21 WHEN Przr level is at the desired level AND stable, THEN place 1-CH-FC-1122C in Auto.

6.6.22 Record the following indications. Enter N/A if RCS is less than 350°F and 450 psig.

- Przr Level 53.2 %
- VCT Level 43 %
- LTDN Relief Line Temperature (1-CH-TI-1141) 106 °F
- Non-Regen Hx Temperature (1-CH-TI-1144) 102 °F
- Letdown Line Pressure (1-CH-PI-1145) 310 psi

6.6.23 Open 1-CH-MOV-1269B.

6.6.24 Verify that 1-CH-P-1B operating parameters are normal.

6.6.25 Inspect all piping outlined on Attachment 5. Collect any leakage found for a two minute period and record the leak location and the quantity collected on Attachment 1, 1-CH-P-1B Performance Test Data Sheet, (20 drops = 1 cc).

N/A

6.6.26 Record Condition Report number on Attachment 1 for each leak found. Otherwise, enter N/A.

6.7 1-CH-P-1B Return to Service with 1-CH-P-1C, ALT FEED, in Service

6.7.1 Verify that the following isolation valves are open.

N/A ______ IV
a. 1-CH-MOV-1267A, CHG PUMP A SUCT NORM

______ ______ IV
b. 1-CH-MOV-1267B, CHG PUMP A SUCT ALT

______ ______ IV
c. 1-CH-MOV-1286A, CHG PUMP A DISCH NORM

______ ______ IV
d. 1-CH-MOV-1287A, CHG PUMP A DISCH ALT

______ ______ IV
e. 1-CH-MOV-1275A, CHG PUMP MINIFLOW RECIRC VALVES PUMP A

______ ______ IV
f. 1-CH-MOV-1373, CHG MINIFLOW RECIRC

______
6.7.2 Verify that Aux Lube Oil Pump Discharge Pressure is between 4 psig and 8 psig as indicated on 1-CH-PI-110A. Record Lube Oil Pressure. Submit a Condition Report if Lube Oil Pressure is greater than 8 psig.

Lube Oil Pressure ________ psig

NOTE: A Charging Pump may be started if oil flow can not be verified to bearing(s). Contingency actions for monitoring bearing temperature are in place as a compensatory measure if pump will be started without oil flow to bearing(s).

✓ ______
6.7.3 Verify oil flow to the pump bearings. Enter N/A if flow can not be verified to bearing(s).

N/A

6.7.4 IF the difference between RCS boron and Charging pump boron is greater than 360 ppm, OR it is desired to flush to further reduce boron differential, THEN initiate Attachment 8. Otherwise, enter N/A. **(Ref. 2.4.20)**

____ 6.7.5 Record Lube Oil Temperature from 1-CH-TI-110A. Submit a Condition Report if Lube Oil Temperature is less than 60°F or greater than 120°F.

Lube Oil Temperature __________________ °F

____ 6.7.6 Verify that the Auxiliary Building Operator has determined that 1-CH-P-1A is ready to start and that all personnel are clear of the shaft.

CAUTION

Simultaneous operation of two Charging Pumps below 350°F shall be limited to the time required to swap from one Charging Pump to another. **(Reference 2.4.2)**

If pump bearing oil flow can NOT be verified, bearing temperature must be monitored closely upon pump start. If temperature rise greater than 30°F is observed during first minute of pump operation, the pump must be secured immediately.

____ 6.7.7 Start 1-CH-P-1A.

____ 6.7.8 Verify Chg Pump AMPS stabilize between 50 amps and 65 amps.

6.7.9 IF pump started with no bearing oil flow observed prior to start, THEN do the following. Otherwise, enter N/A.

____ a. Immediately after pump start, have Aux Building operator verify oil flow.

____ b. IF no oil flow observed, THEN immediately secure pump.

NOTE: If the Reactor is Critical, the performance of the following substep will result in the entry into a Tech Spec LCO clock due to operating with less than the minimum number of operable Charging Pumps.

____ 6.7.10 Place 1-CH-P-1C ALT FEED in PTL.

N/A

6.7.11 Monitor Charging Pump A bearing temperatures on the PCS computer.

6.7.12 IF either of the following temperature limits is exceeded when the Charging Pump is operating, THEN the pump should be monitored for degradation as soon as possible by performance of 1-OPT-CH-001, Charging Pump Operability and Performance Test for 1-CH-P-1A.

- Oil Cooler outlet oil temperature - 160°F
- Charging Pump bearing temperature - 180°F

6.7.13 Verify that 1-VS-MOD-101A, Charging Pump Ventilation Suction Motor Operated Damper, is open.

6.7.14 Check that the Aux Lube Oil Pump is stopped.

6.7.15 Verify that Lube Oil Pump Discharge Pressure is between 8 psig and 25 psig as indicated on 1-CH-PI-110A. Record Lube Oil Pressure.

Lube Oil Pressure ________ psig

6.7.16 WHEN Charging Pump Lube Oil temperatures have stabilized, THEN verify that the TCV is controlling Lube Oil temperature between 100°F and 120°F.

6.7.17 Verify that the Aux Lube Oil Pump for 1-CH-P-1C is running with a Lube Oil Pump Discharge Pressure between 4 psig and 8 psig. Record Lube Oil Pressure. Submit a Condition Report if Lube Oil Pressure is greater than 8 psig.

Lube Oil Pressure ________ psig (1-CH-PI-110C)

6.7.18 Check that 1-VS-MOD-101C, 1-CH-P-1C Charging Pump Ventilation Suction Motor Operated Damper, is closed.

6.7.19 Verify or place the following Charging Pumps in PTL.

a. 1-CH-P-1B, CHARGING PUMP B

b. 1-CH-P-1C, CHARGING PUMP C NORM FEED

6.7.20 Rack Breaker 15J2, 1-CH-P-1C, CHARGING PUMP C ALT FEED, to DISCONNECT IAW the following substeps. <u>IF</u> breaker is in DISCONNECT, <u>THEN</u> enter N/A.

N/A ______ ______ IV

a. Verify that the mechanical position indicator for Breaker 15J2 indicates OPEN with a green flag.

______ ______ IV

b. Rack Breaker 15J2, 1-CH-P-1C, CHARGING PUMP C ALT FEED, to DISCONNECT.

6.7.21 Rack in Breaker 15J5, 1-CH-P-1B to CONNECT IAW the following substeps.

______ ______ IV

a. Verify that the ground straps for Breaker 15J5 have been removed.

______ ______ IV

b. Verify the charging spring motor toggle switch for Breaker 15J5 is ON.

______ ______ IV

c. Rack Breaker 15J5, 1-CH-P-1B to CONNECT.

6.7.22 Verify that the following isolation valves are open.

______ ______ IV

a. 1-CH-MOV-1269A, CHG PUMP B SUCT NORM

______ ______ IV

b. 1-CH-MOV-1269B, CHG PUMP B SUCT ALT

______ ______ IV

c. 1-CH-MOV-1286B, CHG PUMP B DISCH NORM

______ ______ IV

d. 1-CH-MOV-1287B, CHG PUMP B DISCH ALT

N/A ______ IV ______ e. 1-CH-MOV-1275B, CHG PUMP MINIFLOW RECIRC VALVE PUMP B

______ IV ______ f. 1-CH-MOV-1373, CHG MINIFLOW RECIRC

______ 6.7.23 Verify that Aux Lube Oil Pump Discharge Pressure for 1-CH-P-1B is between 4 psig and 8 psig as indicated on 1-CH-PI-110B. Record Lube Oil Pressure. Submit a Condition Report if Lube Oil Pressure is greater than 8 psig.

Lube Oil Pressure ________ psig

NOTE: A Charging Pump may be started if oil flow can not be verified to bearing(s). Contingency actions for monitoring bearing temperature are in place as a compensatory measure if pump will be started without oil flow to bearing(s).

______ 6.7.24 Verify oil flow to the pump bearings. Enter N/A if flow can not be verified to bearing(s).

______ 6.7.25 Record Lube Oil Temperature from 1-CH-TI-110B. Submit a Condition Report if Lube Oil Temperature is less than 60°F or greater than 120°F.

Lube Oil Temperature __________________ °F

CAUTION

Racking in Breaker 1H 15H6 (1-CH-P-1C NORM FEED) will trip/lockout Breaker 1J 15J2 (1-CH-P-1C ALT FEED).

6.7.26 Rack Breaker 15H6, 1-CH-P-1C, NORM FEED, to CONNECT IAW the following substeps. IF 1-CH-P-1C NORM FEED is to remain in PTL, THEN enter N/A for the remaining steps in Subsection 6.7.

✓ ______ IV ______ a. Verify that the ground straps for Breaker 15H6 have been removed.

N/A ____ IV b. Verify that the charging spring motor toggle switch for Breaker 15H6 is ON.

____ ____ IV c. Rack Breaker 15H6, 1-CH-P-1C, NORM FEED, to CONNECT.

____ 6.7.27 Place 1-CH-P-1C, NORM FEED, in AUTO. IF 1-CH-P-1C, NORM FEED, is to be racked in and left in PTL, THEN enter N/A.

____ 6.7.28 GO TO Subsection 6.5.

6.8 Testing of Charging Pump MOVs

NOTE: This section allows testing of MOVs individually following Maintenance. If return to service testing of a Charging Pump is required, refer to Step 6.1.5 for required actions.

N/A 6.8.1 Verify all Maintenance has been completed on MOV(s) being tested.

6.8.2 Notify Maintenance Personnel if required.

NOTE: Full stroke time is defined as the interval from initiation of the actuating signal (initiation of manual actuation of the control panel switch) to the end of the actuating cycle (final control panel light extinguished).

6.8.3 From the Control Room, close the following MOV(s). Using Control Room indication, verify each valve travels from full open to full closed. Record time required for each valve to travel closed on Attachment 4. Enter N/A for valve(s) not being stroked.

a. 1-CH-MOV-1286B, CHG PUMP B DISCH NORM

b. 1-CH-MOV-1287B, CHG PUMP B DISCH ALT

c. 1-CH-MOV-1275B, CHG PUMP MINIFLOW RECIRC VALVE PUMP B

d. 1-CH-MOV-1269A, CHG PUMP B SUCT NORM
(Valve exercise only. Do not record stroke time on Attachment 4.)

6.8.4 From the Control Room, open the following MOV(s). Using Control Room indication, verify each valve travels from full closed to full open. Record time required for each valve to travel open on Attachment 4. Enter N/A for valve(s) not being stroked.

N/A a. 1-CH-MOV-1286B, CHG PUMP B DISCH NORM

b. 1-CH-MOV-1287B, CHG PUMP B DISCH ALT

c. 1-CH-MOV-1275B, CHG PUMP MINIFLOW RECIRC VALVES PUMP

d. 1-CH-MOV-1269A, CHG PUMP B SUCT NORM
(Valve exercise only. Do not record stroke time on Attachment 4.)

6.8.5 Continue with pump / valve maintenance or return to service, whichever applies.

6.9 Obtaining Oil Samples

NOTE: This procedure may continue while oil samples are taken.

NOTE: Oil samples should be taken as soon as possible after stopping pump, but may be delayed per SRO until 1-CH-P-1B is returned to service.

6.9.1 Obtain oil samples for 1-CH-P-1A IAW the following steps. Enter N/A if sampling 1-CH-P-1C.

a. Review T.S Section 3.2. B, Charging Pump Operability, and T.S. Section 3.3.A, Safety Injection System Operability, to determine if any actions are required before placing 1-CH-P-1A in PTL.

b. Enter any required T.S. clock for placing 1-CH-P-1A in PTL.

c. Place 1-CH-P-1A in PTL.

d. Obtain reservoir oil sample IAW the following steps:

1. Verify auxiliary oil pump running.

2. Remove downstream pipe cap from 1-CH-495, CHG Pump A LO Sample Isol.

3. Perform the following steps.

    - Open 1-CH-495 and drain approximately 500 mls to clean container.

    - Obtain reservoir oil sample of 120 mls (completely fill bottle).

    - Close 1-CH-495.

4. Replace downstream pipe cap at 1-CH-495.

5. Remove the speed increaser fill cap AND carefully pour the 500 mls flush sample into the speed increaser.

6. Check the oil reservoir level and replenish as necessary.
7. Replace speed increaser fill cap.

e. Obtain motor inboard bearing oil sample IAW the following steps:

1. Remove the inboard bearing chicken feeder.
2. Remove the inboard bearing drain valve cap.
3. Open inboard bearing drain valve <u>AND</u> obtain one inboard bearing oil sample of 120 mls (completely fill bottle).
4. Close inboard bearing drain valve.
5. Replace inboard bearing drain valve cap.
6. Add 120 mls of the approved oil through the chicken feeder base.
7. Replace the inboard bearing chicken feeder.

f. Obtain motor outboard bearing oil sample IAW the following steps:

1. Remove the outboard bearing chicken feeder.
2. Remove the outboard bearing drain valve cap.
3. Open outboard bearing drain valve <u>AND</u> obtain one outboard bearing oil sample of 120 mls (completely fill bottle).
4. Close outboard bearing drain valve.
5. Replace outboard bearing drain valve cap.
6. Add 120 mls of the approved oil through the chicken feeder base.
7. Replace the outboard bearing chicken feeder.

IV

g. Place 1-CH-P-1A in AUTO.

h. Exit any clock entered in Step 6.9.1.b.

i. Label the oil samples with the following information.

- ✓ Equipment Location
- ✓ Name of sample
- ✓ Date and time of sample
- ✓ Name and initials of person taking sample

j. Deliver the oil samples to Count Room window and notify PAG to pick them up.

6.9.2 Obtain oil samples for 1-CH-P-1C IAW the following steps. Enter N/A if sampling 1-CH-P-1A.

N/A

a. Review T.S Section 3.2. B, Charging Pump Operability, and T.S. Section 3.3.A, Safety Injection System Operability, to determine if any actions are required before placing 1-CH-P-1C in PTL.

b. Enter any required T.S. clock for placing 1-CH-P-1C in PTL.

c. Place 1-CH-P-1C in PTL.

d. Obtain reservoir oil sample IAW the following steps:

1. Verify auxiliary oil pump running.
2. Remove downstream pipe cap from 1-CH-497, CHG Pump C LO Sample Isol.
3. Perform the following steps.

   - Open 1-CH-497 and drain approximately 500 mls to clean container.

N/A

- Obtain reservoir oil sample of 120 mls. (completely fill bottle)
- Close 1-CH-497.

4. Replace downstream pipe cap at 1-CH-497.
5. Remove the speed increaser fill cap AND carefully pour the 500 mls flush sample into the speed increaser.
6. Check the oil reservoir level and replenish as necessary.
7. Replace speed increaser fill cap.

e. Obtain motor inboard bearing oil sample IAW the following steps:

1. Remove the inboard bearing chicken feeder.
2. Remove the inboard bearing drain valve cap.
3. Open inboard bearing drain valve AND obtain one inboard bearing oil sample of 120 mls. (completely fill bottle)
4. Close inboard bearing drain valve.
5. Replace inboard bearing drain valve cap.
6. Add 120 mls of the approved oil through the chicken feeder base.
7. Replace the inboard bearing chicken feeder.

f. Obtain motor outboard bearing oil sample IAW the following steps:

1. Remove the outboard bearing chicken feeder.
2. Remove the outboard bearing drain valve cap.
3. Open outboard bearing drain valve AND obtain one outboard bearing oil sample of 120 mls. (completely fill bottle)

N/A

4. Close outboard bearing drain valve.

5. Replace outboard bearing drain valve cap.

6. Add 120 mls of the approved oil through the chicken feeder base.

7. Replace the outboard bearing chicken feeder.

IV

g. Place 1-CH-P-1C in AUTO.

h. Exit any clock entered in Step 6.9.2.b.

i. Label the oil samples with the following information.

- Equipment Location
- Name of sample
- Date and time of sample
- Name and initials of person taking sample

j. Deliver the oil samples to Count Room window and notify PAG to pick them up.

6.10 Discharge Check Valve Backleakage Test on Non-running Charging Pump

NOTE:

- This Subsection is not required during the normal quarterly Charging Pump run. This Subsection is to be used as required for increased monitoring of a suspected leaking discharge check valve.
- The performance of this Subsection will result in the entry into a Tech Spec LCO due to operating with less than the minimum number of operable Charging Pumps.
- The Accu-cal plus precision test gauge is the preferred instrument for use in this Subsection. If the Accu-cal plus precision test gauge is not available, the normal discharge pressure gauge is acceptable.
- The Accu-cal plus precision test gauge saves power by turning off after 30 minutes. The gauge may need to be energized by holding the power button for 2 - 3 seconds.

N/A ______ 6.10.1 Verify 1-CH-P-1B secured and place pump in PTL.

6.10.2 From the Control Room, close the following MOV(s).

______ a. 1-CH-MOV-1286B, CHG PUMP B DISCH NORM

______ b. 1-CH-MOV-1287B, CHG PUMP B DISCH ALT

______ c. 1-CH-MOV-1275B, CHG PUMP MINIFLOW RECIRC VALVE PUMP B

______ 6.10.3 Record discharge pressure of running Charging pump from Accu-cal plus precision test gauge or the normal discharge gauge.

