

**Final Submittal**  
(Blue Paper)

**CATAWBA DECEMBER 2005 EXAM**

**05000413/2005301 & 05000414/2005301**

**DECEMBER 5 - 8, 2005**  
**DECEMBER 14, 2005 (WRITTEN)**

**FINAL RO/SRO WRITTEN**  
**EXAMINATION REFERENCES**

# **SRO REFERENCE SET**

3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

3.5.1 Accumulators

LCO 3.5.1 Four ECCS accumulators shall be OPERABLE.

APPLICABILITY: MODES 1 and 2,  
MODE 3 with RCS pressure > 1000 psig.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One accumulator inoperable due to boron concentration not within limits.	A.1 Restore boron concentration to within limits.	72 hours
B. One accumulator inoperable for reasons other than Condition A.	B.1 Restore accumulator to OPERABLE status.	24 hours
C. Required Action and associated Completion Time of Condition A or B not met.	C.1 Be in MODE 3. <u>AND</u> C.2 Reduce RCS pressure to ≤ 1000 psig.	6 hours  12 hours
D. Two or more accumulators inoperable.	D.1 Enter LCO 3.0.3.	Immediately

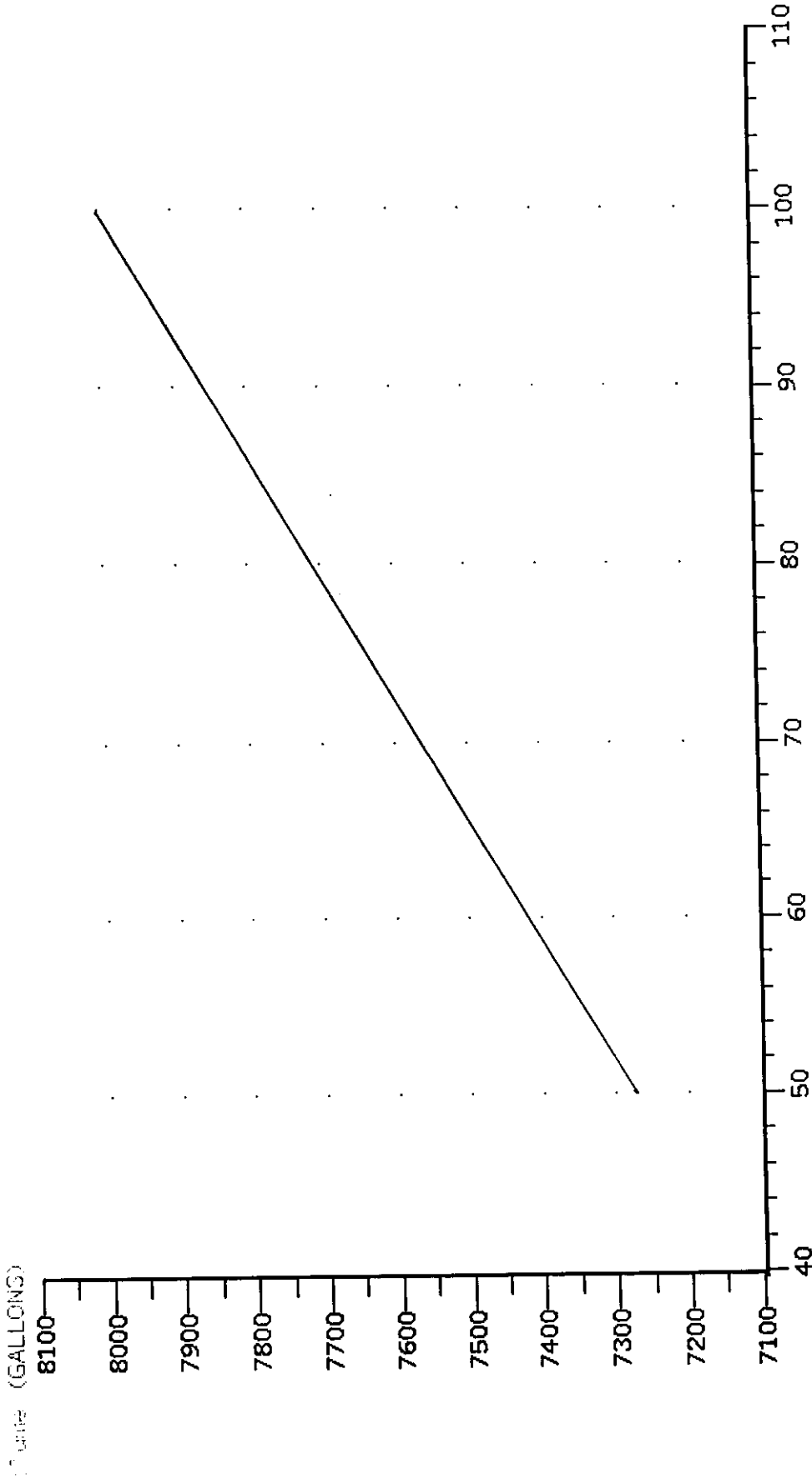
SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.5.1.1 Verify each accumulator isolation valve is fully open.	12 hours
SR 3.5.1.2 Verify borated water volume in each accumulator is $\geq 7630$ gallons and $\leq 8079$ gallons.	12 hours
SR 3.5.1.3 Verify nitrogen cover pressure in each accumulator is $\geq 585$ psig and $\leq 678$ psig.	12 hours
SR 3.5.1.4 Verify boron concentration in each accumulator is within the limits specified in the COLR.	31 days  <u>AND</u>  -----NOTE----- Only required to be performed for affected accumulators -----  Once within 6 hours after each solution volume increase of $\geq 75$ gallons that is not the result of addition from the refueling water storage tank
SR 3.5.1.5 Verify power is removed from each accumulator isolation valve operator when RCS pressure is $> 1000$ psig.	31 days

