

Fort Calhoun Station  
Unit No. 1

## SS-ST-SI-3015

### SURVEILLANCE TEST

Title: SAFETY INJECTION TANK DISCHARGE CHECK VALVES  
TEST

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Setpoint/Procedure  
Form Number (FC-68): 38552

Reason for Change: To improve the safety injection tank  
discharge check valves test by  
revising the initial conditions and  
by providing individual acceptance  
criteria for each tank.

Contact Person: Ron Lippy

9209140171 920903  
PDR ADOCK 05000285  
PDR

ISSUED: 06-12-92 4:00 pm

R5

SAFETY INJECTION TANK DISCHARGE CHECK VALVES TEST

SAFETY RELATED

1.0 PURPOSE

- 1.1 To satisfy in part, each refueling outage, the requirements of Technical Specifications 3.3(1)a for the following check valves:

SI-207	SI-211	SI-215	SI-219
SI-208	SI-212	SI-216	SI-220

2.0 REFERENCES

2.1 Technical Specifications:

- 2.1.1: Reactor Coolant System
- 2.8: Refueling Operations
- 3.3: Reactor Coolant System and Other Components  
Subject to ASME XI Boiler and Pressure Vessel  
Code Inspection and Testing Surveillance
- 3.6(4): Safety Injection and Containment Spray  
Systems Tests

2.2 Fort Calhoun Station Inservice Inspection (ISI)  
Program Plan

2.3 Standing Order G-23, Surveillance Test Program

2.4 Operating Instructions:

- OI-NG-1: Nitrogen System - Normal Operation
- OI-SI-1: Safety Injection System - Normal  
Operation

2.5 P&ID:

- E-23866-210-130 (Sh 2): Safety Injection and  
Containment Spray System (File No. 10480)
- E-23866-210-110: Reactor Coolant System  
(File No. 10475)
- 11405-M-42: Nitrogen Flow Diagram (File No. 10450)
- 11405-A-13: Primary Plant Diagram (File No. 12170)

2.6 Instrumentation and Control Interconnect Diagrams

- 161F561 SHT. 83 File No. 9581
- 161F561 SHT. 84 File No. 9582
- 161F561 SHT. 85 File No. 9583
- 161F561 SHT. 86 File No. 9584
- 161F561 SHT. 99 File No. 9597
- 161F561 SHT. 100 File No. 9598
- 161F561 SHT. 101 File No. 9599
- 161F561 SHT. 102 File No. 9600

2.7 Instrument Loop Drawings

- EM-2901 File No. 20574
- EM-2904 File No. 20592
- EM-2921 File No. 20575
- EM-2924 File No. 20593
- EM-2941 File No. 20576
- EM-2944 File No. 20594
- EM-2961 File No. 20577
- EM-2964 File No. 20595

2.8 USAR:

- 6.2: Safety Injection System

2.9 Calculation:

- FC-05280
- FC-05428, Rev. 1

2.10 Surveillance and Calibration Procedures

- CP-106, Pressurizer Level
- IC-ST-RC-0004, Channel Calibration of Pressurizer Level Instrument Channel L-101X. (If LIC-101X is used)

- 2.10 • IC-ST-RC-0005, Channel Calibration of Pressurizer level Instrument Channel L-101Y. (If LIC-101Y is used)
- IC-ST-SI-0005, Channel Calibration of SI-Tank SI-6A Nitrogen Pressure, Loop P-2901
  - IC-ST-SI-0008, Channel Calibration of SI Tank SI-6A Wide Range Level, Loop P-2904X
  - IC-ST-SI-0011, Channel Calibration of SI Tank SI-6B Nitrogen Pressure, Loop P-2921
  - IC-ST-SI-0014, Channel Calibration of SI Tank SI-6B Wide Range Level, Loop P-2924X
  - IC-ST-SI-0017, Channel Calibration of SI Tank SI-6C Nitrogen Pressure, Loop P-2941
  - IC-ST-SI-0020, Channel Calibration of SI Tank SI-6C Wide Range Level, Loop P-2944X
  - IC-ST-SI-0023, Channel Calibration of SI Tank SI-6D Nitrogen Pressure, Loop P-2961
  - IC-ST-SI-0026, Channel Calibration of SI Tank SI-6D Wide Range Level, Loop P-2964X

2.11 Technical Data Book

- TDB-III.20 Page 1



### 3.0 DEFINITIONS

SIT - Safety Injection Tank

PT-1 and PT-2 - Points on SIT level trace where SIT Isolation valve is >90% (as determined by valve stroke time). PT-1 and PT-2 represent a period of time when the valve is fully open and fluid is flowing through the check valve at approximately its maximum velocity with the SIT Isolation Valve fully open. PT-1 represents an arbitrary beginning time and PT-2 is an arbitrary end time (usually 1 - 10 secs after PT-1). The time interval between PT-1 and PT-2 is used for calculation for fluid flowrate.

- PT-5 - Point midway between PT-1 and PT-2
- $L_R$  - Level in Reactor Refueling Cavity (in %)
- $L_{PT-1}$  - Level of SIT at PT-1 (in feet)
- $L_{PT-2}$  - Level of SIT at PT-2 (in feet)
- $L_{V1}$  - Level of SIT at PT-1 (in volts)
- $L_{V2}$  - Level of SIT at PT-2 (in volts)
- $L_{V5}$  - Level of SIT at PT-5 (in volts)
- $\Delta L$  - SIT Level change during the time period between PT-1 and PT-2 (in feet)
- D - Distance between PT-1 and PT-2 (in mm on the strip chart)
- S - Strip Chart Speed (in mm/sec)
- R - Rate of SIT level change (in ft/sec)
- Q - Calculated flow rate (in gpm)
- $P_{PT-5}$  - Total pressure in SIT at time PT-5 (in psig)
- $P_{V5}$  - Gas pressure in SIT at PT-5 (in volts)
- $P_g$  - Gas pressure in SIT at PT-5 (in psig)
- $P_H$  - Head pressure due to level in SIT plus the difference in elevation from the lower SIT level tap to the top of reactor vessel flange (in psig)
- $P_R$  - Head pressure due to reactor vessel cavity level (in psig)

### 3.0 DEFINITIONS (Continued)

- AP - Difference in pressure between  $P_{PT-5}$  and  $P_R$   
(in psi)
- $C_v$  - Flow Coefficient

### 4.0 EQUIPMENT LIST

#### 4.1 TEST EQUIPMENT REQUIRED/USED:

**NOTE:** During the course of this procedure, some portable or temporary test equipment may be used to prove operability of a plant component. All such equipment must be entered into the appropriate I&C Instrument Log.

<u>EQUIPMENT</u>	<u>CALIBRATION</u>		<u>INITIALS/DATE</u>
	<u>OPPD NO./</u>	<u>DUE DATE</u>	
LI-106	N/A /		/
PT-2901	N/A /		/
LT-2904X	N/A /		/
PT-2921	N/A /		/
LT-2924X	N/A /		/
PT-2941	N/A /		/
LT-2944X	N/A /		/
PT-2961	N/A /		/
LT-2964X	N/A /		/
Strip Chart Recorder	/		/
	/		/
	/		/

### 5.0 PRECAUTIONS AND LIMITATIONS

- 5.1 All anomalies and deficiencies shall be reported immediately to the Shift Supervisor and noted in the Remarks Section. An immediate check shall be made to verify Limiting Conditions for Operation per Technical Specifications, have not been exceeded.
- 5.2 A Maintenance Work Request (MWR) shall be initiated to correct any reported deficiency and the MWR number shall be referenced on the Comment Sheet/Chronological Log.

- 5.3 Test data shall be evaluated by the Special Services Engineer (SS) AND reviewed by the Shift Supervisor for acceptability within 24 hours following completion of this test.
- 5.4 The System Engineer shall be notified within 24 hours of the completion of this test of any marginal, unexpected, or unacceptable results.
- 5.5 The use of N/A (not applicable) in this procedure shall be in accordance with the requirements listed in Standing Order G-23.
- 5.6 The completed Surveillance Test procedure and all applicable attachments shall be signed and dated by the person(s) who actually performed the test.
- 5.7 To prevent overflow of the Reactor Refueling Cavity and to provide adequate Radiological Shielding in the event of a crud burst, the Reactor Refueling Cavity level must be between 40% and 50% as indicated on LI-106 at the beginning of this test. If LI-106 is unavailable, the Reactor Refueling Cavity must be between 1032 ft and 1034 ft as indicated on LI-199 at the beginning of this test.
- 5.8 All steps in this procedure shall be conducted in sequence written unless otherwise noted.
- 5.9 If the procedure becomes contaminated or damaged, the "Lead Person" or designee shall ensure that all data, verifications, or other pertinent information is transcribed to another copy of the procedure, which will become the official copy.
- 5.10 An Incident Report shall be initiated, in accordance with SO-R-4, to report any anomalies or deficiencies. The Incident Report number shall be recorded on the Comment sheet/Chronological Log.
- 5.11 No maintenance shall be conducted within this Surveillance Test other than that specifically directed by this procedure.

6.0 INITIAL CONDITIONS

INITIALS/DATE

NOTE: The Initial Conditions may be performed in any sequence.

6.1 Procedure revision verification

Master Revision No. \_\_\_\_\_ / \_\_\_\_\_

INITIALS/DATE

6.2 No other test is in progress which could potentially affect this test, or if this test were performed, could have an effect on that test.

