CALVERT CLIFFS NUCLEAR POWER PLANT

EOP-0 POST-TRIP IMMEDIATE ACTIONS

REVISION 1

	SIGNATURE	DATE
PREPARED BY;	James K. Groome	12/18/87
VERIFIED BY;	[illegible]	12-18-87
POSRC;	MEETING # 88-7	2-10-88
APPROVED BY;	J R Lemons	2-10-88

Manager-Nuclear Operations or General Supervisor-Operations if POSRC review is not required

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POST-TRIP IMMEDIATE ACTIONS

I. PRECAUTIONS

A. Do not adopt manual operation of automatically controlled systems unless a malfunction is apparent or automatic system operation will not support the maintenance of a safety function.

B. Systems shifted to manual operation must be monitored frequently to ensure correct operation.

C. At least two independent indications should be used, when available, to evaluate and corroborate a specific plant condition since an incident could induce inconsistencies between instruments.

D. If a pump or component fails, the cause of the failure should be determined prior to restarting or starting a standby pump or component to prevent a common failure.

II. ENTRY CONDITIONS

The below listing constitutes the most immediate and reliable indication of a reactor trip:

A. Reactor Trip Bus U/V Relay Trip alarm.

B. CEA Trip Circuit Breaker(s) Trip alarm(s).

C. Rapidly decreasing Generator output.

D. Protective Channel Trip alarm.

E. RPS Trip Bistable Lights lit.

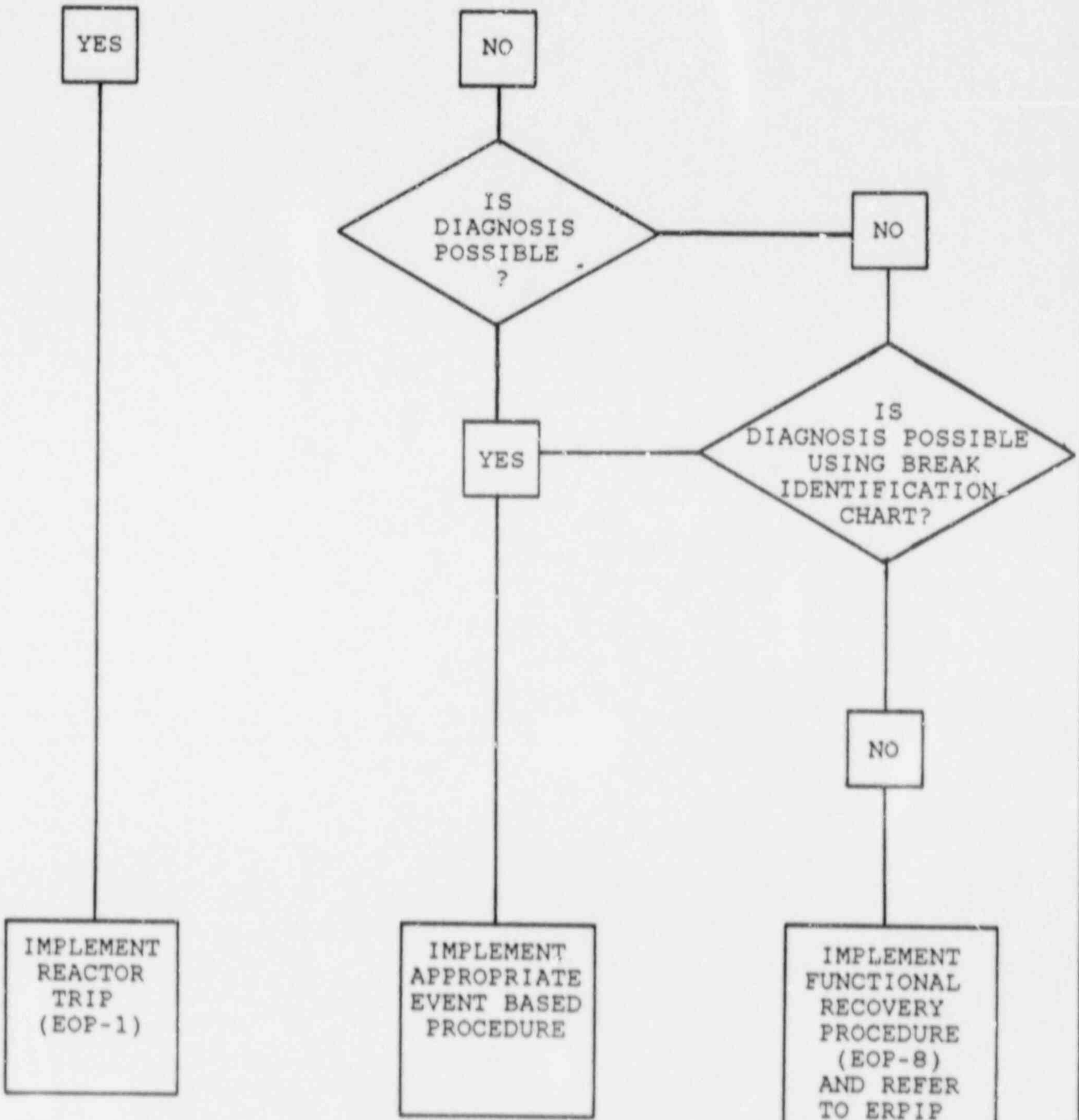
III. IMMEDIATE ACTIONS	ALTERNATE ACTIONS
A. MONITOR REACTIVITY CONTROL:	
1. Depress one set of Manual Reactor Trip Buttons.	
2. Ensure prompt drop in NI power.	2.1 **IF** reactor **NOT** tripped, **THEN** de-energize CEDM Motor Generator Sets: a. Open feeder breaker to 12A 480V Bus. b. Open feeder breaker to 13A 480V Bus. c. Open tie breakers to 12A and 13A 480V Buses.
3. Ensure all CEAs fully inserted.	3.1 **IF** one CEA fails to fully insert, **THEN** borate 200 ppm: a. Open Boric Acid Direct Makeup Valve, 1-CVC-514-MOV. b. Start a Boric Acid Pump. c. Start all available Charging Pumps. 3.2 **IF** more than one CEA fails to fully insert, **THEN** borate the RCS to 2300 ppm.
B. MONITOR RCS PRESSURE AND INVENTORY CONTROL:	
1. Ensure pressurizer level stabilizes between 80 and 180 inches.	1.1 Operate charging and letdown to restore pressurizer level.

III. IMMEDIATE ACTIONS	ALTERNATE ACTIONS
2. Ensure pressurizer pressure stabilizes between 1850 and 2275 PSIA.	2.1 Operate heaters and sprays to restore pressurizer pressure. 2.2 Verify PORVs open at 2400 PSIA and shut by 2300 PSIA. 2.3 **IF** RCS pressure decreases to 1725 PSIA, **THEN** verify SIAS actuation. 2.4 Implement RCP trip strategy: a. **IF** RCS pressure decreases to 1725 PSIA, **THEN** trip 11A and 12B RCPs **OR** trip 11B and 12A RCPs. b. **IF** positive LOCA indications exist: (1) RCS subcooling less than 30°F. (2) Steady S/G pressure. (3) S/G Blowdown RMS alarms clear, **OR** Main Vent Gaseous RMS (1-RI-5415) alarm clear. **AND** RCS pressure decreases to less than 1300 PSIA, **THEN** trip all RCPs. c. **IF** RCS temperature and pressure are less than the minimum pump operating limits per the RCP curve on Attachment (1), **THEN** trip all RCPs. d. **IF** CIS has actuated, **THEN** trip all RCPs.
3. Ensure RCS subcooling greater than 30°F.	

II. **IMMEDIATE ACTIONS**	**ALTERNATE ACTIONS**
C. MONITOR CORE AND RCS HEAT REMOVAL:	
1. Ensure both S/G levels above (-)170 inches.	1.1 **IF** S/G level decreases to (-)170 inches, **THEN** verify AFAS actuation.
Ensure feed rate is maintaining a constant level or controlled increase in S/G level.	2.1 **IF** feed flow is lost **OR** excessive, **THEN** perform the following: a Trip the S/G Feed Pumps. b. Shut the S/G Feedwater Isolation Valves. c. Initiate AFW when feed flow required.
3. Ensure proper operation of Turbine Bypass and Atmospheric Dump Valves: a. S/G pressures stabilize between 850 and 920 PSIA. b. Tcold stabilizes between 525 and 535°F.	3.1 Operate Turbine Bypass or Atmospheric Dump Valves to restore S/G pressure and Tcold. 3.2 **IF** S/G pressure decreases to 800 PSIA, **THEN** shut both MSIVs. 3.3 **IF** S/G pressure decreases to 685 PSIA, **THEN** verify SGIS actuation.
D. MONITOR VITAL AUXILIARIES.	
1. Ensure 11 or 14 4KV Bus energized.	1.1 **IF** both 4KV vital buses are de-energized, **THEN** start 11 or 12 D/G **AND** close the associated D/G output breaker.

III. IMMEDIATE ACTIONS	ALTERNATE ACTIONS
	1.2 **IF** the D/G fails to load, **THEN** perform the following: a. Verify D/G output breaker open. b. Place the 4KV Bus LOCI/SD Sequencer Manual Initiate Keyswitch in ON. c. Close the alternate 4KV feeder breaker.
E. MONITOR NORMAL CONTAINMENT ENVIRONMENT:	
1. Ensure containment pressure less than 0.7 PSIG. 2. Ensure containment temperature less than $120^{\circ}F$. 3. Ensure containment radiation monitor alarms clear.	1.1 **IF** containment pressure increases to 2.8 PSIG, **THEN** verify ESFAS actuation: a. SIAS. b. CIS **AND** trip all RCPs. 1.2 **IF** containment pressure increases to 4.25 PSIG, **THEN** verify CSAS actuation.
F. MONITOR NORMAL RADIATION LEVELS EXTERNAL TO CONTAINMENT:	
1. Ensure Main Vent Gaseous RMS (1-RI-5415) alarm clear. 2. Ensure Condenser Off-Gas and S/G Blowdown RMS alarms clear.	2.1 **IF** Condenser Off-Gas **OR** S/G Blowdown RMS alarm(s) received, **THEN** secure S/G Blowdown.

G. ARE POST-TRIP IMMEDIATE ACTIONS COMPLETED AND SAFETY FUNCTIONS WITHIN ACCEPTANCE CRITERIA?

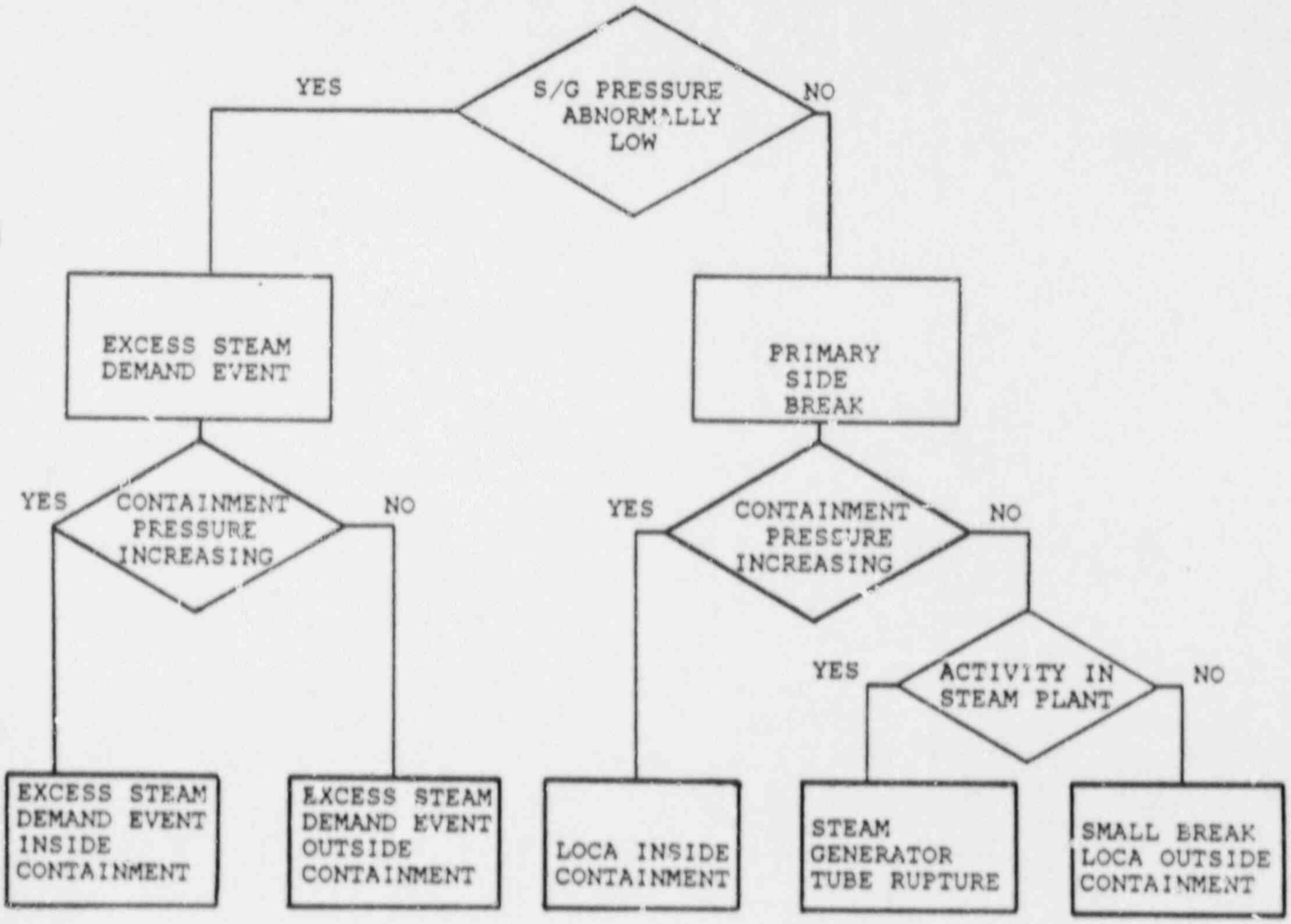


END OF SECTION III.

BREAK IDENTIFICATION CHART

PRESSURIZER LEVEL CHANGING AND

PRESSURIZER PRESSURE RAPIDLY DECREASING



IV. INITIAL SAFETY FUNCTION STATUS CHECK

A. The STA (or person designated by the STA) will perform the safety function status check on entry into this procedure.

B. Immediately notify Shift Supervisor or Control Room Supervisor if any safety function criteria is not being satisfied.

C. Notify the Control Room Supervisor and Control Room Operator when initial status check is completed.

D. Review and verify that safety function acceptance criteria are satisfied.

REACTIVITY CONTROL PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA	
	CRITERIA	STATUS CHECK
a. WRNI power	less than 5%	__________
b. SUR (DPM)	negative	__________
c. CEA status	all inserted	
or	or	
Boration status (GPM)	greater than 40	__________

RCS PRESSURE AND INVENTORY PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA	
	CRITERIA	STATUS CHECK
a. Pressurizer pressure (PSIA)	1850 to 2275	________
b. Pressurizer level (inches)	80 to 180	________
c. RCS subcooling (°F)	greater than 30	________

CORE AND RCS HEAT REMOVAL PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA	
	CRITERIA	STATUS CHECK
a. RCS Tcold (°F)	525 to 535	________
b. Thot minus Tcold (°F)	less than 10	________
c. # RCPs operating per loop	1 or 2	________
d. S/G pressure (PSIA)	850 to 920	________
e. S/G level (inches)	(-)170 to (+)30	________

VITAL AUXILIARIES	SAFETY FUNCTION ACCEPTANCE CRITERIA	
	CRITERIA	STATUS CHECK
a. 4KV vital buses 11 or 14	energized	________
b. Instrument Air pressure (PSIG)	greater than 88	________
c. Component Cooling (# pumps running)	1 or 2	________
d. Saltwater (# pumps running)	1 or 2	________
e. Service Water (# pumps running)	1 or 2	________
f. 125V DC buses 11, 12, 21, 22	energized	________
g. 120V AC vital buses 11, 12, 13, 14	energized	________
h. 208/120V Instrument Bus 11 or 12	energized	________

NORMAL CONTAINMENT ENVIRONMENT PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA	
	CRITERIA	STATUS CHECK
a. Containment pressure (PSIG)	less than 0.7	________
b. Containment temperature (^{o}F)	less than 120	________
c. Containment level (inches)	less than 4	________
d. Containment radiation	alarms clear	________

NORMAL RADIATION LEVELS EXTERNAL TO CONTAINMENT	SAFETY FUNCTION ACCEPTANCE CRITERIA	
	CRITERIA	STATUS CHECK
a. Noble Gas Monitor	alarm clear	________
b. Condenser Off-Gas RMS	alarm clear	________
c. S/G B/D RMS	alarm clear	________
d. Main Vent Gaseous RMS (1-RI-5415)	alarm clear	________

CALVERT CLIFFS NUCLEAR POWER PLANT

EOP-0 POST-TRIP IMMEDIATE ACTIONS

REVISION 1

	SIGNATURE	DATE
PREPARED BY;	[signature]	12-18-87
VERIFIED BY;	James V. Grooms	12/18/87
POSRC;	MEETING # 88-7	2-10-88
APPROVED BY;	J R Lemons Manager-Nuclear Operations or General Supervisor-Operations if POSRC review is not required	2-10-88

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3. Ensure all CEAs fully inserted.</td><td>2.1 <u>IF</u> reactor <u>NOT</u> tripped, <u>THEN</u> de-energize CEDM Motor Generator Sets:
a. Open feeder breaker to 22A 480V Bus.
b. Open feeder breaker to 23A 480V Bus.
c. Open tie breakers to 22A and 23A 480V Buses.

3.1 <u>IF</u> one CEA fails to fully insert, <u>THEN</u> borate 200 ppm:
a. Open Boric Acid Direct Makeup Valve, 2-CVC-514-MOV.
b. Start a Boric Acid Pump.
c. Start all available Charging Pumps.

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III. IMMEDIATE ACTIONS	ALTERNATE ACTIONS
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C. MONITOR CORE AND RCS HEAT REMOVAL:	
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D. MONITOR VITAL AUXILIARIES.	
1. Ensure 21 or 24 4KV Bus energized.	1.1 **IF** both 4KV vital buses are de-energized, **THEN** start 21 or 12 D/G **AND** close the associated D/G output breaker.

III. IMMEDIATE ACTIONS	ALTERNATE ACTIONS
	1.2 **IF** the D/G fails to load, **THEN** perform the following: a. Verify D/G output breaker open. b. Place the 4KV Bus LOCI/SD Sequencer Manual Initiate Keyswitch in ON. c. Close the alternate 4KV feeder breaker.
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1. Ensure containment pressure less than 0.7 PSIG.	1.1 **IF** containment pressure increases to 2.8 PSIG, **THEN** verify ESFAS actuation: a. SIAS. b. CIS **AND** trip all RCPs. 1.2 **IF** containment pressure increases to 4.25 PSIG, **THEN** verify CSAS actuation.
2. Ensure containment temperature less than 120°F.	
3. Ensure containment radiation monitor alarms clear.	
F. MONITOR NORMAL RADIATION LEVELS EXTERNAL TO CONTAINMENT:	
1. Ensure Main Vent Gaseous RMS (2-RI-5415) alarm clear.	
2. Ensure Condenser Off-Gas and S/G Blowdown RMS alarms clear.	2.1 **IF** Condenser Off-Gas **OR** S/G Blowdown RMS alarm(s) received, **THEN** secure S/G Blowdown.

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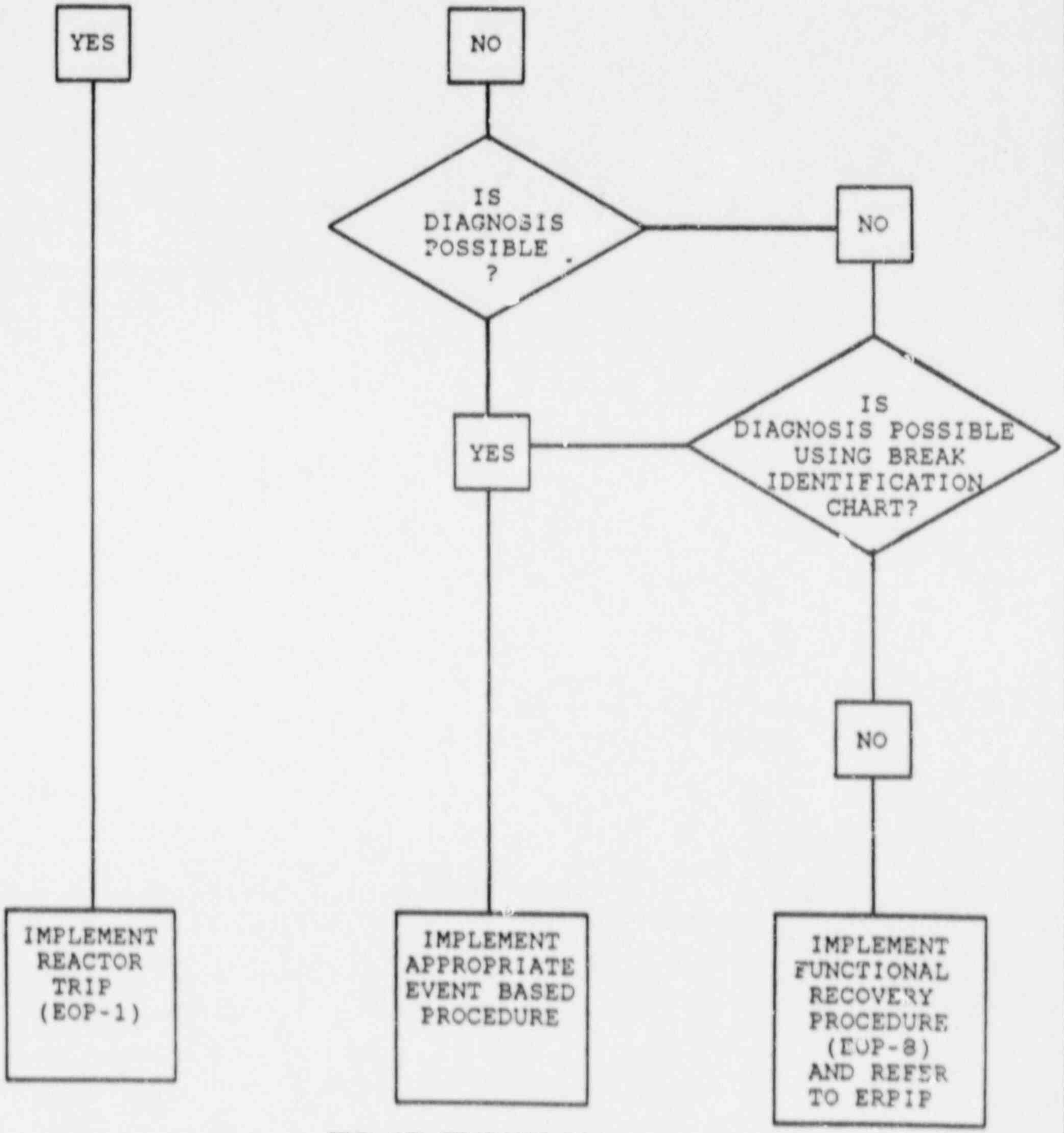

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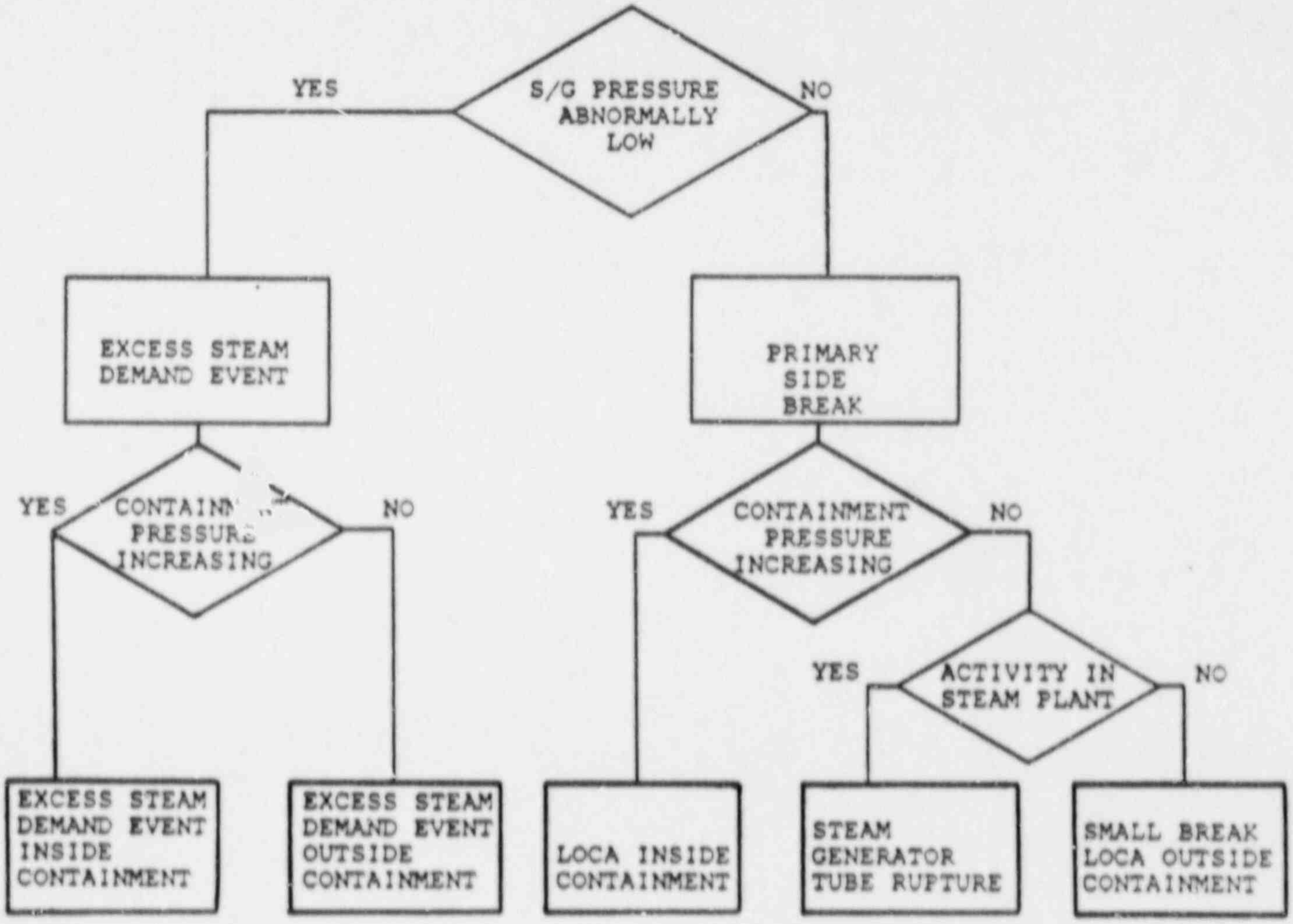

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REACTIVITY CONTROL PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA	
	CRITERIA	STATUS CHECK
a. WRNI power	less than 5%	________
b. SUR (DPM)	negative	________
c. CEA status	all inserted	
or	or	
Boration status (GPM)	greater than 40	________

RCS PRESSURE AND INVENTORY PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA	
	CRITERIA	STATUS CHECK
a. Pressurizer pressure (PSIA)	1850 to 2275	________
b. Pressurizer level (inches)	80 to 180	________
c. RCS subcooling ($^{\circ}$F)	greater than 30	________

CORE AND RCS HEAT REMOVAL PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA	
	CRITERIA	STATUS CHECK
a. RCS Tcold ($^{\circ}$F)	525 to 535	________
b. Thot minus Tcold ($^{\circ}$F)	less than 10	________
c. # RCPs operating per loop	1 or 2	________
d. S/G pressure (PSIA)	850 to 920	________
e. S/G level (inches)	(-)170 to (+)30	________

VITAL AUXILIARIES	SAFETY FUNCTION ACCEPTANCE CRITERIA	
	CRITERIA	STATUS CHECK
a. 4KV vital buses 21 or 24	energized	________
b. Instrument Air pressure (PSIG)	greater than 88	________
c. Component Cooling (# pumps running)	1 or 2	________
d. Saltwater (# pumps running)	1 or 2	________
e. Service Water (# pumps running)	1 or 2	________
f. 125V DC buses 11, 12, 21, 22	energized	________
g. 120V AC vital buses 21, 22, 23, 24	energized	________
h. 208/120V Instrument Bus 21 or 22	energized	________

NORMAL CONTAINMENT ENVIRONMENT PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA	
	CRITERIA	STATUS CHECK
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NORMAL RADIATION LEVELS EXTERNAL TO CONTAINMENT	SAFETY FUNCTION ACCEPTANCE CRITERIA	
	CRITERIA	STATUS CHECK
a. Noble Gas Monitor	alarm clear	________
b. Condenser Off-Gas RMS	alarm clear	________
c. S/G B/D RMS	alarm clear	________
d. Main Vent Gaseous RMS (2-RI-5415)	alarm clear	________

CALVERT CLIFFS NUCLEAR POWER PLANT

EOP-1 REACTOR TRIP

REVISION 1

	SIGNATURE	DATE
PREPARED BY;	James V. Groom	12/18/87
VERIFIED BY;	[illegible]	12-18-87
POSRC;	MEETING # 88-7	2-10-88
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REACTOR TRIP

I. PRECAUTIONS

A. Do not adopt manual operation of automatically controlled systems unless a malfunction is apparent or automatic system operation will not support the maintenance of a safety function.

B. Systems shifted to manual operation must be monitored frequently to ensure correct operation.

C. At least two independent indications should be used, when available, to evaluate and corroborate a specific plant condition since an incident could induce inconsistencies between instruments.

D. If a pump or component fails, the cause of the failure should be determined prior to restarting or starting a standby pump or component to prevent a common failure.

II. ENTRY CONDITIONS

A. Post-Trip Immediate Actions are completed.

B. Safety Functions are within Acceptance Criteria of EOP-0.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
A. VERIFY POST-TRIP IMMEDIATE ACTIONS COMPLETED.	
B. COMMENCE INTERMEDIATE SAFETY FUNCTION STATUS CHECK.	
C. CONFIRM TURBINE TRIP:	
1. Check Turbine Stop Valves shut and speed decreasing.	1.1 Depress Turbine Trip Button.
2. Check Turbine Generator output breakers open: a. 11 Generator Bus Breaker, 552-22. b. 11 Generator Tie Breaker, 552-23.	2.1 **IF** an output breaker remains closed **AND** unable to confirm Turbine Stop Valves shut, **THEN** shut both MSIVs.
3. Verify 11 Generator Field Breaker open.	
4. Verify 11 Exciter Field Breaker open.	
D. RESTORE NORMAL PRESSURIZER LEVEL.	
1. Verify charging and letdown flow restoring pressurizer level to between 130 and 180 inches.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
E. RESTORE NORMAL PRESSURIZER PRESSURE.	
1. Verify heaters or sprays restoring pressurizer pressure to between 2225 and 2275 PSIA.	
F. MAINTAIN Tcold BETWEEN 525 AND 535°F:	
1. Verify proper operation of Turbine Bypass and Atmospheric Dump Valves.	1.1 **IF** Tcold decreases to 525°F, **THEN** perform the following: a. Shut S/G Blowdown Valves: 1-BD-4010-CV 1-BD-4011-CV 1-BD-4012-CV 1-BD-4013-CV b. Shut upstream drains by placing handswitch 1-HS-6622 in CLOSE. 1.2 **IF** Tcold decreases to 518°F (800 PSIA S/G pressure), **THEN** perform the following: a. Shut both MSIVs. - **CAUTION** - **D/G supplying power to 13 AFW Pump flow limit is 300 GPM; otherwise, flow limit is 575 GPM.** b. Start 13 AFW Pump. c. Shift Gland Seal to Auxiliary Steam by performing the following: (1) Verify Auxiliary Steam available.

III. RECOVERY ACTIONS

ALTERNATE ACTIONS

(2) Open Aux Steam To Gland Seal Valve, 1-TGS-4678-MOV.

(3) Shut Main Steam To Gland Seal Valve, 1-TGS-4659-MOV.

2. Verify MSR Second Stage Steam Source Valves shut:

1-MS-4025-MOV
1-MS-4026-MOV

3. Verify Main Feed Regulating Valves shut and S/G feed rate allowing proper temperature control.

G. RESTORE NORMAL S/G WATER LEVEL:

- **CAUTION** -

Severe waterhammer may occur if Main Feed Ring is allowed to drain then subsequently refilled.

1. Establish a shutdown feed system lineup:

a. One operating S/G Feed Pump.

1.a.1. IF S/G Feed Pump NOT available, THEN perform the following:

- **CAUTION** -

D/G supplying power to 13 AFW Pump flow limit is 300 GPM; otherwise, flow limit is 575 GPM.

a. Start an AFW Pump.

b. Shut S/G Feedwater Isolation Valves:

1-FW-4516-MOV
1-FW-4517-MOV

III. RECOVERY ACTIONS

b. One operating Condensate Booster Pump.

c. One operating Condensate Pump.

d. Both Heater Drain Pumps secured.

2. Ensure Main Feed rate:

   a. Slowly increasing S/G level.

   b. Maintaining Tcold between 525 and 535°F.

3. **WHEN** manual control of feed flow rate desired **OR** S/G levels between (-)24 and (+)30 inches, **THEN** perform the following:

   a. Depress Feed Regulating Bypass Valve Reset Buttons.

   b. Adjust Feed Regulating Bypass Valves to raise S/G levels to approximately 0 inches.

4. **WHEN** S/G levels are 0 inches, **THEN** shift Feed Regulating Bypass Controllers to AUTO.

5. **IF** S/G level exceeds (+)30 inches during the recovery, **THEN** isolate appropriate feed train:

   a. Shut appropriate Feed Regulating Bypass Valve.

   b. Shut appropriate Main Feed Regulating Valve.

   c. Shut appropriate S/G Feedwater Isolation Valve.

ALTERNATE ACTIONS

2.1 Operate AFW to:

   a. Slowly raise S/G level to between 0 and (+)30 inches.

   b. Maintain Tcold between 525 and 535°F.

2.2 **WHEN** S/G level is between 0 and (+)30 inches **AND** Main Feed is available, **THEN** initiate Main Feed.

5.1 **IF** operating AFW **AND** S/G level exceeds (+) 30 inches, **THEN** shut appropriate AFW Flow Control Valves:

11 S/G	12 S/G
1-AFW-4511-CV	1-AFW-4512-CV
1-AFW-4525-CV	1-AFW-4535-CV

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
6. **IF** S/G level exceeds (+)50 inches **AND** increasing, **THEN** trip both S/G Feed Pumps.	6.1 **IF** operating AFW **AND** S/G level exceeds (+)50 inches, **THEN** shut appropriate AFW Block valves: 11 S/G: 1-AFW-4520-CV, 1-AFW-4521-CV, 1-AFW-4522-CV, 1-AFW-4523-CV 12 S/G: 1-AFW-4530-CV, 1-AFW-4531-CV, 1-AFW-4532-CV, 1-AFW-4533-CV
7. **IF** S/G level exceeds (+)63.5 inches, **THEN** shut appropriate MSIV.	
8. **WHEN** recovery from high level condition accomplished, **THEN** establish Main Feed **OR** AFW flow.	
ENSURE SAFE TURBINE COASTDOWN:	
1. Start Turning Gear Oil Pump.	
2. Start Motor Suction Pump.	
3 Start Turbine Oil Lift Pumps.	
4. Start computer typed trend blocks 1 and 2 (turbine bearing temperatures) on a 1 minute update frequency.	
5. Continue Main Turbine shutdown per OI-43A.	
I. VERIFY FINAL SAFETY FUNCTION STATUS CHECK SATISFACTORY AND COMPLETE ADMINISTRATIVE POST-TRIP ACTIONS.	

J. ADMINISTRATIVE POST-TRIP ACTIONS:

- **NOTE** -

The following actions may be accomplished whenever feasible. They may be done in any order.

_______ 1. Perform notifications per CCI-118.

_______ 2. Notify ESO of trip.

_______ 3. Request RCS boron sample.

_______ 4. Perform shutdown margin calculation per NEOG 2 and 7.

_______ 5. Document trip in transient log.

_______ 6. Recall post-trip review (preferably within 30 minutes of trip).

_______ 7. Perform post-trip review per CCI-111

_______ 8. Implement Reactor Trip Recovery (AOP-8) or appropriate operating procedures.

END OF SECTION III.

IV. SAFETY FUNCTION STATUS CHECK

A. The STA (or person designated by STA) will perform the intermediate and final safety function checks respectively on entry and prior to exiting from this procedure.

B. Perform intermediate safety function status checks at 10 minute intervals until plant conditions stabilize.

C. Immediately notify Shift Supervisor or Control Room Supervisor if any safety function criteria is not being satisfied.

D. Review data and verify that safety function acceptance criteria are satisfied.

E. When EOP completed, then perform final safety function check.

REACTIVITY CONTROL PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. WRNI power	less than 3%	___________	less than 1%	_______
b. SUR (DPM)	negative	___________	0	_______
c. CEA status	all inserted	___________	all inserted	_______
or				
Boration status:				
concentration	increasing	___________	appropriate S/D margin	_______
BAST level	decreasing	___________	N/A	N/A

RCS PRESSURE AND INVENTORY PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Pressurizer pressure (PSIA)	1850 to 2275	___________	2225 to 2275	_____
b. Pressurizer pressure trend (PSIA)	trending towards 2250	___________	N/A	_____
c. Pressurizer level (inches)	101 to 180	___________	130 to 180	_____
d. Pressurizer level trend (inches)	trending towards 160	___________	N/A	_____
e. RCS subcooling ($^{\circ}$F)	30 to 140	___________	30 to 140	_____

CORE AND RCS HEAT REMOVAL PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. RCS Tcold ($^{\circ}$F)	525 to 535	___________	530 to 535	_____
b. Thot minus Tcold ($^{\circ}$F)	less than 5	___________	less than 5	_____
c. # RCPs operating per loop	1 or 2	___________	1 or 2	_____
d. S/G pressure (PSIA)	850 to 920	___________	885 to 920	_____
e. S/G level (inches)	(-)170 to (+)30	___________	(-)24 to (+)30	_____
f. S/G level trend (inches)	trending towards 0	___________	trending towards 0	_____

VITAL AUXILIARIES	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. 4KV vital buses 11 or 14	energized	___________	energized	_____
b. Instrument Air pressure (PSIG)	greater than 88	___________	greater than 88	_____
c. Component Cooling (# pumps running)	1 or 2	___________	1 or 2	_____
d. Saltwater (# pumps running)	1 or 2	___________	1 or 2	_____
e. Service Water (# pumps running)	1 or 2	___________	1 or 2	_____
f. 125V DC buses 11, 12, 21, 22	energized	___________	energized	_____
g. 120V AC vital buses 11, 12, 13, 14	energized	___________	energized	_____
h. Condenser vacuum (IN Hg)	greater than 20	___________	greater than 20	_____

NORMAL CONTAINMENT ENVIRONMENT PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Containment pressure (PSIG)	less than 0.7	____________	less than 0.7	_____
b. Containment temperature (^{o}F)	less than 120	____________	less than 120	_____
c. Containment Gaseous Radiation RMS	alarm clear	____________	alarm clear	_____
d. Containment level (inches)	less than 4	____________	less than 4	_____

NORMAL RADIATION LEVELS EXTERNAL TO CONTAINMENT	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Noble Gas Monitor	alarm clear	____________	alarm clear	______
b. Condenser Off-Gas RMS	alarm clear	____________	alarm clear	______
c. S/G B/D RMS	alarm clear	____________	alarm clear	______
d. Main Vent Gaseous RMS (1-RI-5415)	alarm clear	____________	alarm clear	______

STATUS CHECK NUMBER	COMPLETE AT TIME
1	________
2	________
3	________
4	________
________	________
________	________
________	________
________	________

CALVERT CLIFFS NUCLEAR POWER PLANT

EOP-1 REACTOR TRIP

REVISION 1

	SIGNATURE	DATE
PREPARED BY;		12-18-87
VERIFIED BY;	James V. Grooms	12/18/87
POSRC;	MEETING # 88-7	2-10-88
APPROVED BY;		2-10-88
	Manager-Nuclear Operations or General Supervisor-Operations if POSRC review is not required	

LIST OF EFFECTIVE PAGES

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REACTOR TRIP

I. PRECAUTIONS

A. Do not adopt manual operation of automatically controlled systems unless a malfunction is apparent or automatic system operation will not support the maintenance of a safety function.

B. Systems shifted to manual operation must be monitored frequently to ensure correct operation.

C. At least two independent indications should be used, when available, to evaluate and corroborate a specific plant condition since an incident could induce inconsistencies between instruments.

D. If a pump or component fails, the cause of the failure should be determined prior to restarting or starting a standby pump or component to prevent a common failure.

II. ENTRY CONDITIONS

A. Post-Trip Immediate Actions are completed.

B. Safety Functions are within Acceptance Criteria of EOP-0.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
A. VERIFY POST-TRIP IMMEDIATE ACTIONS COMPLETED.	
B. COMMENCE INTERMEDIATE SAFETY FUNCTION STATUS CHECK.	
C. CONFIRM TURBINE TRIP:	
1. Check Turbine Throttle Valves shut and speed decreasing.	1.1 Depress Turbine Trip Button.
2. Check Turbine Generator output breakers open:	2.1 **IF** an output breaker remains closed **AND** unable to confirm Turbine Throttle Valves shut, **THEN** shut both MSIVs.
a. 21 Generator Bus Breaker, 552-61.	
b. 21 Generator Tie Breaker, 552-63.	
3. Verify 21 Exciter Field Breaker open.	
D. RESTORE NORMAL PRESSURIZER LEVEL.	
1. Verify charging and letdown flow restoring pressurizer level to between 130 and 180 inches.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
E. RESTORE NORMAL PRESSURIZER PRESSURE.	
1. Verify heaters or sprays restoring pressurizer pressure to between 2225 and 2275 PSIA.	
F. MAINTAIN Tcold BETWEEN 525 AND 535°F:	
1. Verify proper operation of Turbine Bypass and Atmospheric Dump Valves.	1.1 **IF** Tcold decreases to 525°F, **THEN** perform the following: a. Shut S/G Blowdown Valves: 2-BD-4010-CV 2-BD-4011-CV 2-BD-4012-CV 2-BD-4013-CV b. Shut upstream drains by placing handswitch 2-HS-6622 in CLOSE. 1.2 **IF** Tcold decreases to 518°F (800 PSIA S/G pressure), **THEN** perform the following: a. Shut both MSIVs. - **CAUTION** - **D/G supplying power to 23 AFW Pump flow limit is 300 GPM; otherwise, flow limit is 575 GPM.** b. Start 23 AFW Pump. c. Shift Gland Seal to Auxiliary Steam by performing the following: (1) Verify Auxiliary Steam available.

III. RECOVERY ACTIONS

ALTERNATE ACTIONS

(2) Open Aux Steam To Gland Seal Valve, 2-TGS-4684-MOV.

(3) Shut Main Steam To Gland Seal Valve, 2-TGS-4659-MOV.

2. Depress Reset Button on MSR Control Panel and verify Second Stage Steam Source Valves shut:

   2-MS-4017-CV
   2-MS-4018-CV
   2-MS-4019-CV
   2-MS-4020-CV

3. Verify Main Feed Regulating Valves shut and S/G feed rate allowing proper temperature control.

. RESTORE NORMAL S/G WATER LEVEL:

- **CAUTION** -

Severe waterhammer may occur if Main Feed Ring is allowed to drain then subsequently refilled.

1. Establish a shutdown feed system lineup:

   a. One operating S/G Feed Pump.

1.a.1. **IF** S/G Feed Pump **NOT** available, **THEN** perform the following:

- **CAUTION** -

D/G supplying power to 23 AFW Pump flow limit is 300 GPM; otherwise, flow limit is 575 GPM.

a. Start an AFW Pump.

b. Shut S/G Feedwater Isolation Valves:

   2-FW-4516-MOV
   2-FW-4517-MOV

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
b. One operating Condensate Booster Pump.	
c. One operating Condensate Pump.	
d. Both Heater Drain Pumps secured.	
2. Ensure Main Feed rate:	2.1 Operate AFW to:
a. Slowly increasing S/G level.	a. Slowly raise S/G level to between 0 and (+)30 inches.
b. Maintaining Tcold between 525 and 535°F.	b. Maintain Tcold between 525 and 535°F.
	2.2 **WHEN** S/G level is between 0 and (+)30 inches **AND** Main Feed is available, **THEN** initiate Main Feed.
3. **WHEN** manual control of feed flow rate desired **OR** S/G levels between (-)24 and (+)30 inches, **THEN** perform the following:	
a. Depress Feed Regulating Bypass Valve Reset Buttons.	
b. Adjust Feed Regulating Bypass Valves to raise S/G levels to approximately 0 inches.	
4. **WHEN** S/G levels are 0 inches, **THEN** shift Feed Regulating Bypass Controllers to AUTO.	
5. **IF** S/G level exceeds (+)30 inches during the recovery, **THEN** isolate appropriate feed train:	5.1 **IF** operating AFW **AND** S/G level exceeds (+) 30 inches, **THEN** shut appropriate AFW Flow Control Valves: 21 S/G: 2-AFW-4511-CV, 2-AFW-4525-CV 22 S/G: 2-AFW-4512-CV, 2-AFW-4535-CV
a. Shut appropriate Feed Regulating Bypass Valve.	
b. Shut appropriate Main Feed Regulating Valve.	
c. Shut appropriate S/G Feedwater Isolation Valve.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
6. **IF** S/G level exceeds (+)50 inches **AND** increasing, **THEN** trip both S/G Feed Pumps.	6.1 **IF** operating AFW **AND** S/G level exceeds (+)50 inches, **THEN** shut appropriate AFW Block valves: 21 S/G: 2-AFW-4520-CV, 2-AFW-4521-CV, 2-AFW-4522-CV, 2-AFW-4523-CV 22 S/G: 2-AFW-4530-CV, 2-AFW-4531-CV, 2-AFW-4532-CV, 2-AFW-4533-CV
7. **IF** S/G level exceeds (+)63.5 inches, **THEN** shut appropriate MSIV.	
8. **WHEN** recovery from high level condition accomplished, **THEN** establish Main Feed **OR** AFW flow.	
ENSURE SAFE TURBINE COASTDOWN:	
1. Start Bearing Oil Pump.	
2. Start Turbine Oil Lift Pump.	
3. Start computer group display #1 (turbine bearing temperatures) on a 1 minute update frequency.	
4. Continue Main Turbine shutdown per OI-43A.	
I. VERIFY FINAL SAFETY FUNCTION STATUS CHECK SATISFACTORY AND COMPLETE ADMINISTRATIVE POST-TRIP ACTIONS.	

J. ADMINISTRATIVE POST-TRIP ACTIONS:

- **NOTE** -

The following actions may be accomplished whenever feasible. They may be done in any order.

_______ 1. Perform notifications per CCI-118.

_______ 2. Notify ESO of trip.

_______ 3. Request RCS boron sample.

_______ 4. Perform shutdown margin calculation per NEOs 9 and 11.

_______ 5. Document trip in transient log.

_______ 6. Recall post-trip review (preferably within 30 minutes of trip).

_______ 7. Perform post-trip review per CCI-111.

_______ 8. Implement Reactor Trip Recovery (AOP-8) or appropriate operating procedures.

END OF SECTION III.

IV. SAFETY FUNCTION STATUS CHECK

A. The STA (or person designated by STA) will perform the intermediate and final safety function checks respectively on entry and prior to exiting from this procedure.

B. Perform intermediate safety function status checks at 10 minute intervals until plant conditions stabilize.

C. Immediately notify Shift Supervisor or Control Room Supervisor if any safety function criteria is not being satisfied.

D. Review data and verify that safety function acceptance criteria are satisfied.

E. When EOP completed, then perform final safety function check.

REACTIVITY CONTROL PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. WRNI power	less than 3%	__________	less than 1%	______
b. SUR (DPM)	negative	__________	0	______
c. CEA status	all inserted	__________	all inserted	______
or				
Boration status:				
concentration	increasing	__________	appropriate S/D margin	______
BAST level	decreasing	__________	N/A	N/A

RCS PRESSURE AND INVENTORY PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Pressurizer pressure (PSIA)	1850 to 2275	----------	2225 to 2275	____
b. Pressurizer pressure trend (PSIA)	trending towards 2250	----------	N/A	____
c. Pressurizer level (inches)	101 to 180	----------	130 to 180	____
d. Pressurizer level trend (inches)	trending towards 160	----------	N/A	____
e. RCS subcooling ($^{\circ}$F)	30 to 140	----------	30 to 140	____

CORE AND RCS HEAT REMOVAL PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. RCS Tcold ($^{\circ}$F)	525 to 535	----------	530 to 535	____
b. Thot minus Tcold ($^{\circ}$F)	less than 5	----------	less than 5	____
c. # RCPs operating per loop	1 or 2	----------	1 or 2	____
d. S/G pressure (PSIA)	850 to 920	----------	885 to 920	____
e. S/G level (inches)	(-)170 to (+)30	----------	(-)24 to (+)30	____
f. S/G level trend (inches)	trending towards 0	----------	trending towards 0	____

VITAL AUXILIARIES	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. 4KV vital buses 21 or 24	energized	___________	energized	_____
b. Instrument Air pressure (PSIG)	greater than 88	___________	greater than 88	_____
c. Component Cooling (# pumps running)	1 or 2	___________	1 or 2	_____
d. Saltwater (# pumps running)	1 or 2	___________	1 or 2	_____
e. Service Water (# pumps running)	1 or 2	___________	1 or 2	_____
f. 125V DC buses 11, 12, 21, 22	energized	___________	energized	_____
g. 120V AC vital buses 21, 22, 23, 24	energized	___________	energized	_____
h. Condenser vacuum (IN Hg)	greater than 20	___________	greater than 20	_____

NORMAL CONTAINMENT ENVIRONMENT PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Containment pressure (PSIG)	less than 0.7	___________	less than 0.7	_____
b. Containment temperature ($^{\circ}F$)	less than 120	___________	less than 120	_____
c. Containment Gaseous Radiation RMS	alarm clear	___________	alarm clear	_____
d. Containment level (inches)	less than 4	___________	less than 4	_____

NORMAL RADIATION LEVELS EXTERNAL TO CONTAINMENT	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Noble Gas Monitor	alarm clear	------------	alarm clear	_____
b. Condenser Off-Gas RMS	alarm clear	------------	alarm clear	_____
c. S/G B/D RMS	alarm clear	------------	alarm clear	_____
d. Main Vent Gaseous RMS (2-RI-5415)	alarm clear	------------	alarm clear	_____

STATUS CHECK NUMBER	COMPLETE AT TIME
1	________
2	________
3	________
4	________
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CALVERT CLIFFS NUCLEAR POWER PLANT

EOP-2 LOSS OF OFFSITE POWER

REVISION 1

	SIGNATURE	DATE
PREPARED BY;	James V. Grooms	12/18/87
VERIFIED BY;	[illegible]	12-18-87
POSRC;	MEETING # 88-7	2-10-88
APPROVED BY;	J R Lemons Manager-Nuclear Operations or General Supervisor-Operations if POSRC review is not required	2-10-88

LIST OF EFFECTIVE PAGES

LOSS OF OFFSITE POWER

I. PRECAUTIONS

A. Do not adopt manual operation of automatically controlled systems unless a malfunction is apparent or automatic system operation will not support the maintenance of a safety function.

B. Systems shifted to manual operation must be monitored frequently to ensure correct operation.

C. At least two independent indications should be used, when available, to evaluate and corroborate a specific plant condition since an incident could induce inconsistencies between instruments.

D. In Natural Circulation, increased loop transport time causes a 5 to 10 minute delay in temperature responses to a plant change. Pressurizer level and pressure responses typically provide better indication of RCS response during this period.

E. If cooling down with a S/G isolated, an inverted delta T (Tcold higher than Thot) may be observed in the idle loop. This is due to a small amount of reverse heat transfer in the isolated S/G. The inverted delta T is not expected to have any significant effect on natural circulation flow in the operating S/G loop.

F. The concentration of boron in RCS makeup water should be consistent with maintaining the required shutdown margin.

G. Minimize the number of cycles of pressurizer auxiliary spray when the temperature differential is greater than 400°F.

H. Excessive Diesel Generator loading can result if a SIAS is received and the LOCI sequencer actuates. Non-vital loads should be manually shed immediately upon receiving a SIAS.

I. If a pump or component fails, the cause of the failure should be determined prior to restarting or starting a standby pump or component to prevent a common failure.

II. ENTRY CONDITIONS

The presence of one or more of the following conditions indicates that a Loss Of Offsite Power may have occurred:

A. Momentary loss of Control Room lighting on both Units.

B. 500KV Red and Black Bus power available lights de-energized.

C. Diesel Generators running.

D. 12 and 22 Service Bus 13KV power available lights de-energized.

E. No RCPs running on either Unit.

F. Reactor Trip due to RCS low flow.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
A. VERIFY POST-TRIP IMMEDIATE ACTIONS COMPLETED.	
B. COMMENCE INTERMEDIATE SAFETY FUNCTION STATUS CHECK.	
C. DETERMINE APPROPRIATE EMERGENCY RESPONSE ACTIONS PER THE ERPIP.	
D. PROTECT RCS FROM EXCESSIVE COOLDOWN AND CONDENSER FROM OVERPRESSURE:	
1. Shut both MSIVs. 2. Shut S/G Blowdown Valves: 1-BD-4010-CV 1-BD-4011-CV 1-BD-4012-CV 1-BD-4013-CV	
E. ESTABLISH S/G HEAT SINK:	
1. Establish S/G heat removal: a. Shift Atmospheric Dump Controller to MANUAL. b. Operate Atmospheric Dump Valves to return Tcold to between 520 and 530°F.	-NOTE- Atmospheric Dump Valves are reverse acting, i.e., clockwise to open, counterclockwise to shut. 1.b.1 **IF** Atmospheric Dump Valves will **NOT** operate from Control Room, **THEN** locally operate Atmospheric Dump Valves on 45 ft Aux Building.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
	- CAUTION - **13 AFW Pump flow limit is 300 GPM when powered from D/C.**
2. Establish feedwater flow to S/Gs: a. Start 11 or 12 AFW Pump by opening AFW Steam Supply Valves: 1-MS-4070-CV 1-MS-4071-CV b. Adjust AFW Flow Control Valves to restore and maintain S/G levels between (-)170 and (+) 30 inches and trending towards 0 inches.	2.a.1 IF steam driven pumps NOT available, THEN start 13 AFW Pump.
F. RESTORE COMPONENT COOLING FLOW:	
1. IF RCP lower seal temperature less than 280°F, THEN start a Component Cooling Pump.	1.1 IF seal temperature above 230°F, THEN perform the following: a. Shut Component Cooling Supply Containment Isolation Valve, 1-CC-3832-CV. b. Start a Component Cooling Pump.
2. Verify Component Cooling Heat Exchanger on service is being supplied from an operating Saltwater Header.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
G. ALIGN OTHER AVAILABLE POWER SOURCES TO ELECTRICAL SYSTEM:	
- CAUTION - **If only one D/G is available, starting additional loads may cause an overload condition. Alternate operation of equipment may be required to prevent this condition.** 1. Align 12 D/G to Unit with largest power requirement or with redundant safety related equipment out of service. 2. Consider use of SMECO Tie for supplying loads per OI-27E.	
H. VERIFY SHUTDOWN SEQUENCER LOADS OPERATING:	
1. Service Water Pump(s). 2. Saltwater Pump(s). 3. Instrument Air Compressor. 4. 11 or 12 Control Room Ventilation. 5. Switchgear Room Ventilation.	
I. **IF** STEAM DRIVEN AFW PUMP AVAILABLE, **THEN** SECURE 13 AFW PUMP.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
J. SECURE MAIN FEED SYSTEM:	
1. Verify S/G Feed Pumps tripped. 2. Place Condensate Booster Pumps in PULL-TO-LOCK. 3. Place Condensate Pumps in PULL-TO-LOCK. 4. Place Heater Drain Pumps in PULL-TO-LOCK. 5. Shut S/G Feedwater Isolation Valves: 1-FW-4516-MOV 1-FW-4517-MOV	
K. CONFIRM NATURAL CIRCULATION IN AT LEAST ONE LOOP:	
- NOTE - Wide range Thot may be obtained from Subcooled Margin Monitor per Attachment (10). 1. Thot minus Tcold between 10 and 50°F. 2. Tcold constant or decreasing. 3. Thot constant or decreasing. 4. CET temperatures consistent with Thot. 5. Steaming rate affects primary temperature.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
L. RESTORE REACTOR MCCs AND INSTRUMENT BUSES:	
1. IF 11 4KV Bus is energized AND 14 4KV Bus is NOT energized, THEN tie MCC-104 to MCC-114: a. Open MCC-104 Main Feeder Breaker, 52-10401. b. Close MCC-104 Tie Breaker, 52-10420. c. Close MCC-114 Tie Breaker, 52-11420. 2. IF 14 4KV Bus is energized AND 11 4KV Bus is NOT energized, THEN tie MCC-114 to MCC-104: a. Open MCC-114 Main Feeder Breaker, 52-11401. b. Close MCC-114 Tie Breaker, 52-11420. c. Close MCC-104 Tie Breaker, 52-10420.	
M. MAINTAIN PRESSURIZER LEVEL BETWEEN 101 AND 180 INCHES:	
1. Open Loop Charging Valves: 1-CVC-518-CV 1-CVC-519-CV 2. Shut Auxiliary Spray Valve, 1-CVC-517-CV.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
3. Verify at least one Charging Pump operating. 4. Shift Letdown Control Valve Controller, 1-HIC-110, to MANUAL. 5. Adjust controller to shut Letdown Control Valves. 6. Open Letdown Isolation Valves: 1-CVC-515-CV 1-CVC-516-CV - **NOTE** - Degasifier Pumps are powered from non-vital power supply. Excessive diversion may cause Degasifier to overfill. 7. Slowly open the Letdown Control Valve noting the increase in letdown pressure as read on 1-PIC-201, until 1-PIC-201 takes control of the Letdown Backpressure Regulating Valve. 8. Allow temperatures to stabilize, then shift 1-HIC-110 to AUTO.	
N. RESTORE RCS PRESSURE TO BETWEEN 2225 AND 2300 PSIA:	
1. Operate 11 or 13 Backup Heaters as necessary to raise RCS pressure: a. Charge closing spring using manual lever at 480V breakers 52-1127 and 52-1427. b. Push the PUSH-TO-CLOSE button on breaker fronts.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
2. **IF** pressure exceeds 2300 PSIA, **THEN** initiate Auxiliary Spray: a. Record temperature differential between Pressurizer and Regenerative Heat Exchanger Outlet. b. Open Auxiliary Spray Valve, 1-CVC-517-CV. c. Shut Loop Charging Valves: 1-CVC-518-CV 1-CVC-519-CV d. Shift 1-HIC-100 to MANUAL and shut Pressurizer Spray Valves: 1-RC-100E-CV 1-RC-100F-CV	
O. MAINTAIN RCS SUBCOOLING BETWEEN 30 AND 140°F:	
1. Raise subcooling by any of the following: a. Securing Auxiliary Spray. b. Energizing Pressurizer Heaters. 2. Lower subcooling by any of the following: a. Securing Pressurizer Heaters. b. Initiating Auxiliary Spray.	

II. RECOVERY ACTIONS	ALTERNATE ACTIONS
P. VERIFY EMERGENCY DC PUMP OPERATION:	
1. Turbine Emergency Oil Pump. 2. Emergency H_2 Seal Oil Pump. 3. S/G Feed Pump Emergency Oil Pumps.	
Q. **IF** RCS COOLDOWN IS EXPECTED, **THEN** COMMENCE RCS BORATION:	
1. Shut VCT Makeup Valve, 1-CVC-512-CV. 2. Open Boric Acid Direct Makeup Valve, 1-CVC-514-MOV.	
3. Start a Boric Acid Pump.	3.1 **IF** Boric Acid Pumps **NOT** available, **THEN** establish gravity feed: a. Open BAST Gravity Feed Valves: 1-CVC-508-MOV 1-CVC-509-MOV b. Shut VCT Outlet Valve, 1-CVC-501-MOV.
4. Start all available Charging Pumps. 5. **WHEN** shutdown margin requirement of NEOG-7 is achieved, **THEN** secure boration: a. Open VCT Outlet Valve, 1-CVC-501-MOV. b. Stop Boric Acid Pump(s).	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
c. Shut Boric Acid Direct Makeup Valve, 1-CVC-514-MOV. d. Shut BAST Gravity Feed Valves: 1-CVC-508-MOV 1-CVC-509-MOV	
R. ENERGIZE SUPPORT EQUIPMENT AS NECESSARY TO FACILITATE SHUTDOWN AND VERIFY LOAD REMAINS WITHIN RATINGS:	
- CAUTION - If the following load limits can be maintained, actuation of the LOCI Sequencer will not cause a D/G overload condition: without 13 AFW Pump - 1400 KW with 13 AFW Pump - 1800 KW These limits may be exceeded if additional power is required to safely, efficiently shut down the plant. The D/G should not be operated above 3250 KW. - CAUTION - SMECO load limit is 260 AMPS. 1. Start a Main Exhaust Fan. 2. Start a Cavity Cooling Fan as needed to maintain cavity cooling temperature below 200°F. 3. Start Containment Air Cooler(s) in LOW as necessary to maintain containment temperature below 120°F.	

III RECOVERY ACTIONS

ALTERNATE ACTIONS

4. **IF** "SFP LEVEL TEMP HI" alarm received **THEN** start Spent Fuel Pool Cooling Pump(s).

5. Strip MCC-101AT and MCC-101BT of all loads, by opening individual MCC breakers.

6. **IF** 11 4KV Bus is energized **AND** 14 4KV Bus is **NOT** energized, **THEN** tie MCC-101BT to MCC-101AT:

   a. Close MCC-101AT Feeder Breaker, 52-1109.

   b. Open MCC-101BT Main Feeder Breaker, 52-10141.

   c. Close Tie Breakers:

      52-10120
      52-10160

   d. Energize loads per step R.9, page 15.

7. **IF** 14 4KV Bus is energized **AND** 11 4KV Bus is **NOT** energized, **THEN** tie MCC-101AT to MCC-101BT:

   a. Close MCC-101BT Feeder Breaker, 52-1419.

   b. Open MCC-101AT Main Feeder Breaker, 52-10101.

   c. Close Tie Breakers:

      52-10120
      52-10160

   d. Energize loads per step R.9, page 15.

III. RECOVERY ACTIONS

8. **IF** both 11 **AND** 14 4KV Buses are energized, **THEN** energize MCC-101AT and MCC-101BT:

   a. Close MCC-101AT Feeder Breaker, 52-1109.

   b. Close MCC-101BT Feeder Breaker, 52-1419.

   c. Energize loads per step R.9, page 15.

9. Energize MCC-101AT and MCC-101BT loads:

   a. Turbine Building Lighting Transformer Breaker, 52-10103.

   b. Turning Gear Oil Pump Breaker, 52-10102.

   c. Turbine Oil Lift Pump Breakers:

      52-10106
      52-10107
      52-10108

      52-10109
      52-10110

   d. Turbine Turning Gear Piggyback Motor and Turning Gear Motor Breaker, 52-10105.

   e. Technical Support Center HVAC Breaker, 52-10111.

   f. Distribution Panel 11 Breaker, 52-10116.

   g. Telephone Transformer Breaker, 52-10118.

   h. SRW Pump Room Vent Fan, 52-10124 (Restart SRW Pump Room Ventilation, per OI-15).

ALTERNATE ACTIONS

CCOM CR
88-1131

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
i. 11 S/G Feed Pump Turning Gear Breaker, 52-10121. j. Technical Support Center Computer Breaker, 52-10122. k. Turbine Oil Lift Pump Breakers: 52-10146 52-10147 52-10148 52-10149 l. AFW Pump Room Air Conditioner Breaker, 52-10150. m. 12 S/G Feed Pump Turning Gear Breaker, 52-10161. n. Distribution Panel 111 Breaker, 52-10162. 10. <u>IF</u> emergency power requested by Security, **<u>THEN</u>** place disconnect switch 2Y211, located on the North wall of Unit 2 27 ft Switchgear Room, in the EMERGENCY position.	
S. MINIMIZE 250V DC BATTERY DISCHARGE:	
1. Energize 15 or 25 Battery Charger on 13 250V DC Bus. 2. Ensure Main Turbine has stopped rotating or is on Turning Gear. 3. Verify Turning Gear Oil Pump running. 4. Stop Turbine Emergency Oil Pump and place handswitch in AUTO.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
5. **IF** bearing oil header pressure less than 25 PSIG, **THEN** start Turbine Emergency Oil Pump.	
T. LOWER MAIN GENERATOR HYDROGEN PRESSURE TO 2 PSIG:	
1. Align Two-Position Valve, 1-G-01, to VENT position. 2. Throttle open Generator Vent Line Isolation Valve, 1-G-03. 3. **WHEN** Main Generator hydrogen pressure is vented to 2 PSIG, **THEN** perform the following: a. Shut 1-G-03. b. Secure Emergency H_2 Seal Oil Pump.	
U. **IF** LOCI SEQUENCER IS ACTUATED **AND** TURBINE MCCs ARE BEING SUPPLIED BY D/G, **THEN** DE-ENERGIZE MCC-101AT AND MCC-101BT.	
1. **IF** rapid D/G load reduction needed **THEN** perform the following: a. Open 11A 480V Bus Feeder Breaker, 52-1112. b. Open 14B 480V Bus Feeder Breaker, 52-1413. c. Locally open MCC-101AT Main Feeder Breaker, 52-10101. d. Locally open MCC-101BT Main Feeder Breaker, 52-10141.	1.1 **IF** rapid D/G load reduction **NOT** needed, **THEN** perform the following locally: a. Open MCC-101AT Main Feeder Breaker, 52-10101. b. Open MCC-101BT Main Feeder Breaker, 52-10141.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
e. Close 11A 480V Bus Feeder Breaker, 52-1112. f. Close 14B 480V Bus Feeder Breaker, 52-1413.	
V. MAINTAIN VCT LEVEL BETWEEN 60 AND 100 INCHES:	
1. **WHEN** VCT makeup required, **THEN** shift Charging Pump suction to RWT: a. Open RWT To Charging Pump Suction Valve, 1-CVC-504-MOV. b. Observe VCT level increasing. c. Ensure Charging Pump(s) AMPS steady. 2. **WHEN** VCT increases to 100 inches, **THEN** shift Charging Pump suction to VCT: a. Open VCT Outlet Valve, 1-CVC-501-MOV. b. Shut RWT To Charging Pump Suction Valve, 1-CVC-504-MOV.	1.b.1 **IF** VCT level **NOT** increasing, **THEN** shut VCT Outlet Valve, 1-CVC-501-MOV.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
W. **IF** FORCED CIRCULATION DESIRED **AND** PUMP RESTART CRITERIA MET, **THEN** RESTART RCPs WHEN POWER AVAILABLE:	

- **CAUTION** -

Uncontrolled restoration of cooling to hot RCP seals may cause degradation of the metallic seating surfaces by thermal shock.

1. **IF** Component Cooling is isolated to RCP seals, **THEN** reduce RCP lower seal temperature below 280°F prior to initiating full cooling flow to the RCPs:

   a. Shut Component Cooling Supply Containment Manual Isolation Valve, 1-CC-284, located in 5 ft East Penetration Room.

   b. Open Component Cooling Containment Isolation Valves:

      1-CC-3832-CV
      1-CC-3833-CV

   c. Slowly open 1-CC-284 to throttle component cooling flow until lower seal temperatures are less than 280°F.

   d. **WHEN** lower seal temperatures are less than 280°F, **THEN** fully open 1-CC-284.

2. **IF** an RCP lower seal temperature exceeded 280°F, **THEN** an engineering evaluation is required prior to restarting that RCP.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
3. Raise pressurizer level to at least 155 inches.	
4. Lower Tcold to less than 525°F.	
5. Verify RCP restart criteria:	
a. RCS subcooling greater than 30°F.	
b. At least one S/G available for heat removal.	
c. Pressurizer level greater than 155 inches and stable.	
d. Tcold less than 525°F.	
e. RCS temperature and pressure greater than the minimum operating limits per RCP curve on Attachment (1).	
- NOTE - Starting an RCP may cause a pressurizer level transient.	
6. **WHEN** RCP restart criteria are met, **THEN** start one RCP in a loop with an operable S/G:	
a. Verify "COMPT CLG FLOW LO" alarm clear.	
b. Start Oil Lift Pump.	
c. Insert RCP sync stick.	
d. Start one RCP.	

III. RECOVERY ACTIONS

e. Monitor RCP running current:

Tavg	Current
525 to 572°F	238 to 210 AMPS and steady
210 to 525°F	264 to 238 AMPS and steady

7. Monitor RCP seal parameters following pump restart.

8. Allow backflow to equalize temperatures in opposite loop.

9. Start second RCP in opposite loop per steps W.6 and W.7, pages 20 and 21.

10. Secure Auxiliary Spray:

    a. Open Loop Charging Valves:

    1-CVC-518-CV
    1-CVC-519-CV

    b. Shut Auxiliary Spray Valve, 1-CVC-517-CV.

    c. Shift Pressurizer Spray Controller, 1-HIC-100, to AUTO.

11. **WHEN** RCPs restarted, **THEN** implement appropriate operating procedure **AND** complete administrative post-trip actions of this procedure.

ALTERNATE ACTIONS

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
X. DETERMINE TIME UNTIL COOLDOWN REQUIRED:	
1. Determine total CST water available for use as makeup.	
2. Determine time until commencement of required cooldown per Attachment (11).	
3. **IF** RCS cooldown required, **THEN** implement Natural Circulation Cooldown (AOP-3F) **AND** complete administrative post-trip actions of this procedure.	3.1 **IF** RCS cooldown **NOT** required, **THEN** implement Loss Of Flow/Natural Circulation (AOP-3E) **AND** complete administrative post-trip actions of this procedure.

Y. ADMINISTRATIVE POST-TRIP ACTIONS:

- **NOTE** -

The following actions may be accomplished whenever feasible. They may be done in any order.

_______ 1. Refer to ERPIP to determine appropriate emergency response actions.

_______ 2. Perform notifications per CCI-118.

_______ 3. Notify ESO of trip.

_______ 4. Request RCS Boron and Iodine sample.

_______ 5. Perform shutdown margin calculation per NEOG 2 and 7.

_______ 6. Complete transient log entries per CCI-301.

_______ 7. Recall post-trip review (preferably within 30 minutes of trip).

_______ 8. Perform post-trip review per CCI-111.

_______ 9. Monitor turbine bearing temperatures.

_______ 10. Continue Main Turbine Shutdown per applicable step of OI-43A.

END OF SECTION III.