________________ psig

6.10.4 From the Control Room, open the following MOV(s).

______ a. 1-CH-MOV-1286B, CHG PUMP B DISCH NORM

______ b. 1-CH-MOV-1287B, CHG PUMP B DISCH ALT

N/A BC

c. 1-CH-MOV-1275B, CHG PUMP MINIFLOW RECIRC VALVE PUMP B

6.10.5 Record discharge pressure of running Charging pump from Accu-cal plus precision test gauge or the normal discharge gauge.

________________ psig

6.10.6 Place 1-CH-P-1B in Automatic and stop any clock previously started.

6.10.7 Calculate the discharge pressure differential. (Reference - less than or equal to 7.5 psid)

________________ - ________________ = ____________ psid
(Step 6.10.3) (Step 6.10.5)

7.0 FOLLOW-ON

7.1 Acceptance Criteria

7.1.1 Evaluate the test results by reviewing the Acceptance Criteria for the components tested. (✓) Enter N/A for components not tested.

- ✓ 1-CH-267, Charging Pump Discharge Check Valve, operated in the partially open direction as evidenced by an acceptable pump differential pressure. (Attachment 2 or Attachment 3 - Step 6.6.12)
- ✓ 1-CH-267, Charging Pump Discharge Check Valve, operated in the fully closed direction as evidenced by a discharge pressure differential for the running charging pump of less than or equal to 7.5 psid. (Attachment 1, Step 6.5.1.g, or Step 6.10.7)
- ✓ 1-CH-265, Charging Pump Miniflow Recirc Header Check Valve, operated in the open direction as evidenced by an acceptable recirculation flow rate. (Attachment 2 or Attachment 3 - Step 6.6.15)
- ✓ 1-CH-230, VCT Supply Discharge Check Valve, operated in the open direction as evidenced by an acceptable recirculation flow rate. (Attachment 2 or Attachment 3 - Step 6.6.15)
- ✓ Charging Pump ΔP and Vibration status determinations are not INOP. (Attachment 2 or Attachment 3)
- ✓ 1-CH-MOV-1286B, CHG PUMP B DISCH NORM, traveled full open and closed within the acceptable range. (Attachment 4)
- ✓ 1-CH-MOV-1287B, CHG PUMP B DISCH ALT, traveled full stroke open and closed within the acceptable range. (Attachment 4)
- ✓ 1-CH-MOV-1275B, CHG PUMP MINIFLOW RECIRC VALVE PUMP B, traveled full stroke open and closed within the acceptable range. (Attachment 4)

- ✓ 1-SW-TCV-108B recorded data is as follows. (Attachment 4) (✓)
  - ✓ Test position - OPEN
  - ✓ Stroke Time - Less than Maximum Time
- ✓ 1-SW-TCV-108B opens and controls charging pump lube oil temperature out of the cooler below 160°F.

7.1.2 Document the test results. (✓)

✓ Satisfactory ___ Unsatisfactory

7.2 Follow-On Tasks

7.2.1 IF the test was satisfactory, THEN enter N/A in the following substeps. IF the test was unsatisfactory, THEN perform the following:

N/A

a. Notify Shift Supervision.

b. Initiate a Condition Report and record the CR Number.

CR No. ______________________________

CR No. ______________________________

c. Notify the IST and System Engineer of the unsatisfactory condition and record the names of the personnel notified.

______________________________ IST Engineer ______ Date

______________________________ System Engineer ______ Date

7.2.2 Notify STA to compare new Total System External Leakage as determined by Attachment 1 to maximum allowed by 1-NPT-ZZ-001. IF leakage is greater than limit, THEN perform the following substeps. Otherwise, enter N/A.

N/A

a. Notify the System Engineer of the unsatisfactory condition and record the name of the person notified.

System Engineer	Date

b. Initiate a Condition Report and record the CR Number.

CR No. ____________________

c. Start a 7-day administrative clock to decrease the SI external loop leakage to within satisfactory values. **(Reference 2.4.10)**

N/A

7.2.3 IF a partial operability test was performed, THEN document the reason for the partial test in Operator Comments, Subsection 7.3. IF a full test was performed, THEN enter N/A.

7.2.4 IF the test or partial test was satisfactory but in ALERT, THEN perform the following. IF there is no ALERT condition, THEN enter N/A.

N/A

a. Notify Shift Supervision.

b. Notify the IST and System Engineer of the ALERT condition and record the names of the personnel notified.

IST Engineer	Date

System Engineer	Date

7.2.5 Make or verify an entry in the M & TE Usage Log for each SQC device used during this test.

7.2.6 IF test flow could not be achieved, THEN perform the following.

N/A

a. Notify Shift Supervision.

b. Notify the IST Engineer and record name of person notified.

IST Engineer	Date

c. Initiate a Condition Report and record CR number.
(Failure to achieve flow within range DOES NOT, by itself, make this test UNSAT).

Condition Report No. ______________________

7.2.7 IF charging pump discharge check valve backleakage recorded in Attachment 1 Step 6.5.1.g was greater than 2.5 psid, THEN perform the following. Otherwise, enter N/A.

N/A

a. Notify Shift Supervision.

b. Initiate a Condition Report and record the CR Number.

Condition Report No. ______________________

c. Notify the IST and System Engineer of the condition so that an increase in test frequency can be evaluated. Record the names of the personnel notified.

IST Engineer	Date

System Engineer	Date

7.2.8 IF Accu-cal plus precision test gauge was installed by I&C in Step 6.1.2, THEN have I&C remove gauge IAW Attachment 9. Otherwise, enter N/A.

7.3 Notification, Documentation, and Procedure Closeout

BJ 7.3.1 Notify Shift Supervision that the test is complete.

The Initials in this procedure will be identified by the Printed Name.

Initials	Printed Name
SL	Sean Locascio
S	Skip Irwin
BJ	Bonnie Jurewicz
W	Dave Wilson

Operator Comments: ______________________________

Completed by: Bonnie Jurewicz Date: Today
Time: Now

7.4 **Review**

Comments: ____________________

____

____

____

____

____

Reviewed by: ____________________ Date: ________
Shift Supervision

Forward original procedure to Engineering Testing.

____ IST Eng 7.4.1 Make PVIST Data entry. **(Ref. 2.4.21)**

____ Sys Eng 7.4.2 Verify PVIST Data entry. **(Ref. 2.4.21)**

Comments: ____________________

____

____

____

Reviewed by: ____________________ Date: ________
IST Engineer

Comments: ____________________

____

____

____

1-NPT-ZZ-001 Updated ________ Yes ________ No ________ N/A

Reviewed by: ____________________ Date: ________
System Engineer

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Attachment 1

1-CH-P-1B PERFORMANCE TEST DATA SHEET

NOTE: Work Order recording steps may be entered N/A if Work Order Tracking Sheet attached to completed procedure.

Step 6.1.1 WO No.: ______________ Equipment Location: ______________
WO No.: ______________ Equipment Location: ______________
WO No.: ______________ Equipment Location: ______________

Step 6.1.3

	Reference SQC Number	Cal Due Date
Accu-Cal Plus precision gauge (if used))	7423	9-7-10

	SQC Number	Cal Due Date
Vibration detector	5016B	2-6-11
Stopwatch	3698	9-26-10
Stopwatch	3704	4-28-10
Stopwatch	3706	4-2-11

Step 6.1.4 ✓ RCS at normal operating pressure OR _____ RHR in Service (✓one.)

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Attachment 1

1-CH-P-1B PERFORMANCE TEST DATA SHEET

Step 6.5.1.e Discharge Pressure (Accu-cal plus gauge, 1-CH-PI-1151 or 1-CH-PI-1153) 2496.7 psig

Step 6.5.1.f Discharge Pressure (Accu-cal plus gauge, 1-CH-PI-1151 or 1-CH-PI-1153) 2495.2 psig

Step 6.5.1.g Discharge Pressure differential (Reference - less than or equal to 7.5 psid)

2496.7 - 2495.2 = 1.5 psid
(Step 6.5.1.e) (Step 6.5.1.f)

Step 6.6.11 VCT Level 43.3%

VCT Pressure 28 psig

Discharge Pressure (1-CH-PI-1152) 2600 psig

Suction Pressure (1-CH-PI-1188) 31.8 psig

Suction Flow (1-CH-FI-1182) 162 gpm (from local indicator)

Charging Flow (1-CH-FT-1122) 79 gpm (PCS Computer Pt F1CH003A)

RCP A Seal Flow (1-CH-FT-1130) 7.6 gpm (PCS Computer Pt U0983)

RCP B Seal Flow (1-CH-FT-1127) 7.6 gpm (PCS Computer Pt U0982)

RCP C Seal Flow (1-CH-FT-1124) 7.5 gpm (PCS Computer Pt U0981)

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Attachment 1

1-CH-P-1B PERFORMANCE TEST DATA SHEET

Step 6.6.12 Pump Differential Pressure

2660	-	31.8	=	2568.2	psid
(1-CH-PI-1152)		(1-CH-PI-1188)			

Step 6.6.13 Lube Oil Pressure 18 psig

Step 6.6.15 Mini-flow Recirculation Flow Rate

162	-	7.6	-	7.6	-	7.5	-	79	=	60.3 gpm
FI-1182		FT-1130		FT-1127		FT-1124		FT-1122		

Step 6.6.16 • Inboard Bearing ID Point T0116A 128.6 °F (Reference 120°F)

- Outboard Bearing ID Point T0117A 132.5 °F (Reference 130°F)
- Thrust Bearing ID Point T0118A 111.0 °F (Reference 130°F)

Step 6.6.17 Name of System Engineer Notified N/A

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Attachment 1

1-CH-P-1B PERFORMANCE TEST DATA SHEET

Step 6.6.25 Record locations of any leakage found.

N/A - None

Step 6.6.26 Condition Report numbers

N/A - None

Performed by: Bonnie [illegible] (Signature) BG (Initial) Bonie [illegible] (Print) Today (Date)

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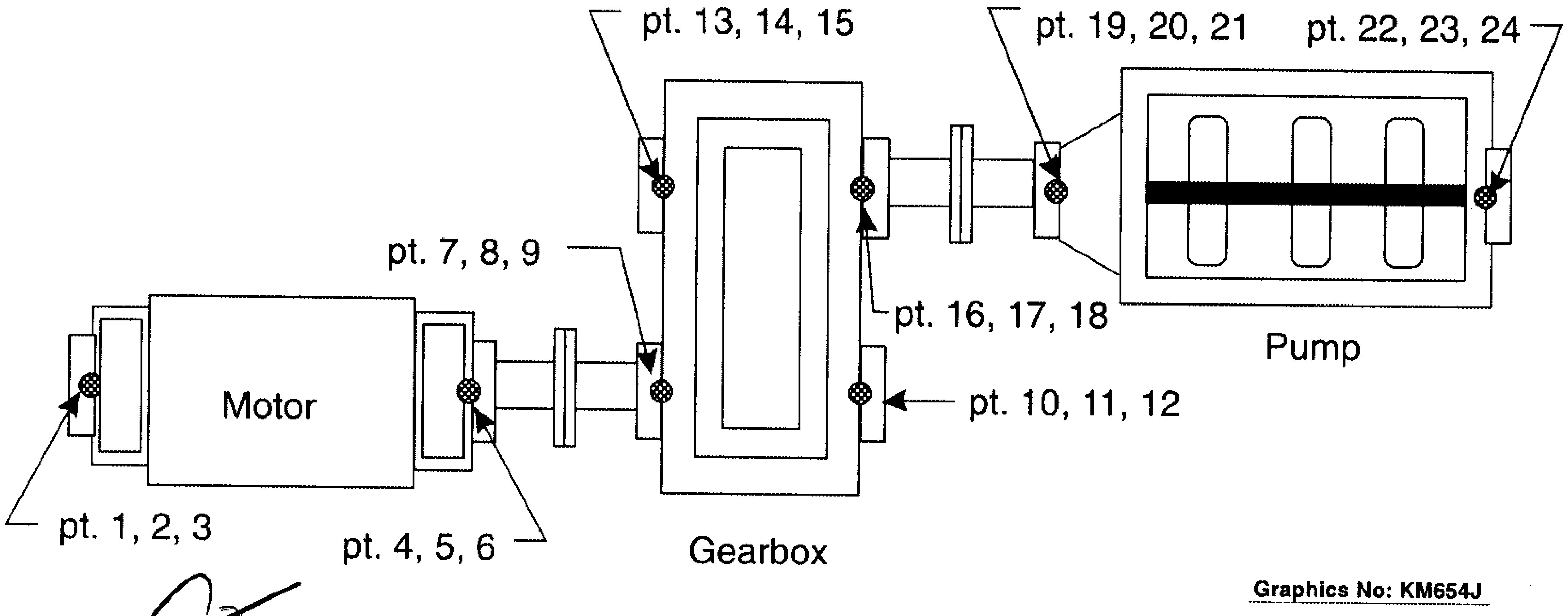
Attachment 2

1-CH-P-1B VIBRATION, FLOW AND ΔP DATA TABLE (> 350°F)



NOTE: ● Represents the Horizontal, Vertical, and Axial Accelerometer Pads Mounted on the Bearing Housing and Indicated in Yellow on the Pump/Driver Assembly.

VIBRATION TESTING POINTS

Parameters in ALERT range are considered SATISFACTORY. Parameters in INOP are UNSATISFACTORY.

PARAMETER	REF VALUE	TEST VALUE	ACCEPT RANGE	ALERT RANGE	INOP RANGE	STATUS SAT, INOP ALERT
ΔP Step 6.6.12 (Ref. 2.3.30)	psid 2553	2568.2	2433 to 2731	NONE	< 2433 OR > 2731	SAT
Inboard Vibration Horizontal (pt 19) Vertical (pt 20) Axial (pt 21)	in/sec 0.1622 0.0981 0.0594	.2673 .062 .0425	≤0.325 ≤0.245 ≤0.148	>0.325 to ≤0.700 >0.245 to ≤0.588 >0.148 to ≤0.356	> 0.700 > 0.588 > 0.356	SAT
Outboard Vibration Horizontal (pt 22) Vertical (pt 23) Axial (pt 24)	in/sec 0.2710 0.0942 0.0483	.7162 .057 .0707	≤0.325 ≤0.235 ≤0.125	>0.325 to ≤0.700 >0.235 to ≤0.565 >0.125 to ≤0.300	> 0.700 > 0.565 > 0.300	SAT
Recirc Flow Rate Step 6.6.15	54 gpm	60.3	≥ 35 to ≤ 80 gpm	N/A	< 35 or > 80 gpm	SAT

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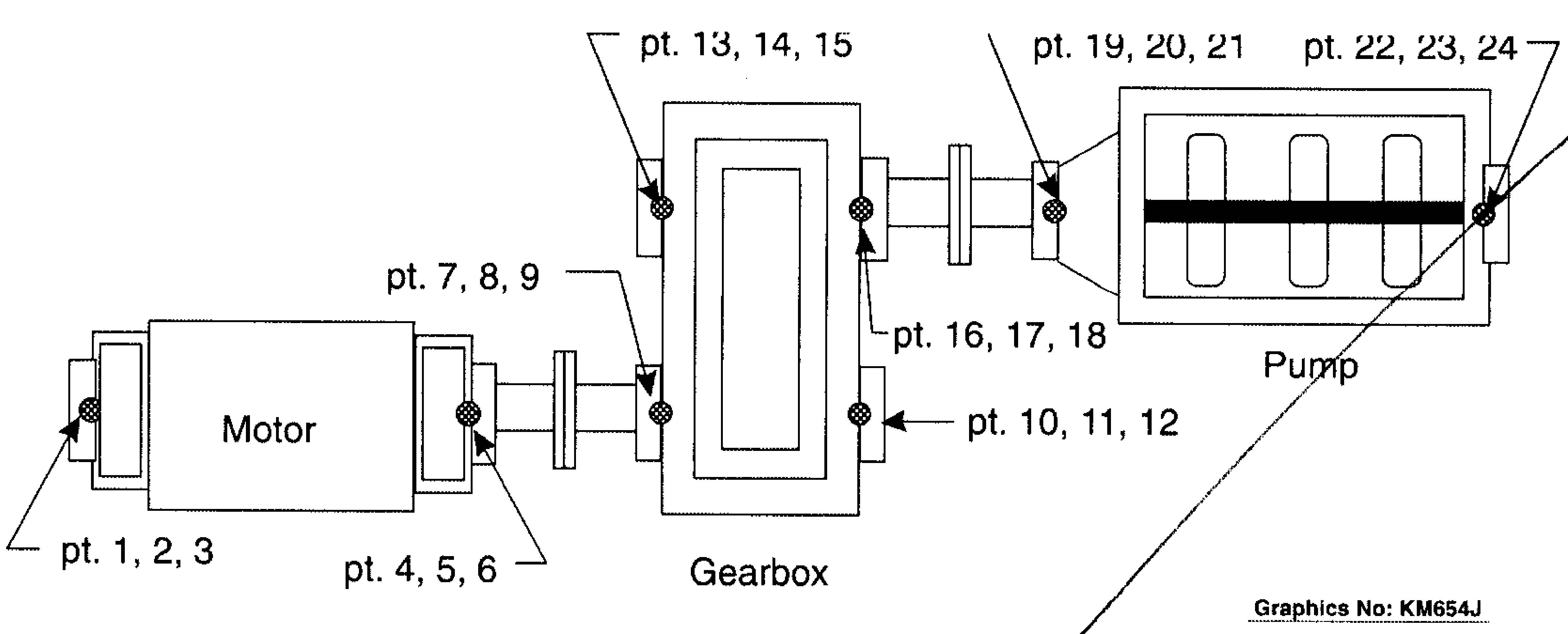
Attachment 3

1-CH-P-1B VIBRATION, FLOW AND ΔP DATA TABLE (< 350°F)



NOTE: ● Represents the Horizontal, Vertical, and Axial Accelerometer Pads Mounted on the Bearing Housing and Indicated in Yellow on the Pump/Driver Assembly.