\_\_\_\_\_ / \_\_\_\_\_

6.3 Calibration of test equipment has been verified and procedures listed below have been satisfactorily completed prior to test.

\_\_\_\_\_ / \_\_\_\_\_

<u>PROCEDURE</u>	<u>DATE COMPLETED</u>
CP-106 (WP-005056)*	_____
IC-ST-SI-0005	_____
IC-ST-SI-0008	_____
IC-ST-SI-0011	_____
IC-ST-SI-0014	_____
IC-ST-SI-0017	_____
IC-ST-SI-0020	_____
IC-ST-SI-0023	_____
IC-ST-SI-0026	_____

\_\_\_\_\_ / \_\_\_\_\_  
\_\_\_\_\_ / \_\_\_\_\_  
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\_\_\_\_\_ / \_\_\_\_\_  
\_\_\_\_\_ / \_\_\_\_\_

\* NOTE: At the discretion of the Test Coordinator, LI-199 may be used as an alternate level indication for LI-106. Note the Comment Sheet/Chronological Log if this is used.

6.4 A prejob briefing has been conducted prior to the start of this test. ALL personnel participating in the performance of this test have read AND understand the procedure AND have completed the Surveillance Test Signature Sheet.

\_\_\_\_\_ / \_\_\_\_\_

6.5 Control power is available for valve operation.

\_\_\_\_\_ / \_\_\_\_\_

6.6 Safety Injection Tank levels are between 85% and 90%.

\_\_\_\_\_ / \_\_\_\_\_

6.7 Shutdown cooling is not in service.

\_\_\_\_\_ / \_\_\_\_\_

6.8 The Reactor Vessel Head has been removed and core off-loaded.

\_\_\_\_\_ / \_\_\_\_\_

6.9 The pressurizer is vented or the manway removed (Pressurizer pressure is the same as Containment pressure).

\_\_\_\_\_ / \_\_\_\_\_

INITIALS/DATE

- 6.10 Notify Radiation Protection prior to the start of this test due to the possibility of increasing airborne radiation in containment. \_\_\_\_\_ / \_\_\_\_\_
- 6.11 The Reactor Refueling Cavity level is between 40% and 50% as indicated on LI-106. If LI-106 is unavailable the reactor refueling cavity level should be between 1032 ft and 1034 ft elevation on LI-199 sightglass. \_\_\_\_\_ / \_\_\_\_\_
- 6.12 Ensure the Strip Chart Recorder is loaded with paper graduated in square centimeters. \_\_\_\_\_ / \_\_\_\_\_
- 6.13 If test instrumentation or temporary equipment is expected to be installed for greater than 24 hours, ensure the requirements of SO-O-25 are met. \_\_\_\_\_ / \_\_\_\_\_
- 6.14 Complete the activities in Attachment 8 to fill and vent the Safety Injection Tanks, as required.
- 6.15 Notify Chemistry prior to start to coordinate containment sampling as needed support containment releases. \_\_\_\_\_ / \_\_\_\_\_
- 6.16 Ensure that the instrument lines to the level transmitter for each S.I. Tank have been flushed and filled prior to the test. \_\_\_\_\_ / \_\_\_\_\_
- 6.17 Shift Supervisor authorizes performance of this test.

I&C

Shift Supervisor \_\_\_\_\_ Date/Time \_\_\_\_\_ / \_\_\_\_\_

7.0 PROCEDURE

NOTE: Step 7.1 through 7.4 may be performed in any order at the discretion of the Shift Supervisor. In order to decrease the time between each test, the determination of the flow coefficient ( $C_v$ ) for each tank need not be completed until all four safety injection tanks have been discharged. (This calculation is located in Steps 18 through 25.1 in Attachments 1, 2, 3, and 4.

- 7.1 Test SI-6A Discharge Check  
Valves SI-219 and SI-220 per  
Attachment 1. \_\_\_\_\_ / \_\_\_\_\_



INITIALS/DATE

- 7.2 Test SI-6B Discharge Check  
Valves SI-215 and SI-216 per  
Attachment 2.
- 7.3 Test SI-6C Discharge Check  
Valves SI-207 and SI-208 per  
Attachment 3.
- 7.4 Test SI-6D Discharge Check  
Valves SI-211 and SI-212 per  
Attachment 4.
- 7.5 Position FH-11 as directed by Shift  
Supervisor.

OPS

REMARKS

Completed by \_\_\_\_\_ Date/Time \_\_\_\_\_ / \_\_\_\_\_

8.0 RESTORATION

- 8.1 Shift Supervisor notified this test is completed.

Shift Supervisor \_\_\_\_\_ Date/Time \_\_\_\_\_ / \_\_\_\_\_

9.0 ACCEPTANCE CRITERIA

- 9.1 The Flow Coefficients ( $C_v$ ) calculated in Attachments 1 through 4 are greater than or equal to the values below:

<u>Tank</u>	<u>Minimum <math>C_v</math></u>
SI-6A	1189
SI-6B	1164
SI-6C	1132
SI-6D	1159

This satisfies the ISI requirement that the discharge check valves were full-stroked open. Acceptance criteria based on Reference 2.9.

10.0 TEST RECORD

- 10.1 This entire procedure.
- 10.2 Attach Strip Charts to this procedure.



11.0 REVIEW

- 11.1 The Supervisor-Special Services is responsible for ensuring this completed surveillance is reviewed in a timely manner and forwarded in accordance with SO-G-23.

Test data shall be evaluated by the Special Services Engineer and reviewed by the Shift Supervisor for acceptability within 24 hours of the completion of this test.

Evaluated by \_\_\_\_\_ Date/Time \_\_\_\_\_ / \_\_\_\_\_  
SS Engr

Reviewed by \_\_\_\_\_ Date/Time \_\_\_\_\_ / \_\_\_\_\_  
Shift Supervisor

- 11.2 The Supervisor-Special Services is responsible for ensuring this test is evaluated and reviewed in a timely manner then forwarded in accordance with SO-G-23.

- 11.2.1 The ISI Coordinator is responsible for reviewing this test to ensure compliance with the FCS ISI Program Plan. This test has been reviewed and found acceptable or the deficiencies have been noted in the Remarks Section.

REMARKS \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

ISI Coordinator \_\_\_\_\_ Date/Time \_\_\_\_\_ / \_\_\_\_\_

11.3 The Supervisor-System Engineering is responsible for ensuring this Surveillance Test is evaluated by the System Engineer in a timely manner and forwarded in accordance with SO-G-23.

11.3.1 The System Engineer is responsible for reviewing the test data and the identified deficiencies noted within the test. This test has been reviewed and found acceptable or deficiencies and actions taken have been noted in the Remarks Section.

REMARKS \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
System Engineer \_\_\_\_\_ Date/Time \_\_\_\_\_ / \_\_\_\_\_

ATTACHMENT 1  
(SI-219 AND SI-220)

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SAFETY RELATED

PROCEDURE

INITIALS/DATE

NOTE: Steps 1 through 10 can be performed in any sequence, but prior to Step 11.

NOTE: This attachment will raise the reactor refueling cavity level by approximately 2% from a 90% initial SIT level.

1. Record the "As Found" position of the following valves, **THEN** Close.

<u>Valve</u>	<u>As Found</u>
HCV-311	_____
HCV-312	_____
HCV-327	_____

\_\_\_\_\_  
OPS

NOTE: Control Room Indication of SI-6A level is to be used for Step 2.0.

2. Ensure that Safety Injection Tank SI-6A level is between 85% and 90% as indicated on LI-2904X and record.

SI-6A Level \_\_\_\_\_ %  
(85% to 90%)

\_\_\_\_\_  
OPS

3. Record the Reactor Refueling Cavity level ( $L_R$ ) as indicated on LI-106.

Reactor Refueling Cavity Level ( $L_R$ )

\_\_\_\_\_ %

\_\_\_\_\_  
OPS

N/A this step if LI-199 is used.

4. If LI-106 is unavailable, ensure the Reactor Refueling Cavity is between 1032 and 1034 ft elevation as indicated on the LI-199 sightglass.

Reactor Refueling Cavity Level

\_\_\_\_\_ ft  
(1032 ft to 1034 ft)

\_\_\_\_\_  
OPS

N/A this step if LI-106 is used.

ATTACHMENT 1  
(Continued)

Page 2 of 7

INITIALS/DATE

5. Use Table 1 in Attachment 5 to determine the test pressure for SI-6A based on the tank level recorded in Step 2. Use the pressure that corresponds to the tank level rounded down to the nearest whole percent.

SI-6A Test Pressure \_\_\_\_\_ psig

NOTE: Control Room Indication of SI-6A pressure is to be used for Step 6.0.

6. Set pressure of Safety Injection Tank SI-6A as indicated on PT-2901 to pressure recorded in Step 8. N/A if not required.

OPS

7. Strip Chart Recorder hooked up as per Attachment 6.

I&C

8. Connect the Strip Chart Recorder to the Safety Injection Tank SI-6A ERF computer input terminals located in cabinet PC-15.