IV. SAFETY FUNCTION STATUS CHECK

A. The STA (or person designated by STA) will perform the intermediate and final safety function checks respectively on entry and prior to exiting from this procedure.

B. Perform intermediate safety function status checks at 10 minute intervals until plant conditions stabilize.

C. Immediately notify Shift Supervisor or Control Room Supervisor if any safety function criteria is not being satisfied.

D. Review data and verify that safety function acceptance criteria are satisfied.

E. When EOP completed, then perform final safety function check.

REACTIVITY CONTROL PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. WRNI power	less than 3%	___________	less than 1%	______
b. SUR (DPM)	negative	___________	0	______
c. CEA status	all inserted	___________	all inserted	______
or				
Boration status:				
concentration	increasing	___________	appropriate S/D margin	______
BAST level	decreasing	___________	N/A	N/A

RCS PRESSURE AND INVENTORY PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Pressurizer pressure (PSIA)	1850 to 2300	___________	2225 to 2300	_____
b. Pressurizer level (inches)	101 to 250	___________	130 to 180	_____
c. RCS subcooling (°F)	30 to 140	___________	30 to 140	_____

CORE AND RCS HEAT REMOVAL PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. RCS Tcold (°F)	515 to 535	___________	520 to 535	_____
b. CET (°F) (1)	less than 560	___________	less than 560	_____
c. Thot minus Tcold (°F):				
Natural Circulation	10 to 50	___________	10 to 50	_____
Forced Circulation	N/A	N/A ___________	less than 5	_____
d. S/G pressure (PSIA)	785 to 920	___________	850 to 920	_____
e. S/G level (inches)	(-)170 to (+)30	___________	(-)24 to (+)30	_____
f. S/G level trend (inches)	trending towards 0	___________	trending towards 0	_____
g. Condensate Storage Tank level (ft)	greater than 5	___________	greater than 5	_____

(1) CET temperatures may be greater than 560°F while Natural Circulation is being established.

VITAL AUXILIARIES	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. 4KV vital buses 11 or 14	energized	____________	energized	______
b. Instrument Air pressure (PSIG)	greater than 88	____________	greater than 88	______
c. Component Cooling (# Pumps running)	1 or 2	____________	1 or 2	______
d. Component Cooling Head Tank level (inches) (2)	greater than 20	____________	greater than 20	______
e. Saltwater (# Pumps running)	1 or 2	____________	1 or 2	______
f. Service Water (# Pumps running)	1 or 2	____________	1 or 2	______
g. Service Water Head Tank level (inches) (2)	greater than 30	____________	greater than 30	______
h. 125V DC buses 11, 12, 21, 22	energized	____________	energized	______
i. 120V AC vital buses 11, 12, 13, 14	energized	____________	energized	______

(2) Refer to OI-15 and OI-16 for filling head tanks.

NORMAL CONTAINMENT ENVIRONMENT PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Containment pressure (PSIG)	less than 0.7		less than 0.7	
b. Containment temperature (°F)	less than 120		less than 120	
c. Containment level (inches)	less than 4		less than 4	

NORMAL RADIATION LEVELS EXTERNAL TO CONTAINMENT	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Noble Gas Monitor	alarm clear		alarm clear	

STATUS CHECK NUMBER	COMPLETE AT TIME
1	
2	
3	
4	

CALVERT CLIFFS NUCLEAR POWER PLANT

EOP-2 LOSS OF OFFSITE POWER

REVISION 1

	SIGNATURE	DATE
PREPARED BY;	[signature]	12-18-87
VERIFIED BY;	James V. Grooms	12/18/87
POSRC;	MEETING # 88-7	2-10-88
APPROVED BY;	J R Lemons	2-10-88

Manager-Nuclear Operations or General Supervisor-Operations if POSRC review is not required

LIST OF EFFECTIVE PAGES

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21	1
22	1
23	1
24	1
25	1
26	1
27	1

LOSS OF OFFSITE POWER

I. PRECAUTIONS

A. Do not adopt manual operation of automatically controlled systems unless a malfunction is apparent or automatic system operation will not support the maintenance of a safety function.

B. Systems shifted to manual operation must be monitored frequently to ensure correct operation.

C. At least two independent indications should be used, when available, to evaluate and corroborate a specific plant condition since an incident could induce inconsistencies between instruments.

D. In Natural Circulation, increased loop transport time causes a 5 to 10 minute delay in temperature responses to a plant change. Pressurizer level and pressure responses typically provide better indication of RCS response during this period.

E. If cooling down with a S/G isolated, an inverted delta T (Tcold higher than Thot) may be observed in the idle loop. This is due to a small amount of reverse heat transfer in the isolated S/G. The inverted delta T is not expected to have any significant effect on natural circulation flow in the operating S/G loop.

F. The concentration of boron in RCS makeup water should be consistent with maintaining the required shutdown margin.

G. Minimize the number of cycles of pressurizer auxiliary spray when the temperature differential is greater than 400°F.

H. Excessive Diesel Generator loading can result if a SIAS is received and the LOCI sequencer actuates. Non-vital loads should be manually shed immediately upon receiving a SIAS.

I. If a pump or component fails, the cause of the failure should be determined prior to restarting or starting a standby pump or component to prevent a common failure.

II. ENTRY CONDITIONS

The presence of one or more of the following conditions indicates that a Loss Of Offsite Power may have occurred:

A. Momentary loss of Control Room lighting on both Units.

B. 500KV Red and Black Bus power available lights de-energized.

C. Diesel Generators running.

D. 12 and 22 Service Bus 13KV power available lights de-energized.

E. No RCPs running on either Unit.

F. Reactor Trip due to RCS low flow.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
A. VERIFY POST-TRIP IMMEDIATE ACTIONS COMPLETED.	
B. COMMENCE INTERMEDIATE SAFETY FUNCTION STATUS CHECK.	
C. DETERMINE APPROPRIATE EMERGENCY RESPONSE ACTIONS PER THE ERPIP.	
D. PROTECT RCS FROM EXCESSIVE COOLDOWN AND CONDENSER FROM OVERPRESSURE:	
1. Shut both MSIVs. 2. Shut S/G Blowdown Valves. 2-BD-4010-CV 2-BD-4011-CV 2-BD-4012-CV 2-BD-4013-CV	
E. ESTABLISH S/G HEAT SINK:	
1. Establish S/G heat removal: a. Shift Atmospheric Dump Controller to MANUAL. b. Operate Atmospheric Dump Valves to return Tcold to between 520 and 530°F.	-**NOTE**- Atmospheric Dump Valves are reverse acting, i.e., clockwise to open, counterclockwise to shut. 1.b.1 **IF** Atmospheric Dump Valves will **NOT** operate from Control Room, **THEN** locally operate Atmospheric Dump Valves on 45 ft Aux Building.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
2. Establish feedwater flow to S/Gs: a. Start 21 or 22 AFW Pump by opening AFW Steam Supply Valves: 2-MS-4070-CV 2-MS-4071-CV b. Adjust AFW Flow Control Valves to restore and maintain S/G levels between (-)170 and (+) 30 inches and trending towards 0 inches.	- <u>CAUTION</u> - **23 AFW Pump flow limit is 300 GPM when powered from D/G.** 2.a.1 <u>IF</u> steam driven pumps <u>NOT</u> available, <u>THEN</u> start 23 AFW Pump.
F. RESTORE COMPONENT COOLING FLOW:	
1. <u>IF</u> RCP lower seal temperature less than 280°F, <u>THEN</u> start a Component Cooling Pump. 2. Verify Component Cooling Heat Exchanger on service is being supplied from an operating Saltwater Header.	1.1 <u>IF</u> seal temperature above 280°F, <u>THEN</u> perform the following: a. Shut Component Cooling Supply Containment Isolation Valve, 2-CC-3832-CV. b. Start a Component Cooling Pump.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
G. ALIGN OTHER AVAILABLE POWER SOURCES TO ELECTRICAL SYSTEM:	
- **CAUTION** - **If only one D/G is available, starting additional loads may cause an overload condition. Alternate operation of equipment may be required to prevent this condition.** 1. Align 12 D/G to Unit with largest power requirement or with redundant safety related equipment out of service. 2. Consider use of SMECO Tie for supplying loads per OI-27E.	
H. VERIFY SHUTDOWN SEQUENCER LOADS OPERATING:	
1. Service Water Pump(s). 2. Saltwater Pump(s). 3. Instrument Air Compressor. 4. 11 or 12 Control Room Ventilation. 5. Switchgear Room Ventilation.	
I. **IF** STEAM DRIVEN AFW PUMP AVAILABLE, **THEN** SECURE 23 AFW PUMP.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
J. SECURE MAIN FEED SYSTEM:	
1. Verify S/G Feed Pumps tripped. 2. Place Condensate Booster Pumps in PULL-TO-LOCK. 3. Place Condensate Pumps in PULL-TO-LOCK. 4. Place Heater Drain Pumps in PULL-TO-LOCK. 5. Shut S/G Feedwater Isolation Valves: 2-FW-4516-MOV 2-FW-4517-MOV	
K. CONFIRM NATURAL CIRCULATION IN AT LEAST ONE LOOP:	
- NOTE - Wide range Thot may be obtained from Subcooled Margin Monitor per Attachment (10). 1. Thot minus Tcold between 10 and 50°F. 2. Tcold constant or decreasing. 3. Thot constant or decreasing. 4. CET temperatures consistent with Thot. 5. Steaming rate affects primary temperature.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
L. RESTORE REACTOR MCCs AND INSTRUMENT BUSES:	
1. **IF** 24 4KV Bus is energized **AND** 21 4KV Bus is **NOT** energized, **THEN** tie MCC-214 to MCC-204: a. Open MCC-214 Main Feeder Breaker, 52-21401. b. Close MCC-214 Tie Breaker, 52-21420. c. Close MCC-204 Tie Breaker, 52-20420. 2. **IF** 21 4KV Bus is energized **AND** 24 4KV Bus is **NOT** energized, **THEN** tie MCC-204 to MCC-214: a. Open MCC-204 Main Feeder Breaker, 52-20401. b. Close MCC-204 Tie Breaker, 52-20420. c. Close MCC-214 Tie Breaker, 52-21420.	
M. MAINTAIN PRESSURIZER LEVEL BETWEEN 101 AND 180 INCHES:	
1. Open Loop Charging Valves: 2-CVC-518-CV 2-CVC-519-CV 2. Shut Auxiliary Spray Valve, 2-CVC-517-CV.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
3. Verify at least one Charging Pump operating. 4. Shift Letdown Control Valve Controller, 2-HIC-110, to MANUAL. 5. Adjust controller to shut Letdown Control Valves. 6. Open Letdown Isolation Valves: 2-CVC-515-CV 2-CVC-516-CV - **NOTE** - Degasifier Pumps are powered from non-vital power supply. Excessive diversion may cause Degasifier to overfill. 7. Slowly open the Letdown Control Valve noting the increase in letdown pressure as read on 2-PIC-201, until 2-PIC-201 takes control of the Letdown Backpressure Regulating Valve. 8. Allow temperatures to stabilize, then shift 2-HIC-110 to AUTO.	
N. RESTORE RCS PRESSURE TO BETWEEN 2225 AND 2300 PSIA:	
1. Operate 21 or 23 Backup Heaters as necessary to raise RCS pressure: a. Charge closing spring using manual lever at 480V breakers 52-2127 and 52-2427. b. Push the PUSH-TO-CLOSE button on breaker fronts.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
2. **IF** pressure exceeds 2300 PSIA, **THEN** initiate Auxiliary Spray: a. Record temperature differential between Pressurizer and Regenerative Heat Exchanger Outlet. b. Open Auxiliary Spray Valve, 2-CVC-517-CV. c. Shut Loop Charging Valves: 2-CVC-518-CV 2-CVC-519-CV d. Shift 2-HIC-100 to MANUAL and shut Pressurizer Spray Valves: 2-RC-100E-CV 2-RC-100F-CV	
O. MAINTAIN RCS SUBCOOLING BETWEEN 30 AND 140°F:	
1. Raise subcooling by any of the following: a. Securing Auxiliary Spray. b. Energizing Pressurizer Heaters. 2. Lower subcooling by any of the following: a. Securing Pressurizer Heaters. b. Initiating Auxiliary Spray.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
P. VERIFY EMERGENCY DC PUMP OPERATION:	
1. Turbine Emergency Oil Pump. 2. Emergency Air Side Seal Oil Pump. 3. S/G Feed Pump Emergency Oil Pumps.	
Q. **IF** RCS COOLDOWN IS EXPECTED, **THEN** COMMENCE RCS BORATION:	
1. Shut VCT Makeup Valve, 2-CVC-512-CV. 2. Open Boric Acid Direct Makeup Valve, 2-CVC-514-MOV. 3. Start a Boric Acid Pump.	3.1 **IF** Boric Acid Pumps **NOT** available, **THEN** establish gravity feed: a. Open BAST Gravity Feed Valves: 2-CVC-508-MOV 2-CVC-509-MOV b. Shut VCT Outlet Valve, 2-CVC-501-MOV.
4. Start all available Charging Pumps. 5. **WHEN** shutdown margin requirement of NEOG-11 is achieved, **THEN** secure boration: a. Open VCT Outlet Valve, 2-CVC-501-MOV. b. Stop Boric Acid Pump(s).	

III. RECOVERY ACTIONS

ALTERNATE ACTIONS

c. Shut Boric Acid Direct Makeup Valve, 2-CVC-514-MOV.

d. Shut BAST Gravity Feed Valves:

2-CVC-508-MOV
2-CVC-509-MOV

R. ENERGIZE SUPPORT EQUIPMENT AS NECESSARY TO FACILITATE SHUTDOWN AND VERIFY LOAD REMAINS WITHIN RATINGS:

- CAUTION -

If the following load limits can be maintained, actuation of the LOCI Sequencer will not cause a D/G overload condition:

without 23 AFW Pump - 1400 KW
with 23 AFW Pump - 1800 KW

These limits may be exceeded if additional power is required to safely, efficiently shut down the plant. The D/G should not be operated above 3250 KW.

- CAUTION -

SMECO load limit is 260 AMPS.

1. Start a Main Exhaust Fan.

2. Start a Cavity Cooling Fan as needed to maintain cavity cooling temperature below 200°F.

3. Start Containment Air Cooler(s) in LOW as necessary to maintain containment temperature below 120°F.

III. RECOVERY ACTIONS

4. IF "SFP LEVEL TEMP HI" alarm received, THEN start Spent Fuel Pool Cooling Pump(s).

5. Strip MCC-201AT and MCC-201BT of all loads, by opening individual MCC breakers.

6. IF 24 4KV Bus is energized AND 21 4KV Bus is NOT energized, THEN tie MCC-201AT to MCC-201BT:

   a. Close MCC-201BT Feeder Breaker, 52-2419.

   b. Open MCC-201AT Main Feeder Breaker, 52-20101.

   c. Close Tie Breakers:

      52-20120
      52-20160

   d. Energize loads per step R.9, page 15.

7. IF 21 4KV Bus is energized AND 24 4KV Bus is NOT energized, THEN tie MCC-201BT to MCC-201AT:

   a. Close MCC-201AT Feeder Breaker, 52-2109.

   b. Open MCC-201BT Main Feeder Breaker, 52-20141.

   c. Close Tie Breakers:

      52-20120
      52-20160

   d. Energize loads per step R.9, page 15.

ALTERNATE ACTIONS

III. RECOVERY ACTIONS

8. IF both 21 AND 24 4KV Buses are energized, THEN energize MCC-201AT and MCC-201BT:

   a. Close MCC-201AT Feeder Breaker, 52-2109.

   b. Close MCC-201BT Feeder Breaker, 52-2419.

   c. Energize loads per step R.9, page 15.

9. Energize MCC-201AT and MCC-201BT loads:

   a. Turbine Building Lighting Transformer Breaker, 52-20103.

   b. Turbine Oil Lift Pump Breaker, 52-20106.

   c. Turbine Turning Gear Motor Breaker, 52-20105.

   d. Distribution Panel 21 Breaker, 52-20116.

   e. 21 S/G Feed Pump Turning Gear Breaker, 52-20121.

   f. AFW Pump Room Air Conditioner Breaker, 52-20150.

   g. 22 S/G Feed Pump Turning Gear Breaker, 52-20161.

   h. Distribution Panel 211 Breaker, 52-20162.

   i. SRW Pump Room Vent Fan, 52-20149 (Restart SRW Pump Room Ventilation, per OI-15).

ALTERNATE ACTIONS

CCOM CR
88-1115

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
10. **IF** emergency power requested by Security, **THEN** place disconnect switch 2Y211, located on the North wall of Unit 2 27 ft Switchgear Room, in the EMERGENCY position.	
S. MINIMIZE 250V DC BATTERY DISCHARGE:	
1. Energize 15 or 25 Battery Charger on 13 250V DC Bus. 2. Ensure Main Turbine has stopped rotating or is on Turning Gear. 3. Verify Bearing Oil Pump running. 4. Stop Turbine Emergency Oil Pump and place handswitch in AUTO. 5. **IF** bearing oil header pressure less than 15 PSIG, **THEN** start Turbine Emergency Oil Pump.	

COOM CR
88-1145

<table>
<tr><th>II. RECOVERY ACTIONS</th><th>ALTERNATE ACTIONS</th></tr>
<tr><td>T. LOWER MAIN GENERATOR HYDROGEN PRESSURE TO 2 PSIG:</td><td></td></tr>
<tr><td>1. Throttle open Generator Bottom Vent To Atmosphere Valve, 2-G-06.

2. <u>WHEN</u> Main Generator hydrogen pressure is vented to 2 PSIG, <u>THEN</u> perform the following:

a. Shut 2-G-06.

b. Secure Emergency Air Side Seal Oil Pump.</td><td></td></tr>
<tr><td>U. <u>IF</u> LOCI SEQUENCER IS ACTUATED <u>AND</u> TURBINE MCCs ARE BEING SUPPLIED BY D/G, <u>THEN</u> DE-ENERGIZE MCC-201AT AND MCC-201BT.</td><td></td></tr>
<tr><td>1. <u>IF</u> rapid D/G load reduction needed, <u>THEN</u> perform the following:

a. Open 21A 480V Bus Feeder Breaker, 52-2112.

b. Open 24B 480V Bus Feeder Breaker, 52-2413.

c. Locally open MCC-201AT Main Feeder Breaker, 52-20101.

d. Locally open MCC-201BT Main Feeder Breaker, 52-20141.

e. Close 21A 480V Bus Feeder Breaker, 52-2112.

f. Close 24B 480V Bus Feeder Breaker, 52-2413.</td><td>1.1 <u>IF</u> rapid D/G load reduction <u>NOT</u> needed, <u>THEN</u> perform the following locally:

a. Open MCC-201AT Main Feeder Breaker, 52-20101.

b. Open MCC-201BT Main Feeder Breaker, 52-20141.</td></tr>
</table>

III. <u>RECOVERY ACTIONS</u>	<u>ALTERNATE ACTIONS</u>
V. MAINTAIN VCT LEVEL BETWEEN 60 AND 100 INCHES:	
1. **<u>WHEN</u>** VCT makeup required, **<u>THEN</u>** shift Charging Pump suction to RWT:	
a. Open RWT To Charging Pump Suction Valve, 2-CVC-504-MOV.	
b. Observe VCT level increasing.	1.b.1 **<u>IF</u>** VCT level **<u>NOT</u>** increasing, **<u>THEN</u>** shut VCT Outlet Valve, 2-CVC-501-MOV.
c. Ensure Charging Pump(s) AMPS steady.	
2. **<u>WHEN</u>** VCT increases to 100 inches, **<u>THEN</u>** shift Charging Pump suction to VCT:	
a. Open VCT Outlet Valve, 2-CVC-501-MOV.	
b. Shut RWT To Charging Pump Suction Valve, 2-CVC-504-MOV.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
W. **IF** FORCED CIRCULATION DESIRED **AND** PUMP RESTART CRITERIA MET, **THEN** RESTART RCPs WHEN POWER AVAILABLE:	
- **CAUTION** - **Uncontrolled restoration of cooling to hot RCP seals may cause degradation of the metallic seating surfaces by thermal shock.** 1. **IF** Component Cooling is isolated to RCP seals, **THEN** reduce RCP lower seal temperature below 280°F prior to initiating full cooling flow to the RCPs: a. Shut Component Cooling Supply Containment Manual Isolation Valve, 2-CC-284, located in 5 ft East Penetration Room. b. Open Component Cooling Containment Isolation Valves: 2-CC-3832-CV 2-CC-3833-CV c. Slowly open 2-CC-284 to throttle component cooling flow until lower seal temperatures are less than 280°F. d. **WHEN** lower seal temperatures are less than 280°F, **THEN** fully open 2-CC-284. 2. **IF** an RCP lower seal temperature exceeded 280°F, **THEN** an engineering evaluation is required prior to restarting that RCP.	

III. RECOVERY ACTIONS

3. Raise pressurizer level to at least 155 inches.

4. Lower Tcold to less than 525°F.

5. Verify RCP restart criteria:

   a. RCS subcooling greater than 30°F.

   b. At least one S/G available for heat removal.

   c. Pressurizer level greater than 155 inches and stable.

   d. Tcold less than 525°F.

   e. RCS temperature and pressure greater than the minimum operating limits per RCP curve on Attachment (1).

- **NOTE** -

Starting an RCP may cause a pressurizer level transient.

6. **WHEN** RCP restart criteria are met,
   THEN start one RCP in a loop with an operable S/G:

   a. Verify "COMPT CLG FLOW LO" alarm clear.

   b. Start Oil Lift Pump.

   c. Insert RCP sync stick.

   d. Start one RCP.

ALTERNATE ACTIONS

III. RECOVERY ACTIONS

e. Monitor RCP running current:

Tavg	Current
525 to 572°F	238 to 210 AMPS and steady
210 to 525°F	264 to 238 AMPS and steady

7. Monitor RCP seal parameters following pump restart.

8. Allow backflow to equalize temperatures in opposite loop.

9. Start second RCP in opposite loop per steps W.6 and W.7, pages 20 and 21.

10. Secure Auxiliary Spray:

    a. Open Loop Charging Valves:

       2-CVC-518-CV
       2-CVC-519-CV

    b. Shut Auxiliary Spray Valve, 2-CVC-517-CV.

    c. Shift Pressurizer Spray Controller, 2-HIC-100, to AUTO.

11. **WHEN** RCPs restarted, **THEN** implement appropriate operating procedure **AND** complete administrative post-trip actions of this procedure.

ALTERNATE ACTIONS

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
X. DETERMINE TIME UNTIL COOLDOWN REQUIRED:	
1. Determine total CST water available for use as makeup.	
2. Determine time until commencement of required cooldown per Attachment (11).	
3. **IF** RCS cooldown required, **THEN** implement Natural Circulation Cooldown (AOP-3F) **AND** complete administrative post-trip actions of this procedure.	3.1 **IF** RCS cooldown **NOT** required, **THEN** implement Loss Of Flow/Natural Circulation (AOP-3E) **AND** complete administrative post-trip actions of this procedure.

Y. ADMINISTRATIVE POST-TRIP ACTIONS:

- **NOTE** -

The following actions may be accomplished whenever feasible. They may be done in any order.

_____ 1. Refer to ERPIP to determine appropriate emergency response actions.

_____ 2. Perform notifications per CCI-118.

_____ 3. Notify ESO of trip.

_____ 4. Request RCS Boron and Iodine sample.

_____ 5. Perform shutdown margin calculation per NEOG 9 and 11.

_____ 6. Complete transient log entries per CCI-301.

_____ 7. Recall post-trip review (preferably within 30 minutes of trip).

_____ 8. Perform post-trip review per CCI-111.

_____ 9. Monitor turbine bearing temperatures.

_____ 10. Continue Main Turbine Shutdown per applicable step of OI-43A.

END OF SECTION III.

IV. SAFETY FUNCTION STATUS CHECK

A. The STA (or person designated by STA) will perform the intermediate and final safety function checks respectively on entry and prior to exiting from this procedure.

B. Perform intermediate safety function status checks at 10 minute intervals until plant conditions stabilize.

C. Immediately notify Shift Supervisor or Control Room Supervisor if any safety function criteria is not being satisfied.

D. Review data and verify that safety function acceptance criteria are satisfied.

E. When EOP completed, then perform final safety function check.

REACTIVITY CONTROL PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. WRNI power	less than 3%	___________	less than 1%	______
b. SUR (DPM)	negative	___________	0	______
c. CEA status	all inserted	___________	all inserted	______
or				
Boration status:				
concentration	increasing	___________	appropriate S/D margin	______
BAST level	decreasing	___________	N/A	N/A

RCS PRESSURE AND INVENTORY PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Pressurizer pressure (PSIA)	1850 to 2300	___________	2225 to 2300	_____
b. Pressurizer level (inches)	101 to 250	___________	130 to 180	_____
c. RCS subcooling (°F)	30 to 140	___________	30 to 140	_____

CORE AND RCS HEAT REMOVAL PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. RCS Tcold (°F)	515 to 535	___________	520 to 535	_____
b. CET (°F) (1)	less than 560	___________	less than 560	_____
c. Thot minus Tcold (°F):				
Natural Circulation	10 to 50	___________	10 to 50	_____
Forced Circulation	N/A	N/A	less than 5	_____
d. S/G pressure (PSIA)	785 to 920	___________	850 to 920	_____
e. S/G level (inches)	(-)170 to (+)30	___________	(-)24 to (+)30	_____
f. S/G level trend (inches)	trending towards 0	___________	trending towards 0	_____
g. Condensate Storage Tank level (ft)	greater than 5	___________	greater than 5	_____

(1) CET temperatures may be greater than 560°F while Natural Circulation is being established.

VITAL AUXILIARIES	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. 4KV vital buses 21 or 24	energized	____________	energized	______
b. Instrument Air pressure (PSIG)	greater than 88	____________	greater than 88	______
c. Component Cooling (# Pumps running)	1 or 2	____________	1 or 2	______
d. Component Cooling Head Tank level (inches) (2)	greater than 20	____________	greater than 20	______
e. Saltwater (# Pumps running)	1 or 2	____________	1 or 2	______
f. Service Water (# Pumps running)	1 or 2	____________	1 or 2	______
g. Service Water Head Tank level (inches) (2)	greater than 30	____________	greater than 30	______
h. 125V DC buses 11, 12, 21, 22	energized	____________	energized	______
i. 120V AC vital buses 21, 22, 23, 24	energized	____________	energized	______

(2) Refer to OI-15 and OI-16 for filling head tanks.

NORMAL CONTAINMENT ENVIRONMENT PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Containment pressure (PSIG)	less than 0.7	___________	less than 0.7	_____
b. Containment temperature (°F)	less than 120	___________	less than 120	_____
c. Containment level (inches)	less than 4	___________	less than 4	_____

NORMAL RADIATION LEVELS EXTERNAL TO CONTAINMENT	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Noble Gas Monitor	alarm clear	___________	alarm clear	_____

STATUS CHECK NUMBER	COMPLETE AT TIME
1	_________
2	_________
3	_________
4	_________
_________	_________
_________	_________
_________	_________
_________	_________

CALVERT CLIFFS NUCLEAR POWER PLANT

EOP-3 TOTAL LOSS OF ALL FEEDWATER

REVISION 1

	SIGNATURE	DATE
PREPARED BY;	James V. Arvons	, 12/18/87
VERIFIED BY;	[illegible]	, 12-18-87
POSRC;	MEETING # 88-7	, 2-10-88
APPROVED BY;	J R Lemons	, 2-10-88

Manager-Nuclear Operations or General Supervisor-Operations if POSRC review is not required

LIST OF EFFECTIVE PAGES

PAGE NUMBER	REVISION
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3	1
4	1
5	1
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13	1
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29	1
30	1
31	1
32	1
33	1
34	1
35	1
36	1
37	1
38	1
39	1
40	1

TOTAL LOSS OF ALL FEEDWATER

I. PRECAUTIONS

A. Do not adopt manual operation of automatically controlled systems unless a malfunction is apparent or automatic system operation will not support the maintenance of a safety function.

B. Systems shifted to manual operation must be monitored frequently to ensure correct operation.

C. At least two independent indications should be used, when available, to evaluate and corroborate a specific plant condition since an incident could induce inconsistencies between instruments.

D. Solid operation of the RCS should only be attempted in order to maintain a subcooled margin of 30°F.

E. If solid operation of the RCS is undertaken, any functions or actions directly affecting makeup, letdown, system heatup or cooldown should be closely monitored to avoid rapid pressure excursions.

F. Feedwater should not be added to a dry S/G if the other S/G still contains water. If both S/Gs become dry, refill only one S/G to reinitiate Natural Circulation.

G. Minimize the number of cycles of pressurizer auxiliary spray when the temperature differential is greater than 400°F.

H. In Natural Circulation, increased loop transport time causes a 5 to 10 minute delay in temperature responses to a plant change. Pressurizer level and pressure responses, if available, typically provide better indication of RCS response during this period.

I. S/G pressure, pressurizer pressure, and containment temperature affect the level indication for the S/Gs and Pressurizer. Attachments (8) and (9) contain the corrected S/G and pressurizer levels for various S/G pressures, pressurizer pressures, and containment temperatures.

J. If a pump or component fails, the cause of the failure should be determined prior to restarting or starting a standby pump or component to prevent a common failure.

II. ENTRY CONDITIONS

The presence of one or more of the following conditions indicates that a Total Loss Of All Feedwater may have occurred:

A. Loss of Condensate Storage Tank inventory.

B. Loss of Condenser Hotwell level.

C. Low suction or discharge pressure for either the Condensate, Condensate Booster, or S/G Feed Pumps.

D. S/G Turbine Tripped alarm on both S/G Feed Pumps.

E. Low suction or discharge pressure for the AFW Pumps.

F. Motor System No Flow alarm for AFW.

G. Turbine System No Flow alarm for AFW.

III RECOVERY ACTIONS	ALTERNATE ACTIONS
A. VERIFY POST-TRIP IMMEDIATE ACTIONS COMPLETED.	
B. COMMENCE INTERMEDIATE SAFETY FUNCTION STATUS CHECK.	
C. ERPIP REQUIRES THAT A SITE EMERGENCY BE DECLARED IF TOTAL LOSS OF MAIN AND AUXILIARY FEEDWATER EXISTS FOR LONGER THAN TEN MINUTES.	
D. TRIP ALL RCPs.	
E. MINIMIZE S/G INVENTORY LOSS.	
1. Shut S/G Blowdown Valves: 1-BD-4010-CV 1-BD-4011-CV 1-BD-4012-CV 1-BD-4013-CV	
F. COMMENCE RCS BORATION:	
1. Shut VCT Makeup Valve, 1-CVC-512-CV. 2. Open Boric Acid Direct Makeup Valve, 1-CVC-514-MOV.	

II. **RECOVERY ACTIONS**	**ALTERNATE ACTIONS**
3. Start a Boric Acid Pump.	3.1 **IF** Boric Acid Pumps **NOT** available, **THEN** establish gravity feed: a. Open BAST Gravity Feed Valves: 1-CVC-508-MOV 1-CVC-509-MOV b. Shut VCT Outlet Valve, 1-CVC-501-MOV.
4. Start all available Charging Pumps.	
5. Continue boration until a total 65 inch decrease in BAST level(s) is achieved, or shutdown margin requirement of NEOG-7 is achieved.	
ESTABLISH NATURAL CIRCULATION AND COOL DOWN RCS:	
1. Block ESFAS actuation: a. **WHEN** "SGIS A(B) BLOCK PERMITTED" alarm(s) received, **THEN** block SGIS A(B).	1.a.1 **IF** SGIS actuates, **THEN** reset SGIS: a. Place Condensate Booster Pumps in PULL-TO-LOCK. b. Match handswitches per SGIS Verification Checklist, Attachment (7). c. Block SGIS. d. Reset SGIS signal.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
	e. Open S/G Feedwater Isolation Valves: 1-FW-4516-MOV 1-FW-4517-MOV f. Start a Condensate Booster Pump.
b. **WHEN** "PRSR PRESS BLOCK A(B) PERMITTED" alarm(s) received, **THEN** block SIAS A(B).	
2. Commence cooldown by throttling Turbine Bypass or Atmospheric Dump Valves while maintaining: a. Less than $100^{\circ}F/h$ RCS cooldown rate. b. Pressurizer level between 50 and 180 inches.	
3. Shut Letdown Isolation Valves: 1-CVC-515-CV 1-CVC-516-CV	
4. Maintain RCS subcooling between 30 and $140^{\circ}F$: a. Raise subcooling by: (1) Energizing Pressurizer Heaters. (2) Increasing cooldown rate. b. Lower subcooling by initiating Auxiliary Spray: (1) Record temperature differential between Pressurizer and Regenerative Heat Exchanger Outlet.	

III. RECOVERY ACTIONS

ALTERNATE ACTIONS

(2) Open Auxiliary Sp... Valve, 1-CVC-517-CV

(3) Shut Loop Charging Valves:

1-CVC-518-CV
1-CVC-519-CV

(4) Shift 1-HIC-100 to MANUAL and shut Pressurizer Spray Valves:

1-RC-100E-CV
1-RC-100F-CV

5. Confirm Natural Circulation in at least one loop:

- NOTE -

Wide range Thot may be obtained from Subcooled Margin Monitor per Attachment (10).

a. Thot minus Tcold between 10 and 50°F.

b. Tcold constant or decreasing.

c. Thot constant or decreasing.

d. CET temperatures consistent with Thot.

e. Steaming rate affects primary temperature.

6. **IF** either S/G level decreases to (-)350 inches before Main Feed or AFW can be restored, **THEN** proceed to step J, page 13 **AND** continue efforts to restore Main Feed or AFW.

VII. RECOVERY ACTIONS	ALTERNATE ACTIONS
H. ATTEMPT TO ESTABLISH AFW FLOW TO S/Gs:	
1. Confirm 12 CST operable: a. Ensure 12 CST level greater than 5 ft. b. Open 12 CST Unit 1 AFW Pump Suction Valve, 1-AFW-161.	**-CAUTION-** **Before transferring AFW Pump suction to an alternate supply the possibility of suction line or CST rupture should be considered.** 1.1 **IF** 12 CST **NOT** operable, **THEN** line up 11 CST as alternate suction supply: a. Locally open 11 CST AFW Pump Suction Valves: 1-AFW-131 1-AFW-167 b. Locally shut 12 CST Unit 1 AFW Pump Suction Valve, 1-AFW-161. c. Confirm normal CST level response. **-NOTE-** The following step will cause CST levels to equalize. 1.2 **IF** 11 CST **NOT** available, **THEN** line up 21 CST as alternate suction supply: a. Locally open 21 CST AFW Pump Suction Valves: 2-AFW-131 2-AFW-167 b. Locally open 12 CST AFW Pump Suction Valves: 1-AFW-161 2-AFW-161 c. Confirm normal CST level response.

III. RECOVERY ACTIONS

2. Ensure normal AFW flowpath available:

a. Open all motor and steam driven train AFW Block Valves:

11 S/G	12 S/G
1-AFW-4520-CV	1-AFW-4530-CV
1-AFW-4521-CV	1-AFW-4531-CV
1-AFW-4522-CV	1-AFW-4532-CV
1-AFW-4523-CV	1-AFW-4533-CV

b. Open AFW Flow Control Valves:

11 S/G	12 S/G
1-AFW-4511-CV	1-AFW-4512-CV
1-AFW-4525-CV	1-AFW-4535-CV

3. Start Unit 1 AFW Pumps:

- CAUTION -

D/G supplying power to 13 AFW Pump flow limit is 300 GPM; otherwise, flow limit is 575 GPM.

a. Start 13 AFW Pump:

(1) Place 13 AFW Pump Handswitch in START.

ALTERNATE ACTIONS

2.a.1 IF AFW Block Valve(s) will NOT open from Control Room, THEN locally open valve(s) using Hand Transfer Station(s) on North wall of SRW Room.

2.b.1 IF AFW Flow Control Valve(s) will NOT open, THEN locally throttle open bypass valve(s):

a. 4511-CV 11 S/G Bypass Valve, 1-AFW-163, located in 27 ft East Penetration Room.

b. 4525-CV 11 S/G Bypass Valve, 1-AFW-195, located in SRW Room.

c. 4512-CV 12 S/G Bypass Valve, 1-AFW-165, located in 27 ft East Penetration Room.

d. 4535-CV 12 S/G Bypass Valve, 1-AFW-196, located in SRW Room.

3.1 IF unable to feed S/Gs with Unit 1 AFW Pumps, THEN establish Unit 2 to Unit 1 cross connect operation:

a. Shut Unit 2 motor train AFW Block Valves:

2-AFW-4522-CV
2-AFW-4523-CV
2-AFW-4532-CV
2-AFW-4533-CV

III. RECOVERY ACTIONS

(2) Ensure normal pump running current of 60 to 70 AMPS.

(3) Verify 13 AFW Pump flow of 150 GPM per S/G.

b. Start 11 or 12 AFW Pump:

(1) Open 11 and 12 AFW Pump Turbine Throttle/ Stop Valves:

1-MS-3986
1-MS-3988

(2) Open 11 and 12 AFW Pump Main Steam Supply Valves:

1-MS-109
1-MS-107

(3) Open 11 or 12 S/G AFW Steam Supply Valves:

1-MS-4070-CV
1-MS-4071-CV

(4) Verify 11 or 12 AFW Pump discharge pressure approximately 100 PSI greater than S/G pressure.

(5) Verify 11 or 12 AFW Pump flow of 150 GPM per S/G.

c. Ensure normal or emergency AFW Room Ventilation operable.

4. **IF** AFW restored, **THEN** proceed to appropriate step:

a. Once Through Core Cooling in progress, proceed to step N, page 20.

b. Once Through Core Cooling **NOT** in progress, proceed to step V, page 30.

ALTERNATE ACTIONS

b. Open Unit 2 To Unit 1 AFW Cross Connect Valve, 2-AFW-4550-CV.

- CAUTION -

D/G Supplying power to 23 AFW Pump flow limit is 300 GPM, otherwise, flow limit is 575 GPM

c. Start 23 AFW Pump:

(1) Place 23 AFW Pump Handswitch in START.

(2) Ensure normal pump running current of 60 to 70 AMPS.

(3) Maintain 150 GPM flow to each S/G using Unit 1 AFW Flow Control Valves:

1-AFW-4525-CV
1-AFW-4535-CV

4.1 **IF** AFW **NOT** restored, **THEN** proceed to step 1, page 12.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
I. PREPARE TO FEED S/G WITH CONDENSATE BOOSTER PUMP:	
1. Open S/G Feedwater Isolation Valves. 2. Shut Main Feed Regulating Valves. 3. Depress Feed Regulating Bypass Valve Reset Buttons. 4. Manually adjust Feed Regulating Bypass Valve Controllers to 30% output. 5. Open Condensate Precoat Filter and Condensate Demin Bypass Valves. 6. Verify one Condensate Pump running. 7. Verify one Condensate Booster Pump running. 8. Place Heater Drain Pump Handswitches in PULL-TO-LOCK. - NOTE - Feedwater flow to S/Gs should start when S/G pressure decreases to approximately 500 PSIA. 9. Monitor feedwater flow to S/G: a. Main Feed Regulating Valve Differential Pressure Controller indicates greater than 0. b. S/G level constant or increasing.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
10. **IF** Condensate Booster Pump flow restored, **THEN** proceed to appropriate step: a. Once Through Core Cooling in progress, proceed to step N, page 20. b. Once Through Core Cooling **NOT** in progress, proceed to step V, page 30.	10.1 **IF** Condensate Booster Pump will **NOT** feed S/G, **THEN** proceed to step J, page 13.
J. ISOLATE S/Gs IN PREPARATION FOR ONCE THROUGH CORE COOLING:	
1. **WHEN** the first S/G decreases to (-)350 inches, **THEN** isolate that S/G: a. For S/G to be isolated, shut the motor and steam driven train AFW Block Valves: 11 S/G or 12 S/G 1-AFW-4520-CV 1-AFW-4530-CV 1-AFW-4521-CV 1-AFW-4531-CV 1-AFW-4522-CV 1-AFW-4532-CV 1-AFW-4523-CV 1-AFW-4533-CV b. For S/G remaining to be steamed, place the motor and steam driven train AFW Block Valve Handswitches in OPEN. c. For S/G to be isolated, shut the AFW Steam Supply Valve. 11 S/G or 12 S/G 1-MS-4070-CV 1-MS-4071-CV	

III. **RECOVERY ACTIONS** — **ALTERNATE ACTIONS**

d. For S/G to be isolated, shut the Atmospheric Dump Valve using the Hand Transfer Valves on the West wall of the Unit 1 45 ft Switchgear Room:

(1) Verify 1C43 Atmospheric Dump Controllers at 0% output.

(2) Align Hand Transfer Valves to 1C43 position:

11 S/G	12 S/G
1-HV-3938A	1-HV-3939A
1-HV-3938B	1-HV-3939B

1.d.1 **IF** Atmospheric Dump Valve will **NOT** shut from 1C43, **THEN** shut Atmospheric Dump Manual Isolation Valve.

11 S/G	12 S/G
1-MS-101	1-MS-104

e. For S/G to be isolated, shut the MSIV.

f. Shut upstream drains by placing handswitch 1-HS-6622 in CLOSE.

2. Continue to steam unisolated S/G, attempting to maintain CET temperatures constant or decreasing using Turbine Bypass Valve(s).

2.1 **IF** Turbine Bypass Valves unavailable, **THEN** continue to steam unisolated S/G using Atmospheric Dump Valve.

3. **WHEN** the remaining S/G level decreases to (-)375 inches **OR** CET temperatures begin to increase, **THEN** isolate both S/Gs:

a. Shut the motor and steam driven train AFW Block Valves:

11 S/G	12 S/G
1-AFW-4520-CV	1-AFW-4530-CV
1-AFW-4521-CV	1-AFW-4531-CV
1-AFW-4522-CV	1-AFW-4532-CV
1-AFW-4523-CV	1-AFW-4533-CV

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
b. Shut the AFW Steam Supply Valves: 11 S/G — 1-MS-4070-CV 12 S/G — 1-MS-4071-CV c. Shut Atmospheric Dump Valves. d. Shut Turbine Bypass Valves. e. Shut both MSIVs.	
K. COMMENCE ONCE THROUGH CORE COOLING:	
- CAUTION - **After S/G becomes ineffective for heat removal, Once Through Core Cooling must be initiated prior to CET temperatures reaching 560°F to ensure adequate heat removal.** 1. **WHEN** either of the following conditions exist: a. Steaming S/G becomes ineffective and CET temperatures begin to increase. b. Both S/Gs isolated due to low level. **THEN** commence Once Through Core Cooling. 2. Shift Letdown Control Valve Controller, 1-HIC-110, to MANUAL and shut Letdown Control Valves: 1-CVC-110P-CV 1-CVC-110Q-CV	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
3. Start all available Charging Pumps. 4. Open Main and Aux HPSI Header Valves: 1-SI-616-MOV 1-SI-617-MOV 1-SI-626-MOV 1-SI-627-MOV 1-SI-636-MOV 1-SI-637-MOV 1-SI-646-MOV 1-SI-647-MOV 5. Start 11 and 13 HPSI Pumps. 6. De-energize the Pressurizer Heaters by placing all handswitches in OFF. 7. Start all available Containment Air Coolers in HIGH with maximum SRW flow. 8. Open both PORVs: a. **WHEN** "PRSR PRESS BLOCK A(B) PERMITTED" alarm(s) received, **THEN** block SIAS A(B). b. Verify both PORV Block Valves open. c. Pull two High Pressurizer Pressure Trip Units. d. Verify PORVs open.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
9. **IF** containment pressure increases to 2.8 PSIG, **THEN** verify ESFAS actuation **AND** commence Verification Checklists:	
a. SIAS per Attachment (2).	
b. CIS per Attachment (4).	
10. **IF** containment pressure increases to 4.25 PSIG, **THEN** verify CSAS actuation **AND** commence Verification Checklist, Attachment (3).	
11. Confirm initiation of Once Through Core Cooling.	
a. **WHEN** RCS pressure is less than 1270 PSIA, **THEN** ensure HPSI flow **AND** CET temperatures constant or decreasing.	
12. Using CET temperatures, maintain subcooling between 30 and 140°F per Attachment (1) by throttling HPSI flow:	
a. Lower subcooling by lowering HPSI flow.	
b. Raise subcooling by raising HPSI flow.	
13. Continue cooldown using Once Through Core Cooling until feedwater restored or shutdown cooling entry conditions are established.	
- **NOTE** - Additional guidance for feeding S/Gs is given in the Core and RCS Heat Removal section of EOP-8.	
14. Continue efforts to restore Main Feed or AFW.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
L. **WHEN** RCS BORATION COMPLETE, **THEN** SHIFT CHARGING PUMP SUCTION SUPPLY TO MAKEUP SUPPLY WITH A LOWER BORIC ACID CONCENTRATION.	
1. **IF** SIAS actuated, **THEN** perform the following: a. Open RWT To Charging Pump Suction Valve, 1-CVC-504-MOV. b. Shut VCT Outlet Valve, 1-CVC-501-MOV. c. Place Boric Acid Pumps in PULL-TO-LOCK. d. Ensure Charging Pump AMPS steady.	1.1 **IF** SIAS **NOT** actuated, **THEN** line up Charging Pump suction to VCT: a. Determine blend required to maintain shutdown boron concentration per NEOG-7. b. Open VCT Outlet Valve, 1-CVC-501-MOV. c. Secure Boric Acid Pump(s). d. Shut Boric Acid Direct Makeup Valve, 1-CVC-514-MOV. e. Shut BAST Gravity Feed Valves: 1-CVC-508-MOV 1-CVC-509-MOV **OR** line up Charging Pump suction to RWT: a. Open RWT To Charging Pump Suction Valve, 1-CVC-504-MOV. b. Shut VCT Outlet Valve, 1-CVC-501-MOV. c. Shut Boric Acid Direct Makeup Valve, 1-CVC-514-MOV. d. Secure Boric Acid Pump(s).

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
M. **IF** RWT LEVEL DECREASES TO BETWEEN 0.5 AND 1.0 FT **OR** "ACTUATION SYS RAS TRIPPED" ALARM RECEIVED, **THEN** VERIFY RAS ACTUATION:	
1. Place SI Pump Recirc Lockout Switches in ON. 2. Commence RAS Verification Checklist, Attachment (6). 3. Shut RWT Outlet Valves: 1-SI-4142-MOV 1-SI-4143-MOV 4. **IF** HPSI flow greater than 1000 GPM with two HPSI Pumps operating, **THEN** equally throttle HPSI flow to 1000 GPM. 5. **IF** HPSI flow greater than 600 GPM with one HPSI Pump operating, **THEN** equally throttle HPSI flow to 600 GPM. - **CAUTION** - **To prevent pump damage, minimum flow per operating HPSI Pump is 30 GPM.**	
6. **IF** HPSI Pump cavition occurs in recirculation mode, **THEN** throttle HPSI flow per Attachment (12).	6.1 **IF** Attachment (12) does **NOT** allow throttling HPSI flow, **THEN** align Containment Spray Pump(s) to HPSI Pump suction: a. **IF** 11 HPSI Pump cavitating, **THEN** open 11 SDC HX To HPSI Suction Valve, 1-SI-663-MOV **AND** start 11 Containment Spray Pump.

VII. RECOVERY ACTIONS	ALTERNATE ACTIONS
	b. **IF** 13 HPSI Pump cavitating, **THEN** open 12 SDC HX To HPSI Suction Valve, 1-SI-662-MOV **AND** start 12 Containment Spray Pump.
7. Commence ECCS Pump Room cooling: a. Open ECCS Pump Room Air Cooler Saltwater Valves: 1-SW-5170-CV 1-SW-5171-CV 1-SW-5173-CV b. Start 11 and 12 ECCS Pump Room Cooling Fans. 8. Adjust saltwater flow to maintain SRW and component cooling temperatures. 9. **IF** Charging Pumps are aligned with suction from RWT **AND** HPSI Pumps maintaining RCS inventory, **THEN** place Charging Pumps in PULL-TO-LOCK.	
N. **IF** FEEDWATER AVAILABLE **AND** ONCE THROUGH CORE COOLING IN PROGRESS, **THEN** EVALUATE FEEDING S/G:	
1. **IF** decision made to feed S/G, **THEN** establish secondary heat sink in S/G with highest level. - **CAUTION** - **If voids exist in the S/G tubes, a rapid RCS pressure reduction will occur when the voids collapse.**	1.1 **IF** decision made **NOT** to feed S/G, **THEN** continue Once Through Core Cooling until Shutdown Cooling can be used.

III. RECOVERY ACTIONS

ALTERNATE ACTIONS

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2. Throttle Auxiliary Feedwater flow to less than 150 GPM **OR** throttle Main Feedwater flow to minimum by cracking the Feed Regulating Bypass Valve off its shut seat.

3. **WHEN** S/G level increases **OR** continuous feed has been maintained for 5 minutes, **THEN** slowly raise feed rate to raise S/G level to greater than (-)250 inches and trending toward 0 inches.

4. Align Atmospheric Dump Valve for S/G with highest level to 1C03 and Atmospheric Dump Valve for S/G with lowest level to 1C43.

5. Adjust Atmospheric Dump Valve to establish Natural Circulation.

- **CAUTION** -

The RCS may be solid. Any action involving RCS cooldown or heatup should be closely monitored to prevent rapid pressure excursions.

6. **WHEN** secondary heat sink established, **THEN** secure Once Through Core Cooling:

   a. Operate HPSI and Charging Pumps as necessary to maintain RCS subcooling between 30 and 140°F.

   b. Shut both PORVs:

      (1) Insert High Pressurizer Pressure Trip Units that were previously pulled.

      (2) Ensure "PORV ENERGIZED" alarm clear.

III. **RECOVERY ACTIONS**

ALTERNATE ACTIONS

7. Confirm Natural Circulation:

- **NOTE** -

Wide range Thot may be obtained from Subcooled Margin Monitor per Attachment (10).

a. Thot minus Tcold between 10 and 50°F.

b. Tcold constant or decreasing.

c. Thot constant or decreasing.

d. CET temperatures consistent with Thot.

e. Steaming rate affects primary temperature.

8. Monitor for Core and RCS voiding:

- **CAUTION** -

Potential for void formation increases rapidly when pressure decreases below 1500 PSIA.

a. Letdown flow greater than charging flow.

b. Rapid unexplained increase in pressurizer level during an RCS pressure reduction.

c. Loss of subcooled margin as determined using CET temperatures.

d. "REACTOR VESSEL WATER LEVEL LOW" alarm.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
9. **IF** voiding inhibits heat removal, **THEN** reduce or eliminate voided area:	
a. Shut Letdown Isolation Valve, 1-CVC-515-CV.	
-**CAUTION**- **The potential exists for pressurized thermal shock from an excessive cooldown rate followed by a repressurization.**	
b. Pressurize RCS to maintain subcooling as near 140°F as practical.	9.b.1 **IF** pressurizing the RCS does **NOT** restore heat removal, **THEN** operate Reactor Vessel Vent Valves per OI-1G.
c. **IF** voiding occurs in the S/G Tubes (saturation pressure of S/G greater than saturation pressure of RCS), **THEN** cool the S/G by raising any of the following: (1) Steaming rate. (2) Feed rate. (3) S/G Blowdown rate. **AND** maintaining less than 100°F/h cooldown rate.	
- **CAUTION** - **Technical Specifications require MPT protection when Tcold less than 275°F.**	
10. Continue RCS cooldown until able to initiate Shutdown Cooling.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
O. RESTORE CONTAINMENT ENVIRONMENT:	
1. Direct Chemistry to place Hydrogen Monitors in service. 2. IF hydrogen concentration increases to 1%, THEN start Hydrogen Recombiners per OI-41A. 3. Maintain Iodine Filter Fans running. 4. WHEN containment pressure less than 4.0 PSIG, THEN perform the following: a. Reset CSAS signal. b. Secure one Containment Spray Pump. c. Verify all Containment Air Coolers operating to maintain containment temperature less than 120°F. d. Restore equipment per CSAS Verification Checklist, Attachment (3), to desired condition. 5. WHEN containment pressure less than 2.8 PSIG, THEN perform the following: a. Block pressurizer pressure signals and reset SIAS signal. b. Reset CIS signal. c. Secure remaining Containment Spray Pump. d. Restore equipment per SIAS and CIS Verification Checklists, Attachments (2) and (4), to desired condition.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
P. **WHEN** CET TEMPERATURES LESS THAN 300°F **AND** RADIATION LEVELS PERMIT, **THEN** INITIATE SHUTDOWN COOLING:	
1. **WHEN** RCS pressure less than 300 PSIA, **THEN** shut SI Tank Outlet Valves: 1-SI-614-MOV 1-SI-624-MOV 1-SI-634-MOV 1-SI-644-MOV	
2. Lower RCS pressure to less than 250 PSIA by throttling HPSI flow while maintaining: a. Greater than 30°F subcooling using CET temperatures. b. Greater than 30 GPM flow per operating HPSI Pump.	2.1 **IF** voiding prevents depressurization to 250 PSIA, **THEN** attempt to eliminate voids: a. Alternately pressurize and depressurize RCS by throttling HPSI flow. b. Operate Reactor Vessel Vent Valves per OI-1G.
3. **WHEN** RCS pressure less than 250 PSIA **AND** containment pressure less than 4.0 PSIG, **THEN** initiate Shutdown Cooling per OI-3.	3.1 **IF** unable to initiate Shutdown Cooling, **THEN** continue Once Through Core Cooling until able to initiate Shutdown Cooling **OR** Feedwater available.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
- CAUTION - **The RCS may be solid. Any action involving RCS cooldown or heatup should be closely monitored to prevent rapid pressure excursions.** 4. **WHEN** Shutdown Cooling flow is established, **THEN** secure Once Through Core Cooling: a. Operate HPSI or Charging Pumps as necessary to maintain RCS pressure between 150 and 250 PSIA until CVCS letdown available. **- CAUTION -** **Technical specifications require MPT protection when Tcold less than 275°F.** b. Shut both PORVs: (1) Insert High Pressurizer Pressure Trip Units that were previously pulled. (2) Ensure "PORV ENERGIZED" alarm clear. Q. RESTORE SERVICE WATER TO TURBINE BUILDING:	
1. Verify 21 Plant Air Compressor operating. 2. Shut Plant Air To Plant Air Header Valve, 1-PA-2059-CV.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
3. Open Plant Air To Instrument Air Cross Connect Valve, 1-PA-2061-CV. 4. Open SRW Turbine Building Header Isolation Valves: 1-SRW-1600-CV 1-SRW-1637-CV 1-SRW-1638-CV 1-SRW-1639-CV R. RESTORE INSTRUMENT AIR COMPRESSORS TO SERVICE:	
1. **IF** high temperature alarm exists on the Instrument Air Compressors, **THEN** open the service water isolation valves by placing their handswitches in OPEN until temperature alarm clears. 11 or 12 1-HS-2063 1-HS-2065 2. Start at least one Instrument Air Compressor. S. RESTORE INSTRUMENT AIR TO CONTAINMENT:	
1. Open Cntmt Instrument Air Isolation MOV, 1-IA-2080-MOV. - **NOTE** - 1-HS-2085 located on West wall of 27 ft Switchgear Room; Key #85 in Control Room Key Locker. 2. Open Cntmt Instrument Air Supply CV, 1-IA-2085-CV, by momentarily placing 1-HS-2085 in OPEN.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
T. RESTORE LETDOWN FLOW:	
1. Verify charging flowpath through Loop Charging Valves or Auxiliary Spray Valve. 2. Verify at least one Charging Pump operating. 3. Shift Letdown Control Valve Controller, 1-HIC-110, to MANUAL. 4. Adjust controller to shut Letdown Control Valves. 5. Open Letdown Isolation Valves: 1-CVC-515-CV 1-CVC-516-CV -CAUTION- **The setpoint of 1-PIC-201 must be above the saturation pressure for the letdown outlet temperature of the Regenerative Heat Exchanger.** 6. Adjust the setpoint on 1-PIC-201 and adjust 1-HIC-110 to maintain desired RCS pressure.	
U. DRAW PRESSURIZER BUBBLE IF DESIRED:	
1. Adjust steaming rate or Shutdown Cooling to stabilize Tcold. 2. Heat up Pressurizer by energizing Backup and Proportional Heaters. 3. Adjust letdown flow and Tcold to maintain RCS subcooling between 30 and 140°F.	

III. RECOVERY ACTIONS

4. **WHEN** pressurizer temperature exceeds CET temperatures by $50^{\circ}F$,
THEN maximize letdown:

   a. Lower the setpoint on Letdown Backpressure Regulator Controller to obtain letdown flow of 100 GPM.

   b. Secure Charging Pump(s) as needed to increase effective letdown.

5. **WHEN** saturation pressure for the existing pressurizer temperature is reached,
THEN confirm bubble formation by observing steady pressurizer pressure.

6. Using CET temperatures, maintain subcooling between 30 and $140^{\circ}F$ per Attachment (1) by operating:

   a. Backup and Proportional Heater(s).

   b. Auxiliary Spray.

7. Maintain pressurizer level between 101 and 180 inches by operating:

   a. Charging flow.

   b. Letdown flow.

ALTERNATE ACTIONS

III. RECOVERY ACTIONS

ALTERNATE ACTIONS

V. **IF** FEEDWATER AVAILABLE **AND** SHUTDOWN COOLING **NOT** OPERATING, **THEN** EVALUATE NEED FOR FORCED OR NATURAL CIRCULATION:

1. **WHEN** RCPs available **AND** Forced Circulation desired **THEN** start RCPs per steps 2-12.

1.1 **IF** RCPs **NOT** available **OR** Natural Circulation desired, **THEN** implement Natural Circulation (AOP-3E) **AND** complete administrative post-trip actions.

2. **IF** RCPs exposed to excessive moisture, **THEN** consider meggering RCP motor.

- CAUTION -

Uncontrolled restoration of cooling to hot RCP seals may cause degradation of the metallic seating surfaces by thermal shock.

3. **IF** Component Cooling is isolated to RCP seals, **THEN** reduce RCP lower seal temperature below 280°F prior to initiating full cooling flow to the RCPs:

   a. Shut Component Cooling Supply Containment Manual Isolation Valve, 1-CC-284, located in 5 ft East Penetration Room.

   b. Verify CIS reset.

   c. Open Component Cooling Containment Isolation Valves:

      1-CC-3832-CV
      1-CC-3833-CV

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
d. Slowly open 1-CC-284 to throttle component cooling flow until lower seal temperatures are less than 280°F.	
e. **WHEN** lower seal temperatures are less than 280°F, **THEN** fully open 1-CC-284.	
4. **IF** an RCP lower seal temperature exceeded 280°F, **THEN** an engineering evaluation is required prior to restarting that RCP.	
5. Raise pressurizer level to at least 155 inches.	
6. Verify RCP restart criteria:	
a. RCS subcooling greater than 30°F.	
b. At least one S/G available for heat removal.	
c. Pressurizer level greater than 155 inches and stable.	
d. Tcold less than 525°F.	
e. RCS temperature and pressure greater than the minimum operating limits per the RCP curve on Attachment (1).	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS

- NOTE -

Starting an RCP may cause a pressurizer level transient.

7. **WHEN** RCP restart criteria are met, **THEN** start one RCP in a loop with an operable S/G:

   a. Verify "COMPT CLG FLOW LO" alarm clear.

   b. Start Oil Lift Pump.

   c. Insert RCP sync stick.

   d. Start one RCP.

   e. Monitor RCP running current:

Tavg	Current
525 to 572°F	238 to 210 AMPS and steady
210 to 525°F	264 to 238 AMPS and steady

8. **IF** pressurizer level decreases, **THEN** start Charging or HPSI Pump(s) as necessary to restore **AND** maintain level greater than 155 inches.

9. Monitor RCP seal parameters following pump restart.

10. Allow backflow to equalize temperatures in opposite loop.

11. Start second RCP in opposite loop per Step V.7 and V.9, page 32.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
12. Secure Auxiliary Spray: a. Open Loop Charging Valves: 1-CVC-518-CV 1-CVC-519-CV b. Shut Auxiliary Spray Valve, 1-CVC-517-CV. c. Shift Pressurizer Spray Controller, 1-HIC-100, to AUTO.	
W. COMPLETE ADMINISTRATIVE POST-TRIP ACTIONS AND IMPLEMENT APPROPRIATE OPERATING PROCEDURE.	

X. ADMINISTRATIVE POST-TRIP ACTIONS:

- NOTE -

The following actions may be accomplished whenever feasible. They may be done in any order.

_______ 1. Refer to ERPIP to determine appropriate emergency response actions.

_______ 2. Perform notifications per CCI-118.

_______ 3. Notify ESO of trip.

_______ 4. Request RCS Boron and Iodine sample.

_______ 5. Perform shutdown margin calculation per NEOG 2 and 7.

_______ 6. Complete transient log entries per CCI-301.

_______ 7. Recall post-trip review (preferably within 30 minutes of trip).

_______ 8. Perform post-trip review per CCI-111.

_______ 9. Monitor turbine bearing temperatures.

_______ 10. Continue Main Turbine shutdown per applicable step of CI-43A.

END OF SECTION X.

IV. SAFETY FUNCTION STATUS CHECK

A. The STA (or person designated by STA) will perform the intermediate and final safety function checks respectively on entry and prior to exiting from this procedure.

B. Perform intermediate safety function status check at 10 minute intervals until plant conditions stabilize.

C. Immediately notify Shift Supervisor or Control Room Supervisor if any safety function criteria is not being satisfied.

D. Review data and verify that safety function acceptance criteria are satisfied.

E. When EOP completed, then perform final safety function check.

REACTIVITY CONTROL PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. WRNI power	less than 3%		less than 2%	
b. SUR (DPM)	negative		0	
c. CEA status	all inserted		all inserted	
or				
oration status:				
concentration	increasing		appropriate S/D margin	
BAST level	decreasing		N/A	N/A

RCS PRESSURE AND INVENTORY PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Pressurizer pressure (PSIA)	1000 to 2350	----------	less than 2300	______
b. Pressurizer level (inches)	50 to 350	----------	101 to 180	______
c. RCS subcooling (°F)	30 to 140	----------	30 to 140	______
If PORVs were opened, once an hour monitor the following:				
d. Quench Tank parameters: level (inches) temperature (°F) pressure (PSIG)	constant or decreasing	----------	constant or decreasing	______
e. PORV discharge piping temperature (°F) (computer points T107, T108)	decreasing	----------	decreasing	______

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CORE AND RCS HEAT REMOVAL PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. RCS Tcold (°F)	less than 540	--------	less than 535	________
b. CET (°F)	less than 560	--------	less than 540	________
c. Thot minus Tcold (°F)				
Natural Circulation	10 to 50	--------	10 to 50	________
Forced Circulation	less than 10	--------	less than 5	________
d. S/G pressure	less than 960	--------	less than 920	________
e. S/G level (inches)	(-)400 to (+)30	--------	(-)24 to (+)30	________
f. Condensate Storage Tank level (ft)	greater than 5	--------	greater than 5 and increasing	________

SAFETY FUNCTION ACCEPTANCE CRITERIA

VITAL AUXILIARIES	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. 4KV vital buses 11 or 14	energized	----------	energized	______
b. Instrument Air pressure (PSIG)	greater than 88	----------	greater than 88	______
c. Component Cooling (# pumps running)	1 or 2	----------	1 or 2	______
d. Saltwater (# pumps running)	1 or 2	----------	1 or 2	______
e. Service Water (# pumps running)	1 or 2	----------	1 or 2	______
f. 125V DC buses 11, 12, 21, 22	energized	----------	energized	______
g. 120V AC vital buses 11, 12, 13, 14	energized	----------	energized	______

NORMAL CONTAINMENT ENVIRONMENT PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Containment pressure (PSIG)	less than 50	--------	less than 2.8	________
b. Containment temperature (°F)	less than 276	--------	less than 220	________
c. Containment High Range Radiation Monitor	alarm clear	--------	alarm clear	________
d. Hydrogen concentration	N/A	N/A	less than 2%	________

NORMAL RADIATION LEVELS EXTERNAL TO CONTAINMENT	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Noble Gas Monitor	alarm clear	__________	alarm clear	__________
b. Condenser Off-Gas RMS	alarm clear	__________	alarm clear	__________
c. S/G B/D RMS	alarm clear	__________	alarm clear	__________
d. Main Vent Gaseous RMS (1-RI-5415)	alarm clear	__________	alarm clear	__________

STATUS CHECK NUMBER	COMPLETE AT TIME
1	______
2	______
3	______
4	______
______	______
______	______
______	______

CALVERT CLIFFS NUCLEAR POWER PLANT

EOP-3 TOTAL LOSS OF ALL FEEDWATER

REVISION 1

	SIGNATURE	DATE
PREPARED BY;	[signature]	12-18-87
VERIFIED BY;	James V. Grooms	12/18/87
POSRC;	MEETING # 88-7	2-10-88
APPROVED BY;	J R Lemons Manager-Nuclear Operations or General Supervisor-Operations if POSRC review is not required	2-10-88

LIST OF EFFECTIVE PAGES

PAGE NUMBER	REVISION
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3	1
4	1
5	1
6	1
7	1
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10	1
11	1
12	1
13	1
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29	1
30	1
31	1
32	1
33	1
34	1
35	1
36	1
37	1
38	1
39	1
40	1

TOTAL LOSS OF ALL FEEDWATER

I. PRECAUTIONS

A. Do not adopt manual operation of automatically controlled systems unless a malfunction is apparent or automatic system operation will not support the maintenance of a safety function.

B. Systems shifted to manual operation must be monitored frequently to ensure correct operation.

C. At least two independent indications should be used, when available, to evaluate and corroborate a specific plant condition since an incident could induce inconsistencies between instruments.

D. Solid operation of the RCS should only be attempted in order to maintain a subcooled margin of 30°F.

E. If solid operation of the RCS is undertaken, any functions or actions directly affecting makeup, letdown, system heatup or cooldown should be closely monitored to avoid rapid pressure excursions.

F. Feedwater should not be added to a dry S/G if the other S/G still contains water. If both S/Gs become dry, refill only one S/G to reinitiate Natural Circulation.

G. Minimize the number of cycles of pressurizer auxiliary spray when the temperature differential is greater than 400°F.

H. In Natural Circulation, increased loop transport time causes a 5 to 10 minute delay in temperature responses to a plant change. Pressurizer level and pressure responses, if available, typically provide better indication of RCS response during this period.

I. S/G pressure, pressurizer pressure, and containment temperature affect the level indication for the S/Gs and Pressurizer. Attachments (8) and (9) contain the corrected S/G and pressurizer levels for various S/G pressures, pressurizer pressures, and containment temperatures.

J. If a pump or component fails, the cause of the failure should be determined prior to restarting or starting a standby pump or component to prevent a common failure.

II. ENTRY CONDITIONS

The presence of one or more of the following conditions indicates that a Total Loss Of All Feedwater may have occurred:

A. Loss of Condensate Storage Tank inventory.

B. Loss of Condenser Hotwell level.

C. Low suction or discharge pressure for either the Condensate, Condensate Booster, or S/G Feed Pumps.

D. S/G Turbine Tripped alarm on both S/G Feed Pumps.

E. Low suction or discharge pressure for the AFW Pumps.

F. Motor System No Flow alarm for AFW.

G. Turbine System No Flow alarm for AFW.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
A. VERIFY POST-TRIP IMMEDIATE ACTIONS COMPLETED.	
B. COMMENCE INTERMEDIATE SAFETY FUNCTION STATUS CHECK.	
C. ERPIP REQUIRES THAT A SITE EMERGENCY BE DECLARED IF TOTAL LOSS OF MAIN AND AUXILIARY FEEDWATER EXISTS FOR LONGER THAN TEN MINUTES.	
D. TRIP ALL RCPs.	
E. MINIMIZE S/G INVENTORY LOSS.	
1. Shut S/G Blowdown Valves: 2-BD-4010-CV 2-BD-4011-CV 2-BD-4012-CV 2-BD-4013-CV 2. Depress Reset Button on MSR Control Panel to shut Second Stage Steam Source Valves: 2-MS-4017-CV 2-MS-4018-CV 2-MS-4019-CV 2-MS-4020-CV	
F. COMMENCE RCS BORATION:	
1. Shut VCT Makeup Valve, 2-CVC-512-CV.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
2. Open Boric Acid Direct Makeup Valve, 2-CVC-514-MOV.	
3. Start a Boric Acid Pump.	3.1 **IF** Boric Acid Pumps **NOT** available, **THEN** establish gravity feed: a. Open BAST Gravity Feed Valves: 2-CVC-508-MOV 2-CVC-509-MOV b. Shut VCT Outlet Valve, 2-CVC-501-MOV.
4. Start all available Charging Pumps.	
5. Continue boration until a total 65 inch decrease in BAST level(s) is achieved, or shutdown margin requirement of NEOG-11 is achieved.	
G. ESTABLISH NATURAL CIRCULATION AND COOL DOWN RCS:	
1. Block ESFAS actuation:	
a. **WHEN** "SGIS A(B) BLOCK PERMITTED" alarm(s) received, **THEN** block SGIS A(B).	1.a.1 **IF** SGIS actuates, **THEN** reset SGIS: a. Place Condensate Booster Pumps in PULL-TO-LOCK. b. Match handswitches per SGIS Verification Checklist, Attachment (7). c. Block SGIS. d. Reset SGIS signal.

III. RECOVERY ACTIONS

b. **WHEN** "PRSR PRESS BLOCK A(B) PERMITTED" alarm(s) received,
THEN block SIAS A(B).

2. Commence cooldown by throttling Turbine Bypass or Atmospheric Dump Valves while maintaining:

   a. Less than 100°F/h RCS cooldown rate.

   b. Pressurizer level between 50 and 180 inches.

3. Shut Letdown Isolation Valves:

   2-CVC-515-CV
   2-CVC-516-CV

4. Maintain RCS subcooling between 30 and 140°F:

   a. Raise subcooling by:

      (1) Energizing Pressurizer Heaters.

      (2) Increasing cooldown rate.

   b. Lower subcooling by initiating Auxiliary Spray:

      (1) Record temperature differential between Pressurizer and Regenerative Heat Exchanger Outlet.

ALTERNATE ACTIONS

e. Open S/G Feedwater Isolation Valves:

   2-FW-4516-MOV
   2-FW-4517-MOV

f. Start a Condensate Booster Pump.

III. RECOVERY ACTIONS

(2) Open Auxiliary Spray Valve, 2-CVC-517-CV.

(3) Shut Loop Charging Valves:

2-CVC-518-CV
2-CVC-519-CV

(4) Shift 2-HIC-100 to MANUAL and shut Pressurizer Spray Valves:

2-RC-100E-CV
2-RC-100F-CV

5. Confirm Natural Circulation in at least one loop:

- **NOTE** -

Wide range Thot may be obtained from Subcooled Margin Monitor per Attachment (10).

a. Thot minus Tcold between 10 and 50°F.

b. Tcold constant or decreasing.

c. Thot constant or decreasing.

d. CET temperatures consistent with Thot.

e. Steaming rate affects primary temperature.