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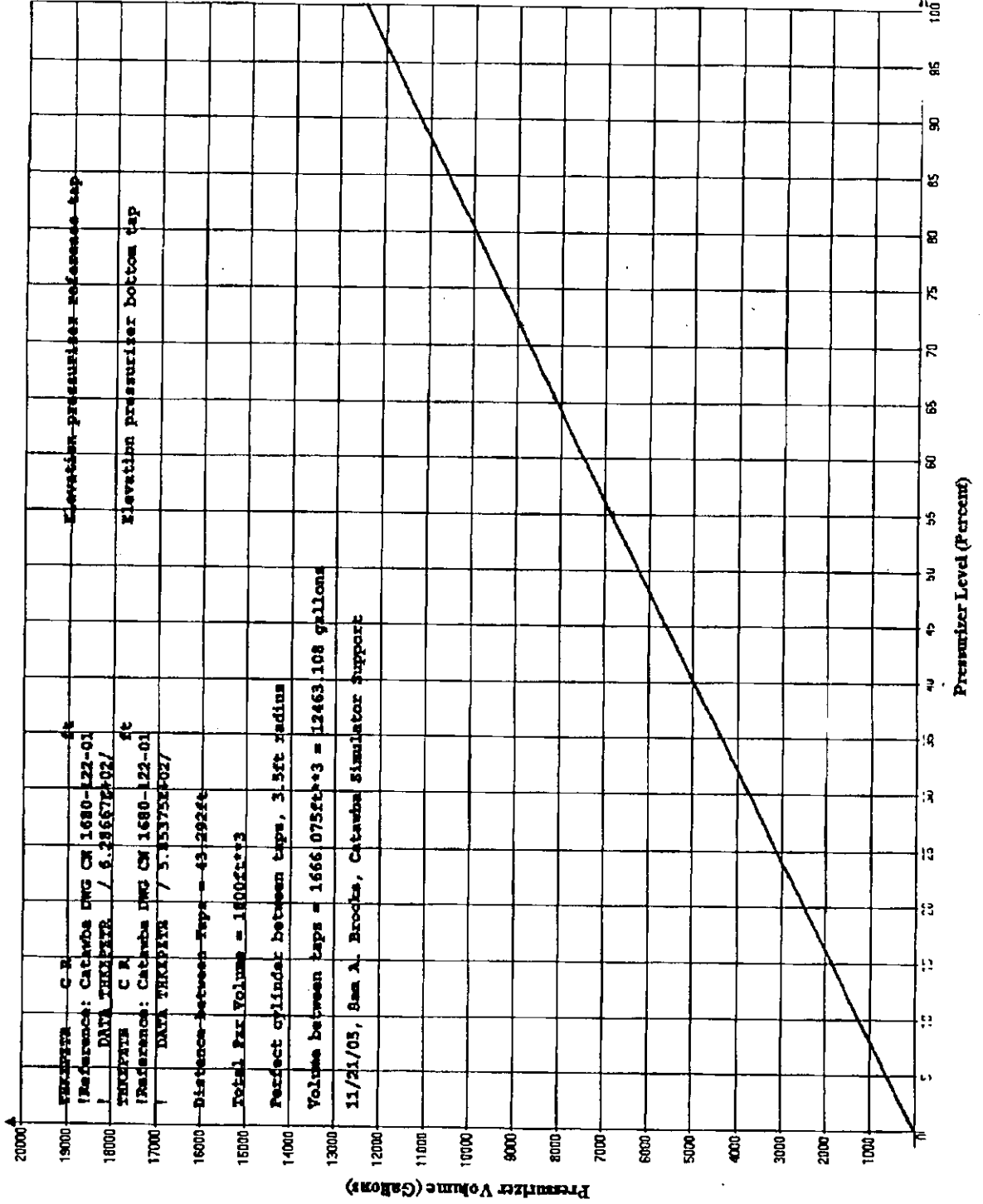
### III Cold Leg Accumulator Indicated Volume