- 8.1 To record SI-6A pressure, connect one channel to terminals:

TB402-15(-)

TB402-16(+)

I&C

Independent Verification

I&C

- 8.2 To record SI-6A level, connect one channel to terminals:

TB401-15(-)

TB401-16(+)

I&C

Independent Verification

I&C

9. Adjust Strip Chart Recorder Speed (S) to 10 mm/sec, or as desired, and record.

(S) = \_\_\_\_\_ mm/sec

I&C

ATTACHMENT 1  
(Continued)

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INITIALS/DATE

10. Ensure that FH-11 is closed.

OPS /

11. Start the Strip Chart Recorder.

I&C /

12. Open HCV-2914 AND Mark the Strip Chart to indicate the start of the test (T=0) when HCV-2914 begins to open.

OPS /

NOTE: HCV-2914 takes approximately 55 seconds to open. When HCV-2914 is full open, only the red light will be on.

13. WHEN HCV-2914 indicates full open, Wait approximately 10 seconds, THEN close HCV-2914.

OPS /

NOTE: When HCV-2914 is closed only the green light is on.

14. WHEN HCV-2914 indicates closed, THEN stop the Strip Chart Recorder.

I&C /

15. Return valves in Step 1 to "As Found" position or as directed by the Shift Supervisor.

OPS /

16. Restore Safety Injection Tank SI-6A to service as directed by the Shift Supervisor.

OPS /

17. Remove Strip Chart Recorder from the following ERF Computer terminals:

TB401-15(-)  
TB401-16(+)  
TB402-15(-)  
TB402-16(+)

I&C /

Independent Verification

I&C /

ATTACHMENT 1  
(Continued)

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INITIALS/DATE

18. Record the following information on the Strip Recorder Chart:

- 18.1 Surveillance Test Number
- 18.2 Attachment Number
- 18.3 Safety Injection Tank Number
- 18.4 Date
- 18.5 Chart Speed (mm/sec)
- 18.6 Pressure Trace
- 18.7 Pressure Scale (psig/volt)
- 18.8 Level Trace
- 18.9 Level Scale (ft/volt)
- 18.10 Start of test ( $t=0$ )
- 18.11 Segment of pressure and level traces when HCV-2914 is >90% open: First Point (PT-1), Second Point (PT-2)
- 18.12 Point (PT-5) on the pressure and level traces halfway between PT-1 and PT-2.

\_\_\_\_\_ /

19. Measure and record the chart run along the trace (D) between PT-1 and PT-2.

D=\_\_\_\_\_mm

\_\_\_\_\_ /

20. Record the level change ( $\Delta L$ ) in SI-6A between PT-1 and PT-2 when HCV-2914 was >90% open.

- 20.1 Determine the level ( $L_{PT-1}$ ) of SI-6A at PT-1.

$$L_{PT-1} = LV_1 \text{ (volts)} \times 3.6042 \text{ ft/volt}$$

$$L_{PT-1} = \text{_____} \times 3.6042 \text{ ft/volt}$$

$$L_{PT-1} = \text{_____} \text{ ft}$$

\_\_\_\_\_ /

- 20.2 Determine the level ( $L_{PT-2}$ ) of SI-6A at PT-2.

$$L_{PT-2} = LV_2 \text{ (volts)} \times 3.6042 \text{ ft/volt}$$

$$L_{PT-2} = \text{_____} \times 3.6042 \text{ ft/volt}$$

$$L_{PT-2} = \text{_____} \text{ ft}$$

\_\_\_\_\_ /



ATTACHMENT 1  
(Continued)

Page 5 of 7

INITIALS/DATE

20.3 Calculate  $\Delta L$  for SI-6A.

$$\Delta L = L_{PT-1} - L_{PT-2} \text{ ft}$$

$$\Delta L = \underline{\hspace{2cm}} - \underline{\hspace{2cm}} \text{ ft}$$

$$\Delta L = \underline{\hspace{2cm}} \text{ ft}$$

21. Determine the tank level Rate of Change (R) for SI-6A.

$$R = (\Delta L \div D) \times S \text{ ft/sec}$$

$$R = (\underline{\hspace{2cm}} \div \underline{\hspace{2cm}}) \times \underline{\hspace{2cm}} \text{ ft/sec}$$

$$R = \underline{\hspace{2cm}} \text{ ft/sec}$$

Where: S = chart speed recorded in  
Step 9 (mm/sec)

D = chart run recorded in  
Step 19 (mm)

22. Calculate the flowrate (Q) from SI-6A through check valves SI-219 and SI-220 (based on a 10 second average when HCV-2914 is >90% open).

$$Q = R \times 530.24 \text{ gal/ft} \times 60 \text{ sec/min}$$

$$Q = R \times 31,814.4 \text{ gal/min}$$

$$Q = \underline{\hspace{2cm}} \times 31,814.4 \text{ gal/min}$$

$$Q = \underline{\hspace{2cm}} \text{ GPM}$$

23. Determine the pressure ( $P_{PT-5}$ ) of SI-6A at PT-5.

23.1 Determine the gas pressure ( $P_g$ ) in SI-6A at PT-5.

$$P_g = PV_5 \text{ (volts)} \times 75 \text{ psig/volt}$$

$$P_g = \underline{\hspace{2cm}} \times 75 \text{ psig/volt}$$

$$P_g = \underline{\hspace{2cm}} \text{ psig}$$

ATTACHMENT 1  
(Continued)

Page 6 of 7

INITIALS/DATE

- 23.2 Determine the head pressure ( $P_H$ ) due to the level in SI-6A at PT-5.

$$P_H = (LV_5 \text{ (volts)} \times 3.6042 \text{ ft/volt} \times .434 \text{ psig/ft}) + 2.42 \text{ psig}$$

$$P_H = (LV_5 \text{ (volts)} \times 1.56) + 2.42 \text{ psig}$$

$$P_H = (\text{_____} \times 1.56) + 2.42 \text{ psig}$$

$$P_H = \text{_____} \text{ psig}$$

2.42 = head pressure from 0% level in SI-6A at the Reactor Vessel Flange level (psig)

- 23.3 Calculate the total pressure ( $P_{PT-5}$ ) of SI-6A at PT-5.

$$P_{PT-5} = P_g + P_H \text{ psig}$$

$$P_{PT-5} = \text{_____} + \text{_____} \text{ psig}$$

$$P_{PT-5} = \text{_____} \text{ psig}$$

24. Determine the head pressure ( $P_R$ ) due to the reactor refueling cavity level.

$$P_R = [(L_R(\%) \times 20) + 11] \times .434 \text{ psig/ft}$$

$$P_R = (L_R \times 8.68) + 4.77 \text{ psig}$$

$$P_R = (\text{_____} \times 8.68) + 4.77 \text{ psig}$$

$$P_R = \text{_____} \text{ psig}$$

Where:

$L_R$  = Reactor Cavity level recorded in Step 3 (%).

20 = distance between LI-106 0% and 100% level taps (ft). If LI-199 is used, refer to Attachment 7 for cavity level.

11 = height of 0% level tap above Reactor Vessel Flange (ft)

- 24.1 Determine  $\Delta P$  for SI-6A at PT-5

$$\Delta P = P_{PT-5} - P_R \text{ psid}$$

$$\Delta P = \text{_____} - \text{_____} \text{ psid}$$

$$\Delta P = \text{_____} \text{ psid}$$

INITIALS/DATE

$$C_v = Q \div (\Delta P)^{1/2}$$

$$C_v = \frac{\text{_____}}{\text{_____}} \div (\text{_____})^{1/2}$$

$$C_y =$$

Where:  $Q$  = flowrate calculated in Step 22 \_\_\_\_\_ /

REMARKS \_\_\_\_\_

Completed by \_\_\_\_\_ Date/Time \_\_\_\_\_ / \_\_\_\_\_

ATTACHMENT 2  
(SI-215 AND SI-216)

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PROCEDURE

INITIALS/DATE

**NOTE:** Steps 1 through 10 can be performed in any sequence, but prior to Step 11.

**NOTE:** This attachment will raise the reactor refueling cavity level by approximately 2% from a 90% initial SIT level.

1. Record the "As Found" position of the following valves, **THEN** Close.

<u>Valve</u>	<u>As Found</u>
HCV-314	_____
HCV-315	_____
HCV-329	_____

\_\_\_\_\_/\_\_\_\_\_  
OPS

**NOTE:** Control Room indication of SI-6B level is to be used for Step 2.0.

2. Ensure that Safety Injection Tank SI-6B level is between 85% and 90% as indicated on LI-2924X and record.

SI-6B Level \_\_\_\_\_ %  
(85% to 90%)

\_\_\_\_\_/\_\_\_\_\_  
OPS

3. Record the Reactor Refueling Cavity Level ( $L_R$ ) as indicated on LI-106.

Reactor Refueling Cavity Level ( $L_R$ )  
\_\_\_\_\_ %

\_\_\_\_\_/\_\_\_\_\_  
OPS

N/A this step if LI-199 is used

4. Record the Reactor Refueling Cavity Level as indicated on LI-199 Sightglass

Reactor Refueling Cavity Level ( $L_R$ )  
\_\_\_\_\_ ft

\_\_\_\_\_/\_\_\_\_\_  
OPS

N/A if LI-106 is used.

5. Use Table 1 in Attachment 5 to determine the test pressure for SI-6B based on the tank level recorded in Step 2. Use the pressure that corresponds to the Tank Level rounded down to the nearest whole percent.