VIBRATION TESTING POINTS

N/A

Parameters in ALERT range are considered SATISFACTORY. Parameters in INOP are UNSATISFACTORY.

PARAMETER	REF VALUE	TEST VALUE	ACCEPT RANGE	ALERT RANGE	INOP RANGE	STATUS SAT, INOP ALERT
ΔP Step 6.6.12 (Ref. 2.3.30)	psid 2416	____	2421 to 2585	NONE	< 2421 OR > 2585	____
Inboard Vibration	in/sec					
Horizontal (pt 19)	0.1433	____	≤0.3250	>0.3250 to ≤0.7000	> 0.7000	
Vertical (pt 20)	0.0758	____	≤0.1895	>0.1895 to ≤0.4548	> 0.4548	
Axial (pt 21)	0.0797	____	≤0.1992	>0.1992 to ≤0.4782	> 0.4782	____
Outboard Vibration	in/sec					
Horizontal (pt 22)	0.1887	____	≤0.3250	>0.325 to ≤0.7000	> 0.7000	
Vertical (pt 23)	0.1001	____	≤0.2500	>0.2500 to ≤0.6001	> 0.6001	
Axial (pt 24)	0.1247	____	≤0.3117	>0.3117 to ≤0.7000	> 0.7000	____
Recirc Flow Rate Step 6.6.15	53 gpm	____	≥ 35 to ≤ 80 gpm	N/A	< 35 or > 80 gpm	____

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Attachment 4

MOV STROKE TIME DATA TABLE

Stroke Test - Closed

Step	Valve	Stroke Position	Reference Time	Acceptable Range Time	Actual Time
6.5.1.d / 6.8.3.a	1-CH-MOV-1286B	Closed	10.9 sec	9.3 to 12.5 sec	10.2 Seconds
6.5.1.d / 6.8.3.b	1-CH-MOV-1287B	Closed	5.21 sec	4.0 to 6.5 sec	5.45 Seconds
6.5.1.d / 6.8.3.c	1-CH-MOV-1275B	Closed	8.8 sec	6.6 to 11.0 sec	8.49 Seconds

Stroke Test - Open

Step	Valve	Stroke Position	Reference Time	Acceptable Range Time	Actual Time
6.5.1.f / 6.8.4.a	1-CH-MOV-1286B	Open	9.8 sec	7.4 to 12.2 sec	9.24 Seconds
6.5.1.f / 6.8.4.b	1-CH-MOV-1287B	Open	5.05 sec	3.8 to 6.3 sec	6.78 Seconds
6.5.1.f / 6.8.4.c	1-CH-MOV-1275B	Open	9.0 sec	6.8 to 11.2 sec	8.59 Seconds

Subsection 6.5.3	Test Position (Step 6.5.3.i)	Stroke Time in Seconds (Step 6.5.3.i)	Reference Time	Maximum Time	As Left Position (Step 6.5.3.m)
1-SW-TCV-108B	open	6.1	3.7 sec	30.0 sec	closed

Performed by: Bonnie Jurewicz Ble Bonnie Jurewicz Today
Signature Initial Print Date

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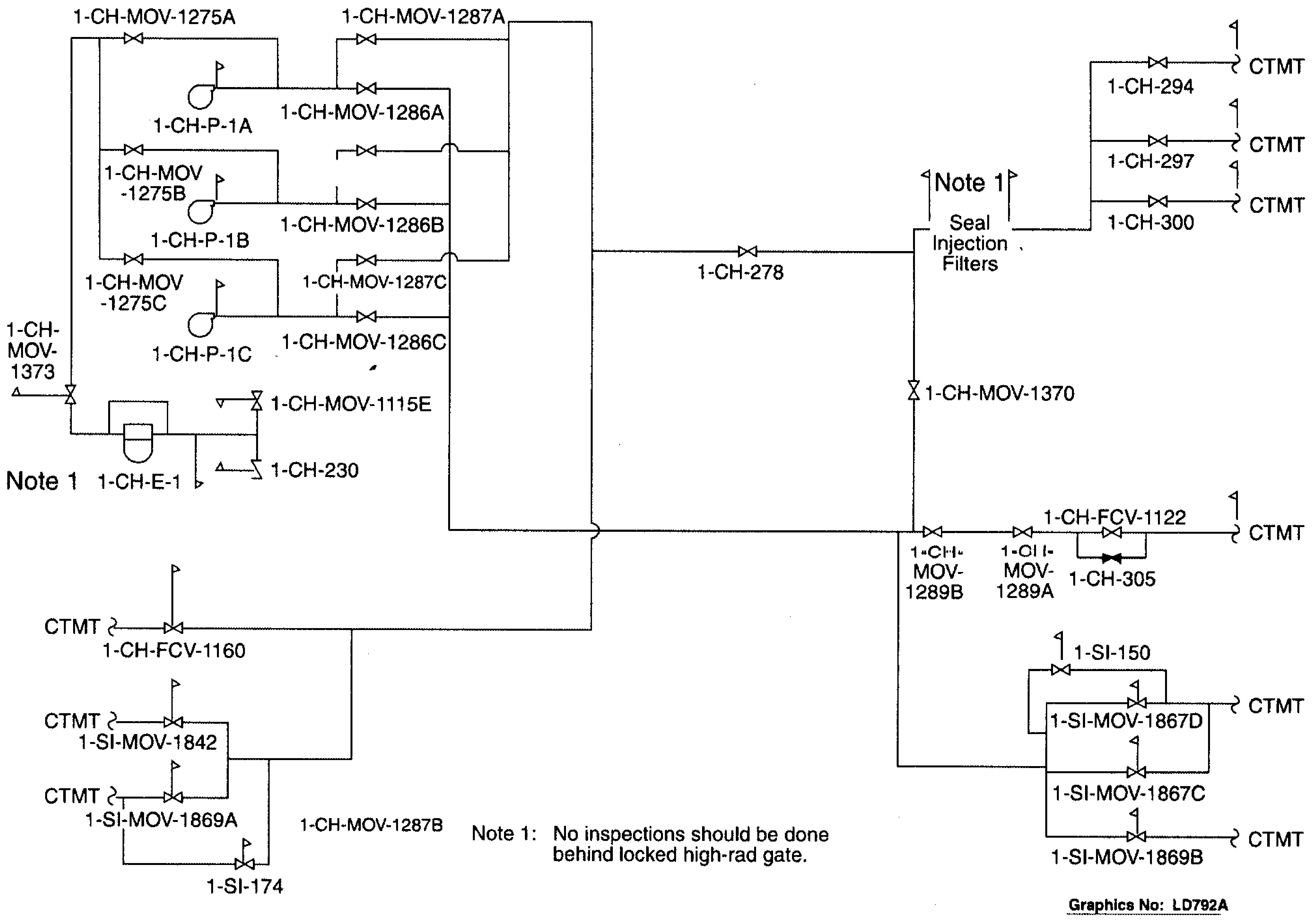
Attachment 5

CHARGING SYSTEM EXTERNAL LEAK INSPECTION DIAGRAM



Note 1: No inspections should be done behind locked high-rad gate.

Graphics No: LD792A

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Attachment 6

VENTING 1-CH-FT-1182

NOTE: The water and gas vented is potentially contaminated. Appropriate HP precautions shall be taken to prevent the spread of contamination.

NOTE: An HP approved catch container shall be used to collect any water that is vented.

N/A 1. Open 1-CH-ICV-3543, CH Pump 1B Suct FT-1182 Equalizing Valve.

2. Uncap and open 1-CH-ICV-3541, CH Pump 1B Suct FT-1182 (L) Test Isol.

IV 3. WHEN a solid stream of water is obtained, THEN close and cap 1-CH-ICV-3541.

4. Uncap and open 1-CH-ICV-3542, CH Pump 1B Suct FT-1182 (H) Test Isol.

IV 5. WHEN a solid stream of water is obtained, THEN close and cap 1-CH-ICV-3542.

IV 6. Close 1-CH-ICV-3543, CH Pump 1B Suct FT-1182 Equalizing Valve.

7. IF additional venting is required to stabilize 1-CH-P-1B suction flow, THEN perform Steps 8 through 18. IF additional venting NOT required, THEN enter N/A for Steps 8 through 18.

8. Open 1-CH-ICV-3543, CH Pump 1B Suct FT-1182 Equalizing Valve.

9. Uncap and open 1-CH-ICV-3545, CH Pump 1B Suct FT-1182 (L) Vent.

IV 10. WHEN a solid stream of water is obtained, THEN close and cap 1-CH-ICV-3545.

11. Uncap and open 1-CH-ICV-3544, CH Pump 1B Suct FT - 1182 (H) Vent.

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Attachment 6

VENTING 1-CH-FT-1182

N/A ______ ______ IV 12. WHEN a solid stream of water is obtained, THEN close and cap 1-CH-ICV-3544.

______ 13. Uncap and open 1-CH-ICV-3549, CH Pump 1B Suct FT - 1182 (L) Vent.

______ ______ IV 14. WHEN a solid stream of water is obtained, THEN close and cap 1-CH-ICV-3549.

______ 15. Uncap and open 1-CH-ICV-3548, CH Pump 1B Suct FT - 1182 (H) Vent.

______ ______ IV 16. WHEN a solid stream of water is obtained, THEN close and cap 1-CH-ICV-3548.

______ ______ IV 17. Close 1-CH-ICV-3543, CH Pump 1B Suct FT-1182 Equalizing Valve.

______ 18. IF additional venting is required to stabilize 1-CH-P-1B suction flow, THEN repeat Steps 1 through 18 as necessary.

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Attachment 7

VENTING OF CHARGING PUMP SEALS

N/A
MECH

1. Manually rotate pump shaft.

______

2. Vent the inboard seal by opening 1-CH-501, CHG Pump 1B Seal Cooler 7D Vent Valve.

______

3. <u>WHEN</u> air-free water issues from vent, <u>THEN</u> close 1-CH-501.

______

4. Vent the outboard seal by opening 1-CH-502, CHG Pump 1B Seal Cooler 7C Vent Valve.

______

5. <u>WHEN</u> air-free water issues from vent, <u>THEN</u> close 1-CH-502.

______
MECH

6. Remove the pump vent rig and install the blank flange on the CHG Pump casing vent flange.

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Attachment 8

FLUSHING CHARGING PUMP TO REDUCE BORON DIFFERENTIAL

NOTE: A Charging Pump contains approximately 30 gallons.

N/A ______ 1. Notify Chemistry that pump will be flushed and to standby to take sample for boron.

______ 2. Verify or place Auxiliary Building General ventilation system in service IAW 0-OP-VS-002, Auxiliary Building Ventilation System.

3. Verify open or open sample isolation valve for pump to be started. (✓)

______ • 1-CH-254, Chg Pump A Disch Sample Isol

______ • 1-CH-263, Chg Pump B Disch Sample Isol

______ • 1-CH-272, Chg Pump C Disch Sample Isol

4. Open sample HCV for pump to be started. (✓) .

______ • 1-SS-HCV-103A, Chg Pump 1A Disch Sample Isol

______ • 1-SS-HCV-103B, Chg Pump 1B Disch Sample Isol

______ • 1-SS-HCV-103C, Chg Pump 1C Disch Sample Isol

______ 5. Open 1-SS-14, Chg Pump Disch Sample Isol.

______ 6. Open 1-SS-13, Chg Pump Disch Sample Throttle Valve.

______ 7. Verify flow to Sample Sink.

______ 8. WHEN approximately ten gallons have been flushed, THEN notify Chemistry to obtain sample.

______ 9. Continue flushing pump and obtaining samples until difference between Charging Pump Boron and RCS Boron is less than 360 ppm. IF the difference between RCS boron and pump boron is less than 360 ppm AND it is desired to flush to further reduce boron differential, THEN continue to flush IAW Shift Supervision direction.

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Attachment 8

FLUSHING CHARGING PUMP TO REDUCE BORON DIFFERENTIAL

10. WHEN ready to secure flush, THEN do the following:

N/A ______ ______ IV — a. Close 1-SS-13, Chg Pump Disch Sample Throttle Valve.

______ ______ IV — b. Close 1-SS-14, Chg Pump Disch Sample Isol.

✓ ______ ______ IV — c. Close sample HCV opened in Step 4.

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Attachment 9

SETUP AND INSTALLATION / REMOVAL OF THE ACCU-CAL PLUS DIGITAL PRECISION TEST GAUGE (I&C)

W
I&C

1. Turn on the device by holding the power button for 2 - 3 seconds.

   ✓ **NOTE:** Press the CONFIG button to enter setting mode, and press CONFIG to advance to the next option. The up or down arrows will change any individual setting.

   ✓ **NOTE:** If backlighting is necessary to read the display, use the ENTER key to cycle backlighting on or off.

W
I&C

2. Verify or set the following settings:
   - ✓ Engineering units = PSI
   - ✓ Auto Off = 30 minutes
   - ✓ Battery Voltage > 3.3 Volts
   - ✓ Temperature is displayed (value/units not important)
   - ✓ Damping = ON
   - ✓ Rate = 10.0/sec
   - ✓ Tare = 0.0
   - ✓ When display reads FUNC LOCK, press CONFIG to return to the actual pressure reading

N/A W
I&C

3. IF required to zero gauge, THEN hold the ZERO key for 1 - 2 seconds until the word HOLD disappears. Otherwise, enter N/A.

4. IF battery voltage is less than 3.3 volts, THEN change batteries IAW the following. (Three AA batteries required) Otherwise, enter N/A.

N/A W
I&C

   a. Grasp the face ring and turn approximately 1/4 turn counter-clockwise to remove.

N/A W
I&C

   b. Replace the three AA batteries with new ones installed with proper polarity.

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Attachment 9

SETUP AND INSTALLATION / REMOVAL OF THE ACCU-CAL PLUS DIGITAL PRECISION TEST GAUGE (I&C)

N/A W
I&C

c. Reassemble the case making certain the face is properly oriented.

N/A W
I&C

5. IF 1-CH-P-1A running, THEN remove swagelock cap/plug and install the gauge downstream of 1-CH-ICV-3516. Otherwise, enter N/A.

W
I&C

6. IF 1-CH-P-1C running, THEN remove swagelock cap/plug and install the gauge downstream of 1-CH-ICV-3524. Otherwise, enter N/A.

W
I&C

7. Open appropriate ICV to place gauge in service. (✓)

_____ 1-CH-ICV-3516

✓ 1-CH-ICV-3524

W
I&C

8. Notify Operations that gauge is in service.

9. WHEN notified by Operations, THEN remove gauge from service IAW the following:

W
I&C

a. Close ICV opened in Step 7. (✓)

_____ 1-CH-ICV-3516

✓ 1-CH-ICV-3524

W
I&C

b. Remove the test gauge.

W
I&C

c. Reinstall swagelock cap/plug.

W
I&C

d. Wipe down fitting and tubing for boric acid residue.