Source: CMM-1201.04-151 Sh. 1.2



Indicated Level (%)

# Pressurizer Level Vs Volume



PRESSURIZER C-R  
 Reference: Catawba DWG CN 1680-122-01  
 DATA THICKNESS / 6.28667E-07/  
 THICKNESS C-R  
 Reference: Catawba DWG CN 1680-122-01  
 DATA THICKNESS / 5.75375E-02/  
 Distance between Taps = 43.292ft  
 Total Pres Volume = 1600ft<sup>3</sup>  
 Perfect cylinder between taps, 3.5ft radius  
 Volume between taps = 1666.075ft<sup>3</sup> \* 3 = 12463.108 gallons  
 11/21/05, Sam A. Brocks, Catawba Simulator Support

Elevation-pressurizer reference tap

Elevation pressurizer bottom tap

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.16 RCS Specific Activity

LCO 3.4.16 The specific activity of the reactor coolant shall be within limits.

APPLICABILITY: MODES 1 and 2,  
MODE 3 with RCS average temperature ( $T_{avg}$ )  $\geq$  500°F.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>A. DOSE EQUIVALENT I-131 <math>&gt;</math> 1.0 <math>\mu</math>Ci/gm.</p>	<p>-----Note----- LCO 3.0.4.c is applicable. -----</p> <p>A.1 Verify DOSE EQUIVALENT I-131 within the acceptable region of Figure 3.4.16-1.</p> <p><u>AND</u></p> <p>A.2 Restore DOSE EQUIVALENT I-131 to within limit.</p>	<p>Once per 4 hours</p> <p>48 hours</p>
<p>B. Gross specific activity of the reactor coolant not within limit.</p>	<p>B.1 Be in MODE 3 with <math>T_{avg}</math> <math>&lt;</math> 500°F.</p>	<p>6 hours</p>

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>C. Required Action and associated Completion Time of Condition A not met.</p> <p><u>OR</u></p> <p>DOSE EQUIVALENT I-131 in the unacceptable region of Figure 3.4.16-1.</p>	<p>C.1 Be in MODE 3 with <math>T_{avg} &lt; 500^{\circ}\text{F}</math>.</p>	<p>6 hours</p>