SI-6B Test Pressure \_\_\_\_\_ psig

ATTACHMENT 2  
(Continued)

Page 2 of 7

INITIALS/DATE

NOTE: Control Room indication for SI-6B pressure is to be used for Step 6.0.

6. Set pressure of Safety Injection Tank SI-6B as indicated on PT-2921 to pressure recorded in Step 5. N/A if not required.

OPS

7. Strip Chart Recorder hooked up as per Attachment 6.

I&C

8. Connect the Strip Chart Recorder to the Safety Injection Tank SI-6B ERF computer input terminals located in cabinet PC-15.

- 8.1 To record SI-6B pressure, connect one channel to terminals:

TB402-17(-)

TB402-18(+)

I&C

Independent Verification

I&C

- 8.2 To record SI-6B level, connect one channel to terminals:

TB401-17(-)

TB401-18(+)

I&C

Independent Verification

I&C

9. Adjust Strip Chart Recorder Speed (S) to 10 mm/sec, or as desired, and record.

(S) = \_\_\_\_\_ mm/sec

I&C

10. Ensure that FH-11 is closed.

OPS

11. Start the Strip Chart Recorder.

I&C

12. Open HCV-2934 AND Mark the Strip Chart to indicate the start of the test (T=0) when HCV-2934 begins to open.

OPS

ATTACHMENT 2  
(Continued)

Page 3 of 7

INITIALS/DATE

NOTE: HCV-2934 takes approximately 55 seconds to open. When HCV-2934 is full open only the red light will be on.

13. WHEN HCV-2934 indicates full open, Wait approximately 10 seconds, THEN close HCV-2934.

OPS

NOTE: When HCV-2934 is closed only the green light will be on.

14. WHEN HCV-2934 indicates closed, THEN stop the Strip Chart Recorder.

I&C

15. Return valves in Step 1 to "As Found" position or as directed by the Shift Supervisor.

OPS

16. Restore Safety Injection Tank SI-6B to service as directed by the Shift Supervisor.

OPS

17. Remove Strip Chart Recorder from the following ERF Computer terminals:

TB401-17(-)

TB401-18(+)

TB402-17(-)

TB402-18(+)

I&C

Independent Verification

I&C

18. Record the following information on the Strip Recorder Chart:

- 18.1 Surveillance Test Number
- 18.2 Attachment Number
- 18.3 Safety Injection Tank Number
- 18.4 Date
- 18.5 Chart Speed (mm/sec)
- 18.6 Pressure Trace
- 18.7 Pressure Scale (psig/volt)
- 18.8 Level Trace
- 18.9 Level Scale (ft/volt)
- 18.10 Start of test (T=0)
- 18.11 Segment of pressure and level traces when HCV-2934 is >90% open: First Point (PT-1), Second Point (PT-2)
- 18.12 Point (PT-5) on the pressure and level traces halfway between PT-1 and PT-2.



ATTACHMENT 2  
(Continued)

Page 4 of 7

INITIALS/DATE

19. Measure and record the chart run along the trace (D) between PT-1 and PT-2.

D = \_\_\_\_\_ mm

\_\_\_\_\_/\_\_\_\_

20. Record the level change ( $\Delta L$ ) in SI-6B between PT-1 and PT-2 when HCV-2934 was >90% open.

- 20.1 Determine the level ( $L_{PT-1}$ ) of SI-6B at PT-1.

$L_{PT-1} = LV_1 \text{ (volts)} \times 3.6042 \text{ ft/volt}$

$L_{PT-1} = \text{_____} \times 3.6042 \text{ ft/volt}$

$L_{PT-1} = \text{_____} \text{ ft}$

\_\_\_\_\_/\_\_\_\_

- 20.2 Determine the level ( $L_{PT-2}$ ) of SI-6B at PT-2.

$L_{PT-2} = LV_2 \text{ (volts)} \times 3.6042 \text{ ft/volts}$

$L_{PT-2} = \text{_____} \times 3.6042 \text{ ft/volts}$

$L_{PT-2} = \text{_____} \text{ ft}$

\_\_\_\_\_/\_\_\_\_

- 20.3 Calculate  $\Delta L$  for SI-6B.

$\Delta L = L_{PT-1} - L_{PT-2} \text{ ft}$

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

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

\_\_\_\_\_/\_\_\_\_

21. Determine the tank level Rate of Change (R) for SI-6B.

$R = (\Delta L \div D) \times S \text{ ft/sec}$

$R = (\text{_____} \div \text{_____}) \times \text{_____} \text{ ft/sec}$

$R = \text{_____} \text{ ft/sec}$

Where: S = chart speed recorded in  
Step 9 (mm/sec)

D = chart run recorded in  
Step 19 (mm)

\_\_\_\_\_/\_\_\_\_

INITIALS/DATE

22. Calculate the flowrate (Q) from SI-6B through check valves SI-215 and SI-216 (based on a 10 second average when HCV-2934 is >90% open).

$$Q = R \times 530.24 \text{ gal/ft} \times 60 \text{ sec/min}$$

$$Q = R \times 31,814.4 \text{ gal/min}$$

$$Q = \underline{\hspace{2cm}} \times 31,814.4 \text{ gal/min}$$

Q = \_\_\_\_\_ GPM

23. Determine the pressure ( $P_{PT-5}$ ) of SI-6B at PT-5.

- 23.1 Determine the gas pressure ( $P_g$ ) in SI-6B at PT-5.

$$P_g = PV_5 \text{ (volts)} \times 75 \text{ psig/volt}$$

$$P_g = \underline{\hspace{2cm}} \times 75 \text{ psig/volt}$$

$P_a =$  \_\_\_\_\_ psig

- 23.2 Determine the head pressure ( $P_H$ ) due to the level in SI-6B at PT-5.

$$P_H = (LV_5 \text{ (volts)} \times 3.6042 \text{ ft/volt} \times .434 \text{ psig/ft}) + 2.42 \text{ psig}$$

$$P_H = (LV_5 \text{ (volts)} \times 1.56) + 2.42 \text{ psig}$$

$$P_H = (\text{_____} \times 1.56) + 2.42 \text{ psig}$$

$P_H =$  \_\_\_\_\_ psig

2.42 = head pressure from 0% level in  
SI-6B at the Reactor Vessel Flange  
level (psig)

- 23.3 Calculate the total pressure ( $P_{PT-5}$ ) of SI-6B at PT-5.

$$P_{PT-5} = P_G + P_H \text{ psig}$$

$$P_{PT+5} = \text{_____} + \text{_____} \text{ psig}$$

P<sub>PT-5</sub> = \_\_\_\_\_ psia

ATTACHMENT 2  
(Continued)

Page 6 of 7

INITIALS/DATE

24. Determine the head pressure ( $P_R$ ) due to the reactor refueling cavity level.

$$P_R = [(L_R(\%) \times 20) + 11] \times .434 \text{ psig/ft}$$

$$P_R = (L_R \times 8.68) + 4.77 \text{ psig}$$

$$P_R = (\text{_____} \times 8.68) + 4.77 \text{ psig}$$

$$P_R = \text{_____} \text{ psig}$$

Where:

$L_R$  = Reactor Cavity level recorded in Step 3 (%).

20 = distance between LI-106 0% and 100% level taps (ft). If LI-199 is used, refer to Attachment 7 for Cavity Level.

11 = height of 0% level tap above Reactor Vessel Flange (ft)

- 24.1 Determine  $\Delta P$  for SI-6B at PT-5

$$\Delta P = P_{PT-5} - P_R \text{ psid}$$

$$\Delta P = \text{_____} - \text{_____} \text{ psid}$$

$$\Delta P = \text{_____} \text{ psid}$$

## Page 7 of 7

INITIALS/DATE

$$C_v = Q + (\Delta P)^{1/2}$$

$$C_v = \frac{\text{_____}}{\text{_____}} + (\text{_____})^{1/2}$$

$$C_v = \frac{m}{M} \frac{R}{\gamma - 1}$$

Where: Q = flowrate calculated in Step 22 \_\_\_\_\_ / \_\_\_\_\_

REMARKS \_\_\_\_\_

Completed by \_\_\_\_\_ Date/Time \_\_\_\_\_ / \_\_\_\_\_

ATTACHMENT 3  
(SI-207 AND SI-208)

Page 1 of 7

PROCEDURE

INITIALS/DATE

NOTE: Steps 1 through 10 can be performed in any sequence, but prior to Step 11.

NOTE: This attachment will raise the reactor refueling cavity level by approximately 2% from a 90% initial SIT level.

1. Record the "As Found" position of the following valves, **THEN** Close.

<u>Valve</u>	<u>As Found</u>
HCV-317	_____
HCV-318	_____
HCV-331	_____

\_\_\_\_\_  
OPS

NOTE: Control Room indication of SI-6C level is to be used for Step 2.0.

2. Ensure that Safety Injection Tank SI-6C level is between 85% and 90% as indicated on LI-2944X and record.

SI-6C Level \_\_\_\_\_ %  
(85% to 90%)

\_\_\_\_\_  
OPS

3. Record the Reactor Refueling Cavity Level ( $L_R$ ) as indicated on LI-106.

Reactor Refueling Cavity Level ( $L_R$ )  
\_\_\_\_\_ %

\_\_\_\_\_  
OPS

N/A this step if LI-199 is used.