Date	Total(gpm)	Identified(gpm)	Unidentified(gpm)	Sump(gpm)	'A' (gpd)
05/15/09	0.320	0.290	0.030	0.180	0.200
05/16/09	0.360	0.300	0.060	0.190	0.300
05/17/09	0.310	0.270	0.040	0.180	0.300
05/18/09	0.290	0.260	0.030	0.170	0.300
05/19/09	0.310	0.220	0.090	0.160	0.300
05/20/09	0.290	0.200	0.080	0.150	0.300
05/21/09	0.260	0.230	0.030	0.140	0.300
05/22/09	0.270	0.200	0.070	0.150	0.300
05/23/09	0.250	0.170	0.080	0.140	0.300
05/24/09	0.230	0.230	0.000	0.150	0.300
05/25/09	0.230	0.220	0.010	0.130	0.300
05/26/09	0.230	0.180	0.050	0.120	0.300
05/27/09	0.220	0.220	0.000	0.130	0.300
05/28/09	0.230	0.190	0.040	0.140	0.300
05/29/09	0.850	0.810	0.040	0.130	0.300
05/30/09	0.380	0.360	0.020	0.120	0.300
05/31/09	0.310	0.310	0.000	0.140	0.300
06/01/09	0.280	0.250	0.030	0.140	0.200
06/02/09	0.260	0.260	0.000	0.140	0.200
06/03/09	0.250	0.240	0.010	0.150	0.300
06/04/09	0.280	0.270	0.010	0.140	0.300
06/05/09	0.260	0.210	0.050	0.140	0.300
06/06/09	0.240	0.240	0.000	0.140	0.300
06/07/09	0.230	0.170	0.060	0.130	0.300
06/08/09	0.230	0.210	0.020	0.130	0.300
06/09/09	0.260	0.210	0.050	0.120	0.300
06/10/09	0.230	0.220	0.010	0.150	0.300
06/11/09	0.260	0.200	0.060	0.130	0.300
06/12/09	0.230	0.230	0.000	0.190	0.300
06/13/09	0.220	0.190	0.030	0.140	0.300
06/14/09	0.310	0.230	0.100	0.150	0.300
06/15/09	0.270	0.200	0.080	0.140	0.300
06/16/09	0.280	0.180	0.100	0.150	0.300
06/17/09	0.260	0.190	0.060	0.150	0.300
06/18/09	0.260	0.200	0.030	0.150	0.300
06/19/09	0.270	0.190	0.080	0.130	0.300
06/20/09	0.260	0.200	0.060	0.130	0.300
06/21/09	0.280	0.170	0.110	0.000	0.300
06/22/09	0.270	0.210	0.060	0.140	0.200
06/23/09	0.270	0.210	0.060	0.150	0.300
06/24/09	0.280	0.270	0.090	0.300	0.300
06/25/09	0.690	0.690	0.000	0.170	0.300
06/26/09	0.440	0.410	0.030	0.180	0.300
06/27/09	0.380	0.350	0.030	0.190	0.300
06/28/09	0.350	0.300	0.050	0.170	0.300
06/29/09	0.320	0.260	0.050	0.170	0.300

06/30/09	0.320	0.240	0.080	0.170	0.300
07/01/09	0.320	0.240	0.090	0.170	0.300
07/02/09	0.350	0.290	0.080	0.180	0.300
07/03/09	0.310	0.260	0.050	0.170	0.300
07/04/09	0.300	0.240	0.060	0.170	0.300
07/05/09	0.300	0.260	0.040	0.160	0.300
07/06/09	0.280	0.230	0.050	0.170	0.300
07/07/09	0.280	0.250	0.030	0.150	0.300
07/08/09	0.290	0.210	0.080	0.160	0.300
07/09/09	0.270	0.270	0.010	0.160	0.300
07/10/09	0.270	0.220	0.050	0.150	0.300
07/11/09	0.270	0.220	0.050	0.160	0.300
07/12/09	0.260	0.200	0.060	0.160	0.300
07/13/09	0.270	0.220	0.050	0.150	0.300
07/14/09	0.260	0.170	0.090	0.170	0.300
07/15/09	0.270	0.230	0.040	0.190	0.300
07/16/09	0.280	0.180	0.100	0.200	0.300
07/17/09	0.250	0.240	0.010	0.170	0.300
07/18/09	0.240	0.190	0.050	0.190	0.300
07/19/09	0.270	0.190	0.070	0.170	0.300
07/20/09	0.240	0.210	0.030	0.170	0.300
07/21/09	0.280	0.220	0.050	0.190	0.300
07/22/09	0.260	0.210	0.050	0.180	0.300
07/23/09	0.270	0.160	0.110	0.180	0.300
07/24/09	0.280	0.180	0.100	0.180	0.300
07/25/09	0.280	0.160	0.120	0.160	0.300
07/26/09	0.280	0.200	0.090	0.170	0.300
07/27/09	0.260	0.180	0.090	0.170	0.300
07/28/09	0.270	0.220	0.050	0.170	0.300
07/29/09	0.270	0.160	0.110	0.190	0.300
07/30/09	0.240	0.190	0.050	0.150	0.300
07/31/09	0.260	0.190	0.070	0.150	0.300
08/01/09	0.240	0.170	0.070	0.170	0.300
08/02/09	0.260	0.190	0.070	0.170	0.300
08/03/09	0.230	0.190	0.050	0.170	0.300
08/04/09	0.260	0.160	0.090	0.165	0.300
08/05/09	0.260	0.180	0.090	0.161	0.300
08/06/09	0.260	0.220	0.040	0.157	0.300
08/07/09	0.250	0.160	0.090	0.150	0.300
08/08/09	0.250	0.160	0.090	0.160	0.300
08/09/09	0.250	0.170	0.090	0.140	0.300
08/10/09	0.250	0.160	0.090	0.160	0.300
08/11/09	0.280	0.170	0.110	0.160	0.300
08/12/09	0.270	0.190	0.080	0.150	0.300
08/13/09	0.260	0.260	0.010	0.150	0.300
08/14/09	0.250	0.190	0.060	0.150	0.300
08/15/09	0.240	0.190	0.050	0.150	0.300

08/16/09	0.260	0.200	0.060	0.150	0.300
08/17/09	0.250	0.190	0.060	0.290	0.300
08/18/09	0.260	0.190	0.070	0.160	0.300
08/19/09	0.260	0.200	0.070	0.170	0.300
08/20/09	0.250	0.180	0.070	0.160	0.300
08/21/09	0.250	0.190	0.060	0.150	0.300
08/22/09	0.230	0.210	0.020	0.160	0.300
08/23/09	0.250	0.180	0.060	0.150	0.300
08/24/09	0.240	0.200	0.030	0.170	0.300
08/25/09	0.260	0.190	0.070	0.160	0.300
08/26/09	0.260	0.210	0.060	0.160	0.300
08/27/09	0.300	0.240	0.060	0.160	0.300
08/28/09	0.230	0.170	0.060	0.160	0.300
08/29/09	0.230	0.230	0.010	0.150	0.300
08/30/09	0.270	0.240	0.030	0.150	0.300
08/31/09	0.250	0.170	0.090	0.150	0.300
09/01/09	0.290	0.200	0.090	0.160	0.300
09/02/09	0.260	0.190	0.070	0.150	0.300
09/03/09	0.230	0.190	0.040	0.160	0.300
09/04/09	0.280	0.180	0.100	0.150	0.300
09/05/09	0.250	0.180	0.070	0.150	0.300
09/06/09	0.340	0.290	0.080	0.140	0.300
09/07/09	0.240	0.150	0.090	0.140	0.300
09/08/09	0.310	0.250	0.050	0.140	0.300
09/09/09	0.300	0.280	0.020	0.150	0.300
09/10/09	0.340	0.290	0.050	0.110	0.300
09/11/09	0.270	0.210	0.060	0.120	0.300
09/12/09	0.310	0.240	0.080	0.150	0.300
09/13/09	0.240	0.210	0.030	0.180	0.300
09/14/09	0.290	0.200	0.090	0.110	0.300
09/15/09	0.280	0.170	0.100	0.110	0.300
09/16/09	0.230	0.160	0.070	0.130	0.300
09/17/09	0.230	0.160	0.070	0.130	0.300
09/18/09	0.220	0.130	0.090	0.110	0.300
09/19/09	0.280	0.220	0.060	0.130	0.300
09/20/09	0.220	0.150	0.070	0.110	0.300
09/21/09	0.220	0.160	0.060	0.140	0.300
09/22/09	0.200	0.170	0.030	0.100	0.300
09/23/09	0.280	0.210	0.070	0.170	0.300
09/24/09	0.160	0.130	0.030	0.210	0.300
09/25/09	0.280	0.240	0.040	0.230	0.300
09/26/09	0.220	0.170	0.040	0.160	0.300
09/27/09	0.280	0.180	0.090	0.140	0.300
09/28/09	0.210	0.110	0.100	0.180	0.300
09/29/09	0.260	0.170	0.090	0.150	0.300
09/30/09	0.320	0.250	0.060	0.140	0.300
10/01/09	0.320	0.240	0.080	0.200	0.300

10/02/09	0.280	0.250	0.030	0.140	0.300
10/03/09	0.270	0.200	0.070	0.170	0.300
10/04/09	0.300	0.240	0.060	0.130	0.300
10/05/09	0.270	0.220	0.060	0.190	0.300
10/06/09	0.280	0.290	0.000	0.190	0.300
10/07/09	0.210	0.210	0.000	0.190	0.300
10/08/09	0.180	0.150	0.020	0.130	0.300
10/09/09	0.330	0.260	0.070	0.120	0.300
10/10/09	0.320	0.290	0.030	0.110	0.300
10/11/09	0.330	0.290	0.040	0.180	0.300
10/12/09	0.250	0.180	0.070	0.140	0.300
10/13/09	0.350	0.290	0.060	0.120	0.300
10/14/09	0.380	0.330	0.050	0.130	0.300
10/15/09	0.340	0.270	0.070	0.140	0.300
10/16/09	0.180	0.150	0.030	0.110	0.300
10/17/09	0.200	0.200	0.010	0.110	0.300
10/18/09	0.160	0.150	0.010	0.110	0.300
10/19/09	0.370	0.350	0.010	0.120	0.300
10/20/09	0.500	0.460	0.040	0.120	0.300
10/21/09	0.370	0.350	0.020	0.110	0.300
10/22/09	0.410	0.410	0.000	0.170	0.300
10/23/09	0.480	0.480	0.000	0.150	0.300
10/24/09	0.420	0.360	0.060	0.150	0.300
10/25/09	0.530	0.420	0.110	0.150	0.300
10/26/09	0.310	0.250	0.060	0.150	0.300
10/27/09	0.300	0.200	0.100	0.140	0.300
10/28/09	0.360	0.350	0.000	0.140	0.300
10/29/09	0.290	0.290	0.000	0.160	0.300
10/30/09	0.390	0.310	0.080	0.160	0.300
10/31/09	0.500	0.380	0.120	0.140	0.300
11/01/09	0.490	0.450	0.040	0.130	0.300
11/02/09	0.340	0.260	0.070	0.140	0.300
11/03/09	0.370	0.260	0.110	0.140	0.300
11/04/09	0.450	0.450	0.000	0.140	0.300
11/05/09	0.410	0.380	0.030	0.130	0.300
11/06/09	0.470	0.390	0.080	0.120	0.300
11/07/09	0.400	0.270	0.130	0.140	0.300
11/08/09	0.230	0.160	0.070	0.150	0.300
11/09/09	0.520	0.460	0.060	0.130	0.300
11/10/09	0.470	0.390	0.080	0.130	0.300
11/11/09	0.350	0.290	0.060	0.147	0.300
11/12/09	0.470	0.380	0.090	0.150	0.300
11/13/09	0.520	0.430	0.090	0.140	0.300
11/14/09	0.450	0.360	0.090	0.130	0.300
11/15/09	0.330	0.270	0.060	0.130	0.300
11/16/09	0.420	0.330	0.090	0.130	0.300
11/17/09	0.550	0.500	0.040	0.140	0.300

11/18/09	0.560	0.540	0.020	0.140	0.300
11/19/09	0.390	0.300	0.090	0.140	0.300
11/20/09	0.420	0.390	0.040	0.140	0.300
11/21/09	0.500	0.430	0.070	0.140	0.300
11/22/09	0.530	0.500	0.020	0.140	0.300
11/23/09	0.540	0.480	0.060	0.140	0.300
11/24/09	0.390	0.320	0.070	0.140	0.300
11/25/09	0.600	0.520	0.080	0.140	0.300
11/26/09	0.700	0.660	0.040	0.130	0.300
11/27/09	0.530	0.480	0.050	0.130	0.300
11/28/09	0.550	0.530	0.020	0.130	0.300
11/29/09	0.540	0.500	0.040	0.130	0.300
11/30/09	0.640	0.560	0.070	0.130	0.300
12/01/09	0.600	0.500	0.110	0.130	0.300
12/02/09	0.470	0.370	0.100	0.140	0.300
12/03/09	0.430	0.410	0.020	0.180	0.300
12/04/09	0.550	0.430	0.120	0.140	0.300
12/05/09	0.560	0.440	0.120	0.135	0.300
12/06/09	0.650	0.550	0.100	0.125	0.300
12/07/09	0.330	0.290	0.050	0.130	0.300
12/08/09	0.510	0.490	0.020	0.140	0.300
12/09/09	0.540	0.430	0.100	0.140	0.300
12/10/09	0.520	0.440	0.080	0.130	0.300
12/11/09	0.360	0.270	0.090	0.130	0.300
12/12/09	0.500	0.470	0.030	0.130	0.300
12/13/09	0.610	0.530	0.080	0.130	0.300
12/14/09	0.620	0.520	0.100	0.130	0.300
12/15/09	0.730	0.670	0.060	0.140	0.300
12/16/09	0.290	0.230	0.070	0.110	0.300
12/17/09	0.330	0.250	0.080	0.100	0.300
12/18/09	0.510	0.400	0.110	0.090	0.300
12/19/09	0.390	0.340	0.050	0.140	0.300
12/20/09	0.540	0.430	0.110	0.120	0.300
12/21/09	0.250	0.150	0.100	0.130	0.300
12/22/09	0.470	0.370	0.100	0.130	0.300
12/23/09	0.500	0.410	0.090	0.100	0.300
12/24/09	0.370	0.270	0.110	0.110	0.300
12/25/09	0.280	0.250	0.040	0.120	0.400
12/26/09	0.400	0.330	0.070	0.120	0.300
12/27/09	0.520	0.400	0.120	0.130	0.300
12/28/09	0.570	0.470	0.100	0.130	0.200
12/29/09	0.570	0.540	0.030	0.130	0.300
12/30/09	0.540	0.390	0.150	0.100	0.300
12/31/09	0.420	0.310	0.100	0.100	0.300
01/01/10	0.450	0.410	0.050	0.110	24.300
01/02/10	0.350	0.230	0.120	0.125	24.400
01/03/10	0.510	0.460	0.060	0.120	24.100

01/04/10	0.480	0.350	0.130	0.130	24.500
01/05/10	0.240	0.220	0.020	0.120	24.400
01/06/10	0.410	0.350	0.060	0.110	24.300
01/07/10	0.560	0.510	0.040	0.130	24.400
01/08/10	0.640	0.610	0.030	0.110	24.200
01/09/10	0.420	0.320	0.100	0.120	24.400
01/10/10	0.730	0.570	0.170	0.165	24.300
01/11/10	0.570	0.470	0.110	0.120	24.200
01/12/10	0.660	0.540	0.120	0.160	24.400
01/13/10	0.560	0.470	0.090	0.120	24.200
01/14/10	0.560	0.470	0.090	0.140	24.300
01/15/10	0.690	0.610	0.080	0.030	24.500
01/16/10	0.460	0.380	0.070	0.120	24.200
01/17/10	0.680	0.600	0.080	0.120	24.400
01/18/10	0.530	0.410	0.120	0.110	24.400
01/19/10	0.570	0.490	0.080	0.120	24.300
01/20/10	0.510	0.410	0.110	0.110	24.500
01/21/10	0.720	0.650	0.080	0.120	24.200
01/22/10	0.630	0.530	0.100	0.130	24.400
01/23/10	0.520	0.500	0.020	0.120	24.400
01/24/10	0.660	0.500	0.160	0.190	24.500
01/25/10	0.550	0.480	0.080	0.100	24.400
01/26/10	0.760	0.760	0.000	0.130	24.300
01/27/10	0.450	0.370	0.090	0.100	24.400
01/28/10	0.800	0.760	0.030	0.120	24.200
01/29/10	0.590	0.520	0.070	0.133	24.400
01/30/10	0.630	0.580	0.050	0.116	24.300
01/31/10	0.550	0.500	0.050	0.099	24.200
02/01/10	0.740	0.710	0.030	0.113	24.400
02/02/10	0.730	0.610	0.130	0.140	24.200
02/03/10	0.580	0.490	0.090	0.096	24.300
02/04/10	0.510	0.420	0.090	0.120	24.500
02/05/10	0.820	0.790	0.030	0.140	24.200
02/06/10	0.570	0.570	0.000	0.130	24.400
02/07/10	0.590	0.480	0.110	0.120	24.400
02/08/10	0.660	0.560	0.110	0.120	24.300
02/09/10	0.720	0.660	0.060	0.123	24.400
02/10/10	0.520	0.410	0.100	0.136	24.100
02/11/10	0.470	0.430	0.040	0.090	24.500
02/12/10	0.640	0.560	0.080	0.090	24.400
02/13/10	0.540	0.440	0.090	0.110	24.300
02/14/10	0.560	0.500	0.060	0.160	24.400
02/15/10	0.500	0.340	0.160	0.120	24.200
02/16/10	0.470	0.360	0.120	0.109	24.400
02/17/10	0.630	0.470	0.150	0.128	24.300
02/18/10	0.470	0.290	0.170	0.141	24.200
02/19/10	0.250	0.230	0.020	0.120	24.400