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
<p>SR 3.4.16.1 Verify reactor coolant gross specific activity <math>\leq 100/\bar{E}</math> <math>\mu\text{Ci/gm}</math>.</p>	<p>7 days</p>
<p>SR 3.4.16.2 -----NOTE----- Only required to be performed in MODE 1. -----</p> <p>Verify reactor coolant DOSE EQUIVALENT I-131 specific activity <math>\leq 1.0 \mu\text{Ci/gm}</math>.</p>	<p>14 days</p> <p><u>AND</u></p> <p>Between 2 and 6 hours after a THERMAL POWER change of <math>\geq 15\%</math> RTP within a 1 hour period</p>

(continued)



SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
<p>SR 3.4.16.3 -----NOTE-----</p> <p>Not required to be performed until 31 days after a minimum of 2 effective full power days and 20 days of MODE 1 operation have elapsed since the reactor was last subcritical for <math>\geq 48</math> hours.</p> <p>-----</p> <p>Determine <math>\bar{E}</math> from a sample taken in MODE 1 after a minimum of 2 effective full power days and 20 days of MODE 1 operation have elapsed since the reactor was last subcritical for <math>\geq 48</math> hours.</p>	<p>184 days</p>

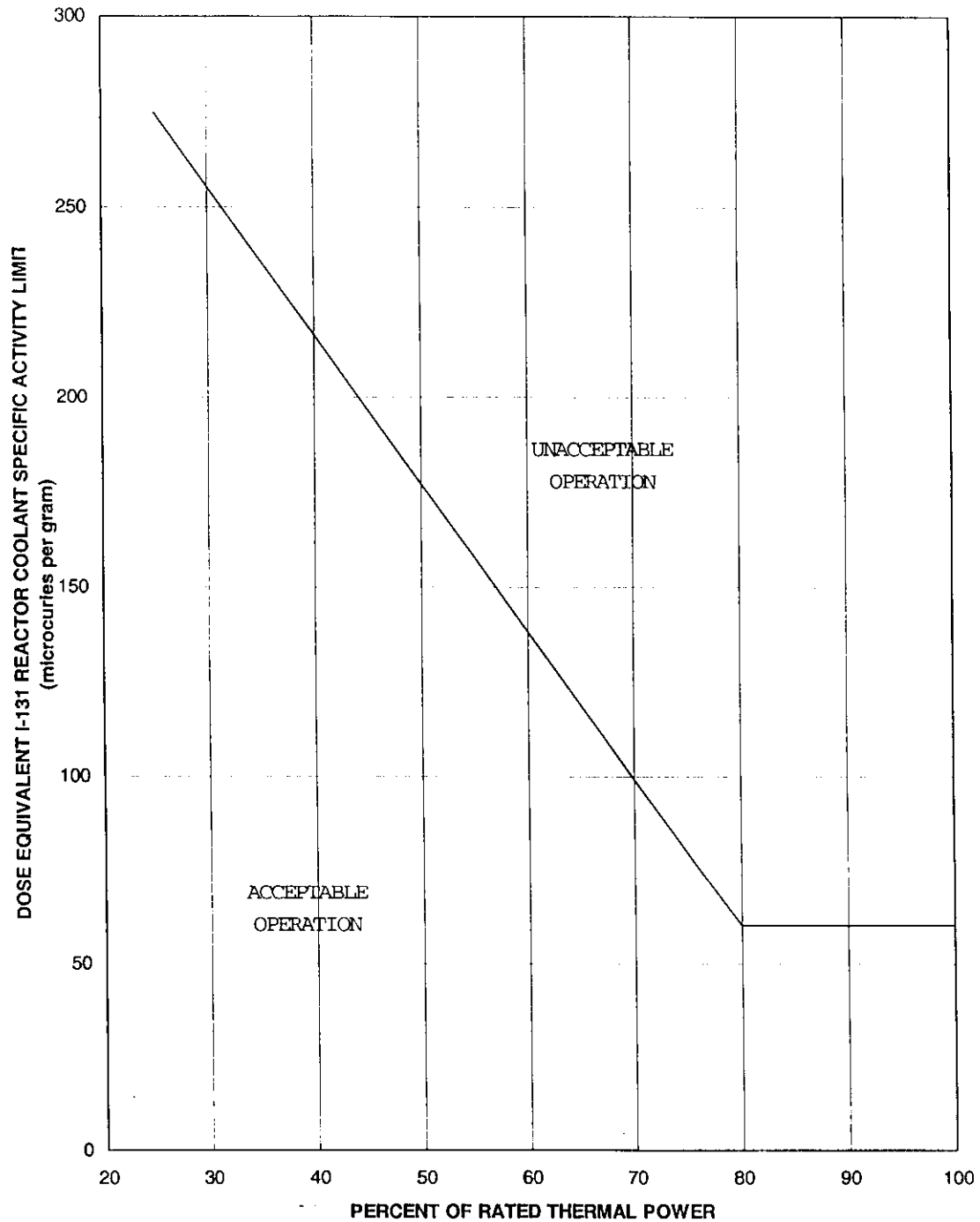


Figure 3.4.16-1 (page 1 of 1)  
Reactor Coolant DOSE EQUIVALENT I-131 Specific Activity  
Limit Versus Percent of RATED THERMAL POWER

ACTION/EXPECTED RESPONSE

RESPONSE NOT OBTAINED

19. Reduce NV S/I flow as follows:

\_\_\_ a. Verify both NV pumps - ON.

\_\_\_ a. GO TO Step 20.

\_\_\_ b. Determine required NC subcooling from the following table:

NI PUMP STATUS	NC SUBCOOLING (°F)	
	AT LEAST ONE NC PUMP ON	ALL NC PUMPS OFF
0	18	30
1	7	12
2	6	11

\_\_\_ c. Verify NC subcooling based on core exit T/Cs - **GREATER THAN REQUIRED SUBCOOLING.**