4. Record the Reactor Refueling Cavity Level as indicated on LI-199 Sightglass

Reactor Refueling Cavity Level ( $L_R$ )  
\_\_\_\_\_ ft

\_\_\_\_\_  
OPS

N/A if LI-106 is used.

5. Use Table 1 in Attachment 5 to determine the test pressure for SI-6C based on the tank level recorded in Step 2. Use the pressure that corresponds to the tank level rounded down to the nearest whole percent.

SI-6C Test Pressure \_\_\_\_\_ psig

ATTACHMENT 3  
(Continued)

Page 2 of 7

INITIALS/DATE

NOTE: Control Room indication of SI-6C pressure is to be used for Step 6.0.

6. Set pressure of Safety Injection Tank SI-6C as indicated on PT-2941 to pressure recorded in Step 5. N/A if not required.

\_\_\_\_\_/\_\_\_\_\_  
OPS

7. Strip Chart Recorder hooked up as per Attachment 6.

\_\_\_\_\_/\_\_\_\_\_  
I&C

8. Connect the Strip Chart Recorder to the Safety Injection Tank SI-6C ERF computer input terminals located in cabinet PC-15.

- 8.1 To record SI-6C pressure, connect one channel to terminals:

TB402-19(-)

TB402-20(+)

\_\_\_\_\_/\_\_\_\_\_  
I&C

Independent Verification

\_\_\_\_\_/\_\_\_\_\_  
I&C

- 8.2 To record SI-6C level, connect one channel to terminals:

TB401-19(-)

TB401-20(+)

\_\_\_\_\_/\_\_\_\_\_  
I&C

Independent Verification

\_\_\_\_\_/\_\_\_\_\_  
I&C

9. Adjust Strip Chart Recorder Speed (S) to 10 mm/sec, or as desired, and record.

(S) = \_\_\_\_\_ mm/sec

\_\_\_\_\_/\_\_\_\_\_  
I&C

10. Ensure FH-11 is closed.

\_\_\_\_\_/\_\_\_\_\_  
OPS

11. Start the Strip Chart Recorder.

\_\_\_\_\_/\_\_\_\_\_  
I&C

12. Open HCV-2954 AND Mark the Strip Chart to indicate the start of the test (T=0) when HCV-2954 begins to open.

\_\_\_\_\_/\_\_\_\_\_  
OPS



ATTACHMENT 3  
(Continued)

Page 3 of 7

INITIALS/DATE

NOTE: HCV-2954 takes approximately 55 seconds to open. When HCV-2954 is full open only the red light will be on.

13. WHEN HCV-2954 indicates full open, wait approximately 10 seconds, THEN close HCV-2954.

\_\_\_\_\_/\_\_\_\_\_  
OPS

NOTE: When HCV-2954 is closed only the green light will be on.

14. WHEN HCV-2954 indicates closed, THEN stop the Strip Chart Recorder.

\_\_\_\_\_/\_\_\_\_\_  
I&C

15. Return valves in Step 1 to "As Found" position or as directed by the Shift Supervisor.

\_\_\_\_\_/\_\_\_\_\_  
OPS

16. Restore Safety Injection Tank SI-6C to service as directed by the Shift Supervisor.

\_\_\_\_\_/\_\_\_\_\_  
OPS

17. Remove Strip Chart Recorder from the following ERF Computer terminals:

TB401-19(-)

TB401-20(+)

TB402-19(-)

TB402-20(+)

\_\_\_\_\_/\_\_\_\_\_  
I&C

Independent Verification

\_\_\_\_\_/\_\_\_\_\_  
I&C

ATTACHMENT 3  
(Continued)

Page 4 of 7

INITIALS/DATE

18. Record the following information on the Strip Recorder Chart:

- 18.1 Surveillance Test Number
- 18.2 Attachment Number
- 18.3 Safety Injection Tank Number
- 18.4 Date
- 18.5 Chart Speed (mm/sec)
- 18.6 Pressure Trace
- 18.7 Pressure Scale (psig/volt)
- 18.8 Level Trace
- 18.9 Level Scale (ft/volt)
- 18.10 Start of test (T=0)
- 18.11 Segment of pressure and level traces when HCV-2954 is >90% open: First Point (PT-1), Second Point (PT-2)
- 18.12 Point (PT-5) on the pressure and level traces halfway between PT-1 and PT-2.

19. Measure and record the chart run along the trace (D) between PT-1 and PT-2.

D=\_\_\_\_\_mm

20. Record the level change ( $\Delta L$ ) in SI-6C between PT-1 and PT-2 when HCV-2954 was >90% open.

20.1 Determine the level ( $L_{PT-1}$ ) of SI-6C at PT-1.

$L_{PT-1} = LV_1 \text{ (volts)} \times 3.6042 \text{ ft/volt}$

$L_{PT-1} = \text{_____} \times 3.6042 \text{ ft/volt}$

$L_{PT-1} = \text{_____} \text{ ft}$

20.2 Determine the level ( $L_{PT-2}$ ) of SI-6C at PT-2.

$L_{PT-2} = LV_2 \text{ (volts)} \times 3.6042 \text{ ft/volt}$

$L_{PT-2} = \text{_____} \times 3.6042 \text{ ft/volt}$

$L_{PT-2} = \text{_____} \text{ ft}$

ATTACHMENT 3  
(Continued)

Page 5 of 7

INITIALS/DATE

20.3 Calculate  $\Delta L$  for SI-6C.

$$\Delta L = L_{PT-1} - L_{PT-2} \text{ ft}$$

$$\Delta L = \underline{\hspace{2cm}} - \underline{\hspace{2cm}} \text{ ft}$$

$$\Delta L = \underline{\hspace{2cm}} \text{ ft}$$

                    /                    

21. Determine the tank level Rate of Change (R) for SI-6C.

$$R = (\Delta L \div D) \times S \text{ ft/sec}$$

$$R = (\underline{\hspace{2cm}} \div \underline{\hspace{2cm}}) \times \underline{\hspace{2cm}} \text{ ft/sec}$$

$$R = \underline{\hspace{2cm}} \text{ ft/sec}$$

Where: S = chart speed recorded in  
Step 9 (mm/sec)

D = chart run recorded in  
Step 19 (mm)

                    /                    

22. Calculate the flowrate (Q) from SI-6C through check valves SI-207 and SI-208 (based on a 10 second average when HCV-2954 is >90% open).

$$Q = R \times 530.24 \text{ gal/ft} \times 60 \text{ sec/min}$$

$$Q = R \times 31,814.4 \text{ gal/min}$$

$$Q = \underline{\hspace{2cm}} \times 31,814.4 \text{ gal/min}$$

$$Q = \underline{\hspace{2cm}} \text{ GPM}$$

                    /                    

23. Determine the pressure ( $P_{PT-5}$ ) of SI-6C at PT-5.

23.1 Determine the gas pressure ( $P_g$ ) in SI-6C at PT-5.

$$P_g = PV_5 \text{ (volts)} \times 75 \text{ psig/volt}$$

$$P_g = \underline{\hspace{2cm}} \times 75 \text{ psig/volt}$$

$$P_g = \underline{\hspace{2cm}} \text{ psig}$$

                    /

ATTACHMENT 3  
(Continued)

Page 6 of 7

INITIALS/DATE

- 23.2 Determine the head pressure ( $P_H$ ) due to the level in SI-6C at PT-5.

$$P_H = (LV_5 \text{ (volts)} \times 3.6042 \text{ ft/volt} \times .434 \text{ psig/ft}) + 2.42 \text{ psig}$$

$$P_H = (LV_5 \text{ (volts)} \times 1.56) + 2.42 \text{ psig}$$

$$P_H = (\text{_____} \times 1.56) + 2.42 \text{ psig}$$

$$P_H = \text{_____ psig}$$

2.42 = head pressure from 0% level in SI-6C at the Reactor Vessel Flange level (psig)

\_\_\_\_\_ /

- 23.3 Calculate the total pressure ( $P_{PT-5}$ ) of SI-6C at PT-5.

$$P_{PT-5} = P_g + P_H \text{ psig}$$

$$P_{PT-5} = \text{_____} + \text{_____ psig}$$

$$P_{PT-5} = \text{_____ psig}$$

\_\_\_\_\_ /

24. Determine the head pressure ( $P_R$ ) due to the reactor refueling cavity level.

$$P_R = [(L_R(\%) \times 20) + 11 \text{ ft}] \times .434 \text{ psig/ft}$$

$$P_R = (L_R (\%) \times 8.68) + 4.77 \text{ psig}$$

$$P_R = (\text{_____} \times 8.68) + 4.77 \text{ psig}$$

$$P_R = \text{_____ psig}$$

Where:

$L_R$  = Reactor Cavity level recorded in Step 3 (%).

20 = distance between LI-106 0% and 100% level taps (ft). If LI-199 is used, refer to Attachment 7 for Cavity Level.