6. IF either S/G level decreases to (-)350 inches before Main Feed or AFW can be restored, THEN proceed to step J, page 13 AND continue efforts to restore Main Feed or AFW.

ALTERNATE ACTIONS

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
H. ATTEMPT TO ESTABLISH AFW FLOW TO S/Gs:	
	-<u>CAUTION</u>- **Before transferring AFW Pump suction to an alternate supply the possibility of suction line or CST rupture should be considered.**
1. Confirm 12 CST operable: a. Ensure 12 CST level greater than 5 ft. b. Open 12 CST Unit 2 AFW Pump Suction Valve, 2-AFW-161.	1.1 <u>**IF**</u> 12 CST <u>**NOT**</u> operable, <u>**THEN**</u> line up 21 CST as alternate suction supply: a. Locally open 21 CST AFW Pump Suction Valves: 2-AFW-131 2-AFW-167 b. Locally shut 12 CST Unit 2 AFW Pump Suction Valve, 2-AFW-161. c. Confirm normal CST level response. -<u>**NOTE**</u>- The following step will cause CST levels to equalize. 1.2 <u>**IF**</u> 21 CST <u>**NOT**</u> available, <u>**THEN**</u> line up 11 CST as alternate suction supply: a. Locally open 11 CST AFW Pump Suction Valves: 1-AFW-131 1-AFW-167 b. Locally open 12 CST AFW Pump Suction Valves: 1-AFW-161 2-AFW-161 c. Confirm normal CST level response.

III. RECOVERY ACTIONS

2. Ensure normal AFW flowpath available:

   a. Open all motor and steam driven train AFW Block Valves:

21 S/G	22 S/G
2-AFW-4520-CV	2-AFW-4530-CV
2-AFW-4521-CV	2-AFW-4531-CV
2-AFW-4522-CV	2-AFW-4532-CV
2-AFW-4523-CV	2-AFW-4533-CV

   b. Open AFW Flow Control Valves:

21 S/G	22 S/G
2-AFW-4511-CV	2-AFW-4512-CV
2-AFW-4525-CV	2-AFW-4535-CV

3. Start Unit 2 AFW Pumps:

- CAUTION -

D/G supplying power to 23 AFW Pump flow limit is 300 GPM; otherwise, flow limit is 575 GPM.

   a. Start 23 AFW Pump:

      (1) Place 23 AFW Pump Handswitch in START.

ALTERNATE ACTIONS

2.a.1 **IF** AFW Block Valve(s) will **NOT** open from Control Room, **THEN** locally open valve(s) using Hand Transfer Station(s) on South wall of SRW Room.

2.b.1 **IF** AFW Flow Control Valve(s) will **NOT** open, **THEN** locally throttle open bypass valve(s):

   a. 4511-CV 21 S/G Bypass Valve, 2-AFW-163, located in 27 ft East Penetration Room.

   b. 4525-CV 21 S/G Bypass Valve, 2-AFW-195, located in SRW Room.

   c. 4512-CV 22 S/G Bypass Valve, 2-AFW-165, located in 27 ft East Penetration Room.

   d. 4535-CV 22 S/G Bypass Valve, 2-AFW-196, located in SRW Room.

3.1 **IF** unable to feed S/Gs with Unit 2 AFW Pumps, **THEN** establish Unit 1 to Unit 2 cross connect operation:

   a. Shut Unit 1 motor train AFW Block Valves:

      1-AFW-4522-CV
      1-AFW-4523-CV
      1-AFW-4532-CV
      1-AFW-4533-CV

III. RECOVERY ACTIONS

(2) Ensure normal pump running current of 60 to 70 AMPS.

(3) Verify 23 AFW Pump flow of 150 GPM per S/G.

b. Start 21 or 22 AFW Pump:

(1) Open 21 and 22 AFW Pump Turbine Throttle/ Stop Valves:

2-MS-3986
2-MS-3988

(2) Open 21 and 22 AFW Pump Main Steam Supply Valves:

2-MS-109
2-MS-107

(3) Open 21 or 22 S/G AFW Steam Supply Valves:

2-MS-4070-CV
2-MS-4071-CV

(4) Verify 21 or 22 AFW Pump discharge pressure approximately 100 PSI greater than S/G pressure.

(5) Verify 21 or 22 AFW Pump flow of 150 GPM per S/G.

c. Ensure normal or emergency AFW Room Ventilation operable.

4. IF AFW restored, THEN proceed to appropriate step:

a. Once Through Core Cooling in progress, proceed to step N, page 20.

b. Once Through Core Cooling NOT in progress, proceed to step V, page 30.

ALTERNATE ACTIONS

b. Open Unit 1 To Unit 2 AFW Cross Connect Valve, 1-AFW-4550-CV.

- CAUTION -

D/G Supplying power to 13 AFW Pump flow limit is 300 GPM, otherwise, flow limit is 575 GPM

c. Start 13 AFW Pump:

(1) Place 13 AFW Pump Handswitch in START.

(2) Ensure normal pump running current of 60 to 70 AMPS.

(3) Maintain 150 GPM flow to each S/G using Unit 2 AFW Flow Control Valves:

2-AFW-4525-CV
2-AFW-4535-CV

4.1 IF AFW NOT restored, THEN proceed to step I, page 12.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
I. PREPARE TO FEED S/G WITH CONDENSATE BOOSTER PUMP:	
1. Open S/G Feedwater Isolation Valves. 2. Shut Main Feed Regulating Valves. 3. Depress Feed Regulating Bypass Valve Reset Buttons. 4. Manually adjust Feed Regulating Bypass Valve Controllers to 30% output. 5. Open Condensate Precoat Filter and Condensate Demin Bypass Valves. 6. Verify one Condensate Pump running. 7. Verify one Condensate Booster Pump running. 8. Place Heater Drain Pump Handswitches in PULL-TO-LOCK. - NOTE - Feedwater flow to S/Gs should start when S/G pressure decreases to approximately 500 PSIA. 9. Monitor feedwater flow to S/G: a. Main Feed Regulating Valve Differential Pressure Controller indicates greater than 0. b. S/G level constant or increasing.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
10. **IF** Condensate Booster Pump flow restored, **THEN** proceed to appropriate step: a. Once Through Core Cooling in progress, proceed to step N, page 20. b. Once Through Core Cooling **NOT** in progress, proceed to step V, page 30.	10.1 **IF** Condensate Booster Pump will **NOT** feed S/G, **THEN** proceed to step J, page 13.
J. ISOLATE S/Gs IN PREPARATION FOR ONCE THROUGH CORE COOLING:	
1. **WHEN** the first S/G decreases to (-)350 inches, **THEN** isolate that S/G: a. For S/G to be isolated, shut the motor and steam driven train AFW Block Valves: 21 S/G or 22 S/G 2-AFW-4520-CV 2-AFW-4530-CV 2-AFW-4521-CV 2-AFW-4531-CV 2-AFW-4522-CV 2-AFW-4532-CV 2-AFW-4523-CV 2-AFW-4533-CV b. For S/G remaining to be steamed, place the motor and steam driven train AFW Block Valve Handswitches in OPEN. c. For S/G to be isolated, shut the AFW Steam Supply Valve. 21 S/G or 22 S/G 2-MS-4070-CV 2-MS-4071-CV	

III. RECOVERY ACTIONS

d. For S/G to be isolated, shut the Atmospheric Dump Valve using the Hand Transfer Valves on the West wall of the Unit 2 45 ft Switchgear Room:

(1) Verify 2C43 Atmospheric Dump Controllers at 0% output.

(2) Align Hand Transfer Valves to 2C43 position:

21 S/G	or 22 S/G
2-HV-3939A	2-HV-3938A
2-HV-3939B	2-HV-3938B

e. For S/G to be isolated, shut the MSIV.

f. Shut upstream drains by placing handswitch 2-HS-6622 in CLOSE.

2. Continue to steam unisolated S/G, attempting to maintain CET temperatures constant or decreasing using Turbine Bypass Valve(s).

3. **WHEN** the remaining S/G level decreases to (-)375 inches **OR** CET temperatures begin to increase,
THEN isolate both S/Gs:

a. Shut the motor and steam driven train AFW Block Valves:

21 S/G	22 S/G
2-AFW-4520-CV	2-AFW-4530-CV
2-AFW-4521-CV	2-AFW-4531-CV
2-AFW-4522-CV	2-AFW-4532-CV
2-AFW-4523-CV	2-AFW-4533-CV

ALTERNATE ACTIONS

1.d.1 **IF** Atmospheric Dump Valve will **NOT** shut from 2C43, **THEN** shut Atmospheric Dump Manual Isolation Valve.

21 S/G	or 22 S/G
2-MS-101	2-MS-104

2.1 **IF** Turbine Bypass Valves unavailable,
THEN continue to steam unisolated S/G using Atmospheric Dump Valve.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
b. Shut the AFW Steam Supply Valves: 21 S/G — 2-MS-4070-CV 22 S/G — 2-MS-4071-CV c. Shut Atmospheric Dump Valves. d. Shut Turbine Bypass Valves. e. Shut both MSIVs.	
K. COMMENCE ONCE THROUGH CORE COOLING:	
- CAUTION - **After S/G becomes ineffective for heat removal, Once Through Core Cooling must be initiated prior to CET temperatures reaching 560°F to ensure adequate heat removal.** 1. **WHEN** either of the following conditions exist: a. Steaming S/G becomes ineffective and CET temperatures begin to increase. b. Both S/Gs isolated due to low level. **THEN** commence Once Through Core Cooling. 2. Shift Letdown Control Valve Controller, 2-HIC-110, to MANUAL and shut Letdown Control Valves: 2-CVC-110P-CV 2-CVC-110Q-CV	

III. RECOVERY ACTIONS

3. Start all available Charging Pumps.

4. Open Main and Aux HPSI Header Valves:

2-SI-616-MOV	2-SI-617-MOV
2-SI-626-MOV	2-SI-627-MOV
2-SI-636-MOV	2-SI-637-MOV
2-SI-646-MOV	2-SI-647-MOV

5. Start 21 and 23 HPSI Pumps.

6. De-energize the Pressurizer Heaters by placing all handswitches in OFF.

7. Start all available Containment Air Coolers in HIGH with maximum SRW flow.

8. Open both PORVs:

   a. **WHEN** "PRSR PRESS BLOCK A(B) PERMITTED" alarm(s) received,
   THEN block SIAS A(B).

   b. Verify both PORV Block Valves open.

   c. Pull two High Pressurizer Pressure Trip Units.

   d. Verify PORVs open.

ALTERNATE ACTIONS

VI. RECOVERY ACTIONS

9. IF containment pressure increases to 2.8 PSIG, THEN verify ESFAS actuation AND commence Verification Checklists:

   a. SIAS per Attachment (2).

   b. CIS per Attachment (4).

10. IF containment pressure increases to 4.25 PSIG, THEN verify CSAS actuation AND commence Verification Checklist, Attachment (3).

11. Confirm initiation of Once Through Core Cooling.

   a. WHEN RCS pressure is less than 1270 PSIA, THEN ensure HPSI flow AND CET temperatures constant or decreasing.

12. Using CET temperatures, maintain subcooling between 30 and 140°F per Attachment (1) by throttling HPSI flow:

   a. Lower subcooling by lowering HPSI flow.

   b. Raise subcooling by raising HPSI flow.

13. Continue cooldown using Once Through Core Cooling until feedwater restored or shutdown cooling entry conditions are established.

- NOTE -

Additional guidance for feeding S/Gs is given in the Core and RCS Heat Removal section of EOP-8.

14. Continue efforts to restore Main Feed or AFW.

ALTERNATE ACTIONS

I. RECOVERY ACTIONS

1. **WHEN** RCS BORATION COMPLETE, **THEN** SHIFT CHARGING PUMP SUCTION SUPPLY TO MAKEUP SUPPLY WITH A LOWER BORIC ACID CONCENTRATION.

1. **IF** SIAS actuated, **THEN** perform the following:

   a. Open RWT To Charging Pump Suction Valve, 2-CVC-504-MOV.

   b. Shut VCT Outlet Valve, 2-CVC-501-MOV.

   c. Place Boric Acid Pumps in PULL-TO-LOCK.

   d. Ensure Charging Pump AMPS steady.

ALTERNATE ACTIONS

1.1 **IF** SIAS **NOT** actuated, **THEN** line up Charging Pump suction to VCT:

   a. Determine blend required to maintain shutdown boron concentration per NEOG-11.

   b. Open VCT Outlet Valve, 2-CVC-501-MOV.

   c. Secure Boric Acid Pump(s).

   d. Shut Boric Acid Direct Makeup Valve, 2-CVC-514-MOV.

   e. Shut BAST Gravity Feed Valves:

   2-CVC-508-MOV
   2-CVC-509-MOV

   OR line up Charging Pump suction to RWT:

   a. Open RWT To Charging Pump Suction Valve, 2-CVC-504-MOV.

   b. Shut VCT Outlet Valve, 2-CVC-501-MOV.

   c. Shut Boric Acid Direct Makeup Valve, 2-CVC-514-MOV.

   d. Secure Boric Acid Pump(s).

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
M. IF RWT LEVEL DECREASES TO BETWEEN 0.5 AND 1.0 FT OR "ACTUATION SYS RAS TRIPPED" ALARM RECEIVED, THEN VERIFY RAS ACTUATION:	
1. Place SI Pump Recirc Lockout Switches in ON. 2. Commence RAS Verification Checklist, Attachment (6). 3. Shut RWT Outlet Valves: 2-SI-4142-MOV 2-SI-4143-MOV 4. IF HPSI flow greater than 1000 GPM with two HPSI Pumps operating, THEN equally throttle HPSI flow to 1000 GPM. 5. IF HPSI flow greater than 600 GPM with one HPSI Pump operating, THEN equally throttle HPSI flow to 600 GPM. - CAUTION - **To prevent pump damage, minimum flow per operating HPSI Pump is 30 GPM.** 6. IF HPSI Pump cavition occurs in recirculation mode, THEN throttle HPSI flow per Attachment (12).	6.1 IF Attachment (12) does NOT allow throttling HPSI flow, THEN align Containment Spray Pump(s) to HPSI Pump suction: a. IF 21 HPSI Pump cavitating, THEN open 21 SDC HX To HPSI Suction Valve, 2-SI-663-MOV AND start 21 Containment Spray Pump.

IMAGE EVALUATION TEST TARGET (MT-3)

150mm

6"

IMAGE EVALUATION
TEST TARGET (MT-3)

150mm

6"

IMAGE EVALUATION
TEST TARGET (MT-3)

150mm

6"

VII. RECOVERY ACTIONS	ALTERNATE ACTIONS
	b. **IF** 23 HPSI Pump cavitating, **THEN** open 22 SDC HX To HPSI Suction Valve, 2-SI-662-MOV **AND** start 22 Containment Spray Pump.
7. Commence ECCS Pump Room cooling: a. Open ECCS Pump Room Air Cooler Saltwater Valves: 2-SW-5170-CV 2-SW-5171-CV 2-SW-5173-CV b. Start 21 and 22 ECCS Pump Room Cooling Fans. 8. Adjust saltwater flow to maintain SRW and component cooling temperatures. 9. **IF** Charging Pumps are aligned with suction from RWT **AND** HPSI Pumps maintaining RCS inventory, **THEN** place Charging Pumps in PULL-TO-LOCK.	
N. **IF** FEEDWATER AVAILABLE **AND** ONCE THROUGH CORE COOLING IN PROGRESS, **THEN** EVALUATE FEEDING S/G:	
1. **IF** decision made to feed S/G, **THEN** establish secondary heat sink in S/G with highest level. - **CAUTION** - **If voids exist in the S/G tubes, a rapid RCS pressure reduction will occur when the voids collapse.**	1.1 **IF** decision made **NOT** to feed S/G, **THEN** continue Once Through Core Cooling until Shutdown Cooling can be used.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
CCOM CR 88-1214 2. Throttle Auxiliary Feedwater flow to less than 150 GPM **OR** throttle Main Feedwater flow to minimum by cracking the Feed Regulating Bypass Valve off its shut seat.	
3. **WHEN** S/G level increases **OR** continuous feed has been maintained for 5 minutes, **THEN** slowly raise feed rate to raise S/G level to greater than (-)250 inches and trending toward 0 inches.	
4. Align Atmospheric Dump Valve for S/G with highest level to 2C03 and Atmospheric Dump Valve for S/G with lowest level to 2C43.	
5. Adjust Atmospheric Dump Valve to establish Natural Circulation.	
- **CAUTION** - **The RCS may be solid. Any action involving RCS cooldown or heatup should be closely monitored to prevent rapid pressure excursions.**	
6. **WHEN** secondary heat sink established, **THEN** secure Once Through Core Cooling: a. Operate HPSI and Charging Pumps as necessary to maintain RCS subcooling between 30 and 140°F. b. Shut both PORVs: (1) Insert High Pressurizer Pressure Trip Units that were previously pulled. (2) Ensure "PORV ENERGIZED" alarm clear.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
7. Confirm Natural Circulation: - **NOTE** - Wide range Thot may be obtained from Subcooled Margin Monitor per Attachment (10). a. Thot minus Tcold between 10 and 50°F. b. Tcold constant or decreasing. c. Thot constant or decreasing. d. CET temperatures consistent with Thot. e. Steaming rate affects primary temperature. 8. Monitor for Core and RCS voiding: - **CAUTION** - **Potential for void formation increases rapidly when pressure decreases below 1500 PSIA.** a. Letdown flow greater than charging flow. b. Rapid unexplained increase in pressurizer level during an RCS pressure reduction. c. Loss of subcooled margin as determined using CET temperatures. d. "REACTOR VESSEL WATER LEVEL LOW" alarm.	

I. RECOVERY ACTIONS

9. **IF** voiding inhibits heat removal,
THEN reduce or eliminate voided area:

a. Shut Letdown Isolation Valve, 2-CVC-515-CV.

-CAUTION-

The potential exists for pressurized thermal shock from an excessive cooldown rate followed by a repressurization.

b. Pressurize RCS to maintain subcooling as near 140°F as practical.

c. **IF** voiding occurs in the S/G Tubes (saturation pressure of S/G greater than saturation pressure of RCS),
THEN cool the S/G by raising any of the following:

(1) Steaming rate.

(2) Feed rate.

(3) S/G Blowdown rate.

AND maintaining less than 100°F/h cooldown rate.

- CAUTION -

Technical Specifications require MPT protection when Tcold less than 275°F.

10. Continue RCS cooldown until able to initiate Shutdown Cooling.

ALTERNATE ACTIONS

9.b.1 **IF** pressurizing the RCS does **NOT** restore heat removal,
THEN operate Reactor Vessel Vent Valves per OI-1G.

VII. RECOVERY ACTIONS	ALTERNATE ACTIONS
O. RESTORE CONTAINMENT ENVIRONMENT:	
1. Direct Chemistry to place Hydrogen Monitors in service. 2. **IF** hydrogen concentration increases to 1%, **THEN** start Hydrogen Recombiners per OI-41A. 3. Maintain Iodine Filter Fans running. 4. **WHEN** containment pressure less than 4.0 PSIG, **THEN** perform the following: a. Reset CSAS signal. b. Secure one Containment Spray Pump. c. Verify all Containment Air Coolers operating to maintain containment temperature less than 120°F. d. Restore equipment per CSAS Verification Checklist, Attachment (3), to desired condition. 5. **WHEN** containment pressure less than 2.8 PSIG, **THEN** perform the following: a. Block pressurizer pressure signals and reset SIAS signal. b. Reset CIS signal. c. Secure remaining Containment Spray Pump. d. Restore equipment per SIAS and CIS Verification Checklists, Attachments (2) and (4), to desired condition.	

VII. RECOVERY ACTIONS	ALTERNATE ACTIONS
P. **WHEN** CET TEMPERATURES LESS THAN 300°F **AND** RADIATION LEVELS PERMIT, **THEN** INITIATE SHUTDOWN COOLING:	
1. **WHEN** RCS pressure less than 300 PSIA, **THEN** shut SI Tank Outlet Valves: 2-SI-614-MOV 2-SI-624-MOV 2-SI-634-MOV 2-SI-644-MOV	
2. Lower RCS pressure to less than 250 PSIA by throttling HPSI flow while maintaining: a. Greater than 30°F subcooling using CET temperatures. b. Greater than 30 GPM flow per operating HPSI Pump.	2.1 **IF** voiding prevents depressurization to 250 PSIA, **THEN** attempt to eliminate voids: a. Alternately pressurize and depressurize RCS by throttling HPSI flow. b. Operate Reactor Vessel Vent Valves per OI-1G.
3. **WHEN** RCS pressure less than 250 PSIA **AND** containment pressure less than 4.0 PSIG, **THEN** initiate Shutdown Cooling per OI-3.	3.1 **IF** unable to initiate Shutdown Cooling, **THEN** continue Once Through Core Cooling until able to initiate Shutdown Cooling **OR** Feedwater available.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
- **CAUTION** - **The RCS may be solid. Any action involving RCS cooldown or heatup should be closely monitored to prevent rapid pressure excursions.** 4. **WHEN** Shutdown Cooling flow is established, **THEN** secure Once Through Core Cooling: a. Operate HPSI or Charging Pumps as necessary to maintain RCS pressure between 150 and 250 PSIA until CVCS letdown available. - **CAUTION** - **Technical specifications require MPT protection when Tcold less than 275°F.** b. Shut both PORVs: (1) Insert High Pressurizer Pressure Trip Units that were previously pulled. (2) Ensure "PORV ENERGIZED" alarm clear.	
Q. RESTORE SERVICE WATER TO TURBINE BUILDING:	
1. Verify 11 Plant Air Compressor operating. 2. Shut Plant Air To Plant Air Header Valve, 2-PA-2059-CV.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
3. Open Plant Air To Instrument Air Cross Connect Valve, 2-PA-2061-CV. 4. Open SRW Turbine Building Header Isolation Valves: 2-SRW-1600-CV 2-SRW-1637-CV 2-SRW-1638-CV 2-SRW-1639-CV	
R. RESTORE INSTRUMENT AIR COMPRESSORS TO SERVICE:	
1. **IF** high temperature alarm exists on the Instrument Air Compressors, **THEN** open the service water isolation valves by placing their handswitches in OPEN until temperature alarm clears. 21 or 22 2-HS-2063 2-HS-2065 2. Start at least one Instrument Air Compressor.	
S. RESTORE INSTRUMENT AIR TO CONTAINMENT·	
1. Open Cntmt Instrument Air Isolation MOV, 2-IA-2080-MOV. - **NOTE** - 2-HS-2085 located on West wall of 27 ft Switchgear Room; Key #80 in Control Room Key Locker. 2. Open Cntmt Instrument Air Supply CV, 2-IA-2085-CV, by momentarily placing 2-HS-2085 in OPEN.	

VII. RECOVERY ACTIONS	ALTERNATE ACTIONS
T. RESTORE LETDOWN FLOW:	
1. Verify charging flowpath through Loop Charging Valves or Auxiliary Spray Valve. 2. Verify at least one Charging Pump operating. 3. Shift Letdown Control Valve Controller, 2-HIC-110, to MANUAL. 4. Adjust controller to shut Letdown Control Valves. 5. Open Letdown Isolation Valves: 2-CVC-515-CV 2-CVC-516-CV -CAUTION- **The setpoint of 2-PIC-201 must be above the saturation pressure for the letdown outlet temperature of the Regenerative Heat Exchanger.** 6. Adjust the setpoint on 2-PIC-201 and adjust 2-HIC-110 to maintain desired RCS pressure.	
U. DRAW PRESSURIZER BUBBLE IF DESIRED:	
1. Adjust steaming rate or Shutdown Cooling to stabilize Tcold. 2. Heat up Pressurizer by energizing Backup and Proportional Heaters. 3. Adjust letdown flow and Tcold to maintain RCS subcooling between 30 and 140°F.	

III. RECOVERY ACTIONS

4. **WHEN** pressurizer temperature exceeds CET temperatures by 50°F,
THEN maximize letdown:

   a. Lower the setpoint on Letdown Backpressure Regulator Controller to obtain letdown flow of 100 GPM.

   b. Secure Charging Pump(s) as needed to increase effective letdown.

5. **WHEN** saturation pressure for the existing pressurizer temperature is reached,
THEN confirm bubble formation by observing steady pressurizer pressure.

6. Using CET temperatures, maintain subcooling between 30 and 140°F per Attachment (1) by operating:

   a. Backup and Proportional Heater(s).

   b. Auxiliary Spray.

7. Maintain pressurizer level between 101 and 180 inches by operating:

   a. Charging flow.

   b. Letdown flow.

ALTERNATE ACTIONS

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
V. **IF** FEEDWATER AVAILABLE **AND** SHUTDOWN COOLING **NOT** OPERATING, **THEN** EVALUATE NEED FOR FORCED OR NATURAL CIRCULATION:	
1. **WHEN** RCPs available **AND** Forced Circulation desired **THEN** start RCPs per steps 2-12.	1.1 **IF** RCPs **NOT** available **OR** Natural Circulation desired, **THEN** implement Natural Circulation (AOP-3E) **AND** complete administrative post-trip actions.
2. **IF** RCPs exposed to excessive moisture, **THEN** consider meggering RCP motor.	
- **CAUTION** - **Uncontrolled restoration of cooling to hot RCP seals may cause degradation of the metallic seating surfaces by thermal shock.**	
3. **IF** Component Cooling is isolated to RCP seals, **THEN** reduce RCP lower seal temperature below 280°F prior to initiating full cooling flow to the RCPs: a. Shut Component Cooling Supply Containment Manual Isolation Valve, 2-CC-234, located in 5 ft East Penetration Room. b. Verify CIS reset. c. Open Component Cooling Containment Isolation Valves: 2-CC-3832-CV 2-CC-3833-CV	

III. RECOVERY ACTIONS

d. Slowly open 2-CC-284 to throttle component cooling flow until lower seal temperatures are less than 280°F.

e. **WHEN** lower seal temperatures are less than 280°F, **THEN** fully open 2-CC-284.

4. **IF** an RCP lower seal temperature exceeded 280°F, **THEN** an engineering evaluation is required prior to restarting that RCP.

5. Raise pressurizer level to at least 155 inches.

6. Verify RCP restart criteria:

   a. RCS subcooling greater than 30°F.

   b. At least one S/G available for heat removal.

   c. Pressurizer level greater than 155 inches and stable.

   d. Tcold less than 525°F.

   e. RCS temperature and pressure greater than the minimum operating limits per the RCP curve on Attachment (1).

ALTERNATE ACTIONS

II. RECOVERY ACTIONS

- **NOTE** -

Starting an RCP may cause a pressurizer level transient.

7. **WHEN** RCP restart criteria are met, **THEN** start one RCP in a loop with an operable S/G:

   a. Verify "COMPT CLG FLOW LO" alarm clear.

   b. Start Oil Lift Pump.

   c. Insert RCP sync stick.

   d. Start one RCP.

   e. Monitor RCP running current:

Tavg	Current
525 to 572°F	238 to 210 AMPS and steady
210 to 525°F	264 to 238 AMPS and steady

8. **IF** pressurizer level decreases, **THEN** start Charging or HPSI Pump(s) as necessary to restore **AND** maintain level greater than 155 inches.

9. Monitor RCP seal parameters following pump restart.

10. Allow backflow to equalize temperatures in opposite loop.

11. Start second RCP in opposite loop per Step V.7 and V.9, page 32.

ALTERNATE ACTIONS

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
12. Secure Auxiliary Spray: a. Open Loop Charging Valves: 2-CVC-518-CV 2-CVC-519-CV b. Shut Auxiliary Spray Valve, 2-CVC-517-CV. c. Shift Pressurizer Spray Controller, 2-HIC-100, to AUTO.	
W. COMPLETE ADMINISTRATIVE POST-TRIP ACTIONS AND IMPLEMENT APPROPRIATE OPERATING PROCEDURE.	

X. ADMINISTRATIVE POST-TRIP ACTIONS:

- **NOTE** -

The following actions may be accomplished whenever feasible. They may be done in any order.

_______ 1. Refer to ERPIP to determine appropriate emergency response actions.

_______ 2. Perform notifications per CCI-118.

_______ 3. Notify ESO of trip.

_______ 4. Request RCS Boron and Iodine sample.

_______ 5. Perform shutdown margin calculation per NEOG 9 and 11

_______ 6. Complete transient log entries per CCI-301.

_______ 7. Recall post-trip review (preferably within 30 minutes of trip).

_______ 8. Perform post-trip review per CCI-111.

_______ 9. Monitor turbine bearing temperatures.

_______ 10. Continue Main Turbine shutdown per applicable step of OI-43A.

END OF SECTION III.

IV. SAFETY FUNCTION STATUS CHECK

A. The STA (or person designated by STA) will perform the intermediate and final safety function checks respectively on entry and prior to exiting from this procedure.

B. Perform intermediate safety function status check at 10 minute intervals until plant conditions stabilize.

C. Immediately notify Shift Supervisor or Control Room Supervisor if any safety function criteria is not being satisfied.

D. Review data and verify that safety function acceptance criteria are satisfied.

E. When EOP completed, then perform final safety function check.

REACTIVITY CONTROL PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. WRNI power	less than 3%	----------	less than 2%	____
b. SUR (DPM)	negative	----------	0	____
c. CEA status	all inserted	----------	all inserted	____
or				
Boration status:				
concentration	increasing	----------	appropriate S/D margin	____
BAST level	decreasing	----------	N/A	N/A

RCS PRESSURE AND INVENTORY PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Pressurizer pressure (PSIA)	1000 to 2350	----------	less than 2300	________
b. Pressurizer level (inches)	50 to 350	----------	101 to 180	________
c. RCS subcooling (°F)	30 to 140	----------	30 to 140	________
If PORVs were opened, once an hour monitor the following:				
d. Quench Tank parameters: level (inches) temperature (°F) pressure (PSIG)	constant or decreasing	----------	constant or decreasing	________
e. PORV discharge piping temperature (°F) (computer points T107, T108)	decreasing	----------	decreasing	________

CORE AND RCS HEAT REMOVAL PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. RCS Tcold ($^{\circ}$F)	less than 540	--------	less than 535	________
b. CET ($^{\circ}$F)	less than 560	--------	less than 540	________
c. Thot minus Tcold ($^{\circ}$F)				
Natural Circulation	10 to 50	--------	10 to 50	________
Forced Circulation	less than 10	--------	less than 5	________
d. S/G pressure	less than 960	--------	less than 920	________
e. S/G level (inches)	(-)400 to (+)30	--------	(-)24 to (+)30	________
f. Condensate Storage Tank level (ft)	greater than 5	--------	greater than 5 and increasing	________

SAFETY FUNCTION ACCEPTANCE CRITERIA

VITAL AUXILIARIES	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. 4KV vital buses 21 or 24	energized	----------	energized	________
b. Instrument Air pressure (PSIG)	greater than 88	----------	greater than 88	________
c. Component Cooling (# pumps running)	1 or 2	----------	1 or 2	________
d. Saltwater (# pumps running)	1 or 2	----------	1 or 2	________
e. Service Water (# pumps running)	1 or 2	----------	1 or 2	________
f 125V DC buses 11, 12, 21, 22	energized	----------	energized	________
g. 120V AC vital buses 21, 22, 23, 24	energized	----------	energized	________

NORMAL CONTAINMENT ENVIRONMENT PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Containment pressure (PSIG)	less than 50	--------	less than 2.8	________
b. Containment temperature (°F)	less than 276	--------	less than 220	________
c. Containment High Range Radiation Monitor	alarm clear	--------	alarm clear	________
d. Hydrogen concentration	N/A	N/A	less than 2%	________

NORMAL RADIATION LEVELS EXTERNAL TO CONTAINMENT	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Noble Gas Monitor	alarm clear	----------	alarm clear	______
b. Condenser Off-Gas RMS	alarm clear	----------	alarm clear	______
c. S/G B/D RMS	alarm clear	----------	alarm clear	______
d. Main Vent Gaseous RMS (2-RI-5415)	alarm clear	----------	alarm clear	______

STATUS CHECK NUMBER	COMPLETE AT TIME
1	______
2	______
3	______
4	______
______	______
______	______
______	______

CALVERT CLIFFS NUCLEAR POWER PLANT

EOP-4 EXCESS STEAM DEMAND

REVISION 1

	SIGNATURE	DATE
PREPARED BY;	James V. Grooms	, 12/18/87
VERIFIED BY;	[illegible]	, 12-18-87
POSRC;	MEETING # 88-7	, 2-10-88
APPROVED BY;	J R Lemons Manager-Nuclear Operations or General Supervisor-Operations if POSRC review is not required	, 2-10-88

LIST OF EFFECTIVE PAGES

EXCESS STEAM DEMAND

I. PRECAUTIONS

A. Do not adopt manual operation of automatically controlled systems unless a malfunction is apparent or automatic system operation will not support the maintenance of a safety function.

B. Systems shifted to manual operation must be monitored frequently to ensure correct operation.

C. At least two independent indications should be used, when available, to evaluate and corroborate a specific plant condition since an incident could induce inconsistencies between instruments.

D. High energy line break may cause erratic instrumentation response depending on the magnitude and location of the break.

E. Minimize the number of cycles of pressurizer auxiliary spray when the temperature differential is greater than 400°F.

F. In Natural Circulation, increased loop transport time causes a 5 to 10 minute delay in temperature responses to a plant change. Pressurizer level and pressure responses, if available, typically provide better indication of RCS response during this period.

G. S/G pressure, pressurizer pressure, and containment temperature affect the level indication for the S/Gs and Pressurizer. Attachments (8) and (9) contain the corrected S/G and pressurizer levels for various S/G pressures, pressurizer pressures, and containment temperatures.

H. If a pump or component fails, the cause of the failure should be determined prior to restarting or starting a standby pump or component to prevent a common failure.

II. ENTRY CONDITIONS

The presence of one or more of the following conditions indicates that an Excess Steam Demand may have occurred:

A. Decrease in S/G pressure in one or both S/Gs.

B. Reactor Trip on low S/G pressure.

C. Reactor Trip on high containment pressure.

D. Possible actuation of:

1. SIAS
2. CIS
3. CSAS
4. SGIS

E. Decrease in Tcold.

F. Loud noise and poor visibility in plant (location dependent).

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
A. VERIFY POST-TRIP IMMEDIATE ACTIONS COMPLETED.	
B. COMMENCE INTERMEDIATE SAFETY FUNCTION STATUS CHECK.	
C. DETERMINE APPROPRIATE EMERGENCY RESPONSE ACTIONS PER THE ERPIP.	
D. ISOLATE BOTH S/Gs:	
1. Shut both MSIVs. 2. Shut S/G Feedwater Isolation Valves: 1-FW-4516-MOV 1-FW-4517-MOV 3. Shut MSIV Bypass Valves: 1-MS-4045-MOV 1-MS-4052-MOV 4. Shut S/G Blowdown Valves: 1-BD-4010-CV 1-BD-4011-CV 1-BD-4012-CV 1-BD-4013-CV	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
5. Shut AFW Steam Supply Valves by placing handswitches in CLOSE: 1-MS-4070-CV 1-MS-4071-CV 6. Shut AFW Block Valves by placing handswitches in CLOSE: 11 S/G: 1-AFW-4520-CV, 1-AFW-4521-CV, 1-AFW-4522-CV, 1-AFW-4523-CV 12 S/G: 1-AFW-4530-CV, 1-AFW-4531-CV, 1-AFW-4532-CV, 1-AFW-4533-CV 7. Shut Atmospheric Dump Valves. 8. Shut upstream drains by placing handswitch 1-HS-6622 in CLOSE.	
E. MONITOR RCS DEPRESSURIZATION.	
1. <u>IF</u> rapid depressurization to 1725 PSIA, <u>THEN</u> verify SIAS actuation <u>AND</u> the following actions: a. All available Charging Pumps running. b. 11 and 13 HPSI Pumps running. c. Main and Aux HPSI Header Valves open: 1-SI-616-MOV 1-SI-617-MOV 1-SI-626-MOV 1-SI-627-MOV 1-SI-636-MOV 1-SI-637-MOV 1-SI-646-MOV 1-SI-647-MOV	1.1. <u>IF</u> RCS pressure is greater than 1725 PSIA <u>AND</u> SIAS <u>NOT</u> actuated, <u>THEN</u> block SIAS: a. Open Main and Aux HPSI Header valves: 1-SI-616-MOV 1-SI-617-MOV 1-SI-626-MOV 1-SI-627-MOV 1-SI-636-MOV 1-SI-637-MOV 1-SI-646-MOV 1-SI-647-MOV b. Start 11 and 13 HPSI Pumps. c. <u>WHEN</u> "PRSR PRESS BLOCK A(B) PERMITTED" alarms(s) received, <u>THEN</u> block SIAS A(B).

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
F. IMPLEMENT RCP TRIP STRATEGY:	
1. **IF** RCS pressure decreases to 1725 PSIA, **THEN** trip 11A and 12B RCPs **OR** trip 11B and 12A RCPs. 2. **IF** positive LOCA indications exist: a. RCS subcooling less than 30°F. b. Steady S/G pressure. c. S/G Blowdown RMS alarms clear **OR** Main Vent Gaseous RMS (1-RI-5415) alarm clear. **AND** RCS pressure decreases to less than 1300 PSIA, **THEN** trip all RCPs. 3. **IF** RCS temperature and pressure are less than the minimum pump operating limits per the RCP curve on Attachment (1), **THEN** trip all RCPs. 4. **IF** CIS has actuated, **THEN** trip all RCPs.	
G. MONITOR CONTAINMENT PRESSURE:	
1. **IF** CSAS **NOT** actuated, **THEN** start all available Containment Air Coolers in HIGH with maximum SRW flow.	

III. RECOVERY ACTIONS

ALTERNATE ACTIONS

2. **IF** containment pressure increases to 2.8 PSIG, **THEN** verify ESFAS actuation:

   a. SIAS.

   b. CIS **AND** trip all RCPs.

3. Verify SRW Pump Room Ventilation in service, per OI-15.

4. **IF** containment pressure increases to 4.25 PSIG, **THEN** verify CSAS actuation **AND** spray flow approximately 1350 GPM.

H. VERIFY BORATION IN PROGRESS:

RECOVERY ACTIONS	ALTERNATE ACTIONS
1. **IF** SIAS has actuated, **THEN** verify boration in progress: a. Shut VCT Makeup Valve, 1-CVC-512-CV. b. Open Boric Acid Direct Makeup Valve, 1-CVC-514-MOV. c. Boric Acid Pumps running. d. Open BAST Gravity Feed Valves: 1-CVC-508-MOV 1-CVC-509-MOV	1.1 **IF** SIAS **NOT** actuated, **THEN** commence boration: a. Shut VCT Makeup Valve, 1-CVC-512-CV. b. Open Boric Acid Direct Makeup Valve, 1-CVC-514-MOV. c. Start a Boric Acid Pump. d. Start all available Charging Pumps.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
e. Shut VCT Outlet Valve, 1-CVC-501-MOV. f. All available Charging Pumps running.	1.2 IF Boric Acid Pumps NOT available, THEN establish gravity feed: a. Open BAST Gravity Feed Valves: 1-CVC-508-MOV 1-CVC-509-MOV b. Shut VCT Outlet Valve, 1-CVC-501-MOV. c. Start all available Charging Pumps.
2. Continue boration until a total 65 inch decrease in BAST level(s) is achieved, or shutdown margin requirement of NEOG-7 is achieved.	
I. IDENTIFY AFFECTED S/G.	
1. Compare the following parameters: a. S/G pressures. b. Tcold on both loops. c. S/G levels.	

III. RECOVERY ACTIONS

J. MAINTAIN HEAT SINK OPERABILITY OF UNAFFECTED S/G DURING BLOWDOWN PHASE:

1. For the affected S/G, shut the Atmospheric Dump Valve using the Hand Transfer Valves on the West wall of the Unit 1 45 ft Switchgear Room:

   a. Verify 1C43 Atmospheric Dump Controllers at 0% output.

   b. Align Hand Transfer Valves to 1C43 position:

11 S/G	or	12 S/G
1-HV-3938A		1-HV-3939A
1-HV-3938B		1-HV-3939B

- **NOTE** -

Unaffected S/G temperature may be obtained by using the saturation temperature for the existing S/G pressure.

2. **IF** RCS cooldown rate greater than or equal to 100°F/h **AND** CET temperatures less than unaffected S/G temperature, **THEN** cool unaffected S/G to within 25°F of CET temperatures:

   a. Open motor driven train AFW Block Valves on unaffected S/G:

11 S/G	or	12 S/G
1-AFW-4522-CV		1-AFW-4532-CV
1-AFW-4523-CV		1-AFW-4533-CV

ALTERNATE ACTIONS

1.1 **IF** Atmospheric Dump Valve will **NOT** shut from 1C43, **THEN** shut Atmospheric Dump Manual Isolation Valve.

11 S/G	or	12 S/G
1-MS-101		1-MS-104

- **NOTE** -

For steam breaks in Containment, resulting in small cooldown rates, the energy released to Containment may be reduced by use of S/G Blowdown on affected S/G.

2.1 **IF** RCS cooldown rate less than 100°F/h, **THEN** establish Natural Circulation using unaffected S/G:

   a. Open motor driven train AFW Block Valves on unaffected S/G:

11 S/G	or	12 S/G
1-AFW-4522-CV		1-AFW-4532-CV
1-AFW-4523-CV		1-AFW-4533-CV

III. RECOVERY ACTIONS

- CAUTION -

D/G supplying power to 13 AFW Pump flow limit is 300 GPM; otherwise, flow limit is 575 GPM.

b Start 13 AFW Pump.

c. Adjust AFW Flow Control Valves to feed unaffected S/G.

<u>11 S/G</u>	or	<u>12 S/G</u>
1-AFW-4525-CV		1-AFW-4535-CV

- CAUTION -

CET temperatures must always be less than unaffected S/G temperature while affected S/G blowdown is in progress.

d. Open Atmospheric Dump Valve as necessary to cool unaffected S/G to within 25°F of CET temperatures.

e. Stabilize unaffected S/G level between (-)170 and (+)30 inches.

K. RESTORE PRESSURIZER LEVEL TO BETWEEN 50 AND 110 INCHES DURING S/G BLOWDOWN:

1. Verify letdown isolated.

2. **<u>IF</u>** RCS pressure less than 1270 PSIA,
<u>THEN</u> verify HPSI flow to RCS per Attachment (12).

ALTERNATE ACTIONS

- CAUTION -

D/G supplying power to 13 AFW Pump flow limit is 300 GPM; otherwise flow limit is 575 GPM.

b. Start 13 AFW Pump.

c. Manually throttle open AFW Flow Control Valve.

<u>11 S/G</u>	or	<u>12 S/G</u>
1-AFW-4525-CV		1-AFW-4535-CV

d. Open Atmospheric Dump Valve as necessary to cool unaffected S/G, while maintaining RCS cooldown rate less than 100°F/h.

e. Stabilize unaffected S/G level between (-)170 and (+)30 inches.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
3. **IF** additional HPSI flow required to control pressurizer level, **THEN** lower RCS pressure using Auxiliary Spray per step M, page 13. 4. **WHEN** pressurizer level greater than 50 inches, **THEN** secure all but one Charging Pump. 5. **IF** the following conditions exist: a. At least 30°F subcooling. b. Pressurizer level greater than 50 inches. c. At least one S/G available for heat removal. d. RVLMS indicates that the Core is covered. **THEN** throttle HPSI flow to maintain pressurizer level between 50 and 110 inches.	
L. **WHEN** STEADY Tcold INDICATES S/G BLOWDOWN COMPLETE **OR** COOLDOWN RATE LESS THAN 100°F/h, **THEN** ESTABLISH UNAFFECTED S/G AS A HEAT SINK:	
1. Restore S/G wide range level to between (-)24 and (+)30 inches using 13 AFW Pump. 2. Open Atmospheric Dump Valve as necessary to cool unaffected S/G, while maintaining RCS cooldown rate less than 100°F/h. 3. Stabilize pressurizer level between 101 and 155 inches.	

VII. RECOVERY ACTIONS	ALTERNATE ACTIONS
M. MAINTAIN RCS SUBCOOLING BETWEEN 30 AND 140°F:	
- **CAUTION** - **The potential exists for pressurized thermal shock from an excessive cooldown rate followed by a repressurization.** 1. Operate Pressurizer Heaters as necessary to maintain RCS subcooling greater than 30°F. 2. **IF** necessary to lower RCS subcooling **AND** pressurizer level less than 350 inches, **THEN** verify heaters secured **AND** initiate Auxiliary Spray: a. Place Instrument Air CIS Override Switch, 1-HS-2080A, in OVERRIDE. b. Open Cntmt Instrument Air Isolation MOV, 1-IA-2080-MOV. c. Record temperature differential between Pressurizer and Regenerative Heat Exchanger Outlet. d. Open Auxiliary Spray Valve, 1-CVC-517-CV.	2.1 **IF** pressurizer level greater than 350 inches **AND** RCS subcooling is greater than 140°F, **THEN** open PORV: a. Verify primary makeup path operable. b. Place both PORV Override Control Switches in OVERRIDE SHUT. - **NOTE** - The "PORV ENERGIZED" alarm will annunciate when two RPS trip units are pulled. The PORVs will not open. c. Pull two High Pressurizer Pressure Trip Units out on RPS. d. Place one PORV Override Control Switch in AUTO. e. **IF** second PORV needed to lower subcooling, **THEN** place the other PORV Override Control Switch in AUTO. f. **WHEN** subcooling less than 140°F, **THEN** perform the following:

<table>
<tr><th>XII. RECOVERY ACTIONS</th><th>ALTERNATE ACTIONS</th></tr>
<tr><td>
e. Shut Loop Charging Valves:

1-CVC-518-CV
1-CVC-519-CV

- NOTE -

1-HS-2085 located on West wall of 27 ft Switchgear Room; Key #85 in Control Room Key Locker.

f. Open Cntmt Instrument Air Supply CV, 1-IA-2085-CV, by momentarily placing 1-HS-2085 in OPEN.

g. Shift 1-HIC-100 to MANUAL and shut Pressurizer Spray Valves:

1-RC-100E-CV
1-RC-100F-CV

h. Maintain pressurizer cooldown rate less than 200°F/h.
</td><td>
(1) Place the PORV Override Control Switches in OVERRIDE SHUT.

(2) Insert High Pressurizer Pressure Trip Units that were previously pulled.

(3) Ensure "PORV ENERGIZED" alarm clear.

(4) <u>IF</u> Acoustic Monitor indicates flow through the PORV,
<u>THEN</u> shut the PORV Block Valve.
</td></tr>
<tr><td>
N. <u>IF</u> RCPs SECURED,
<u>THEN</u> CONFIRM NATURAL CIRCULATION IN UNAFFECTED S/G LOOP:
</td><td></td></tr>
<tr><td>
- NOTE -

Wide range Thot may be obtained from Subcooled Margin Monitor per Attachment (10).

1. Thot minus Tcold between 10 and 50°F.

2. Tcold constant or decreasing.

3. Thot constant or decreasing.

4. CET temperatures consistent with Thot.

5. Steaming rate affects primary temperature.
</td><td></td></tr>
</table>

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
O. MONITOR FOR CORE AND RCS VOIDING:	
- **CAUTION** - **Potential for void formation increases rapidly when pressure decreases below 1500 PSIA.** 1. Letdown flow greater than charging flow. 2. Rapid unexplained increase in pressurizer level during an RCS pressure reduction. 3. Loss of subcooled margin as determined using CET temperatures. 4. "REACTOR VESSEL WATER LEVEL LOW" alarm.	
P. IF VOIDING INHIBITS HEAT REMOVAL, THEN REDUCE OR ELIMINATE VOIDED AREA:	
1. Shut Letdown Isolation Valve, 1-CVC-515-CV. - **CAUTION** - **The potential exists for pressurized thermal shock from an excessive cooldown rate followed by a repressurization.** 2. Pressurize the RCS to maintain subcooling as near 140°F as practical, by any of the following: - **NOTE** - Pressurizer Backup Heater Banks 11 and 13 trip on U, √ and SIAS.	2.1 IF pressurizing the RCS does **NOT** restore heat removal, **THEN** operate Reactor Vessel Vent Valves per OI-1G.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
a. Operate Pressurizer Heater(s). b. Operate Turbine Bypass or Atmospheric Dump Valves to maximize RCS cooldown, while maintaining cooldown rate less than 100°F/h. c. Raise HPSI flow to RCS. - **CAUTION** - **If voids exist in the S/G tubes, a rapid RCS pressure reduction will occur when the voids collapse.** 3. **IF** voiding occurs in the S/G tubes (saturation pressure of S/G greater than saturation pressure of RCS), **THEN** cool the S/G by raising any of the following: a. Steaming rate. b. Feed rate. c. S/G Blowdown rate. **AND** maintaining less than 100°F/h cooldown rate.	
Q. SECURE THE FOLLOWING SECONDARY PUMPS:	
1. Trip S/G Feed Pumps. 2. Place Condensate Booster Pumps in PULL-TO-LOCK. 3. Place 2 of the 3 Condensate Pumps in PULL-TO-LOCK. 4. Secure Heater Drain Pumps.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
R. **WHEN** RCS BORATION COMPLETE, **THEN** SHIFT CHARGING PUMP SUCTION SUPPLY TO MAKEUP SUPPLY WITH A LOWER BORIC ACID CONCENTRATION.	
1. **IF** SIAS actuated, **THEN** perform the following: a. Open RWT To Charging Pump Suction Valve, 1-CVC-504-MOV. b. Shut VCT Outlet Valve, 1-CVC-501-MOV. c. Place Boric Acid Pumps in PULL-TO-LOCK. d. Ensure Charging Pump AMPS steady.	1.1 **IF** SIAS **NOT** actuated, **THEN** line up Charging Pump suction to VCT: a. Determine blend requirements to maintain shutdown boron concentration per NEOG-7. b. Open VCT Outlet Valve, 1-CVC-501-MOV. c. Secure Boric Acid Pump(s). d. Shut Boric Acid Direct Makeup Valve, 1-CVC-514-MOV. e. Shut BAST Gravity Feed Valves: 1-CVC-508-MOV 1-CVC-509-MOV **OR** line up Charging Pump suction to RWT: a. Open RWT To Charging Pump Suction Valve, 1-CVC-504-MOV. b. Shut VCT Outlet Valve, 1-CVC-501-MOV. c. Shut Boric Acid Direct Makeup Valve, 1-CVC-514-MOV. d. Secure Boric Acid Pumps(s).

III. **RECOVERY ACTIONS**	**ALTERNATE ACTIONS**
S. COMMENCE ESFAS VERIFICATION CHECKLISTS:	
1. SIAS Attachment (2). 2. CSAS Attachment (3). 3. CIS Attachment (4). 4. SGIS Attachment (7).	
T. RESTORE CONTAINMENT ENVIRONMENT:	
1. Direct Chemistry to place Hydrogen Monitors in service. 2. **IF** hydrogen concentration increases to 1%, **THEN** start Hydrogen Recombiners per OI-41A. 3. **WHEN** containment pressure less than 4.0 PSIG, **THEN** perform the following: a. Reset CSAS signal. b. Secure one Containment Spray Pump. c. Verify all Containment Air Coolers operating to maintain containment temperature less than 120°F. d. Restore equipment per CSAS Verification Checklist, Attachment (3), to desired condition.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
4. **WHEN** containment pressure less than 2.8 PSIG, **THEN** perform the following: a. Block pressurizer pressure signals and reset SIAS signal. b. Reset CIS signal. c. Secure remaining Containment Spray Pump. d. Restore equipment per SIAS and CIS Verification Checklists, Attachments (2) and (4), to desired condition.	
U. RESTORE SERVICE WATER TO TURBINE BUILDING:	
1. Verify 21 Plant Air Compressor operating. 2. Shut Plant Air To Plant Air Header Valve, 1-PA-2059-CV. 3. Open Plant Air To Instrument Air Cross Connect Valve, 1-PA-2061-CV. 4. Open SRW Turbine Building Header Isolation Valves: 1-SRW-1600-CV 1-SRW-1637-CV 1-SRW-1638-CV 1-SRW-1639-CV	

III. <u>RECOVERY ACTIONS</u>	<u>ALTERNATE ACTIONS</u>
V. RESTORE INSTRUMENT AIR COMPRESSORS TO SERVICE:	
1. **<u>IF</u>** high temperature alarm exists on the Instrument Air Compressors, **<u>THEN</u>** open the service water isolation valves by placing their handswitches in OPEN until temperature alarm clears. <u>11</u> or <u>12</u> 1-HS-2063 1-HS-2065 2. Start at least one Instrument Air Compressor.	
RESTORE INSTRUMENT AIR TO CONTAINMENT:	
1. Open Cntmt Instrument Air Isolation MOV, 1-IA-2080-MOV. - **<u>NOTE</u>** - 1-HS-2085 located on West wall of 27 ft Switchgear Room; Key #85 in Control Room Key Locker. 2. Open Cntmt Instrument Air Supply CV, 1-IA-2085-CV, by momentarily placing 1-HS-2085 in OPEN.	
X. RESTORE LETDOWN FLOW:	
1. Verify charging flowpath through Loop Charging Valves or Auxiliary Spray Valve.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
2. Verify at least one Charging Pump operating. 3. Shift Letdown Control Valve Controller, 1-HIC-110, to MANUAL. 4. Adjust controller to shut Letdown Control Valves. 5. Open Letdown Isolation Valves: 1-CVC-515-CV 1-CVC-516-CV -CAUTION- **The setpoint of 1-PIC-201 must be above the saturation pressure for the letdown outlet temperature of the Regenerative Heat Exchanger.** 6. Adjust the setpoint on 1-PIC-201 and adjust 1-HIC-110 to maintain desired pressurizer level.	
Y. IF RCPs AVAILABLE, THEN EVALUATE NEED FOR FORCED OR NATURAL CIRCULATION:	
1. WHEN RCPs available AND Forced Circulation desired, THEN start RCPs per steps 2-12. 2. IF RCPs exposed to excessive moisture, THEN consider meggering RCP motor.	1.1 IF RCPs NOT available OR Natural Circulation desired, THEN implement Natural Circulation (AOP-3E) AND complete administrative post-trip actions.

III. RECOVERY ACTIONS

ALTERNATE ACTIONS

- CAUTION -

Uncontrolled restoration of cooling to hot RCP seals may cause degradation of the metallic seating surfaces by thermal shock.

3. IF Component Cooling is isolated to RCP seals, THEN reduce RCP lower seal temperature below 280°F prior to initiating full cooling flow to the RCPs:

    a. Shut Component Cooling Supply Containment Manual Isolation Valve, 1-CC-284, located in 5 ft East Penetration Room.

    b. Verify CIS reset.

    c. Open Component Cooling Containment Isolation Valves:

        1-CC-3832-CV
        1-CC-3833-CV

    d. Slowly open 1-CC-284 to throttle component cooling flow until lower seal temperatures are less than 280°F.

    e. WHEN lower seal temperatures are less than 280°F, THEN fully open 1-CC-284.

4. IF an RCP lower seal temperature exceeded 280°F, THEN an engineering evaluation is required prior to restarting that RCP.

5. Raise pressurizer level to at least 155 inches.

III. RECOVERY ACTIONS

ALTERNATE ACTIONS

6. Verify RCP restart criteria:

   a. RCS subcooling greater than 30°F.

   b. At least one S/G available for heat removal.

   c. Pressurizer level greater than 155 inches and stable.

   d. Tcold less than 525°F.

   e. RCS temperature and pressure greater than the minimum operating limits per the RCP curve on Attachment (1).

- **NOTE** -

Starting an RCP may cause a pressurizer level transient.

7. **WHEN** RCP restart criteria met, **THEN** start one RCP in a loop with an operable S/G:

   a. Verify "COMPT CLG FLOW LO" alarm clear.

   b. Start Oil Lift Pump.

   c. Insert RCP sync stick.

   d. Start one RCP.

   e. Monitor RCP running current:

Tavg	Current
525 to 572°F	238 to 210 AMPS and steady
210 to 525°F	264 to 238 AMPS and steady

VII. RECOVERY ACTIONS	ALTERNATE ACTIONS
8. IF pressurizer level decreases, THEN start Charging or HPSI Pump(s) as necessary to restore AND maintain level greater than 155 inches.	
9. Monitor RCP seal parameters following pump restart.	
10. Allow backflow to equalize temperatures in opposite loop.	
11. Start second RCP in opposite loop per step Y.7 and Y.9, pages 23 and 24.	
12. Secure Auxiliary Spray: a. Open Loop Charging Valves: 1-CVC-518-CV 1-CVC-519-CV b. Shut Auxiliary Spray Valve, 1-CVC-517-CV. c. Shift Pressurizer Spray Controller, 1-HIC-100, to AUTO.	
Z. COMPLETE ADMINISTRATIVE POST-TRIP ACTIONS AND IMPLEMENT APPROPRIATE OPERATING PROCEDURE.	

AA. ADMINISTRATIVE POST-TRIP ACTIONS:

- **NOTE** -

The following actions may be accomplished whenever feasible. They may be done in any order.

_______ 1. Refer to ERPIP to determine appropriate emergency response actions.

_______ 2. Perform notifications per CCI-118.

_______ 3. Notify ESO of trip.

_______ 4. Request RCS Boron and Iodine sample.

_______ 5. Perform shutdown margin calculation per NEOG 2 and 7.

_______ 6. Complete transient log entries per CCI-301.

_______ 7. Recall post-trip review (preferably within 30 minutes of trip).

_______ 8. Perform post-trip review per CCI-111.

_______ 9. Monitor turbine bearing temperatures.

_______ 10. Continue Main Turbine shutdown per applicable step of OI-43A.

END OF SECTION III.

IV. SAFETY FUNCTION STATUS CHECK

A. The STA (or person designated by STA) will perform the intermediate and final safety functions checks respectively on entry and prior to exiting from this procedure.

B. Perform intermediate safety function status check at 10 minute intervals until plant conditions stabilize.

C. Immediately notify Shift Supervisor or Control Room Supervisor if any safety function criteria is not being satisfied.

D. Review data and verify that safety function acceptance criteria are satisfied.

E. When EOP completed, then perform final safety function check.

REACTIVITY CONTROL PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. WRNI power	less than 8%	----------	less than 2%	________
b. SUR (DPM)	negative	----------	0	________
c. CEA status	all inserted	----------	all inserted	________
or				
Boration status:				
concentation	increasing	----------	appropriate S/D margin	________
BAST level	decreasing	----------	N/A	N/A

RCS PRESSURE AND INVENTORY PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Pressurizer pressure (PSIA)	300 to 1900	----------	300 to 1900	________
b. Pressurizer level (inches)	0 to 350	----------	101 to 160	________
c. RCS subcooling ($^{\circ}$F)	30 to 140	----------	30 to 140	________
If PORVs were opened, once an hour monitor the following:				
d. Quench Tank parameters: level (inches) temperature ($^{\circ}$F) pressure (PSIG)	constant or decreasing	----------	constant or decreasing	________
e. PORV discharge piping temperature ($^{\circ}$F) (computer points T107, T108)	decreasing	----------	decreasing	________

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CORE AND RCS HEAT REMOVAL PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. RCS Tcold ($^{\circ}$F)	less than 515	--------	less than 500	________
b. CET ($^{\circ}$F)	less than 565	--------	less than 550	________
c. Thot minus Tcold ($^{\circ}$F)				
Natural Circulation	10 to 50	--------	10 to 50	________
Forced Circulation	less than 10	--------	less than 5	________
d. Unaffected S/G pressure (PSIA)	150 to 900	--------	greater than 50	________
e. Unaffected S/G level (inches)	(-)250 to (+)30	--------	(-)24 to (+)30	________
f. Condensate Storage Tank level (ft)	greater than 5	--------	greater than 5	________

VITAL AUXILIARIES	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. 4KV vital buses 11 or 14	energized	----------	energized	________
b. Instrument Air pressure (PSIG)	greater than 88	----------	greater than 88	________
c. Component Cooling (# pumps running)	1 or 2	----------	1 or 2	________
d. Saltwater (# pumps running)	1 or 2	----------	1 or 2	________
e. Service Water (# pumps running)	1 or 2	----------	1 or 2	________
f. 125V DC buses 11, 12, 21, 22	energized	----------	energized	________
g. 120V AC vital buses 11, 12, 13, 14	energized	----------	energized	________

NORMAL CONTAINMENT ENVIRONMENT PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Containment pressure (PSIG)	less than 50	--------	less than 2.8	_______
b. Containment temperature (°F)	less than 276	--------	less than 220	_______
c. Containment High Range Radiation Monitor	alarm clear	--------	alarm clear	_______
d. Hydrogen concentration	N/A	N/A --------	less than 2%	_______

NORMAL RADIATION LEVELS EXTERNAL TO CONTAINMENT	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Noble Gas Monitor	alarm clear	----------	alarm clear	________
b. Condenser Off-Gas (1) RMS	alarm clear	----------	alarm clear	________
c. S/G B/D RMS (1)	alarm clear	----------	alarm clear	________
d. Main Vent Gaseous RMS (1-RI-5415)	alarm clear	----------	alarm clear	________

1) With MSIVs shut and S/G Blowdown isolated, request Chemistry to sample S/Gs for activity.

STATUS CHECK NUMBER	COMPLETE AT TIME
1	________
2	________
3	________
4	________
________	________
________	________
________	________

CALVERT CLIFFS NUCLEAR POWER PLANT

EOP-4 EXCESS STEAM DEMAND

REVISION 1

	SIGNATURE	DATE
PREPARED BY;	[signature]	12-18-87
VERIFIED BY;	James V. Grooms	12/18/87
POSRC;	MEETING # 88-7	2-10-88
APPROVED BY;	J R Lemons	2-10-88

Manager-Nuclear Operations or General Supervisor-Operations if POSRC review is not required

LIST OF EFFECTIVE PAGES

PAGE NUMBER	REVISION
1	1
2	1
3	1
4	1
5	1
6	1
7	1
8	1
9	1
10	1
11	1
12	1
13	1
14	1
15	1
16	1
17	1
18	1
19	1
20	1
21	1
22	1
23	1
24	1
25	1
26	1
27	1
28	1
29	1
30	1
31	1

EXCESS STEAM DEMAND

I. PRECAUTIONS

A. Do not adopt manual operation of automatically controlled systems unless a malfunction is apparent or automatic system operation will not support the maintenance of a safety function.

B. Systems shifted to manual operation must be monitored frequently to ensure correct operation.

C. At least two independent indications should be used, when available, to evaluate and corroborate a specific plant condition since an incident could induce inconsistencies between instruments.

D. High energy line break may cause erratic instrumentation response depending on the magnitude and location of the break.

E. Minimize the number of cycles of pressurizer auxiliary spray when the temperature differential is greater than 400°F.

F. In Natural Circulation, increased loop transport time causes a 5 to 10 minute delay in temperature responses to a plant change. Pressurizer level and pressure responses, if available, typically provide better indication of RCS response during this period.

G. S/G pressure, pressurizer pressure, and containment temperature affect the level indication for the S/Gs and Pressurizer. Attachments (8) and (9) contain the corrected S/G and pressurizer levels for various S/G pressures, pressurizer pressures, and containment temperatures.

H. If a pump or component fails, the cause of the failure should be determined prior to restarting or starting a standby pump or component to prevent a common failure.

II. ENTRY CONDITIONS

The presence of one or more of the following conditions indicates that an Excess Steam Demand may have occurred:

A. Decrease in S/G pressure in one or both S/Gs.

B. Reactor Trip on low S/G pressure.

C. Reactor Trip on high containment pressure.

D. Possible actuation of:

1. SIAS
2. CIS
3. CSAS
4. SGIS

E. Decrease in Tcold.

F. Loud noise and poor visibility in plant (location dependent).

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
A. VERIFY POST-TRIP IMMEDIATE ACTIONS COMPLETED.	
B. COMMENCE INTERMEDIATE SAFETY FUNCTION STATUS CHECK.	
C. DETERMINE APPROPRIATE EMERGENCY RESPONSE ACTIONS PER THE ERPIP.	
D. ISOLATE BOTH S/Gs:	
1. Shut both MSIVs. 2. Shut S/G Feedwater Isolation Valves: 2-FW-4516-MOV 2-FW-4517-MOV 3. Shut MSIV Bypass Valves: 2-MS-4045-MOV 2-MS-4052-MOV 4. Shut S/G Blowdown Valves: 2-BD-4010-CV 2-BD-4011-CV 2-BD-4012-CV 2-BD-4013-CV	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
5. Shut AFW Steam Supply Valves by placing handswitches in CLOSE: 2-MS-4070-CV 2-MS-4071-CV 6. Shut AFW Block Valves by placing handswitches in CLOSE: 21 S/G: 2-AFW-4520-CV, 2-AFW-4521-CV, 2-AFW-4522-CV, 2-AFW-4523-CV 22 S/G: 2-AFW-4530-CV, 2-AFW-4531-CV, 2-AFW-4532-CV, 2-AFW-4533-CV 7. Shut Atmospheric Dump Valves. 8. Shut upstream drains by placing handswitch 2-HS-6622 in CLOSE.	
E. MONITOR RCS DEPRESSURIZATION.	
1. **IF** rapid depressurization to 1725 PSIA, **THEN** verify SIAS actuation **AND** the following actions: a. All available Charging Pumps running. b. 21 and 23 HPSI Pumps running. c. Main and Aux HPSI Header Valves open: 2-SI-616-MOV 2-SI-617-MOV 2-SI-626-MOV 2-SI-627-MOV 2-SI-636-MOV 2-SI-637-MOV 2-SI-646-MOV 2-SI-647-MOV	1.1. **IF** RCS pressure is greater than 1725 PSIA **AND** SIAS **NOT** actuated, **THEN** block SIAS: a. Open Main and Aux HPSI Header valves: 2-SI-616-MOV 2-SI-617-MOV 2-SI-626-MOV 2-SI-627-MOV 2-SI-636-MOV 2-SI-637-MOV 2-SI-646-MOV 2-SI-647-MOV b. Start 21 and 23 HPSI Pumps. c. **WHEN** "PRSR PRESS BLOCK A(B) PERMITTED" alarms(s) received, **THEN** block SIAS A(B).

VII. RECOVERY ACTIONS	ALTERNATE ACTIONS
F. IMPLEMENT RCP TRIP STRATEGY:	
1. IF RCS pressure decreases to 1725 PSIA, THEN trip 21A and 22B RCPs OR trip 21B and 22A RCPs. 2. IF positive LOCA indications exist: a. RCS subcooling less than 30°F. b. Steady S/G pressure. c. S/G Blowdown RMS alarms clear OR Main Vent Gaseous RMS (2-RI-5415) alarm clear. AND RCS pressure decreases to less than 1300 PSIA, THEN trip all RCPs. 3. IF RCS temperature and pressure are less than the minimum pump operating limits per the RCP curve on Attachment (1), THEN trip all RCPs. 4. IF CIS has actuated, THEN trip all RCPs.	
G. MONITOR CONTAINMENT PRESSURE:	
1. IF CSAS NOT actuated, THEN start all available Containment Air Coolers in HIGH with maximum SRW flow.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
2. **IF** containment pressure increases to 2.8 PSIG, **THEN** verify ESFAS actuation: a. SIAS. b. CIS **AND** trip all RCPs. 3. Verify SRW Pump Room Ventilation in service per OI-15. 4. **IF** containment pressure increases to 4.25 PSIG, **THEN** verify CSAS actuation **AND** spray flow approximately 1350 GPM.	
H. VERIFY BORATION IN PROGRESS:	
1. **IF** SIAS has actuated, **THEN** verify boration in progress: a. Shut VCT Makeup Valve, 2-CVC-512-CV. b. Open Boric Acid Direct Makeup Valve, 2-CVC-514-MOV. c. Boric Acid Pumps running. d. Open BAST Gravity Feed Valves: 2-CVC-508-MOV 2-CVC-509-MOV	1.1 **IF** SIAS **NOT** actuated, **THEN** commence boration: a. Shut VCT Makeup Valve, 2-CVC-512-CV. b. Open Boric Acid Direct Makeup Valve, 2-CVC-514-MOV. c. Start a Boric Acid Pump. d. Start all available Charging Pumps.

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III. RECOVERY ACTIONS	ALTERNATE ACTIONS
e. Shut VCT Outlet Valve, 2-CVC-501-MOV. f. All available Charging Pumps running. 2. Continue boration until a total 65 inch decrease in BAST level(s) is achieved, or shutdown margin requirement of NFOG-11 is achieved.	1.2 **IF** Boric Acid Pumps **NOT** available, **THEN** establish gravity feed: a. Open BAST Gravity Feed Valves: 2-CVC-508-MOV 2-CVC-509-MOV b. Shut VCT Outlet Valve, 2-CVC-501-MOV. c. Start all available Charging Pumps.
I. IDENTIFY AFFECTED S/G.	
1. Compare the following parameters: a. S/G pressures. b. Tcold on both loops. c. S/G levels.	

III. RECOVERY ACTIONS

J. MAINTAIN HEAT SINK OPERABILITY OF UNAFFECTED S/G DURING BLOWDOWN PHASE:

1. For the affected S/G, shut the Atmospheric Dump Valve using the Hand Transfer Valves on the West wall of the Unit 2 45 ft Switchgear Room:

   a. Verify 2C43 Atmospheric Dump Controllers at 0% output.

   b. Align Hand Transfer Valves to 2C43 position:

21 S/G	or	22 S/G
1-HV-3939A		1-HV-3938A
1-HV-3939B		1-HV-3938B

- **NOTE** -

Unaffected S/G temperature may be obtained by using the saturation temperature for the existing S/G pressure.

2. **IF** RCS cooldown rate greater than or equal to 100°F/h **AND** CET temperatures less than unaffected S/G temperature, **THEN** cool unaffected S/G to within 25°F of CET temperatures:

   a. Open motor driven train AFW Block Valves on unaffected S/G:

21 S/G	or	22 S/G
2-AFW-4522-CV		2-AFW-4532-CV
2-AFW-4523-CV		2-AFW-4533-CV

ALTERNATE ACTIONS

1.1 **IF** Atmospheric Dump Valve will **NOT** shut from 2C43, **THEN** shut Atmospheric Dump Manual Isolation Valve.

21 S/G	or	22 S/G
2-MS-101		2-MS-104

- **NOTE** -

For steam breaks in Containment, resulting in small cooldown rates, the energy released to Containment may be reduced by use of S/G Blowdown on affected S/G.