02/20/10	0.370	0.290	0.080	0.130	24.200
02/21/10	0.600	0.470	0.130	0.150	24.300
02/22/10	0.600	0.590	0.010	0.200	24.500
02/23/10	0.730	0.630	0.090	0.130	24.200
02/24/10	0.510	0.390	0.120	0.110	24.400
02/25/10	0.560	0.480	0.090	0.120	24.400
02/26/10	0.800	0.730	0.070	0.120	24.300
02/27/10	0.600	0.540	0.060	0.140	24.500
02/28/10	0.580	0.530	0.050	0.100	24.200
03/01/10	0.610	0.530	0.090	0.130	24.400
03/02/10	0.680	0.680	0.000	0.170	24.400
03/03/10	0.480	0.440	0.040	0.120	24.300
03/04/10	0.310	0.310	0.000	0.100	24.400
03/05/10	0.420	0.340	0.080	0.123	24.100
03/06/10	0.430	0.390	0.040	0.151	24.500
03/07/10	0.510	0.500	0.010	0.120	24.400
03/08/10	0.400	0.330	0.080	0.110	24.300
03/09/10	0.520	0.470	0.050	0.150	24.400
03/10/10	0.500	0.420	0.080	0.170	24.200
03/11/10	0.780	0.710	0.070	0.120	24.400
03/12/10	0.690	0.640	0.050	0.120	24.300
03/13/10	0.600	0.540	0.060	0.140	24.200
03/14/10	0.480	0.430	0.040	0.160	24.400
03/15/10	0.570	0.570	0.000	0.120	24.200
03/16/10	0.640	0.640	0.000	0.110	24.300
03/17/10	0.360	0.300	0.060	0.130	24.500
03/18/10	0.410	0.380	0.030	0.100	24.200
03/19/10	0.270	0.250	0.020	0.100	24.400
03/20/10	0.330	0.280	0.060	0.140	24.400
03/21/10	0.390	0.360	0.030	0.150	24.400
03/22/10	0.230	0.230	0.000	0.140	24.300
03/23/10	0.530	0.530	0.000	0.126	24.400
03/24/10	0.340	0.290	0.050	0.142	24.100
03/25/10	0.570	0.530	0.040	0.120	24.500
03/26/10	0.810	0.730	0.070	0.120	24.400
03/27/10	0.380	0.300	0.080	0.130	24.300
03/28/10	0.330	0.270	0.060	0.130	24.400
03/29/10	0.340	0.300	0.040	0.110	24.200
03/30/10	0.500	0.500	0.000	0.110	24.400
03/31/10	0.560	0.560	0.000	0.130	24.300
04/01/10	0.440	0.440	0.000	0.120	24.200
04/02/10	0.280	0.240	0.040	0.130	24.400
04/03/10	0.340	0.270	0.060	0.110	24.200
04/04/10	0.380	0.380	0.000	0.110	24.300
04/05/10	0.180	0.180	0.000	0.100	24.500
04/06/10	0.490	0.480	0.020	0.130	24.200
04/07/10	0.400	0.400	0.000	0.100	24.400

04/08/10	0.320	0.300	0.030	0.170	24.400
04/09/10	0.430	0.430	0.000	0.142	24.200
04/10/10	0.170	0.150	0.020	0.139	24.300
04/11/10	0.500	0.500	0.000	0.135	24.500
04/12/10	0.470	0.430	0.040	0.115	24.200
04/13/10	0.400	0.400	0.000	0.140	24.400
04/14/10	0.670	0.670	0.000	0.140	24.400
04/15/10	0.330	0.330	0.000	0.130	24.300
04/16/10	0.350	0.300	0.050	0.130	24.400
04/17/10	0.730	0.660	0.070	0.160	24.100
04/18/10	0.400	0.400	0.000	0.190	24.500
04/19/10	0.180	0.150	0.030	0.160	24.400
04/20/10	0.300	0.300	0.000	0.160	24.300
04/21/10	0.440	0.440	0.000	0.120	24.400
04/22/10	0.280	0.270	0.100	0.140	24.200
04/24/10	0.560	0.500	0.060	0.130	24.400
04/25/10	0.230	0.190	0.040	0.150	24.300
04/26/10	0.570	0.570	0.000	0.122	24.200
04/27/10	0.143	0.340	0.000	0.150	24.400
04/28/10	0.138	0.430	0.010	0.110	24.200
04/29/10	0.300	0.290	0.010	0.150	24.300
04/30/10	0.340	0.340	0.000	0.140	24.500
05/01/10	0.510	0.490	0.020	0.140	24.200
05/02/10	0.380	0.350	0.030	0.120	24.400
05/03/10	0.400	0.400	0.000	0.110	24.400
05/04/10	0.150	0.150	0.000	0.120	24.100
05/05/10	0.190	0.140	0.050	0.130	24.300
05/06/10	0.210	0.140	0.060	0.180	24.400
05/07/10	0.220	0.160	0.060	0.140	24.100
05/08/10	0.200	0.130	0.080	0.140	24.500
05/09/10	0.210	0.120	0.050	0.120	24.400
05/10/10	0.230	0.150	0.070	0.140	24.300
05/11/10	0.210	0.140	0.070	0.130	24.400
05/12/10	0.240	0.170	0.060	0.160	24.200
05/13/10	0.220	0.150	0.070	0.150	24.400
05/14/10	0.250	0.180	0.060	0.140	24.300
05/15/10	0.240	0.150	0.090	0.140	24.200
05/16/10	0.220	0.120	0.110	0.130	24.400
05/17/10	0.250	0.150	0.100	0.130	24.200
05/18/10	0.230	0.130	0.090	0.130	24.300
05/19/10	0.230	0.140	0.100	0.130	24.500
05/20/10	0.250	0.160	0.090	0.130	24.200
05/21/10	0.250	0.160	0.090	0.130	24.400

'B' (gpd)	'C' (gpd)
1.100	0.300
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15.300	25.300

14.900	25.700
14.800	25.400
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14.600	25.700
14.200	25.400
15.000	25.400
15.200	25.300
15.300	25.700
14.800	25.400
14.900	25.400
15.200	25.600
15.300	25.100
15.200	25.300
15.200	25.700
15.100	25.400
15.200	25.600
15.300	25.300
14.900	25.700
14.800	25.400
14.600	25.400
14.800	25.600
14.600	25.100
14.200	25.300
15.000	25.700
15.200	25.400
15.300	25.100
14.800	25.300
14.900	25.600
15.200	25.300
15.300	25.700
15.200	25.400
15.200	25.400
15.200	25.600
15.300	25.100
14.800	25.300
14.900	25.700
15.200	25.400
15.300	25.600
15.200	25.300
15.200	25.700
15.300	25.400
14.900	25.400
14.900	25.600
14.800	25.100
14.600	25.300
14.800	25.700

14.600	25.400
14.700	25.600
15.000	25.200
14.900	25.300
15.100	25.600
15.200	25.300
15.300	25.700
14.900	25.400
14.800	25.400
14.600	25.600
14.700	25.100
15.000	25.300
15.100	25.700
15.200	25.400
15.300	25.600
14.900	25.300
14.800	25.700
14.600	25.400
14.800	25.400
14.600	25.600
14.200	25.100
15.000	25.300
15.200	25.700
15.300	25.400
14.800	25.600
14.900	25.300
15.200	25.600
15.300	25.300
15.200	25.700
15.200	25.400
15.300	25.400
14.900	25.600
14.900	25.100
14.800	25.300
14.600	25.700
14.800	25.400
14.600	25.600
14.700	25.300
15.000	25.700
14.900	25.400
15.100	25.400
15.200	25.600
15.300	25.100
14.900	25.300
14.800	25.700
14.600	25.400
14.800	25.600

14.600	25.300
14.200	25.600
15.000	25.300
15.200	25.700
15.300	25.400
14.800	25.400
14.900	25.600
15.200	25.100
15.300	25.300
15.200	25.700
15.200	25.400
15.300	25.600
14.900	25.300
14.900	25.700
14.800	25.400
14.600	25.400
14.800	25.600
14.600	25.100
14.200	25.300
15.000	25.700
15.200	25.400
15.300	25.600
14.800	25.300
14.900	25.600
15.200	25.300
15.300	25.700
15.200	25.400
15.200	25.400
15.300	25.600
14.900	25.100
14.800	25.300
14.600	25.700
14.800	25.400
14.600	25.600
14.200	25.300
15.000	25.700
15.200	25.400
15.300	25.400
14.800	25.600
14.900	25.100
15.200	25.300
15.300	25.700
15.200	25.400

U.S. Nuclear Regulatory Commission
Surry Power Station

SR10301
Administrative Job Performance Measure 2.3.4

Applicant______________________________ Start Time__________________

Examiner______________________________

Date _________________________________ Stop Time__________________

Title

Determine the Stay Time of an Operator in a Radiological Area without Exceeding Administrative Limits.

K/A: G2.3.4 – Knowledge of radiation exposure limits under normal or emergency conditions. (3.2/3.7)

Applicability	Est Completion Time	Actual Time
RO/SRO(I)	20 Minutes	___________

Conditions

- Task is to be PERFORMED in the SIMULATOR or CLASSROOM.

Standards

- Determines if an operator can spend in a radiological area without exceeding administrative dose limits and also determines how long an operator can remain in the radiological area assuming extensions are authorized.

Initiating Cues

- Given simulated plant conditions, determine how long an operator can work in a radiological are without exceeding administrative dose limits. Also, assuming the maximum dose limit extension is authorized, how long can an operator perform work in a radiological area.

Initial Conditions

- I am the Nuclear Shift Manager. I need you to perform work in an area with a general dose rate of 400 mrem/hour. I anticipate that the work I need you to perform will take approximately 6 hours.

- Based on the dose that you have received this year, you have already been upgraded to receive the Annual Administrative Dose Limit. I need you to tell me how long you can perform work in that area without requiring a further dose limit extension.

- It is currently the fourth quarter of the year and the dose you have received during the year is as follows:

  - Quarter #1 (January – March): 0.68 Rem
  - Quarter #2 (April – June): 0.43 Rem
  - Quarter #3 (July – September): 0.59 Rem
  - Quarter #4 (October – **Today**): 0.10 Rem

- Finally, assuming that I am able to receive the maximum dose limit extension for you, inform me of how long you will be able to perform work in that area and if you will be able to complete the job without assistance.

- When you have completed this task please inform me of the results.

Terminating Cues

- Determination that work in the RCA cannot be performed without an extension and accurate stay time determination following maximum dose limit extension.

Procedures

- VPAP-2101, Radiological Protection Program
- RP-AA-105, External Radiation Exposure Control Program
- C-HP-1031.024, Attachment 2

Tools and Equipment

- Calculator
- Computer with only access to Webtop

Safety Considerations

- None

Notes

Performance Checklist

Notes to the Evaluator.

- Task critical elements are bolded and noted by the words “Critical Step” at the end of the step.
- **START TIME:**

STEP 1:

_______ **SAT**

_______ **UNSAT**

Answer to first question by the Shift Manager:

Based on the dose that you have received this year, I need you to tell me how long you can perform work in that area without requiring a dose limit extension and if you will be able to complete the job without assistance (assuming no dose extensions to the administrative limits).

STANDARD:

(a) Calculates dose received year to date as follows:
680 mrem + 430 mrem + 590 mrem + 100 mrem = 1800 mrem.

(b) Notes that the yearly dose limit without extension is 2000 mrem

(c) Determines margin to yearly limit: 2000 – 1800 = 200 mrem

(d) Calculates Stay Time: 200 mrem / 400 mrem/hour = 0.5 hours.
This is a Critical Step

(e) Notes that the 6 hour task cannot be performed without assistance.
This is a Critical Step.

EVALUATOR’S NOTE:

- Administrative limit is 2 Rem/year, with RCA lockout at 85% of administrative limit
- Can get extended to 3 Rem/Year with worker, manager and RP Manager approval.
- Can get extended to 5 Rem/year with worker, manager, RP Manager and Site VP approval.

COMMENTS:

STEP 2: Answer to second question by the Shift Manager: Finally, assuming that I am able to receive the maximum dose limit extension for you, inform me of how long you will be able to can perform work in that area and if you will be able to complete the job without assistance. **STANDARD:** (a) Calculates dose received year to date as follows: 680 mrem + 430 mrem + 590 mrem + 100 mrem = 1800 mrem. (b) Notes that the maximum yearly dose limit with extension is 5000 mrem (c) Determines margin to yearly limit: 5000 – 1800 = 3200 mrem **(d) Calculates Stay Time: 3200 mrem / 400 mrem/hour = 8 hours. This is a Critical Step** **(e) Notes that the 6 hour task can be performed without assistance. This is a Critical Step.** **EVALUATOR'S NOTE:** • Administrative limit is 2 Rem/year, with RCA lockout at 85% of administrative limit • Can get extended to 3 Rem/Year with worker, manager and RP Manager approval. • Can get extended to 5 Rem/year with worker, manager, RP Manager and Site VP approval. • ***A candidate may state 6 hours for part (d), as this is the projected time to complete the job. Follow-up question concerning how the candidate arrived at 6 hours may be necessary to determine if the candidate is documenting actual stay time vice job completion time.*** **COMMENTS:**	_______ **SAT** _______ **UNSAT**

STEP 3:

Reports task is complete.

STANDARD:

(a) Verbal or written status report that the work cannot be done without assistance if a dose limit extension is not given and that with the extension the work can be performed without assistance.

EVALUATOR'S NOTE:

- Acknowledge the completion of the task.

COMMENTS:

_______ **SAT**

_______ **UNSAT**

STOP TIME:

Operator Directions Handout
(TO BE READ TO APPLICANT BY EXAMINER)

Task

- Task may be PERFORMED in the simulator or classroom.
- Correctly determines the ability of an operator to perform a job in the RCA with or without an extension and the time the operator can perform that job without an extension.

Directions

The evaluator will explain the initial conditions of the task to be performed and will provide the initiating cue. Ensure you indicate to the evaluator when you understand your assigned task.

Initial Conditions:

- I am the Nuclear Shift Manager. I need you to perform work in an area with a general dose rate of 400 mrem/hour. I anticipate that the work I need you to perform will take approximately 6 hours.

- Based on the dose that you have received this year, you have already been upgraded to receive the Annual Administrative Dose Limit. I need you to tell me how long you can perform work in that area without requiring a further dose limit extension.

- It is currently the fourth quarter of the year and the dose you have received during the year is as follows:

Quarter #1 (January – March):	0.68 Rem
Quarter #2 (April – June):	0.43 Rem
Quarter #3 (July – September):	0.59 Rem
Quarter #4 (October – **Today**):	0.10 Rem

- Finally, assuming that I am able to receive the maximum dose limit extension for you, inform me of how long you will be able to perform work in that area and if you will be able to complete the job without assistance.

Initiating Cues:

- Answer the two radiological control questions posed by the Nuclear Shift Manager and place your responses on the paper containing the questions.

- When you have completed this task please inform me of the results.

Operator Directions Handout
(TO BE GIVEN TO APPLICANT)

Initial Conditions:

- I am the Nuclear Shift Manager. I need you to perform work in an area with a general dose rate of 400 mrem/hour. I anticipate that the work I need you to perform will take approximately 6 hours.

- Based on the dose that you have received this year, you have already been upgraded to receive the Annual Administrative Dose Limit. I need you to tell me how long you can perform work in that area without requiring a further dose limit extension.

- It is currently the fourth quarter of the year and the dose you have received during the year is as follows:

o Quarter #1 (January – March):	0.68 Rem
o Quarter #2 (April – June):	0.43 Rem
o Quarter #3 (July – September):	0.59 Rem
o Quarter #4 (October – **Today**):	0.10 Rem

- Finally, assuming that I am able to receive the maximum dose limit extension for you, inform me of how long you will be able to perform work in that area and if you will be able to complete the job without assistance.

Initiating Cues:

- Answer the two radiological control questions posed by the Nuclear Shift Manager and place your responses on the paper containing the questions.

- When you have completed this task please inform me of the results.

Shift Manager Questions and Operator Answers
(TO BE GIVEN TO APPLICANT)

Question #1:

- Based on the dose that you have received this year, I need you to tell me how long you can perform work in that area without requiring a dose limit extension and if you will be able to complete the job without assistance (assuming no dose extensions to the administrative limits).

Can be in the radiation area for: ______________________ minutes / hours (circle one)

Can complete the job without a dose extension in the allotted time: YES / NO (circle one)

Question #2:

- Assuming that I am able to receive the maximum dose limit extension for you, inform me of how long you will be able to can perform work in that area and if you will be able to complete the job without assistance.

Can be in the radiation area for: ______________________ minutes / hours (circle one)

After receiving the maximum extension can complete the job in the allotted time: YES / NO (circle one)

U.S. Nuclear Regulatory Commission
Surry Power Station

SR10301
Administrative Job Performance Measure 2.1.23

Applicant________________________________ Start Time___________________

Examiner_______________________________

Date ___________________________________ Stop Time___________________

Title

COMPLETE 1-OPT-RC-10.0, REACTOR COOLANT LEAKAGE – COMPUTER CALCULATED

K/A: G2.1.23 – Ability to perform specific system and integrated plant procedure during all modes of plant operation. (4.3/4.4)

Applicability	Est Completion Time	Actual Time
SRO(I)	40 Minutes	___________

Initial Conditions

- Task is to be PERFORMED in the SIMULATOR or CLASSROOM.
- Performance of 1-OPT-RC-10.0, Reactor Coolant Leakage – Computer Calculated, is required.