11 = height of 0% level tap above Reactor Vessel Flange (ft)

\_\_\_\_\_ /

ATTACHMENT 3  
(Continued)

Page 7 of 7

INITIALS/DATE

24.1 Determine  $\Delta P$  for SI-6C at PT-5

$$\Delta P = P_{PT-5} - P_R \text{ psid}$$

$$\Delta P = \underline{\hspace{2cm}} - \underline{\hspace{2cm}} \text{ psid}$$

$$\Delta P = \underline{\hspace{2cm}} \text{ psid}$$

25. Determine the Flow Coefficient ( $C_v$ ) for SI-6C Discharge Piping.

25.1 Determine the Flow Coefficient ( $C_v$ ).

$$C_v = Q \div (\Delta P)^{1/2}$$

$$C_v = \underline{\hspace{2cm}} \div (\underline{\hspace{2cm}})^{1/2}$$

$$C_v = \underline{\hspace{2cm}}$$

Where:  $Q$  = flowrate calculated in step 22

REMARKS \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Completed by \_\_\_\_\_ Date/Time \_\_\_\_\_

ATTACHMENT 4  
(SI-211 AND SI-212)

Page 1 of 7

PROCEDURE

INITIALS/DATE

NOTE: Steps 1 through 10 can be performed in any sequence, but prior to Step 11.

NOTE: This attachment will raise reactor refueling cavity level by approximately 2% from a 90% initial SIT level.

1. Record the "As Found" position of the following valves. **THEN** Close.

<u>Valve</u>	<u>As Found</u>
HCV-320	_____
HCV-321	_____
HCV-333	_____

\_\_\_\_\_  
OPS

NOTE: Control Room indication of SI-6D level is to be used for Step 2.0.

2. Ensure that Safety Injection Tank SI-6D level is between 85% and 90% as indicated on LI-2964X and record.

SI-6D Level \_\_\_\_\_ %  
(85% to 90%)

\_\_\_\_\_  
OPS

3. Record the Reactor Refueling Cavity Level ( $L_R$ ) as indicated on LI-106.

Reactor Refueling Cavity Level ( $L_R$ )  
\_\_\_\_\_ %

\_\_\_\_\_  
OPS

N/A this step if LI-199 is used.

4. Record the Reactor Refueling Cavity Level as indicated on LI-199 Sightglass

Reactor Refueling Cavity Level ( $L_R$ )  
\_\_\_\_\_ ft

\_\_\_\_\_  
OPS

N/A if LI-106 is used.

ATTACHMENT 4  
(Continued)

Page 2 of 7

INITIALS/DATE

5. Use Table 1 in Attachment 5 to determine the test pressure for SI-6D based on the tank level recorded in Step 2. Use the pressure that corresponds to the Tank Level rounded down to the nearest whole percent.

SI-6D Test Pressure \_\_\_\_\_ psig

**NOTE:** Control Room indication of SI-6D pressure is to be used in Step 6.0.

6. Set pressure of Safety Injection Tank SI-6D as indicated on PT-2961 to pressure recorded in Step 5. N/A if not required.

\_\_\_\_\_  
OPS

7. Strip Chart Recorder hooked up as per Attachment 6.

\_\_\_\_\_  
I&C

8. Connect the Strip Chart Recorder to the Safety Injection Tank SI-6D ERF computer input terminals located in cabinet PC-15.

- 8.1 To record SI-6D pressure, connect one channel to terminals:

TB402-21(-)

TB402-22(+)

\_\_\_\_\_  
I&C

Independent Verification

\_\_\_\_\_  
I&C

- 8.2 To record SI-6D level, connect one channel to terminals:

TB401-21(-)

TB401-22(+)

\_\_\_\_\_  
I&C

Independent Verification

\_\_\_\_\_  
I&C

9. Adjust Strip Chart Recorder Speed (S) to 10 mm/sec, or as desired, and record.

(S) = \_\_\_\_\_ mm/sec

\_\_\_\_\_  
I&C



ATTACHMENT 4  
(Continued)

Page 3 of 7

INITIALS/DATE

10. Ensure FH-11 is closed.

\_\_\_\_\_  
OPS

11. Start the Strip Chart Recorder.

\_\_\_\_\_  
I&C

12. Open HCV-2974 AND Mark the Strip Chart to indicate the start of the test (T=0) when HCV-2974 begins to open.

\_\_\_\_\_  
OPS

NOTE: HCV-2974 takes approximately 55 seconds to open. When HCV-2974 is full open only the red light will be on.

13. WHEN HCV-2974 indicates full open, wait approximately 10 seconds, THEN close HCV-2974.

\_\_\_\_\_  
OPS

NOTE: When HCV-2974 indicates closed only the green light is on.

14. WHEN HCV-2974 indicates closed, THEN stop the Strip Chart Recorder.

\_\_\_\_\_  
I&C

15. Return valves in Step 1 to "As Found" position or as directed by the Shift Supervisor.

\_\_\_\_\_  
OPS

16. Restore Safety Injection Tank SI-6D to service as directed by the Shift Supervisor.

\_\_\_\_\_  
OPS

17. Remove Strip Chart Recorder from the following ERF Computer terminals:

TB401-21(-)

TB401-22(+)

TB402-21(-)

TB402-22(+)

\_\_\_\_\_  
I&C

Independent Verification

\_\_\_\_\_  
I&C

ATTACHMENT 4  
(Continued)

Page 4 of 7

INITIALS/DATE

18. Record the following information on the Strip Recorder Chart:

- 18.1 Surveillance Test Number
- 18.2 Attachment Number
- 18.3 Safety Injection Tank Number
- 18.4 Date
- 18.5 Chart Speed (mm/sec)
- 18.6 Pressure Trace
- 18.7 Pressure Scale (psig/volt)
- 18.8 Level Trace
- 18.9 Level Scale (ft/volt)
- 18.10 Start of test (T=0)
- 18.11 Segment of pressure and level traces when HCV-2974 is >90% open: First Point (PT-1), Second Point (PT-2)
- 18.12 Point (PT-5) on the pressure and level traces halfway between PT-1 and PT-2.

19. Measure and record the chart run along the trace (D) between PT-1 and PT-2.

D=\_\_\_\_\_mm

20. Record the level change ( $\Delta L$ ) in SI-6D between PT-1 and PT-2 when HCV-2974 was >90% open.

20.1 Determine the level ( $L_{PT-1}$ ) of SI-6D at PT-1.

$L_{PT-1} = LV_1 \text{ (volts)} \times 3.6042 \text{ ft/volt}$

$L_{PT-1} = \text{_____} \times 3.6042 \text{ ft/volt}$

$L_{PT-1} = \text{_____} \text{ ft}$

20.2 Determine the level ( $L_{PT-2}$ ) of SI-6D at PT-2.

$L_{PT-2} = LV_2 \text{ (volts)} \times 3.6042 \text{ ft/volt}$

$L_{PT-2} = \text{_____} \times 3.6042 \text{ ft/volt}$

$L_{PT-2} = \text{_____} \text{ ft}$

ATTACHMENT 4  
(Continued)

Page 5 of 7

INITIALS/DATE

20.3 Calculate  $\Delta L$  for SI-6D.

$$\Delta L = L_{PT-1} - L_{PT-2} \text{ ft}$$

$$\Delta L = \underline{\hspace{2cm}} - \underline{\hspace{2cm}} \text{ ft}$$

$$\Delta L = \underline{\hspace{2cm}} \text{ ft}$$

                    /                    

21. Determine the tank level Rate of Change (R) for SI-6D.

$$R = (\Delta L + D) \times S \text{ ft/sec}$$

$$R = (\underline{\hspace{2cm}} + \underline{\hspace{2cm}}) \times \underline{\hspace{2cm}} \text{ ft/sec}$$

$$R = \underline{\hspace{2cm}} \text{ ft/sec}$$

Where: S = chart speed recorded in  
Step 9 (mm/sec)

D = chart run recorded in  
Step 19 (mm)

                    /                    

22. Calculate the flowrate (Q) from SI-6D through check valves SI-211 and SI-212 (based on a 10 second average when HCV-2974 is >90% open).

$$Q = R \times 530.24 \text{ gal/ft} \times 60 \text{ sec/min}$$

$$Q = R \times 31,814.4 \text{ gal/min}$$

$$Q = \underline{\hspace{2cm}} \times 31,814.4 \text{ gal/min}$$

$$Q = \underline{\hspace{2cm}} \text{ GPM}$$

                    /                    

23. Determine the pressure ( $P_{PT-5}$ ) of SI-6D at PT-5.

23.1 Determine the gas pressure ( $P_g$ ) in SI-6D at PT-5.

$$P_g = PV_S \text{ (volts)} \times 75 \text{ psig/volt}$$

$$P_g = \underline{\hspace{2cm}} \times 75 \text{ psig/volt}$$

$$P_g = \underline{\hspace{2cm}} \text{ psig}$$

                    /

ATTACHMENT 4  
(Continued)

Page 6 of 7

INITIALS/DATE

- 23.2 Determine the head pressure ( $P_H$ ) due to the level in SI-6D at PT-5.

$$P_H = (LV_5 \text{ (volts)} \times 3.6042 \text{ ft/volt} \times .434 \text{ psig/ft}) + 2.42 \text{ psig}$$

$$P_H = (LV_5 \text{ (volts)} \times 1.56) + 2.42 \text{ psig}$$

$$P_H = (\text{_____} \times 1.56) + 2.42 \text{ psig}$$

$$P_H = \text{_____ psig}$$

2.42 = head pressure from 0% level in SI-6D at the Reactor Vessel Flange level (psig)

- 23.3 Calculate the total pressure ( $P_{PT-5}$ ) of SI-6D at PT-5.

$$P_{PT-5} = P_G + P_H \text{ psig}$$

$$P_{PT-5} = \text{_____} + \text{_____ psig}$$

$$P_{PT-5} = \text{_____ psig}$$

24. Determine the head pressure ( $P_R$ ) due to the reactor refueling cavity level.

$$P_R = [(L_R(\%) \times 20) + 11] \times .434 \text{ psig/ft}$$

$$P_R = (L_R(\%) \times 8.68) + 4.77 \text{ psig}$$

$$P_R = (\text{_____} \times 8.68) + 4.77 \text{ psig}$$

$$P_R = (\text{_____} \text{ psig}$$

Where:

$L_R$  = Reactor Cavity level recorded in Step 3 (%).