c. Perform the following:

\_\_\_ 1) **IF** any NC T-Hot is greater than 345°F, **THEN GO TO** Step 30.

2) **IF** all NC T-Hots are less than 345°F, **THEN:**

\_\_\_ a) **IF** both ND pumps are off, **THEN** start one ND pump.

\_\_\_ b) **IF** running ND pump is in RHR mode, **THEN** start other ND pump.

\_\_\_ c) **IF** any ND pump is on in S/I mode **AND** its associated ND aux containment spray header is isolated, **THEN GO TO** Step 19.d.

\_\_\_ d) GO TO Step 30.

\_\_\_ d. Verify Pzr level - **GREATER THAN 25% (34% ACC).**

\_\_\_ d. Observe Note prior to Step 16 and **RETURN TO** Step 16.

\_\_\_ e. Stop one NV pump.

ACTION/EXPECTED RESPONSE

RESPONSE NOT OBTAINED

20. Reduce NI injection flow as follows:

- a. Verify any NI pump - ON.  a. **GO TO** Step 21.
- b. Determine required NC subcooling from table:

NI PUMP STATUS	NC SUBCOOLING (°F)			
	ONE NV PUMP ON		ALL NV PUMPS OFF	
	AT LEAST ONE NC PUMP ON	ALL NC PUMPS OFF	AT LEAST ONE NC PUMP ON	ALL NC PUMPS OFF
1	42	82	1000	1000
2	4	8	7	16

- c. Verify NC subcooling based on core exit T/Cs - GREATER THAN REQUIRED SUBCOOLING.
- c. Perform the following:
- 1) **IF** any NC T-Hot is greater than 345°F, **THEN GO TO** Step 30.
- 2) **IF** all NC T-Hots are less than 345°F, **THEN**:
- a) **IF** both ND pumps are off, **THEN** start one ND pump.
- b) **IF** running ND pump is in RHR mode, **THEN** start other ND pump.
- c) **IF** any ND pump is on in S/I mode **AND** its associated ND aux containment spray header is isolated, **THEN GO TO** Step 20.d.
- d) **GO TO** Step 30.
- d. Verify Pzr level - GREATER THAN 25% (34% ACC).
- d. Observe Note prior to Step 16 and **RETURN TO** Step 16.