Standards

- Completes the remaining portions of 1-OPT-RC-10.0, Reactor Coolant Leakage – Computer Calculated, and determines that the procedure was unsatisfactory.

Standards for Part 2 (after completion of 1-OPT-RC-10.0)

- Determines that the primary to secondary leakage from the completed copy of 1-OPT-RC-10.0 violates Technical Specification requirement and notes that the actions contained within Technical Specification 3.1.C.3 are applicable.

Initiating Cues

- Given simulated plant conditions, perform the remainder of 1-OPT-RC-10.0, Reactor Coolant Leakage – Computer Calculated, and submitted the procedure for review by the Unit Supervisor.

Initiating Cues for Part 2 (after completion of 1-OPT-RC-10.0)

- Given a completed copy of 1-OPT-RC-10.0 determine if the results are within the bounds of the Technical Specifications, and if not, what actions are necessary.

Initial Conditions

- It is mid-shift on May 22, 2010. Unit 1 power is 100 percent.
- I am the Nuclear Shift Manager. I have assigned you to complete the normal daily 1-OPT-RC-10.0, Reactor Coolant Leakage – Computer Calculated. The procedure is complete up through Step 6.2.11 and the computer generated leak rate data sheet has just been printed out, the leak rate ran for 125 minutes. You are to complete 1-OPT-RC-10.0, Reactor Coolant Leakage – Computer Calculated it is entirety and when done turn the procedure in for review.

- The following are the Unit conditions:
    - Reactor power: 100%
    - Charging flow control is in automatic.
    - One PDTT pump was placed in automatic after the PCS computer leak rate program results were printed.
    - Containment Sump Data:
        - Initial containment sump level was 47% as indicated on 1-DA-LI-100 (CTMT SUMP LEVEL).
        - Final containment sump level was 62% as indicated on 1-DA-LI-100 (CTMT SUMP LEVEL).
        - Containment Sump leak rate elapsed time – 60 minutes.
        - After this data was recorded, one containment sump pump was placed back in automatic

    Primary to Secondary Leakage exists and is known and has been indicating in the 15 – 25 gpd range per steam generator for the past week. Today the N-16 monitors are slightly elevated and indicate the following:
    SG A: 24.4 gpd
    SG B: 22.1 gpd
    SG C: 25.6 gpd

    The Leakrate spreadsheet is located at folder S:\SURRY PWR STA\3\Ops\Leakrate on the desktop of your laptop computer.

- Here is a partially completed copy of 1-OPT-RC-10.0, Reactor Coolant Leakage – Computer Calculated. I need you to complete 1-OPT-RC-10.0, Reactor Coolant Leakage – Computer Calculated in its entirety and when done turn the procedure in for review.

- When you are ready to have your work reviewed, please inform me, as this will end the JPM.

Initial Conditions for Part 2 (after completion of 1-OPT-RC-10.0)

- Now that you have completed 1-OPT-RC-10.0, Reactor Coolant Leakage – Computer Calculated, I need you to determine if the results are within the bounds of the Technical Specifications, and if not, what actions are necessary.

Terminating Cues

- 1-OPT-RC-10.0 has been completed and is ready to be reviewed.

Terminating Cues for Part 2 (after completion of 1-OPT-RC-10.0)

- 1-OPT-RC-10.0 has been completed and is ready to be reviewed.

Procedures

- 1-OPT-RC-10.0, Reactor Coolant Leakage – Computer Calculated (Revision 33)

Tools and Equipment

- Calculator
- RCS Leakrate Spreadsheet
- Large Stapler

Safety Considerations

- None

Notes

Performance Checklist

Notes to the Evaluator.

- Task critical elements are bolded and noted by the words “Critical Step” at the end of the step.
- **START TIME:**

STEP 1:

_______ **SAT**

_______ **UNSAT**

3.0 INITIAL CONDITIONS

Notes prior to Step 3.1

- Reactor Coolant System (RCS) temperature and pressure stability for the purposes of this procedure shall be determined by Shift Supervision.
- An RCS water inventory balance must be performed once every 24 hours. Surveillance requirement specified time intervals may be adjusted plus or minus 25% to accommodate normal test schedules.
- If required RCS pressure conditions cannot be met, 1-OPT-RC-10.01, Reactor Coolant Leakage – Manually Calculated, must be performed.

3.1 Verify that the Reactor Coolant System is being maintained at stable temperature and pressure.

3.2 Verify that Reactor Coolant System Pressure is greater than 2100 psig and less than 2500 psig.

STANDARD:

(a) Acknowledges/Reviews the Initial Conditions.

EVALUATOR’S NOTE:

- None

COMMENTS:

STEP 2:

_______ **SAT**

_______ **UNSAT**

4.0 PRECAUTIONS AND LIMITATIONS

4.1 The RCS leak rate program on the PCS plant computer will halt if VCT level increases by 2.0%, if PDTT level decreases by 1.0%, or if PRZR level changes (increases or decreases) by 2.0% during the performance of the program.

4.2 Routine daily leak rate determinations should be performed over a minimum time period of two hours, when a computer calculation of the RCS leak rate is performed.

4.3 Reactor Coolant System sampling should **not** take place during the performance of this procedure.

4.4 RCS temperature and pressure should be maintained as stable as possible when a RCS leak rate calculation is being performed during a pause in a Reactor Coolant System (RCS) heat up or cool down.

4.5 A leak rate based on an RCS water inventory balance is required once every 24 hours, but is not required to be completed until 12 hours after establishment of steady state operation. (stable pressure, temperature, power level, Pressurizer and makeup tank levels, makeup and letdown, and RCP seal injection and return flow) Refer to Tech Spec 4.13, SR 4.13.A.

4.6 The initials identification block in Subsection 7.3 must be completed before this procedure is closed out.

4.7 If any one data point from the leakrate printout or the final leakrate results are marked with POOR or BAD, or has any reason code, (for example, L, H, or S) the leakrate should be considered unreliable.

4.8 The RCS leak rate calculation should not be performed until 10 minutes have passed following pumping the PDTT.

4.9 The RCS must be maintained at steady state during the performance of the leak rate. Steady state is defined as:

- Power change less than one percent of rated Thermal Power
- RCS temperature change less than 2°F
- RCS pressure change less than 5 psig
- No change in letdown or makeup systems
- PRZR level change less than 2%
- No RCP standpipe fills

4.10 Any evolution that changes level in the PDTT (for example, draining the PRT, making up to the RCP Vapor Seal Tank, or cycling of the Gas Stripper) may negate the validity of this OPT.

STANDARD:

(a) Acknowledges/Reviews the Precautions and Limitations.

EVALUATOR'S NOTE:

- None

COMMENTS:

STEP 3:

_______ **SAT**

_______ **UNSAT**

Reviews completed procedure Section 6.1 and procedure Section 6.12 up to Step 6.2.12.

STANDARD:

(a) Acknowledges procedure status up to Step 6.2.12.

EVALUATOR'S NOTE:

- None

COMMENTS:

STEP 4:

_______ **SAT**

_______ **UNSAT**

Step 6.2.12:

6.2.12 Evaluate unidentified RCS leak rate result and perform the actions indicated in the table below. Enter N/A for the condition that does not exist, or if the unidentified RCS leak rate is positive

Evaluation of RCS Leakrate

Unidentified RCS Leakrate:	**Actions to be taken:**	**Initials**
With a negative Unidentified leakrate greater than -0.08 gpm	a. REPEAT steps 6.2.7 through 6.2.12 to obtain valid unidentified RCS Leak Rate Calculation. b. IF a valid Unidentified RCS Leak Rate calculation cannot be obtained, THEN perform a manual leak rate IAW 1-OPT-RC-10.0	_________ _________
With a negative Unidentified leakrate less than or equal to -0.08 gpm	a. Enter zero for unidentified RCS leak rate. b. Adjust total leak rate fto equal to the identified leak rate. c. Make a comment in the Operator Comments in Subsection 7.3.	_________ _________ _________

STANDARD:

(a) Marks the Initial Column Lines as "N/A".

EVALUATOR'S NOTE:

- None.

COMMENTS:

STEP 5:

_______ **SAT**

_______ **UNSAT**

Step 6.2.13

6.2.13 Record the Total, Unidentified, and Identified RCS leak rates (gpm) in Attachment 1. Use results from Step 6.2.12 if performed, otherwise use computer printout results.

STANDARD:

(a) Proceeds to Attachment 1 to record data from RCS Leak Rate Printout.

EVALUATOR'S NOTE:

Summary of Reactor Coolant Leak Rate Test Results

RCS Leak Rate Data	Identified leakage from the LAST (most recent previously calculated leak rate data) performance of 1-OPT-RC-10.0 or 1-OPT-RC-10.1, as appropriate	Current values:	
Total OTHER Identified Leakage:	0 (gpm)	0 (gpm)	
Total Unidentified RCS Leak Rate:		0.13 (gpm)	
Identified RCS Leak Rate:		0.15 (gpm)	
Total RCS Leak Rate:		0.28 (gpm)	

COMMENTS:

STEP 6:

Step 6.2.14

6.2.14 Print and attach the PCS computer printout leak rate program results to this procedure as a permanent record of the derivation of the RCS Leak rates recorded in Step 6.2.13.

STANDARD:

(a) Acknowledges and signs this Step.

EVALUATOR’S NOTE:

- None

COMMENTS:

_______ **SAT**

_______ **UNSAT**

STEP 7:

Step 6.2.15

6.2.15 Verify one PDTT pump is in AUTO.

STANDARD:

(a) Recalls from initial conditions that one PDTT pump is in Automatic.

EVALUATOR’S NOTE:

- None

COMMENTS:

_______ **SAT**

_______ **UNSAT**

STEP 8:

Step 6.2.16

6.2.16 IF charging flow control was placed in Manual in Step 6.2.4, THEN do the following. Otherwise, enter N/A.

a. Verify or adjust CHG flow to maintain PRZR level at programmed setpoint.
b. Place 1-CH-FCV-1122, CHG FLOW CNTRL, in Auto.

STANDARD:

(a) Recalls from initial conditions that charging flow control is in Automatic and marks this step as N/A.

EVALUATOR'S NOTE:

- Candidate will proceed to Section 6.3.

COMMENTS:

_______ **SAT**

_______ **UNSAT**

STEP 9:

Reviews procedure Section 6.3 up to Step 6.3.2.

STANDARD:

(a) Acknowledges procedure status up to Step 6.3.2 and that these steps have been signed off as completed.

EVALUATOR'S NOTE:

- None

COMMENTS:

_______ **SAT**

_______ **UNSAT**

STEP 10:

_______ **SAT**

_______ **UNSAT**

Step 6.3.3

6.3.3 Record the required initial data for calculating the Containment Sump in-leakage rate (Attachment 4, Table 1 – Containment Sump In Leakage Rate, Column 3).

STANDARD:

(a) Recalls from initial conditions that initial containment sump level was 47%.

(b) Records initial containment sump level in Attachment 4.

EVALUATOR'S NOTE:

Table 1 – Containment Sump In Leakage Rate

Parameter being analyzed	Column 2	Column 3	
	Final Value of Parameter at END of Time	Initial Value of Parameter at START of Time	** Change in Parameter (+ or -) (final value – initial value)
Elapsed Time	65 minutes ago	125 minutes ago	60 (Minutes)
CTMT Sump Level instrument used: 1-DA-LI-100, 1-DA-LI-110A, or 1-DA-LI-110B	Circle instrument used 1-DA-LI-100, 1-DA-LI-110A, or 1-DA-LI-110B	Circle instrument used [✓ 1-DA-LI-100,] 1-DA-LI-110A, or 1-DA-LI-110B	N/A
CTMT Sump Level	(% or IN)	47 (% or IN)	N/A
CTMT Sump Volume from curve in 1-DRP-003	(gallons)	(gallons) 34.6465	(gallons)

Elapsed time will be filled in as an initial condition.
If candidate uses chart to determine containment volume:
Answer: 34.6465 [range 34.6465 – 35 gallons]

If candidate uses graph to determine containment volume:
Answer: 35 gallons [range 34 – 36 gallons]

COMMENTS:

STEP 11:

_______ **SAT**

_______ **UNSAT**

Step 6.3.4

6.3.4 Record the required final data for calculating the Containment Sump in-leakage rate (Attachment 4, Table 1 – Containment Sump In Leakage Rate, Column 2).

STANDARD:

(a) Recalls from initial conditions that final containment sump level was 62%.
(b) Records final containment sump level in Attachment 4.

EVALUATOR'S NOTE:

Table 1 – Containment Sump In Leakage Rate

Parameter being analyzed	Column 2	Column 3	
	Final Value of Parameter at END of Time	Initial Value of Parameter at START of Time	** Change in Parameter (+ or -) (final value – initial value)
Elapsed Time	65 minutes ago	125 minutes ago	60 (Minutes)
CTMT Sump Level instrument used: 1-DA-LI-100, 1-DA-LI-110A, or 1-DA-LI-110B	Circle instrument used [✓ 1-DA-LI-100,] 1-DA-LI-110A, or 1-DA-LI-110B	Circle instrument used [✓ 1-DA-LI-100,] 1-DA-LI-110A, or 1-DA-LI-110B	N/A
CTMT Sump Level	62 (% or IN)	47 (% or IN)	N/A
CTMT Sump Volume from curve in 1-DRP-003	(gallons) 39.439	(gallons) 34.6465	(gallons)

Elapsed time will be filled in as an initial condition.
If candidate uses chart to determine containment volume:
Answer: 39.439 [range 39 – 39.439 gallons]

If candidate uses graph to determine containment volume:
Answer: 39 gallons [range 38 – 40 gallons]

COMMENTS:

STEP 12:

Step 6.3.5

6.3.5 Calculate the change in parameter from the initial start conditions to the final end conditions and record the elapsed time in Table 2 – Containment Sump In-leakage Rate. (Attachment 4).

STANDARD:

(a) Calculated the difference in containment sump volume.
This is a critical step.

(b) Records difference in containment sump level in Attachment 4.

EVALUATOR'S NOTE:

Table 1 – Containment Sump In Leakage Rate

Parameter being analyzed	Column 2	Column 3	
	Final Value of Parameter at END of Time	Initial Value of Parameter at START of Time	** Change in Parameter (+ or -) (final value – initial value)
Elapsed Time	65 minutes ago	125 minutes ago	60 (Minutes)
CTMT Sump Level instrument used: 1-DA-LI-100, 1-DA-LI-110A, or 1-DA-LI-110B	Circle instrument used [✓ 1-DA-LI-100,] 1-DA-LI-110A, or 1-DA-LI-110B	Circle instrument used [✓ 1-DA-LI-100,] 1-DA-LI-110A, or 1-DA-LI-110B	N/A
CTMT Sump Level	62 (% or IN)	47 (% or IN)	N/A
CTMT Sump Volume from curve in 1-DRP-003	(gallons) 39.439	(gallons) 34.6465	(gallons) 4.7925

Elapsed time will be filled in as an initial condition.

If candidate uses chart to determine containment volume:
Answer: 4.7925 [range 4 – 5 gallons]

If candidate uses graph to determine containment volume:
Answer: 4 gallons [range 2 – 6 gallons]

Table 2 – Containment Sump In Leakage rate

Change in Parameter (+/-) (final value – initial value)	Divided by Elapsed Time	Sump In Leakage rate
CTMT Sump Volume Change 4.7925 (gallons)	(minutes) 60	(gpm)

Elapsed time will be filled in as an initial condition.

COMMENTS:

_______ **SAT**

_______ **UNSAT**

STEP 13:

Step 6.3.6

6.3.6 Calculate the total Containment Sump In Leakage Rate in gallons per minute. (Attachment 4, Table 2 – Containment Sump In Leakage Rate).

STANDARD:

(a) Calculates the containment sump in leakage rate in gallons per minute. This is a critical step.

(b) Records containment sump in leakage rate in Attachment 4.

EVALUATOR'S NOTE:

Table 2 – Containment Sump In Leakage rate

Change in Parameter (+/-) (final value – initial value)	Divided by Elapsed Time	Sump In Leakage rate
CTMT Sump Volume Change 4.7925 (gallons)	(minutes) 60	(gpm) 0.08

If candidate uses chart to determine containment volume:

Answer: 0.0798754 gpm [range 0.06 – 0.083 gpm]

If candidate uses graph to determine containment volume:

Answer: 0.06667 gpm [range 0.03 – 0.1 gallons]

COMMENTS:

_______ **SAT**

_______ **UNSAT**

STEP 14:

Step 6.3.7

6.3.7 Transfer the Containment Sump In Leakage Rate from Attachment 4, Table 2 – Containment Sump In Leakage Rate, to Attachment 1.