20 = distance between LI-106 0% and 100% level taps (ft). If LI-199 is used, refer to Attachment 7 for Cavity Level.

11 = height of 0% level tap above Reactor Vessel Flange (ft)

24.1 Determine  $\Delta P$  for SI-6D at PT-5.

$$\Delta P = P_{PT-5} - P_R \text{ psid}$$

$$\Delta P = \text{_____} \text{ psid}$$

$\Delta P =$  \_\_\_\_\_ psid \_\_\_\_\_ /

- 25.1 Determine the Flow Coefficient ( $C_v$ ).

$$C_v = Q \div (\Delta P)^{1/2}$$

$$C_v = \frac{\text{_____}}{\text{_____}} + (\text{_____})^{1/2}$$

$$C_{xy} =$$

Where: Q = flowrate calculated in Step 22 \_\_\_\_\_ /

REMARKS \_\_\_\_\_

Completed by \_\_\_\_\_ Date/Time \_\_\_\_\_ / \_\_\_\_\_

ATTACHMENT 5  
(SAFETY INJECTION TANK TEST PRESSURES)

Page 1 of 1

SAFETY INJECTION TANK LEVEL	TEST PRESSURE (PSIG)
84%	80.0
85%	82.5
86%	87.5
87%	90.0
88%	95.0
89%	100.0
90%	105.0

NOTE: Test Pressures are based on Calculation FC-05280.

NOTE: Set pressure at above test pressure +0 -2.5 psig



ATTACHMENT 6

Page 1 of 2

CALIBRATION CONSTANTS AND REFERENCE VALUES

LOOP INSTRUMENT OUTPUTS - ERF Computer

Tank 6A			
Pressure: P2901	1 - 5 volts	0 - 300 psig	
Level L2904X	1 - 5 volts	0 - 100%	(173" - 0)
Tank 6B			
Pressure: P2921	1 - 5 volts	0 - 300 psig	
Level L2924X	1 - 5 volts	0 - 100%	(173" - 0)
Tank 6C			
Pressure: P2941	1 - 5 volts	0 - 300 psig	
Level L2944X	1 - 5 volts	0 - 100%	(173" - 0)
Tank 6D			
Pressure: P2961	1 - 5 volts	0 - 300 psig	
Level L2964X	1 - 5 volts	0 - 100%	(173" - 0)

Strip Chart Set-Up Parameters

Speed            10 mm/sec (suggested)

Channel 1        Pressure

                  Set 1 - 3 Volts to correspond to 0 - 150 psig

Channel 2        Level

                  Set 1 - 5 Volts to correspond to 0 - 173"

                  (14.42 feet)

ATTACHMENT 6  
(CONTINUED)

Page 2 of 2

CONVERSION FACTORS

Level

$$\begin{aligned} & 14.42 \text{ feet}/4 \text{ Volts} \\ & = 3.6042 \text{ ft/volt} \end{aligned}$$

Pressure

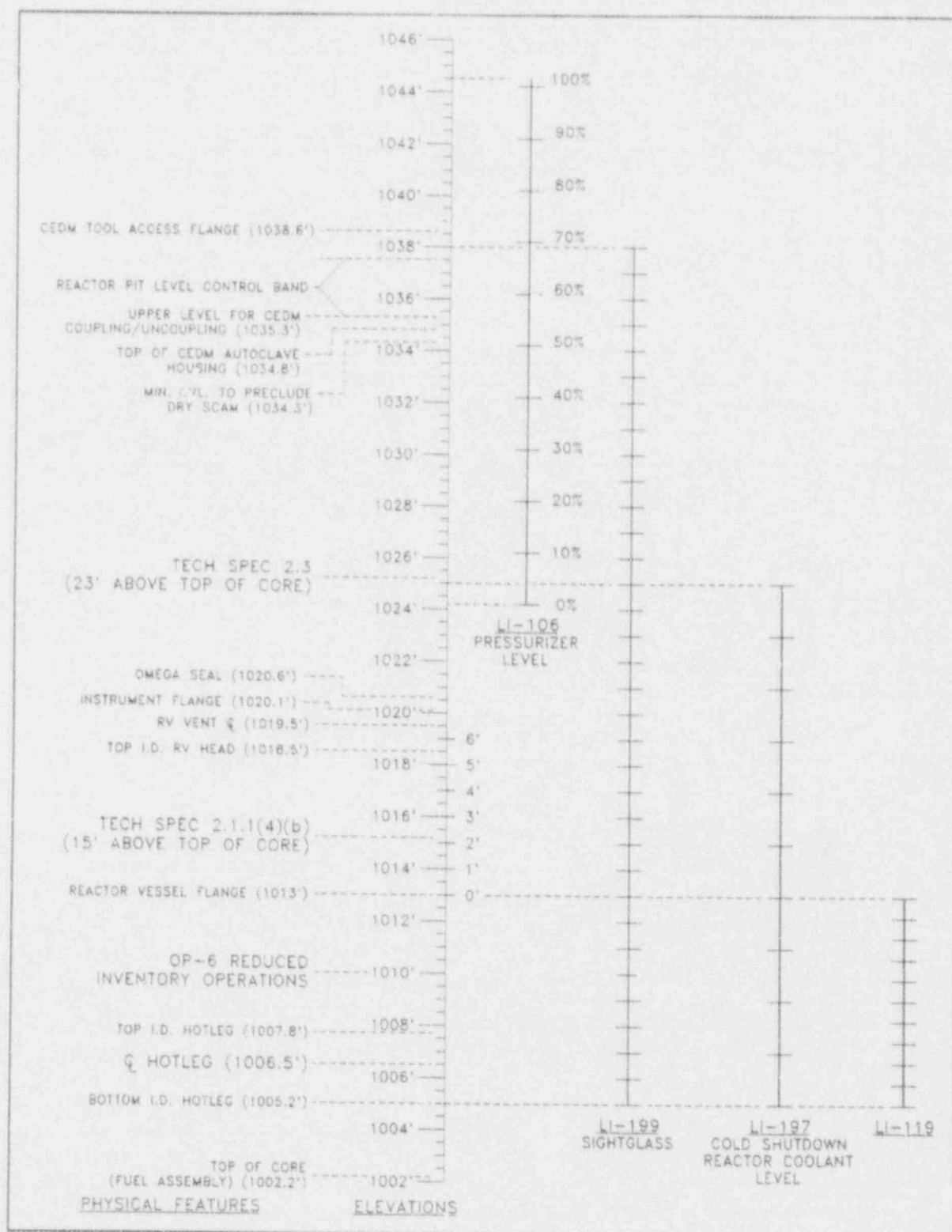
$$\begin{aligned} & 75 \text{ psig}/2 \text{ volts} \\ & = 75 \text{ psig/volt} \end{aligned}$$

Volume

$$\begin{aligned} \text{Tank ID} &= 9'-6" \\ \text{Volume} &= \pi D^2 h / 4 \\ &= \frac{\pi (9.5 \text{ ft})^2 (1 \text{ ft})}{(4)} \\ &= 70.88218 \text{ ft}^3 \text{ per foot of height} \\ \text{Water volume} &= 7.48052 \text{ gal/ft}^3 \\ \text{Tank volume} &= 7.48052 \text{ gal/ft}^3 \times 70.88218 \text{ ft}^3 \\ &= 530.24 \text{ gal/ft of height} \end{aligned}$$

ATTACHMENT 7

Page 1 of 1



{AOP-19-D.WPG}

ATTACHMENT 8

Page 1 of 8

Depressurizing and Filling SI Tank(s) Using  
Containment Spray Pumps.