ACTION/EXPECTED RESPONSE

RESPONSE NOT OBTAINED

20. (Continued)

e. Verify one of the following conditions is satisfied:

• NC pressure - STABLE OR INCREASING

OR

• NC subcooling based on core exit T/Cs - INCREASING.

f. Stop one NI pump.

g. **RETURN TO** Step 20.a.

e. **GO TO** Step 30.

ACTION/EXPECTED RESPONSE

RESPONSE NOT OBTAINED

29. **Verify adequate shutdown margin as follows:**

- a. Obtain current NC boron concentration from Primary Chemistry.
- b. Perform shutdown margin calculation.  
**REFER TO OP/0/A/6100/006**  
(Reactivity Balance Calculation).
- c. Verify NC boron concentration -  
GREATER THAN OR EQUAL TO  
REQUIRED BORON  
CONCENTRATION.
- c. Borate as required to restore shutdown margin.

30. **Verify S/I flow not required as follows:**

- a. NC subcooling based on core exit T/Cs  
- GREATER THAN 0°F.
- a. Perform the following:
  - 1) Manually start S/I pumps and align valves as required to restore NC subcooling.
  - 2) **GO TO** Step 31.
- b. Pzr level - GREATER THAN 11%  
(20% ACC).
- b. Perform the following:
  - 1) Manually start S/I pumps and align valves as required to restore Pzr level.
  - 2) Observe Note prior to Step 16 and **RETURN TO** Step 16.

ACTION/EXPECTED RESPONSE

RESPONSE NOT OBTAINED

31. Isolate CLAs as follows:

- a. Verify NC subcooling based on core exit T/Cs - GREATER THAN 0°F.
  - b. Verify Pzr level - GREATER THAN 11% (20% ACC).
  - c. Dispatch operator to restore power to all CLA discharge isolation valves.  
**REFER TO** Enclosure 4 (Power Alignment for CLA Valves).
  - d. Maintain NC pressure greater than CLA pressure until the CLAs are isolated or vented.
- a. Perform the following:
    - 1) **IF** at least two NC T-Hots are less than 328°F, **THEN GO TO** Step 31.c.
    - 2) **GO TO** Step 32.
  - b. Observe Note prior to Step 16 and **RETURN TO** Step 16.

# **RO REFERENCE SET**



3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

3.5.1 Accumulators

LCO 3.5.1 Four ECCS accumulators shall be OPERABLE.

APPLICABILITY: MODES 1 and 2,  
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A. One accumulator inoperable due to boron concentration not within limits.	A.1 Restore boron concentration to within limits.	72 hours
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C. Required Action and associated Completion Time of Condition A or B not met.	C.1 Be in MODE 3. <u>AND</u> C.2 Reduce RCS pressure to $\leq$ 1000 psig.	6 hours  12 hours
D. Two or more accumulators inoperable.	D.1 Enter LCO 3.0.3.	Immediately

SURVEILLANCE REQUIREMENTS

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SR 3.5.1.4 Verify boron concentration in each accumulator is within the limits specified in the COLR.	31 days <u>AND</u> -----NOTE----- Only required to be performed for affected accumulators ----- Once within 6 hours after each solution volume increase of $\geq 75$ gallons that is not the result of addition from the refueling water storage tank
SR 3.5.1.5 Verify power is removed from each accumulator isolation valve operator when RCS pressure is $> 1000$ psig.	31 days