2.1 **IF** RCS cooldown rate less than 100°F/h, **THEN** establish Natural Circulation using unaffected S/G:

   a. Open motor driven train AFW Block Valves on unaffected S/G:

21 S/G	or	22 S/G
2-AFW-4522-CV		2-AFW-4532-CV
2-AFW-4523-CV		2-AFW-4533-CV

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
- CAUTION - **D/G supplying power to 23 AFW Pump flow limit is 300 GPM; otherwise, flow limit is 575 GPM.** b Start 23 AFW Pump. c. Adjust AFW Flow Control Valves to feed unaffected S/G. 21 S/G or 22 S/G 2-AFW-4525-CV 2-AFW-4535-CV **- CAUTION -** **CET temperatures must always be less than unaffected S/G temperature while affected S/G blowdown is in progress.** d. Open Atmospheric Dump Valve as necessary to cool unaffected S/G to within 25°F of CET temperatures. e. Stabilize unaffected S/G level between (-)170 and (+)30 inches.	**- CAUTION -** **D/G supplying power to 23 AFW Pump flow limit is 300 GPM; otherwise flow limit is 575 GPM.** b. Start 23 AFW Pump. c. Manually throttle open AFW Flow Control Valve. 21 S/G or 22 S/G 2-AFW-4525-CV 2-AFW-4535-CV d. Open Atmospheric Dump Valve as necessary to cool unaffected S/G, while maintaining RCS cooldown rate less than 100°F/h. e. Stabilize unaffected S/G level between (-)170 and (+)30 inches.
K. RESTORE PRESSURIZER LEVEL TO BETWEEN 50 AND 110 INCHES DURING S/G BLOWDOWN:	
1. Verify letdown isolated. 2. IF RCS pressure less than 1270 PSIA, THEN verify HPSI flow to RCS per Attachment (12).	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
3. **IF** additional HPSI flow required to control pressurizer level, **THEN** lower RCS pressure using Auxiliary Spray per step M, page 13. 4. **WHEN** pressurizer level greater than 50 inches, **THEN** secure all but one Charging Pump. 5. **IF** the following conditions exist: a. At least 30°F subcooling. b. Pressurizer level greater than 50 inches. c. At least one S/G available for heat removal. d. RVLMS indicates that the Core is covered. **THEN** throttle HPSI flow to maintain pressurizer level between 50 and 110 inches.	
L. **WHEN** STEADY Tcold INDICATES S/G BLOWDOWN COMPLETE **OR** COOLDOWN RATE LESS THAN 100°F/h, **THEN** ESTABLISH UNAFFECTED S/G AS A HEAT SINK:	
1. Restore S/G wide range level to between (-)24 and (+)30 inches using 23 AFW Pump. 2. Open Atmospheric Dump Valve as necassary to cool unaffected S/G, while maintaining RCS cooldown rate less than 100°F/h. 3. Stabilize pressurizer level between 101 and 155 inches.	

III. RECOVERY ACTIONS

M. MAINTAIN RCS SUBCOOLING BETWEEN 30 AND 140°F:

- **CAUTION** -

The potential exists for pressurized thermal shock from an excessive cooldown rate followed by a repressurization.

1. Operate Pressurizer Heaters as necessary to maintain RCS subcooling greater than 30°F.

2. **IF** necessary to lower RCS subcooling **AND** pressurizer level less than 350 inches, **THEN** verify heaters secured **AND** initiate Auxiliary Spray:

   a. Place Instrument Air CIS Override Switch, 2-HS-2080A, in OVERRIDE.

   b. Open Cntmt Instrument Air Isolation MOV, 2-IA-2080-MOV.

   c. Record temperature differential between Pressurizer and Regenerative Heat Exchanger Outlet.

   d. Open Auxiliary Spray Valve, 2-CVC-517-CV.

ALTERNATE ACTIONS

2.1 **IF** pressurizer level greater than 350 inches **AND** RCS subcooling is greater than 140°F, **THEN** open PORV:

   a. Verify primary makeup path operable.

   b. Place both PORV Override Control Switches in OVERRIDE SHUT.

   - **NOTE** -

   The "PORV ENERGIZED" alarm will annunciate when two RPS trip units are pulled. The PORVs will not open.

   c. Pull two High Pressurizer Pressure Trip Units out on RPS.

   d. Place one PORV Override Control Switch in AUTO.

   e. **IF** second PORV needed to lower subcooling, **THEN** place the other PORV Override Control Switch in AUTO.

   f. **WHEN** subcooling less than 140°F, **THEN** perform the following:

III. RECOVERY ACTIONS

e. Shut Loop Charging Valves:

2-CVC-518-CV
2-CVC-519-CV

- **NOTE** -

2-HS-2085 located on West wall of 27 ft Switchgear Room; Key #80 in Control Room Key Locker.

f. Open Cntmt Instrument Air Supply CV, 2-IA-2085-CV, by momentarily placing 2-HS-2085 in OPEN.

g. Shift 2-HIC-100 to MANUAL and shut Pressurizer Spray Valves:

2-RC-100E-CV
2-RC-100F-CV

h. Maintain pressurizer cooldown rate less than 200°F/h

N. **IF** RCPs SECURED, **THEN** CONFIRM NATURAL CIRCULATION IN UNAFFECTED S/G LOOP:

- **NOTE** -

Wide range Thot may be obtained from Subcooled Margin Monitor per Attachment (10).

1. Thot minus Tcold between 10 and 50°F.
2. Tcold constant or decreasing.
3. Thot constant or decreasing.
4. CET temperatures consistent with Thot.
5. Steaming rate affects primary temperature.

ALTERNATE ACTIONS

(1) Place the PORV Override Control Switches in OVERRIDE SHUT.

(2) Insert High Pressurizer Pressure Trip Units that were previously pulled.

(3) Ensure "PORV ENERGIZED" alarm clear.

(4) **IF** Acoustic Monitor indicates flow through the PORV, **THEN** shut the PORV Block Valve.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
O. MONITOR FOR CORE AND RCS VOIDING:	
- **CAUTION** - **Potential for void formation increases rapidly when pressure decreases below 1500 PSIA.** 1. Letdown flow greater than charging flow. 2. Rapid unexplained increase in pressurizer level during an RCS pressure reduction. 3. Loss of subcooled margin as determined using CET temperatures. 4. "REACTOR VESSEL WATER LEVEL LOW" alarm.	
P. **IF** VOIDING INHIBITS HEAT REMOVAL, **THEN** REDUCE OR ELIMINATE VOIDED AREA:	
1. Shut Letdown Isolation Valve, 2-CVC-515-CV. - **CAUTION** - **The potential exists for pressurized thermal shock from an excessive cooldown rate followed by a repressurization.** 2. Pressurize the RCS to maintain subcooling as near 140°F as practical, by any of the following: - **NOTE** - Pressurizer Backup Heater Banks 21 and 23 trip on U/V and SIAS.	2.1 **IF** pressurizing the RCS does **NOT** restore heat removal, **THEN** operate Reactor Vessel Vent Valves per OI-1G.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
a. Operate Pressurizer Heater(s). b. Operate Turbine Bypass or Atmospheric Dump Valves to maximize RCS cooldown, while maintaining cooldown rate less than 100°F/h. c. Raise HPSI flow to RCS. - **CAUTION** - **If voids exist in the S/G tubes, a rapid RCS pressure reduction will occur when the voids collapse.** 3. IF voiding occurs in the S/G tubes (saturation pressure of S/G greater than saturation pressure of RCS), THEN cool the S/G by raising any of the following: a. Steaming rate. b. Feed rate. c. S/G Blowdown rate. AND maintaining less than 100°F/h cooldown rate.	
Q. SECURE THE FOLLOWING SECONDARY PUMPS:	
1. Trip S/G Feed Pumps. 2. Place Condensate Booster Pumps in PULL-TO-LOCK. 3. Place 2 of the 3 Condensate Pumps in PULL-TO-LOCK. 4. Secure Heater Drain Pumps.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
R. **WHEN** RCS BORATION COMPLETE, **THEN** SHIFT CHARGING PUMP SUCTION SUPPLY TO MAKEUP SUPPLY WITH A LOWER BORIC ACID CONCENTRATION.	
1. **IF** SIAS actuated, **THEN** perform the following: a. Open RWT To Charging Pump Suction Valve, 2-CVC-504-MOV. b. Shut VCT Outlet Valve, 2-CVC-501-MOV. c. Place Boric Acid Pumps in PULL-TO-LOCK. d. Ensure Charging Pump AMPS steady.	1.1 **IF** SIAS **NOT** actuated, **THEN** line up Charging Pump suction to VCT: a. Determine blend requirements to maintain shutdown boron concentration per NEOG-11. b. Open VCT Outlet Valve, 2-CVC-501-MOV. c. Secure Boric Acid Pump(s). d. Shut Boric Acid Direct Makeup Valve, 2-CVC-514-MOV. e. Shut BAST Gravity Feed Valves: 2-CVC-508-MOV 2-CVC-509-MOV **OR** line up Charging Pump suction to RWT: a. Open RWT To Charging Pump Suction Valve, 2-CVC-504-MOV. b. Shut VCT Outlet Valve, 2-CVC-501-MOV. c. Shut Boric Acid Direct Makeup Valve, 2-CVC-514-MOV. d. Secure Boric Acid Pumps(s).

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
S. COMMENCE ESFAS VERIFICATION CHECKLISTS:	
1. SIAS Attachment (2). 2. CSAS Attachment (3). 3. CIS Attachment (4). 4. SGIS Attachment (7).	
T. RESTORE CONTAINMENT ENVIRONMENT:	
1. Direct Chemistry to place Hydrogen Monitors in service. 2. **IF** hydrogen concentration increases to 1%, **THEN** start Hydrogen Recombiners per OI-41A. 3. **WHEN** containment pressure less than 4.0 PSIG, **THEN** perform the following: a. Reset CSAS signal. b. Secure one Containment Spray Pump. c. Verify all Containment Air Coolers operating to maintain containment temperature less than 120°F. d. Restore equipment per CSAS Verification Checklist, Attachment (3), to desired condition.	

III. RECOVERY ACTIONS

ALTERNATE ACTIONS

4. **WHEN** containment pressure less than 2.8 PSIG, **THEN** perform the following:

   a. Block pressurizer pressure signals and reset SIAS signal.

   b. Reset CIS signal.

   c. Secure remaining Containment Spray Pump.

   d. Restore equipment per SIAS and CIS Verification Checklists, Attachments (2) and (4), to desired condition.

U. RESTORE SERVICE WATER TO TURBINE BUILDING:

1. Verify 11 Plant Air Compressor operating.

2. Shut Plant Air To Plant Air Header Valve, 2-PA-2059-CV.

3. Open Plant Air To Instrument Air Cross Connect Valve, 2-PA-2061-CV.

4. Open SRW Turbine Building Header Isolation Valves:

   2-SRW-1600-CV
   2-SRW-1637-CV
   2-SRW-1638-CV
   2-SRW-1639-CV

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
V. RESTORE INSTRUMENT AIR COMPRESSORS TO SERVICE:	
1. **IF** high temperature alarm exists on the Instrument Air Compressors, **THEN** open the service water isolation valves by placing their handswitches in OPEN until temperature alarm clears. 21 or 22 2-HS-2063 2-HS-2065 2. Start at least one Instrument Air Compressor.	
[illegible]. RESTORE INSTRUMENT AIR TO CONTAINMENT:	
1. Open Cntmt Instrument Air Isolation MOV, 2-IA-2080-MOV. - **NOTE** - 2-HS-2085 located on West wall of 27 ft Switchgear Room; Key #80 in Control Room Key Locker. 2. Open Cntmt Instrument Air Supply CV, 2-IA-2085-CV, by momentarily placing 2-HS-2085 in OPEN.	
X. RESTORE LETDOWN FLOW:	
1. Verify charging flowpath through Loop Charging Valves or Auxiliary Spray Valve.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
2. Verify at least one Charging Pump operating. 3. Shift Letdown Control Valve Controller, 2-HIC-110, to MANUAL. 4. Adjust controller to shut Letdown Control Valves. 5. Open Letdown Isolation Valves: 2-CVC-515-CV 2-CVC-516-CV -CAUTION- **The setpoint of 2-PIC-201 must be above the saturation pressure for the letdown outlet temperature of the Regenerative Heat Exchanger.** 6. Adjust the setpoint on 2-PIC-201 and adjust 2-HIC-110 to maintain desired pressurizer level.	
Y. **IF** RCPs AVAILABLE, **THEN** EVALUATE NEED FOR FORCED OR NATURAL CIRCULATION:	
1. **WHEN** RCPs available **AND** Forced Circulation desired, **THEN** start RCPs per steps 2-12. 2. **IF** RCPs exposed to excessive moisture, **THEN** consider meggering RCP motor.	1.1 **IF** RCPs **NOT** available **OR** Natural Circulation desired, **THEN** implement Natural Circulation (AOP-3E) **AND** complete administrative post-trip actions.

VII. RECOVERY ACTIONS

- CAUTION -

Uncontrolled restoration of cooling to hot RCP seals may cause degradation of the metallic seating surfaces by thermal shock.

3. IF Component Cooling is isolated to RCP seals, THEN reduce RCP lower seal temperature below 280°F prior to initiating full cooling flow to the RCPs:

   a. Shut Component Cooling Supply Containment Manual Isolation Valve, 2-CC-284, located in 5 ft East Penetration Room.

   b. Verify CIS reset.

   c. Open Component Cooling Containment Isolation Valves:

      2-CC-3832-CV
      2-CC-3833-CV

   d. Slowly open 2-CC-284 to throttle component cooling flow until lower seal temperatures are less than 280°F.

   e. WHEN lower seal temperatures are less than 280°F, THEN fully open 2-CC-284.

4. IF an RCP lower seal temperature exceeded 280°F, THEN an engineering evaluation is required prior to restarting that RCP.

5. Raise pressurizer level to at least 155 inches.

ALTERNATE ACTIONS

III. RECOVERY ACTIONS

ALTERNATE ACTIONS

6. Verify RCP restart criteria:

   a. RCS subcooling greater than 30°F.

   b. At least one S/G available for heat removal.

   c. Pressurizer level greater than 155 inches and stable.

   d. Tcold less than 525°F.

   e. RCS temperature and pressure greater than the minimum operating limits per the RCP curve on Attachment (1).

- **NOTE** -

Starting an RCP may cause a pressurizer level transient.

7. **WHEN** RCP restart criteria met, **THEN** start one RCP in a loop with an operable S/G:

   a. Verify "COMPT CLG FLOW LO" alarm clear.

   b. Start Oil Lift Pump.

   c. Insert RCP sync stick.

   d. Start one RCP.

   e. Monitor RCP running current:

Tavg	Current
525 to 572°F	238 to 210 AMPS and steady
210 to 525°F	264 to 238 AMPS and steady

III. RECOVERY ACTIONS

8. **IF** pressurizer level decreases, **THEN** start Charging or HPSI Pump(s) as necessary to restore **AND** maintain level greater than 155 inches.

9. Monitor RCP seal parameters following pump restart.

10. Allow backflow to equalize temperatures in opposite loop.

11. Start second RCP in opposite loop per step Y.7 and Y.9, pages 23 and 24.

12. Secure Auxiliary Spray:

    a. Open Loop Charging Valves:

       2-CVC-518-CV
       2-CVC-519-CV

    b. Shut Auxiliary Spray Valve, 2-CVC-517-CV.

    c. Shift Pressurizer Spray Controller, 2-HIC-100, to AUTO.

Z. COMPLETE ADMINISTRATIVE POST-TRIP ACTIONS AND IMPLEMENT APPROPRIATE OPERATING PROCEDURE.

ALTERNATE ACTIONS

AA. ADMINISTRATIVE POST-TRIP ACTIONS:

- **NOTE** -

The following actions may be accomplished whenever feasible. They may be done in any order.

_______ 1. Refer to ERPIP to determine appropriate emergency response actions.

_______ 2. Perform notifications per CCI-118.

_______ 3. Notify ESO of trip.

_______ 4. Request RCS Boron and Iodine sample.

_______ 5. Perform shutdown margin calculation per NEOG 9 and 11.

_______ 6. Complete transient log entries per CCI-301.

_______ 7. Recall post-trip review (preferably within 30 minutes of trip).

_______ 8. Perform post-trip review per CCI-111.

_______ 9. Monitor turbine bearing temperatures.

_______ 10. Continue Main Turbine shutdown per applicable step of OI-43A.

END OF SECTION III.

IV. SAFETY FUNCTION STATUS CHECK

A. The STA (or person designated by STA) will perform the intermediate and final safety functions checks respectively on entry and prior to exiting from this procedure.

B. Perform intermediate safety function status check at 10 minute intervals until plant conditions stabilize.

C. Immediately notify Shift Supervisor or Control Room Supervisor if any safety function criteria is not being satisfied.

D. Review data and verify that safety function acceptance criteria are satisfied.

E. When EOP completed, then perform final safety function check.

REACTIVITY CONTROL PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. WRNI power	less than 8%	----------	less than 2%	______
b. SUR (DPM)	negative	----------	0	______
c. CEA status	all inserted	----------	all inserted	______
or				
Boration status:				
concentation	increasing	----------	appropriate S/D margin	______
BAST level	decreasing	----------	N/A	N/A

RCS PRESSURE AND INVENTORY PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Pressurizer pressure (PSIA)	300 to 1900	----------	300 to 1900	________
b. Pressurizer level (inches)	0 to 350	----------	101 to 160	________
c. RCS subcooling (^{o}F)	30 to 140	----------	30 to 140	________
If PORVs were opened, once an hour monitor the following:				
d. Quench Tank parameters: level (inches) temperature (^{o}F) pressure (PSIG)	constant or decreasing	----------	constant or decreasing	________
e. PORV discharge piping temperature (^{o}F) (computer points T107, T108)	decreasing	----------	decreasing	________

CORE AND RCS HEAT REMOVAL PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. RCS Tcold (°F)	less than 515	--------	less than 500	________
b. CET (°F)	less than 565	--------	less than 550	________
c. Thot minus Tcold (°F)				
Natural Circulation	10 to 50	--------	10 to 50	________
Forced Circulation	less than 10	--------	less than 5	________
d. Unaffected S/G pressure (PSIA)	150 to 900	--------	greater than 50	________
e. Unaffected S/G level (inches)	(-)250 to (+)30	--------	(-)24 to (+)30	________
f. Condensate Storage Tank level (ft)	greater than 5	--------	greater than 5	________

VITAL AUXILIARIES	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. 4KV vital buses 21 or 24	energized	----------	energized	________
b. Instrument Air pressure (PSIG)	greater than 88	----------	greater than 88	________
c. Component Cooling (# pumps running)	1 or 2	----------	1 or 2	________
d. Saltwater (# pumps running)	1 or 2	----------	1 or 2	________
e. Service Water (# pumps running)	1 or 2	----------	1 or 2	________
f. 125V DC buses 11, 12, 21, 22	energized	----------	energized	________
g. 120V AC vital buses 21, 22, 23, 24	energized	----------	energized	________

NORMAL CONTAINMENT ENVIRONMENT PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Containment pressure (PSIG)	less than 50	--------	less than 2.8	______
b. Containment temperature ($^{\circ}F$)	less than 276	--------	less than 220	______
c. Containment High Range Radiation Monitor	alarm clear	--------	alarm clear	______
d. Hydrogen concentration	N/A	N/A --------	less than 2%	______

NORMAL RADIATION LEVELS EXTERNAL TO CONTAINMENT		SAFETY FUNCTION ACCEPTANCE CRITERIA			
		CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Noble Gas Monitor		alarm clear	----------	alarm clear	______
b. Condenser Off-Gas RMS	(1)	alarm clear	----------	alarm clear	______
c. S/G B/D RMS	(1)	alarm clear	----------	alarm clear	______
d. Main Vent Gaseous RMS (2-RI-5415)		alarm clear	----------	alarm clear	______

(1) With MSIVs shut and S/G Blowdown isolated, request Chemistry to sample S/Gs for activity.

STATUS CHECK NUMBER	COMPLETE AT TIME
1	______
2	______
3	______
4	______
______	______
______	______
______	______

CALVERT CLIFFS NUCLEAR POWER PLANT

EOP-5 LOSS O COOLANT ACCIDENT

REVISION 1

	SIGNATURE	DATE
PREPARED BY;	James V. Grooms	12/18/87
VERIFIED BY;	[illegible]	12-18-87
POSRC;	MEETING # 88-7	2-10-88
APPROVED BY;	J R Lemons Manager-Nuclear Operations or General Supervisor-Operations if POSRC review is not required	2-10-88

LIST OF EFFECTIVE PAGES

PAGE NUMBER	REVISION
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4	1
5	1
6	1
7	1
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13	1
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37	1
38	1
39	1
40	1
41	1

LOSS OF COOLANT ACCIDENT

I. PRECAUTIONS

A. Do not adopt manual operation of automatically controlled systems unless a malfunction is apparent or automatic system operation will not support the maintenance of a safety function.

B. Systems shifted to manual operation must be monitored frequently to ensure correct operation.

C. At least two independent indications should be used, when available, to evaluate and corroborate a specific plant condition since an incident could induce inconsistencies between instruments.

D. High energy line break may cause erratic instrumentation response depending on the magnitude and location of the break.

E. ESFAS actuated safety features should only be overridden to support a threatened safety function or when directed by the procedure.

F. During a LOCA, pressurizer level may not provide an accurate indication of RCS inventory due to the formation of voids. Pressurizer level when combined with RCS subcooling will indicate that the core is covered.

G. For small breaks in the RCS where the S/Gs are important for heat removal, one S/G must be used for this purpose even if primary to secondary leaks are detected.

H. Minimize the number of cycles of pressurizer auxiliary spray when the temperature differential is greater than 400°F.

I. In Natural Circulation, increased loop transport time causes a 5 to 10 minute delay in temperature responses to a plant change. Pressurizer level and pressure responses, if available, typically provide better indication of RCS response during this period.

J. S/G pressure, pressurizer pressure, and containment temperature affect the level indication for the S/Gs and Pressurizer. Attachments (8) and (9) contain the corrected S/G and pressurizer levels for various S/G pressures, pressurizer pressures, and containment temperatures.

K. If a pump or component fails, the cause of the failure should be determined prior to restarting or starting a standby pump or component to prevent a common failure.

II. ENTRY CONDITIONS

The presence of one or more of the following conditions indicates that a Loss Of Coolant Accident may have occurred:

A. Unexplained decreasing pressurizer level.

B. Unexplained decreasing pressurizer pressure.

C. Loss of RCS subcooled margin.

D. High containment radiation alarm.

E. Increase in containment sump level.

F. Increase in containment sump alarm frequency.

VI. RECOVERY ACTIONS	ALTERNATE ACTIONS
A. VERIFY POST-TRIP IMMEDIATE ACTIONS COMPLETED.	
B. COMMENCE INTERMEDIATE SAFETY FUNCTION STATUS CHECK.	
C. DETERMINE APPROPRIATE EMERGENCY RESPONSE ACTIONS PER THE ERPIP.	
D. MONITOR RCS DEPRESSURIZATION.	
1. **IF** rapid depressurization to 1725 PSIA, **THEN** verify SIAS actuation **AND** the following actions: a. All available Charging Pumps running. b. 11 and 13 HPSI Pumps running. c. Main and Aux HPSI Header Valves open: 1-SI-616-MOV 1-SI-617-MOV 1-SI-626-MOV 1-SI-627-MOV 1-SI-636-MOV 1-SI-637-MOV 1-SI-646-MOV 1-SI-647-MOV	1.1 **IF** RCS pressure is greater than 1725 PSIA **AND** SIAS **NOT** actuated, **THEN** attempt leak isolation: a. Shut Letdown Isolation Valves: 1-CVC-515-CV 1-CVC-516-CV b. Shut RCS Sample Isolation Valve, 1-PS-5464-CV. c. Shut Reactor Vessel Vent Valves: 1-RC-103-SV 1-RC-104-SV d. Shut Pressurizer Vent Valves: 1-RC-105-SV 1-RC-106-SV

VI. RECOVERY ACTIONS	ALTERNATE ACTIONS
	e. IF PORV leakage is indicated by: (1) High Quench Tank parameters. (2) High PORV discharge piping temperature, computer points T107 and T108. (CCOM CR 88-1175) (3) Abnormal Acoustic Monitor indication. THEN shut PORV Block Valves: 1-RC-403-MOV 1-RC-405-MOV f. IF leak is isolated AND SIAS NOT actuated, THEN implement Reactor Trip (EOP-1) AND complete administrative post-trip actions step AC, page 35. 1.2 IF leak is NOT isolated AND RCS pressure still greater than 1725 PSIA, THEN block SIAS: a. Open Main and Aux HPSI Header Valves: 1-SI-616-MOV 1-SI-617-MOV 1-SI-626-MOV 1-SI-627-MOV 1-SI-636-MOV 1-SI-637-MOV 1-SI-646-MOV 1-SI-647-MOV b. Start 11 and 13 HPSI Pumps. c. WHEN "PRSR PRESS BLOCK A(B) PERMITTED" alarm(s) received, THEN block SIAS A(B).

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
E. IMPLEMENT RCP TRIP STRATEGY:	
1. **IF** RCS pressure decreases to 1725 PSIA, **THEN** trip 11A and 12B RCPs **OR** trip 11B and 12A RCPs. 2. **IF** positive LOCA indications exist: a. RCS subcooling less than 30°F. b. Steady S/G pressure. c. S/G Blowdown RMS alarms clear **OR** Main Vent Gaseous RMS (1-RI-5415) alarm clear. **AND** RCS pressure decreases to less than 1300 PSIA, **THEN** trip all RCPs. 3. **IF** RCS temperature and pressure are less than the minimum pump operating limits per the RCP curve on Attachment (1), **THEN** trip all RCPs. 4. **IF** CIS has actuated, **THEN** trip all RCPs.	

III. **RECOVERY ACTIONS**	**ALTERNATE ACTIONS**
F. VERIFY BORATION IN PROGRESS:	
1. **IF** SIAS has actuated, **THEN** verify boration in progress: a. Shut VCT Makeup Valve, 1-CVC-512-CV. b. Open Boric Acid Direct Makeup Valve, 1-CVC-514-MOV. c. Boric Acid Pumps running. d. Open BAST Gravity Feed Valves: 1-CVC-508-MOV 1-CVC-509-MOV e. Shut VCT Outlet Valve, 1-CVC-501-MOV. f. All available Charging Pumps running.	1.1 **IF** SIAS **NOT** actuated, **THEN** commence boration: a. Shut VCT Makeup Valve, 1-CVC-512-CV. b. Open Boric Acid Direct Makeup Valve, 1-CVC-514-MOV. c. Start a Boric Acid Pump. d. Start all available Charging Pumps. 1.2 **IF** Boric Acid Pumps **NOT** available, **THEN** establish gravity feed: a. Open BAST Gravity Feed Valves: 1-CVC-508-MOV 1-CVC-509-MOV b. Shut VCT Outlet Valve, 1-CVC-501-MOV. c. Start all available Charging Pumps.
2. Continue boration until a total 65 inch decrease in BAST level(s) is achieved, or shutdown margin requirements of NEOG-7 is achieved.	

VII. RECOVERY ACTIONS	ALTERNATE ACTIONS
G. **IF** RCS PRESSURE DECREASES TO LESS THAN 225 PSIA, **THEN** VERIFY SAFETY INJECTION SYSTEM OPERATION:	
1. Verify HPSI and LPSI flow to RCS per Attachments (12) and (13). 2. Verify SI Tanks discharging to RCS cold legs. 3. Monitor containment pressure per step K, page 13.	1.1 **IF** 11 or 13 HPSI Pump fails, **THEN** start 12 HPSI Pump **AND** align to appropriate header.
H. RESTORE NORMAL S/G WATER LEVEL:	
- **CAUTION** - **Severe water hammer may occur if Main Feed Ring is allowed to drain then subsequently refilled.** 1. **IF** Main Feed available, **THEN** establish a shutdown feed system lineup: a. One operating S/G Feed Pump. b. One operating Condensate Booster Pump. c. One operating Condensate Pump. d. Both Heater Drain Pumps secured.	1.1 **IF** Main Feed **NOT** available, **THEN** establish AFW as follows: - **CAUTION** - **D/G supplying power to 13 AFW Pump flow limit is 300 GPM; otherwise, flow limit is 575 GPM.** a. Start an AFW Pump. b. Adjust AFW Flow Control Valves to maintain S/G levels between (-)170 and (+)30 inches.

XII. RECOVERY ACTIONS	ALTERNATE ACTIONS
2. **WHEN** manual control of feed flow rate desired **OR** S/G levels between (-)24 and (+)30 inches, **THEN** perform the following: a. Depress Feed Regulating Bypass Valve Reset Buttons. b. Adjust Feed Regulating Bypass Valves to raise S/G levels to approximately 0 inches. 3. **WHEN** S/G levels are 0 inches, **THEN** shift Feed Regulating Bypass Controllers to AUTO.	
I. **IF** RCS PRESSURE GREATER THAN 225 PSIA, **THEN** ESTABLISH COOLDOWN IN AT LEAST ONE LOOP:	
1. **WHEN** "SGIS A(B) BLOCK PERMITTED" alarm(s) received, **THEN** block SGIS A(B). 2. Open Turbine Bypass or Atmospheric Dump Valves as necessary to maximize RCS cooldown, while maintaining cooldown rate less than 100°F/h.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
3. **IF** RCPs are secured, **THEN** verify Natural Circulation: - **NOTE** - Wide range Thot may be obtained from Subcooled Margin Monitor per Attachment (10). a. Thot minus Tcold between 10 and 50°F. b. Tcold constant or decreasing. c. Thot constant or decreasing. d. CET temperatures consistent with Thot. e. Steaming rate affects primary temperature. 4. Monitor for Core and RCS voiding: - **CAUTION** - Potential for void formation increases rapidly when pressure decreases below 1500 PSIA. a. Letdown flow greater than charging flow. b. Rapid unexplained increase in pressurizer level during an RCS pressure reduction. c. Loss of subcooled margin as determined using CET temperatures. d. "REACTOR VESSEL WATER LEVEL LOW" alarm.	

III. <u>RECOVERY ACTIONS</u>

5. <u>IF</u> voiding inhibits heat removal,
<u>THEN</u> reduce or eliminate voided area:

a. Shut Letdown Isolation Valve, 1-CVC-515-CV.

\- <u>CAUTION</u> -

The potential exists for pressurized thermal shock from an excessive cooldown rate followed by a repressurization.

b. Pressurize the RCS to maintain subcooling as near 140°F as practical.

\- <u>CAUTION</u> -

If voids exist in the S/G Tubes, a rapid RCS pressure reduction will occur when the voids collapse.

c. <u>IF</u> voiding occurs in the S/G tubes (saturation pressure of S/G greater than saturation pressure of RCS),
<u>THEN</u> cool the S/G by raising any of the following:

(1) Steaming rate.

(2) Feed rate.

(3) S/G Blowdown rate.

<u>AND</u> maintaining less than 100°F/h cooldown rate.

6. Continue cooldown to 300°F.

<u>ALTERNATE ACTIONS</u>

5.b.1 <u>IF</u> pressurizing the RCS does <u>NOT</u> restore heat removal <u>THEN</u> operate Reactor Vessel Vent Valves per OI-1G.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
J. **IF** RCS PRESSURE LESS THAN 1270 PSIA, **THEN** VERIFY HPSI FLOW TO RCS PER ATTACHMENT (12).	
	J.1 **IF** 11 or 13 HPSI Pump fails, **THEN** start 12 HPSI Pump **AND** align to appropriate header.
K. MONITOR CONTAINMENT PRESSURE:	
1. **IF** CSAS **NOT** actuated, **THEN** start all available Containment Air Coolers in HIGH with maximum SRW flow. 2. **IF** containment pressure increases to 2.0 PSIG **AND** still increasing, **THEN** start 11 and 12 Containment Spray Pumps and open both Cntmt Spray Header CVs. 11: 1-SI-4150-CV 12: 1-SI-4151-CV 3. **IF** contaiment pressure increases to 2.8 PSIG, **THEN** verify ESFAS actuation: a. SIAS. b. CIS **AND** trip all RCPs. 4. Verify SRW Pump Room Ventilation in service, per OI-15. 5. **IF** containment pressure increases to 4.25 PSIG, **THEN** verify CSAS actuation **AND** spray flow approximately 1350 GPM.	

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III. RECOVERY ACTIONS	ALTERNATE ACTIONS
L. COMMENCE ESFAS VERIFICATION CHECKLISTS:	
1. SIAS Attachment (2). 2. CSAS Attachment (3). 3. CIS Attachment (4).	
M. MAINTAIN RCS SUBCOOLING AND PRESSURIZER LEVEL:	
1. Maintain subcooling between 30 and 140°F using CET temperatures. - **CAUTION** - **The potential exists for pressurized thermal shock from an excessive cooldown rate followed by a repressurization.** 2. Raise subcooling by any of the following: - **NOTE** - Pressurizer Backup Heater Banks 11 and 13 trip on U/V and SIAS. a. Operate Pressurizer Heater(s). b. Operate Turbine Bypass or Atmospheric Dump Valves to maximize RCS cooldown, while maintaining cooldown rate less than 100°F/h. c. Raise HPSI flow to RCS.	2.b.1 <u>IF</u> unable to obtain desired cooldown rate with Turbine Bypass and Atmospheric Dump Valves, **<u>THEN</u>** use steam driven AFW Pump(s) to increase cooldown rate.

VII. RECOVERY ACTIONS	ALTERNATE ACTIONS
3. Lower subcooling by any of the following: a. De-energize Pressurizer Heater(s). b. Lower RCS cooldown rate. c. **IF** the following conditions can be maintained: (1) At least 30°F subcooling. (2) Pressurizer level greater than 155 inches. (3) At least one S/G available for heat removal. (4) RVLMS indicates that the Core is covered. **THEN** throttle HPSI flow or operate Charging Pumps as necessary to maintain subcooling between 30 and 140°F.	3.1 **IF** unable to lower subcooling, **THEN** initiate Auxiliary Spray: a. Place Instrument Air CIS Override Switch, 1-HS-2080A, in OVERRIDE. b. Open Cntmt Instrument Air Isolation MOV, 1-IA-2080-MOV. c. Record temperature differential between Pressurizer and Regenerative Heat Exchanger Outlet. d. Open Auxiliary Spray Valve, 1-CVC-517-CV. e. Shut Loop Charging Valves: 1-CVC-518-CV 1-CVC-519-CV - **NOTE** - 1-HS-2085 located on West wall of 27 ft Switchgear Room; Key #85 in Control Room Key Locker. f. Open Cntmt Instrument Air Supply CV, 1-IA-2085-CV, by momentarily placing 1-HS-2085 in OPEN. g. Shift 1-HIC-100 to MANUAL and shut Pressurizer Spray Valves: 1-RC-100E-CV 1-RC-100F-CV h. Maintain pressurizer cooldown rate less than 200°F/h.

III. RECOVERY ACTIONS

ALTERNATE ACTIONS

- **NOTE** -

A break on top of Pressurizer will result in an uncontrollable increase in pressurizer level until Pressurizer is solid.

4. Maintain pressurizer level between 101 and 160 inches.

- **CAUTION** -

Do not throttle HPSI flow unless 30°F subcooling can be maintained.

a. IF the following conditions can be maintained:

(1) At least 30°F subcooling.

(2) Pressurizer level greater than 101 inches.

(3) At least one S/G available for heat removal.

(4) RVLMS indicates that the Core is covered.

THEN throttle HPSI flow or operate Charging Pumps as necessary to maintain pressurizer level between 101 and 160 inches.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
N. **WHEN** RCS BORATION COMPLETE, **THEN** SHIFT CHARGING PUMP SUCTION SUPPLY TO MAKEUP SUPPLY WITH A LOWER BORIC ACID CONCENTRATION.	
1. **IF** SIAS actuated, **THEN** perform the following: a. Open RWT To Charging Pump Suction Valve, 1-CVC-504-MOV. b. Shut VCT Outlet Valve, 1-CVC-501-MOV. c. Place Boric Acid Pumps in PULL-TO-LOCK. d. Ensure Charging Pump AMPS steady. e. Ensure BAST levels steady.	1.1 **IF** SIAS **NOT** actuated, **THEN** lineup Charging Pump suction to VCT: a. Determine blend required to maintain shutdown boron concentration per NEOG-7. b. Open VCT Outlet Valve, 1-CVC-501-MOV. c. Secure Boric Acid Pump(s). d. Shut Boric Acid Direct Makeup Valve, 1-CVC-514-MOV. e. Shut BAST Gravity Feed Valves: 1-CVC-508-MOV 1-CVC-509-MOV **OR** lineup Charging Pump suction to RWT: a. Open RWT To Charging Pump Suction Valve, 1-CVC-504-MOV. b. Shut VCT Outlet Valve, 1-CVC-501-MOV. c. Shut Boric Acid Direct Makeup Valve, 1-CVC-514-MOV. d. Secure Boric Acid Pump(s).

VI. RECOVERY ACTIONS	ALTERNATE ACTIONS
O. IF RWT LEVEL DECREASES TO BETWEEN 0.5 AND 1.0 FT OR "ACTUATION SYS RAS TRIPPED" ALARM RECEIVED, THEN VERIFY RAS ACTUATION:	
1. Place SI Pump Recirc Lockout Switches in ON. 2. Commence RAS Verification Checklist, Attachment (6). 3. Shut RWT Outlet Valves: 1-SI-4142-MOV 1-SI-4143-MOV 4. IF HPSI flow greater than 1000 GPM with two HPSI Pumps operating, THEN equally throttle HPSI flow to 1000 GPM. 5. IF HPSI flow greater than 600 GPM with one HPSI Pump operating, THEN equally throttle HPSI flow to 600 GPM. - CAUTION - **To prevent pump damage, minimum flow per operating HPSI Pump is 30 GPM.** 6. IF HPSI Pump cavitation occurs in recirculation mode, THEN throttle HPSI flow per Attachment (12).	6.1 IF Attachment (12) does NOT allow throttling HPSI flow, THEN align Containment Spray Pump(s) to HPSI Pump suction: a. IF 11(12) HPSI Pump cavitating, THEN open 11 SDC HX To HPSI Suction Valve, 1-SI-663-MOV AND start 11 Containment Spray Pump.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
	b. **IF** 13 HPSI Pump cavitating, **THEN** open 12 SDC HX To HPSI Suction Valve, 1-SI-662-MOV **AND** start 12 Containment Spray Pump.
7. Commence ECCS Pump Room cooling: a. Open ECCS Pump Room Air Cooler Saltwater Valves: 1-SW-5170-CV 1-SW-5171-CV 1-SW-5173-CV b. Start 11 and 12 ECCS Pump Room Cooling Fans.	
8. Adjust saltwater flow to maintain SRW and component cooling temperatures.	
9. **IF** Charging Pumps are aligned with suction from RWT **AND** HPSI Pumps maintaining RCS inventory, **THEN** place Charging Pumps in PULL-TO-LOCK.	
P. RESTORE CONTAINMENT ENVIRONMENT:	
1. Direct Chemistry to place Hydrogen Monitors in service. 2. **IF** hydrogen concentration increases to 1%, **THEN** start Hydrogen Recombiners per OI-41A. 3. Maintain Iodine Filter Fans running.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
4. **WHEN** containment pressure less than 4.0 PSIG, **THEN** perform the following: a. Reset CSAS signal. b. Secure one Containment Spray Pump. c. Verify all Containment Air Coolers operating to maintain containment temperature less than 120°F. d. Restore equipment per CSAS Verification Checklist, Attachment (3), to desired condition. 5. **WHEN** containment pressure less than 2.8 PSIG, **THEN** perform the following: a. Block pressurizer pressure signals and reset SIAS signal. b. Reset CIS signal. c. Secure remaining Containment Spray Pump. d. Restore equipment per SIAS and CIS Verification Checklists, Attachments (2) and (4), to desired condition.	

VII. RECOVERY ACTIONS	ALTERNATE ACTIONS
Q. EVALUATE NEED FOR HPSI TERMINATION:	
1. **WHEN** HPSI termination criteria met: a. At least 30°F subcooling. b. Pressurizer level greater than 155 inches and stable. c. At least one S/G available for heat removal. d. RVLMS indicates that the Core is covered. **THEN** HPSI Pump(s) may be secured. 2. **IF** HPSI termination criteria can **NOT** be maintained, **THEN** start 11 and 13 HPSI Pumps.	
R. RESTORE SERVICE WATER TO TURBINE BUILDING:	
1. Verify 21 Plant Air Compressor operating. 2. Shut Plant Air To Plant Air Header Valve, 1-PA-2059-CV. 3. Open Plant Air To Instrument Air Cross Connect Valve, 1-PA-2061-CV. 4. Open SRW Turbine Building Header Isolation Valves: 1-SRW-1600-CV 1-SRW-1637-CV 1-SRW-1638-CV 1-SRW-1639-CV	

I. RECOVERY ACTIONS	ALTERNATE ACTIONS
S. RESTORE INSTRUMENT AIR COMPRESSORS TO SERVICE:	
1. **IF** high temperature alarm exists on the Instrument Air Compressors, **THEN** open the service water isolation valves by placing their handswitches in OPEN until temperature alarm clears. <u>11</u> or <u>12</u> 1-HS-2063 1-HS-2065 2. Start at least one Instrument Air Compressor.	
RESTORE INSTRUMENT AIR TO CONTAINMENT:	
1. Open Cntmt Instrument Air Isolation MOV, 1-IA-2080-MOV. - **NOTE** - 1-HS-2085 located on West wall of 27 ft Switchgear Room; Key #85 in Control Room Key Locker. 2. Open Cntmt Instrument Air Supply CV, 1-IA-2085-CV, by momentarily placing 1-HS-2085 in OPEN.	
U. RESTORE LETDOWN FLOW:	
1. Verify charging flow path through Loop Charging Valves or Auxiliary Spray Valve.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
2. Verify at least one Charging Pump operating. 3. Shift Letdown Control Valve Controller, 1-HIC-110, to MANUAL. 4. Adjust controller to shut Letdown Control Valves. 5. Open Letdown Isolation Valves: 1-CVC-515-CV 1-CVC-516-CV - **CAUTION** - **The setpoint of 1-PIC-201 must be above the saturation pressure for the letdown outlet temperature of the Regenerative Heat Exchanger.** 6. Adjust the setpoint on 1-PIC-201 and adjust 1-HIC-110 to maintain desired pressurizer level.	
V. **IF** FORCED CIRCULATION DESIRED **AND** PUMP RESTART CRITERIA MET, **THEN** START RCPs:	
1. **IF** RCPs exposed to excessive moisture, **THEN** consider meggering RCP motor. - **CAUTION** - **Uncontrolled restoration of cooling to hot RCP seals may cause degradation of the metallic seating surfaces by thermal shock.**	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
2. **IF** Component Cooling is isolated to RCP seals, **THEN** reduce RCP lower seal temperature below 280°F prior to initiating full cooling flow to the RCPs: a. Shut Component Cooling Supply Containment Manual Isolation Valve, 1-CC-284, located in 5 ft East Penetration Room. b. Verify CIS reset. c. Open Component Cooling Containment Isolation Valves: 1-CC-3832-CV 1-CC-3833-CV d. Slowly open 1-CC-284 to throttle component cooling flow until lower seal temperatures are less than 280°F. e. **WHEN** lower seal temperatures are less than 280°F, **THEN** fully open 1-CC-284. 3. **IF** an RCP lower seal temperature exceeded 280°F, **THEN** an engineering evaluation is required prior to restarting that RCP. 4. Raise pressurizer level to at least 155 inches. 5. Verify RCP restart criteria: a. RCS subcooling greater than 30°F. b. At least one S/G available for heat removal.	

III. RECOVERY ACTIONS

ALTERNATE ACTIONS

c. Pressurizer level greater than 155 inches and stable.

d. Tcold less than 525°F.

e. RCS temperature and pressure greater than the minimum operating limits per the RCP Curve on Attachment (1).

- **NOTE** -

Starting an RCP may cause a pressurizer level transient.

6. **WHEN** RCP restart criteria are met,
   THEN start one RCP in a loop with an operable S/G:

   a. Verify "COMPT CLG FLOW LO" alarm clear.

   b. Start Oil Lift Pump.

   c. Insert RCP sync stick.

   d. Start one RCP.

   e. Monitor RCP running current:

Tavg	Current
525 to 572°F	238 to 210 AMPS and steady
210 to 525°F	264 to 238 AMPS and steady

7. **IF** pressurizer level decreases, **THEN** start Charging or HPSI Pump(s) as necessary to restore **AND** maintain level greater than 155 inches.

8. Monitor RCP seal parameters following pump restart.

III. RECOVERY ACTIONS

9. Allow backflow to equalize temperatures in opposite loop.

10. Start second RCP in opposite loop per step V.6 and V.8, page [illegible].

11. Secure Auxiliary Spray:

    a. [illegible] Loop Charging Valves:

        1-CVC-518-CV
        1-CVC-519-CV

    b. Shut Auxiliary Spray Valve, 1-CVC-517-CV.

    c. Shift Pressurizer Spray Controller, 1-HIC-100, to AUTO.

W. **WHEN** RCS TEMPERATURE IS LESS THAN 330°F **AND** RCS PRESSURE IS LESS THAN 380 PSIA, **THEN** ESTABLISH MPT PROTECTION:

- CAUTION -

PORVs must be in MPT ENABLE before Tcold indication on T115 or T125 is less than 325°F.

1. Manually reset 1-PY-103 and 1-PY-103-1 bistables by pressing the reset buttons located on 1C25A behind 1C06.

2. Place both PORVs in the MPT ENABLE mode.

3. Place both PORV Override Switches in OVERRIDE CLOSED position.

ALTERNATE ACTIONS

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
X. **WHEN** RCS TEMPERATURE IS LESS THAN 300°F **AND** RCS PRESSURE IS LESS THAN 300 PSIA, **THEN** PERFORM THE FOLLOWING:	

- **NOTE** -

Cavity Cooling and CEDM Cooling aid in cooling Reactor Vessel Head if a void exists.

1. **IF** Cavity Cooling and CEDM Cooling Fans available, **THEN** maintain Cavity Cooling and CEDM Cooling Fans running.

2. Shut SI Tank Outlet Valves:

   1-SI-614-MOV
   1-SI-624-MOV
   1-SI-634-MOV
   1-SI-644-MOV

3. **IF** AFW **NOT** being used to feed S/Gs, **THEN** perform the following:

   a. Shut the motor and steam driven train AFW Block Valves:

11 S/G	12 S/G
1-AFW-4520-CV	1-AFW-4530-CV
1-AFW-4521-CV	1-AFW-4531-CV
1-AFW-4522-CV	1-AFW-4532-CV
1-AFW-4523-CV	1-AFW-4533-CV

   b. Place 13 AFW Pump in PULL-TO-LOCK.

   c. Shut AFW Steam Supply Valves:

11 S/G	12 S/G
1-MS-4070-CV	1-MS-4071-CV

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
Y. **IF** CET SUBCOOLING LESS THAN 30°F, **THEN** COMMENCE CORE FLUSH WITHIN 24 HOURS AFTER THE SIAS ACTUATION:	
1. Line up for Pressurizer Injection: a. Open SI Discharge To Charging Header Core Flush Valve, 1-CVC-269-MOV. b. Shut Loop Charging Valves: 1-CVC-518-CV 1-CVC-519-CV c. Shut Pressurizer Spray Valves: 1-RC-100E-CV 1-RC-100F-CV d. Open HPSI Aux Header Isolation Valve, 1-SI-656-MOV. e. Open Auxiliary Spray Valve, 1-CVC-517-CV. f. Shut HPSI Main Header Cross Connect Valve, 1-SI-653-MOV. g. Shut Aux HPSI Header Valves: 1-SI-617-MOV 1-SI-627-MOV 1-SI-637-MOV 1-SI-647-MOV h. Start 11 or 12 HPSI Pump and maintain a minimum flow of 40 GPM.	1.1 **IF** Pressurizer Injection **NOT** available **AND** the following conditions are met: a. RCS pressure less than 270 PSIA. b. RCS pressure minus containment pressure less than 160 PSID. **THEN** line up for Hot Leg Injection: a. Place 11 or 12 LPSI Pump RAS Override Switch in OVERRIDE. b. Open Cntmt Sump Discharge Valves: 1-SI-4144-MOV 1-SI-4145-MOV c. Open Shutdown Cooling Heat Exchanger Recirc Isolation Valve, 1-SI-399-MOV. d. Shut LPSI Header Valves: 1-SI-615-MOV 1-SI-625-MOV 1-SI-635-MOV 1-SI-645-MOV

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
i. **IF** minimum flow can **NOT** be determined, **THEN** initiate Hot Leg Injection.	e. Verify RCS pressure less than 270 PSIA. f. Open Shutdown Cooling Suction Header Isolation Valves: 1-SI-651-MOV 1-SI-652-MOV g. Start selected LPSI Pump. h. Maintain a minimum flow of 40 GPM.
2. **WHEN** Pressurizer Injection **OR** Hot Leg Injection in progress, balance flow by throttling Main HPSI Header Valves: 1-SI-616-MOV 1-SI-626-MOV 1-SI-636-MOV 1-SI-646-MOV **THEN** maintain required flow to remove decay heat per Attachment (12).	
3. Ensure CET temperatures remain constant or decreasing.	

VII. RECOVERY ACTIONS	ALTERNATE ACTIONS
Z. **WHEN** CET TEMPERATURES LESS THAN 300°F **AND** RADIATION LEVELS PERMIT, **THEN** COMMENCE SHUTDOWN COOLING.	
1. **IF** all the following conditions exist: a. Pressurizer level less than 101 inches. b. RCS subcooling less than 30°F. c. RCS pressure minus containment pressure less than 160 PSID. **THEN** commence Shutdown Cooling as follows: a. Shut 11 Containment Spray Pump Discharge Valve, 1-SI-314. b. Shut 12 Containment Spray Pump Discharge Valve, 1-SI-324. c. Shut 11 Shutdown Cooling Heat Exchanger Outlet To Spray Header Valve, 1-SI-319. d. Shut 12 Shutdown Cooling Heat Exchanger Outlet To Spray Header Valve, 1-SI-329. e. Open 11 Shutdown Cooling Heat Exchanger Inlet Cross Connect Valve, 1-SI-452. f. Open 11 Shutdown Cooling Heat Exchanger Outlet To RCS Valve, 1-SI-456.	1.1 **IF** pressurizer level greater than 101 inches **AND** RCS subcooling greater than 30°F, **THEN** initiate Shutdown Cooling per OI-3. 1.2 Operate HPSI and Charging Pumps as necessary to maintain pressurizer level and pressure.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
g. Open 12 Shutdown Cooling Heat Exchanger Inlet Cross Connect Valve, 1-SI-453.	
h. Open 12 Shutdown Cooling Heat Exchanger Outlet to RCS Valve, 1-SI-457.	
i. Place second Component Cooling Heat Exchanger in service by opening appropriate Component Cooling Heat Exchanger Outlet Valve: 1-CC-3824-CV 1-CC-3826-CV	
j. Start second Component Cooling Pump.	
k. Open 11 Shutdown Cooling Heat Exchanger Component Cooling Outlet Valve, 1-CC-3828-CV.	
l. Open 12 Shutdown Cooling Heat Exchanger Component Cooling Outlet Valve, 1-CC-3830-CV.	
m. Open Shutdown Cooling Heat Exchanger Inlet Isolation, 1-SI-658-MOV.	
n. **IF** Hot Leg Injection being used for core flush, **THEN** shut 12A LPSI Header Valve, 1-SI-635-MOV.	1.n.1 **IF** Hot Leg Injection **NOT** being used for core flush, **THEN** open 12A LPSI Header Valve, 1-SI-635-MOV.
o. Open LPSI Header Valves: 1-SI-615-MOV 1-SI-625-MOV 1-SI-645-MOV	
p. Place keyswitch for 1-SI-306-CV in AUTO.	
q. Shift 1-FIC-306 to MANUAL with 5% open signal.	

III. **RECOVERY ACTIONS**

r. Open Cntmt Sump Discharge Valve:

1-SI-4144-MOV
1-SI-4145-MOV

s. Shut SI Pump Mini Flow Isolations:

1-SI-659-MOV
1-SI-660-MOV

t. Ensure level indication exists on wide range containment level indicator 1-LI-4146.

\- **CAUTION** -

The possibility of cavitation increases when taking suction from containment sump.

u. IF LPSI Pump NOT operating, THEN clear RAS from one operable LPSI Pump by placing LPSI Pump RAS Override Switch in OVERRIDE AND start selected pump.

\- **CAUTION** -

Cooldown limit changes from 100^{o}F/h to 20^{o}F/h at RCS temperature of 250^{o}F.

v. Adjust the signal on 1-FIC-306 to raise flow to 3000 GPM, while maintaining cooldown rate within limits.

w. Place keyswitch for 1-SI-657-CV in AUTO.

ALTERNATE ACTIONS

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
- CAUTION - **Do not exceed 12°F/m heatup rate or greater than 5000 GPM through one heat exchanger.** x. Adjust Shutdown Cooling Temperature Control Valve, 1-SI-657-CV, to obtain 12°F/m heatup rate at Shutdown Cooling Heat Exchanger Outlet (1-TI-303X and 1-TI-303Y). y. IF desired RCS cooldown rate can NOT be maintained with one LPSI Pump, THEN start second LPSI Pump AND adjust 1-FIC-306 to 6000 GPM. z. Adjust Shutdown Cooling Temperature Control Valve, 1-SI-657-CV, to obtain desired cooldown rate.	
AA. WHEN CET TEMPERATURES LESS THAN 200°F, THEN SECURE CORE FLUSH FLOWPATH:	
1. IF HPSI Pump(s) NOT required for RCS pressure or level control, THEN secure HPSI Pump(s). 2. Shut SI Discharge To Charging Header Core Flush Valve, 1-CVC-269-MOV. 3. Open Loop Charging Valves: 1-CVC-518-CV 1-CVC-519-CV 4. Shut Auxiliary Spray Valve, 1-CVC-517-CV.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
5. Shut Shutdown Cooling Heat Exchanger Recirc Isolation, 1-SI-399-MOV. 6. Open 12A LPSI Header Valve, 1-SI-635-MOV.	
AB. COMPLETE ADMINISTRATIVE POST-TRIP ACTIONS AND IMPLEMENT APPROPRIATE OPERATING PROCEDURE.	

AC. ADMINISTRATIVE POST-TRIP ACTIONS:

- **NOTE** -

The following actions may be accomplished whenever feasible. They may be done in any order.

_______ 1. Refer to ERPIP to determine appropriate emergency response actions.

_______ 2. Perform notifications per CCI-118.

_______ 3. Notify ESO of trip.

_______ 4. Request RCS Boron and Iodine sample.

_______ 5. Perform shutdown margin calculation per NEOG 2 and 7.

_______ 6. Complete transient log entries per CCI-301.

_______ 7. Recall post-trip review (preferably within 30 minutes of trip).

_______ 8. Perform post-trip review per CCI-111.

_______ 9. Monitor turbine bearing temperatures.

_______ 10. Continue Main Turbine shutdown per applicable step of OI-43A.

END OF SECTION III.

IV. SAFETY FUNCTION STATUS CHECK

A. The STA (or person designated by STA) will perform the intermediate and final safety function checks respectively on entry and prior to exiting from this procedure.

B. Perform intermediate safety function status check at 10 minute intervals until plant conditions stabilize.

C. Immediately notify Shift Supervisor or Control Room Supervisor if any safety function criteria is not being satisfied.

D. Review data and verify that safety function acceptance criteria are satisfied.

E. When EOP completed, then perform final safety function check.

REACTIVITY CONTROL PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. WRNI power	less than 3%	----------	less than 1%	________
b. SUR (DPM)	negative	----------	0	________
c. CEA status	all inserted	----------	all inserted	________
or				
Boration status:				
concentation	increasing	----------	appropriate S/D margin	________
BAST level	decreasing	----------	N/A	N/A

RCS PRESSURE AND INVENTORY PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Pressurizer pressure (PSIA)	less than 1900	__________	less than 1900	________
b. Pressurizer level (inches) (1)	0 to 160	__________	0 to 160	________
c. RCS subcooling (°F)	0 to 140	__________	greater than 30	________

(1) A break at top of Pressurizer will result in solid pressurizer indication. This is an acceptable value provided the other parameters still indicate a LOCA.

CORE AND RCS HEAT REMOVAL PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. CET (°F)	less than 700	--------	less than 500	________
b. Thot minus Tcold (°F) (2)	10 to 50	--------	10 to 50	________
c. S/G pressure (PSIA)	150 to 900	--------	N/A	N/A
d. S/G level (inches)	(-)170 to (+)30	--------	(-)24 to (+)30	________
e. Cold Leg Injection (GPM)	greater than 40	--------	greater than 40	________
f. Condensate Storage Tank level (ft)	greater than 5	--------	greater than 5	________
g. Core flush established within 24 hours (GPM)	greater than 40	--------	greater than 40	________

(2) Thot and Tcold indication may be influenced by charging or SI temperatures during a large break LOCA. If this occurs Thot minus Tcold may be deleted from the check provided CET temperatures meet their acceptance criteria.

VITAL AUXILIARIES	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. 4KV vital buses 11 or 14	energized	----------	energized	__________
b. Instrument Air pressure (PSIG)	greater than 88	----------	greater than 88	__________
c. Component Cooling (# pumps running)	1 or 2	----------	1 or 2	__________
d. Saltwater (# pumps running)	1 or 2	----------	1 or 2	__________
e. Service Water (# pumps running)	1 or 2	----------	1 or 2	__________
f. 125V DC buses 11, 12, 21, 22	energized	----------	energized	__________
g. 120V AC vital buses 11, 12, 13, 14	energized	----------	energized	__________

NORMAL CONTAINMENT ENVIRONMENT PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Containment pressure (PSIG)	less than 50	--------	less than 2.8	_______
b. Containment temperature (°F)	less than 276	--------	less than 220	_______
c. Containment High Range Radiation Monitor	alarm clear	--------	alarm clear	_______
d. Hydrogen concentration	N/A	N/A --------	less than 2%	_______

NORMAL RADIATION LEVELS EXTERNAL TO CONTAINMENT	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Noble Gas Monitor	alarm clear	----------	alarm clear	________
b. Condenser Off-Gas RMS	alarm clear	----------	alarm clear	________
c. S/G B/D RMS	alarm clear	----------	alarm clear	________
d. Main Vent Gaseous RMS (1-RI-5415)	alarm clear	----------	alarm clear	________

STATUS CHECK NUMBER	COMPLETE AT TIME
1	________
2	________
3	________
4	________
________	________
________	________
________	________

CALVERT CLIFFS NUCLEAR POWER PLANT

EOP-5 LOSS OF COOLANT ACCIDENT

REVISION 1

	SIGNATURE	DATE
PREPARED BY;	[signature]	12-18-87
VERIFIED BY;	James V. Grooms	12/18/87
POSRC;	MEETING # 88-7	2-10-88
APPROVED BY;	J.R. Lemons Manager-Nuclear Operations or General Supervisor-Operations if POSRC review is not required	2-10-88

LIST OF EFFECTIVE PAGES

LOSS OF COOLANT ACCIDENT

I. PRECAUTIONS

A. Do not adopt manual operation of automatically controlled systems unless a malfunction is apparent or automatic system operation will not support the maintenance of a safety function.

B. Systems shifted to manual operation must be monitored frequently to ensure correct operation.

C. At least two independent indications should be used, when available, to evaluate and corroborate a specific plant condition since an incident could induce inconsistencies between instruments.

D. High energy line break may cause erratic instrumentation response depending on the magnitude and location of the break.

E. ESFAS actuated safety features should only be overridden to support a threatened safety function or when directed by the procedure.

F. During a LOCA, pressurizer level may not provide an accurate indication of RCS inventory due to the formation of voids. Pressurizer level when combined with RCS subcooling will indicate that the core is covered.

G. For small breaks in the RCS where the S/Gs are important for heat removal, one S/G must be used for this purpose even if primary to secondary leaks are detected.

H. Minimize the number of cycles of pressurizer auxiliary spray when the temperature differential is greater than 400°F.

I. In Natural Circulation, increased loop transport time causes a 5 to 10 minute delay in temperature responses to a plant change. Pressurizer level and pressure responses, if available, typically provide better indication of RCS response during this period.

J. S/G pressure, pressurizer pressure, and containment temperature affect the level indication for the S/Gs and Pressurizer. Attachments (8) and (9) contain the corrected S/G and pressurizer levels for various S/G pressures, pressurizer pressures, and containment temperatures.

K. If a pump or component fails, the cause of the failure should be determined prior to restarting or starting a standby pump or component to prevent a common failure.

II. ENTRY CONDITIONS

The presence of one or more of the following conditions indicates that a Loss Of Coolant Accident may have occurred:

A. Unexplained decreasing pressurizer level.

B. Unexplained decreasing pressurizer pressure.

C. Loss of RCS subcooled margin.

D. High containment radiation alarm.

E. Increase in containment sump level.

F. Increase in containment sump alarm frequency.

VI. RECOVERY ACTIONS	ALTERNATE ACTIONS
A. VERIFY POST-TRIP IMMEDIATE ACTIONS COMPLETED.	
B. COMMENCE INTERMEDIATE SAFETY FUNCTION STATUS CHECK.	
C. DETERMINE APPROPRIATE EMERGENCY RESPONSE ACTIONS PER THE ERPIP.	
D. MONITOR RCS DEPRESSURIZATION.	
1. **IF** rapid depressurization to 1725 PSIA, **THEN** verify SIAS actuation **AND** the following actions: a. All available Charging Pumps running. b. 21 and 23 HPSI Pumps running. c. Main and Aux HPSI Header Valves open: 2-SI-616-MOV 2-SI-617-MOV 2-SI-626-MOV 2-SI-627-MOV 2-SI-636-MOV 2-SI-637-MOV 2-SI-646-MOV 2-SI-647-MOV	1.1 **IF** RCS pressure is greater than 1725 PSIA **AND** SIAS **NOT** actuated, **THEN** attempt leak isolation: a. Shut Letdown Isolation Valves: 2-CVC-515-CV 2-CVC-516-CV b. Shut RCS Sample Isolation Valve, 2-PS-5464-CV. c. Shut Reactor Vessel Vent Valves: 2-RC-103-SV 2-RC-104-SV d. Shut Pressurizer Vent Valves: 2-RC-105-SV 2-RC-106-SV

III. RECOVERY ACTIONS

ALTERNATE ACTIONS

e. IF PORV leakage is indicated by:

(1) High Quench Tank parameters.

(2) High PORV discharge piping temperature, computer points T107 and T108.

(3) Abnormal Acoustic Monitor indication.

THEN shut PORV Block Valves:

2-RC-403-MOV
2-RC-405-MOV

f. IF leak is isolated AND SIAS NOT actuated, THEN implement Reactor Trip (EOP-1) AND complete administrative post-trip actions step AC, page 35.

1.2 IF leak is NOT isolated AND RCS pressure still greater than 1725 PSIA, THEN block SIAS:

a. Open Main and Aux HPSI Header Valves:

2-SI-616-MOV 2-SI-617-MOV
2-SI-626-MOV 2-SI-627-MOV
2-SI-636-MOV 2-SI-637-MOV
2-SI-646-MOV 2-SI-647-MOV

b. Start 21 and 23 HPSI Pumps.

c. WHEN "PRSR PRESS BLOCK A(B) PERMITTED" alarm(s) received, THEN block SIAS A(B).

VII. RECOVERY ACTIONS	ALTERNATE ACTIONS
E. IMPLEMENT RCP TRIP STRATEGY:	
1. **IF** RCS pressure decreases to 1725 PSIA, **THEN** trip 21A and 22B RCPs **OR** trip 21B and 22A RCPs. 2. **IF** positive LOCA indications exist: a. RCS subcooling less than 30°F. b. Steady S/G pressure. c. S/G Blowdown RMS alarms clear **OR** Main Vent Gaseous RMS (2-RI-5415) alarm clear. **AND** RCS pressure decreases to less than 1300 PSIA, **THEN** trip all RCPs. 3. **IF** RCS temperature and pressure are less than the minimum pump operating limits per the RCP curve on Attachment (1), **THEN** trip all RCPs. 4. **IF** CIS has actuated, **THEN** trip all RCPs.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
F. VERIFY BORATION IN PROGRESS:	
1. IF SIAS has actuated, THEN verify boration in progress: a. Shut VCT Makeup Valve, 2-CVC-512-CV. b. Open Boric Acid Direct Makeup Valve, 2-CVC-514-MOV. c. Boric Acid Pumps running. d. Open BAST Gravity Feed Valves: 2-CVC-508-MOV 2-CVC-509-MOV e. Shut VCT Outlet Valve, 2-CVC-501-MOV. f. All available Charging Pumps running.	1.1 IF SIAS NOT actuated, THEN commence boration: a. Shut VCT Makeup Valve, 2-CVC-512-CV. b. Open Boric Acid Direct Makeup Valve, 2-CVC-514-MOV. c. Start a Boric Acid Pump. d. Start all available Charging Pumps. 1.2 IF Boric Acid Pumps NOT available, THEN establish gravity feed: a. Open BAST Gravity Feed Valves: 2-CVC-508-MOV 2-CVC-509-MOV b. Shut VCT Outlet Valve, 2-CVC-501-MOV. c. Start all available Charging Pumps.
2. Continue boration until a total 65 inch decrease in BAST level(s) is achieved, or shutdown margin requirements of NEOG-11 is achieved.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
G. **IF** RCS PRESSURE DECREASES TO LESS THAN 225 PSIA, **THEN** VERIFY SAFETY INJECTION SYSTEM OPERATION:	
1. Verify HPSI and LPSI flow to RCS per Attachments (12) and (13). 2. Verify SI Tanks discharging to RCS cold legs. 3. Monitor containment pressure per step K, page 13.	1.1 **IF** 21 or 23 HPSI Pump fails, **THEN** start 22 HPSI Pump **AND** align to appropriate header.
H. RESTORE NORMAL S/G WATER LEVEL:	
- **CAUTION** - **Severe water hammer may occur if Main Feed Ring is allowed to drain then subsequently refilled.** 1. **IF** Main Feed available, **THEN** establish a shutdown feed system lineup: a. One operating S/G Feed Pump. b. One operating Condensate Booster Pump. c. One operating Condensate Pump. d. Both Heater Drain Pumps secured.	1.1 **IF** Main Feed **NOT** available, **THEN** establish AFW as follows: - **CAUTION** - **D/G supplying power to 23 AFW Pump flow limit is 300 GPM; otherwise, flow limit is 575 GPM.** a. Start an AFW Pump. b. Adjust AFW Flow Control Valves to maintain S/G levels between (-)170 and (+)30 inches.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
2. **WHEN** manual control of feed flow rate desired **OR** S/G levels between (-)24 and (+)30 inches, **THEN** perform the following: a. Depress Feed Regulating Bypass Valve Reset Buttons. b. Adjust Feed Regulating Bypass Valves to raise S/G levels to approximately 0 inches. 3. **WHEN** S/G levels are 0 inches, **THEN** shift Feed Regulating Bypass Controllers to AUTO. I. **IF** RCS PRESSURE GREATER THAN 225 PSIA, **THEN** ESTABLISH COOLDOWN IN AT LEAST ONE LOOP:	
1. **WHEN** "SGIS A(B) BLOCK PERMITTED" alarm(s) received, **THEN** block SGIS A(B). 2. Open Turbine Bypass or Atmospheric Dump Valves as necessary to maximize RCS cooldown, while maintaining cooldown rate less than 100°F/h.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
3. **IF** RCPs are secured, **THEN** verify Natural Circulation:	
- **NOTE** - Wide range Thot may be obtained from Subcooled Margin Monitor per Attachment (10).	
a. Thot minus Tcold between 10 and 50°F.	
b. Tcold constant or decreasing.	
c. Thot constant or decreasing.	
d. CET temperatures consistent with Thot.	
e. Steaming rate affects primary temperature.	
4. Monitor for Core and RCS voiding:	
- **CAUTION** - Potential for void formation increases rapidly when pressure decreases below 1500 PSIA.	
a. Letdown flow greater than charging flow.	
b. Rapid unexplained increase in pressurizer level during an RCS pressure reduction.	
c. Loss of subcooled margin as determined using CET temperatures.	
d. "REACTOR VESSEL WATER LEVEL LOW" alarm.	

III. RECOVERY ACTIONS

5. IF voiding inhibits heat removal,
THEN reduce or eliminate voided area:

a. Shut Letdown Isolation Valve, 2-CVC-515-CV.

- CAUTION -

The potential exists for pressurized thermal shock from an excessive cooldown rate followed by a repressurization.

b. Pressurize the RCS to maintain subcooling as near 140°F as practical.

- CAUTION -

If voids exist in the S/G Tubes, a rapid RCS pressure reduction will occur when the voids collapse.

c. IF voiding occurs in the S/G tubes (saturation pressure of S/G greater than saturation pressure of RCS),
THEN cool the S/G by raising any of the following:

(1) Steaming rate.

(2) Feed rate.

(3) S/G Blowdown rate.

AND maintaining less than 100°F/h cooldown rate.

6. Continue cooldown to 300°F.

ALTERNATE ACTIONS

5.b.1 IF pressurizing the RCS does NOT restore heat removal,
THEN operate Reactor Vessel Vent Valves per OI-1G.

VII. RECOVERY ACTIONS	ALTERNATE ACTIONS
J. **IF** RCS PRESSURE LESS THAN 1270 PSIA, **THEN** VERIFY HPSI FLOW TO RCS PER ATTACHMENT (12).	
	J.1 **IF** 21 or 23 HPSI Pump fails, **THEN** start 22 HPSI Pump **AND** align to appropriate header.
K. MONITOR CONTAINMENT PRESSURE:	
1. **IF** CSAS **NOT** actuated, **THEN** start all available Containment Air Coolers in HIGH with maximum SRW flow. 2. **IF** containment pressure increases to 2.0 PSIG **AND** still increasing, **THEN** start 21 and 22 Containment Spray Pumps and open both Cntmt Spray Header CVs. 21: 2-SI-4150-CV; 22: 2-SI-4151-CV 3. **IF** containment pressure increases to 2.8 PSIG, **THEN** verify ESFAS actuation: a. SIAS. b. CIS **AND** trip all RCPs. 4. Verify SRW Pump Room Ventilation in service, per OI-15. 5. **IF** containment pressure increases to 4.25 PSIG, **THEN** verify CSAS actuation **AND** spray flow approximately 1350 GPM.	

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III. RECOVERY ACTIONS	ALTERNATE ACTIONS
L. COMMENCE ESFAS VERIFICATION CHECKLISTS:	
1. SIAS Attachment (2). 2. CSAS Attachment (3). 3. CIS Attachment (4).	
M. MAINTAIN RCS SUBCOOLING AND PRESSURIZER LEVEL:	
1. Maintain subcooling between 30 and 140°F using CET temperatures. - CAUTION - **The potential exists for pressurized thermal shock from an excessive cooldown rate followed by a repressurization.** 2. Raise subcooling by any of the following: - NOTE - Pressurizer Backup Heater Banks 21 and 23 trip on U/V and SIAS. a. Operate Pressurizer Heater(s). b. Operate Turbine Bypass or Atmospheric Dump Valves to maximize RCS cooldown while maintaining cooldown rate less than 100°F/h. c. Raise HPSI flow to RCS.	2.b.1 IF unable to obtain desired cooldown rate with Turbine Bypass and Atmospheric Dump Valves, THEN use steam driven AFW Pump(s) to increase cooldown rate.