_______ **SAT**

_______ **UNSAT**

STANDARD:

(a) Records containment sump in leakage rate on Attachment 1.

EVALUATOR'S NOTE:

Summary of Reactor Coolant Leak Rate Test Results			
RCS Leak Rate Data	Identified leakage from the LAST (most recent previously calculated leak rate data) performance of 1-OPT-RC-10.0 or 1-OPT-RC-10.1, as appropriate	Current values:	
Total OTHER Identified Leakage:	0 (gpm)	0 (gpm)	
Total Unidentified RCS Leak Rate:		0.13 (gpm)	
Identified RCS Leak Rate:		0.15 (gpm)	
Total RCS Leak Rate:		0.28 (gpm)	

CTMT Sump In Leakage
CTMT Sump In Leakage Rate:_____0.08___ (gpm)

If candidate uses chart to determine containment volume:

Answer: 0.0798754 gpm [range 0.06 – 0.083 gpm]

If candidate uses graph to determine containment volume:

Answer: 0.06667 gpm [range 0.03 – 0.1 gallons]

COMMENTS:

STEP 15: Step 6.3.8 6.3.8 Verify or place one CTMT sump pump is in AUTO. **STANDARD:** (a) Recalls from initial conditions that one CTMT sump pump is in Automatic. **EVALUATOR'S NOTE:** • None **COMMENTS:**	_______ **SAT** _______ **UNSAT**
STEP 16: Step 6.4 Note prior to Step 6.4.1: • This Subsection is not required if performing a backup leak rate. **STANDARD:** (a) Acknowledges the note. **EVALUATOR'S NOTE:** • None **COMMENTS:**	_______ **SAT** _______ **UNSAT**

STEP 17:

_______ **SAT**

_______ **UNSAT**

Step 6.4.1

6.4.1 Verify primary to secondary leakage through SG A and SG C is less than or equal to 100 gallons per day AND less than or equal to 20 gallons per day through SG B IAW either of the following. Enter N/A for this subsection if RCS temperature is less than 200 °F.

_______ If Reactor power is greater than 25%, all N-16 Radiation Monitors are operable.

_______ If Reactor power is less than or equal to 25%, OR any N-16 Radiation Monitor is inoperable, Chemistry has verified leakage IAW 0-CPT-SG-003, Steam Generator Primary to Secondary Leakage, if stable RCS conditions exist.

STANDARD:

(a) Acknowledges that reactor power is greater than 25% and that SG B is greater than 20 gallons per day.

EVALUATOR'S NOTE:

- None

COMMENTS:

STEP 18:

_______ **SAT**

_______ **UNSAT**

Note prior to Step 6.4.2:

- Primary to secondary leakage determination through each SG is required every 72 hours. If an SG N-16 Radiation Monitor is inoperable, sampling will be used to determine this leak rate.

STANDARD:

(a) Acknowledges the note.

EVALUATOR'S NOTE:

- None

COMMENTS:

STEP 19:

_______ **SAT**

_______ **UNSAT**

Step 6.4.2

6.4.2 Record primary to secondary leakage from each SG below. Enter N/A for SG(s) if N-16 monitor inoperable.

- SG A __________ gpd
- SG B __________ gpd
- SG C __________ gpd

STANDARD:

(a) Records the values from the initial conditions as indicated below

- SG A 24.4 gpd
- SG B 22.1 gpd
- SG C 25.6 gpd

EVALUATOR'S NOTE:

- None

COMMENTS:

STEP 20:

_______ **SAT**

_______ **UNSAT**

Step 6.4.3

6.4.3 If any N-16 inoperable, AND RCS is in a stable condition to perform leakrate, THEN notify Chemistry AND record person notified and date/time below. Otherwise, enter N/A.

STANDARD:

(a) Records N/A for this step.

EVALUATOR'S NOTE:

- None

COMMENTS:

STEP 21: Step 6.5 Notes prior to Step 6.5.1: • The Leakrate spreadsheet is located at S:\SURRY PWR STA\3\Data1\OPS\Leakrate\1-OPT-RC-10.0. Backup leakrates are to be entered in "Backup Statistics" tab of spreadsheet, if applicable. **STANDARD:** (a) Acknowledges the notes. **EVALUATOR'S NOTE:** • None **COMMENTS:**	_______ **SAT** _______ **UNSAT**

STEP 22:

Step 6.5.1

6.5.1 Update 1-OPT-RC-10.0 Data Entry tab in 1-OPT-RC-10.0 spreadsheet with Daily primary leak rate, primary to secondary leak rate, and sump in-leakage information.

_______ **SAT**

_______ **UNSAT**

STANDARD:

(a) Opens the leakrate spreadsheet and enters the required data.

EVALUATOR'S NOTE:

- Pre-data Entry

Date	Total (gpm)	Identified (gpm)	Unidentified (gpm)	Sump (gpm)	'A' (gpd)	'B' (gpd)	'C' (gpd)
05/15/10	0.240	0.150	0.090	0.140	24.200	15.200	25.400
05/16/10	0.220	0.120	0.110	0.130	24.400	15.300	25.400
05/17/10	0.250	0.150	0.100	0.130	24.200	14.800	25.600
05/18/10	0.230	0.130	0.090	0.130	24.300	14.900	25.100
05/19/10	0.230	0.140	0.100	0.130	24.500	15.200	25.300
05/20/10	0.250	0.160	0.090	0.130	24.200	15.300	25.700
05/21/10	0.250	0.160	0.090	0.130	24.400	15.200	25.400

	Action Level 1			Action Level 2		Action Level 3	
Date	Unident. Leakage (gpm)	7 Day Average Unidentified Leak Rate > .1 gpm	9 last Consecutive Unidentified Leak Rates > baseline mean	2 Consecutive Unidentified Leak Rates >.15 gpm	2 of 3 consecutive Unidentified Leak Rates > baseline mean + 2 standard deviations	Unident. Leak Rate > baseline mean + 3 standard deviations	Unident. Leak Rate >.3 gpm
05/21/10	0.090	0	0	0	0	0	0
05/20/10	0.090	0	0	0	0	0	0
05/19/10	0.100	0	0	0	0	0	0
05/18/10	0.090	0	0	0	0	0	0
05/17/10	0.100	0	0	0	0	0	0
05/16/10	0.110	0	0	0	0	0	0
05/15/10	0.090	0	0	0	0	0	0

COMMENTS:

STEP 23:

_______ **SAT**

_______ **UNSAT**

Step 6.5.2

6.5.2 Review leakage trends in 1-OPT-RC-10.0 spreadsheet.

STANDARD:

(a) Reviews the trends for 5/22/10 and notes that B SG primary to secondary leakage is elevated and that the plant is in action level 1 for RCS leakage.

EVALUATOR'S NOTE:

- Post-data Entry

Date	Total (gpm)	Identified (gpm)	Unidentified (gpm)	Sump (gpm)	'A' (gpd)	'B' (gpd)	'C' (gpd)
05/15/10	0.240	0.150	0.090	0.140	24.200	15.200	25.400
05/16/10	0.220	0.120	0.110	0.130	24.400	15.300	25.400
05/17/10	0.250	0.150	0.100	0.130	24.200	14.800	25.600
05/18/10	0.230	0.130	0.090	0.130	24.300	14.900	25.100
05/19/10	0.230	0.140	0.100	0.130	24.500	15.200	25.300
05/20/10	0.250	0.160	0.090	0.130	24.200	15.300	25.700
05/21/10	0.250	0.160	0.090	0.130	24.400	15.200	25.400
05/22/10	**0.280**	**0.150**	**0.130**	**0.080**	**24.400**	**22.100**	**25.600**

	Action Level 1			Action Level 2		Action Level 3	
Date	Unident. Leakage (gpm)	7 Day Average Unidentified Leak Rate > .1 gpm	9 last Consecutive Unidentified Leak Rates > baseline mean	2 Consecutive Unidentified Leak Rates >.15 gpm	2 of 3 consecutive Unidentified Leak Rates > baseline mean + 2 standard deviations	Unident. Leak Rate > baseline mean + 3 standard deviations	Unident. Leak Rate >.3 gpm
5/22/10	**0.13**	**1**	**0**	**0**	**0**	**0**	**0**
05/21/10	0.090	0	0	0	0	0	0
05/20/10	0.090	0	0	0	0	0	0
05/19/10	0.100	0	0	0	0	0	0
05/18/10	0.090	0	0	0	0	0	0
05/17/10	0.100	0	0	0	0	0	0
05/16/10	0.110	0	0	0	0	0	0
05/15/10	0.090	0	0	0	0	0	0

COMMENTS:

STEP 24: Notes prior to Step 6.5.3: • The following information is determined by 1-OPT-RC-10.0 spreadsheet in “Daily Statistics” tab with Yellow representing Action Level 1, Orange representing Action Level 2, and Red representing Action Level 3. If all Action levels are Green, then all criteria is satisfied. • The OPT-RC-10.0 spreadsheet Action Level criteria are not subject to change and do not need to have the revision number verified. Changes will be made to the baseline mean unidentified leak rate and baseline standard deviation of unidentified leak rate by Engineering following Refueling Outages and as required. **STANDARD:** (a) Acknowledges the Notes. **EVALUATOR’S NOTE:** • None **COMMENTS:**	_______ **SAT** _______ **UNSAT**

STEP 25:

Step 6.5.3

6.5.3 IF any of the following criteria apply to the unidentified leakage, THEN initiate 1-OP-RC-014. Otherwise, enter N/A.

Action Level 1

_______ One seven day rolling average of Unified RCS Leak Rate greater than 0.1 gpm.

_______ Nine consecutive daily Unidentified RCS Leakrates greater than baseline mean.

Action Level 2

_______ Two consecutive daily Unidentified RCS leakrates greater than 0.15 gpm.

_______ Two of Three consecutive daily Unidentified RCS Leakrates greater than mean +2 standard deviations.

Action Level 3

_______ One Unidentified RCS leakrates greater than 0.3 gpm.

_______ One Unidentified RCS Leakrate greater than mean +3 standard deviations.

_______ **SAT**

_______ **UNSAT**

STANDARD:

(a) Marks the step as follows:.

Action Level 1:

___X___ One seven day rolling average of Unified RCS Leak Rate greater than 0.1 gpm.

_______ Nine consecutive daily Unidentified RCS Leakrates greater than baseline mean.

This is a critical step.

EVALUATOR'S NOTE:

- If asked, acknowledge the need to perform 1-OP-RC-014. State another operator will perform this procedure and to continue on with 1-OPT-RC-10.0

COMMENTS:

STEP 26:

_______ **SAT**

_______ **UNSAT**

7.1 Acceptance Criteria.

7.1.1 Evaluate the test results by reviewing the following acceptance criteria.

_______ The Unidentified Leakage Rate is less than or equal to 1.0 gpm.
_______ The Total Identified Leakage Rate is less than or equal to 10.0 gpm.
_______ Primary to secondary leakage through each Steam Generator is being monitored IAW 0-CPT-SG-003, OR is less than or equal to 100 gallons per day through SG A and SG C AND less than or equal to 20 gallons per day through SG B as determined by N-16 Radiation Monitors

7.1.2 Document the test results.

_______ Satisfactory _______ Unsatisfactory

STANDARD:

(a) Completes this section as follows:

7.1.1 Evaluate the test results by reviewing the following acceptance criteria.

___X___ The Unidentified Leakage Rate is less than or equal to 1.0 gpm.
___X___ The Total Identified Leakage Rate is less than or equal to 10.0 gpm.
_______ Primary to secondary leakage through each Steam Generator is being monitored IAW 0-CPT-SG-003, OR is less than or equal to 100 gallons per day through SG A and SG C AND less than or equal to 20 gallons per day through SG B as determined by N-16 Radiation Monitors

7.1.2 Document the test results.

_______ Satisfactory ___X___ Unsatisfactory

This is a critical step.

EVALUATOR'S NOTE:

- Acknowledge the completion of the task.

COMMENTS:

STEP 27:

_______ **SAT**

_______ **UNSAT**

7.2 Follow on Tasks.

7.2.1 If the test was unsatisfactory, THEN perform the following actions. Otherwise, enter N/A.

a. Document the reason for the unsatisfactory test in Operator Comments.

b. Notify System Engineering of unsatisfactory conditions and record the name of the person notified.

c. The system engineer will initiate an evaluation for license renewal of potential aging effects such as material or cracking.

d. Initiate a Condition Report and record the number below.

e. Initiate the use of 1-AP-16.00, Excessive RCS Leakage.

7.2.2 IF a partial operability test was performed, THEN document the reason for the partial test in Operator Comments. Otherwise, enter N/A.

STANDARD:

(a) The candidate will document that the test was performed unsat in the Operator Comments due to the primary to secondary leakage. May also note that the plant is in action level 1 and 1-OP-RC-014 is required. Words to the effect follow: “This PT was completed unsat due to primary to secondary leakage greater than 20 gpd on B SG.”
(b) Will inform the evaluator that system engineering needs to be notified, a CR will be required and that AP-16 will need to be evaluated.
(c) STA has initiated a CR and the number is CR123456

EVALUATOR’S NOTE:

- System Engineer: Karlie F. Irwine.

COMMENTS:

STEP 28: 7.3 Notification, Documentation and Procedure Closeout. 7.3.1 Notify Shift Supervision that the test is complete. 7.3.2 Document Leak Rate results in Unit 1 Narrative Logs. **STANDARD:** (a) Will inform the evaluator that the test is complete. (b) Will inform the evaluator that the leak rate needs to be documented. **EVALUATOR'S NOTE:** • None. **COMMENTS:**	_______ **SAT** _______ **UNSAT**

STOP TIME (Part 1):

PART 2 of JPM:

Start Time:_________________

<table>
<tr>
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STEP 29: PART 2 of JPM

See note below!!

Directions to Candidate:

- Now that you have completed 1-OPT-RC-10.0, Reactor Coolant Leakage – Computer Calculated, I need you to determine if the results are within the bounds of the Technical Specifications, and if not, what actions are necessary.

STANDARD:

(a) Will inform the evaluator that the results are not within the bound of Technical Specifications.

(b) Will inform the evaluator that the actions from Technical Specification 3.1.C.3 need to be adhered to (i.e., 6 hour clock to hot shutdown).

EVALUATOR'S NOTE:

- ***Provide candidate with second page of instructions (Part 2) prior to reading these directions***.

COMMENTS:

</td>
<td>

_______ **SAT**

_______ **UNSAT**

</td>
</tr>
</table>

STOP TIME (Part 2):

Operator Directions Handout
(TO BE READ TO APPLICANT BY EXAMINER)

Task

- Task is to be PERFORMED in the SIMULATOR or CLASSROOM.
- Given simulated plant conditions, perform the remainder of 1-OPT-RC-10.0, Reactor Coolant Leakage – Computer Calculated, and submitted the procedure for review by the Unit Supervisor.

Directions

The evaluator will explain the initial conditions of the task to be performed and will provide the initiating cue. Ensure you indicate to the evaluator when you understand your assigned task.

Initial Conditions

- It is mid-shift on May 22, 2010. Unit 1 power is 100 percent.
- I am the Nuclear Shift Manager. I have assigned you to complete the normal daily 1-OPT-RC-10.0, Reactor Coolant Leakage – Computer Calculated. The procedure is complete up through Step 6.2.11 and the computer generated leak rate data sheet has just been printed out, the leak rate ran for 125 minutes. You are to complete 1-OPT-RC-10.0, Reactor Coolant Leakage – Computer Calculated in its entirety and when done turn the procedure in for review.

- The following are the Unit conditions:
  - Reactor power: 100%
  - Charging flow control is in automatic.
  - One PDTT pump was placed in automatic after the PCS computer leak rate program results were printed.
  - Containment Sump Data:
    - Initial containment sump level was 47% as indicated on 1-DA-LI-100 (CTMT SUMP LEVEL).
    - Final containment sump level was 62% as indicated on 1-DA-LI-100 (CTMT SUMP LEVEL).
    - Containment Sump leak rate elapsed time – 60 minutes.
    - After this data was recorded, one containment sump pump was placed back in automatic

Primary to Secondary Leakage exists and is known and has been indicating in the 15 – 25 gpd range per steam generator for the past week. Today the N-16 monitors are slightly elevated and indicate the following:
SG A: 24.4 gpd
SG B: 22.1 gpd
SG C: 25.6 gpd

The Leakrate spreadsheet is located at folder S:\SURRY PWR STA\3\Ops\Leakrate on the desktop of your laptop computer.

Initiating Cues:

- Here is a partially completed copy of 1-OPT-RC-10.0, Reactor Coolant Leakage – Computer Calculated. I need you to complete 1-OPT-RC-10.0, Reactor Coolant Leakage – Computer Calculated it is entirety and when done turn the procedure in for review.

- When you are ready to have your work reviewed, please inform me, as this will end the JPM.