INITIALS/DATE

**NOTE:** This procedure prevents SDHX  
AC-41 from being used for Shutdown  
Cooling.

1. Ensure SI Tank level and pressure instrumentation is operable by completing applicable portions of OI-SI-1-CL-C.

             /    
OPS

2. Verify SIRWT is at Refueling Boron Concentration.

                                     /  

3. If on shutdown cooling ensure the following valves are CLOSED:

<u>Valve</u>	<u>Description</u>	<u>(✓)</u>
SI-306	SIRWT Fill Valve	<u>          </u>
HCV-349	Cooled Water Suction to HPSI Pump SI-2B	<u>          </u>
HCV-2914	SI Tank 6A Discharge Isolation Valve	<u>          </u>
HCV-2934	SI Tank 6B Discharge Isolation Valve	<u>          </u>
HCV-2954	SI Tank 6C Discharge Isolation Valve	<u>          </u>
HCV-2974	SI Tank 6D Discharge Isolation Valve	<u>          </u>
SI-170	Crosstie from SDHX 4A to 4B	<u>          </u>
SI-174	SD Cooling Discharge Isolation Valve	<u>          </u>

                                     /    
OPS

ATTACHMENT 8  
(Continued)

Page 2 of 8

INITIALS/DATE

4. If not on shutdown cooling ensure the following valves are CLOSED:

<u>Valve</u>	<u>Description</u>	<u>(v)</u>
SI-306	SIRWT Fill Valve	_____
SI-183	Containment Spray Flow Test Stop Valve	_____
HCV-349	Cooled Water Suction to HPSI Pump SI-2B	_____
HCV-350	HPSI Pumps SI-2A and C Alternate Suction valve	_____
HCV-2914	SI Tank 6A Discharge Isolation Valve	_____
HCV-2934	SI Tank 6B Discharge Isolation Valve	_____
HCV-2954	SI Tank 6C Discharge Isolation Valve	_____
HCV-2974	SI Tank 6D Discharge Isolation Valve	_____
HCV-335	Shutdown Cooling Heat Exchanger Inlet Header Isolation Valve	_____
HCV-2983	Safety Injection Leakage To CVCS Isolation Valve	_____
HCV-341	Shutdown Cooling Heat Exchanger Outlet Temperature Control Valve	_____

5. Ensure the following SDC Hx AC-4A  
Isolation Valves are open:

SI-171

\_\_\_\_\_/\_\_\_\_\_  
OPS

SI-172

\_\_\_\_\_/\_\_\_\_\_  
OPS

ATTACHMENT 8  
(Continued)

Page 3 of 8

INITIALS/DATE

6. Uncap SI Tank(s) Vent Line(s):

<u>Tank</u>	<u>(v)</u>
SI-6A	_____
SI-6B	_____
SI-6C	_____
SI-6D	_____

\_\_\_\_\_/\_\_\_\_\_  
PE

7. Throttle SI Tank(s) Manual Vent  
Valves:

<u>Tank</u>	<u>Valve</u>	<u>(v)</u>
SI-6A	NG-171	_____
SI-6B	NG-172	_____
SI-6C	NG-173	_____
SI-6D	NG-174	_____

\_\_\_\_\_/\_\_\_\_\_  
OPS

8. Open SI Tank Vent to atmosphere valves  
as required to lower tank pressure to  
no lower than 25 psig then close  
valve:

<u>Tank</u>	<u>Valve</u>	<u>(v)</u>
SI-6A	HCV-2630	_____
SI-6B	HCV-2632	_____
SI-6C	HCV-2634	_____
SI-6D	HCV-2636	_____

\_\_\_\_\_/\_\_\_\_\_  
OPS



ATTACHMENT 8  
(Continued)

Page 4 of 8

INITIALS/DATE

9. Ensure the SIRWT Suction to SI Pumps is OPEN for the desired Containment Spray Pump:

Containment Spray Pump \_\_\_\_\_

<u>Pump</u>	<u>Valve</u>	<u>(v)</u>
-------------	--------------	------------

SI-3A	LCV-383-2	_____
-------	-----------	-------

SI-3B	LCV-383-1	_____
-------	-----------	-------

SI-3C	LCV-383-1	_____
-------	-----------	-------

\_\_\_\_\_/\_\_\_\_\_  
OPS

10. Open the Suction Valve for the desired Containment Spray Pump:

<u>Pump</u>	<u>Valve</u>	<u>(v)</u>
-------------	--------------	------------

SI-3A	HCV-2957	_____
-------	----------	-------

SI-3B	HCV-2967	_____
-------	----------	-------

SI-3C	HCV-2977	_____
-------	----------	-------

\_\_\_\_\_/\_\_\_\_\_  
OPS

11. Open the Discharge Valve for the desired Containment Spray Pump:

<u>Pump</u>	<u>Valve</u>	<u>(v)</u>
-------------	--------------	------------

SI-3A	HCV-2958	_____
-------	----------	-------

SI-3B	HCV-2968	_____
-------	----------	-------

SI-3C	HCV-2978	_____
-------	----------	-------

\_\_\_\_\_/\_\_\_\_\_  
OPS

ATTACHMENT 8  
(Continued)

Page 5 of 8

INITIALS/DATE

12. Open the Recirculation Isolation Valve to SIRWT for the desired Containment Spray Pump:

<u>Pump</u>	<u>Valve</u>	<u>(v)</u>
SI-3A	SI-138	_____
SI-3B	SI-146	_____
SI-3C	SI-152	_____

\_\_\_\_\_/\_\_\_\_\_  
OPS

13. Ensure the Minimum Recirculation Stop Valve for the inservice LPSI Pump is closed: (N/A if SDC not in service)

<u>Pump</u>	<u>Valve</u>	<u>(v)</u>
SI-1A	SI-132	_____
SI-1B	SI-124	_____

\_\_\_\_\_/\_\_\_\_\_  
OPS

14. Open both SI Minimum Recirculation to SIRWT Isolation Valves:

HCV-385

\_\_\_\_\_/\_\_\_\_\_  
OPS

HCV-386

\_\_\_\_\_/\_\_\_\_\_  
OPS

15. Verify both Containment Spray Valve Test Switches are in TEST:

HCV-344 Test Switch

\_\_\_\_\_/\_\_\_\_\_  
OPS

HCV-345 Test Switch

\_\_\_\_\_/\_\_\_\_\_  
OPS

ATTACHMENT 8  
(Continued)

Page 6 of 8

INITIALS/DATE

16. Verify both HCV-344/345 SET SPRAY  
PUMPS TEST PERMIT annunciators are IN  
ALARM:

A33-1, H-5

\_\_\_\_\_/\_\_\_\_\_  
OPS

A34-1, H-3

\_\_\_\_\_/\_\_\_\_\_  
OPS

17. Start the desired Containment Spray  
Pump.

\_\_\_\_\_/\_\_\_\_\_  
OPS

18. Open the Fill and Drain Valve(s) for  
the Tank(s) to be filled:

Tank

Valve

(✓)

SI-6A

HCV-2916

SI-6B

HCV-2936

SI-6C

HCV-2956

SI-6D

HCV-2976

\_\_\_\_\_/\_\_\_\_\_  
OPS

19. Unlock and open SI Tank Fill Isolation  
Valve SI-185.

\_\_\_\_\_/\_\_\_\_\_  
OPS

20. Unlock and throttle open Containment  
Spray to SI Check Valve Leakage Header  
Valve SI-342.

\_\_\_\_\_/\_\_\_\_\_  
OPS

**CAUTION**

As SI Tank level increases SI Tank  
pressure will also increase. Do not  
allow tank pressure to exceed  
260 psig.

21. Fill and/or vent SI Tanks as necessary  
to achieve a level and pressure as  
indicated on Attachment 5 of this  
procedure.

\_\_\_\_\_/\_\_\_\_\_  
OPS

ATTACHMENT 8  
(Continued)

Page 7 of 8

INITIALS/DATE

22. When SI Tank(s) reach desired indicated level, THEN close their respective Fill and Drain Valve. Repeat as necessary for subsequent tank fillings.

<u>Tank</u>	<u>Valve</u>	<u>(v)</u>
SI-6A	HCV-2916	_____
SI-6B	HCV-2936	_____
SI-6C	HCV-2956	_____
SI-6D	HCV-2976	_____

\_\_\_\_\_/\_\_\_\_\_  
OPS

23. LOCK CLOSED SI-342.

\_\_\_\_\_/\_\_\_\_\_  
OPS

24. Stop the Containment Spray Pump.

\_\_\_\_\_/\_\_\_\_\_  
OPS

25. LOCK CLOSED the Minimum Recirculation Isolation Valve for the Containment Spray Pump used.

<u>Pump</u>	<u>Valve</u>	<u>(v)</u>
SI-3A	SI-138	_____
SI-3B	SI-146	_____
SI-3C	SI-152	_____

\_\_\_\_\_/\_\_\_\_\_  
OPS

26. Ensure SI Tank Vent to Atmosphere Valve(s) are closed:

<u>Tank</u>	<u>Valve</u>	<u>(v)</u>
SI-6A	HCV-2630	_____
SI-6B	HCV-2632	_____
SI-6C	HCV-2634	_____
SI-6D	HCV-2636	_____

\_\_\_\_\_/\_\_\_\_\_  
OPS

ATTACHMENT 8  
(Continued)

Page 8 of 8

INITIALS/DATE

27. Close SI Tank Manual Vent Valves (N/A if valves are desired to remain open at Shift Supervisor's discretion):

<u>Tank</u>	<u>Valve</u>	<u>(v)</u>
SI-6A	NG-171	_____
SI-6B	NG-172	_____
SI-6C	NG-173	_____
SI-6D	NG-174	_____

OPS

28. Replace caps on SI Tank Vent Lines (N/A if caps are desired to remain off at the discretion of the Shift Supervisor):

<u>Tank</u>	<u>(v)</u>
SI-6A	_____
SI-6B	_____
SI-6C	_____
SI-6D	_____

PE

29. LOCK CLOSED SI-185.

OPS

IND VER

30. Close the Discharge Valve opened in Step 10 (N/A if desired to remain open at Shift Supervisor's discretion).

OPS

31. Open SI-170.

OPS

32. Open SI-174.

OPS

All persons participating in the performance of this test shall enter their printed name, signature and initials below.

[illegible]



COMMENT SHEET/CHRONOLOGICAL LOG

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There is no handwriting or other markings on the paper.

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