III. RECOVERY ACTIONS

3. Lower subcooling by any of the following:

   a. De-energize Pressurizer Heater(s).

   b. Lower RCS cooldown rate.

   c. **IF** the following conditions can be maintained:

      (1) At least 30°F subcooling.

      (2) ..essurizer level greater than 155 inches.

      (3) At least one S/G available for heat removal.

      (4) RVLMS indicates that the Core is covered.

      THEN throttle HPSI flow or operate Charging Pumps as necessary to maintain subcooling between 30 and 140°F.

ALTERNATE ACTIONS

3.1 **IF** unable to lower subcooling, **THEN** initiate Auxiliary Spray:

   a. Place Instrument Air CIS Override Switch, 2-HS-2080A, in OVERRIDE.

   b. Open Cntmt Instrument Air Isolation MOV, 2-IA-2080-MOV.

   c. Record temperature differential between Pressurizer and Regenerative Heat Exchanger Outlet.

   d. Open Auxiliary Spray Valve, 2-CVC-517-CV.

   e. Shut Loop Charging Valves:

      2-CVC-518-CV
      2-CVC-519-CV

- **NOTE** -

2-HS-2085 located on West wall of 27 ft Switchgear Room; Key #80 in Control Room Key Locker.

   f. Open Cntmt Instrument Air Supply CV, 2-IA-2085-CV, by momentarily placing 2-HS-2085 in OPEN.

   g. Shift 2-HIC-100 to MANUAL and shut Pressurizer Spray Valves:

      2-RC-100E-CV
      2-RC-100F-CV

   h. Maintain pressurizer cooldown rate less than 200°F/h.

VI. RECOVERY ACTIONS

ALTERNATE ACTIONS

- NOTE -

A break on top of Pressurizer will result in an uncontrollable increase in pressurizer level until Pressurizer is solid.

4. Maintain pressurizer level between 101 and 160 inches.

- CAUTION -

Do not throttle HPSI flow unless 30°F subcooling can be maintained.

a. IF the following conditions can be maintained:

(1) At least 30°F subcooling.

(2) Pressurizer level greater than 101 inches.

(3) At least one S/G available for heat removal.

(4) RVLMS indicates that the core is covered.

THEN throttle HPSI flow or operate Charging Pumps as necessary to maintain pressurizer level between 101 and 160 inches.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
1. **WHEN** RCS BORATION COMPLETE, **THEN** SHIFT CHARGING PUMP SUCTION SUPPLY TO MAKEUP SUPPLY WITH A LOWER BORIC ACID CONCENTRATION.	
1. **IF** SIAS actuated, **THEN** perform the following: a. Open RWT To Charging Pump Suction Valve, 2-CVC-504-MOV. b. Shut VCT Outlet Valve, 2-CVC-501-MOV. c. Place Boric Acid Pumps in PULL-TO-LOCK. d. Ensure Charging Pump AMPS steady. e. Ensure BAST levels steady.	1.1 **IF** SIAS **NOT** actuated, **THEN** lineup Charging Pump suction to VCT: a. Determine blend required to maintain shutdown boron concentration per NEOG-11. b. Open VCT Outlet Valve, 2-CVC-501-MOV. c. Secure Boric Acid Pump(s). d. Shut Boric Acid Direct Makeup Valve, 2-CVC-514-MOV. e. Shut BAST Gravity Feed Valves: 2-CVC-508-MOV 2-CVC-509-MOV **OR** lineup Charging Pump suction to RWT: a. Open RWT To Charging Pump Suction Valve, 2-CVC-504-MOV. b. Shut VCT Outlet Valve, 2-CVC-501-MOV. c. Shut Boric Acid Direct Makeup Valve, 2-CVC-514-MOV. d. Secure Boric Acid Pump(s).

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
O. **IF** RWT LEVEL DECREASES TO BETWEEN 0.5 AND 1.0 FT **OR** "ACTUATION SYS RAS TRIPPED" ALARM RECEIVED, **THEN** VERIFY RAS ACTUATION:	
1. Place SI Pump Recirc Lockout Switches in ON. 2. Commence RAS Verification Checklist, Attachment (6). 3. Shut RWT Outlet Valves: 2-SI-4142-MOV 2-SI-4143-MOV 4. **IF** HPSI flow greater than 1000 GPM with two HPSI Pumps operating, **THEN** equally throttle HPSI flow to 1000 GPM. 5. **IF** HPSI flow greater than 600 GPM with one HPSI Pump operating, **THEN** equally throttle HPSI flow to 600 GPM. - **CAUTION** - **To prevent pump damage, minimum flow per operating HPSI Pump is 30 GPM.** 6. **IF** HPSI Pump cavitation occurs in recirculation mode, **THEN** throttle HPSI flow per Attachment (12).	6.1 **IF** Attachment (12) does **NOT** allow throttling HPSI flow, **THEN** align Containment Spray Pump(s) to HPSI Pump suction: a. **IF** 21(22) HPSI Pump cavitating, **THEN** open 21 SDC HX To HPSI Suction Valve, 2-SI-663-MOV **AND** start 21 Containment Spray Pump.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
	b. **IF** 23 HPSI Pump cavitating, **THEN** open 22 SDC HX To HPSI Suction Valve, 2-SI-662-MOV **AND** start 22 Containment Spray Pump.
7. Commence ECCS Pump Room cooling: a. Open ECCS Pump Room Air Cooler Saltwater Valves: 2-SW-5170-CV 2-SW-5171-CV 2-SW-5173-CV b. Start 21 and 22 ECCS Pump Room Cooling Fans.	
8. Adjust saltwater flow to maintain SRW and component cooling temperatures.	
9. **IF** Charging Pumps are aligned with suction from RWT **AND** HPSI Pumps maintaining RCS inventory, **THEN** place Charging Pumps in PULL-TO-LOCK.	
P. RESTORE CONTAINMENT ENVIRONMENT:	
1. Direct Chemistry to place Hydrogen Monitors in service.	
2. **IF** hydrogen concentration increases to 1%, **THEN** start Hydrogen Recombiners per OI-41A.	
3. Maintain Iodine Filter Fans running.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
4. **WHEN** containment pressure less than 4.0 PSIG, **THEN** perform the following: a. Reset CSAS signal. b. Secure one Containment Spray Pump. c. Verify all Containment Air Coolers operating to maintain containment temperature less than 120°F. d. Restore equipment per CSAS Verification Checklist, Attachment (3), to desired condition. 5. **WHEN** containment pressure less than 2.8 PSIG, **THEN** perform the following: a. Block pressurizer pressure signals and reset SIAS signal. b. Reset CIS signal. c. Secure remaining Containment Spray Pump. d. Restore equipment per SIAS and CIS Verification Checklists, Attachments (2) and (4), to desired condition.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
Q. EVALUATE NEED FOR HPSI TERMINATION:	
1. **WHEN** HPSI termination criteria met: a. At least 30°F subcooling. b. Pressurizer level greater than 155 inches and stable. c. At least one S/G available for heat removal. d. RVLMS indicates that the Core is covered. **THEN** HPSI Pump(s) may be secured. 2. **IF** HPSI termination criteria can **NOT** be maintained, **THEN** start 21 and 23 HPSI Pumps.	
R. RESTORE SERVICE WATER TO TURBINE BUILDING:	
1. Verify 11 Plant Air Compressor operating. 2. Shut Plant Air To Plant Air Header Valve, 2-PA-2059-CV. 3. Open Plant Air To Instrument Air Cross Connect Valve, 2-PA-2061-CV. 4. Open SRW Turbine Building Header Isolation Valves: 2-SRW-1600-CV 2-SRW-1637-CV 2-SRW-1638-CV 2-SRW-1639-CV	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
S. RESTORE INSTRUMENT AIR COMPRESSORS TO SERVICE:	
1. **IF** high temperature alarm exists on the Instrument Air Compressors, **THEN** open the service water isolation valves by placing their handswitches in OPEN until temperature alarm clears. 21 or 22 2-HS-2063 2-HS-2065 2. Start at least one Instrument Air Compressor.	
T. RESTORE INSTRUMENT AIR TO CONTAINMENT:	
1. Open Cntmt Instrument Air Isolation MOV, 2-IA-2080-MOV. - **NOTE** - 2-HS-2085 located on West wall of 27 ft Switchgear Room; Key #80 in Control Room Key Locker. 2. Open Cntmt Instrument Air Supply CV, 2-IA-2085-CV, by momentarily placing 2-HS-2085 in OPEN.	
U. RESTORE LETDOWN FLOW:	
1. Verify charging flow path through Loop Charging Valves or Auxiliary Spray Valve.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
2. Verify at least one Charging Pump operating. 3. Shift Letdown Control Valve Controller, 2-HIC-110, to MANUAL. 4. Adjust controller to shut Letdown Control Valves. 5. Open Letdown Isolation Valves: 2-CVC-515-CV 2-CVC-516-CV - **CAUTION** - **The setpoint of 2-PIC-201 must be above the saturation pressure for the letdown outlet temperature of the Regenerative Heat Exchanger.** 6. Adjust the setpoint on 2-PIC-201 and adjust 2-HIC-110 to maintain desired pressurizer level.	
V. <u>IF</u> FORCED CIRCULATION DESIRED <u>AND</u> PUMP RESTART CRITERIA MET, <u>THEN</u> START RCPs:	
1. <u>IF</u> RCPs exposed to excessive moisture, <u>THEN</u> consider meggering RCP motor. - **CAUTION** - **Uncontrolled restoration of cooling to hot RCP seals may cause degradation of the metallic seating surfaces by thermal shock.**	

VI. RECOVERY ACTIONS	ALTERNATE ACTIONS
2. **IF** Component Cooling is isolated to RCP seals, **THEN** reduce RCP lower seal temperature below 280°F prior to initiating full cooling flow to the RCPs:	
a. Shut Component Cooling Supply Containment Manual Isolation Valve, 2-CC-284, located in 5 ft East Penetration Room.	
b. Verify CIS reset.	
c. Open Component Cooling Containment Isolation Valves: 2-CC-3832-CV 2-CC-3833-CV	
d. Slowly open 2-CC-284 to throttle component cooling flow until lower seal temperatures are less than 280°F.	
e. **WHEN** lower seal temperatures are less than 280°F, **THEN** fully open 2-CC-284.	
3. **IF** an RCP lower seal temperature exceeded 280°F, **THEN** an engineering evaluation is required prior to restarting that RCP.	
4. Raise pressurizer level to at least 155 inches.	
5. Verify RCP restart criteria:	
a. RCS subcooling greater than 30°F.	
b. At least one S/G available for heat removal.	

III. RECOVERY ACTIONS

c. Pressurizer level greater than 155 inches and stable.

d. Tcold less than 525°F.

e. RCS temperature and pressure greater than the minimum operating limits per the RCP Curve on Attachment (1).

- **NOTE** -

Starting an RCP may cause a pressurizer level transient.

6. **WHEN** RCP restart criteria are met, **THEN** start one RCP in a loop with an operable S/G:

   a. Verify "COMPT CLG FLOW LO" alarm clear.

   b. Start Oil Lift Pump.

   c. Insert RCP sync stick.

   d. Start one RCP.

   e. Monitor RCP running current:

Tavg	Current
525 to 572°F	238 to 210 AMPS and steady
210 to 525°F	264 to 238 AMPS and steady

7. **IF** pressurizer level decreases, **THEN** start Charging or HPSI Pump(s) as necessary to restore **AND** maintain level greater than 155 inches.

8. Monitor RCP seal parameters following pump restart.

ALTERNATE ACTIONS

VII. **RECOVERY ACTIONS**	**ALTERNATE ACTIONS**
9. Allow backflow to equalize temperatures in opposite loop. 10. Start second RCP in opposite loop per step V.6 and V.8, page 25. 11. Secure Auxiliary Spray: a. Open Loop Charging Valves: 2-CVC-518-CV 2-CVC-519-CV b. Shut Auxiliary Spray Valve, 2-CVC-517-CV. c. Shift Pressurizer Spray Controller, 2-HIC-100, to AUTO.	
W. **WHEN** RCS TEMPERATURE IS LESS THAN 300°F **AND** RCS PRESSURE IS LESS THAN 300 PSIA, **THEN** PERFORM THE FOLLOWING:	
- **NOTE** - Cavity Cooling and CEDM Cooling aid in cooling Reactor Vessel Head if a void exists. 1. **IF** Cavity Cooling and CEDM Cooling Fans available, **THEN** maintain Cavity Cooling and CEDM Cooling Fans running. 2. Shut SI Tank Outlet Valves: 2-SI-614-MOV 2-SI-624-MOV 2-SI-634-MOV 2-SI-644-MOV	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
3. IF AFW NOT being used to feed S/Gs, THEN perform the following: a. Shut the motor and steam driven train AFW Block Valves: 21 S/G: 2-AFW-4520-CV, 2-AFW-4521-CV, 2-AFW-4522-CV, 2-AFW-4523-CV 22 S/G: 2-AFW-4530-CV, 2-AFW-4531-CV, 2-AFW-4532-CV, 2-AFW-4533-CV b. Place 23 AFW Pump in PULL-TO-LOCK. c. Shut AFW Steam Supply Valves: 21 S/G: 2-MS-4070-CV 22 S/G: 2-MS-4071-CV	
X. **WHEN** RCS TEMPERATURE IS LESS THAN 280°F **AND** RCS PRESSURE IS LESS THAN 300 PSIA, **THEN** ESTABLISH MPT PROTECTION:	
- CAUTION - **PORVs must be in MPT ENABLE before Tcold indication on T115 or T125 is less than 275°F.** 1. Place both PORVs in the MPT ENABLE mode. 2. Place both PORV Override Switches in OVERRIDE CLOSED position.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
Y. **IF** CET SUBCOOLING LESS THAN 30°F, **THEN** COMMENCE CORE FLUSH WITHIN 24 HOURS AFTER THE SIAS ACTUATION:	
1. Line up for Pressurizer Injection: a. Open SI Discharge To Charging Header Core Flush Valve, 2-CVC-269-MOV. b. Shut Loop Charging Valves: 2-CVC-518-CV 2-CVC-519-CV c. Shut Pressurizer Spray Valves: 2-RC-100E-CV 2-RC-100F-CV d. Open HPSI Aux Header Isolation Valve, 2-SI-656-MOV. e. Open Auxiliary Spray Valve, 2-CVC-517-CV. f. Shut HPSI Main Header Cross Connect Valve, 2-SI-653-MOV. g. Shut Aux HPSI Header Valves: 2-SI-617-MOV 2-SI-627-MOV 2-SI-637-MOV 2-SI-647-MOV h. Start 21 or 22 HPSI Pump and maintain a minimum flow of 40 GPM.	1.1 **IF** Pressurizer Injection **NOT** available **AND** the following conditions are met: a. RCS pressure less than 270 PSIA. b. RCS pressure minus containment pressure less than 160 PSID. **THEN** line up for Hot Leg Injection: a. Place 21 or 22 LPSI Pump RAS Override Switch in OVERRIDE. b. Open Cntmt Sump Discharge Valves: 2-SI-4144-MOV 2-SI-4145-MOV c. Open Shutdown Cooling Heat Exchanger Recirc Isolation Valve, 2-SI-399-MOV. d. Shut LPSI Header Valves: 2-SI-615-MOV 2-SI-625-MOV 2-SI-635-MOV 2-SI-645-MOV

VII. RECOVERY ACTIONS	ALTERNATE ACTIONS
	e. Verify RCS pressure less than 270 PSIA.
i. **IF** minimum flow can **NOT** be determined, **THEN** initiate Hot Leg Injection.	f. Open Shutdown Cooling Suction Header Isolation Valves: 2-SI-651-MOV 2-SI-652-MOV
	g. Start selected LPSI Pump.
	h. Maintain a minimum flow of 40 GPM.
2. **WHEN** Pressurizer Injection **OR** Hot Leg Injection in progress, balance flow by throttling Main HPSI Header Valves: 2-SI-616-MOV 2-SI-626-MOV 2-SI-636-MOV 2-SI-646-MOV **THEN** maintain required flow to remove decay heat per Attachment (12).	
3. Ensure CET temperatures remain constant or decreasing.	

VII. RECOVERY ACTIONS	ALTERNATE ACTIONS
Z. **WHEN** CET TEMPERATURES LESS THAN 300°F **AND** RADIATION LEVELS PERMIT, **THEN** COMMENCE SHUTDOWN COOLING.	
1. **IF** all the following conditions exist: a. Pressurizer level less than 101 inches. b. RCS subcooling less than 30°F. c. RCS pressure minus containment pressure less than 160 PSID. **THEN** commence Shutdown Cooling as follows: a. Shut 21 Containment Spray Pump Discharge Valve, 2-SI-314. b. Shut 22 Containment Spray Pump Discharge Valve, 2-SI-324. c. Shut 21 Shutdown Cooling Heat Exchanger Outlet To Spray Header Valve, 2-SI-319. d. Shut 22 Shutdown Cooling Heat Exchanger Outlet To Spray Header Valve, 2-SI-329. e. Open 21 Shutdown Cooling Heat Exchanger Inlet Cross Connect Valve, 2-SI-452. f. Open 21 Shutdown Cooling Heat Exchanger Outlet To RCS Valve, 2-SI-456.	1.1 **IF** pressurizer level greater than 101 inches **AND** RCS subcooling greater than 30°F, **THEN** initiate Shutdown Cooling per OI-3. 1.2 Operate HPSI and Charging Pumps as necessary to maintain pressurizer level and pressure.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
g. Open 22 Shutdown Cooling Heat Exchanger Inlet Cross Connect Valve, 2-SI-453.	
h. Open 22 Shutdown Cooling Heat Exchanger Outlet to RCS Valve, 2-SI-457.	
i. Place second Component Cooling Heat Exchanger in service by opening appropriate Component Cooling Heat Exchanger Outlet Valve: 2-CC-3824-CV 2-CC-3826-CV	
j. Start second Component Cooling Pump.	
k. Open 21 Shutdown Cooling Heat Exchanger Component Cooling Outlet Valve, 2-CC-3828-CV.	
l. Open 22 Shutdown Cooling Heat Exchanger Component Cooling Outlet Valve, 2-CC-3830-CV.	
m. Open Shutdown Cooling Heat Exchanger Inlet Isolation, 2-SI-658-MOV.	
n. **IF** Hot Leg Injection being used for core flush, **THEN** shut 22B LPSI Header Valve, 2-SI-635-MOV.	1.n.1 **IF** Hot Leg Injection **NOT** being used for core flush, **THEN** open 22B LPSI Header Valve, 2-SI-635-MOV.
o. Open LPSI Header Valves: 2-SI-615-MOV 2-SI-625-MOV 2-SI-645-MOV	
p. Place keyswitch for 2-SI-306-CV in AUTO.	
q. Shift 2-FIC-306 to MANUAL with 5% open signal.	

III. **RECOVERY ACTIONS**

r. Open Cntmt Sump Discharge Valve:

2-SI-4144-MOV
2-SI-4145-MOV

s. Shut SI Pump Mini Flow Isolations:

2-SI-659-MOV
2-SI-660-MOV

t. Ensure level indication exists on wide range containment level indicator 2-LI-4146.

- **CAUTION** -

The possibility of cavitation increases when taking suction from containment sump.

u. **IF** LPSI Pump **NOT** operating, **THEN** clear RAS from one operable LPSI Pump by placing LPSI Pump RAS Override Switch in OVERRIDE **AND** start selected pump.

- **CAUTION** -

Cooldown limit changes from 100°F/h to 20°F/h at RCS temperature of 250°F.

v. Adjust the signal on 2-FIC-306 to raise flow to 3000 GPM, while maintaining cooldown rate within limits.

w. Place keyswitch for 2-SI-657-CV in AUTO.

ALTERNATE ACTIONS

II. RECOVERY ACTIONS	ALTERNATE ACTIONS
- **CAUTION** - **Do not exceed 12°F/m heatup rate or greater than 5000 GPM through one heat exchanger.** x. Adjust Shutdown Cooling Temperature Control Valve, 2-SI-657-CV, to obtain 12°F/m heatup rate at Shutdown Cooling Heat Exchanger Outlet (2-TI-303X and 2-TI-303Y). y. IF desired RCS cooldown rate can NOT be maintained with one LPSI Pump, THEN start second LPSI Pump AND adjust 2-FIC-306 to 6000 GPM. z. Adjust Shutdown Cooling Temperature Control Valve, 2-SI-657-CV, to obtain desired cooldown rate.	
AA. WHEN CET TEMPERATURES LESS THAN 200°F, THEN SECURE CORE FLUSH FLOWPATH:	
1. IF HPSI Pump(s) NOT required for RCS pressure or level control, THEN secure HPSI Pump(s). 2. Shut SI Discharge To Charging Header Core Flush Valve, 2-CVC-269-MOV. 3. Open Loop Charging Valves: 2-CVC-518-CV 2-CVC-519-CV 4. Shut Auxiliary Spray Valve, 2-CVC-517-CV.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
5. Shut Shutdown Cooling Heat Exchanger Recirc Isolation, 2-SI-399-MOV. 6. Open 22B LPSI Header Valve, 2-SI-635-MOV.	
AB. COMPLETE ADMINISTRATIVE POST-TRIP ACTIONS AND IMPLEMENT APPROPRIATE OPERATING PROCEDURE.	

AC. ADMINISTRATIVE POST-TRIP ACTIONS:

- **NOTE** -

The following actions may be accomplished whenever feasible. They may be done in any order.

_______ 1. Refer to ERPIP to determine appropriate emergency response actions.

_______ 2. Perform notifications per CCI-118.

_______ 3. Notify ESO of trip.

_______ 4. Request RCS Boron and Iodine sample.

_______ 5. Perform shutdown margin calculation per NEOG 9 and 11.

_______ 6. Complete transient log entries per CCI-301.

_______ 7. Recall post-trip review (preferably within 30 minutes of trip).

_______ 8. Perform post-trip review per CCI-111.

_______ 9. Monitor turbine bearing temperatures.

_______ 10. Continue Main Turbine shutdown per applicable step of OI-43A.

END OF SECTION III.

IV. SAFETY FUNCTION STATUS CHECK

A. The STA (or person designated by STA) will perform the intermediate and final safety function checks respectively on entry and prior to exiting from this procedure.

B. Perform intermediate safety function status check at 10 minute intervals until plant conditions stabilize.

C. Immediately notify Shift Supervisor or Control Room Supervisor if any safety function criteria is not being satisfied.

D. Review data and verify that safety function acceptance criteria are satisfied.

E. When EOP completed, then perform final safety function check.

REACTIVITY CONTROL PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. WRNI power	less than 3%	----------	less than 1%	________
b. SUR (DPM)	negative	----------	0	________
c. CEA status	all inserted	----------	all inserted	________
or				
Boration status:				
concentation	increasing	----------	appropriate S/D margin	________
BAST level	decreasing	----------	N/A	N/A

RCS PRESSURE AND INVENTORY PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Pressurizer pressure (PSIA)	less than 1900	----------	less than 1900	________
b. Pressurizer level (inches) (1)	0 to 160	----------	0 to 160	________
c. RCS subcooling (°F)	0 to 140	----------	greater than 30	________

(1) A break at top of Pressurizer will result in solid pressurizer indication. This is an acceptable value provided the other parameters still indicate a LOCA.

CORE AND RCS HEAT REMOVAL PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. CET (°F)	less than 700	--------	less than 500	________
b. Thot minus Tcold (°F) (2)	10 to 50	--------	10 to 50	________
c. S/G pressure (PSIA)	150 to 900	--------	N/A	N/A
d. S/G level (inches)	(-)170 to (+)30	--------	(-)24 to (+)30	________
e. Cold Leg Injection (GPM)	greater than 40	--------	greater than 40	________
f. Condensate Storage Tank level (ft)	greater than 5	--------	greater than 5	________
g. Core flush established within 24 hours (GPM)	greater than 40	--------	greater than 40	________

(2) Thot and Tcold indication may be influenced by charging or SI temperatures during a large break LOCA. If this occurs Thot minus Tcold may be deleted from the check provided CET temperatures meet their acceptance criteria.

VITAL AUXILIARIES	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. 4KV vital buses 21 or 24	energized	----------	energized	________
b. Instrument Air pressure (PSIG)	greater than 88	----------	greater than 88	________
c. Component Cooling (# pumps running)	1 or 2	----------	1 or 2	________
d. Saltwater (# pumps running)	1 or 2	----------	1 or 2	________
e. Service Water (# pumps running)	1 or 2	----------	1 or 2	________
f. 125V DC buses 11, 12, 21, 22	energized	----------	energized	________
g. 120V AC vital buses 21, 22, 23, 24	energized	----------	energized	________

NORMAL CONTAINMENT ENVIRONMENT PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Containment pressure (PSIG)	less than 50	--------	less than 2.8	______
b. Containment temperature (°F)	less than 276	--------	less than 220	______
c. Containment High Range Radiation Monitor	alarm clear	--------	alarm clear	______
d. Hydrogen concentration	N/A	N/A --------	less than 2%	______

NORMAL RADIATION LEVELS EXTERNAL TO CONTAINMENT	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Noble Gas Monitor	alarm clear	----------	alarm clear	________
b. Condenser Off-Gas RMS	alarm clear	----------	alarm clear	________
c. S/G B/D RMS	alarm clear	----------	alarm clear	________
d. Main Vent Gaseous RMS (2-RI-5415)	alarm clear	----------	alarm clear	________

STATUS CHECK NUMBER	COMPLETE AT TIME
1	________
2	________
3	________
4	________
________	________
________	________
________	________

CALVERT CLIFFS NUCLEAR POWER PLANT

EOP-6 STEAM GENERATOR TUBE RUPTURE

REVISION 1

	SIGNATURE	DATE
PREPARED BY;	James V. Grooms	12/18/87
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POSRC;	MEETING # 88-7	2-10-88
APPROVED BY;	J R Lemons Manager-Nuclear Operations or General Supervisor-Operations if POSRC review is not required	2-10-88

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STEAM GENERATOR TUBE RUPTURE

I. PRECAUTIONS

A. Do not adopt manual operation of automatically controlled systems unless a malfunction is apparent or automatic system operation will not support the maintenance of a safety function.

B. Systems shifted to manual must be monitored frequently to ensure correct operation.

C. At least two independent indications should be used, when available, to evaluate and corroborate a specific plant condition since an incident could induce inconsistencies between instruments.

D. If the damaged S/G has been isolated and the cooldown is proceeding via Natural Circulation, an inverted temperature differential may be observed in the idle loop. This condition will have no effect on natural circulation flow in the intact S/G.

E. Minimize the number of cycles of pressurizer auxiliary spray when the temperature differential is greater than 400°F.

F. If a pump or component fails, the cause of the failure should be determined prior to restarting or starting a standby pump or component to prevent a common failure.

II. ENTRY CONDITIONS

The presence of one or more of the following conditions indicates that a Steam Generator Tube Rupture may have occurred:

A. Unexplained decrease in VCT level or pressurizer level.

B. Condenser Off-Gas RMS alarm.

C. S/G Blowdown RMS alarm.

D. Main Steam Line RMS alarm.

E. Main Vent RMS alarm.

F. Decreasing pressurizer pressure.

III. <u>RECOVERY ACTIONS</u>	<u>ALTERNATE ACTIONS</u>
A. VERIFY POST-TRIP IMMEDIATE ACTIONS COMPLETED.	
B. COMMENCE INTERMEDIATE SAFETY FUNCTION STATUS CHECK.	
C. DETERMINE APPROPRIATE EMERGENCY RESPONSE ACTIONS PER THE ERPIP.	
D. MONITOR RCS DEPRESSURIZATION.	
1. <u>IF</u> rapid depressurization to 1725 PSIA, <u>THEN</u> verify SIAS actuation <u>AND</u> the following actions: a. All available Charging Pumps running. b. 11 and 13 HPSI Pumps running. c. Main and Aux HPSI Header Valves open: 1-SI-616-MOV 1-SI-617-MOV 1-SI-626-MOV 1-SI-627-MOV 1-SI-636-MOV 1-SI-637-MOV 1-SI-646-MOV 1-SI-647-MOV	1.1 <u>IF</u> RCS pressure is greater than 1725 PSIA <u>AND</u> SIAS <u>NOT</u> actuated, <u>THEN</u> block SIAS: a. Open Main and Aux HPSI Header Valves: 1-SI-616-MOV 1-SI-617-MOV 1-SI-626-MOV 1-SI-627-MOV 1-SI-636-MOV 1-SI-637-MOV 1-SI-646-MOV 1-SI-647-MOV b. Start 11 and 13 HPSI Pumps. c. <u>WHEN</u> "PRSR PRESS BLOCK A(B) PERMITTED" alarm(s) received, <u>THEN</u> block SIAS A(B).

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
E. IMPLEMENT RCP TRIP STRATEGY:	
1. **IF** RCS pressure decreases to 1725 PSIA, **THEN** trip 11A and 12B RCPs **OR** trip 11B and 12A RCPs. 2. **IF** positive LOCA indications exist: a. RCS subcooling less than 30°F. b. Steady S/G pressure. c. S/G Blowdown RMS alarms clear **OR** Main Vent Gaseous RMS (1-RI-5415) alarm clear. **AND** RCS pressure decreases to less than 1300 PSIA, **THEN** trip all RCPs. 3. **IF** RCS temperature and pressure are less than the minimum pump operating limits per the RCP curve on Attachment (1), **THEN** trip all RCPs. 4. **IF** CIS has actuated, **THEN** trip all RCPs.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
F. DEPRESSURIZE RCS TO MAINTAIN SUBCOOLING BETWEEN 25 AND 35°F AND PRESSURIZER LEVEL BETWEEN 101 AND 160 INCHES:	
1. Shift 1-HIC-100 to MANUAL and open Pressurizer Spray Valve, on leg with operating RCP, as necessary to maintain subcooling between 25 and 35°F.	1.1 **IF** Pressurizer Spray Valves **NOT** effective, **THEN** initiate Auxiliary Spray: a. Record temperature differential between Pressurizer and Regenerative Heat Exchanger Outlet. b. Open Auxiliary Spray Valve, 1-CVC-517-CV. c. Shut Loop Charging Valves: 1-CVC-518-CV 1-CVC-519-CV d. Shift 1-HIC-100 to MANUAL and shut Pressurizer Spray Valves: 1-RC-100E-CV 1-RC-100F-CV
2. **WHEN** RCS pressure less than 1270 PSIA, **THEN** verify HPSI flow per Attachment (12).	

III. **RECOVERY ACTIONS** | **ALTERNATE ACTIONS**

3. **IF** the following conditions exist:

    a. At least 25°F subcooling.

    b. Pressurizer level greater than 101 inches.

    c. At least one S/G available for heat removal.

    d. RVLMS indicates that the Core is covered.

    THEN throttle HPSI flow to maintain pressurizer level between 101 and 160 inches.

4. **IF** RCS subcooling less than 25°F in an operating S/G loop, **THEN** raise RCS subcooling using one or more of the following actions:

    a. Shut Pressurizer Spray Valves.

    \- **NOTE** -

    Pressurizer Backup Heater Banks 11 and 13 trip on U/V and SIAS.

    b. Energize Pressurizer Heaters.

    c. Raise RCS cooldown rate.

5. **IF** RCS subcooling greater than 35°F in an operating S/G loop, **THEN** lower RCS subcooling using one or more of the following actions:

    a. De-energize Pressurizer Heaters.

    b. Operate Pressurizer Spray Valve on leg with operating RCP.

    Alternate action: 5.b.1 Initiate Auxiliary Spray per step F.1.1, page 6.

    c. Lower RCS cooldown rate.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
G. COMMENCE RCS COOLDOWN TO LOWER Thot TO 515°F:	
1. **WHEN** "SGIS A(B) BLOCK PERMITTED" alarm(s) received, **THEN** block SGIS A(B).	1.1 **IF** SGIS actuates, **THEN** reset SGIS: a. Place Condensate Booster Pumps in PULL-TO-LOCK. b. Match handswitches per SGIS Verification Checklist, Attachment (7). c. Block SGIS. d. Reset SGIS signal. e. Open MSIVs.
2. Commence cooldown to 515°F by throttling Turbine Bypass Valves, while maintaining less than 100°F/h RCS cooldown rate.	2.1 **IF** Turbine Bypass Valves **NOT** available, **THEN** throttle Atmospheric Dump Valves to commence cooldown. 2.2 Record total time Atmospheric Dump Valve open, for dose calculations, prior to identifying and isolating affected S/G.
3. **IF** Turbine Bypass Valves available, **THEN** ensure Atmospheric Dump Valves are shut.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
H. VERIFY BORATION IN PROGRESS:	
1. **IF** SIAS has actuated, **THEN** verify boration in progress: a. Shut VCT Makeup Valve, 1-CVC-512-CV. b. Open Boric Acid Direct Makeup Valve, 1-CVC-514-MOV. c. Boric Acid Pumps running. d. Open BAST Gravity Feed Valves: 1-CVC-508-MOV 1-CVC-509-MOV e. Shut VCT Outlet Valve, 1-CVC-501-MOV. f. All available Charging Pumps running.	1.1 **IF** SIAS **NOT** actuated, **THEN** commence boration: a. Shut VCT Makeup Valve, 1-CVC-512-CV. b. Open Boric Acid Direct Makeup Valve, 1-CVC-514-MOV. c. Start a Boric Acid Pump. d. Start all available Charging Pumps. 1.2 **IF** Boric Acid Pumps **NOT** available, **THEN** establish gravity feed: a. Open BAST Gravity Feed Valves: 1-CVC-508-MOV 1-CVC-509-MOV b. Shut VCT Outlet Valve, 1-CVC-501-MOV. c. Start all available Charging Pumps.
2. Continue boration until a total 65 inch decrease in BAST level(s) is achieved, or shutdown margin requirement of NEOG-7 is achieved.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
I. IDENTIFY AND CONFIRM AFFECTED S/G:	
1. Attempt to identify affected S/G by comparing the following trends: a. Mismatch in feed flow prior to trip. b. Unexplained increase in S/G level prior to trip. c. Main Steam Line RMS. d. Post-trip S/G level changes. e. S/G samples. 2. Shut S/G Blowdown Valves: 1-BD-4010-CV 1-BD-4011-CV 1-BD-4012-CV 1-BD-4013-CV 3. Shut AFW Steam Supply Valves by placing handswitches in CLOSE: 1-MS-4070-CV 1-MS-4071-CV 4. Secure Main Feed system: a. Trip S/G Feed Pumps. b. Place Condensate Booster Pumps in PULL-TO-LOCK. c. Place 2 of the 3 Condensate Pumps in PULL-TO-LOCK. d. Secure Heater Drain Pumps.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
e. Shut S/G Feedwater Isolation Valves: 1-FW-4516-MOV 1-FW-4517-MOV	
f. Shut Hotwell To CST Dump CV by shifting 1-LIC-4405 to MANUAL with 50% output.	
5. IF affected S/G NOT identified, THEN perform the following:	
a. Shut motor driven train AFW Block Valves on both S/Gs: 11 S/G: 1-AFW-4522-CV, 1-AFW-4523-CV 12 S/G: 1-AFW-4532-CV, 1-AFW-4533-CV	
b. Monitor S/G levels to determine affected S/G.	
c. Direct Chemistry to sample S/Gs.	
d. Direct Rad Con to perform a radiological survey of main steam lines.	
6. WHEN affected S/G identified OR if it is determined that both S/Gs are affected, OR if either S/G level decreases to -170 inches, THEN feed unaffected or least affected S/G per step J, page 12.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
J. FEED UNAFFECTED S/G.	
1. Establish AFW flow to unaffected S/G using 13 AFW Pump: a. For the affected S/G, shut the motor driven train AFW Block Valves: 11 S/G or 12 S/G 1-AFW-4522-CV 1-AFW-4532-CV 1-AFW-4523-CV 1-AFW-4533-CV b. For the unaffected S/G, place the motor driven train AFW Block Valve Handswitches in OPEN. - **CAUTION** - **D/G supplying power to 13 AFW Pump flow limit is 300 GPM; otherwise, flow limit is 575 GPM.** c. Start 13 AFW Pump. d. Adjust AFW Flow Control Valve on unaffected S/G to maintain S/G level between (-)24 and (+)30 inches. 11 S/G or 12 S/G 1-AFW-4525-CV 1-AFW-4535-CV	1.1 **IF** 13 AFW Pump **NOT** available, **THEN** establish AFW flow to unaffected S/G using 11 or 12 AFW Pump: a. For the affected S/G, shut the steam driven train AFW Block Valves: 11 S/G or 12 S/G 1-AFW-4520-CV 1-AFW-4530-CV 1-AFW-4521-CV 1-AFW-4531-CV b. For the unaffected S/G, place the steam driven train AFW Block Valve Handswitches in OPEN. - **CAUTION** - **The following step could result in an unmonitored radiation release if performed improperly.** c. For the unaffected S/G, open the AFW Steam Supply Valve. 11 S/G or 12 S/G 1-MS-4070-CV 1-MS-4071-CV d. Verify 11 or 12 AFW Pump discharge pressure approximately 100 PSI greater than unaffected S/G pressure. e. Adjust AFW Flow Control Valve on unaffected S/G to maintain S/G level between (-)24 and (+)30 inches. 11 S/G or 12 S/G 1-AFW-4511-CV 1-AFW-4512-CV

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
K. **WHEN** Thot DECREASES TO 515°F, **THEN** ISOLATE AFFECTED S/G:	
1. For the affected S/G, shut the MSIV.	
2. For the affected S/G, shut S/G Feedwater Isolation Valve. 11 S/G or 12 S/G 1-FW-4516-MOV 1-FW-4517-MOV	
3. For the affected S/G, shut the AFW Flow Control Valves: 11 S/G or 12 S/G 1-AFW-4511-CV 1-AFW-4512-CV 1-AFW-4525-CV 1-AFW-4535-CV	
4. For the affected S/G, shut the motor and steam driven train AFW Block Valves: 11 S/G or 12 S/G 1-AFW-4520-CV 1-AFW-4530-CV 1-AFW-4521-CV 1-AFW-4531-CV 1-AFW-4522-CV 1-AFW-4532-CV 1-AFW-4523-CV 1-AFW-4533-CV	
5. For the affected S/G, shut the AFW Steam Supply Valve. 11 S/G or 12 S/G 1-MS-4070-CV 1-MS-4071-CV	
6. For the affected S/G, shut the Atmospheric Dump Valve using the Hand Transfer Valves on the West wall of the Unit 1 45 ft Switchgear Room: a. Verify 1C43 Atmospheric Dump Controllers at 0% output.	6.1 **IF** Atmospheric Dump Valve will **NOT** shut from 1C43, **THEN** shut Atmospheric Dump Manual Isolation Valve. 11 S/G or 12 S/G 1-MS-101 1-MS-104

II. RECOVERY ACTIONS	ALTERNATE ACTIONS
b. Align Hand Transfer Valves to 1C43 position: 11 S/G or 12 S/G 1-HV-3938A 1-HV-3939A 1-HV-3938B 1-HV-3939B	
7. Shut MSIV Bypass Valves: 1-MS-4045-MOV 1-MS-4052-MOV	
8. Shut S/G Blowdown Valves: 1-BD-4010-CV 1-BD-4011-CV 1-BD-4012-CV 1-BD-4013-CV	
9. Shut upstream drains by placing handswitch 1-HS-6622 in CLOSE.	
10. Verify locally, from the Auxiliary Building Roof, that S/G Safety Valves are shut.	
11. **IF** wrong S/G was isolated, **THEN** unisolate that S/G **AND** isolate proper S/G.	
12. Maintain affected S/G level less than (+)30 inches and S/G pressure less than 900 PSIA per step W, page 25.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
L. **IF** RCPs SECURED, **THEN** CONFIRM NATURAL CIRCULATION IN UNAFFECTED S/G LOOP:	
- **NOTE** - Wide range Thot may be obtained from Subcooled Margin Monitor per Attachment (10). 1. Thot minus Tcold between 10 and 50°F. 2. Tcold constant or decreasing. 3. Thot constant or decreasing. 4. CET temperatures consistent with Thot. 5. Steaming rate affects primary temperature.	
M. MONITOR FOR CORE AND RCS VOIDING:	
- **CAUTION** - **Potential for void formation increases rapidly when pressure decreases below 1500 PSIA.** 1. Letdown flow greater than charging flow. 2. Rapid unexplained increase in pressurizer level during an RCS pressure reduction. 3. Loss of subcooled margin as determined using CET temperatures. 4. "REACTOR VESSEL WATER LEVEL LOW" alarm.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
N. **IF** VOIDING INHIBITS HEAT REMOVAL, **THEN** REDUCE OR ELIMINATE VOIDED AREA:	
1. Shut Letdown Isolation Valve, 1-CVC-515-CV. - **CAUTION** - **The potential exists for pressurized thermal shock from an excessive cooldown rate followed by a repressurization.** 2. Pressurize the RCS to maintain subcooling as near 140°F as practical. - **CAUTION** - **If voids exist in the S/G tubes, a rapid RCS pressure reduction will occur when the voids collapse.** 3. **IF** voiding occurs in the S/G tubes (saturation pressure of S/G greater than saturation pressure of RCS), **THEN** cool the S/G by raising any of the following: a. Steaming rate. b. Feed rate. c. S/G Blowdown rate. **AND** maintaining less than 100°F/h cooldown rate.	2.1 **IF** pressurizing the RCS does **NOT** restore heat removal, **THEN** operate Reactor Vessel Vent Valves per OI-1G.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
O. **WHEN** AFFECTED S/G IS ISOLATED, **THEN** CONTINUE RCS COOLDOWN AND DEPRESSURIZATION:	
1. Continue cooldown by throttling Turbine Bypass Valves, while maintaining less than 100°F/h RCS cooldown rate.	1.1 **IF** Turbine Bypass Valves **NOT** available, **THEN** throttle Atmospheric Dump Valve on unaffected S/G to continue RCS cooldown. 1.2 **IF** unable to obtain desired cooldown rate, **THEN** start 11 or 12 AFW Pump per step J.1.1, page 12.
2. Depressurize RCS to maintain RCS pressure approximately equal to affected S/G pressure.	
- **CAUTION** - **As RCS pressure decreases below 900 PSIA, NPSH requirements for the RCPs may require RCS subcooling to be greater than 35°F.**	
3. **WHEN** RCS pressure decreases below 900 PSIA, **THEN** perform the following: a. Ensure RCP NPSH requirements are maintained per Attachment (1). b. Maintain subcooling as low as the RCP operating curve will allow. c. Evaluate starting a second RCP, in desired loop per step V., page 22; secure RCP in opposite loop to allow a lower minimum RCS pressure.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
4. Maintain affected S/G pressure and level per step W, page 25. 5. Direct Chemistry and Rad Con to perform periodic samples for the following: a. RCS boron and activity. b. Both S/Gs for activity and boron. c. Turbine Building Sumps for activity. d. Condensate and CSTs for activity. e. Air samples and radiation surveys throughout plant to determine the spread of contamination.	
P. **WHEN** RCS BORATION COMPLETE, **THEN** SHIFT CHARGING PUMP SUCTION SUPPLY TO MAKEUP SUPPLY WITH A LOWER BORIC ACID CONCENTRATION.	
1. **IF** SIAS actuated, **THEN** perform the following: a. Open RWT To Charging Pump Suction Valve, 1-CVC-504-MOV. b. Shut VCT Outlet Valve, 1-CVC-501-MOV. c. Place Boric Acid Pumps in PULL-TO-LOCK. d. Ensure Charging Pump AMPS steady. e. Ensure BAST levels steady.	1.1 **IF** SIAS **NOT** actuated, **THEN** line up Charging Pump suction to VCT: a. Determine blend required to maintain shutdown boron concentration per NEOG-7. b. Open VCT Outlet Valve, 1-CVC-501-MOV. c. Secure Boric Acid Pump(s). d. Shut Boric Acid Direct Makeup Valve, 1-CVC-514-MOV.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
	e. Shut BAST Gravity Feed Valves: 1-CVC-508-MOV 1-CVC-509-MOV **OR** line up Charging Pump suction to RWT: a. Open RWT To Charging Pump Suction Valve, 1-CVC-504-MOV. b. Shut VCT Outlet Valve, 1-CVC-501-MOV. c. Shut Boric Acid Direct Makeup Valve, 1-CVC-514-MOV. d. Secure Boric Acid Pump(s).
Q. **IF** SIAS ACTUATED, **THEN** RESET SIAS:	
1. Perform SIAS Verification Checklist, Attachment (2). 2. Block pressurizer pressure signals and reset SIAS signal. 3. Restore equipment per SIAS Verification Checklist, Attachment (2), to desired condition.	
R. RESTORE SERVICE WATER TO TURBINE BUILDING:	
1. Verify 21 Plant Air Compressor operating. 2. Shut Plant Air To Plant Air Header Valve, 1-PA-2059-CV.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
3. Open Plant Air To Instrument Air Cross Connect Valve, 1-PA-2061-CV. 4. Open SRW Turbine Building Header Isolation Valves: 1-SRW-1600-CV 1-SRW-1637-CV 1-SRW-1638-CV 1-SRW-1639-CV	
S. RESTORE INSTRUMENT AIR COMPRESSORS TO SERVICE:	
1. **IF** high temperature alarm exists on the Instrument Air Compressors, **THEN** open the service water isolation valves by placing their handswitches in OPEN until temperature alarm clears. 11 or 12 1-HS-2063 1-HS-2065 2. Start at least one Instrument Air Compressor.	
T. RESTORE INSTRUMENT AIR TO CONTAINMENT:	
1. Open Cntmt Instrument Air Isolation MOV, 1-IA-2080-MOV.	

III. RECOVERY ACTIONS

ALTERNATE ACTIONS

- **NOTE** -

1-HS-2085 located on West wall of 27 ft Switchgear Room; Key #85 in Control Room Key Locker.

2. Open Cntmt Instrument Air Supply CV, 1-IA-2085-CV, by momentarily placing 1-HS-2085 in OPEN.

U. RESTORE LETDOWN FLOW:

1. Verify charging flowpath through Loop Charging Valves or Auxiliary Spray Valve.

2. Verify at least one Charging Pump operating.

3. Shift Letdown Control Valve Controller, 1-HIC-110, to MANUAL.

4. Adjust controller to shut Letdown Control Valves.

5. Open Letdown Isolation Valves:

   1-CVC-515-CV
   1-CVC-516-CV

- **CAUTION** -

The setpoint of 1-PIC-201 must be above the saturation pressure for the letdown outlet temperature of the Regenerative Heat Exchanger.

6. Adjust the setpoint on 1-PIC-201 and adjust 1-HIC-110 to maintain desired pressurizer level.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
V. **IF** RCPs WERE SECURED **AND** RCP RESTART CRITERIA MET, **THEN** RESTORE RCS FORCED CIRCULATION:	
- **CAUTION** - **Uncontrolled restoration of cooling to hot RCP seals may cause degradation of the metallic seating surfaces by thermal shock.** 1. **IF** Component Cooling is isolated to RCP seals, **THEN** reduce RCP lower seal temperature below 280°F prior to initiating full cooling flow to the RCPs: a. Shut Component Cooling Supply Containment Manual Isolation Valve, 1-CC-284, located in 5 ft East Penetration Room. b. Verify CIS reset. c. Open Component Cooling Containment Isolation Valves: 1-CC-3832-CV 1-CC-3833-CV d. Slowly open 1-CC-284 to throttle component cooling flow until lower seal temperatures are less than 280°F. e. **WHEN** lower seal temperatures are less than 280°F, **THEN** fully open 1-CC-284.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
2. **IF** an RCP lower seal temperature exceeded 280°F, **THEN** an engineering evaluation is required prior to restarting that RCP.	
3. Raise pressurizer level to at least 155 inches.	
4. Verify RCP restart criteria:	
a. RCS subcooling greater than 30°F.	
b. At least one S/G available for heat removal.	
c. Pressurizer level greater than 155 inches and stable.	
d. Tcold less than 525°F.	
e. RCS temperature and pressure greater than the minimum operating limits per the RCP curve on Attachment (1).	
- **NOTE** - Starting an RCP may cause a pressurizer level transient.	
5. **WHEN** RCP restart criteria met, **THEN** start one RCP in a loop with an operable S/G:	
a. Verify "COMPT CLG FLOW LO" alarm clear.	
b. Start Oil Lift Pump.	
c. Insert RCP sync stick.	
d. Start one RC[illegible]	

III. RECOVERY ACTIONS

ALTERNATE ACTIONS

e. Verify RCP running current:

Tavg	Current
525 to 572°F	238 to 210 AMPS and steady
210 to 525°F	264 to 238 AMPS and steady

6. **IF** pressurizer level decreases, **THEN** start Charging or HPSI Pump(s) as necessary to restore **AND** maintain level greater than 155 inches.

7. Monitor RCP seal parameters following pump restart.

8. Allow backflow to equalize temperatures in opposite loop.

9. Start second RCP in opposite loop per steps V.5 and V.7, pages 23 and 24.

10. Secure Auxiliary Spray:

    a. Open Loop Charging Valves:

       1-CVC-518-CV
       1-CVC-519-CV

    b. Shut Auxiliary Spray Valve, 1-CVC-517-CV.

    c. Shift Pressurizer Spray Controller, 1-HIC-100, to AUTO.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
W. PRESSURE AND LEVEL CONTROL OF AFFECTED S/G:	
- **NOTE** - The following methods for controlling affected S/G pressure and level are listed in preferred order and should be attempted in that order. 1. Maintain affected S/G pressure approximately equal to RCS pressure and S/G level between (-)24 and (+)30 inches by: a. Steaming S/G to Condenser per step W.2, page 25. b. S/G Blowdown to Condenser per step W.3, page 27. c. S/G Blowdown to MWS per step W.4, page 29. d. Steaming S/G to atmosphere per step W.5, page 31. e. Filling S/G to MSIV per step W.6, page 32. 2. Pressure and level control of affected S/G by steaming to Condenser: a. Ensure condenser vacuum greater than 20 IN Hg. b. Ensure at least one Condensate Demin in service. c. Open Condensate Precoat Filter Bypass Valve, 1-CD-5818-CV. d. Shut Condensate Demin Bypass Valve, 1-CD-4439-MOV.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
e. Throttle open Feedwater Dump To Condenser Hotwell Valves, 1-FW-134 and 1-FW-135, to obtain maximum condensate flow through Condensate Demin.	
f. Shut Condenser High Level Dump CV Inlet Valve, 1-CD-232.	
- NOTE - Maintaining S/G level above top of tube bundle provides a large decontamination factor due to the water covering the break.	
g. Maintain affected S/G level between (-)24 and (+)30 inches by operating AFW.	
h. Operate upstream drains using 1-HS-6622 as necessary to control affected S/G pressure.	
- CAUTION - **Do not operate MSIV Bypass Valve on a S/G whose level exceeded (+)63.5 inches.**	
i. IF additional steam flow desired, THEN operate MSIV Bypass Valve on affected S/G. 11 S/G or 12 S/G 1-MS-4045-MOV 1-MS-4052-MOV	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
3. Pressure and level control of affected S/G by blowdown to Condenser: a. Ensure at least one Condensate Demin in service. b. Open Condensate Precoat Filter Bypass Valve, 1-CD-5818-CV. c. Shut Condensate Demin Bypass Valve, 1-CD-4439-MOV. d. Throttle open Feedwater Dump To Condenser Hotwell Valves, 1-FW-134 and 1-FW-135, to obtain maximum condensate flow through Condensate Demin. e. Shut Condenser High Level Dump CV Inlet Valve, 1-CD-232. f. Place S/G Blowdown Recovery System Radiation Monitor, 1-RE-4095, in RESET. g. Shut B/D Recovery Discharge To MWS, 1-BD-4097-CV. h. Shut B/D Recovery Discharge To Circ Water, 1-BD-4015-CV. i. Open B/D Recovery To Condenser, 1-BD-4096-CV. j. Shut S/G Combined B/D Header Throttle Valves: 1-BD-102 1-BD-104	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
k. Open the affected S/G Bottom Blowdown Valve by placing handswitch in RAD TRIP OVERRIDE. 11 S/G or 12 S/G 1-BD-4011-CV 1-BD-4013-CV l. Throttle open S/G Combined B/D Header Throttle Valve on affected S/G to obtain a blowdown flow of approximately 100 GPM. 11 S/G or 12 S/G 1-BD-102 1-BD-104 m. Throttle SRW flow to 12 Blowdown Heat Exchanger to maintain a blowdown discharge temperature between 105 and 115°F using 12 B/D Heat Exchanger Discharge Valve, 1-SRW-522. - **NOTE** - Maintaining S/G level above top of tube bundle provides a large decontamination factor due to the water covering the break. n. Alternately lower and raise affected S/G level by: (1) S/G Blowdown to Condenser to (-)24 inches. (2) Operating AFW to (+)30 inches.	

VII. RECOVERY ACTIONS	ALTERNATE ACTIONS
4. Pressure and level control of affected S/G by blowdown to MWS:	
a. Place S/G Blowdown Recovery System Radiation Monitor, 1-RE-4095, in PULSE CAL and bypass its alarm.	
b. Open B/D Recovery Discharge To MWS, 1-BD-4097-CV.	
c. Shut B/D Recovery Discharge To Circ Water, 1-BD-4015-CV.	
d. Shut B/D Recovery To Condenser, 1-BD-4096-CV.	
e. Shut S/G Combined B/D Header Throttle Valves: 1-BD-102 1-BD-104	
f. Open the affected S/G Bottom Blowdown Valve by placing handswitch in RAD TRIP OVERRIDE. 11 S/G or 12 S/G 1-BD-4011-CV 1-BD-4013-CV	
g. Throttle open S/G Combined B/D Header Throttle Valve on affected S/G to obtain a blowdown flow of approximately 100 GPM. 11 S/G or 12 S/G 1-BD-102 1-BD-104	

III. RECOVERY ACTIONS

h. Throttle SRW flow to 12 Blowdown Heat Exchanger to maintain a blowdown discharge temperature between 105 and 115°F using 12 B/D Heat Exchanger Discharge Valve, 1-SRW-522.

i. Pump MWRT to RCWMT per OI-17D.

j. Monitor MWRT level at 1C33.

k. Throttle S/G blowdown rate to maintain a constant level in MWRT while pumping to RCWMT.

- **NOTE** -

Maintaining S/G level above top of tube bundle provides a large decontamination factor due to the water covering the break.

l. Alternately lower and raise affected S/G level by:

(1) S/G Blowdown to MWS to (-)24 inches.

(2) Operating AFW to (+)30 inches.

ALTERNATE ACTIONS

III. RECOVERY ACTIONS

- **CAUTION** -

Do not operate Atmospheric Dump Valve on a S/G whose level exceeded (+)63.5 inches.

5. Pressure and level control of affected S/G by steaming to atmosphere from 1C43:

   a. Establish communications at 1C43.

   b. Verify 1C43 Atmospheric Dump Controllers at 0 output.

   c. Verify Hand Transfer Valves for affected S/G are selected to 1C43 position:

11 S/G	or	12 S/G
1-HV-3938A		1-HV-3939A
1-HV-3938B		1-HV-3939B

- **NOTE** -

Maintaining S/G level above top of tube bundle provides a large decontamination factor due to the water covering the break.

   d. Maintain affected S/G level between (-)24 and (+)30 inches by operating AFW.

   e. Adjust Atmospheric Dump from 1C43 as directed by Control Room Personnel to control affected S/G pressure.

   f. Record total time Atmospheric Dump Valve open, for dose calculations.

ALTERNATE ACTIONS

5.1 **IF** Atmospheric Dump was previously isolated, **THEN** throttle open Atmospheric Dump Manual Isolation Valve as directed by Control Room Personnel to control affected S/G pressure.

11 S/G	or	12 S/G
1-MS-101		1-MS-104

5.2 Maintain affected S/G level between (-)24 and (+)30 inches by operating AFW.

5.3 Record total time Atmospheric Dump Valve open, for dose calculations.

II. RECOVERY ACTIONS	ALTERNATE ACTIONS
6. Affected S/G may be allowed to fill to MSIV provided the following conditions are maintained: a. RCS pressure below 900 PSIA. b. MSIVs, Atmospheric Dump Valves and MSIV Bypass Valves remain shut.	
X. COMPLETE ADMINISTRATIVE POST-TRIP ACTIONS AND IMPLEMENT APPROPRIATE OPERATING PROCEDURE.	

Y. ADMINISTRATIVE POST-TRIP ACTIONS:

- **NOTE** -

The following actions may be accomplished whenever feasible. They may be done in any order.

_______ 1. Refer to ERPIP to determine appropriate emergency response actions.

_______ 2. Perform notifications per CCI-118.

_______ 3. Notify ESO of trip.

_______ 4. Request RCS Boron and Iodine sample.

_______ 5. Perform shutdown margin calculation per NEOG 2 and 7.

_______ 6. Complete transient log entries per CCI-301.

_______ 7. Recall post-trip review (preferably within 30 minutes of trip).

_______ 8. Perform post-trip review per CCI-111.

_______ 9. Monitor turbine bearing temperatures.

_______ 10. Continue Main Turbine shutdown per applicable step of OI-43A.

END OF SECTION III.

IV. SAFETY FUNCTION STATUS CHECK

A. The STA (or person designated by STA) will perform the intermediate and final safety function checks respectively on entry and prior to exiting from this procedure.

B. Perform intermediate safety function status check at 10 minute intervals until plant conditions stabilize.

C. Immediately notify Shift Supervisor or Control Room Supervisor if any safety function criteria is not being satisfied.

D. Review data and verify that safety function acceptance criteria are satisfied.

E. When EOP completed, then perform final safety function check.

REACTIVITY CONTROL PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. WRNI power	less than 3%	__________	less than 1%	__________
b. SUR (DPM)	negative	__________	0	__________
c. CEA status	all inserted	__________	all inserted	__________
or				
Boration status:				
concentation	increasing	__________	appropriate S/D margin	__________
BAST level	decreasing	__________	N/A	N/A

RCS PRESSURE AND INVENTORY PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Pressurizer pressure (PSIA)	300 to 1900	----------	greater than 300	________
b. Pressurizer level (inches)	0 to 200	----------	101 to 160	________
c. RCS subcooling (^{O}F)	25 to 140	----------	25 to 140	________

CORE AND RCS HEAT REMOVAL PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. RCS Tcold (^{O}F)	less than 535	--------	300 to 515	________
b. Thot minus Tcold (^{O}F)				
Natural Circulation	10 to 50	--------	10 to 50	________
Forced Circulation	less than 10	--------	less than 10	________
c. Affected S/G pressure (PSIA)	less than 920	--------	less than 900	________
d. Affected S/G level (inches)	less than (+)30	--------	less than (+)30	________
e. Unaffected S/G pressure (PSIA)	70 to 920	--------	70 to 730	________
f. Unaffected S/G level (inches)	(-)170 to (+)30	--------	(-)24 to (+)30	________
g. Condensate Storage Tank level (ft)	greater than 5	--------	greater than 5	________

VITAL AUXILIARIES	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. 4KV vital buses 11 or 14	energized	----------	energized	________
b. Instrument Air pressure (PSIG)	greater than 88	----------	greater than 88	________
c. Component Cooling (# pumps running)	1 or 2	----------	1 or 2	________
d. Saltwater (# pumps running)	1 or 2	----------	1 or 2	________
e. Service Water (# pumps running)	1 or 2	----------	1 or 2	________
f. 125V DC buses 11, 12, 21, 22	energized	----------	energized	________
g. 120V AC vital buses 11, 12, 13, 14	energized	----------	energized	________

NORMAL CONTAINMENT ENVIRONMENT PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Containment pressure (PSIG)	less than 0.7	--------	less than 0.7	________
b. Containment temperature (°F)	less than 120	--------	less than 120	________
c. Containment High Range Radiation Monitor	alarm clear	--------	alarm clear	________

NORMAL RADIATION LEVELS EXTERNAL TO CONTAINMENT		SAFETY FUNCTION ACCEPTANCE CRITERIA		
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Noble Gas Monitor (1)	alarming	----------	alarm clear	________
b. Condenser Off-Gas (1) RMS	alarming	----------	alarm clear	________
c. S/G B/D RMS (1)	alarming	----------	alarm clear	________
d. Main Vent Gaseous (1) RMS (1-RI-5415)	alarming	----------	alarm clear	________

(1) RMS alarms are break size and RCS activity dependent.

STATUS CHECK NUMBER	COMPLETE AT TIME
1	________
2	________
3	________
4	________
________	________
________	________
________	________

CALVERT CLIFFS NUCLEAR POWER PLANT

EOP-6 STEAM GENERATOR TUBE RUPTURE

REVISION 1

	SIGNATURE	DATE
PREPARED BY;	[signature]	12-18-87
VERIFIED BY;	James V. Grooms	12/18/87
POSRC;	MEETING # 88-7	2-10-88
APPROVED BY;	J.R. Lemons	2-10-88

Manager-Nuclear Operations or General Supervisor-Operations if POSRC review is not required

LIST OF EFFECTIVE PAGES

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13	1
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35	1
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37	1

STEAM GENERATOR TUBE RUPTURE

I. PRECAUTIONS

A. Do not adopt manual operation of automatically controlled systems unless a malfunction is apparent or automatic system operation will not support the maintenance of a safety function.

B. Systems shifted to manual must be monitored frequently to ensure correct operation.

C. At least two independent indications should be used, when available, to evaluate and corroborate a specific plant condition since an incident could induce inconsistencies between instruments.

D. If the damaged S/G has been isolated and the cooldown is proceeding via Natural Circulation, an inverted temperature differential may be observed in the idle loop. This condition will have no effect on natural circulation flow in the intact S/G.

E. Minimize the number of cycles of pressurizer auxiliary spray when the temperature differential is greater than 400°F.

F. If a pump or component fails, the cause of the failure should be determined prior to restarting or starting a standby pump or component to prevent a common failure.

II. ENTRY CONDITIONS

The presence of one or more of the following conditions indicates that a Steam Generator Tube Rupture may have occurred:

A. Unexplained decrease in VCT level or pressurizer level.

B. Condenser Off-Gas RMS alarm.

C. S/G Blowdown RMS alarm.

D. Main Steam Line RMS alarm.

E. Main Vent RMS alarm.

F. Decreasing pressurizer pressure.

III. **RECOVERY ACTIONS**	**ALTERNATE ACTIONS**
A. VERIFY POST-TRIP IMMEDIATE ACTIONS COMPLETED.	
B. COMMENCE INTERMEDIATE SAFETY FUNCTION STATUS CHECK.	
C. DETERMINE APPROPRIATE EMERGENCY RESPONSE ACTIONS PER THE ERPIP.	
D. MONITOR RCS DEPRESSURIZATION.	
1. **IF** rapid depressurization to 1725 PSIA, **THEN** verify SIAS actuation **AND** the following actions: a. All available Charging Pumps running. b. 21 and 23 HPSI Pumps running. c. Main and Aux HPSI Header Valves open: 2-SI-616-MOV 2-SI-617-MOV 2-SI-626-MOV 2-SI-627-MOV 2-SI-636-MOV 2-SI-637-MOV 2-SI-646-MOV 2-SI-647-MOV	1.1 **IF** RCS pressure is greater than 1725 PSIA **AND** SIAS **NOT** actuated, **THEN** block SIAS: a. Open Main and Aux HPSI Header Valves: 2-SI-616-MOV 2-SI-617-MOV 2-SI-626-MOV 2-SI-627-MOV 2-SI-636-MOV 2-SI-637-MOV 2-SI-646-MOV 2-SI-647-MOV b. Start 21 and 23 HPSI Pumps. c. **WHEN** "PRSR PRESS BLOCK A(B) PERMITTED" alarm(s) received, **THEN** block SIAS A(B).

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
E. IMPLEMENT RCP TRIP STRATEGY:	
1. IF RCS pressure decreases to 1725 PSIA, THEN trip 21A and 22B RCPs OR trip 21B and 22A RCPs. 2. IF positive LOCA indications exist: a. RCS subcooling less than 30°F. b. Steady S/G pressure. c. S/G Blowdown RMS alarms clear OR Main Vent Gaseous RMS (2-RI-5415) alarm clear. AND RCS pressure decreases to less than 1300 PSIA, THEN trip all RCPs. 3. IF RCS temperature and pressure are less than the minimum pump operating limits per the RCP curve on Attachment (1), THEN trip all RCPs. 4. IF CIS has actuated, THEN trip all RCPs.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
F. DEPRESSURIZE RCS TO MAINTAIN SUBCOOLING BETWEEN 25 AND 35°F AND PRESSURIZER LEVEL BETWEEN 101 AND 160 INCHES:	
1. Shift 2-HIC-100 to MANUAL and open Pressurizer Spray Valve, on leg with operating RCP, as necessary to maintain subcooling between 25 and 35°F.	1.1 **IF** Pressurizer Spray Valves **NOT** effective, **THEN** initiate Auxiliary Spray: a. Record temperature differential between Pressurizer and Regenerative Heat Exchanger Outlet. b. Open Auxiliary Spray Valve, 2-CVC-517-CV. c. Shut Loop Charging Valves: 2-CVC-518-CV 2-CVC-519-CV d. Shift 2-HIC-100 to MANUAL and shut Pressurizer Spray Valves: 2-RC-100E-CV 2-RC-100F-CV
2. **WHEN** RCS pressure less than 1270 PSIA, **THEN** verify HPSI flow per Attachment (12).	

III. RECOVERY ACTIONS

ALTERNATE ACTIONS

3. **IF** the following conditions exist:

   a. At least 25°F subcooling.

   b. Pressurizer level greater than 101 inches.

   c. At least one S/G available for heat removal.

   d. RVLMS indicates that the Core is covered.

   THEN throttle HPSI flow to maintain pressurizer level between 101 and 160 inches.

4. **IF** RCS subcooling less than 25°F in an operating S/G loop, **THEN** raise RCS subcooling using one or more of the following actions:

   a. Shut Pressurizer Spray Valves.

   \- **NOTE** -

   Pressurizer Backup Heater Banks 21 and 23 trip on U/V and SIAS.

   b. Energize Pressurizer Heaters.

   c. Raise RCS cooldown rate.

5. **IF** RCS subcooling greater than 35°F in an operating S/G loop, **THEN** lower RCS subcooling using one or more of the following actions:

   a. De-energize Pressurizer Heaters.

   b. Operate Pressurizer Spray Valve on leg with operating RCP.

   5.b.1 Initiate Auxiliary Spray per step F.1.1, page 6.

   c. Lower RCS cooldown rate.

II. RECOVERY ACTIONS	ALTERNATE ACTIONS
G. COMMENCE RCS COOLDOWN TO LOWER Thot TO 515°F:	
1. **WHEN** "SGIS A(B) BLOCK PERMITTED" alarm(s) received, **THEN** block SGIS A(B).	1.1 **IF** SGIS actuates, **THEN** reset SGIS: a. Place Condensate Booster Pumps in PULL-TO-LOCK. b. Match handswitches per SGIS Verification Checklist, Attachment (7). c. Block SGIS. d. Reset SGIS signal. e. Open MSIVs.
2. Commence cooldown to 515°F by throttling Turbine Bypass Valves, while maintaining less than 100°F/h RCS cooldown rate.	2.1 **IF** Turbine Bypass Valves **NOT** available, **THEN** throttle Atmospheric Dump Valves to commence cooldown. 2.2 Record total time Atmospheric Dump Valve open, for dose calculations, prior to identifying and isolating affected S/G.
3. **IF** Turbine Bypass Valves available, **THEN** ensure Atmospheric Dump Valves are shut.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
H. VERIFY BORATION IN PROGRESS:	
1. **IF** SIAS has actuated, **THEN** verify boration in progress: a. Shut VCT Makeup Valve, 2-CVC-512-CV. b. Open Boric Acid Direct Makeup Valve, 2-CVC-514-MOV. c. Boric Acid Pumps running. d. Open BAST Gravity Feed Valves: 2-CVC-508-MOV 2-CVC-509-MOV e. Shut VCT Outlet Valve, 2-CVC-501-MOV. f. All available Charging Pumps running.	1.1 **IF** SIAS **NOT** actuated, **THEN** commence boration: a. Shut VCT Makeup Valve, 2-CVC-512-CV. b. Open Boric Acid Direct Makeup Valve, 2-CVC-514-MOV. c. Start a Boric Acid Pump. d. Start all available Charging Pumps. 1.2 **IF** Boric Acid Pumps **NOT** available, **THEN** establish gravity feed: a. Open BAST Gravity Feed Valves: 2-CVC-508-MOV 2-CVC-509-MOV b. Shut VCT Outlet Valve. 2-CVC-501-MOV. c. Start all available Charging Pumps.
2. Continue boration until a total 65 inch decrease in BAST level(s) is achieved, or shutdown margin requirement of NEOG-11 is achieved.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
I. IDENTIFY AND CONFIRM AFFECTED S/G:	
1. Attempt to identify affected S/G by comparing the following trends: a. Mismatch in feed flow prior to trip. b. Unexplained increase in S/G level prior to trip. c. Main Steam Line RMS. d. Post-trip S/G level changes. e. S/G samples. 2. Shut S/G Blowdown Valves: 2-BD-4010-CV 2-BD-4011-CV 2-BD-4012-CV 2-BD-4013-CV 3. Shut AFW Steam Supply Valves by placing handswitches in CLOSE: 2-MS-4070-CV 2-MS-4071-CV 4. Secure Main Feed system: a. Trip S/G Feed Pumps. b. Place Condensate Booster Pumps in PULL-TO-LOCK. c. Place 2 of the 3 Condensate Pumps in PULL-TO-LOCK. d. Secure Heater Drain Pumps.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS

e. Shut S/G Feedwater Isolation Valves:

2-FW-4516-MOV
2-FW-4517-MOV

f. Shut Hotwell To CST Dump CV by shifting 2-LIC-4405 to MANUAL with 50% output.

5. **IF** affected S/G **NOT** identified, **THEN** perform the following:

a. Shut motor driven train AFW Block Valves on both S/Gs:

21 S/G	22 S/G
2-AFW-4522-CV	2-AFW-4532-CV
2-AFW-4523-CV	2-AFW-4533-CV

b. Monitor S/G levels to determine affected S/G.

c. Direct Chemistry to sample S/Gs.

d. Direct Rad Con to perform a radiological survey of main steam lines.

6. **WHEN** affected S/G identified **OR** if it is determined that both S/Gs are affected, **OR** if either S/G level decreases to -170 inches, **THEN** feed unaffected or least affected S/G per step J, page 12.

III. RECOVERY ACTIONS

ALTERNATE ACTIONS

J. FEED UNAFFECTED S/G.

Recovery Actions

1. Establish AFW flow to unaffected S/G using 23 AFW Pump:

   a. For the affected S/G, shut the motor driven train AFW Block Valves:

21 S/G	or	22 S/G
2-AFW-4522-CV		2-AFW-4532-CV
2-AFW-4523-CV		2-AFW-4533-CV

   b. For the unaffected S/G, place the motor driven train AFW Block Valve Handswitches in OPEN.

- **CAUTION** -

D/G supplying power to 23 AFW Pump flow limit is 300 GPM; otherwise, flow limit is 575 GPM.

   c. Start 23 AFW Pump.

   d. Adjust AFW Flow Control Valve on unaffected S/G to maintain S/G level between (-)24 and (+)30 inches.