Operator Directions Handout
(TO BE GIVEN TO APPLICANT)

Initial Conditions

- It is mid-shift on May 22, 2010. Unit 1 power is 100 percent.
- I am the Nuclear Shift Manager. I have assigned you to complete the normal daily 1-OPT-RC-10.0, Reactor Coolant Leakage – Computer Calculated. The procedure is complete up through Step 6.2.11 and the computer generated leak rate data sheet has just been printed out, the leak rate ran for 125 minutes. You are to complete 1-OPT-RC-10.0, Reactor Coolant Leakage – Computer Calculated in its entirety and when done turn the procedure in for review.

- The following are the Unit conditions:
  - Reactor power: 100%
  - Charging flow control is in automatic.
  - One PDTT pump was placed in automatic after the PCS computer leak rate program results were printed.
  - Containment Sump Data:
    - Initial containment sump level was 47% as indicated on 1-DA-LI-100 (CTMT SUMP LEVEL).
    - Final containment sump level was 62% as indicated on 1-DA-LI-100 (CTMT SUMP LEVEL).
    - Containment Sump leak rate elapsed time – 60 minutes.
    - After this data was recorded, one containment sump pump was placed back in automatic

Primary to Secondary Leakage exists and is known and has been indicating in the 15 – 25 gpd range per steam generator for the past week. Today the N-16 monitors are slightly elevated and indicate the following:
SG A: 24.4 gpd
SG B: 22.1 gpd
SG C: 25.6 gpd

The Leakrate spreadsheet is located at folder S:\SURRY PWR STA\3\Ops\Leakrate on the desktop of your laptop computer.

Initiating Cues:

- Here is a partially completed copy of 1-OPT-RC-10.0, Reactor Coolant Leakage – Computer Calculated. I need you to complete 1-OPT-RC-10.0, Reactor Coolant Leakage – Computer Calculated it is entirety and when done turn the procedure in for review.

- When you are ready to have your work reviewed, please inform me, as this will end the JPM.

Operator Directions Handout

(TO BE GIVEN TO APPLICANT AFTER COMPLETION OF 1-OPT-RC-10.0)

PART 2

Additional Directions to Candidate:

- Now that you have completed 1-OPT-RC-10.0, Reactor Coolant Leakage – Computer Calculated, I need you to determine if the results are within the bounds of the Technical Specifications, and if not, what actions are necessary.

REACTOR COOLANT SYSTEM LEAK RATE

DATE: 5/22/10
START TIME: 125 Minutes ago
DURATION REQUESTED: 125
ESTIMATED STOP TIME: Now

OPERATOR ENTERED PARAMETERS:
YLR0001K, OP ENTERED MINUTES TO RUN = 125 MIN
YLR0002K, OP ENTERED IDENT LEAKAGE   = 0   GPM
U9130, ROLLING PRT LEAKRATE   = 0.00 GPM

REACTOR COOLANT SYSTEM LEAK RATE

DATE: 5/22/10
START TIME: 125 Minutes ago
DURATION REQUESTED: 125
ESTIMATED STOP TIME: Now

OPERATOR ENTERED PARAMETERS:
YLR0001K, OP ENTERED MINUTES TO RUN = 125 MIN
YLR0002K, OP ENTERED IDENT LEAKAGE   = 0   GPM
U9130, ROLLING PRT LEAKRATE   = 0.00 GPM

CALCULATION OF LEAK RATES

1) RAW DATA OF PDTT LEVEL – START: 40.70 END: 42.91

2) SAMPLE DATA:

RCS TEMPERATURE AVERAGE ((T0400A + T0420A + T0440A)/3):

573.36	573.38	573.37	573.39	573.32	573.38	573.31	573.28	573.40	573.32	573.43	573.32
573.40	573.34	573.35	573.30	573.32	573.34	573.33	573.30	573.33	573.38	573.32	573.35
573.30	573.32	573.37	573.33	573.32	573.32	573.34	573.36	573.34	573.34	573.32	573.32
573.30	573.34	573.31	573.31	573.30							

PRESSURIZER LEVEL AVERAGE ((L0480A + L0481A + L0482A)/3):

56.67	56.79	56.77	56.82	56.77	56.77	56.76	56.71	56.77	56.76	56.77	56.75
56.72	56.69	56.70	56.70	56.69	56.70	56.70	56.71	56.72	56.77	56.75	56.76
56.74	56.76	56.77	56.72	56.65	56.72	56.73	56.76	56.74	56.76	56.72	56.72
56.73	56.70	56.73	56.70	56.73							

VCT LEVEL (L0112A):

42.90	42.81	42.63	42.60	42.50	42.44	42.35	42.38	42.35	42.32	42.26	42.20
42.14	42.14	42.14	42.05	41.93	41.83	41.74	41.65	41.56	41.44	41.41	41.31
41.19	41.25	41.13	41.07	41.01	40.95	40.95	40.77	40.80	40.67	40.61	40.58
40.52	40.49	40.40	40.40	40.34							

RCS PRESSURE AVERAGE ((P0480A + P0481A + P0482A)/3):

2243.38	2243.62	2243.38	2243.87	2243.30	2243.54	2243.22	2243.13	2243.22	2243.54	2243.79	2243.87
2242.89	2242.81	2243.22	2242.73	2243.05	2243.54	2243.54	2242.73	2243.70	2243.95	2244.11	2243.79
2243.54	2244.44	2243.22	2243.46	2243.30	2242.97	2243.70	2244.44	2244.03	2243.54	2244.03	2243.54
2243.30	2242.65	2243.46	2243.22	2243.70							

```
3)      LINEAR REGRESSION STATISTICS:
        PARAMETER                          SLOPE                START VALUE          END VALUE
        ------------------------------     -------------        -------------------  -----------------
        TEMPERATURE                        -0.00037             573.36               573.31
        PRESSURIZER LEVEL                  -0.00026             56.75                56.71
        VCT LEVEL                          -0.02070             42.86                40.27

4)      MASS CHANGE DATA (A NEGATIVE RATE IMPLIES MASS TRANSFER OUT OF THE VOLUME):
        RCS:        -0.00037 DEGF/MIN  *   -0.07 LBM/CU FT(DEGF)  *   82.08.8 CU FT                                      =     0.22 LBM/MIN
        PRZR:       -0.00026 PCT/MIN   *   74.0  GAL/PCT   *          0.13368 CU FT/GAL   *     37.12 LBM/CU FT          =     -0.10 LBM/MIN
        VCT:        -0.02070 PCT/MIN   *   14.1 GAL/PCT    *          0.13368CU FT/GAL    *     61.87 LBM/CU FT          =     -2.41 LBM/MIN

5)      CONVERSIONS FOR PDTT, PRT AND IDENTIFIED LEAKAGE TO LBM:
        PDTT CHANGE:             42.91 PCT  -         40.70 PCV                                          =     2.21 PCT
        PDTT:                    2.21 PCT   *         71.16 LBM/PCT   /        125 MIN                   =     1.26 LBM/MIN
        PRT:                     0.00 GAL/MIN    *    0.13368 CU FT/GAL    *   61.856 LBM/CU FT          =     0.00 LBM.MIN
        IDENTIFIED LEAKAGE:      0.00 GAL/MIN    *    0.13368 CU FT/GAL    *   62.310 LBM/CU FT          =     0.00 LBM.MIN

6)      TOTAL LEAKAGES IN LBM/MIN:
        RCS:        (-1.0)  *    0.22 LBM/MIN   +     -0.10 LBM/MIN      +     -2.41 LBM/MIN             =     2.29 LBM/MIN
        IDENTIFIED:              1.26 LBM/MIN   +     0.00 LBM/MIN       +     0.00 LBM/MIN              =     1.26 LBM/MIN
        UNIDENTIFIED:            2.29 LBM/MIN   -     1.26 LBM/MIN                                       =     1.03 LBM/MIN

7)      TOTAL LEAKAGES IN GALLONS/MINUTE:
        RCS:                     2.29 LBM/MIN   *     7.48052 GAL/CU FT   /    61.856 LBM/CU FT          =     0.28 GAL/MIN
        IDENTIFIED:              1.26 LBM/MIN   *     7.48052 GAL/CU FT   /    61.856 LBM/CU FT          =     0.15 GAL/MIN
        UNIDENTIFIED:            0.28 GAL/MIN   -     0.15 GAL/MIN                                       =     0.13 GAL/MIN


        NOTE:       VALUES WITH A QUALITY OF “B” ARE UNRELIABLE


                                       REACTOR COOLANT SYSTEM LEAK RATE
                                       ------------------------------------------------------------
                                       DATE:  5/22/10
                                       START TIME:  Now
```

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65 minutes ago 125 minutes ago 60

60

U.S. Nuclear Regulatory Commission
Surry Power Station

SR10301
Administrative Job Performance Measure 2.4.41
TIME CRITICAL

Applicant________________________________ Start Time___________________

Examiner_______________________________

Date ___________________________________ Stop Time___________________

Title

CLASSIFY AN EVENT

K/A: G2.4.41 – Knowledge of the emergency action level thresholds and classifications. (2.9/4.6)

Applicability	**Est Completion Time**	**Actual Time**
SRO(I)	20 Minutes (Time Critical)	___________

Conditions

- Task is to be PERFORMED in the SIMULATOR or CLASSROOM.
- A simulated SITE AREA EMERGENCY is in progress.

Standards

- Declares a Site Area Emergency using EAL Identifier SS1.2 in accordance with EPIP-1.01/EAL Table.

Initiating Cues

- Given simulated plant conditions, utilize EPIP-1.10 and determine if classification is warranted.

Initial Conditions

- **This JPM is TIME CRITICAL.**

- You are the Nuclear Shift Manager. An event is in progress with plant conditions as follows:
    - The AAC DG is tagged out for governor valve replacement. The Plan of the Day (POD) shows that the diesel will be returned to service next weekend.
    - Both Units were initially at 100% power when a severe thunderstorm passed through the area.
    - Approximately 50 minutes ago, the station experienced a loss of the ‘D’ Transfer bus as the ‘A’ Reserve Station Service Transformer was struck and damaged by lightning (no fire).
        - At that time, #3 EDG tripped on overspeed during start-up. Mechanics reset the overspeed, and when started, the #3 EDG experienced extremely high vibrations and the casing was penetrated by a connecting rod, and #3 EDG was subsequently tripped.
    - Approximately 35 minutes ago, Unit 1 reactor tripped due to a fault on the ‘A’ DC bus that damaged the ‘A’ Station Battery. Due to the significant amount of damage to the ‘A’ Station Battery, the electricians are estimating 2 – 3 days before the ‘A’ DC bus is restored.
    - Approximately 10 minutes ago, while performing 1-AP-10.06, Loss of DC Power, the BOP reported that the 1B DC bus was 102 Volts and decreasing.

- Here is a copy of EPIP-1.01, Emergency Manager Controlling Procedure. I need you to perform EPIP-1.01 and determine if this event should be classified.
- When you finish the actions necessary to accomplish this, please inform me of your classification, if necessary.

Terminating Cues

- Report of classification determination.

Procedures

- EPIP-1.01, Emergency Manager Controlling Procedure (Revision 52)

Tools and Equipment

- None

Safety Considerations

- None

Notes

Performance Checklist

Notes to the Evaluator.

- Task critical elements are bolded and noted by the words "Critical Step" at the end of the step.
- **START TIME:**

STEP 1: Caution and Note prior to step 1. **CAUTION:** Declaration of the highest emergency class for which an Emergency Action Level is exceeded shall be made. **NOTE:** The PCS is potentially unreliable in the event of an earthquake. Therefore, PCS parameters should be evaluated for accuracy should an earthquake occur. **STANDARD:** (a) Acknowledges CAUTION and NOTE **EVALUATOR'S NOTE:** • ***Candidate may choose to make EAL classification straight from EAL tables and NOT implement steps of EPIP-1.01. Steps are given here as guidance. Critical task time ends when the classification is determined regardless of determination method.*** **COMMENTS:**	_______ **SAT** _______ **UNSAT**

STEP 2: Step1 - EVALUATE EMERGENCY ACTION LEVELS: a) Determine event category using the applicable Emergency Action Level Matrix: • Hot Conditions (RCS > 200 °F) • Cold Conditions (RCS ≤ 200 °F) b) Review EAL associated with event category c) Use Control Room monitors, PCS, and outside reports to get indications of emergency conditions listed in the EAL Matrix d) Verify EAL - CURRENTLY EXCEEDED e) Initiate a chronological log of events **STANDARD:** (a) Refers to the HOT chart (b) Determines event category to be Loss of Power. (c) Refers to given conditions to determine EAL applicability **(d) Determines EAL Identifier SS1.2 conditions are met and declares a Site Area Emergency on this Identifier.** **This is a Critical Step.** (e) Initiates (or verbalizes) a chronological log of events. **EVALUATOR'S NOTE**: • If candidate makes EAL determination at this step, record stop time. **COMMENTS:** **STOP CRITICAL TASK TIME: ___________** **TIME CRITICAL- 15 minutes**	_______ **SAT** _______ **UNSAT**

STEP 3:

Step 2 - RECORD EAL IDENTIFIER, TIME EMERGENCY DECLARED AND SM/SEM NAME:

Emergency Classification	EAL Identifier	Time Declared	SM /SEM Name
Notification of Unusual Event			
Alert			
Site Area Emergency			
General Emergency			

_______ **SAT**

_______ **UNSAT**

STANDARD:

(a) Completes the table as indicated below:

Emergency Classification	EAL Identifier	Time Declared	SM /SEM Name
Notification of Unusual Event			
Alert			
Site Area Emergency	SS1.2	TBD	TBD
General Emergency			

EVALUATOR'S NOTE:

- Completion of this table is not required for successful completion of the JPM.

COMMENTS:

STEP 5: Reports declaration of the event in progress. **STANDARD:** **(a) Verbal or written status report that a Site Area Emergency should be declared on Tab SS1.2. This is a Critical Step if not already performed.** **EVALUATOR'S NOTE:** • Acknowledge the completion of the task. **COMMENTS:** **STOP CRITICAL TASK TIME:** ___________ **TIME CRITICAL- 15 minutes**	_______ **SAT** _______ **UNSAT**

STOP TIME:

Operator Directions Handout
(TO BE READ TO APPLICANT BY EXAMINER)

Task

- Task may be PERFORMED in the simulator or classroom.
- Classify an event in accordance with EPIP-1.01, Emergency Manager Controlling Procedure.

Directions

The evaluator will explain the initial conditions of the task to be performed and will provide the initiating cue. Ensure you indicate to the evaluator when you understand your assigned task.

Initial Conditions:

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- You are the Nuclear Shift Manager. An event is in progress with plant conditions as follows:
  - The AAC DG is tagged out for governor valve replacement. The Plan of the Day (POD) shows that the diesel will be returned to service next weekend.
  - Both Units were initially at 100% power when a severe thunderstorm passed through the area.
  - Approximately 50 minutes ago, the station experienced a loss of the ‘D’ Transfer bus as the ‘A’ Reserve Station Service Transformer was struck and damaged by lightning (no fire).
    - At that time, #3 EDG tripped on overspeed during start-up. Mechanics reset the overspeed, and when started, the #3 EDG experienced extremely high vibrations and the casing was penetrated by a connecting rod, and #3 EDG was subsequently tripped.
  - Approximately 35 minutes ago, Unit 1 reactor tripped due to a fault on the ‘A’ DC bus that damaged the ‘A’ Station Battery. Due to the significant amount of damage to the ‘A’ Station Battery, the electricians are estimating 2 – 3 days before the ‘A’ DC bus is restored.
  - Approximately 10 minutes ago, while performing 1-AP-10.06, Loss of DC Power, the BOP reported that the 1B DC bus was 102 Volts and decreasing.

Initiating Cues:

- Here is a copy of EPIP-1.01, Emergency Manager Controlling Procedure. I need you to perform EPIP-1.01 and determine if this event should be classified.

- When you finish the actions necessary to accomplish this, please inform me of your classification, if necessary.

Operator Directions Handout
(TO BE GIVEN TO APPLICANT)

Initial Conditions:

- **This JPM is TIME CRITICAL.**
- You are the Nuclear Shift Manager. An event is in progress with plant conditions as follows:
    - The AAC DG is tagged out for governor valve replacement. The Plan of the Day (POD) shows that the diesel will be returned to service next weekend.
    - Both Units were initially at 100% power when a severe thunderstorm passed through the area.
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        - At that time, #3 EDG tripped on overspeed during start-up. Mechanics reset the overspeed, and when started, the #3 EDG experienced extremely high vibrations and the casing was penetrated by a connecting rod, and #3 EDG was subsequently tripped.
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    - Approximately 10 minutes ago, while performing 1-AP-10.06, Loss of DC Power, the BOP reported that the 1B DC bus was 102 Volts and decreasing.

Initiating Cues:

- Here is a copy of EPIP-1.01, Emergency Manager Controlling Procedure. I need you to perform EPIP-1.01 and determine if this event should be classified.

- When you finish the actions necessary to accomplish this, please inform me of your classification, if necessary.

- **Record classification and EAL identifier (if any):**

____________________________ ________________________________

EPIPs not included in ADAMS package.