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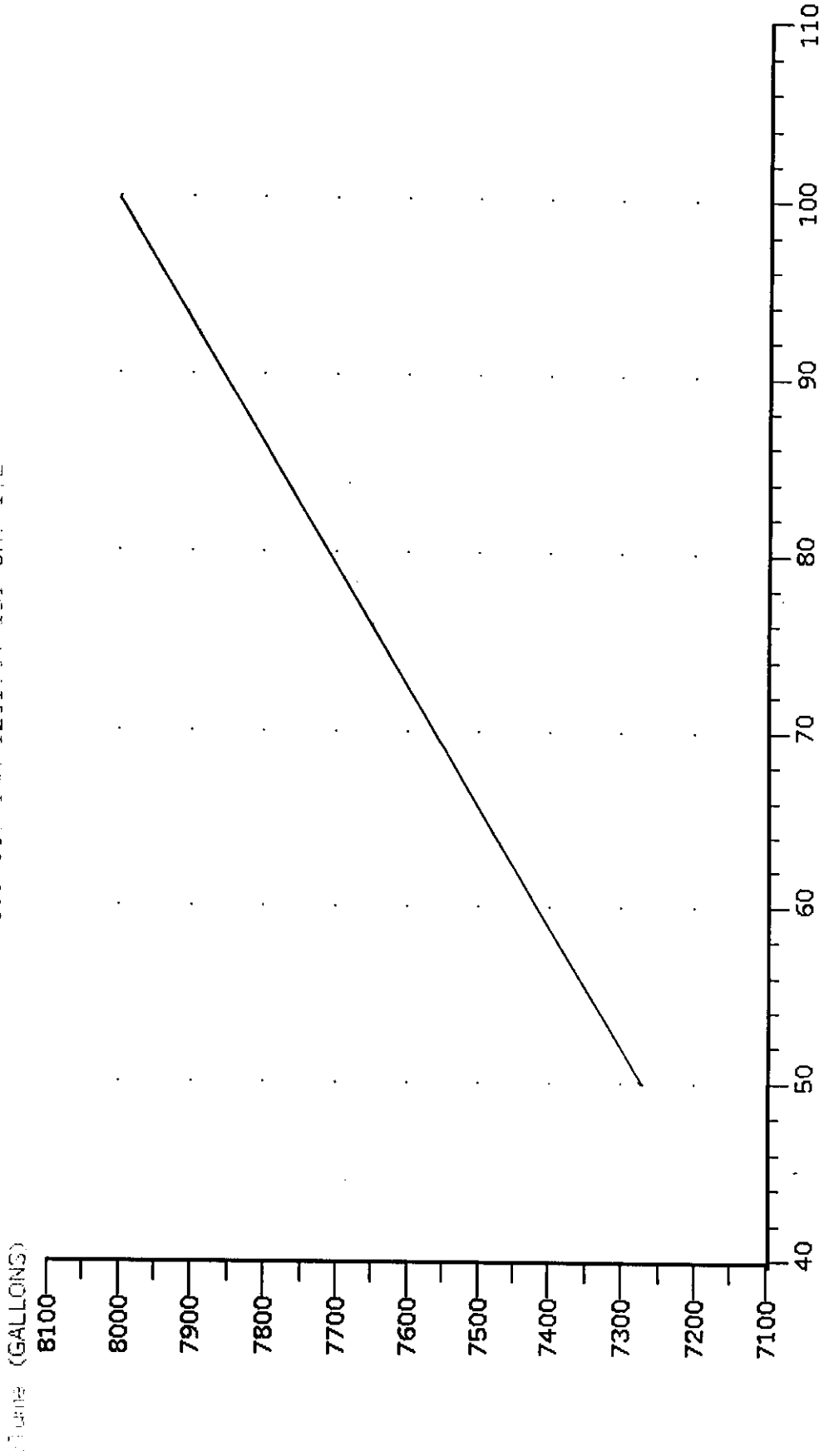
1.47 A

1.47 B

SPDS

### HI Cold Leg Accumulator Indicated Volume

Source: CRM-1201.04-151 Sh. 1.2



Indicated Level (inches)

C\_Leg\_A2

PREV

CANC

F1= CLEAR

F2=

F3=

F4=

F5=

F6=