21 S/G	or	22 S/G
2-AFW-4525-CV		2-AFW-4535-CV

Alternate Actions

1.1 **IF** 23 AFW Pump **NOT** available, **THEN** establish AFW flow to unaffected S/G using 21 or 22 AFW Pump:

   a. For the affected S/G, shut the steam driven train AFW Block Valves:

21 S/G	or	22 S/G
2-AFW-4520-CV		2-AFW-4530-CV
2-AFW-4521-CV		2-AFW-4531-CV

   b. For the unaffected S/G, place the steam driven train AFW Block Valve Handswitches in OPEN.

- **CAUTION** -

The following step could result in an unmonitored radiation release if performed improperly.

   c. For the unaffected S/G, open the AFW Steam Supply Valve.

21 S/G	or	22 S/G
2-MS-4070-CV		2-MS-4071-CV

   d. Verify 21 or 22 AFW Pump discharge pressure approximately 100 PSI greater than unaffected S/G pressure.

   e. Adjust AFW Flow Control Valve on unaffected S/G to maintain S/G level between (-)24 and (+)30 inches.

21 S/G	or	22 S/G
2-AFW-4511-CV		2-AFW-4512-CV

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
K. **WHEN** Thot DECREASES TO 515°F, **THEN** ISOLATE AFFECTED S/G:	
1. For the affected S/G, shut the MSIV.	
2. For the affected S/G, shut S/G Feedwater Isolation Valve. 21 S/G or 22 S/G 2-FW-4516-MOV 2-FW-4517-MOV	
3. For the affected S/G, shut the AFW Flow Control Valves: 21 S/G or 22 S/G 2-AFW-4511-CV 2-AFW-4512-CV 2-AFW-4525-CV 2-AFW-4535-CV	
4. For the affected S/G, shut the motor and steam driven train AFW Block Valves: 21 S/G or 22 S/G 2-AFW-4520-CV 2-AFW-4530-CV 2-AFW-4521-CV 2-AFW-4531-CV 2-AFW-4522-CV 2-AFW-4532-CV 2-AFW-4523-CV 2-AFW-4533-CV	
5. For the affected S/G, shut the AFW Steam Supply Valve. 21 S/G or 22 S/G 2-MS-4070-CV 2-MS-4071-CV	
6. For the affected S/G, shut the Atmospheric Dump Valve using the Hand Transfer Valves on the West wall of the Unit 2 45 ft Switchgear Room: a. Verify 2C43 Atmospheric Dump Controllers at 0% output.	6.1 **IF** Atmospheric Dump Valve will **NOT** shut from 2C43, **THEN** shut Atmospheric Dump Manual Isolation Valve. 21 S/G or 22 S/G 2-MS 101 2-MS-104

III. RECOVERY ACTIONS

b. Align Hand Transfer Valves to 2C43 position:

21 S/G	or 22 S/G
2-HV-3939A	2-HV-3938A
2-HV-3939B	2-HV-3938B

7. Shut MSIV Bypass Valves:

   2-MS-4045-MOV
   2-MS-4052-MOV

8. Shut S/G Blowdown Valves:

   2-BD-4010-CV
   2-BD-4011-CV
   2-BD-4012-CV
   2-BD-4013-CV

9. Shut upstream drains by placing handswitch 2-HS-6622 in CLOSE.

10. Verify locally, from the Auxiliary Building Roof, that S/G Safety Valves are shut.

11. IF wrong S/G was isolated, THEN unisolate that S/G AND isolate proper S/G.

12. Maintain affected S/G level less than (+)30 inches and S/G pressure less than 900 PSIA per step W, page 25.

ALTERNATE ACTIONS

III. **RECOVERY ACTIONS**	**ALTERNATE ACTIONS**
L. **IF** RCPs SECURED, **THEN** CONFIRM NATURAL CIRCULATION IN UNAFFECTED S/G LOOP:	
- **NOTE** - Wide range Thot may be obtained from Subcooled Margin Monitor per Attachment (10). 1. Thot minus Tcold between 10 and 50°F. 2. Tcold constant or decreasing. 3. Thot constant or decreasing. 4. CET temperatures consistent with Thot. 5. Steaming rate affects primary temperature.	
M. MONITOR FOR CORE AND RCS VOIDING:	
- **CAUTION** - Potential for void formation increases rapidly when pressure decreases below 1500 PSIA. 1. Letdown flow greater than charging flow. 2. Rapid unexplained increase in pressurizer level during an RCS pressure reduction. 3. Loss of subcooled margin as determined using CET temperatures. 4. "REACTOR VESSEL WATER LEVEL LOW" alarm.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
N. IF VOIDING INHIBITS HEAT REMOVAL, THEN REDUCE OR ELIMINATE VOIDED AREA:	
1. Shut Letdown Isolation Valve, 2-CVC-515-CV. - CAUTION - **The potential exists for pressurized thermal shock from an excessive cooldown rate followed by a repressurization.** 2. Pressurize the RCS to maintain subcooling as near 140°F as practical. - CAUTION - **If voids exist in the S/G tubes, a rapid RCS pressure reduction will occur when the voids collapse.** 3. IF voiding occurs in the S/G tubes (saturation pressure of S/G greater than saturation pressure of RCS), THEN cool the S/G by raising any of the following: a. Steaming rate. b. Feed rate. c. S/G Blowdown rate. AND maintaining less than 100°F/h cooldown rate.	2.1 IF pressurizing the RCS does NOT restore heat removal, THEN operate Reactor Vessel Vent Valves per OI-1G.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
O. **WHEN** AFFECTED S/G IS ISOLATED, **THEN** CONTINUE RCS COOLDOWN AND DEPRESSURIZATION:	
1. Continue cooldown by throttling Turbine Bypass Valves, while maintaining less than 100°F/h RCS cooldown rate.	1.1 **IF** Turbine Bypass Valves **NOT** available, **THEN** throttle Atmospheric Dump Valve on unaffected S/G to continue RCS cooldown. 1.2 **IF** unable to obtain desired cooldown rate, **THEN** start 21 or 22 AFW Pump per step J.1.1, page 12.
2. Depressurize RCS to maintain RCS pressure approximately equal to affected S/G pressure.	
- CAUTION - **As RCS pressure decreases below 900 PSIA, NPSH requirements for the RCPs may require RCS subcooling to be greater than 35°F.**	
3. **WHEN** RCS pressure decreases below 900 PSIA, **THEN** perform the following: a. Ensure RCP NPSH requirements are maintained per Attachment (1). b. Maintain subcooling as low as the RCP operating curve will allow. c. Evaluate starting a second RCP, in desired loop per step V., page 22; secure RCP in opposite loop to allow a lower minimum RCS pressure.	

VII. RECOVERY ACTIONS	ALTERNATE ACTIONS
4. Maintain affected S/G pressure and level per step W, page 25. 5. Direct Chemistry and Rad Con to perform periodic samples for the following: a. RCS boron and activity. b. Both S/Gs for activity and boron. c. Turbine Building Sumps for activity. d. Condensate and CSTs for activity. e. Air samples and radiation surveys throughout plant to determine the spread of contamination.	
P. **WHEN** RCS BORATION COMPLETE, **THEN** SHIFT CHARGING PUMP SUCTION SUPPLY TO MAKEUP SUPPLY WITH A LOWER BORIC ACID CONCENTRATION.	
1. **IF** SIAS actuated, **THEN** perform the following: a. Open RWT To Charging Pump Suction Valve, 2-CVC-504-MOV. b. Shut VCT Outlet Valve, 2-CVC-501-MOV. c. Place Boric Acid Pumps in PULL-TO-LOCK. d. Ensure Charging Pump AMPS steady. e. Ensure BAST levels steady.	1.1 **IF** SIAS **NOT** actuated, **THEN** line up Charging Pump suction to VCT: a. Determine blend required to maintain shutdown boron concentration per NEOG-11. b. Open VCT Outlet Valve, 2-CVC-501-MOV. c. Secure Boric Acid Pump(s). d. Shut Boric Acid Direct Makeup Valve, 2-CVC-514-MOV.

III. **RECOVERY ACTIONS**	**ALTERNATE ACTIONS**
	e. Shut BAST Gravity Feed Valves: 2-CVC-508-MOV 2-CVC-509-MOV **OR** line up Charging Pump suction to RWT: a. Open RWT To Charging Pump Suction Valve, 2-CVC-504-MOV. b. Shut VCT Outlet Valve, 2-CVC-501-MOV. c. Shut Boric Acid Direct Makeup Valve, 2-CVC-514-MOV. d. Secure Boric Acid Pump(s).
. **IF** SIAS ACTUATED, **THEN** RESET SIAS:	
1. Perform SIAS Verification Checklist, Attachment (2). 2. Block pressurizer pressure signals and reset SIAS signal. 3. Restore equipment per SIAS Verification Checklist, Attachment (2), to desired condition.	
R. RESTORE SERVICE WATER TO TURBINE BUILDING:	
1. Verify 11 Plant Air Compressor operating. 2. Shut Plant Air To Plant Air Header Valve, 2-PA-2059-CV.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
3. Open Plant Air To Instrument Air Cross Connect Valve, 2-PA-2061-CV. 4. Open SRW Turbine Building Header Isolation Valves: 2-SRW-1600-CV 2-SRW-1637-CV 2-SRW-1638-CV 2-SRW-1639-CV	
S. RESTORE INSTRUMENT AIR COMPRESSORS TO SERVICE:	
1. **IF** high temperature alarm exists on the Instrument Air Compressors, **THEN** open the service water isolation valves by placing their handswitches in OPEN until temperature alarm clears. 21 or 22 2-HS-2063 2-HS-2065 2. Start at least one Instrument Air Compressor.	
T. RESTORE INSTRUMENT AIR TO CONTAINMENT:	
1. Open Cntmt Instrument Air Isolation MOV, 2-IA-2080-MOV.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
- **NOTE** - 2-HS-2085 located on West wall of 27 ft Switchgear Room; Key #80 in Control Room Key Locker. 2. Open Cntmt Instrument Air Supply CV, 2-IA-2085-CV, by momentarily placing 2-HS-2085 in OPEN.	
U. RESTORE LETDOWN FLOW:	
1. Verify charging flowpath through Loop Charging Valves or Auxiliary Spray Valve. 2. Verify at least one Charging Pump operating. 3. Shift Letdown Control Valve Controller, 2-HIC-110, to MANUAL. 4. Adjust controller to shut Letdown Control Valves. 5. Open Letdown Isolation Valves: 2-CVC-515-CV 2-CVC-516-CV - **CAUTION** - **The setpoint of 2-PIC-201 must be above the saturation pressure for the letdown outlet temperature of the Regenerative Heat Exchanger.** 6. Adjust the setpoint on 2-PIC-201 and adjust 2-HIC-110 to maintain desired pressurizer level.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
V. **IF** RCPs WERE SECURED **AND** RCP RESTART CRITERIA MET, **THEN** RESTORE RCS FORCED CIRCULATION:	
- **CAUTION** - **Uncontrolled restoration of cooling to hot RCP seals may cause degradation of the metallic seating surfaces by thermal shock.** 1. **IF** Component Cooling is isolated to RCP seals, **THEN** reduce RCP lower seal temperature below 280°F prior to initiating full cooling flow to the RCPs: a. Shut Component Cooling Supply Containment Manual Isolation Valve, 2-CC-284, located in 5 ft East Penetration Room. b. Verify CIS reset. c. Open Component Cooling Containment Isolation Valves: 2-CC-3832-CV 2-CC-3833-CV d. Slowly open 2-CC-284 to throttle component cooling flow until lower seal temperatures are less than 280°F. e. **WHEN** lower seal temperatures are less than 280°F, **THEN** fully open 2-CC-284.	

III. RECOVERY ACTIONS

ALTERNATE ACTIONS

2. **IF** an RCP lower seal temperature exceeded 280°F, **THEN** an engineering evaluation is required prior to restarting that RCP.

3. Raise pressurizer level to at least 155 inches.

4. Verify RCP restart criteria:

   a. RCS subcooling greater than 30°F.

   b. At least one S/G available for heat removal.

   c. Pressurizer level greater than 155 inches and stable.

   d. Tcold less than 525°F.

   e. RCS temperature and pressure greater than the minimum operating limits per the RCP curve on Attachment (1).

- **NOTE** -

Starting an RCP may cause a pressurizer level transient.

5. **WHEN** RCP restart criteria met, **THEN** start one RCP in a loop with an operable S/G:

   a. Verify "COMPT CLG FLOW LO" alarm clear.

   b. Start Oil Lift Pump.

   c. Insert RCP sync stick.

   d. Start one RCP.

V. RECOVERY ACTIONS	ALTERNATE ACTIONS
e. Verify RCP running current: **Tavg** — **Current** 525 to 572°F — 238 to 210 AMPS and steady 210 to 525°F — 264 to 238 AMPS and steady	
6. **IF** pressurizer level decreases, **THEN** start Charging or HPSI Pump(s) as necessary to restore **AND** maintain level greater than 155 inches.	
7. Monitor RCP seal parameters following pump restart.	
8. Allow backflow to equalize temperatures in opposite loop.	
9. Start second RCP in opposite loop per steps V.5 and V.7, pages 23 and 24.	
10. Secure Auxiliary Spray: a. Open Loop Charging Valves: 2-CVC-518-CV 2-CVC-519-CV b. Shut Auxiliary Spray Valve, 2-CVC-517-CV. c. Shift Pressurizer Spray Controller, 2-HIC-100, to AUTO.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
W. PRESSURE AND LEVEL CONTROL OF AFFECTED S/G:	
- **NOTE** - The following methods for controlling affected S/G pressure and level are listed in preferred order and should be attempted in that order. 1. Maintain affected S/G pressure approximately equal to RCS pressure and S/G level between (-)24 and (+)30 inches by: a. Steaming S/G to Condenser per step W.2, page 25. b. S/G Blowdown to Condenser per step W.3, page 27. c. S/G Blowdown to MWS per step W.4, page 29. d. Steaming S/G to atmosphere per step W.5, page 31. e. Filling S/G to MSIV per step W.6, page 32. 2. Pressure and level control of affected S/G by steaming to Condenser: a. Ensure condenser vacuum greater than 20 IN Hg. b. Ensure at least one Condensate Demin in service. c. Open Condensate Precoat Filter Bypass Valve, 2-CD-5818-CV. d. Shut Condensate Demin Bypass Valve, 2-CD-4439-MOV.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
e. Throttle open Feedwater Dump To Condenser Hotwell Valves, 2-FW-134 and 2-FW-135, to obtain maximum condensate flow through Condensate Demin.	
f. Shut Condenser High Level Dump CV Inlet Valve, 2-CD-232.	
- **NOTE** - Maintaining S/G level above top of tube bundle provides a large decontamination factor due to the water covering the break.	
g. Maintain affected S/G level between (-)24 and (+)30 inches by operating AFW.	
h. Operate upstream drains using 2-HS-6622 as necessary to control affected S/G pressure.	
- **CAUTION** - **Do not operate MSIV Bypass Valve on a S/G whose level exceeded (+)63.5 inches.**	
i. **IF** additional steam flow desired, **THEN** operate MSIV Bypass Valve on affected S/G. 21 S/G: 2-MS-4045-MOV or 22 S/G: 2-MS-4052-MOV	

III. RECOVERY ACTIONS

ALTERNATE ACTIONS

3. Pressure and level control of affected S/G by blowdown to Condenser:

   a. Ensure at least one Condensate Demin in service.

   b. Open Condensate Precoat Filter Bypass Valve, 2-CD-5818-CV.

   c. Shut Condensate Demin Bypass Valve, 2-CD-4439-MOV.

   d. Throttle open Feedwater Dump To Condenser Hotwell Valves, 2-FW-134 and 2-FW-135, to obtain maximum condensate flow through Condensate Demin.

   e. Shut Condenser High Level Dump CV Inlet Valve, 2-CD-232.

   f. Place S/G Blowdown Recovery System Radiation Monitor, 2-RE-4095, in RESET.

   g. Shut B/D Recovery Discharge To MWS, 2-BD-4097-CV.

   h. Shut B/D Recovery Discharge To Circ Water, 2-BD-4015-CV.

   i. Open B/D Recovery To Condenser, 2-BD-4096-CV.

   j. Shut S/G Combined B/D Header Throttle Valves:

      2-BD-102
      2-BD-104

III. RECOVERY ACTIONS

k. Open the affected S/G Bottom Blowdown Valve by placing handswitch in RAD TRIP OVERRIDE.

21 S/G	or	22 S/G
2-BD-4011-CV		2-BD-4013-CV

l. Throttle open S/G Combined B/D Header Throttle Valve on affected S/G to obtain a blowdown flow of approximately 100 GPM.

21 S/G	or	22 S/G
2-BD-102		2-BD-104

m. Throttle SRW flow to 22 Blowdown Heat Exchanger to maintain a blowdown discharge temperature between 105 and 115 °F using 22 B/D Heat Exchanger Discharge Valve, 2-SRW-635.

- **NOTE** -

Maintaining S/G level above top of tube bundle provides a large decontamination factor due to the water covering the break.

n. Alternately lower and raise affected S/G level by:

(1) S/G Blowdown to Condenser to (-)24 inches.

(2) Operating AFW to (+)30 inches.

ALTERNATE ACTIONS

III. RECOVERY ACTIONS

4. Pressure and level control of affected S/G by blowdown to MWS:

   a. Place S/G Blowdown Recovery System Radiation Monitor, 2-RE-4095, in PULSE CAL and bypass its alarm.

   b. Open B/D Recovery Discharge To MWS, 2-BD-4097-CV.

   c. Shut B/D Recovery Discharge To Circ Water, 2-BD-4015-CV.

   d. Shut B/D Recovery To Condenser, 2-BD-4096-CV.

   e. Shut S/G Combined B/D Header Throttle Valves:

      2-BD-102
      2-BD-104

   f. Open the affected S/G Bottom Blowdown Valve by placing handswitch in RAD TRIP OVERRIDE.

21 S/G	or	22 S/G
2-BD-4011-CV		2-BD-4013-CV

   g. Throttle open S/G Combined B/D Header Throttle Valve on affected S/G to obtain a blowdown flow of approximately 100 GPM.

21 S/G	or	22 S/G
2-BD-102		2-BD-104

ALTERNATE ACTIONS

III. RECOVERY ACTIONS

h. Throttle SRW flow to 22 Blowdown Heat Exchanger to maintain a blowdown discharge temperature between 105 and 115°F using 22 B/D Heat Exchanger Discharge Valve, 2-SRW-635.

i. Pump MWRT to RCWMT per OI-17D.

j. Monitor MWRT level at 1C33.

k. Throttle S/G blowdown rate to maintain a constant level in MWRT while pumping to RCWMT.

- **NOTE** -

Maintaining S/G level above top of tube bundle provides a large decontamination factor due to the water covering the break.

l. Alternately lower and raise affected S/G level by:

(1) S/G Blowdown to MWS to (-)24 inches.

(2) Operating AFW to (+)30 inches.

ALTERNATE ACTIONS

III. RECOVERY ACTIONS

- **CAUTION** -

Do not operate Atmospheric Dump Valve on a S/G whose level exceeded (+)63.5 inches.

5. Pressure and level control of affected S/G by steaming to atmosphere from 2C43:

   a. Establish communications at 2C43.

   b. Verify 2C43 Atmospheric Dump Controllers at 0% output.

   c. Verify Hand Transfer Valves for affected S/G are selected to 2C43 position:

21 S/G	or	22 S/G
2-HV-3939A		2-HV-3938A
2-HV-3939B		2-HV-3938B

- **NOTE** -

Maintaining S/G level above top of tube bundle provides a large decontamination factor due to the water covering the break.

   d. Maintain affected S/G level between (-)24 and (+)30 inches by operating AFW.

   e. Adjust Atmospheric Dump from 2C43 as directed by Control Room Personnel to control affected S/G pressure.

   f. Record total time Atmospheric Dump Valve open, for dose calculations.

ALTERNATE ACTIONS

5.1 **IF** Atmospheric Dump was previously isolated, **THEN** throttle open Atmospheric Dump Manual Isolation Valve as directed by Control Room Personnel to control affected S/G pressure.

21 S/G	or	22 S/G
2-MS-101		2-MS-104

5.2 Maintain affected S/G level between (-)24 and (+)30 inches by operating AFW.

5.3 Record total time Atmospheric Dump Valve open, for dose calculations.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
6. Affected S/G may be allowed to fill to MSIV provided the following conditions are maintained: a. RCS pressure below 900 PSIA. b. MSIVs, Atmospheric Dump Valves and MSIV Bypass Valves remain shut.	
X. COMPLETE ADMINISTRATIVE POST-TRIP ACTIONS AND IMPLEMENT APPROPRIATE OPERATING PROCEDURE.	

Y. ADMINISTRATIVE POST-TRIP ACTIONS:

- **NOTE** -

The following actions may be accomplished whenever feasible. They may be done in any order.

_______ 1. Refer to ERPIP to determine appropriate emergency response actions.

_______ 2. Perform notifications per CCI-118.

_______ 3. Notify ESO of trip.

_______ 4. Request RCS Boron and Iodine sample.

_______ 5. Perform shutdown margin calculation per NEOG 9 and 11.

_______ 6. Complete transient log entries per CCI-301.

_______ 7. Recall post-trip review (preferably within 30 minutes of trip).

_______ 8. Perform post-trip review per CCI-111.

_______ 9. Monitor turbine bearing temperatures.

_______ 10. Continue Main Turbine shutdown per applicable step of OI-43A.

END OF SECTION III.

IV. SAFETY FUNCTION STATUS CHECK

A. The STA (or person designated by STA) will perform the intermediate and final safety function checks respectively on entry and prior to exiting from this procedure.

B. Perform intermediate safety function status check at 10 minute intervals until plant conditions stabilize.

C. Immediately notify Shift Supervisor or Control Room Supervisor if any safety function criteria is not being satisfied.

D. Review data and verify that safety function acceptance criteria are satisfied.

E. When EOP completed, then perform final safety function check.

REACTIVITY CONTROL PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. WRNI power	less than 3%	__________	less than 1%	________
b. SUR (DPM)	negative	__________	0	________
c. CEA status	all inserted	__________	all inserted	________
or				
Boration status:				
concentation	increasing	__________	appropriate S/D margin	________
BAST level	decreasing	__________	N/A	N/A

RCS PRESSURE AND INVENTORY PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Pressurizer pressure (PSIA)	300 to 1900	----------	greater than 300	________
b. Pressurizer level (inches)	0 to 200	----------	101 to 160	________
c. RCS subcooling (^{o}F)	25 to 140	----------	25 to 140	________

CORE AND RCS HEAT REMOVAL PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. RCS Tcold (^{o}F)	less than 535	--------	300 to 515	________
b. Thot minus Tcold (^{o}F)				
Natural Circulation	10 to 50	--------	10 to 50	________
Forced Circulation	less than 10	--------	less than 10	________
c. Affected S/G pressure (PSIA)	less than 920	--------	less than 900	________
d. Affected S/G level (inches)	less than (+)30	--------	less than (+)30	________
e. Unaffected S/G pressure (PSIA)	70 to 920	--------	70 to 730	________
f. Unaffected S/G level (inches)	(-)170 to (+)30	--------	(-)24 to (+)30	________
g. Condensate Storage Tank level (ft)	greater than 5	--------	greater than 5	________

VITAL AUXILIARIES	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. 4KV vital buses 21 or 24	energized	----------	energized	________
b. Instrument Air pressure (PSIG)	greater than 88	----------	greater than 88	________
c. Component Cooling (# pumps running)	1 or 2	----------	1 or 2	________
d. Saltwater (# pumps running)	1 or 2	----------	1 or 2	________
e. Service Water (# pumps running)	1 or 2	----------	1 or 2	________
f. 125V DC buses 11, 12, 21, 22	energized	----------	energized	________
g. 120V AC vital buses 21, 22, 23, 24	energized	----------	energized	________

NORMAL CONTAINMENT ENVIRONMENT PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Containment pressure (PSIG)	less than 0.7	--------	less than 0.7	________
b. Containment temperature (°F)	less than 120	--------	less than 120	________
c. Containment High Range Radiation Monitor	alarm clear	--------	alarm clear	________

NORMAL RADIATION LEVELS EXTERNAL TO CONTAINMENT		SAFETY FUNCTION ACCEPTANCE CRITERIA			
		CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Noble Gas Monitor	(1)	alarming	----------	alarm clear	______
b. Condenser Off-Gas RMS	(1)	alarming	----------	alarm clear	______
c. S/G B/D RMS	(1)	alarming	----------	alarm clear	______
d. Main Vent Gaseous RMS (2-RI-5415)	(1)	alarming	----------	alarm clear	______

(1) RMS alarms are break size and RCS activity dependent.

STATUS CHECK NUMBER	COMPLETE AT TIME
1	______
2	______
3	______
4	______
______	______
______	______
______	______

CALVERT CLIFFS NUCLEAR POWER PLANT

EOP-7 STATION BLACKOUT

REVISION 1

	SIGNATURE	DATE
PREPARED BY;	Michael L Wass	12-18-87
VERIFIED BY;	[illegible]	12-18-87
POSRC;	MEETING # 88-7	2-10-88
APPROVED BY;	J R Lemons	2-10-88

Manager-Nuclear Operations or General Supervisor-Operations if POSRC review is not required

LIST OF EFFECTIVE PAGES

STATION BLACKOUT

I. PRECAUTIONS

A. Do not adopt manual operation of automatically controlled systems unless a malfunction is apparent or automatic system operation will not support the maintenance of a safety function.

B. Systems shifted to manual must be monitored frequently to ensure correct operation.

C. At least two independent indications should be used, when available, to evaluate and corroborate a specific plant condition since an incident could induce inconsistencies between instruments.

D. In Natural Circulation, increased loop transport time causes a 5 to 10 minute delay in temperature responses to a plant change. Pressurizer level and pressure responses typically provide better indication of RCS response during this period.

E. If cooling down with a S/G isolated, an inverted delta T(Tcold higher than Thot) may be observed in the idle loop. This is due to a small amount of reverse heat transfer in the isolated S/G. The inverted delta T is not expected to have any significant effect on natural circulation flow in the operating S/G loop.

F. The concentration of boron in RCS makeup water should be consistent with maintaining the required shutdown margin.

G. Personnel should be prepared for the possibility of inadequate lighting in access areas and equipment rooms.

H. Excessive Diesel Generator loading can result if a SIAS is received and the LOCI sequencer actuates. Non-vital loads should be manually shed immediately upon receiving a SIAS.

I. If a pump or component fails, the cause of the failure should be determined prior to restarting or starting a standby pump or component to prevent a common failure.

II. ENTRY CONDITIONS

The presence of one or more of the following conditions indicates that a Station Blackout may have occurred:

A. Loss of Control Room lighting on both Units.

B. 500KV Red and Black Bus power available lights de-energized.

C. Diesel Generators not loaded.

D. No RCPs running on either Unit.

E. All 4KV Unit bus power available lights de-energized.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
A. VERIFY POST-TRIP IMMEDIATE ACTIONS COMPLETED.	
B. COMMENCE INTERMEDIATE SAFETY FUNCTION STATUS CHECK.	
C. DETERMINE APPROPRIATE EMERGENCY RESPONSE ACTIONS PER THE ERPIP.	
D. PROTECT RCS FROM EXCESSIVE COOLDOWN AND CONDENSER FROM OVERPRESSURE:	
1. Shut both MSIVs. 2. Shut S/G Blowdown Valves: 1-BD-4010-CV 1-BD-4011-CV 1-BD-4012-CV 1-BD-4013-CV	
E. ESTABLISH S/G HEAT SINK:	
1. Establish S/G heat removal: a. Establish communications with an operator stationed to manually operate Atmospheric Dump Valves at the 45 ft level of the Auxiliary Building.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
- **NOTE** - Atmospheric Dump Valves are reverse acting, i.e., clockwise to open, counterclockwise to shut.	
b. Adjust Atmospheric Dump Valves to maintain S/G pressures between 850 and 920 PSIA. 11 S/G: 1-MS-3938-CV 12 S/G: 1-MS-3939-CV	
2. Establish AFW flow to the S/Gs:	
a. Start 11 or 12 AFW Pump by opening AFW Steam Supply Valves: 1-MS-4070-CV 1-MS-4071-CV	2.a.1 Start 11 or 12 AFW Pump by opening AFW Steam Supply Bypass Valves: 1-MS-102 1-MS-105
b. Adjust AFW Flow Control Valves to restore and maintain S/G levels between (-)170 and (+)30 inches and trending towards 0 inches.	
- **NOTE** - Turbine Building N_2 Storage Tanks may be used if Liquid N_2 System unavailable.	
c. Align nitrogen to supply AFW Flow Control Valves by opening the following valves located in SRW Room: (1) N_2 Supply To AFW Amplifier Air System, N_2-105. (2) AFW Amplifier Air System N_2 Backup Supply, 1-IA-182.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
d. Assign an operator to control AFW discharge pressure locally: (1) Open AFW Pump Room double doors. (2) Establish communications. (3) Adjust turbine governor control knob to maintain AFW Pump discharge pressure 100 PSI greater than S/G pressure.	
F. CONFIRM NATURAL CIRCULATION IN AT LEAST ONE LOOP:	
- **NOTE** - Wide range Thot may be obtained from Subcooled Margin Monitor per Attachment (10). 1. Thot minus Tcold between 10 and 50°F. 2. Tcold constant or decreasing. 3. Thot constant or decreasing. - **NOTE** - CET temperature may be read locally per AOP-7H. 4. CET temperatures consistent with Thot. 5. Steaming rate affects primary temperature.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
G. MINIMIZE RCS INVENTORY LOSS:	
1. Shut Letdown Isolation Valves: 1-CVC-515-CV 1-CVC-516-CV 2. Maintain an RCP Bleedoff flowpath: a. Shut RCP Bleedoff Isolation Valves: 1-CVC-505-CV 1-CVC-506-CV b. Open RCP Bleedoff RV Isolation, 1-CVC-507-CV. c. Open RC Drain Tank Drain To Cntmt Floor Valve, 1-RCW-4258-SV. 3. Shut RCS Sample Isolation Valve, 1-PS-5464-CV. 4. Shut Reactor Vessel and Pressurizer Vent Valves: 1-RC-103-SV 1-RC-104-SV 1-RC-105-SV 1-RC-106-SV	
H. VERIFY EMERGENCY DC PUMP OPERATION:	
1. Turbine Emergency Oil Pump. 2. Emergency H_2 Seal Oil Pump. 3. S/G Feed Pump Emergency Oil Pumps.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
I. ALIGN ELECTRICAL SYSTEMS FOR POWER RESTORATION:	
1. Open the following 13KV breakers: a. U-4000-13 Feeder, 252-1101. b. U-4000-11 Feeder, 252-1102. c. U-4000-12 Feeder, 252-1103. d. Service Bus 11 Feeder, 252-1104. e. Tie Breaker Service Bus 11, 252-1105. 2. Open the following 4KV breakers: a. 11 4KV Bus Normal Feeder, 152-1115. b. 11 4KV Bus Alternate Feeder, 152-1101. c. Switchyard Feeder, 152-1113. d. 12 4KV Bus Normal Feeder, 152-1201. e. 12 4KV Bus Alternate Feeder, 152-1209. f. 13 4KV Bus Normal Feeder, 152-1311. g. 13 4KV Bus Alternate Feeder, 152-1301. h. 14 4KV Bus Normal Feeder, 152-1414. i. 14 4KV Bus Alternate Feeder, 152-1401.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
j. 15 4KV Bus Feeder, 152-1501. k. 16 4KV Bus Feeder, 152-1604. 3. Place 4KV Bus LOCI/SD Sequencer Manual Initiate Keyswitches for 11 and 14 4KV Buses in ON.	
J. ALIGN FEED SYSTEMS FOR POWER RESTORATION:	
1. Place 13 AFW Pump in PULL-TO-LOCK. 2. Verify S/G Feed Pumps tripped. 3. Place Condensate Booster Pumps in PULL-TO-LOCK. 4. Place Condensate Pumps in PULL-TO-LOCK. 5. Place Heater Drain Pumps in PULL-TO-LOCK.	
K. MONITOR RCS DEPRESSURIZATION.	
1. <u>IF</u> "PRSR PRESS BLOCK A(B) PERMITTED" alarm(s) received, <u>THEN</u> block SIAS A(B).	

III. **RECOVERY ACTIONS**	**ALTERNATE ACTIONS**
L. **IF** RCS SUBCOOLING DECREASES TO LESS THAN 30°F, **THEN** COOL DOWN TO MAINTAIN 30 TO 50°F SUBCOOLING, USING CET TEMPERATURES:	
1. Operate AFW to maintain S/G levels between (-)170 and (+)30 inches. - **NOTE** - If two phase natural circulation is in progress, 30°F subcooling cannot be achieved. CET temperatures constant or decreasing indicates adequate core cooling. 2. Operate Atmospheric Dump Valves to maintain 30 to 50°F subcooling.	
M. ALIGN BACKUP WATER SUPPLIES FOR AFW AS NECESSARY:	
1. **IF** 12 CST level decreases to 5 ft, **THEN** line up 11 CST as alternate suction supply: a. Locally open 11 CST AFW Pump Suction Valves: 1-AFW-131 1-AFW-167	- **NOTE** - The following step will cause CST levels to equalize. 1.1 **IF** 11 CST **NOT** available, **THEN** line up 21 CST as alternate suction supply: a. Locally open 21 CST AFW Pump Suction Valves: 2-AFW-131 2-AFW-167

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
b. Locally shut 12 CST Unit 1 AFW Pump Suction Valve, 1-AFW-161.	b. Locally open 12 CST AFW Pump Suction Valves: 1-AFW-161 2-AFW-161
c. Confirm normal CST level response.	c. Confirm normal CST level response.
2. **IF** DI Water Storage Tank level is greater than 10 ft, **THEN** gravity fill 12 CST by opening 12 CST Fill Valve, O-DW-284.	2.1 **IF** gravity fill of CST **NOT** effective, **THEN** connect fire hoses to fill CSTs.
N. ENSURE CONTAINMENT INTEGRITY.	
1. **IF** unable to ensure the Containment Normal Sump Drain Isolation Valves shut from the Control Room: 1-EAD-5462-MOV 1-EAD-5463-MOV **THEN** locally check valves shut.	
O. RESTORE POWER TO AT LEAST ONE 4KV BUS.	
1. Start 11 or 12 D/G per OI-21 and close the associated D/G output breaker.	1.1 Restore power from the 500KV Switchyard per the applicable procedure: a. OI-28, 500KV Switchyard. b. OI-27B, 13KV System. c. OI-27C, 4KV System. 1.2 Restore power to 11 or 14 4KV Bus using SMECO feeder per OI-27E.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
P. WHEN AT LEAST ONE VITAL 4KV BUS IS ENERGIZED, THEN VERIFY SHUTDOWN SEQUENCER LOADS OPERATING:	
1. Service Water Pump(s). 2. Saltwater Pump(s). 3. Instrument Air Compressor. 4. 11 or 12 Control Room Ventilation. 5. Switchgear Room Ventilation.	
Q. RESTORE REACTOR MCCs AND INSTRUMENT BUSES:	
1. IF 11 4KV Bus is energized AND 14 4KV Bus is NOT energized, THEN tie MCC-104 to MCC-114: a. Open MCC-104 Main Feeder Breaker, 52-10401. b. Close MCC-104 Tie Breaker, 52-10420. c. Close MCC-114 Tie Breaker, 52-11420. 2. IF 14 4KV Bus is energized AND 11 4KV Bus is NOT energized, THEN tie MCC-114 to MCC-104: a. Open MCC-114 Main Feeder Breaker, 52-11401. b. Close MCC-114 Tie Breaker, 52-11420. c. Close MCC-104 Tie Breaker, 52-10420.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
R. RESTORE COMPONENT COOLING FLOW:	
1. **IF** RCP lower seal temperature above 280°F, **THEN** shut Component Cooling Supply Containment Isolation Valve, 1-CC-3832-CV **AND** start a Component Cooling Pump. 2. Verify Component Cool.ng Heat Exchanger on service is being supplied from an operating Saltwater Header.	1.1 **IF** seal temperature less than 280°F, **THEN** start a Component Cooling Pump.
S. COMMENCE RCS BORATION:	
1. Open Loop Charging Valves: 1-CVC-518-CV 1-CVC-519-CV 2. Shut Auxiliary Spray Valve, 1-CVC-517-CV. 3. Start all available Charging Pumps. 4. Shut VCT Makeup Valve, 1-CVC-512-CV. 5. Open Boric Acid Direct Makeup Valve, 1-CVC-514-MOV. 6. Start a Boric Acid Pump.	6.1 **IF** Boric Acid Pumps **NOT** available, **THEN** establish gravity feed: a. Open BAST Gravity Feed Valves: 1-CVC-508-MOV 1-CVC-509-MOV b. Shut VCT Outlet Valve, 1-CVC-501-MOV.

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III. **RECOVERY ACTIONS** | **ALTERNATE ACTIONS**

7. **WHEN** shutdown margin requirement of NEOG-7 is achieved, **THEN** secure boration:

   a. Open VCT Outlet Valve, 1-CVC-501-MOV.

   b. Stop Boric Acid Pump(s).

T. RESTORE RCS INVENTORY.

1. Operate Charging or HPSI Pump(s) as necessary to restore and maintain pressurizer level between 101 and 160 inches.

U. **IF** INSTRUMENT AIR LOST, **THEN** RESTORE INSTRUMENT AIR:

1. Align fire main to supply cooling water to air compressors per OI-19.

2. Start at least one Instrument Air Compressor per OI-19.

3. **WHEN** service water cooling restored to Turbine Building, **THEN** return air compressor service water lineup to normal.

III. **RECOVERY ACTIONS**	**ALTERNATE ACTIONS**
V. RESTORE INSTRUMENT AIR TO CONTAINMENT:	
1. Open Cntmt Instrument Air Isolation MOV, 1-IA-2080-MOV. - **NOTE** - 1-HS-2085 located on West wall of 27 ft Switchgear Room; Key #85 in Control Room Key Locker. 2. Open Cntmt Instrument Air Supply CV, 1-IA-2085-CV, by momentarily placing 1-HS-2085 in OPEN.	
W. RESTORE LETDOWN AND BLEEDOFF FLOW:	
1. Open Loop Charging Valves: 1-CVC-518-CV 1-CVC-519-CV 2. Shut Auxiliary Spray Valve, 1-CVC-517-CV. 3. Verify at least one Charging Pump operating. 4. Shift Letdown Control Valve Controller, 1-HIC-110, to MANUAL. 5. Adjust controller to shut Letdown Control Valves. 6. Open Letdown Isolation Valves: 1-CVC-515-CV 1-CVC-516-CV	

III. **RECOVERY ACTIONS**

- **NOTE** -

Degasifier Pumps are powered from non-vital power supply. Excessive diversion may cause Degasifier to overfill.

7. Slowly open the Letdown Control Valve noting the increase in letdown pressure as read on 1-PIC-201, until 1-PIC-201 takes control of the Letdown Backpressure Regulating Valve.

8. Allow temperatures to stabilize, then shift 1-HIC-110 to AUTO.

9. Restore RCP Bleedoff flow to VCT:

   a. Open RCP Bleedoff Isolation Valves:

      1-CVC-505-CV
      1-CVC-506-CV

   b. Shut RC Drain Tank Drain To Cntmt Floor, 1-RCW-4258-SV.

ALTERNATE ACTIONS

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
X. MAINTAIN RCS SUBCOOLING BETWEEN 30 AND 140°F:	
1. Raise subcooling by any of the following: a. Securing Auxiliary Spray. b. Operate 11 or 13 Backup Heaters as necessary to raise RCS pressure: (1) Charge closing spring using manual lever at 480V breakers 52-1127 and 52-1427. (2) Push the PUSH-TO-CLOSE button on breaker fronts. 2. Lower subcooling by any of the following: a. Securing Pressurizer Heaters. b. Initiating Auxiliary Spray: (1) Record temperature differential between Pressurizer and Regenerative Heat Exchanger Outlet. (2) Open Auxiliary Spray Valve, 1-CVC-517-CV. (3) Shut Loop Charging Valves: 1-CVC-518-CV 1-CVC-519-CV	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
(4) Shift 1-HIC-100 to MANUAL and shut Pressurizer Spray Valves: 1-RC-100E-CV 1-RC-100F-CV	
Y. MONITOR FOR CORE AND RCS VOIDING:	
- CAUTION - **Potential for void formation increases rapidly when pressure decreases below 1500 PSIA.** 1. Letdown flow greater than charging flow. 2. Rapid unexplained increase in pressurizer level during an RCS pressure reduction. 3. Loss of subcooled margin as determined using CET temperatures. 4. "REACTOR VESSEL WATER LEVEL LOW" alarm.	

II. RECOVERY ACTIONS	ALTERNATE ACTIONS
Z. **IF** VOIDING INHIBITS HEAT REMOVAL, **THEN** REDUCE OR ELIMINATE VOIDED AREA:	
1. Shut Letdown Isolation Valve, 1-CVC-515-CV. - **CAUTION** - **The potential exists for pressurized thermal shock from an excessive cooldown rate followed by a repressurization.** 2. Pressurize the RCS to maintain subcooling as near 140°F as practical. - **CAUTION** - **If voids exist in the S/G tubes, a rapid RCS pressure reduction will occur when the voids collapse.** 3. **IF** voiding occurs in the S/G tubes (saturation pressure of S/G greater than saturation pressure of RCS), **THEN** cool the S/G by raising any of the following: a. Steaming rate. b. Feed rate. c. S/G Blowdown rate. **AND** maintaining less than 100°F/h cooldown rate.	2.1 **IF** pressurizing the RCS does **NOT** restore heat removal, **THEN** operate Reactor Vessel Vent Valves per OI-1G.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
AA. ENERGIZE SUPPORT EQUIPMENT AS NECESSARY TO FACILITATE SHUTDOWN AND VERIFY LOAD REMAINS WITHIN RATINGS:	
- **CAUTION** - **If the following load limits can be maintained, actuation of the LOCI Sequencer will not cause a D/G overload condition:** **without 13 AFW Pump - 1400 KW** **with 13 AFW Pump - 1800 KW** **These limits may be exceeded if additional power is required to safely, efficiently shut down the plant. The D/G should not be operated above 3250 KW.** - **CAUTION** - **SMECO load limit is 260 AMPS.** 1. Start a Main Exhaust Fan. 2. Start Containment Air Cooler(s) in LOW to maintain containment temperature below 120°F. 3. Start a Cavity Cooling Fan to maintain cavity cooling temperature below 200°F. 4. **IF** "SFP LEVEL TEMP HI" alarm received, **THEN** start Spent Fuel Pool Cooling Pump(s). 5. Strip MCC-101AT and MCC-101BT of all loads, by opening individual MCC breakers.	

III. RECOVERY ACTIONS

6. **IF** 11 4KV Bus is energized **AND** 14 4KV Bus is **NOT** energized, **THEN** tie MCC-101BT to MCC-101AT:

   a. Close MCC-101AT Feeder Breaker, 52-1109.

   b. Open MCC-101BT Main Feeder Breaker, 52-10141.

   c. Close Tie Breakers:

      52-10120
      52-10160

   d. Energize loads per step AA.9, page 23.

7. **IF** 14 4KV Bus is energized **AND** 11 4KV Bus is **NOT** energized, **THEN** tie MCC-101AT to MCC-101BT:

   a. Close MCC-101BT Feeder Breaker, 52-1419.

   b. Open MCC-101AT Main Feeder Breaker, 52-10101.

   c. Close Tie Breakers:

      52-10120
      52-10160

   d. Energize loads per step AA.9, page 23.

ALTERNATE ACTIONS

III. RECOVERY ACTIONS	ALTERNATE ACTIONS

8. IF both 11 AND 14 4KV Buses are energized, THEN energize MCC-101AT and MCC-101BT:

   a. Close MCC-101AT Feeder Breaker, 52-1109.

   b Close MCC-101BT Feeder Breaker, 52-1419.

   c. Energize loads per step AA.9, page 23.

9. Energize MCC-101AT and MCC-101BT loads:

   a. Turbine Building Lighting Transformer Breaker, 52-10103.

   b. Turning Gear Oil Pump Breaker, 52-10102.

   c. Turbine Oil Lift Pump Breakers:

      52-10106
      52-10107
      52-10108

      52-10109
      52-10110

   d. Turbine Turning Gear Piggyback Motor and Turning Gear Motor Breaker, 52-10105.

   e. Technical Support Center HVAC Breaker, 52-10111.

   f. Distribution Panel 11 Breaker, 52-10116.

   g. Telephone Transformer Breaker, 52-10118.

   h. 11 S/G Feed Pump Turning Gear Breaker, 52-10121.

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VII. RECOVERY ACTIONS	ALTERNATE ACTIONS
i. SRW Pump Room Vent Fan, 52-10124 (Restart SRW Pump Room Ventilation, per OI-15). j. Technical Support Center Computer Breaker, 52-10122. k. Turbine Oil Lift Pump Breakers: 52-10146 52-10147 52-10148 52-10149 l. AFW Pump Room Air Conditioner Breaker, 52-10150. m. 12 S/G Feed Pump Turning Gear Breaker, 52-10161. n. Distribution Panel 111 Breaker, 52-10162. 10. IF emergency power requested by Security, THEN place disconnect switch 2Y211, located on the North wall of Unit 2 27 ft Switchgear Room, in the EMERGENCY position.	
AB. MINIMIZE 250V DC BATTERY DISCHARGE:	
1. Energize 15 or 25 Battery Charger on 13 250V DC Bus. 2. Ensure Main Turbine has stopped rotating or is on Turning Gear. 3. Verify Turning Gear Oil Pump running.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
4. Stop Turbine Emergency Oil Pump and place handswitch in AUTO. 5. <u>IF</u> bearing oil header pressure less than 25 PSIG, <u>THEN</u> start Turbine Emergency Oil Pump.	
AC. LOWER MAIN GENERATOR HYDROGEN PRESSURE TO 2 PSIG:	
1. Align Two-Position Valve, 1-G-01, to VENT position. 2. Throttle open Generator Vent Line Isolation Valve, 1-G-03. 3. <u>WHEN</u> Main Generator hydrogen pressure decreases to 2 PSIG, <u>THEN</u> perform the following: a. Shut 1-G-03. b. Secure Emergency H_2 Seal Oil Pump.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
AD. **IF** LOCI SEQUENCER IS ACTUATED **AND** TURBINE MCCs ARE BEING SUPPLIED BY D/G, **THEN** DE-ENERGIZE MCC-101AT AND MCC-101BT.	
1. **IF** rapid D/G load reduction needed, **THEN** perform the following: a. Open 11A 480V Bus Feeder Breaker, 52-1112. b. Open 14B 480V Bus Feeder Breaker, 52-1413. c. Locally open MCC-101AT Main Feeder Breaker, 52-10101. d. Locally open MCC-101BT Main Feeder Breaker, 52-10141. e. Close 11A 480V Bus Feeder Breaker, 52-1112. f. Close 14B 480V Bus Feeder Breaker 52-1413.	1.1 **IF** rapid D/G load reduction **NOT** needed, **THEN** perform the following locally: a. Open MCC-101AT Main Feeder Breaker, 52-10101. b. Open MCC-101BT Main Feeder Breaker, 52-10141.
AE. MAINTAIN VCT LEVEL BETWEEN 60 AND 100 INCHES:	
1. **WHEN** VCT makeup required, **THEN** shift Charging Pump suction to RWT: a. Open RWT To Charging Pump Suction Valve, 1-CVC-504-MOV. b. Observe VCT level increasing. c. Ensure Charging Pump(s) AMPS steady.	1.b.1 **IF** VCT level **NOT** increasing, **THEN** shut VCT Outlet Valve, 1-CVC-501-MOV.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
2. **WHEN** VCT increases to 100 inches, **THEN** shift Charging Pump suction to VCT: a. Open VCT Outlet Valve, 1-CVC-501-MOV. b. Shut RWT To Charging Pump Suction Valve, 1-CVC-504-MOV.	
AF. **IF** FORCED CIRCULATION DESIRED **AND** PUMP RESTART CRITERIA MET, **THEN** RESTART RCPs WHEN POWER AVAILABLE:	
- **CAUTION** - **Uncontrolled restoration of cooling to hot RCP seals may cause degradation of the metallic seating surfaces by thermal shock.** 1. **IF** Component Cooling is isolated to RCP seals, **THEN** reduce RCP lower seal temperature below 280°F prior to initiating full cooling flow to the RCPs: a. Shut Component Cooling Supply Containment Manual Isolation Valve, 1-CC-284, located in 5 ft East Penetration Room. b. Open Component Cooling Containment Isolation Valves: 1-CC-3832-CV 1-CC-3833-CV c. Slowly open 1-CC-284 to throttle component cooling flow until lower seal temperatures are less than 280°F.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
d. **WHEN** lower seal temperatures are less than 280°F, **THEN** fully open 1-CC-284.	
2. **IF** an RCP lower seal temperature exceeded 280°F, **THEN** an engineering evaluation is required prior to restarting that RCP.	
3. Raise pressurizer level to at least 155 inches.	
4. Lower Tcold to less than 525°F.	
5. Verify RCP restart criteria:	
a. RCS subcooling greater than 30°F.	
b. At least one S/G available for heat removal.	
c. Pressurizer level greater than 155 inches and stable.	
d. Tcold less than 525°F.	
e. RCS temperature and pressure greater than the minimum operating limits per RCP curve on Attachment (1).	
- **NOTE** - Starting an RCP may cause a pressurizer level transient.	
6. **WHEN** RCP restart criteria are met, **THEN** start one RCP in a loop with an operable S/G:	
a. Verify "COMPT CLG FLOW LO" alarm clear.	

III. <u>RECOVERY ACTIONS</u>

b. Start Oil Lift Pump.

c. Insert RCP sync stick.

d. Start one RCP.

e. Monitor RCP running current:

<u>Tavg</u>	<u>Current</u>
525 to 572°F	238 to 210 AMPS and steady
210 to 525°F	264 to 238 AMPS and steady

7. Monitor RCP seal parameters following pump restart.

8. Allow backflow to equalize temperatures in opposite loop.

9. Start second RCP in opposite loop per steps AF.6 and AF.7, pages 28 and 29.

10. Secure Auxiliary Spray:

    a. Open Loop Charging Valves:

       1-CVC-518-CV
       1-CVC-519-CV

    b. Shut Auxiliary Spray Valve, 1-CVC-517-CV.

    c. Shift Pressurizer Spray Controller, 1-HIC-100, to AUTO.

11. **<u>WHEN</u>** RCPs restarted, **<u>THEN</u>** implement appropriate operating procedure **<u>AND</u>** complete administrative post-trip actions of this procedure.

<u>ALTERNATE ACTIONS</u>

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
AG. DETERMINE TIME UNTIL COOLDOWN REQUIRED:	
1. Determine total water available for use as makeup.	
2. Determine time until commencement of required cooldown per Attachment (11).	
3. IF RCS cooldown required, THEN implement Natural Circulation Cooldown (AOP-3F) AND complete administrative post-trip actions of this procedure.	3.1 IF RCS cooldown NOT required, THEN implement Loss of Flow/Natural Circulation (AOP-3E) AND complete administrative post-trip actions of this procedure.

AH. ADMINISTRATIVE POST-TRIP ACTIONS:

- **NOTE** -

The following actions may be accomplished whenever feasible. They may be done in any order.

_______ 1. Refer to ERPIP to determine appropriate emergency response actions.

_______ 2. Perform notifications per CCI-118.

_______ 3. Notify ESO of trip.

_______ 4. Request RCS Boron and Iodine sample.

_______ 5. Perform shutdown margin calculation per NEOG 2 and 7.

_______ 6. Complete transient log entries per CCI-301.

_______ 7. Recall post-trip review (preferably within 30 minutes of trip).

_______ 8. Perform post-trip review per CCI-111.

_______ 9. Monitor turbine bearing temperatures.

_______ 10. Continue Main Turbine shutdown per applicable step of OI-43A.

END OF SECTION III.

IV. SAFETY FUNCTION STATUS CHECK

A. The STA (or person designated by STA) will perform the intermediate and final safety function checks respectively on entry and prior to exiting from this procedure.

B. Perform intermediate safety function status checks at 10 minute intervals until plant conditions stabilize.

C. Immediately notify Shift Supervisor or Control Room Supervisor if any safety function criteria is not being satisfied.

D. Review data and verify that safety function acceptance criteria are satisfied.

E. When EOP completed, then perform final safety function check.

REACTIVITY CONTROL PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. WRNI power at RPS	less than 3%	__________	less than 1%	__________
b. SUR (DPM) at RPS	negative	__________	0	__________
When Power Restored				
c. CEA status	all inserted	__________	all inserted	__________
or				
Boration status:				
concentation	increasing	__________	appropriate S/D margin	__________
BAST level	decreasing	__________	N/A	N/A

RCS PRESSURE AND INVENTORY PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Pressurizer pressure (PSIA)	less than 2300	----------	less than 2300	________
b. Pressurizer level (inches) (1)	50 to 180	----------	130 to 180	________
c. RCS subcooling ($^{\circ}$F) (2)	30 to 140	----------	30 to 140	________

(1) Pressurizer level may decrease below 50 inches depending upon RCS leakrate and time power unavailable.

(2) RCS subcooling may decrease below 30°F depending upon RCS leakrate and time power unavailable. If CET temperatures remain less than or equal to saturation temperature, for existing RCS pressure, then the Core is covered.

CORE AND RCS HEAT REMOVAL PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. RCS Tcold (°F)	less than 545	--------	less than 535	________
b. CET (°F) (3)	constant or decreasing	--------	constant or decreasing	________
c. Thot minus Tcold (°F):				
Natural Circulation	10 to 50	--------	10 to 50	________
Forced Circulation	N/A	--------	less than 5	________
d. S/G pressure (PSIA)	less than 1000	--------	less than 920	________
e. S/G level (inches)	(-)170 to (+)30	--------	(-)24 to (+)30	________
f. Condensate Storage Tank level (ft)	greater than 5	--------	greater than 5	________

(3) CET temperatures may increase while Natural Circulation is being established.

VITAL AUXILIARIES		SAFETY FUNCTION ACCEPTANCE CRITERIA			
		CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. 4KV vital buses 11 and 14	(4)	de-energized	__________	one energized	___ ___
b. Instrument Air pressure (PSIG)	(4)	decreasing	__________	greater than 88	________
c. Component Cooling (# pumps running)	(4)	0	__________	1 or 2	________
d. Component Cooling Head Tank level (inches)	(5)	greater than 30	__________	greater than 20	________
e. Saltwater (# pumps running)	(4)	0	__________	1 or 2	________
f. Service Water (# pumps running)	(4)	0	__________	1 or 2	________
g. Service Water Head Tank level (inches)	(5)	greater than 30	__________	greater than 30	________
h. 125V DC buses 11, 12, 21, 22		energized	__________	battery charger energized	________
i. 120V AC vital buses 11, 12, 13, 14		energized	__________	battery charger energized	________

(4) Intermediate criteria based on initial conditions prior to restoration of a 4KV vital bus.

(5) Refer to OI-15 and OI-16 for filling head tanks.

NORMAL CONTAINMENT ENVIRONMENT PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Containment pressure (PSIG)	N/A	N/A	less than 0.7	
b. Containment temperature (°F)	N/A	N/A	less than 120	
c. Containment level (inches)	N/A	N/A	less than 4	

NORMAL RADIATION LEVELS EXTERNAL TO CONTAINMENT	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Noble Gas Monitor (6)	alarm clear		alarm clear	

(6) Available when power restored.

STATUS CHECK NUMBER	COMPLETE AT TIME
1	
2	
3	
4	

CALVERT CLIFFS NUCLEAR POWER PLANT

EOP-7 STATION BLACKOUT

REVISION 1

	SIGNATURE	DATE
PREPARED BY;	M.E. Wasem	12-18-87
VERIFIED BY;	James V. Groome	12/18/87
POSRC;	MEETING # 88-7	2-10-88
APPROVED BY;	J.R. Lemons	2-10-88

Manager-Nuclear Operations or General Supervisor-Operations if POSRC review is not required

LIST OF EFFECTIVE PAGES

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31	1
32	1
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36	1

STATION BLACKOUT

I. PRECAUTIONS

A. Do not adopt manual operation of automatically controlled systems unless a malfunction is apparent or automatic system operation will not support the maintenance of a safety function.

B. Systems shifted to manual must be monitored frequently to ensure correct operation.

C. At least two independent indications should be used, when available, to evaluate and corroborate a specific plant condition since an incident could induce inconsistencies between instruments.

D. In Natural Circulation, increased loop transport time causes a 5 to 10 minute delay in temperature responses to a plant change. Pressurizer level and pressure responses typically provide better indication of RCS response during this period.

E. If cooling down with a S/G isolated, an inverted delta T(Tcold higher than Thot) may be observed in the idle loop. This is due to a small amount of reverse heat transfer in the isolated S/G. The inverted delta T is not expected to have any significant effect on natural circulation flow in the operating S/G loop.

F. The concentration of boron in RCS makeup water should be consistent with maintaining the required shutdown margin.

G. Personnel should be prepared for the possibility of inadequate lighting in access areas and equipment rooms.

H. Excessive Diesel Generator loading can result if a SIAS is received and the LOCI sequencer actuates. Non-vital loads should be manually shed immediately upon receiving a SIAS.

I. If a pump or component fails, the cause of the failure should be determined prior to restarting or starting a standby pump or component to prevent a common failure.

II. ENTRY CONDITIONS

The presence of one or more of the following conditions indicates that a Station Blackout may have occurred:

A. Loss of Control Room lighting on both Units.

B. 500KV Red and Black Bus power available lights de-energized.

C. Diesel Generators not loaded.

D. No RCPs running on either Unit.

E. All 4KV Unit bus power available lights de-energized.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
A. VERIFY POST-TRIP IMMEDIATE ACTIONS COMPLETED.	
B. COMMENCE INTERMEDIATE SAFETY FUNCTION STATUS CHECK.	
C. DETERMINE APPROPRIATE EMERGENCY RESPONSE ACTIONS PER THE ERPIP.	
D. PROTECT RCS FROM EXCESSIVE COOLDOWN AND CONDENSER FROM OVERPRESSURE:	
1. Shut both MSIVs. 2. Shut S/G Blowdown Valves: 2-BD-4010-CV 2-BD-4011-CV 2-BD-4012-CV 2-BD-4013-CV	
E. ESTABLISH S/G HEAT SINK:	
1. Establish S/G heat removal: a. Establish communications with an operator stationed to manually operate Atmospheric Dump Valves at the 45 ft level of the Auxiliary Building.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
- **NOTE** - Atmospheric Dump Valves are reverse acting, i.e., clockwise to open, counterclockwise to shut.	
b. Adjust Atmospheric Dump Valves to maintain S/G pressures between 850 and 920 PSIA. 21 S/G: 2-MS-3939-CV 22 S/G: 2-MS-3938-CV	
2. Establish AFW flow to the S/Gs:	
a. Start 21 or 22 AFW Pump by opening AFW Steam Supply Valves: 2-MS-4070-CV 2-MS-4071-CV	2.a.1 Start 21 or 22 AFW Pump by opening AFW Steam Supply Bypass Valves: 2-MS-102 2-MS-105
b. Adjust AFW Flow Control Valves to restore and maintain S/G levels between (-)170 and (+)30 inches and trending towards 0 inches.	
- **NOTE** - Turbine Building N_2 Storage Tanks may be used if Liquid N_2 System unavailable.	
c. Align nitrogen to supply AFW Flow Control Valves by opening the following valves located in SRW Room: (1) N_2 Supply To AFW Amplifier Air System, N_2-107. (2) AFW Amplifier Air System N_2 Backup Supply, 2-IA-390.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
d. Assign an operator to control AFW discharge pressure locally: (1) Open AFW Pump Room double doors. (2) Establish communications. (3) Adjust turbine governor control knob to maintain AFW Pump discharge pressure 100 PSI greater than S/G pressure.	
F. CONFIRM NATURAL CIRCULATION IN AT LEAST ONE LOOP:	
- **NOTE** - Wide range Thot may be obtained from Subcooled Margin Monitor per Attachment (10). 1. Thot minus Tcold between 10 and 50°F. 2. Tcold constant or decreasing. 3. Thot constant or decreasing. - **NOTE** - CET temperature may be read locally per AOP-7H. 4. CET temperatures consistent with Thot. 5. Steaming rate affects primary temperature.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
G. MINIMIZE RCS INVENTORY LOSS:	
1. Shut Letdown Isolation Valves: 2-CVC-515-CV 2-CVC-516-CV 2. Maintain an RCP Bleedoff flowpath: a. Shut RCP Bleedoff Isolation Valves: 2-CVC-505-CV 2-CVC-506-CV b. Open RCP Bleedoff RV Isolation, 2-CVC-507-CV. c. Open RC Drain Tank Drain To Cntmt Floor Valve, 2-RCW-4258-SV. 3. Shut RCS Sample Isolation Valve, 2-PS-5464-CV. 4. Shut Reactor Vessel and Pressurizer Vent Valves: 2-RC-103-SV 2-RC-104-SV 2-RC-105-SV 2-RC-106-SV	
H. VERIFY EMERGENCY DC PUMP OPERATION:	
1. Turbine Emergency Oil Pump. 2. Emergency Air Side Seal Oil Pump. 3. S/G Feed Pump Emergency Oil Pumps.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
I. ALIGN ELECTRICAL SYSTEMS FOR POWER RESTORATION:	
1. Open the following 13KV breakers: a. U-4000-23 Feeder, 252-2101. b. U-4000-21 Feeder, 252-2102. c. U-4000-22 Feeder, 252-2103. d. Service Bus 21 Feeder, 252-2104. e. Tie Breaker Service Bus 21, 252-2105. 2. Open the following 4KV breakers: a. 21 4KV Bus Normal Feeder, 152-2101. b. 21 4KV Bus Alternate Feeder, 152-2115. c. Switchyard Feeder, 152-2113. d. 22 4KV Bus Normal Feeder, 152-2201. e. 22 4KV Bus Alternate Feeder, 152-2209. f. 23 4KV Bus Normal Feeder, 152-2311. g. 23 4KV Bus Alternate Feeder, 152-2301. h. 24 4KV Bus Normal Feeder, 152-2401. i. 24 4KV Bus Alternate Feeder, 152-2414.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
j. 25 4KV Bus Feeder, 152-2501. k. 26 4KV Bus Feeder, 152-2604. 3. Place 4KV Bus LOCI/SD Sequencer Manual Initiate Keyswitches for 21 and 24 4KV Buses in ON.	
J. ALIGN FEED SYSTEMS FOR POWER RESTORATION:	
1. Place 23 AFW Pump in PULL-TO-LOCK. 2. Verify S/G Feed Pumps tripped. 3. Place Condensate Booster Pumps in PULL-TO-LOCK. 4. Place Condensate Pumps in PULL-TO-LOCK. 5. Place Heater Drain Pumps in PULL-TO-LOCK.	
K. MONITOR RCS DEPRESSURIZATION.	
1. <u>IF</u> "PRSR PRESS BLOCK A(B) PERMITTED" alarm(s) received, <u>THEN</u> block SIAS A(B).	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
L. **IF** RCS SUBCOOLING DECREASES TO LESS THAN 30°F, **THEN** COOL DOWN TO MAINTAIN 30 TO 50°F SUBCOOLING, USING CET TEMPERATURES:	
1. Operate AFW to maintain S/G levels between (-)170 and (+)30 inches. - **NOTE** - If two phase natural circulation is in progress, 30°F subcooling cannot be achieved. CET temperatures constant or decreasing indicates adequate core cooling. 2. Operate Atmospheric Dump Valves to maintain 30 to 50°F subcooling.	
M. ALIGN BACKUP WATER SUPPLIES FOR AFW AS NECESSARY:	
1. **IF** 12 CST level decreases to 5 ft, **THEN** line up 21 CST as alternate suction supply: a. Locally open 21 CST AFW Pump Suction Valves: 2-AFW-131 2-AFW-167	- **NOTE** - The following step will cause CST levels to equalize. 1.1 **IF** 21 CST **NOT** available, **THEN** line up 11 CST as alternate suction supply: a. Locally open 11 CST AFW Pump Suction Valves: 1-AFW-131 1-AFW-167

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
b. Locally shut 12 CST Unit 2 AFW Pump Suction Valve, 2-AFW-161. c. Confirm normal CST level response. 2. **IF** DI Water Storage Tank level is greater than 10 ft, **THEN** gravity fill 12 CST by opening 12 CST Fill Valve, 0-DW-284.	b. Locally open 12 CST AFW Pump Suction Valves: 1-AFW-161 2-AFW-161 c. Confirm normal CST level response. 2.1 **IF** gravity fill of CST **NOT** effective, **THEN** connect fire hoses to fill CSTs.
N. ENSURE CONTAINMENT INTEGRITY.	
1. **IF** unable to ensure the Containment Normal Sump Drain Isolation Valves shut from the Control Room: 2-EAD-5462-MOV 2-EAD-5463-MOV **THEN** locally check valves shut.	
O. RESTORE POWER TO AT LEAST ONE 4KV BUS.	
1. Start 21 or 12 D/G per OI-21 and close the associated D/G output breaker.	1.1 Restore power from the 500KV Switchyard per the applicable procedure: a. OI-28, 500KV Switchyard. b. OI-27B, 13KV System. c. OI-27C, 4KV System. 1.2 Restore power to 21 or 24 4KV Bus using SMECO feeder per OI-27E.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
P. **WHEN** AT LEAST ONE VITAL 4KV BUS IS ENERGIZED, **THEN** VERIFY SHUTDOWN SEQUENCER LOADS OPERATING:	
1. Service Water Pump(s). 2. Saltwater Pump(s). 3. Instrument Air Compressor. 4. 11 or 12 Control Room Ventilation. 5. Switchgear Room Ventilation.	
Q. RESTORE REACTOR MCCs AND INSTRUMENT BUSES:	
1. **IF** 24 4KV Bus is energized **AND** 21 4KV Bus is **NOT** energized, **THEN** tie MCC-214 to MCC-204: a. Open MCC-214 Main Feeder Breaker, 52-21401. b. Close MCC-214 Tie Breaker, 52-21420. c. Close MCC-204 Tie Breaker, 52-20420. 2. **IF** 21 4KV Bus is energized **AND** 24 4KV Bus is **NOT** energized, **THEN** tie MCC-204 to MCC-214: a. Open MCC-204 Main Feeder Breaker, 52-20401. b. Close MCC-204 Tie Breaker, 52-20420. c. Close MCC-214 Tie Breaker, 52-21420.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
R. RESTORE COMPONENT COOLING FLOW:	
1. **IF** RCP lower seal temperature above 280°F, **THEN** shut Component Cooling Supply Containment Isolation Valve, 2-CC-3832-CV **AND** start a Component Cooling Pump.	1.1 **IF** seal temperature less than 280°F, **THEN** start a Component Cooling Pump.
2. Verify Component Cooling Heat Exchanger on service is being supplied from an operating Saltwater Header.	
S. COMMENCE RCS BORATION:	
1. Open Loop Charging Valves: 2-CVC-518-CV 2-CVC-519-CV	
2. Shut Auxiliary Spray Valve, 2-CVC-517-CV.	
3. Start all available Charging Pumps.	
4. Shut VCT Makeup Valve, 2-CVC-512-CV.	
5. Open Boric Acid Direct Makeup Valve, 2-CVC-514-MOV.	
6. Start a Boric Acid Pump.	6.1 **IF** Boric Acid Pumps **NOT** available, **THEN** establish gravity feed: a. Open BAST Gravity Feed Valves: 2-CVC-508-MOV 2-CVC-509-MOV b. Shut VCT Outlet Valve, 2-CVC-501-MOV.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
7. **WHEN** shutdown margin requirement of NEOG-11 is achieved, **THEN** secure boration: a. Open VCT Outlet Valve, 2-CVC-501-MOV. b. Stop Boric Acid Pump(s).	
T. RESTORE RCS INVENTORY.	
1. Operate Charging or HPSI Pump(s) as necessary to restore and maintain pressurizer level between 101 and 160 inches.	
U. **IF** INSTRUMENT AIR LOST, **THEN** RESTORE INSTRUMENT AIR:	
1. Align fire main to supply cooling water to air compressors per OI-19. 2. Start at least one Instrument Air Compressor per OI-19. 3. **WHEN** service water cooling restored to Turbine Building, **THEN** return air compressor service water lineup to normal.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
V. RESTORE INSTRUMENT AIR TO CONTAINMENT:	
1. Open Cntmt Instrument Air Isolation MOV, 2-IA-2080-MOV. - **NOTE** - 2-HS-2085 located on West wall of 27 ft Switchgear Room; Key #80 in Control Room Key Locker. 2. Open Cntmt Instrument Air Supply CV, 2-IA-2085-CV, by momentarily placing 2-HS-2085 in OPEN.	
W. RESTORE LETDOWN AND BLEEDOFF FLOW:	
1. Open Loop Charging Valves: 2-CVC-518-CV 2-CVC-519-CV 2. Shut Auxiliary Spray Valve, 2-CVC-517-CV. 3. Verify at least one Charging Pump operating. 4. Shift Letdown Control Valve Controller, 2-HIC-110, to MANUAL. 5. Adjust controller to shut Letdown Control Valves. 6. Open Letdown Isolation Valves: 2-CVC-515-CV 2-CVC-516-CV	

III. RECOVERY ACTIONS

- NOTE -

Degasifier Pumps are powered from non-vital power supply. Excessive diversion may cause Degasifier to overfill.

7. Slowly open the Letdown Control Valve noting the increase in letdown pressure as read on 2-PIC-201, until 2-PIC-201 takes control of the Letdown Backpressure Regulating Valve.

8. Allow temperatures to stabilize, then shift 2-HIC-110 to AUTO.

9. Restore RCP Bleedoff flow to VCT:

   a. Open RCP Bleedoff Isolation Valves:

      2-CVC-505-CV
      2-CVC-506-CV

   b. Shut RC Drain Tank Drain To Cntmt Floor, 2-RCW-4258-SV.

ALTERNATE ACTIONS

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
X. MAINTAIN RCS SUBCOOLING BETWEEN 30 AND 140°F:	
1. Raise subcooling by any of the following: a. Securing Auxiliary Spray. b. Operate 21 or 23 Backup Heaters as necessary to raise RCS pressure: (1) Charge closing spring using manual lever at 480V breakers 52-2127 and 52-2427. (2) Push the PUSH-TO-CLOSE button on breaker fronts. 2. Lower subcooling by any of the following: a. Securing Pressurizer Heaters. b. Initiating Auxiliary Spray: (1) Record temperature differential between Pressurizer and Regenerative Heat Exchanger Outlet. (2) Open Auxiliary Spray Valve, 2-CVC-517-CV. (3) Shut Loop Charging Valves: 2-CVC-518-CV 2-CVC-519-CV	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
(4) Shift 2-HIC-100 to MANUAL and shut Pressurizer Spray Valves: 2-RC-100E-CV 2-RC-100F-CV	
Y. MONITOR FOR CORE AND RCS VOIDING:	
- CAUTION - **Potential for void formation increases rapidly when pressure decreases below 1500 PSIA.** 1. Letdown flow greater than charging flow. 2. Rapid unexplained increase in pressurizer level during an RCS pressure reduction. 3. Loss of subcooled margin as determined using CET temperatures. 4. "REACTOR VESSEL WATER LEVEL LOW" alarm.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
Z. **IF** VOIDING INHIBITS HEAT REMOVAL, **THEN** REDUCE OR ELIMINATE VOIDED AREA:	
1. Shut Letdown Isolation Valve, 2-CVC-515-CV. - **CAUTION** - **The potential exists for pressurized thermal shock from an excessive cooldown rate followed by a repressurization.** 2. Pressurize the RCS to maintain subcooling as near 140°F as practical. - **CAUTION** - **If voids exist in the S/G tubes, a rapid RCS pressure reduction will occur when the voids collapse.** 3. **IF** voiding occurs in the S/G tubes (saturation pressure of S/G greater than saturation pressure of RCS), **THEN** cool the S/G by raising any of the following: a. Steaming rate. b. Feed rate. c. S/G Blowdown rate. **AND** maintaining less than 100°F/h cooldown rate.	2.1 **IF** pressurizing the RCS does **NOT** restore heat removal, **THEN** operate Reactor Vessel Vent Valves per OI-1G.

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
AA. ENERGIZE SUPPORT EQUIPMENT AS NECESSARY TO FACILITATE SHUTDOWN AND VERIFY LOAD REMAINS WITHIN RATINGS:	
- **CAUTION** - **If the following load limits can be maintained, actuation of the LOCI Sequencer will not cause a D/G overload condition:** **Without 23 AFW Pump - 1400 KW** **With 23 AFW Pump - 1800 KW** **These limits may be exceeded if additional power is required to safely, efficiently shut down the plant. The D/G should not be operated above 3250 KW.** - **CAUTION** - **SMECO load limit is 260 AMPS.** 1. Start a Main Exhaust Fan. 2. Start Containment Air Cooler(s) in LOW to maintain containment temperature below 120°F. 3. Start a Cavity Cooling Fan to maintain cavity cooling temperature below 200°F. 4. IF "SFP LEVEL TEMP HI" alarm received, THEN start Spent Fuel Pool Cooling Pump(s). 5. Strip MCC-201AT and MCC-201BT of all loads, by opening individual MCC breakers.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
6. **IF** 24 4KV Bus is energized **AND** 21 4KV Bus is **NOT** energized, **THEN** tie MCC-201AT to MCC-201BT: a. Close MCC-201BT Feeder Breaker, 52-2419. b. Open MCC-201AT Main Feeder Breaker, 52-20101. c. Close Tie Breakers: 52-20120 52-20160 d. Energize loads per step AA.9, page 23.	
7. **IF** 21 4KV Bus is energized **AND** 24 4KV Bus is **NOT** energized, **THEN** tie MCC-201BT to MCC-201AT: a. Close MCC-201AT Feeder Breaker, 52-2109. b. Open MCC-201BT Main Feeder Breaker, 52-20141. c. Close Tie Breakers: 52-20120 52-20160 d. Energize loads per step AA.9, page 23.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
8. **IF** both 21 **AND** 24 4KV Buses are energized, **THEN** energize MCC-201AT and MCC-201BT: a. Close MCC-201AT Feeder Breaker, 52-2109. b. Close MCC-201BT Feeder Breaker, 52-2419. c. Energize loads per step AA.9, page 23. 9. Energize MCC-201AT and MCC-201BT loads: a. Turbine Building Lighting Transformer Breaker, 52-20103. b. Turbine Oil Lift Pump Breaker, 52-20106. c. Turbine Turning Gear Motor Breaker, 52-20105. d. Distribution Panel 21 Breaker, 52-20116. e. 21 S/G Feed Pump Turning Gear Breaker, 52-20121. f. AFW Pump Room Air Conditioner Breaker, 52-20150. g. 22 S/G Feed Pump Turning Gear Breaker, 52-20161. h. Distribution Panel 211 Breaker, 52-20162. i. SRW Pump Room Vent Fan, 52-20149 (Restart SRW Pump Room Ventilation, per OI-15).	

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III. RECOVERY ACTIONS	ALTERNATE ACTIONS
10. **IF** emergency power requested by Security, **THEN** place disconnect switch 2Y211, located on the North wall of Unit 2 27 ft Switchgear Room, in the EMERGENCY position.	

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AB. MINIMIZE 250V DC BATTERY DISCHARGE:

1. Energize 15 or 25 Battery Charger on 13 250V DC Bus. 2. Ensure Main Turbine has stopped rotating or is on Turning Gear. 3. Verify Bearing Oil Pump running. 4. Stop Turbine Emergency Oil Pump and place handswitch in AUTO. 5. **IF** bearing oil header pressure less than 15 PSIG, **THEN** start Turbine Emergency Oil Pump.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
AC. LOWER MAIN GENERATOR HYDROGEN PRESSURE TO 2 PSIG:	
1. Throttle open Generator Bottom Vent To Atmosphere Valve, 2-G-06. 2. **WHEN** Main Generator hydrogen pressure decreases to 2 PSIG, **THEN** perform the following: a. Shut 2-G-06. b. Secure Emergency Air Side Seal Oil Pump.	
AD. **IF** LOCI SEQUENCER IS ACTUATED **AND** TURBINE MCCs ARE BEING SUPPLIED BY D/G, **THEN** DE-ENERGIZE MCC-201AT AND MCC-201BT.	
1. **IF** rapid D/G load reduction needed, **THEN** perform the following: a. Open 21A 480V Bus Feeder Breaker, 52-2112. b. Open 24B 480V Bus Feeder Breaker, 52-2413. c. Locally open MCC-201AT Main Feeder Breaker, 52-20101. d. Locally open MCC-201BT Main Feeder Breaker, 52-20141. e. Close 21A 480V Bus Feeder Breaker, 52-2112. f. Close 24B 480V Bus Feeder Breaker, 52-2413.	1.1 **IF** rapid D/G load reduction **NOT** needed, **THEN** perform the following locally: a. Open MCC-201AT Main Feeder Breaker, 52-20101. b. Open MCC-201BT Main Feeder Breaker, 52-20141.

III. <u>RECOVERY ACTIONS</u>	<u>ALTERNATE ACTIONS</u>
AE. MAINTAIN VCT LEVEL BETWEEN 60 AND 100 INCHES:	
1. **<u>WHEN</u>** VCT makeup required, **<u>THEN</u>** shift Charging Pump suction to RWT:	
a. Open RWT To Charging Pump Suction Valve, 2-CVC-504-MOV.	
b. Observe VCT level increasing.	1.b.1 **<u>IF</u>** VCT level **<u>NOT</u>** increasing, **<u>THEN</u>** shut VCT Outlet Valve, 2-CVC-501-MOV.
c. Ensure Charging Pump(s) AMPS steady.	
2. **<u>WHEN</u>** VCT increases to 100 inches, **<u>THEN</u>** shift Charging Pump suction to VCT:	
a. Open VCT Outlet Valve, 2-CVC-501-MOV.	
b. Shut RWT To Charging Pump Suction Valve, 2-CVC-504-MOV.	

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
AF. IF FORCED CIRCULATION DESIRED AND PUMP RESTART CRITERIA MET, THEN RESTART RCPs WHEN POWER AVAILABLE:	
- CAUTION - **Uncontrolled restoration of cooling to hot RCP seals may cause degradation of the metallic seating surfaces by thermal shock.** 1. IF Component Cooling is isolated to RCP seals, THEN reduce RCP lower seal temperature below 280°F prior to initiating full cooling flow to the RCPs: a. Shut Component Cooling Supply Containment Manual Isolation Valve, 2-CC-284, located in 5 ft East Penetration Room. b. Open Component Cooling Containment Isolation Valves: 2-CC-3832-CV 2-CC-3833-CV c. Slowly open 2-CC-284 to throttle component cooling flow until lower seal temperatures are less than 280°F. d. WHEN lower seal temperatures are less than 280°F, THEN fully open 2-CC-284.	

III. **RECOVERY ACTIONS**

2. **IF** an RCP lower seal temperature exceeded 280°F, **THEN** an engineering evaluation is required prior to restarting that RCP.

3. Raise pressurizer level to at least 155 inches.

4. Lower Tcold to less than 525°F.

5. Verify RCP restart criteria:

   a. RCS subcooling greater than 30°F.

   b. At least one S/G available for heat removal.

   c. Pressurizer level greater than 155 inches and stable.

   d. Tcold less than 525°F.

   e. RCS temperature and pressure greater than the minimum operating limits per RCP curve on Attachment (1).

- **NOTE** -

Starting an RCP may cause a pressurizer level transient.

6. **WHEN** RCP restart criteria are met, **THEN** start one RCP in a loop with an operable S/G:

   a. Verify "COMPT CLG FLOW LO" alarm clear.

ALTERNATE ACTIONS

III. RECOVERY ACTIONS

b. Start Oil Lift Pump.

c. Insert RCP sync stick.

d. Start one RCP.

e. Monitor RCP running current:

Tavg	Current
525 to 572°F	238 to 210 AMPS and steady
210 to 525°F	264 to 238 AMPS and steady

7. Monitor RCP seal parameters following pump restart.

8. Allow backflow to equalize temperatures in opposite loop.

9. Start second RCP in opposite loop per steps AF.6 and AF.7, pages 28 and 29.

10. Secure Auxiliary Spray:

    a. Open Loop Charging Valves:

    2-CVC-518-CV
    2-CVC-519-CV

    b. Shut Auxiliary Spray Valve, 2-CVC-517-CV.

    c. Shift Pressurizer Spray Controller, 2-HIC-100, to AUTO.

11. **WHEN** RCPs restarted, **THEN** implement appropriate operating procedure **AND** complete administrative post-trip actions of this procedure.

ALTERNATE ACTIONS

III. RECOVERY ACTIONS	ALTERNATE ACTIONS
AG. DETERMINE TIME UNTIL COOLDOWN REQUIRED:	
1. Determine total water available for use as makeup.	
2. Determine time until commencement of required cooldown per Attachment (11).	
3. **IF** RCS cooldown required, **THEN** implement Natural Circulation Cooldown (AOP-3F) **AND** complete administrative post-trip actions of this procedure.	3.1 **IF** RCS cooldown **NOT** required, **THEN** implement Loss of Flow/Natural Circulation (AOP-3E) **AND** complete administrative post-trip actions of this procedure.

AH. ADMINISTRATIVE POST-TRIP ACTIONS:

- **NOTE** -

The following actions may be accomplished whenever feasible. They may be done in any order.

_______ 1. Refer to ERPIP to determine appropriate emergency response actions.

_______ 2. Perform notifications per CCI-118.

_______ 3. Notify ESO of trip.

_______ 4. Request RCS Boron and Iodine sample.

_______ 5. Perform shutdown margin calculation per NEOG 9 and 11.

_______ 6. Complete transient log entries per CCI-301.

_______ 7. Recall post-trip review (preferably within 30 minutes of trip).

_______ 8. Perform post-trip review per CCI-111.

_______ 9. Monitor turbine bearing temperatures.

_______ 10. Continue Main Turbine shutdown per applicable step of OI-43A.

END OF SECTION III.

IV. SAFETY FUNCTION STATUS CHECK

A. The STA (or person designated by STA) will perform the intermediate and final safety function checks respectively on entry and prior to exiting from this procedure.

B. Perform intermediate safety function status checks at 10 minute intervals until plant conditions stabilize.

C. Immediately notify Shift Supervisor or Control Room Supervisor if any safety function criteria is not being satisfied.

D. Review data and verify that safety function acceptance criteria are satisfied.

E. When EOP completed, then perform final safety function check.

REACTIVITY CONTROL PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. WRNI power at RPS	less than 3%	________	less than 1%	________
b. SUR (DPM) at RPS	negative	________	0	________
When Power Restored				
c. CEA status	all inserted	________	all inserted	________
or				
Boration status:				
concentation	increasing	________	appropriate S/D margin	________
BAST level	decreasing	________	N/A	N/A

RCS PRESSURE AND INVENTORY PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Pressurizer pressure (PSIA)	less than 2300	----------	less than 2300	________
b. Pressurizer level (inches) (1)	50 to 180	----------	130 to 180	________
c. RCS subcooling (°F) (2)	30 to 140	----------	30 to 140	________

(1) Pressurizer level may decrease below 50 inches depending upon RCS leakrate and time power unavailable.

(2) RCS subcooling may decrease below 30°F depending upon RCS leakrate and time power unavailable. If CET temperatures remain less than or equal to saturation temperature, for existing RCS pressure, then the Core is covered.

CORE AND RCS HEAT REMOVAL PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. RCS Tcold (°F)	less than 545	________	less than 535	________
b. CET (°F) (3)	constant or decreasing	________	constant or decreasing	________
c. Thot minus Tcold (°F):				
Natural Circulation	10 to 50	________	10 to 50	________
Forced Circulation	N/A	________	less than 5	________
d. S/G pressure (PSIA)	less than 1000	________	less than 920	________
e. S/G level (inches)	(-)170 to (+)30	________	(-)24 to (+)30	________
f. Condensate Storage Tank level (ft)	greater than 5	________	greater than 5	________

(3) CET temperatures may increase while Natural Circulation is being established.

VITAL AUXILIARIES		SAFETY FUNCTION ACCEPTANCE CRITERIA			
		CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. 4KV vital buses 21 and 24	(4)	de-energized	----------	one energized	________
b. Instrument Air pressure (PSIG)	(4)	decreasing	----------	greater than 88	________
c. Component Cooling (# pumps running)	(4)	0	----------	1 or 2	________
d. Component Cooling Head Tank level (inches)	(5)	greater than 30	----------	greater than 20	________
e. Saltwater (# pumps running)	(4)	0	----------	1 or 2	________
f. Service Water (# pumps running)	(4)	0	----------	1 or 2	________
g. Service Water Head Tank level (inches)	(5)	greater than 30	----------	greater than 30	________
h. 125V DC buses 11, 12, 21, 22		energized	----------	battery charger energized	________
i. 120V AC vital buses 21, 22, 23, 24		energized	----------	battery charger energized	________

(4) Intermediate criteria based on initial conditions prior to restoration of a 4KV vital bus.

(5) Refer to OI-15 and OI-16 for filling head tanks.

NORMAL CONTAINMENT ENVIRONMENT PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Containment pressure (PSIG)	N/A	N/A	less than 0.7	________
b. Containment temperature (°F)	N/A	N/A	less than 120	________
c. Containment level (inches)	N/A	N/A	less than 4	________

NORMAL RADIATION LEVELS EXTERNAL TO CONTAINMENT	SAFETY FUNCTION ACCEPTANCE CRITERIA			
	CRITERIA	INTERMEDIATE CHECK	CRITERIA	FINAL CHECK
a. Noble Gas Monitor (6)	alarm clear	----------	alarm clear	________

(6) Available when power restored.

STATUS CHECK NUMBER	COMPLETE AT TIME
1	________
2	________
3	________
4	________
________	________
________	________
________	________

CALVERT CLIFFS NUCLEAR POWER PLANT

EOP-8 FUNCTIONAL RECOVERY PROCEDURE

REVISION 1

	SIGNATURE	DATE
PREPARED BY;	James V. Groome	, 12/18/87
VERIFIED BY;	[illegible]	, 12-18-87
POSRC;	MEETING # 88-7	, 2-10-88
APPROVED BY;	J.B. Lemons Manager-Nuclear Operations or General Supervisor-Operations if POSRC review is not required	, 2-10-88

LIST OF EFFECTIVE PAGES

PAGE NUMBER	REVISION	PAGE NUMBER	REVISION
1	1	25	1
2	1	26	1
3	1	27	1
4	1	28	1
5	1	29	1
6	1	30	1
7	1	31	1
8	1	32	1
9	1	33	1
10	1	34	1
11	1	35	1
12	1	36	1
13	1	37	1
14	1	38	1
15	1	39	1
16	1	40	1
17	1	41	1
18	1	42	1
19	1	43	1
20	1	44	1
21	1	45	1
22	1	46	1
23	1	47	1
24	1	48	1
		49	1

I. ENTRY CONDITIONS

The operator should enter the Functional Recovery Procedure under the following circumstances:

A. EOP-0 has been completed but an event diagnosis cannot be made.

OR

B. An event diagnosis has been made and one of the EOP-1 through 7 procedures has been implemented but one or more safety functions are not meeting their acceptance criteria and the reason for the violation has not been established.

OR

C. An event diagnosis has been made and one of the EOP-1 through 7 procedures has been implemented but a subset of parameters for a single safety function are not meeting their acceptance criteria and the Shift Supervisor desires to reference EOP-8 to obtain additional guidance for a specific problem.

For the conditions of A or B, EOP-8 should be implemented in its entirety. The safety functions with the out of spec acceptance criteria should be addressed first.

When EOP-8 is implemented, the safety function status check of EOP-8 should be implemented until an appropriate optimum recovery procedure is selected.

EOP-8 need not be implemented if the parameters of a safety function are outside of their acceptance criteria and:

1. Reason for the violation has been established,

AND

2. Action has been identified that will return the parameter(s) to within their acceptance criteria,

AND

3. The Shift Supervisor determines the recovery of the out of spec parameter(s) to within acceptance criteria to be imminent.

REACTIVITY CONTROL

I. PRECAUTIONS

A. Do not adopt manual operation of automatically controlled systems unless a malfunction is apparent or automatic system operation will not support the maintenance of a safety function.

B. Systems shifted to manual operation must be monitored frequently to ensure correct operation.

C. At least two independent indications should be used, when available, to evaluate and corroborate a specific plant condition since an incident could induce inconsistencies between instruments.

D. The operator should not leave reactivity control until this function is fulfilled. If necessary, other urgent safety functions may be pursued in parallel but attempts to establish reactivity control must be continued until the acceptance criteria are met.

E. If possible, maintain RCS temperature greater than 515°F until reactivity control criteria are satisfied.

F. The concentration of boron in RCS makeup water should be consistent with maintaining the required shutdown margin.

G. When borating the RCS it is possible for a large difference in boron concentration to develop between the RCS and pressurizer fluids if main or auxiliary spray is not operated at intervals. If spray is unavailable, the RCS boron concentration should be increased by 50 ppm to maintain the required shutdown margin should a pressurizer outsurge occur.

II. REACTIVITY CONTROL ACCEPTANCE CRITERIA

A. **IF** any of the following conditions exist:

1. All CEAs inserted and WRNI power decreasing.

OR

2. RCS boration in progress and WRNI power decreasing.

OR

3. WRNI power less than $10^{-4}\%$ and constant or decreasing.

THEN Reactivity Control Safety Function is satisfied.

B. **WHEN** Reactivity Control Safety Function is satisfied, **THEN** proceed to the next safety function in jeopardy.

III. RECOVERY ACTIONS

A. INITIATE REACTOR SHUTDOWN BY CEA INSERTION:

1. Depress both sets of Manual Reactor Trip Buttons.

OR

2. De-energize CEDM Motor Generator Sets:

   a. Open feeder breaker to 12A 480V Bus.

   b. Open feeder breaker to 13A 480V Bus.

   c. Open tie breakers to 12A and 13A 480V Buses.

OR

3. Depress local Emergency Trip Buttons on the Trip Circuit Breakers.

OR

B. INITIATE REACTOR SHUTDOWN BY BORATION:

1. <u>Establish charging flowpath to RCS</u>:

a. Normal CVCS lineup:

(1) Open Loop Charging Valves:

1-CVC-518-CV
1-CVC-519-CV

(2) <u>IF</u> Loop Charging Valves shut,
<u>THEN</u> charging may continue through Loop Charging Valves Bypass Valve, 1-CVC-188.

OR

b. Charging through Aux HPSI Header:

(1) Open SI Discharge To Charging Header Core Flush Valve, 1-CVC-269-MOV.

(2) Shut Charging Header Containment Isolation Valve, 1-CVC-183, located in [illegible] ft West Penetration Room.

(3) Shut HPSI Aux Header Isolation Valve, 1-SI-656-MOV.

(4) Shut Letdown Isolation Valves:

1-CVC-515-CV
1-CVC-516-CV

(5) Open any one of the four Aux HPSI Header Valves:

1-SI-617-MOV
1-SI-627-MOV
1-SI-637-MOV
1-SI-647-MOV

2. <u>Establish boric acid flowpath to Charging Pumps</u>:

a. BAST Lineup:

(1) Ensure BAST level is greater than zero.

(2) Shut VCT Makeup Valve, 1-CVC-512-CV.

(3) Open Boric Acid Direct Makeup Valve, 1-CVC-514-MOV.

(4) Open BAST Gravity Feed Valves:

1-CVC-508-MOV
1-CVC-509-MOV

(5) Shut VCT Outlet Valve, 1-CVC-501-MOV.

(6) Start Boric Acid Pumps.

(7) Start all available Charging Pumps.

(8) Ensure Charging Pump discharge pressure greater than RCS pressure.

OR

b. RWT Lineup:

(1) Ensure RWT level greater than 2 ft.

(2) Open RWT To Charging Pump Suction Valve, 1-CVC-504-MOV.

(3) Shut VCT Outlet Valve, 1-CVC-501-MOV.

(4) Start all available Charging Pumps.

(5) Ensure Charging Pump discharge pressure greater than RCS pressure.

RCS PRESSURE AND INVENTORY CONTROL

I. PRECAUTIONS

A. Do not adopt manual operation of automatically controlled systems unless a malfunction is apparent or automatic system operation will not support the maintenance of a safety function.

B. Systems shifted to manual operation must be monitored frequently to ensure correct operation.

C. At least two independent indications should be used, when available, to evaluate and corroborate a specific plant condition since an incident could induce inconsistencies between instruments.

D. Solid water operation of the Pressurizer should be avoided unless 30°F subcooling cannot be maintained. If the RCS is solid, closely monitor RCS makeup or letdown and avoid system heatup or cooldown rates which could induce rapid pressure excursions.

E. Indications of high RCS inventory (high pressurizer level) may be caused by the displacement of water from voided areas of the RCS. Operation of letdown under these conditions may lower RCS pressure and, subsequently, increase RCS voiding.

II. RCS PRESSURE AND INVENTORY ACCEPTANCE CRITERIA

A. **IF** either of the following conditions exist:

1. RCS pressure and temperature are within the limits per Attachment (1) and:

   a. Pressurizer level is between 35 and 250 inches.

   b. RCS subcooling is greater than 30°F, using CET temperatures.

   c. RVLMS indicates that the Core is covered.

OR

2. RCS pressure and temperature are within the limits per Attachment (1) and:

   a. All available Charging Pumps running.

   b. HPSI and LPSI Pumps are injecting water into RCS per Attachments (12) and (13).

   c. RVLMS indicates that the Core is covered.

THEN RCS Pressure and Inventory Safety Function is satisfied.

B. **WHEN** RCS Pressure and Inventory Safety Function is satisfied, **THEN** proceed to the next safety function in jeopardy.

III. RECOVERY ACTIONS

A. ENSURE AUTOMATIC CONTROL OF PRESSURIZER LEVEL AND PRESSURE:

1. Manually operate control systems which are not providing correct automatic control of pressurizer level or pressure:

   a. **IF** Pressurizer Level Control System **NOT** restoring level to 160 inches, **THEN** manually operate charging and letdown to stabilize level in indicating range.

   b. **IF** Pressurizer Pressure Control System **NOT** restoring pressure to setpoint value, **THEN** manually operate heaters and sprays to maintain RCS subcooling between 30 and 140°F.

2. Ensure automatic protective actions occur:

   a. Verify PORVs open at 2400 PSIA and shut by 2300 PSIA.

   b. **IF** RCS pressure decreases to 1725 PSIA, **THEN** verify SIAS actuation **AND** commence SIAS Verification Checklist, Attachment (2).

   c. **IF** RWT level decreases to between 0.5 and 1.0 ft **OR** "ACTUATION SYS RAS TRIPPED" alarm received, **THEN** verify RAS actuation **AND** commence RAS Verification Checklist, Attachment (6).

B. MONITOR FOR RCP TRIP CRITERIA.

1. Trip RCPs as indicated below:

   a. **IF** RCS pressure decreases to 1725 PSIA, **THEN** trip 11A and 12B RCPs **OR** trip 11B and 12A RCPs.

   b. **IF** RCS pressure decreases to less than 1300 PSIA, **THEN** trip all RCPs.

   c. **IF** CIS has actuated, **THEN** trip all RCPs.

C. MAINTAIN ADEQUATE WATER SUPPLY TO PUMPS CONTROLLING RCS INVENTORY:

- CAUTION -

Long term injection of concentrated boric acid could result in degraded core heat removal due to plating out the boron.

1. Charging Pumps aligned to BASTs using Boric Acid Pumps:

   a. Shut VCT Makeup Valve, 1-CVC-512-CV.

   b. Open Boric Acid Direct Makeup Valve, 1-CVC-514-MOV.

   c. Start a Boric Acid Pump.

OR

2. Charging Pumps aligned to BASTs using gravity feed:

   a. Shut VCT Makeup Valve, 1-CVC-512-CV.

   b. Open BAST Gravity Feed Valves:

      1-CVC-508-MOV
      1-CVC-509-MOV

   c. Shut VCT Outlet Valve, 1-CVC-501-MOV.

OR

3. Charging Pumps aligned to VCT:

   a. Ensure VCT level greater than 50 inches.

   b. Open VCT Outlet Valve, 1-CVC-501-MOV.

OR

4. Charging Pumps aligned to RWT:

   a. Open RWT To Charging Pump Suction Valve, 1-CVC-504-MOV.

   b. Shut VCT Outlet Valve, 1-CVC-501-MOV.

   c. Shut Boric Acid Direct Makeup Valve, 1-CVC-514-MOV.

   d. Secure Boric Acid Pumps.

OR

5. HPSI and LPSI Pumps aligned to RWT:

   a. Open RWT Outlet Valves:

      1-SI-4142-MOV
      1-SI-4143-MOV

   b. Ensure RWT level greater than 4 ft.

OR

6. HPSI and LPSI Pumps aligned to containment sump:

   a. Monitor containment water level to ensure adequate suction water supply.

   b. Place SI Pump Mini Flow Lockout Switches in ON.

   c. Commence RAS Verification Checklist, Attachment (6).

   d. Shut RWT Outlet valves:

      1-SI-4142-MOV
      1-SI-4143-MOV

D. MAINTAIN AT LEAST ONE RCS MAKEUP PATH:

1. Normal charging path:

   a. Open Loop Charging Valves:

      1-CVC-518-CV
      1-CVC-519-CV

   b. IF Loop Charging Valves shut,
      THEN charging may continue through Loop Charging Valves Bypass Valve, 1-CVC-188.

OR

2. Charging through Aux HPSI Header:

   a. Open SI Discharge To Charging Header Core Flush Valve, 1-CVC-269-MOV.

   b. Shut Charging Header Containment Isolation Valve, 1-CVC-183, located in 27 ft West Penetration Room.

   c. Shut HPSI Aux Header Isolation Valve, 1-SI-656-MOV.

   d. Shut Letdown Isolation Valves:

      1-CVC-515-CV
      1-CVC-516-CV

e. Open any one of the four Aux HPSI Header Valves:

1-SI-617-MOV
1-SI-627-MOV
1-SI-637-MOV
1-SI-647-MOV

<u>OR</u>

3. <u>HPSI Pump makeup to RCS in SIAS or RAS mode:</u>

a. Check RCS pressure less than 1270 PSIA.

b. <u>**IF**</u> RCS pressure greater than 1270 PSIA, <u>**THEN**</u> depressurize per guidelines in step F.<u>2</u>.e., page 18.

c. Open Main and Aux HPSI Header Valves:

1-SI-616-MOV	1-SI-617-MOV
1-SI-626-MOV	1-SI-627-MOV
1-SI-636-MOV	1-SI-637-MOV
1-SI-646-MOV	1-SI-647-MOV

<u>OR</u>

4. <u>LPSI Pump makeup.</u>

a. Check RCS pressure less than 180 PSIA.

b. Open LPSI Header Valves:

1-SI-615-MOV
1-SI-625-MOV
1-SI-635-MOV
1-SI-645-MOV

E. ESTABLISH AND MAINTAIN RCS MAKEUP FLOW:

1. <u>Charging Pump makeup:</u>

a. Start all available Charging Pumps.

b. Ensure Charging Pump discharge pressure greater than RCS pressure.

c. Ensure pump running current between 75 and 95 AMPS.

<u>OR</u>

2. HPSI Pump makeup in SIAS mode:

   a. Start 11 and 13 HPSI Pumps.

   b. **IF** 11 or 13 HPSI Pump fails,
   THEN start 12 HPSI Pump **AND** align to appropriate header.

   c. Verify HPSI flow per Attachment (12).

OR

3. HPSI Pump makeup in RAS mode:

   a. Start 11 or 13 HPSI Pumps.

   b. **IF** HPSI flow greater than 1000 GPM with two HPSI Pumps operating,
   THEN equally throttle HPSI flow to 1000 GPM.

   c. **IF** HPSI flow greater than 600 GPM with one HPSI Pump operating,
   THEN equally throttle HPSI flow to 600 GPM.

- **CAUTION** -

To prevent pump damage, minimum flow per operating HPSI Pump is 30 GPM.

   d. **IF** HPSI Pump cavitation occurs in recirculation mode,
   THEN throttle HPSI flow per Attachment (12).

   e. **IF** Attachment (12) does **NOT** allow throttling HPSI flow,
   THEN align Containment Spray Pump(s) to HPSI Pump suction:

      (1) **IF** 11 HPSI Pump cavitating,
      THEN open 11 SDC HX To HPSI Suction Valve, 1-SI-663-MOV **AND** start 11 Containment Spray Pump.

      (2) **IF** 13 HPSI Pump cavitating,
      THEN open 12 SDC HX To HPSI Suction Valve, 1-SI-662-MOV **AND** start 12 Containment Spray Pump.

OR

4. LPSI Pump makeup:

a. Place 11 or 12 LPSI Pump RAS Override Switch in OVERRIDE.

b. Start selected LPSI Pump.

c. Verify LPSI flow per Attachment (13).

F. MAINTAIN SUBCOOLED MARGIN BETWEEN 30 AND 140°F:

-CAUTION-

The potential exists for pressurized thermal shock from an excessive cooldown rate followed by a repressurization.

1. Raise subcooling by any of the following:

-NOTE-

Pressurizer Backup Heater Banks 11 and 13 trip on U/V and SIAS.

a. Energize Pressurizer Heater(s).

OR

b. Operate Turbine Bypass or Atmospheric Dump Valves to maximize RCS cooldown, while maintaining cooldown rate less than 100°F/h.

OR

c. **IF** unable to obtain desired cooldown rate with Turbine Bypass and Atmospheric Dump Valves,
THEN use steam driven AFW Pump(s) to increase cooldown rate.

OR

d. Raise HPSI flow to RCS.

OR

e. Charging system pressurization:

(1) Charge as necessary to maintain at least 30°F subcooling.

(2) **IF** high pressurizer level secures backup Charging Pumps **AND** more than one Charging Pump required, **THEN** locally initiate SIAS A6 and B6 **AND** secure Boric Acid Pump as needed.

(3) Secure Charging Pumps not required to maintain subcooling.

OR

f. Solid plant pressurization:

(1) Station a dedicated pressure control watch at the 1C05 and 1C06 panels.

(2) Verify letdown flowpath operable.

(3) Secure all but one Charging Pump by placing in PULL-TO-LOCK.

(4) Charge as necessary with remaining pump to maintain a minimum 30°F subcooling.

(5) Closely monitor makeup or draining and any heatup or cooldown to avoid rapid pressure excursions.

2. Lower subcooling by any of the following:

a. De-energize Pressurizer Heater(s).

OR

b. Lower RCS cooldown rate.

OR

c. **IF** the following conditions can be maintained:

(1) At least 30°F subcooling.

(2) Pressurizer level greater than 101 inches.

(3) At least one S/G available for heat removal.

(4) RVLMS indicates that the Core is covered.

THEN throttle HPSI or charging flow as necessary to maintain subcooling between 30 and 140°F.

OR

d. Initiate Auxiliary Spray:

(1) Place Instrument Air CIS Override Switch, 1-HS-2080A, in OVERRIDE.

(2) Open Cntmt Instrument Air Isolation MOV, 1-IA-2080-MOV.

(3) Record temperature differential between Pressurizer and Regenerative Heat Exchanger Outlet.

(4) Open Auxiliary Spray Valve, 1-CVC-517-CV.

(5) Shut Loop Charging Valves:

1-CVC-518-CV
1-CVC-519-CV

-NOTE-

1-HS-2085 located on West wall of 27 ft Switchgear Room; Key #85 in Control Room Key Locker.

(6) Open Cntmt Instrument Air Supply CV, 1-IA-2085-CV, by momentarily placing 1-HS-2085 in OPEN.

(7) Shift Pressurizer Spray Valve Controller, 1-HIC-100, to MANUAL and shut Pressurizer Spray Valves:

1-RC-100E-CV
1-RC-100F-CV

(8) Maintain pressurizer cooldown rate less than 200°F/h.

OR

e. PORV depressurization:

(1) Shift Letdown Control Valve Controller, 1-HIC-110, to MANUAL and shut Letdown Control Valves:

1-CVC-110P-CV
1-CVC-110Q-CV

(2) De-energize the Pressurizer Heaters by placing all handswitches in OFF.

(3) Start all available Containment Air Coolers in HIGH with maximum SRW flow.

(4) Open Main and Aux HPSI Header Valves:

1-SI-616-MOV	1-SI-617-MOV
1-SI-626-MOV	1-SI-627-MOV
1-SI-636-MOV	1-SI-637-MOV
1-SI-646-MOV	1-SI-647-MOV

(5) Verify both PORV Block Valves open.

(6) Start all available Charging Pumps.

(7) Start 11 and 13 HPSI Pumps.

(8) Pull two High Pressurizer Pressure Trip Units.

(9) Verify PORVs open.

(10) **WHEN** subcooling less than 140°F, **THEN** insert High Pressurizer Pressure Trip Units that were previously pulled **AND** ensure "PORV ENERGIZED" alarm clear.

G. VERIFY RCS TEMPERATURE AND PRESSURE WITHIN THE LIMITS PER ATTACHMENT (1).

CORE AND RCS HEAT REMOVAL

I. PRECAUTIONS

A. Do not adopt manual operation of automatically controlled systems unless a malfunction is apparent or automatic system operation will not support the maintenance of a safety function.

B. Systems shifted to manual operation must be monitored frequently to ensure correct operation.

C. At least two independent indications should be used, when available, to evaluate and corroborate a specific plant condition since an incident could induce inconsistencies between instruments.

D. If an initial RCS cooldown rate exceeds Technical Specification limits, the potential exists for pressurized thermal shock of the Reactor Vessel unless post accident pressure and temperature limits are restored and maintained.

E. If both S/Gs boil dry, only attempt to refill one S/G to reinitiate core cooling.

F. In Natural Circulation, increased loop transport time causes a 5 to 10 minute delay in temperature responses to a plant change. Pressurizer level and pressure responses, if available, typically provide better indication of RCS response during this period.

G. If cooling down with a S/G isolated, an inverted delta T (Tcold higher than Thot) may be observed in the idle loop. This is due to a small amount of reverse heat transfer in the isolated S/G. The inverted delta T is not expected to have any significant affect on natural circulation flow in the operating S/G loop.

II. CORE AND RCS HEAT REMOVAL ACCEPTANCE CRITERIA

A. IF any of the following conditions exist:

1. One S/G with level between (-)250 and (+)50 inches and trending toward zero and:

   a. RCS flow by Forced Flow or Natural Circulation.

   b. RCS subcooling greater than 30°F using CETs.

   c. CET temperatures constant or decreasing.

   d. RVLMS indicates that the Core is covered.

OR

2. One S/G with feedwater flow greater than 150 GPM and level being restored and:

   a. RCS flow by Forced Flow or Natural Circulation.

   b. RCS subcooling greater than 30°F using CETs.

   c. CET temperatures constant or decreasing.

   d. RVLMS indicates that the Core is covered.

OR

3. HPSI or LPSI Pumps injecting water into RCS and CET temperatures constant or decreasing.

OR

4. Once Through Core Cooling in progress and CET temperatures constant or decreasing.

THEN Core and RCS Heat Removal Safety Function is satisfied.

B. **WHEN** Core and RCS Heat Removal Safety Function is satisfied, **THEN** proceed to the next safety function in jeopardy.

III. RECOVERY ACTIONS

A. MAINTAIN S/G OPERABILITY:

1. **IF** an uncontrolled cooldown occurs,
THEN isolate both S/Gs:

   a. Shut both MSIVs.

   b. Shut S/G Feedwater Isolation Valves:

   1-FW-4516-MOV
   1-FW-4517-MOV

   c. Shut MSIV Bypass Valves:

   1-MS-4045-MOV
   1-MS-4052-MOV

   d. Shut AFW Steam Supply Valves by placing handswitches in CLOSE:

   1-MS-4070-CV
   1-MS-4071-CV

   e. Shut AFW Block Valves by placing handswitches in CLOSE:

11 S/G	12 S/G
1-AFW-4520-CV	1-AFW-4530-CV
1-AFW-4521-CV	1-AFW-4531-CV
1-AFW-4522-CV	1-AFW-4532-CV
1-AFW-4523-CV	1-AFW-4533-CV

   f. Shut upstream drains by placing handswitch 1-HS-6622 in CLOSE.

   g. Shut S/G Blowdown Valves:

   1-BD-4010-CV
   1-BD-4011-CV
   1-BD-4012-CV
   1-BD-4013-CV

   h. Shut Atmospheric Dump Valves.

i. **IF** one S/G has a steam line rupture,
THEN maintain unaffected S/G operability during blowdown phase per EOP-4, Step J, page 10.

j. **WHEN** cooldown rate less than 100°F/h,
THEN establish S/G(s) as heat sink.

OR

2. Control steam flow and maintain Tcold less than 540°F:

a. Operate Turbine Bypass Valves from Control Room.

OR

b. Operate Atmospheric Dump Valves from Control Room.

OR

c. Operate Atmospheric Dump Valves from 1C43:

(1) Verify 1C43 Atmospheric Dump Controllers at 0% output.

(2) Align Hand Transfer Valves to 1C43 position:

11 S/G	12 S/G
1-HV-3938A	1-HV-3939A
1-HV-3938B	1-HV-3939B

(3) Open Atmospheric Dump Valve(s) using 1C43 controller(s).

OR

-NOTE-

Atmospheric Dump Valves are reverse acting, i.e., clockwise to open, counterclockwise to shut.

d. Manually open Atmospheric Dump Valves by using chain operator.

OR

e. Manually position Turbine Bypass Valves.

OR

-CAUTION-

Operating history indicates S/G Safety Valves may fail to reseat completely after lifting.

f. Manually open S/G Safety Valve:

(1) Lower S/G pressure as low as possible using other heat removal methods prior to attempting manual operation of S/G Safety Valve.

(2) Operate manual lifting lever to open S/G Safety Valve.

OR

-CAUTION-

The following step may blow out the Condenser Rupture Disks and may cause equipment damage.

g. Align steam drains to Condenser:

(1) Open upstream drains by placing handswitch 1-HS-6622 in OPEN.

(2) Open downstream drains by placing handswitch 1-HS-6600 in OPEN.

(3) **IF** MSIVs shut,
THEN open MSIV Bypass Valves.

OR

-CAUTION-

The following step will blow out the Condenser Rupture Disks and may cause equipment damage.

h. **IF** additional heat removal required **AND** condenser vacuum **NOT** available,
THEN open Turbine Bypass Valve(s):

(1) Open all doors to the outside on the 45 ft Turbine Building.

(2) Notify personnel to evacuate 45 ft Turbine Building.

(3) Manually operate Turbine Bypass Valve(s) as directed by Control Room personnel.

3. Control Main Feedwater flow to S/Gs:

a. Ensure main feed rate is maintaining a constant level or controlled increase in S/G level.

-CAUTION-

Severe waterhammer may occur if Main Feed Ring is allowed to drain then subsequently refilled.

b. Establish a shutdown feed system lineup:

(1) One operating S/G Feed Pump.

(2) One operating Condensate Booster Pump.

(3) One operating Condensate Pump.

(4) Both Heater Drain Pumps secured.

c. **WHEN** manual control of feed flow rate desired **OR** S/G levels between (-)24 and (+)30 inches, **THEN** perform the following:

(1) Depress Feed Regulating Bypass Valve Reset Buttons.

(2) Adjust Feed Regulating Bypass Valve(s) to raise S/G levels to approximately 0 inches.

d. **WHEN** S/G levels are 0 inches, **THEN** shift Feed Regulating Bypass Controllers to AUTO.

OR

4. **IF** Main Feedwater **NOT** available, **THEN** feed S/Gs with AFW:

a. Establish condensate sources:

(1) Confirm 12 CST operable:

(a) Ensure 12 CST level greater than 5 ft.

(b) Open 12 CST Unit 1 AFW Pump Suction Valve, 1-AFW-161.

(OR)

-CAUTION-

Before transferring AFW Pump suction to an alternate supply the possibility of suction line or CST rupture should be considered.

(2) **IF** 12 CST **NOT** operable,
THEN line up 11 CST as alternate suction supply:

(a) Locally open 11 CST AFW Pump Suction Valves:

1-AFW-131
1-AFW-167

(b) Locally shut 12 CST Unit 1 AFW Pump Suction Valve, 1-AFW-161.

(c) Confirm normal CST level response.

(OR)

-NOTE-

The following step will cause CST levels to equalize.

(3) **IF** 11 CST **NOT** available,
THEN line up 21 CST as alternate suction supply:

(a) Locally open 21 CST AFW Pump Suction Valves:

2-AFW-131
2-AFW-167

(b) Locally open 12 CST AFW Pump Suction Valves:

1-AFW-161
2-AFW-161

(c) Confirm normal CST level response.

(OR)

(4) Align Fire System to 13 AFW Pump suction:

(a) Shut 13 AFW Pump Suction Valve, 1-AFW-182.

(b) Connect fire hoses between pump suction and a fire main.

(c) Open Fire Hose Connection Isolation Valve, 1-AFW-180.

(OR)

(5) Align Fire System to 23 AFW Pump suction for cross connected operation:

(a) Shut 23 AFW Pump Suction Valve, 2-AFW-182.

(b) Connect fire hoses between pump suction and a fire main.

(c) Open Fire Hose Connection Isolation Valve, 2-AFW-180.

(OR)

(6) **IF** Condensate Pump available,
THEN transfer hotwell inventory to 11 CST:

(a) Shift Hotwell Level Controller, 1-LIC-4405-CV, to MANUAL.

(b) Adjust Controller to open Hotwell To CST Dump CV, 1-CD-4405-CV.

(c) Shut one Condensate Pump Discharge Valve:

11 Pump	1-CD-106
12 Pump	1-CD-113
13 Pump	1-CD-120

(d) Start appropriate Condensate Pump.

(e) Slowly open pump discharge valve to maintain flow rate less than 2000 GPM.

(f) Stop pump when cavitation occurs.

(g) Shut Hotwell To CST Dump CV, 1-CD-4405-CV.

(OR)

(7) Emergency fill 11 CST from Fire System:

(a) Connect fire hose between fire house hose manifold and 11 CST Emergency Hose Connection Valve, 1-CD-312.

(b) Open 11 CST Emergency Hose Connection Valve, 1-CD-312.

(c) Ensure 11 CST level increasing.

(OR)

(8) Emergency fill 21 CST from Fire System:

(a) Connect fire hose between fire house hose manifold and 21 CST Emergency Hose Connection Valve, 2-CD-312.

(b) Open 21 CST Emergency Hose Connection Valve, 2-CD-312.

(c) Ensure 21 CST level increasing.

b. Establish AFW flowpath:

(1) Open all motor and steam driven train AFW Block Valves:

<u>11 S/G</u>	<u>12 S/G</u>
1-AFW-4520-CV	1-AFW-4530-CV
1-AFW-4521-CV	1-AFW-4531-CV
1-AFW-4522-CV	1-AFW-4532-CV
1-AFW-4523-CV	1-AFW-4533-CV

(2) **<u>IF</u>** AFW Block Valve(s) will **<u>NOT</u>** open from Control Room,
<u>THEN</u> locally open valve(s) using Hand Transfer Station(s) on North wall of SRW Room.

(3) Open AFW Flow Control Valves:

<u>11 S/G</u>	<u>12 S/G</u>
1-AFW-4511-CV	1-AFW-4512-CV
1-AFW-4525-CV	1-AFW-4535-CV

(4) **<u>IF</u>** AFW Flow Control Valve(s) will **<u>NOT</u>** open,
<u>THEN</u> locally throttle open bypass valve(s):

(a) 4511-CV 11 S/G Bypass Valve, 1-AFW-163, located in 27 ft East Penetration Room.

(b) 4525-CV 11 S/G Bypass Valve, 1-AFW-195, located in SRW Room.

(c) 4512-CV 12 S/G Bypass Valve, 1-AFW-165, located in 27 ft East Penetration Room.

(d) 4535-CV 12 S/G Bypass Valve, 1-AFW-196, located in SRW Room.

c. Start at least one AFW Pump:

-CAUTION-

D/G supplying power to 13 AFW Pump flow limit is 300 GPM; otherwise, flow limit is 575 GPM.

(1) Start 13 AFW Pump:

(a) Place 13 AFW Pump Handswitch in START.

(b) Ensure normal pump running current of 60 to 70 AMPS.

(c) Ensure 13 AFW Pump flow of 150 GPM per S/G.

(OR)

(2) Start 11 or 12 AFW Pump:

(a) Open 11 and 12 AFW Pump Main Steam Supply Valves:

1-MS-109
1-MS-107

(b) Open 11 or 12 S/G AFW Steam Supply Valves:

1-MS-4070-CV
1-MS-4071-CV

(c) Open 11 and 12 AFW Pump Turbine Throttle/Stop Valves:

1-MS-3986
1-MS-3988

(d) Verify 11 or 12 AFW Pump discharge pressure approximately 100 PSI greater than S/G pressure.

(e) Verify 11 or 12 AFW Pump flow of 150 GPM per S/G.

(f) Ensure normal or emergency AFW Room Ventilation operable.

(OR)

(3) **IF** unable to feed S/Gs with Unit 1 AFW Pumps, **THEN** establish Unit 2 to Unit 1 cross connect operation:

(a) Shut Unit 2 motor train AFW Block Valves:

2-AFW-4522-CV
2-AFW-4523-CV
2-AFW-4532-CV
2-AFW-4533-CV

(b) Open Unit 2 to Unit 1 AFW Cross Connect Valve, 2-AFW-4550-CV.

-CAUTION-

D/G Supplying power to 23 AFW Pump flow limit is 300 GPM; otherwise, flow limit is 575 GPM.

(c) Start 23 AFW Pump by placing handswitch in START.

(d) Ensure normal pump running current of 60 to 70 AMPS.

(e) Maintain 150 GPM flow to each S/G using Unit 1 AFW Flow Control Valves:

1-AFW-4525-CV
1-AFW-4535-CV

(OR)

-CAUTION-

D/G supplying power to 13 AFW Pump flow limit is 300 GPM; otherwise, flow limit is 575 GPM.

(4) Locally start 13 AFW Pump:

(a) Press CLOSE button at 152-1116.

-CAUTION-

Removing control power fuses causes a loss of overcurrent, undervoltage and ground protection.

(b) IF breaker fails to close,
THEN remove breaker control power fuses
AND press CLOSE button at 152-1116.

(OR)

(5) Locally start 11 or 12 AFW Pump:

(a) Turn turbine governor control knob counterclockwise to the minimum position.

(b) Isolate the Instrument Air to the Turbine Governor Controller(s):

1-I/P-3987
1-I/P-3989

(c) Open - filter drains on controllers to allow local control.

(d) Open AFW Steam Supply Bypass Valves:

1-MS-102
1-MS-105

(e) Open 11 and 12 AFW Pump Turbine Throttle/Stop Valves:

1-MS-3986
1-MS-3988

(f) Adjust turbine governor control knob to maintain AFW Pump discharge pressure 100 PSI greater than S/G pressure.

OR

5. **IF** AFW flow to S/G **NOT** established **AND** power available to Condensate and Condensate Booster Pump, **THEN** depressurize S/G to allow feeding with Condensate Booster Pump:

a. Verify S/G heat removal available per step A.2, page 22.

b. Establish maximum cooldown rate not exceeding 100°F/h.

c. **WHEN** "SGIS A(B) BLOCK PERMITTED" alarm(s) received, **THEN** block SGIS A(B).

d. **IF** SGIS actuates, **THEN** block SGIS **AND** reset SGIS signal.

(1) Place Condensate Booster Pumps in PULL-TO-LOCK.

(2) Match handswitches per SGIS Verification Checklist, Attachment (7).

(3) Block SGIS.

(4) Reset SGIS signal.

e. Open S/G Feedwater Isolation Valves.

f. Shut Main Feed Regulating Valves.

g. Depress Feed Regulating Bypass Valve Reset Buttons.

h. Manually adjust Feed Regulating Bypass Valve Controllers to 30% output.

i. Open Condensate Precoat Filter and Condensate Demin Bypass Valves.

j. Verify one Condensate Pump running.

k. Verify one Condensate Booster Pump running.

l. Place Heat Drain Pump Handswitches in PULL-TO-LOCK.

-NOTE-

Feedwater flow to S/Gs should start when S/G pressure decreases to approximately 500 PSIA.

m. Monitor feedwater flow to S/G:

(1) Main Feed Regulating Valve Differential Pressure Controller indicates greater than 0.

(2) S/G level constant or increasing.

6. Establish RCS Flow:

a. Ensure at least one RCP operating in a loop with an operable S/G.

OR

b. Confirm Natural Circulation in at least one operable S/G loop:

-NOTE-

Wide range Thot may be obtained from Subcooled Margin Monitor per Attachment (10).

(1) Thot minus Tcold between 10 and 50°F.

(2) Tcold constant or decreasing.

(3) Thot constant or decreasing.

(4) CET temperatures consistent with Thot.

(5) Steaming rate affects primary temperature.

c. Monitor for Core and RCS voiding:

-CAUTION-

Potential for void formation increases rapidly when pressure decreases below 1500 PSIA.

(1) Letdown flow greater than charging flow.

(2) Rapid unexplained increase in pressurizer level during an RCS pressure reduction.

(3) Loss of subcooled margin as determined using CET temperatures.

(4) "REACTOR VESSEL WATER LEVEL LOW" alarm.

d. **IF** voiding inhibits heat removal,
THEN reduce or eliminate voided area:

(1) Shut the Letdown Isolation Valve, 1-CVC-515-CV.

(2) Pressurize the RCS to maintain subcooling as near 140°F as practical.

(3) **IF** pressurizing the RCS does **NOT** eliminate the voids,
THEN operate Reactor Vessel Vent Valves per OI-1G.

-CAUTION-

If voids exist in the S/G tubes, a rapid RCS pressure reduction will occur when the voids collapse.

(4) **IF** voiding occurs in the S/G tubes (saturation pressure of S/G greater than saturation pressure of RCS),
THEN cool the S/G by raising any of the following:

(a) Steaming rate.

(b) Feed rate.

(c) S/G Blowdown rate.

AND maintaining less than 100°F/h cooldown rate.

OR

B. SAFETY INJECTION CORE COOLING.

1. Ensure HPSI or LPSI flow maintaining CET temperatures less than 560°F and constant or decreasing.

OR

C. ONCE THROUGH CORE COOLING.

1. Commence Once Through Core Cooling:

-CAUTION-

After S/G becomes ineffective for heat removal, Once Through Core Cooling must be initiated prior to CET temperatures reaching 560°F to ensure adequate heat removal.

a. **WHEN** either of the following conditions exist:

   (1) Steaming S/G becomes ineffective and CET temperatures begin to increase.

   (2) HPSI or LPSI flow insufficient and CET temperatures begin to increase.

   THEN commence Once Through Core Cooling.

b. Shift Letdown Control Valve Controller, 1-HIC-110, to MANUAL and shut Letdown Control Valves:

   1-CVC-110P-CV
   1-CVC-110Q-CV

c. Start all available Charging Pumps.

d. Open Main and Aux HPSI Header Valves:

1-SI-616-MOV	1-SI-617-MOV
1-SI-626-MOV	1-SI-627-MOV
1-SI-636-MOV	1-SI-637-MOV
1-SI-646-MOV	1-SI-647-MOV

e. Start 11 and 13 HPSI Pumps.

f. De-energize the Pressurizer Heaters by placing all handswitches in OFF.

g. Start all available Containment Air Coolers in HIGH with maximum SRW flow.

h. Open both PORVs:

(1) **WHEN** "PRSR PRESS BLOCK A(B) PERMITTED" alarm(s) received,
THEN block SIAS A(B).

(2) Verify both PORV Block Valves open.

(3) Pull two High Pressurizer Pressure Trip Units.

(4) Verify PORVs open.

i. **IF** containment pressure increases to 2.0 PSIG **AND** still increasing,
THEN start one Containment Spray Pump and open associated Cntmt Spray Header CV.

11	or	12
1-SI-4150-CV		1-SI-4151-CV

j. **IF** containment pressure increases to 2.8 PSIG,
THEN verify ESFAS actuation **AND** commence Verification Checklists:

(1) SIAS per Attachment (2).

(2) CIS per Attachment (4).

k. **IF** containment pressure increases to 4.25 PSIG,
THEN verify CSAS actuation **AND** commence Verification Checklist, Attachment (3).

l. Confirm initiation of Once Through Core Cooling.

(1) **WHEN** RCS pressure is less than 1270 PSIA,
THEN ensure HPSI flow **AND** CET temperatures constant or decreasing.

m. Using CET temperatures, maintain subcooling bet[illegible] 30 and 140°F per Attachment (1) by throttling HPSI [illegible]

(1) Lower subcooling by lowering HPSI flow.

(2) Raise subcooling by raising HPSI flow.

n. Continue cooldown using Once Through Core Cooling until feedwater restored or shutdown cooling entry conditions are established.

CONTAINMENT ISOLATION

I. PRECAUTIONS

A. Local radioactivity levels should be determined before attempting local manual valve isolation.

II. CONTAINMENT ISOLATION ACCEPTANCE CRITERIA

A. **IF** either of the following conditions exist:

1. Containment pressure less than 0.7 PSIG and the following RMS alarms clear:

   a. S/G Blowdown.

   b. Condenser Off-Gas.

   c. Main Vent Gaseous (1-RI-5415).

   d. Containment Radiation Monitors.

   e. Noble Gas Monitor.

OR

2. Each containment penetration required to be shut has an isolation valve shut.

THEN Containment Isolation Safety Function is satisfied.

B. **WHEN** Containment Isolation Safety Function is satisfied, **THEN** proceed to the next Safety Function in jeopardy.

III. RECOVERY ACTIONS

A. VERIFY AUTOMATIC PROTECTIVE ACTIONS OCCUR.

1. Verify SIAS, CIS, CSAS:

a. **IF** containment pressure increases to 2.8 PSIG, **THEN** verify ESFAS actuation **AND** commence Verification Checklists:

(1) SIAS per Attachment (2).

(2) CIS per Attachment (4).

b. **IF** containment pressure increases to 4.25 PSIG, **THEN** verify CSAS actuation **AND** commence Verification Checklist, Attachment (3).

B. **IF** A SIAS, CIS, CSAS VALVE FAILS TO SHUT, **THEN** SHUT LOCALLY **OR** SHUT NEXT VALVE OUT FROM PENETRATION.

C. CHECK LOCKED VALVE DEVIATION LOG TO DETERMINE IF ANY MANUAL CONTAINMENT ISOLATION VALVES NEED TO BE SHUT.

D. **IF** S/G HAS A RUPTURED TUBE **AND** S/G **NOT** REQUIRED FOR HEAT REMOVAL,
THEN ENSURE S/G ISOLATED.

E. **IF** CONTAINMENT RMS ALARM RECEIVED,
THEN START ALL AVAILABLE IODINE FILTER FANS.

CONTAINMENT ENVIRONMENT

I. PRECAUTIONS

None

II. CONTAINMENT ENVIRONMENT ACCEPTANCE CRITERIA

A. IF either of the following conditions exist:

1. Containment temperature and pressure are constant or decreasing and:

   a. Containment temperature is less than 222°F.

   b. Containment pressure is less than 2.8 PSIG.

   c. H_2 concentration less than 2% (only necessary if greater than four hours since initiation of event.)

OR

2. Containment temperature and pressure are constant or decreasing and:

   a. Containment Spray flow is greater than 1350 GPM.

   b. H_2 concentration less than 2% (only necessary if greater than four hours since initiation of event.)

THEN Containment Environment Safety Function is satisfied.

B. WHEN Containment Environment Safety Function is satisfied, THEN proceed to the next safety function in jeopardy.

III. RECOVERY ACTIONS

A. VERIFY AUTOMATIC PROTECTIVE ACTIONS OCCUR.

1. VERIFY SIAS, CIS, CSAS:

   a. **IF** containment pressure increases to 2.8 PSIG, **THEN** verify ESFAS actuation **AND** commence Verification Checklists:

      (1) SIAS per Attachment (2).

      (2) CIS per Attachment (4).

   b. **IF** containment pressure increases to 4.25 PSIG, **THEN** verify CSAS actuation **AND** commence Verification Checklist, Attachment (3).

B. MAINTAIN CONTAINMENT COOLING.

1. Maintain at least one of the following minimum containment cooling combinations in operation while containment pressure is above 4.25 PSIG:

   a. Two Containment Spray trains.

   OR

   b. One Containment Spray train and any two Containment Air Coolers with maximum SRW flow.

   OR

   c. Three Containment Air Coolers with maximum SRW flow.

2. Verify SRW Pump Room Ventilation in service, per OI-15.

C. HYDROGEN CONTROL:

1. Direct Chemistry to place Hydrogen Monitors in service.

2. Establish containment ventilation to ensure no local hydrogen accumulation:

   a. Start available Containment Air Coolers.

   b. Start available Cavity Cooling Fans.

   c. Start Pressurizer Ventilation Fan.

3. **IF** hydrogen concentration increases to 1%, **THEN** start Hydrogen Recombiners per OI-41A.

OR

4. W[illegible] approval of SEC, establish Hydrogen Purge System Operation per OI-41B.

IV. SAFETY FUNCTION STATUS CHECK

A. The STA (or person designated by STA) will perform the safety function status checks at 10 minute intervals until plant conditions stabilize.

B. Immediately notify Shift Supervisor or Control Room Supervisor if any safety function criteria is not being satisfied.

C. Review data and verify that safety function acceptance criteria are satisfied.

D. When all safety function acceptance criteria are being satisfied, diagnosis of event(s) may begin.

E. The safety function status checks of EOP-8 should continue until an appropriate optimum recovery procedure is selected.

REACTIVITY CONTROL ACCEPTANCE CRITERIA

REACTIVITY CONTROL PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA	
	CRITERIA	STATUS CHECK
a. WRNI power	decreasing	----------
b. SUR (DPM)	negative	----------
c. CEA status	all inserted	----------
or		
Boration status:		
concentation	increasing	----------
BAST/RWT level	decroasing	----------

Reactivity Control Safety Function is saticfied if:

CRITERIA	SATISFIED
a. All CEAs inserted and WRNI power decreasing.	----------
OR	
b. RCS boration in progress and WRNI power decreasing.	----------
OR	
c. WRNI power less than 10^{-4}% and constant or decreasing.	----------

RCS PRESSURE AND INVENTORY ACCEPTANCE CRITERIA

RCS PRESSURE AND INVENTORY PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA	
	CRITERIA	STATUS CHECK
a. Pressurizer pressure (PSIA)	within limits per Attachment (1)	______________
b. Pressurizer level (inches)*	35 to 250	______________
c. Charging flow (GPM)	greater than 40	______________
d. HPSI flow (GPM)	per Attachment (12)	______________
e. LPSI flow (GPM)	per Attachment (13)	______________
f. RCS Subcooling (°F)	30 to 140	______________
g. RVLMS	core covered	______________

* Limit may be exceeded for solid plant operation.

RCS Pressure and Inventory Safety Function is satisfied if:

CRITERIA	SATISFIED
a. RCS pressure and temperature are within the limits per Attachment (1) and:	
(1) Pressurizer level is between 35 and 250 inches.	
(2) RCS subcooling is greater than 30°F using CET temperatures.	
(3) RVLMS indicates that the Core is covered.	______________
OR	
b. RCS pressure and temperature are within the limits per Attachment (1) and:	
(1) All available Charging Pumps running.	
(2) HPSI and LPSI Pumps are injecting water into RCS per Attachment (12) and (13).	
(3) RVLMS indicates that the Core is covered.	______________

CORE AND RCS HEAT REMOVAL ACCEPTANCE CRITERIA

CORE AND RCS HEAT REMOVAL PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA	
	CRITERIA	STATUS CHECK
a. S/G pressure (PSIA)	less than 960	-------------------------------
b. S/G level (inches)	(-)250 to (+)50	-------------------------------
c. CST level (ft)	greater than 5	-------------------------------
d. Feedwater flow (GPM)	greater than 150	-------------------------------
e. CET ($^{\circ}$F)	less than 560	-------------------------------
f. RCS Subcooling ($^{\circ}$F)	30 to 140	-------------------------------
g. RVLMS	core covered	-------------------------------
h. Tcold ($^{\circ}$F)	less than 540	-------------------------------
i. Thot minus Tcold ($^{\circ}$F)		
Natural Circulation	10 to 50	-------------------------------
Forced Circulation	less than 10	-------------------------------
j. HPSI flow (GPM)	per Attachment (12)	-------------------------------
k. LPSI flow (GPM)	per Attachment (13)	-------------------------------

Core and RCS Heat Removal Safety Function is satisfied if:

CRITERIA	SATISFIED
a. One S/G with level between (-)250 and (+)50 inches and trending toward zero and: (1) RCS flow by Forced Flow or Natural Circulation. (2) RCS subcooling greater than 30°F using CETs. (3) CET temperatures constant or decreasing. (4) RVLMS indicates that the Core is covered.	-------------------
OR	
b. One S/G with feedwater flow greater than 150 GPM and level being restored and: (1) RCS flow by Forced Flow or Natural Circulation. (2) RCS subcooling greater than 30°F using CETs. (3) CET temperatures constant or decreasing. (4) RVLMS indicates that the Core is covered.	-------------------
OR	
c. HPSI or LPSI Pumps injecting water into RCS and CET temperatures constant or decreasing.	-------------------
OR	
d. Once Through Core Cooling in progress and CET temperatures constant or decreasing.	-------------------

VITAL AUXILIARIES ACCEPTANCE CRITERIA

VITAL AUXILIARIES	SAFETY FUNCTION ACCEPTANCE CRITERIA	
	CRITERIA	STATUS CHECK
a. 4KV vital buses 11 or 14	energized	________________
b. Instrument Air pressure (PSIG)	greater than 88	________________
c. Component Cooling (# pumps running)	1 or 2	________________
d. Saltwater (# pumps running)	1 or 2	________________
e. Service Water (# pumps running)	1 or 2	________________
f. 125V DC buses 11, 12, 21, 22	energized	________________
g. 120V AC vital buses 11, 12, 13, 14	energized	________________

Refer to appropriate AOP for any Vital Auxiliaries in jeopardy.

CONTAINMENT ISOLATION ACCEPTANCE CRITERIA

CONTAINMENT ISOLATION PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA	
	CRITERIA	STATUS CHECK
a. Containment pressure (PSIG)	less than 0.7	______
b. S/G B/D RMS	alarm clear	______
c. Condenser Off-Gas RMS	alarm clear	______
d. Main Vent Gaseous RMS (1-R1-5415)	alarm clear	______
e. Containment Radiation Monitors	alarms clear	______
f. Noble Gas Monitor	alarm clear	______
g. Containment penetration valves	all required to be shut are shut	______

Containment Isolation Safety Function is satisfied if:

CRITERIA	**SATISFIED**
a. Containment pressure less than 0.7 PSIG and the following RMS alarms clear: (1) S/G Blowdown. (2) Condenser Off-Gas. (3) Main Vent Gaseous (1-R1-5415). (4) Containment Radiation Monitors. (5) Noble Gas Monitor.	______
OR	
b. Each containment penetration required to be shut has an isolation valve shut.	______

CONTAINMENT ENVIRONMENT ACCEPTANCE CRITERIA

CONTAINMENT ENVIRONMENT	SAFETY FUNCTION ACCEPTANCE CRITERIA	
	CRITERIA	STATUS CHECK
a. Containment temperature (°F)	less than 222	----------
b. Containment pressure (PSIG)	less than 2.8	----------
c. Containment spray flow (GPM)	greater than 1350	----------
d. Hydrogen concentration	less than 2%	----------

Containment Environment Safety Function is satisfied if:

CRITERIA	SATISFIED
a. Containment temperature and pressure are constant or decreasing and : (1) Containment temperature is less than 222°F. (2) Containment pressure is less than 2.8 PSIG. (3) H_2 concentration less than 2% (only necessary if greater than four hours since initiation of event.)	----------
OR	
b. Containment temperature and pressure are constant or decreasing and : (1) Containment Spray flow is greater than 1350 GPM. (2) H_2 concentration less than 2% (only necessary if greater than four hours since initiation of event.)	----------

STATUS CHECK NUMBER	COMPLETE AT TIME
1	
2	
3	
4	

CALVERT CLIFFS NUCLEAR POWER PLANT

EOP-8 FUNCTIONAL RECOVERY PROCEDURE

REVISION 1

	SIGNATURE	DATE
PREPARED BY;		12-18-87
VERIFIED BY;	James V. Groom	12/18/87
POSRC;	MEETING # 88-7	2-10-88
APPROVED BY;	J B Lemons Manager-Nuclear Operations or General Supervisor-Operations if POSRC review is not required	2-10-88

LIST OF EFFECTIVE PAGES

I. ENTRY CONDITIONS

The operator should enter the Functional Recovery Procedure under the following circumstances:

A. EOP-0 has been compl3ted but an event diagnosis cannot be made.

<u>OR</u>

B. An event diagnosis has been made and one of the EOP-1 through 7 procedures has been implemented but one or more safety functions are not meeting their acceptance criteria and the reason for the violation has not been established.

<u>OR</u>

C. An event diagnosis has been made and one of the EOP-1 through 7 procedures has been implemented but a subset of parameters for a single safety function are not meeting their acceptance criteria and the Shift Supervisor desires to reference EOP-8 to obtain additional guidance for a specific problem.

For the conditions of A or B, EOP-8 should be implemented in its entirety. The safety functions with the out of spec acceptance criteria should be addressed first.

When EOP-8 is implemented, the safety function status check of EOP-8 should be implemented until an appropriate optimum recovery procedure is selected.

EOP-8 need not be implemented if the parameters of a safety function are outside of their acceptance criteria and:

1. Reason for the violation has been established,

<u>AND</u>

2. Action has been identified that will return the parameter(s) to within their acceptance criteria,

<u>AND</u>

3. The Shift Supervisor determines the recovery of the out of spec parameter(s) to within acceptance criteria to be imminent.

REACTIVITY CONTROL

I. PRECAUTIONS

A. Do not adopt manual operation of automatically controlled systems unless a malfunction is apparent or automatic system operation will not support the maintenance of a safety function.

B. Systems shifted to manual operation must be monitored frequently to ensure correct operation.

C. At least two independent indications should be used, when available, to evaluate and corroborate a specific plant condition since an incident could induce inconsistencies between instruments.

D. The operator should not leave reactivity control until this function is fulfilled. If necessary, other urgent safety functions may be pursued in parallel but attempts to establish reactivity control must be continued until the acceptance criteria are met.

E. If possible, maintain RCS temperature greater than 515°F until reactivity control criteria are satisfied.

F. The concentration of boron in RCS makeup water should be consistent with maintaining the required shutdown margin.

G. When borating the RCS it is possible for a large difference in boron concentration to develop between the RCS and pressurizer fluids if main or auxiliary spray is not operated at intervals. If spray is unavailable, the RCS boron concentration should be increased by 50 ppm to maintain the required shutdown margin should a pressurizer outsurge occur.

II. REACTIVITY CONTROL ACCEPTANCE CRITERIA

A. IF any of the following conditions exist:

1. All CEAs inserted and WRNI power decreasing.

OR

2. RCS boration in progress and WRNI power decreasing.

OR

3. WRNI power less than 10^{-4}% and constant or decreasing.

THEN Reactivity Control Safety Function is satisfied.

B. WHEN Reactivity Control Safety Function is satisfied, THEN proceed to the next safety function in jeopardy.

III. RECOVERY ACTIONS

A. INITIATE REACTOR SHUTDOWN BY CEA INSERTION:

1. Depress both sets of Manual Reactor Trip Buttons.

OR

2. De-energize CEDM Motor Generator Sets:

   a. Open feeder breaker to 22A 480V Bus.

   b. Open feeder breaker to 23A 480V Bus.

   c. Open tie breakers to 22A and 23A 480V Buses.

OR

3. Depress local Emergency Trip Buttons on the Trip Circuit Breakers.

OR

B. INITIATE REACTOR SHUTDOWN BY BORATION:

1. Establish charging flowpath to RCS:

   a. Normal CVCS lineup:

      (1) Open Loop Charging Valves:

         2-CVC-518-CV
         2-CVC-519-CV

      (2) **IF** Loop Charging Valves shut,
         THEN charging may continue through Loop Charging Valves Bypass Valve, 2-CVC-188.

   OR

   b. Charging through Aux HPSI Header:

      (1) Open SI Discharge To Charging Header Core Flush Valve, 2-CVC-269-MOV.

      (2) Shut Charging Header Containment Isolation Valve, 2-CVC-183, located in 27 ft West Penetration Room.

      (3) Shut HPSI Aux Header Isolation Valve, 2-SI-656-MOV.

      (4) Shut Letdown Isolation Valves:

         2-CVC-515-CV
         2-CVC-516-CV

      (5) Open any one of the four Aux HPSI Header Valves:

         2-SI-617-MOV
         2-SI-627-MOV
         2-SI-637-MOV
         2-SI-647-MOV

2. Establish boric acid flowpath to Charging Pumps:

   a. BAST Lineup:

      (1) Ensure BAST levels greater than zero.

      (2) Shut VCT Makeup Valve, 2-CVC-512-CV.

      (3) Open Boric Acid Direct Makeup Valve, 2-CVC-514-MOV.

(4) Open BAST Gravity Feed Valves:

2-CVC-508-MOV
2-CVC-509-MOV

(5) Shut VCT Outlet Valve, 2-CVC-501-MOV.

(6) Start Boric Acid Pumps.

(7) Start all available Charging Pumps.

(8) Ensure Charging Pump discharge pressure greater than RCS pressure.

OR

b. RWT Lineup:

(1) Ensure RWT level greater than 2 ft.

(2) Open RWT To Charging Pump Suction Valve, 2-CVC-504-MOV.

(3) Shut VCT Outlet Valve, 2-CVC-501-MOV.

(4) Start all available Charging Pumps.

(5) Ensure Charging Pump discharge pressure greater than RCS pressure.

RCS PRESSURE AND INVENTORY CONTROL

I. PRECAUTIONS

A. Do not adopt manual operation of automatically controlled systems unless a malfunction is apparent or automatic system operation will not support the maintenance of a safety function.

B. Systems shifted to manual operation must be monitored frequently to ensure correct operation.

C. At least two independent indications should be used, when available, to evaluate and corroborate a specific plant condition since an incident could induce inconsistencies between instruments.

D. Solid water operation of the Pressurizer should be avoided unless 30°F subcooling cannot be maintained. If the RCS is solid, closely monitor RCS makeup or letdown and avoid system heatup or cooldown rates which could induce rapid pressure excursions.

E. Indications of high RCS inventory (high pressurizer level) may be caused by the displacement of water from voided areas of the RCS. Operation of letdown under these conditions may lower RCS pressure and, subsequently, increase RCS voiding.

II. RCS PRESSURE AND INVENTORY ACCEPTANCE CRITERIA

A. IF either of the following conditions exist:

1. RCS pressure and temperature are within the limits per Attachment (1) and:

   a. Pressurizer level is between 35 and 250 inches.

   b. RCS subcooling is greater than 30°F, using CET temperatures.

   c. RVLMS indicates that the Core is covered.

OR

2. RCS pressure and temperature are within the limits per Attachment (1) and:

   a. All available Charging Pumps running.

   b. HPSI and LPSI Pumps are injecting water into RCS per Attachments (12) and (13).

   c. RVLMS indicates that the Core is covered.

THEN RCS Pressure and Inventory Safety Function is satisfied.

B. WHEN RCS Pressure and Inventory Safety Function is satisfied, THEN proceed to the next safety function in jeopardy.

III. RECOVERY ACTIONS

____ A. ENSURE AUTOMATIC CONTROL OF PRESSURIZER LEVEL AND PRESSURE:

1. Manually operate control systems which are not providing correct automatic control of pressurizer level or pressure:

   a. IF Pressurizer Level Control System NOT restoring level to 160 inches,
   THEN manually operate charging and letdown to stabilize level in indicating range.

   b. IF Pressurizer Pressure Control System NOT restoring pressure to setpoint value,
   THEN manually operate heaters and sprays to maintain RCS subcooling between 30 and 140°F.

3. Ensure automatic protective actions occur:

   a. Verify PORVs open at 2400 PSIA and shut by 2300 PSIA.

   b. **IF** RCS pressure decreases to 1725 PSIA,
   THEN verify SIAS actuation **AND** commence SIAS Verification Checklist, Attachment (2).

   c. **IF** RWT level decreases to between 0.5 and 1.0 ft
   OR "ACTUATION SYS RAS TRIPPED" alarm received,
   THEN verify RAS actuation **AND** commence RAS Verification Checklist, Attachment (6).

B. MONITOR FOR RCP TRIP CRITERIA.

1. Trip RCPs as indicated below:

   a. **IF** RCS pressure decreases to 1725 PSIA,
   THEN trip 21A and 22B RCPs **OR** trip 21B and 22A RCPs.

   b. **IF** RCS pressure decreases to less than 1300 PSIA,
   THEN trip all RCPs.

   c. **IF** CIS has actuated,
   THEN trip all RCPs.

C. MAINTAIN ADEQUATE WATER SUPPLY TO PUMPS CONTROLLING RCS INVENTORY:

- **CAUTION** -

Long term injection of concentrated boric acid could result in degraded core heat removal due to plating out the boron.

1. Charging Pumps aligned to BASTs using Boric Acid Pumps:

   a. Shut VCT Makeup Valve, 2-CVC-512-CV.

   b. Open Boric Acid Direct Makeup Valve, 2-CVC-514-MOV.

   c. Start a Boric Acid Pump.

OR

2. <u>Charging Pumps aligned to BASTs using gravity feed:</u>

   a. Shut VCT Makeup Valve, 2-CVC-512-CV.

   b. Open BAST Gravity Feed Valves:

      2-CVC-508-MOV
      2-CVC-509-MOV

   c. Shut VCT Outlet Valve, 2-CVC-501-MOV.

<u>OR</u>

3. <u>Charging Pumps aligned to VCT:</u>

   a. Ensure VCT level greater than 50 inches.

   b. Open VCT Outlet Valve, 2-CVC-501-MOV.

<u>OR</u>

4. <u>Charging Pumps aligned to RWT:</u>

   a. Open RWT To Charging Pump Suction Valve, 2-CVC-504-MOV.

   b. Shut VCT Outlet Valve, 2-CVC-501-MOV.

   c. Shut Boric Acid Direct Makeup Valve, 2-CVC-514-MOV.

   d. Secure Boric Acid Pumps.

<u>OR</u>

5. <u>HPSI and LPSI Pumps aligned to RWT:</u>

   a. Open RWT Outlet Valves:

      2-SI-4142-MOV
      2-SI-4143-MOV

   b. Ensure RWT level greater than 4 ft.

<u>OR</u>

6. HPSI and LPSI Pumps aligned to containment sump:

   a. Monitor containment water level to ensure adequate suction water supply.

   b. Place SI Pump Mini Flow Lockout Switches in ON.

   c. Commence RAS Verification Checklist, Attachment (6).

   d. Shut RWT Outlet valves:

      2-SI-4142-MOV
      2-SI-4143-MOV

D. MAINTAIN AT LEAST ONE RCS MAKEUP PATH:

---

1. Normal charging path:

   a. Open Loop Charging Valves:

      2-CVC-518-CV
      2-CVC-519-CV

   b. **IF** Loop Charging Valves shut,
      THEN charging may continue through Loop Charging Valves Bypass Valve, 2-CVC-188.

OR

2. Charging through Aux HPSI Header:

   a. Open SI Discharge To Charging Header Core Flush Valve, 2-CVC-269-MOV.

   b. Shut Charging Header Containment Isolation Valve, 2-CVC-183, located in 27 ft West Penetration Room.

   c. Shut HPSI Aux Header Isolation Valve, 2-SI-656-MOV.

   d. Shut Letdown Isolation Valves:

      2-CVC-515-CV
      2-CVC-516-CV

e. Open any one of the four Aux HPSI Header Valves:

2-SI-617-MOV
2-SI-627-MOV
2-SI-637-MOV
2-SI-647-MOV

<u>OR</u>

<u>3. HPSI Pump makeup to RCS in SIAS or RAS mode:</u>

a. Check RCS pressure less than 1270 PSIA.

b. <u>**IF**</u> RCS pressure greater than 1270 PSIA, <u>**THEN**</u> depressurize per guidelines in step F.<u>2</u>.e., page 18.

c. Open Main and Aux HPSI Header Valves:

2-SI-616-MOV	2-SI-617-MOV
2-SI-626-MOV	2-SI-627-MOV
2-SI-636-MOV	2-SI-637-MOV
2-SI-646-MOV	2-SI-647-MOV

<u>OR</u>

<u>4. LPSI Pump makeup.</u>

a. Check RCS pressure less than 180 PSIA.

b. Open LPSI Header Valves:

2-SI-615-MOV
2-SI-625-MOV
2-SI-635-MOV
2-SI-645-MOV

E. ESTABLISH AND MAINTAIN RCS MAKEUP FLOW:

<u>1. Charging Pump makeup:</u>

a. Start all available Charging Pumps.

b. Ensure Charging Pump discharge pressure greater than RCS pressure.

c. Ensure pump running current between 75 and 95 AMPS.

<u>OR</u>

2. HPSI Pump makeup in SIAS mode:

   a. Start 21 and 23 HPSI Pumps.

   b. **IF** 21 or 23 HPSI Pump fails,
      THEN start 22 HPSI Pump **AND** align to appropriate header.

   c. Verify HPSI flow per Attachment (12).

OR

3. HPSI Pump makeup in RAS mode:

   a. Start 21 or 23 HPSI Pumps.

   b. **IF** HPSI flow greater than 1000 GPM with two HPSI Pumps operating,
      THEN equally throttle HPSI flow to 1000 GPM.

   c. **IF** HPSI flow greater than 600 GPM with one HPSI Pump operating,
      THEN equally throttle HPSI flow to 600 GPM.

- **CAUTION** -

To prevent pump damage, minimum flow per operating HPSI Pump is 30 GPM.

   d. **IF** HPSI Pump cavitation occurs in recirculation mode,
      THEN throttle HPSI flow per Attachment (12).

   e. **IF** Attachment (12) does **NOT** allow throttling HPSI flow,
      THEN align Containment Spray Pump(s) to HPSI Pump suction:

      (1) **IF** 21 HPSI Pump cavitating,
          THEN open 21 SDC HX To HPSI Suction Valve 2-SI-663-MOV **AND** start 21 Containment Spray Pump.

      (2) **IF** 23 HPSI Pump cavitating,
          THEN open 22 SDC HX To HPSI Suction Valve, 2-SI-662-MOV **AND** start 22 Containment Spray Pump.

OR

4. LPSI Pump makeup:

   a. Place 21 or 22 LPSI Pump RAS Override Switch in OVERRIDE.

   b. Start selected LPSI Pump.

   c. Verify LPSI flow per Attachment (13).

F. MAINTAIN SUBCOOLED MARGIN BETWEEN 30 AND 140°F:

-**CAUTION**-

The potential exists for pressurized thermal shock from an excessive cooldown rate followed by a repressurization.

1. Raise subcooling by any of the following:

-**NOTE**-

Pressurizer Backup Heater Banks 21 and 23 trip on U/V and SIAS.

   a. Energize Pressurizer Heater(s).

   OR

   b. Operate Turbine Bypass or Atmospheric Dump Valves to maximize RCS cooldown, while maintaining cooldown rate less than 100°F/h.

   OR

   c. **IF** unable to obtain desired cooldown rate with Turbine Bypass and Atmospheric Dump Valves,
   THEN use steam driven AFW Pump(s) to increase cooldown rate.

   OR

   d. Raise HPSI flow to RCS.

   OR

e. Charging system pressurization:

(1) Charge as necessary to maintain at least 30°F subcooling.

(2) **IF** high pressurizer level secures backup Charging Pumps **AND** more than one Charging Pump required, **THEN** locally initiate SIAS A6 and B6 **AND** secure Boric Acid Pump as needed.

(3) Secure Charging Pumps not required to maintain subcooling.

OR

f. Solid plant pressurization:

(1) Station a dedicated pressure control watch at the 2C05 and 2C06 panels.

(2) Verify letdown flowpath operable.

(3) Secure all but one Charging Pump by placing in PULL-TO-LOCK.

(4) Charge as necessary with remaining pump to maintain a minimum 30°F subcooling.

(5) Closely monitor makeup or draining and any heatup or cooldown to avoid rapid pressure excursions.

2. Lower subcooling by any of the following:

a. De-energize Pressurizer Heater(s).

OR

b. Lower RCS cooldown rate.

OR

c. **IF** the following conditions can be maintained:

(1) At least 30°F subcooling.

(2) Pressurizer level greater than 101 inches.

(3) At least one S/G available for heat removal.

(4) RVLMS indicates that the Core is covered.

THEN throttle HPSI or charging flow as necessary to maintain subcooling between 30 and 140°F.

OR

d. Initiate Auxiliary Spray:

(1) Place Instrument Air CIS Override Switch, 2-HS-2080A, in OVERRIDE.

(2) Open Cntmt Instrument Air Isolation MOV, 2-IA-2080-MOV.

(3) Record temperature differential between Pressurizer and Regenerative Heat Exchanger Outlet.

(4) Open Auxiliary Spray Valve, 2-CVC-517-CV.

(5) Shut Loop Charging Valves:

2-CVC-518-CV
2-CVC-519-CV

-NOTE-

2-HS-2085 located on West wall of 27 ft Switchgear Room; Key #80 in Control Room Key Locker.

(6) Open Cntmt Instrument Air Supply CV, 2-IA-2085-CV, by momentarily placing 2-HS-2085 in OPEN.

(7) Shift Pressurizer Spray Valve Controller, 2-HIC-100, to MANUAL and shut Pressurizer Spray Valves:

2-RC-100E-CV
2-RC-100F-CV

(8) Maintain pressurizer cooldown rate less than 200°F/h.

OR

e. PORV depressurization:

(1) Shift Letdown Control Valve Controller, 2-HIC-110, to MANUAL and shut Letdown Control Valves:

2-CVC-110P-CV
2-CVC-110Q-CV

(2) De-energize the Pressurizer Heaters by placing all handswitches in OFF.

(3) Start all available Containment Air Coolers in HIGH with maximum SRW flow.

(4) Open Main and Aux HPSI Header Valves:

2-SI-616-MOV	2-SI-617-MOV
2-SI-626-MOV	2-SI-627-MOV
2-SI-636-MOV	2-SI-637-MOV
2-SI-646-MOV	2-SI-647-MOV

(5) Verify both PORV Block Valves open.

(6) Start all available Charging Pumps.

(7) Start 21 and 23 HPSI Pumps.

(8) Pull two High Pressurizer Pressure Trip Units.

(9) Verify PORVs open.

(10) **WHEN** subcooling less than 140°F,
THEN insert High Pressurizer Pressure Trip Units that were previously pulled **AND** ensure "PORV ENERGIZED" alarm clear.

G. VERIFY RCS TEMPERATURE AND PRESSURE WITHIN THE LIMITS PER ATTACHMENT (1).

CORE AND RCS HEAT REMOVAL

I. PRECAUTIONS

A. Do not adopt manual operation of automatically controlled systems unless a malfunction is apparent or automatic system operation will not support the maintenance of a safety function.

B. Systems shifted to manual operation must be monitored frequently to ensure correct operation.

C. At least two independent indications should be used, when available, to evaluate and corroborate a specific plant condition since an incident could induce inconsistencies between instruments.

D. If an initial RCS cooldown rate exceeds Technical Specification limits, the potential exists for pressurized thermal shock of the Reactor Vessel unless post accident pressure and temperature limits are restored and maintained.

E. If both S/Gs boil dry, only attempt to refill one S/G to reinitiate core cooling.

F. In Natural Circulation, increased loop transport time causes a 5 to 10 minute delay in temperature responses to a plant change. Pressurizer level and pressure responses, if available, typically provide better indication of RCS response during this period.

G. If cooling down with a S/G isolated, an inverted delta T (Tcold higher than Thot) may be observed in the idle loop. This is due to a small amount of reverse heat transfer in the isolated S/G. The inverted delta T is not expected to have any significant affect on natural circulation flow in the operating S/G loop.

II. <u>CORE AND RCS HEAT REMOVAL ACCEPTANCE CRITERIA</u>

A. <u>IF</u> any of the following conditions exist:

1. One S/G with level between (-)250 and (+)50 inches and trending toward zero and:

   a. RCS flow by Forced Flow or Natural Circulation.

   b. RCS subcooling greater than 30°F using CETs.

   c. CET temperatures constant or decreasing.

   d. RVLMS indicates that the Core is covered.

<u>OR</u>

2. One S/G with feedwater flow greater than 150 GPM and level being restored and:

   a. RCS flow by Forced Flow or Natural Circulation.

   b. RCS subcooling greater than 30°F using CETs.

   c. CET temperatures constant or decreasing.

   d. RVLMS indicates that the Core is covered.

<u>OR</u>

3. HPSI or LPSI Pumps injecting water into RCS and CET temperatures constant or decreasing.

<u>OR</u>

4. Once Through Core Cooling in progress and CET temperatures constant or decreasing.

<u>THEN</u> Core and RCS Heat Removal Safety Function is satisfied.

B. **<u>WHEN</u>** Core and RCS Heat Removal Safety Function is satisfied, **<u>THEN</u>** proceed to the next safety function in jeopardy.

III. RECOVERY ACTIONS

A. MAINTAIN S/G OPERABILITY:

1. **IF** an uncontrolled cooldown occurs, **THEN** isolate both S/Gs:

   a. Shut both MSIVs.

   b. Shut S/G Feedwater Isolation Valves:

      2-FW-4516-MOV
      2-FW-4517-MOV

   c. Shut MSIV Bypass Valves:

      2-MS-4045-MOV
      2-MS-4052-MOV

   d. Shut AFW Steam Supply Valves by placing handswitches in CLOSE:

      2-MS-4070-CV
      2-MS-4071-CV

   e. Shut AFW Block Valves by placing handswitches in CLOSE:

21 S/G	22 S/G
2-AFW-4520-CV	2-AFW-4530-CV
2-AFW-4521-CV	2-AFW-4531-CV
2-AFW-4522-CV	2-AFW-4532-CV
2-AFW-4523-CV	2-AFW-4533-CV

   f. Shut upstream drains by placing handswitch 2-HS-6622 in CLOSE.

   g. Shut S/G Blowdown Valves:

      2-BD-4010-CV
      2-BD-4011-CV
      2-BD-4012-CV
      2-BD-4013-CV

   h. Shut Atmospheric Dump Valves.

i. **IF** one S/G has a steam line rupture, **THEN** maintain unaffected S/G operability during blowdown phase per EOP-4, Step J, page 10.

j. **WHEN** cooldown rate less than 100°F/h, **THEN** establish S/G(s) as heat sink.

OR

2. Control steam flow and maintain Tcold less than 540°F:

a. Operate Turbine Bypass Valves from Control Room.

OR

b. Operate Atmospheric Dump Valves from Control Room.

OR

c. Operate Atmospheric Dump Valves from 2C43:

(1) Verify 2C43 Atmospheric Dump Controllers at 0% output.

(2) Align Hand Transfer Valves to 2C43 position:

21 S/G	22 S/G
2-HV-3939A	2-HV-3938A
2-HV-3939B	2-HV-3938B

(3) Open Atmospheric Dump Valve(s) using 2C43 controller(s).

OR

-**NOTE**-

Atmospheric Dump Valves are reverse acting, i.e., clockwise to open, counterclockwise to shut.

d. Manually open Atmospheric Dump Valves by using chain operator.

OR

e. Manually position Turbine Bypass Valves.

OR

-CAUTION-

Operating history indicates S/G Safety Valves may fail to reseat completely after lifting.

f. Manually open S/G Safety Valve:

(1) Lower S/G pressure as low as possible using other heat removal methods prior to attempting manual operation of S/G Safety Valve.

(2) Operate manual lifting lever to open S/G Safety Valve.

OR

-CAUTION-

The following step may blow out the Condenser Rupture Disks and may cause equipment damage.

g. Align steam drains to Condenser:

(1) Open upstream drains by placing handswitch 2-HS-6622 in OPEN.

(2) Open downstream drains by placing handswitch 2-HS-6600 in OPEN.

(3) **IF** MSIVs shut,
THEN open MSIV Bypass Valves.

OR

-CAUTION-

The following step will blow out the Condenser Rupture Disks and may cause equipment damage.

h. **IF** additional heat removal required **AND** condenser vacuum **NOT** available,
THEN open Turbine Bypass Valve(s):

(1) Open all doors to the outside on the 45 ft Turbine Building.

(2) Notify personnel to evacuate 45 ft Turbine Building.

(3) Manually operate Turbine Bypass Valve(s) as directed by Control Room personnel.

3. Control Main Feedwater flow to S/Gs:

a. Ensure main feed rate is maintaining a constant level or controlled increase in S/G level.

-**CAUTION**-

Severe waterhammer may occur if Main Feed Ring is allowed to drain then subsequently refilled.

b. Establish a shutdown feed system lineup:

(1) One operating S/G Feed Pump.

(2) One operating Condensate Booster Pump.

(3) One operating Condensate Pump.

(4) Both Heater Drain Pumps secured.

c. **WHEN** manual control of feed flow rate desired OR S/G levels between (-)24 and (+)30 inches,
THEN perform the following:

(1) Depress Feed Regulating Bypass Valve Reset Buttons.

(2) Adjust Feed Regulating Bypass Valve(s) to raise S/G levels to approximately 0 inches.

d. **WHEN** S/G levels are 0 inches,
THEN shift Feed Regulating Bypass Controllers to AUTO.

OR

4. **IF** Main Feedwater **NOT** available,
THEN feed S/Gs with AFW:

a. Establish condensate sources:

(1) Confirm 12 CST operable:

(a) Ensure 12 CST level greater than 5 ft.

(b) Open 12 CST Unit 2 AFW Pump Suction Valve, 2-AFW-161.

(OR)

-CAUTION-

Before transferring AFW Pump suction to an alternate supply the possibility of suction line or CST rupture should be considered.

(2) **IF** 12 CST **NOT** operable,
THEN line up 21 CST as alternate suction supply:

(a) Locally open 21 CST AFW Pump Suction Valves:

2-AFW-131
2-AFW-167

(b) Locally shut 12 CST Unit 2 AFW Pump Suction Valve, 2-AFW-161.

(c) Confirm normal CST level response.

(OR)

-NOTE-

The following step will cause CST levels to equalize.

(3) **IF** 21 CST **NOT** available,
THEN line up 11 CST as alternate suction supply:

(a) Locally open 11 CST AFW Pump Suction Valves:

1-AFW-131
1-AFW-167

(b) Locally open 12 CST AFW Pump Suction Valves:

1-AFW-161
2-AFW-161

(c) Confirm normal CST level response.

(OR)

(4) Align Fire System to 23 AFW Pump suction:

(a) Shut 23 AFW Pump Suction Valve, 2-AFW-182.

(b) Connect fire hoses between pump suction and a fire main.

(c) Open Fire Hose Connection Isolation Valve, 2-AFW-180.

(OR)

(5) Align F[illegible] [illegible]stem to 13 AFW Pump suction for cross connect[illegible] [illegible]peration:

(a) Shut 13 AFW Pump Suction Valve, 1-AFW-182.

(b) Connect fire hoses between pump suction and a fire main.

(c) Open Fire Hose Connection Isolation Valve, 1-AFW-180.

(OR)

(6) <u>IF</u> Condensate Pump available, <u>THEN</u> transfer hotwell inventory to 21 CST:

(a) Shift Hotwell Level Controller, 2-LIC-4405-CV, to MANUAL.

(b) Adjust Controller to open Hotwell To CST Dump CV, 2-CD-4405-CV.

(c) Shut one Condensate Pump Discharge Valve:

21 Pump	2-CD-106
22 Pump	2-CD-113
23 Pump	2-CD-120

(d) Start appropriate Condensate Pump.

(e) Slowly open pump discharge valve to maintain flow rate less than 2000 GPM.

(f) Stop pump when cavitation occurs.

(g) Shut Hotwell To CST Dump CV, 2-CD-4405-CV.

(OR)

(7) Emergency fill 21 CST from Fire System:

(a) Connect fire hose between fire house hose manifold and 21 CST Emergency Hose Connection Valve, 2-CD-312.

(b) Open 21 CST Emergency Hose Connection Valve, 2-CD-312.

(c) Ensure 21 CST level increasing.

(OR)

(8) Emergency fill 11 CST from Fire System:

(a) Connect fire hose between fire house hose manifold and 11 CST Emergency Hose Connection Valve, 1-CD-312.

(b) Open 11 CST Emergency Hose Connection Valve, 1-CD-312.

(c) Ensure 11 CST level increasing.

b. Establish AFW flowpath:

(1) Open all motor and steam driven train AFW Block Valves:

<u>21 S/G</u>	<u>22 S/G</u>
2-AFW-4520-CV	2-AFW-4530-CV
2-AFW-4521-CV	2-AFW-4531-CV
2-AFW-4522-CV	2-AFW-4532-CV
2-AFW-4523-CV	2-AFW-4533-CV

(2) <u>IF</u> AFW Block Valve(s) will **<u>NOT</u>** open from Control Room,
<u>THEN</u> locally open valve(s) using Hand Transfer Station(s) on South wall of SRW Room.

(3) Open AFW Flow Control Valves:

<u>21 S/G</u>	<u>22 S/G</u>
2-AFW-4511-CV	2-AFW-4512-CV
2-AFW-4525-CV	2-AFW-4535-CV

(4) <u>IF</u> AFW Flow Control Valve(s) will **<u>NOT</u>** open,
<u>THEN</u> locally throttle open bypass valve(s):

(a) 4511-CV 21 S/G Bypass Valve, 2-AFW-163, located in 27 ft East Penetration Room.

(b) 4525-CV 21 S/G Bypass Valve, 2-AFW-195, located in SRW Room.

(c) 4512-CV 22 S/G Bypass Valve, 2-AFW-165, located in 27 ft East Penetration Room.

(d) 4535-CV 22 S/G Bypass Valve, 2-AFW-196, located in SRW Room.

c. Start at least one AFW Pump:

-<u>CAUTION</u>-

D/G supplying power to 23 AFW Pump flow limit is 300 GPM; otherwise, flow limit is 575 GPM.

(1) Start 23 AFW Pump:

(a) Place 23 AFW Pump Handswitch in START.

(b) Ensure normal pump running current of 60 to 70 AMPS.

(c) Ensure 23 AFW Pump flow of 150 GPM per S/G.

(OR)

(2) Start 21 or 22 AFW Pump:

(a) Open 21 and 22 AFW Pump Main Steam Supply Valves:

2-MS-109
2-MS-107

(b) Open 21 or 22 S/G AFW Steam Supply Valves:

2-MS-4070-CV
2-MS-4071-CV

(c) Open 21 and 22 AFW Pump Turbine Throttle/Stop Valves:

2-MS-3986
2-MS-3988

(d) Verify 21 or 22 AFW Pump discharge pressure approximately 100 PSI greater than S/G pressure.

(e) Verify 21 or 22 AFW Pump flow of 150 GPM per S/G.

(f) Ensure normal or emergency AFW Room Ventilation operable.

(OR)

(3) **IF** unable to feed S/Gs with Unit 2 AFW Pumps, **THEN** establish Unit 1 to Unit 2 cross connect operation:

(a) Shut Unit 1 motor train AFW Block Valves:

1-AFW-4522-CV
1-AFW-4523-CV
1-AFW-4532-CV
1-AFW-4533-CV

(b) Open Unit 1 to Unit 2 AFW Cross Connect Valve, 1-AFW-4550-CV.

-CAUTION-

D/G Supplying power to 13 AFW Pump flow limit is 300 GPM; otherwise, flow limit is 575 GPM.

(c) Start 13 AFW Pump by placing handswitch in START.

(d) Ensure normal pump running current of 60 to 70 AMPS.

(e) Maintain 150 GPM flow to each S/G using Unit 2 AFW Flow Control Valves:

2-AFW-4525-CV
2-AFW-4535-CV

(OR)

-**<u>CAUTION</u>**-

D/G supplying power to 23 AFW Pump flow limit is 300 GPM; otherwise, flow limit is 575 GPM.

(4) Locally start 23 AFW Pump:

(a) Press CLOSE button at 152-2415.

-**<u>CAUTION</u>**-

Removing control power fuses causes a loss of overcurrent, undervoltage and ground protection.

(b) <u>IF</u> breaker fails to close,
<u>THEN</u> remove breaker control power fuses
<u>AND</u> press CLOSE button at 152-2415.

(OR)

(5) Locally start 21 or 22 AFW Pump:

(a) Turn turbine governor control knob counterclockwise to the minimum position.

(b) Isolate the Instrument Air to the Turbine Governor Controller(s):

2-I/P-3987
2-I/P-3989

(c) Open air filter drains on controllers to allow local control.

(d) Open AFW Steam Supply Bypass Valves:

2-MS-102
2-MS-105

(e) Open 21 and 22 AFW Pump Turbine Throttle/Stop Valves:

2-MS-3986
2-MS-3988

(f) Adjust turbine governor control knob to maintain AFW Pump discharge pressure 100 PSI greater than S/G pressure.

<u>OR</u>

5. **IF** AFW flow to S/G **NOT** established **AND** power available to Condensate and Condensate Booster Pump,
THEN depressurize S/G to allow feeding with Condensate Booster Pump:

a. Verify S/G heat removal available per step A.2, page 22.

b. Establish maximum cooldown rate not exceeding 100°F/h.

c. **WHEN** "SGIS A(B) BLOCK PERMITTED" alarm(s) received,
THEN block SGIS A(B).

d. **IF** SGIS actuates,
THEN block SGIS **AND** reset SGIS signal.

(1) Place Condensate Booster Pumps in PULL-TO-LOCK.

(2) Match handswitches per SGIS Verification Checklist, Attachment (7).

(3) Block SGIS.

(4) Reset SGIS signal.

e. Open S/G Feedwater Isolation Valves.

f. Shut Main Feed Regulating Valves.

g. Depress Feed Regulating Bypass Valve Reset Buttons.

h. Manually adjust Feed Regulating Bypass Valve Controllers to 30% output.

i. Open Condensate Precoat Filter and Condensate Demin Bypass Valves.

j. Verify one Condensate Pump running.

k. Verify one Condensate Booster Pump running.

l. Place Heater Drain Pump Handswitches in PULL-TO-LOCK.

-NOTE-

Feedwater flow to S/Gs should start when S/G pressure decreases to approximately 500 PSIA.

m. Monitor feedwater flow to S/G:

(1) Main Feed Regulating Valve Differential Pressure Controller indicates greater than 0.

(2) S/G level constant or increasing.

6. Establish RCS Flow:

a. Ensure at least one RCP operating in a loop with an operable S/G.

OR

b. Confirm Natural Circulation in at least one operable S/G loop:

-NOTE-

Wide range Thot may be obtained from Subcooled Margin Monitor per Attachment (10).

(1) Thot minus Tcold between 10 and 50^{O}F.

(2) Tcold constant or decreasing.

(3) Thot constant or decreasing.

(4) CET temperatures consistent with Thot.

(5) Steaming rate affects primary temperature.

c. Monitor for Core and RCS voiding:

-CAUTION-

Potential for void formation increases rapidly when pressure decreases below 1500 PSIA.

(1) Letdown flow greater than charging flow.

(2) Rapid unexplained increase in pressurizer level during an RCS pressure reduction.

(3) Loss of subcooled margin as determined using CET temperatures.

(4) "REACTOR VESSEL WATER LEVEL LOW" alarm.

d. **IF** voiding inhibits heat removal,
THEN reduce or eliminate voided area:

(1) Shut the Letdown Isolation Valve, 2-CVC-515-CV.

(2) Pressurize the RCS to maintain subcooling as near 140°F as practical.

(3) **IF** pressurizing the RCS does **NOT** eliminate the voids,
THEN operate Reactor Vessel Vent Valves per OI-1G.

-CAUTION-

If voids exist in the S/G tubes, a rapid RCS pressure reduction will occur when the voids collapse.

(4) **IF** voiding occurs in the S/G tubes (saturation pressure of S/G greater than saturation pressure of RCS),
THEN cool the S/G by raising any of the following:

(a) Steaming rate.

(b) Feed rate.

(c) S/G Blowdown rate.

AND maintaining less than 100°F/h cooldown rate.

OR

B. SAFETY INJECTION CORE COOLING.

1. Ensure HPSI or LPSI flow maintaining CET temperatures less than 560°F and constant or decreasing.

OR

C. ONCE THROUGH CORE COOLING.

1. Commence Once Through Core Cooling.

-CAUTION-

After S/G becomes ineffective for heat removal, Once Through Core Cooling must be initiated prior to CET temperatures reaching 560°F to ensure adequate heat removal.

a. **WHEN** either of the following conditions exist:

(1) Steaming S/G becomes ineffective and CET temperatures begin to increase.

(2) HPSI or LPSI flow insufficient and CET temperatures begin to increase.

THEN commence Once Through Core Cooling.

b. Shift Letdown Control Valve Controller, 2-HIC-110, to MANUAL and shut Letdown Control Valves:

2-CVC-110P-CV
2-CVC-110Q-CV

c. Start all available Charging Pumps.

d. Open Main and Aux HPSI Header Valves:

2-SI-616-MOV	2-SI-617-MOV
2-SI-626-MOV	2-SI-627-MOV
2-SI-636-MOV	2-SI-637-MOV
2-SI-646-MOV	2-SI-647-MOV

e. Start 21 and 23 HPSI Pumps.

f. De-energize the Pressurizer Heaters by placing all handswitches in OFF.

g. Start all available Containment Air Coolers in HIGH with maximum SRW flow.

h. Open both PORVs:

(1) **WHEN** "PRSR PRESS BLOCK A(B) PERMITTED" alarm(s) received,
THEN block SIAS A(B).

(2) Verify both PORV Block Valves open.

(3) Pull two High Pressurizer Pressure Trip Units.

(4) Verify PORVs open

i. **IF** containment pressure increases to 2.0 PSIG **AND** still increasing,
THEN start one Containment Spray Pump and open associated Cntmt Spray Header CV.

21	or	22
2-SI-4150-CV		2-SI-4151-CV

j. **IF** containment pressure increases to 2.8 PSIG,
THEN verify ESFAS actuation **AND** commence Verification Checklists:

(1) SIAS per Attachment (2).

(2) CIS per Attachment (4).

k. **IF** containment pressure increases to 4.25 PSIG,
THEN verify CSAS actuation **AND** commence Verification Checklist, Attachment (3).

l. Confirm initiation of Once Through Core Cooling.

(1) **WHEN** RCS pressure is less than 1270 PSIA,
THEN ensure HPSI flow **AND** CET temperatures constant or decreasing.

m. Using CET temperatures, maintain subcooling between 30 and 140°F per Attachment (1) by throttling HPSI flow:

(1) Lower subcooling by lowering HPSI flow.

(2) Raise subcooling by raising HPSI flow.

n. Continue cooldown using Once Through Core Cooling until feedwater restored or shutdown cooling entry conditions are established.

CONTAINMENT ISOLATION

I. PRECAUTIONS

A. Local radioactivity levels should be determined before attempting local manual valve isolation.

II. CONTAINMENT ISOLATION ACCEPTANCE CRITERIA

A. IF either of the following conditions exist:

1. Containment pressure less than 0.7 PSIG and the following RMS alarms clear:

   a. S/G Blowdown.

   b. Condenser Off-Gas.

   c. Main Vent Gaseous (2-RI-5415).

   d. Containment Radiation Monitors.

   e. Noble Gas Monitor.

OR

2. Each containment penetration required to be shut has an isolation valve shut.

THEN Containment Isolation Safety Function is satisfied.

B. WHEN Containment Isolation Safety Function is satisfied, THEN proceed to the next Safety Function in jeopardy.

III. RECOVERY ACTIONS

A. VERIFY AUTOMATIC PROTECTIVE ACTIONS OCCUR.

1. Verify SIAS, CIS, CSAS:

   a. **IF** containment pressure increases to 2.8 PSIG, **THEN** verify ESFAS actuation **AND** commence Verification Checklists:

      (1) SIAS per Attachment (2).

      (2) CIS per Attachment (4).

   b. **IF** containment pressure increases to 4.25 PSIG, **THEN** verify CSAS actuation **AND** commence Verification Checklist, Attachment (3).

B. **IF** A SIAS, CIS, CSAS VALVE FAILS TO SHUT, **THEN** SHUT LOCALLY **OR** SHUT NEXT VALVE OUT FROM PENETRATION.

C. CHECK LOCKED VALVE DEVIATION LOG TO DETERMINE IF ANY MANUAL CONTAINMENT ISOLATION VALVES NEED TO BE SHUT.

D. **IF** S/G HAS A RUPTURED TUBE **AND** S/G **NOT** REQUIRED FOR HEAT REMOVAL,
THEN ENSURE S/G ISOLATED.

E. **IF** CONTAINMENT RMS ALARM RECEIVED,
THEN START ALL AVAILABLE IODINE FILTER FANS.

CONTAINMENT ENVIRONMENT

I. PRECAUTIONS

None

II. CONTAINMENT ENVIRONMENT ACCEPTANCE CRITERIA

A. IF either of the following conditions exist:

1. Containment temperature and pressure are constant or decreasing and:

   a. Containment temperature is less than 222°F.

   b. Containment pressure is less than 2.8 PSIG.

   c. H_2 concentration less than 2% (only necessary if greater than four hours since initiation of event.)

OR

2. Containment temperature and pressure are constant or decreasing and:

   a. Containment Spray flow is greater than 1350 GPM.

   b. H_2 concentration less than 2% (only necessary if greater than four hours since initiation of event.)

THEN Containment Environment Safety Function is satisfied.

B. WHEN Containment Environment Safety Function is satisfied, THEN proceed to the next safety function in jeopardy.

III. RECOVERY ACTIONS

A. VERIFY AUTOMATIC PROTECTIVE ACTIONS OCCUR.

1. VERIFY SIAS, CIS, CSAS:

   a. **IF** containment pressure increases to 2.8 PSIG, **THEN** verify ESFAS actuation **AND** commence Verification Checklists:

      (1) SIAS per Attachment (2).

      (2) CIS per Attachment (4).

   b. **IF** containment pressure increases to 4.25 PSIG, **THEN** verify CSAS actuation **AND** commence Verification Checklist, Attachment (3).

B. MAINTAIN CONTAINMENT COOLING.

1. Maintain at least one of the following minimum containment cooling combinations in operation while containment pressure is above 4.25 PSIG:

   a. Two Containment Spray trains.

   OR

   b. One Containment Spray train and any two Containment Air Coolers with maximum SRW flow.

   OR

   c. Three Containment Air Coolers with maximum SRW flow.

2. Verify SRW Pump Room Ventilation in service, per OI-15.

C. HYDROGEN CONTROL:

1. Direct Chemistry to place Hydrogen Monitors in service.

2. Establish containment ventilation to ensure no local hydrogen accumulation:

   a. Start available Containment Air Coolers.

   b. Start available Cavity Cooling Fans.

3. **IF** hydrogen concentration increases to 1%, **THEN** start Hydrogen Recombiners per OI-41A.

OR

4. With approval of SEC, establish Hydrogen Purge System Operation per OI-41B.

IV. SAFETY FUNCTION STATUS CHECK

A. The STA (or person designated by STA) will perform the safety function status checks at 10 minute intervals until plant conditions stabilize.

B. Immediately notify Shift Supervisor or Control Room Supervisor if any safety function criteria is not being satisfied.

C. Review data and verify that safety function acceptance criteria are satisfied.

D. When all safety function acceptance criteria are being satisfied, diagnosis of event(s) may begin.

E. The safety function status checks of EOP-8 should continue until an appropriate optimum recovery procedure is selected.

REACTIVITY CONTROL ACCEPTANCE CRITERIA

REACTIVITY CONTROL PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA	
	CRITERIA	STATUS CHECK
a. WRNI power	decreasing	______
b. SUR (DPM)	negative	______
c. CEA status	all inserted	______
or		
Boration status:		
concentation	increasing	______
BAST/RWT level	decreasing	______

Reactivity Control Safety Function is satisfied if:

CRITERIA	SATISFIED
a. All CEAs inserted and WRNI power decreasing.	______
OR	
b. RCS boration in progress and WRNI power decreasing.	______
OR	
c. WRNI power less than 10^{-4}% and constant or decreasing.	______

RCS PRESSURE AND INVENTORY ACCEPTANCE CRITERIA

RCS PRESSURE AND INVENTORY PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA: CRITERIA	SAFETY FUNCTION ACCEPTANCE CRITERIA: STATUS CHECK
a. Pressurizer pressure (PSIA)	within limits per Attachment (1)	______
b. Pressurizer level (inches)*	35 to 250	______
c. Charging flow (GPM)	greater than 40	______
d. HPSI flow (GPM)	per Attachment (12)	______
e. LPSI flow (GPM)	per Attachment (13)	______
f. RCS Subcooling (^{o}F)	30 to 140	______
g. RVLMS	core covered	______

* Limit may be exceeded for solid plant operation.

RCS Pressure and Inventory Safety Function is satisfied if:

CRITERIA	SATISFIED
a. RCS pressure and temperature are within the limits per Attachment (1) and:	
(1) Pressurizer level is between 35 and 250 inches.	
(2) RCS subcooling is greater than 30^{o}F using CET temperatures.	
(3) RVLMS indicates that the Core is covered.	______
OR	
b. RCS pressure and temperature are within the limits per Attachment (1) and:	
(1) All available Charging Pumps running.	
(2) HPSI and LPSI Pumps are injecting water into RCS per Attachment (12) and (13).	
(3) RVLMS indicates that the Core is covered.	______

CORE AND RCS HEAT REMOVAL ACCEPTANCE CRITERIA

CORE AND RCS HEAT REMOVAL PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA	
	CRITERIA	STATUS CHECK
a. S/G pressure (PSIA)	less than 960	______________
b. S/G level (inches)	(-)250 to (+)50	______________
c. CST level (ft)	greater than 5	______________
d. Feedwater flow (GPM)	greater than 150	______________
e. CET (^{o}F)	less than 560	______________
f. RCS Subcooling (^{o}F)	30 to 140	______________
g. RVLMS	core covered	______________
h. Tcold (^{o}F)	less than 540	______________
i. Thot minus Tcold (^{o}F)		
Natural Circulation	10 to 50	______________
Forced Circulation	less than 10	______________
j. HPSI flow (GPM)	per Attachment (12)	______________
k. LPSI flow (GPM)	per Attachment (13)	______________

Core and RCS Heat Removal Safety Function is satisfied if:

CRITERIA	SATISFIED
a. One S/G with level between (-)250 and (+)50 inches and trending toward zero and:	
(1) RCS flow by Forced Flow or Natural Circulation.	
(2) RCS subcooling greater than 30°F using CETs.	
(3) CET temperatures constant or decreasing.	
(4) RVLMS indicates that the Core is covered.	-------------------
OR	
b. One S/G with feedwater flow greater than 150 GPM and level being restored and:	
(1) RCS flow by Forced Flow or Natural Circulation.	
(2) RCS subcooling greater than 30°F using CETs.	
(3) CET temperatures constant or decreasing.	
(4) RVLMS indicates that the Core is covered.	-------------------
OR	
c. HPSI or LPSI Pumps injecting water into RCS and CET temperatures constant or decreasing.	-------------------
OR	
d. Once Through Core Cooling in progress and CET temperatures constant or decreasing.	-------------------

VITAL AUXILIARIES ACCEPTANCE CRITERIA

VITAL AUXILIARIES	SAFETY FUNCTION ACCEPTANCE CRITERIA	
	CRITERIA	STATUS CHECK
a. 4KV vital buses 21 or 24	energized	____________
b. Instrument Air pressure (PSIG)	greater than 88	____________
c. Component Cooling (# pumps running)	1 or 2	____________
d. Saltwater (# pumps running)	1 or 2	____________
e. Service Water (# pumps running)	1 or 2	____________
f. 125V DC buses 11, 12, 21, 22	energized	____________
g. 120V AC vital buses 21, 22, 23, 24	energized	____________

Refer to appropriate AOP for any Vital Auxiliaries in jeopardy.

CONTAINMENT ISOLATION ACCEPTANCE CRITÉRIA

CONTAINMENT ISOLATION PARAMETERS	SAFETY FUNCTION ACCEPTANCE CRITERIA	
	CRITERIA	STATUS CHECK
a. Containment pressure (PSIG)	less than 0.7	----------------------------------
b. S/G B/D RMS	alarm clear	----------------------------------
c. Condenser Off-Gas RMS	alarm clear	----------------------------------
d. Main Vent Gaseous RMS (2-R1-5415)	alarm clear	----------------------------------
e. Containment Radiation Monitors	alarms clear	----------------------------------
f. Noble Gas Monitor	alarm clear	----------------------------------
g. Containment penetration valves	all required to be shut are shut	----------------------------------

Containment Isolation Safety Function is satisfied if:

CRITERIA	SATISFIED
a. Containment pressure less than 0.7 PSIG and the following RMS alarms clear: (1) S/G Blowdown. (2) Condenser Off-Gas. (3) Main Vent Gaseous (2-R1-5415). (4) Containment Radiation Monitors. (5) Noble Gas Monitor.	-------------------
OR	
b. Each containment penetration required to be shut has an isolation valve shut.	-------------------

CONTAINMENT ENVIRONMENT ACCEPTANCE CRITERIA

CONTAINMENT ENVIRONMENT	SAFETY FUNCTION ACCEPTANCE CRITERIA	
	CRITERIA	STATUS CHECK
a. Containment temperature (°F)	less than 222	________
b. Containment pressure (PSIG)	less than 2.8	________
c. Containment spray flow (GPM)	greater than 1350	________
d. Hydrogen concentration	less than 2%	________

Containment Environment Safety Function is satisfied if:

CRITERIA	SATISFIED
a. Containment temperature and pressure are constant or decreasing and : (1) Containment temperature is less than 222°F. (2) Containment pressure is less than 2.8 PSIG. (3) H_2 concentration less than 2% (only necessary if greater than four hours since initiation of event.)	________
OR	
b. Containment temperature and pressure are constant or decreasing and : (1) Containment Spray flow is greater than 1350 GPM. (2) H_2 concentration less than 2% (only necessary if greater than four hours since initiation of event.)	________

STATUS CHECK NUMBER	COMPLETE AT TIME
1	
2	
3	
4	

CALVERT CLIFFS NUCLEAR POWER PLANT

ATTACHMENTS

REVISION 1

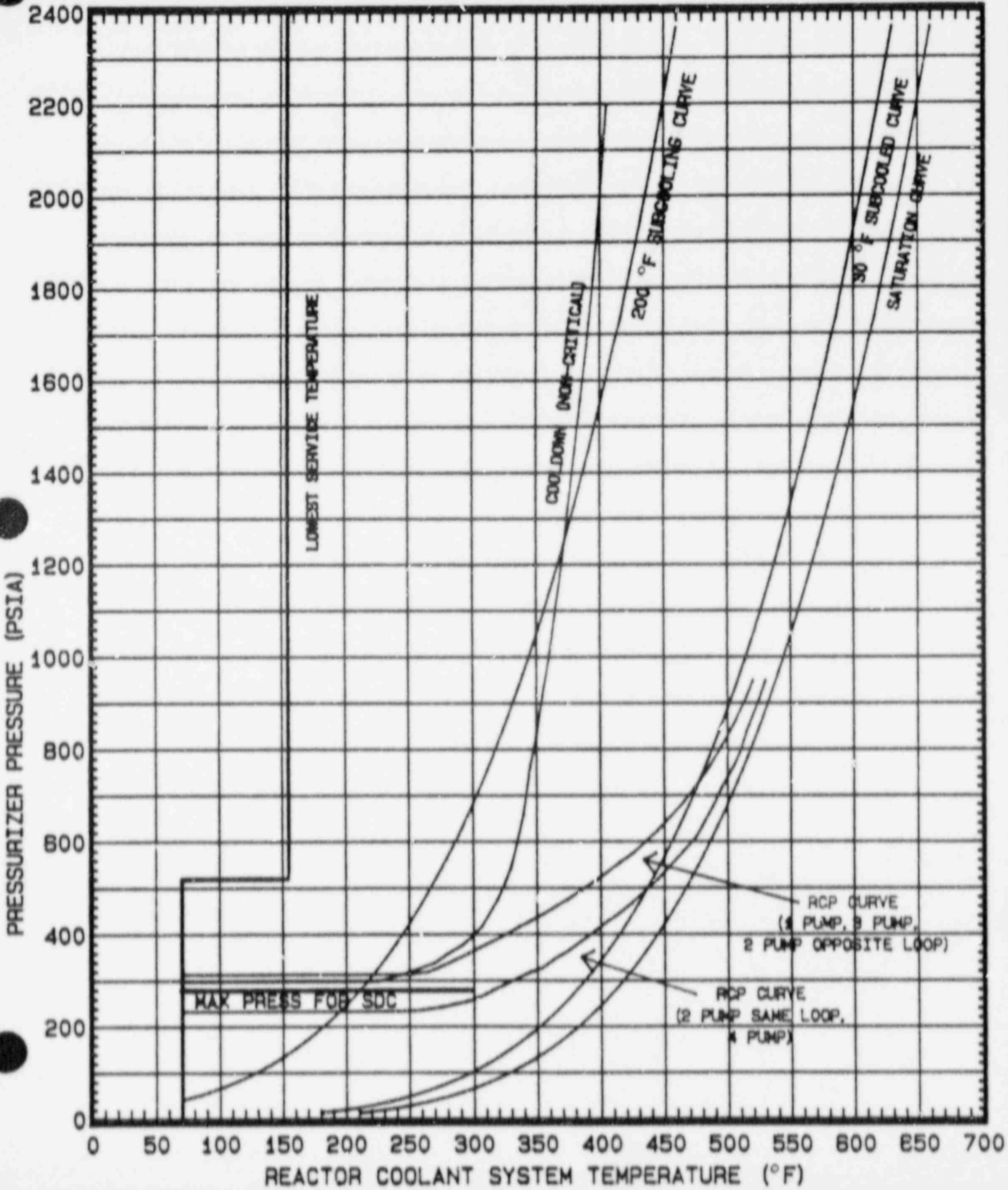
	SIGNATURE	DATE
PREPARED BY;	[signature]	12-10-87
VERIFIED BY;	J. V. Grooms	12/10/87
POSRC;	MEETING # 88-7	2-10-88
APPROVED BY;	J R Lemons Manager-Nuclear Operations or General Supervisor-Operations if POSRC review is not required	2-10-88

LIST OF EFFECTIVE PAGES

ATTACHMENT (1)

RCS PRESSURE TEMPERATURE LIMITS

10-40 YEAR CURVE



ATTACHMENT (2)

SIAS VERIFICATION CHECKLIST

1C08, 1C09, 1C10

a. 11 and 13 HPSI Pumps .... Running

b. 11 and 12 LPSI Pumps .... Running

c. HPSI Aux Header Isolation Valve, 1-SI-656-MOV .... Open

d. 4 Main HPSI Header Valves:

1-SI-616-MOV
1-SI-626-MOV
1-SI-636-MOV
1-SI-646-MOV .... Open

e. 4 Aux HPSI Header Valves:

1-SI-617-MOV
1-SI-627-MOV
1-SI-637-MOV
1-SI-647-MOV .... Open

f. 4 LPSI Header Valves:

1-SI-615-MOV
1-SI-625-MOV
1-SI-635-MOV
1-SI-645-MOV .... Open

g. 4 SI Tank Check Valve Leakage Drain Valves:

1-SI-618-CV
1-SI-628-CV
1-SI-638-CV
1-SI-648-CV .... Shut*

h. 4 SI Tank Outlet Valves:

1-SI-614-MOV
1-SI-624-MOV
1-SI-634-MOV
1-SI-644-MOV .... Open

i. SI Tank Recirc to RCDT Isolation Valve, 1-SI-661-CV ..... Shut*

* HANDSWITCH MUST BE PLACED IN POST-ACCIDENT POSITION BEFORE RESET OF SIAS CAN BE ACCOMPLISHED FROM THE CONTROL ROOM.

ATTACHMENT (2)

SIAS VERIFICATION CHECKLIST

j. 2 Cntmt Spray Header CVs:

1-SI-4150-CV
1-SI-4151-CV .... Open

k. 2 Cntmt Purge Supply Valves:

1-CPA-1410-CV
1-CPA-1411-CV .... Shut*

l. 2 Cntmt Purge Exhaust Valves:

1-CPA-1412-CV
1-CPA-1413-CV .... Shut*

m. RCDT Pump Containment Isolation Valve, 1-RCW-4260-CV .... Shut*

n. 2 Waste Gas Cntmt Isolation Valves:

1-WGS-2180-CV
1-WGS-2181-CV .... Shut*

o. 2 Containment RMS Isolation Valves:

1-CRM-5291-CV
1-CRM-5292-CV .... Shut*

p. 2 Containment Normal Sump Drain Isolation Valves:

1-EAD-5462-MOV
1-EAD-5463-MOV .... Shut*

q. RCS Sample Isolation Valve, 1-PS-5464-CV .... Shut*

r. Containment Heating Water Isolation Valve, 1-PH-6579-MOV. Shut*

s. 2 Hydrogen Purge Cntmt Isolation Valves:

1-HP-6900-MOV
1-HP-6901-MOV .... Shut*

* HANDSWITCH MUST BE PLACED IN POST-ACCIDENT POSITION BEFORE RESET OF SIAS CAN BE ACCOMPLISHED FROM THE CONTROL ROOM.

ATTACHMENT (2)

SIAS VERIFICATION CHECKLIST

1C07

a. 2 Letdown Isolation Valves:

1-CVC-515-CV
1-CVC-516-CV .... Shut*

b. 11, 12, and 13 Charging Pumps .... Running

c. VCT Outlet Valve, 1-CVC-501-MOV .... Shut

d. VCT Makeup Valve, 1-CVC-512-CV .... Shut

e. Boric Acid Direct Makeup Valve, 1-CVC-514-MOV .... Open

f. 11 and 12 Boric Acid Pumps .... Running

g. 2 BAST Gravity Feed Valves:

1-CVC-508-MOV
1-CVC-509-MOV .... Open

h. 2 Boric Acid Recirculation Valves:

1-CVC-510-CV
1-CVC-511-CV .... Shut

i. 2 RCP Bleedoff Isolation Valves:

1-CVC-505-CV
1-CVC-506-CV .... Shut*

1C06

a. 11 and 13 Pressurizer Backup Heaters .... Off

1C13

a. 11 and 12 Component Cooling Pumps .... Running

b. 11 and 12 Saltwater Pumps .... Running

* HANDSWITCH MUST BE PLACED IN POST-ACCIDENT POSITION BEFORE RESET OF SIAS CAN BE ACCOMPLISHED FROM THE CONTROL ROOM.

ATTACHMENT (2)

SIAS VERIFICATION CHECKLIST

c. 11 and 12 Service Water Pumps .... Running

d. 2 SDC HX Component Cooling Outlet Valves:

1-CC-3828-CV
1-CC-3830-CV .... Open

e. 4 SRW Turbine Building Header Isolation Valves:

1-SRW-1600-CV
1-SRW-1637-CV
1-SRW-1638-CV
1-SRW-1639-CV .... Shut

f. 2 Circulating Water Pump Room Air Cooler Isolation Valves:

1-SW-5250-MOV
1-SW-5251-MOV .... Shut

g. 11 and 12 Saltwater Air Compressors .... Running

2C24A

a. 11 Component Cooling HX Saltwater Inlet and Outlet Valves:

1-SW-5160-CV
1-SW-5206-CV .... **DO NOT MATCH HANDSWITCH** .... Shut

b. 12 Component Cooling HX Saltwater Inlet Valve,
1-SW-5162-CV .... **DO NOT MATCH HANDSWITCH** .... Shut

c. 12 Component Cooling HX Saltwater Outlet Valves:

1-SW-5208-CV
1-SW-5163-CV .... **DO NOT MATCH HANDSWITCH** .... Shut

d. 11 SRW HX Saltwater Outlet Valve, 1-SW-5210-CV ....Full Open

e. 12 SRW HX Saltwater Outlet Valve, 1-SW-5212-CV ....Full Open

ATTACHMENT (2)

SIAS VERIFICATION CHECKLIST

1C18, 1C19, 1C20

a. 11 Diesel Generator .... Running

b. 12 Diesel Generator .... Running

c. 21 Diesel Generator .... Running

1C34

a. 11 Containment Purge Exhaust Fan .... Off

b. 11 Containemnt Purge Supply Fan .... Off

1C90 (45 ft S/G B/D Sample Panel)

a. Pressurizer Vapor Sample Valve, 1-PS-5465-CV .... Shut

b. Pressurizer Liquid Sample Valve, 1-PS-5466-CV .... Shut

c. RCS Hot Leg Sample Valve, 1-PS-5467-CV .... Shut

1C101 (45 ft Solid Waste)

a. Quench Tank O_2 Sample Valve, 1-PS-6531-SV .... Shut

ATTACHMENT (3)

CSAS VERIFICATION CHECKLIST

1C03

a. 11 and 12 Main Steam Isolation Valves:

1-MS-4043-CV
1-MS-4048-CV .... Shut*

b. 11 and 12 S/G Feedwater Isolation Valves:

1-FW-4516-MOV
1-FW-4517-MOV .... Shut*

c. 11 and 12 S/G Feed Pumps .... Tripped

d. 11 and 12 Heater Drain Pumps .... Off

e. 11, 12, and 13 Condensate Booster Pumps .... Off

1C08, 1C09, 1C10

a. 11 and 12 Containment Spray Pumps .... Running

b. 4 Containment Air Cooler 8 Inch Outlet Valves:

1-SRW-1582-CV
1-SRW-1585-CV
1-SRW-1590-CV
1-SRW-1593-CV .... Open

c. 11, 12, 13, and 14 Containment Air Coolers ..... Running in low

1C13

a. 11 SFP Cooler Service Water Isolation Valves:

1-SRW-1596-CV
1-SRW-1597-CV .... Shut

* HANDSWITCH MUST BE PLACED IN POST-ACCIDENT POSITION BEFORE RESET OF CSAS CAN BE ACCOMPLISHED FROM THE CONTROL ROOM.

ATTACHMENT (4)

CIS VERIFICATION CHECKLIST

1C09, 1C10

a. 11, 12, and 13 Iodine Filter Fans .... Running

b. 11 and 12 Penetration Room Vent Fans .... Running

c. 11 and 12 Penetration Room Vent Filters Isolation Dampers Open

d. Component Cooling Containment Isolation Valves:

1-CC-3832-CV
1-CC-3833-CV .... Shut*

e. Containment Instrument Air Isolation MOV, 1-IA-2080-MOV . Shut*

f. Instrument Air CIS Override, 1-HS-2080A .... Normal*

1C13

a. Component Cooling Supply To Liquid Waste Evaporator Isolation Valves:

1-CC-3840-CV
1-CC-3842-CV .... Shut

* HANDSWITCH MUST BE PLACED IN POST-ACCIDENT POSITION BEFORE RESET OF CIS CAN BE ACCOMPLISHED FROM THE CONTROL ROOM.

ATTACHMENT (5)

CRS VERIFICATION CHECKLIST

1C10

a. 2 Cntmt Purge Supply Valves:

1-CPA-1410-CV
1-CPA-1411-CV .... Shut*

b. 2 Cntmt Purge Exhaust Valves:

1-CPA-1412-CV
1-CPA-1413-CV .... Shut*

c. 2 Hydrogen Purge Cntmt Isolation Valves:

1-HP-6900-MOV
1-HP-6901-MOV .... Shut*

1C34

a. 11 Containment Purge Exhaust Fan .... Off

b. 11 Containment Purge Supply Fan .... Off

* HANDSWITCH MUST BE PLACED IN POST-ACCIDENT POSITION BEFORE RESET OF CRS CAN BE ACCOMPLISHED FROM THE CONTROL ROOM.

ATTACHMENT (6)

RAS VERIFICATION CHECKLIST

1C08, 1C09, 1C10

a. 11 and 12 LPSI Pumps .... Off

b. SI Pump Mini Flow Isolation Valves:

1-SI-659-MOV
1-SI-660-MOV .... Shut

c. Containment Sump Discharge Valves:

1-SI-4144-MOV
1-SI-4145-MOV .... Open

2C24A

a. 11 Component Cooling HX Saltwater Inlet Valve,
1-SW-5160-CV .... Open

b. 11 Component Cooling HX Saltwater Outlet Valve,
1-SW-5206-CV .... Auto

c. 12 Component Cooling HX Saltwater Inlet Valve,
1-SW-5162-CV .... Open

d. 12 Component Cooling HX Saltwater Outlet Valves:

1-SW-5208-CV
1-SW-5163-CV .... Auto

e. 11 SRW HX Saltwater Outlet Valve, 1-SW-5210-CV .... Auto

f. 12 SRW HX Saltwater Outlet Valve, 1-SW-5212 CV .... Auto

ATTACHMENT (7)

SGIS VERIFICATION CHECKLIST

1C03

a. 11 and 12 Main Steam Isolation Valves:

1-MS-4043-CV
1-MS-4048-CV .... Shut*

b. 11 and 12 S/G Feedwater Isolation Valves:

1-FW-4516-MOV
1-FW-4517-MOV .... Shut*

c. 11 and 12 S/G Feed Pumps .... Tripped

d. 11 and 12 Heater Drain Pumps .... Off

e. 11, 12, and 13 Condensate Booster Pumps .... Off

* HANDSWITCH MUST BE PLACED IN POST-ACCIDENT POSITION BEFORE RESET OF SGIS CAN BE ACCOMPLISHED FROM THE CONTROL ROOM.

ATTACHMENT (8)

WIDE RANGE STEAM GENERATOR LEVEL TABLE FOR VARIABLE STEAM GENERATOR

PRESSURES & VARIABLE CONTAINMENT TEMPERATURES

	INDICATED LEVEL FOR AMBIENT CNTMT TEMP 120°F			INDICATED LEVEL FOR AMBIENT CNTMT TEMP 200°F			INDICATED LEVEL FOR AMBIENT CNTMT TEMP 300°F		
	S/G PRESSURE (PSIA)			S/G PRESSURE (PSIA)			S/G PRESSURE (PSIA)		
ACTUAL LEVEL	900	500	100	900	500	100	900	500	100
-400	-400	-401	-401	-386	-387	-398	-353	-361	-369
-390	-390	-395	-400	-371	-376	-386	-344	-350	-357
-380	-380	-383	-388	-361	-366	-373	-334	-340	-345
-370	-370	-372	-376	-351	-355	-361	-324	-329	-333
-360	-360	-361	-364	-341	-344	-349	-314	-318	-320
-350	-350	-350	-351	-331	-333	-337	-304	-307	-308
-340	-340	-340	-339	-321	-323	-324	-294	-296	-296
-330	-330	-329	-327	-311	-312	-312	-284	-285	-283
-320	-320	-318	-315	-300	-301	-300	-274	-275	-271
-310	-310	-308	-302	-290	-290	-287	-265	-263	-259
-300	-300	-297	-291	-280	-280	-275	-255	-253	-247
-290	-290	-286	-278	-273	-269	-262	-245	-242	-234
-280	-280	-275	-266	-264	-259	-250	-235	-231	-222
-270	-270	-265	-253	-258	-247	-238	-225	-220	-210
-260	-260	-254	-242	-244	-237	-226	-215	-210	-197
-250	-250	-243	-230	-234	-226	-214	-201	-199	-185
-240	-240	-233	-216	-224	-215	-201	-195	-188	-173
-230	-230	-222	-204	-214	-204	-189	-185	-177	-161
-220	-220	-211	-192	-204	-194	-176	-176	-166	-148
-210	-210	-200	-180	-194	-183	-164	-166	-156	-136
-200	-200	-190	-168	-184	-172	-151	-156	-145	-124
-190	-190	-179	-155	-174	-160	-139	-146	-134	-111
-180	-180	-168	-143	-164	-160	-127	-136	-123	-99
-170	-170	-157	-132	-154	-139	-115	-126	-112	-87

ATTACHMENT (8)

WIDE RANGE STEAM GENERATOR LEVEL TABLE FOR VARIABLE STEAM GENERATOR

PRESSURES & VARIABLE CONTAINMENT TEMPERATURES (cont'd)

	INDICATED LEVEL FOR AMBIENT CNTMT TEMP 120°F			INDICATED LEVEL FOR AMBIENT CNTMT TEMP 200°F			INDICATED LEVEL FOR AMBIENT CNTMT TEMP 300°F		
	S/G PRESSURE (PSIA)			S/G PRESSURE (PSIA)			S/G PRESSURE (PSIA)		
ACTUAL LEVEL	900	500	100	900	500	100	900	500	100
-160	-160	-146	-119	-144	-129	-103	-116	-101	-75
-150	-150	-135	-107	-134	-118	-91	-106	-91	-62
-140	-140	-124	-95	-125	-107	-79	-97	-80	-50
-130	-130	-114	-83	-115	-92	-66	-87	-69	-38
-120	-120	-103	-70	-105	-86	-54	-77	-58	-25
-110	-110	-92	-58	-95	-75	-42	-67	-47	-13
-100	-100	-81	-46	-86	-64	-30	-57	-37	-1
-90	-90	-70	-33	-76	-53	-18	-47	-26	+12
-80	-80	-59	-21	-66	-43	-6	-37	-15	+24
-70	-70	-49	-9	-76	-32	+7	-27	-4	+36
-60	-60	-38	+3	-46	-21	+19	-18	+7	+48
-50	-50	-27	+15	-36	-11	+31	-8	+18	+61
-40	-40	-16	+28	-26	0	+44	+2	+28	+63.5
-30	-30	-5	+41	-16	+11	+56	+12	+39	+63.5
-20	-20	+6	+53	-7	+22	+63.5	+22	+50	+63.5
-10	-10	+16	+63.5	+3	+32	+63.5	+32	+61	+63.5
0	0	+27	+63.5	+13	+43	+63.5	+42	+63.5	+63.5
10	+10	+38	+63.5	+23	+54	+63.5	+52	+63.5	+63.5
20	+20	+49	+63.5	+33	+63.5	+63.5	+62	+63.5	+63.5
30	+30	+60	+63.5	+43	+63.5	+63.5	+63.5	+63.5	+63.5
40	+40	+63.5	+63.5	+53	+63.5	+63.5	+63.5	+63.5	+63.5
50	+50	+63.5	+63.5	+63.5	+63.5	+63.5	+63.5	+63.5	+63.5
60	+60	+63.5	+63.5	+63.5	+63.5	+63.5	+63.5	+63.5	+63.5

ATTACHMENT (9)

PRESSURIZER LEVEL TABLE FOR VARIABLE PRESSURIZER

PRESSURES & VARIABLE CONTAINMENT TEMPERATURES

	INDICATED LEVEL FOR AMBIENT CNTMT TEMP 120°F			INDICATED LEVEL FOR AMBIENT CNTMT TEMP 200°F			INDICATED LEVEL FOR AMBIENT CNTMT TEMP 250°F		
	PRESSURIZER PRESSURE (PSIA)			PRESSURIZER PRESSURE (PSIA)			PRESSURIZER PRESSURE (PSIA)		
ACTUAL LEVEL	300	1000	2250	300	1000	2250	300	1000	2250
50	25	29	50	39	44	68	53	57	82
75	65	61	75	84	80	94	99	95	109
100	107	96	100	128	116	119	140	128	134
125	149	131	125	167	152	143	183	167	159
150	191	167	150	211	188	168	228	201	183
175	236	205	175	248	222	192	270	237	208
200	278	240	200	294	259	216	310	274	233
250	362	308	250	370	332	267	370	344	274
300	370	370	300	370	370	318	370	370	334
350	370	370	350	370	370	368	370	370	370
370	370	370	370	370	370	370	370	370	370

ATTACHMENT (10)

PROCEDURE TO READ Thot ON SUBCOOLED MARGIN MONITOR

1. a) If in Press Mode: Depress control switch 3 times within 3 seconds.
   This will illuminate temperature and start testing sequence.
   When the unit is in the test mode, the decimal indicator furthest to the right flashes every 1/2 second.

   b) If in Temperature Mode: Depress control switch 4 times within 3 seconds.
   This will start testing sequence.
   When the Unit is in the test mode, the decimal indicator furthest to the right flashes every 1/2 second.

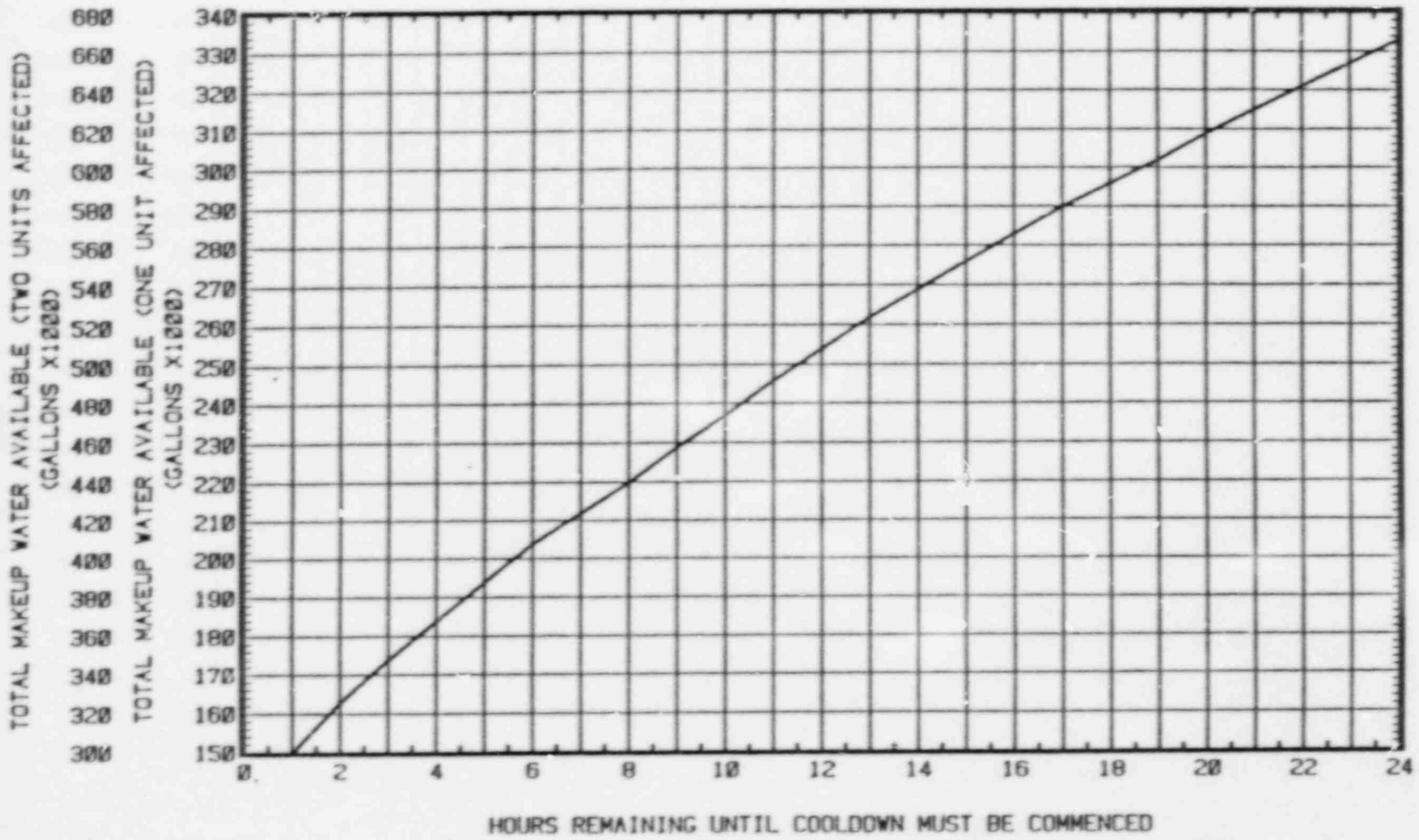
2. Test #0 has started (number sequencing - fast speed). To advance the Test #, depress the control switch. This will illuminate PRESS and the display will count from 1 to 16 (in slow speed). When number "5" is displayed, depress the control switch. This will illuminate TEMP and indicate Thot on the display. Thot will be displayed for a maximum of 20 minutes at which point it automatically returns to normal operation (Press Margin Display). To return to normal operation prior to this 20 minute delay, depress the control switch. This will illuminate PRESS, count to 16, and automatically return to pressure margin display. To read temp margin, depress the control switch once to illuminate TEMP.

MAKEUP WATER REQUIRED FOR RCS COOLDOWN

MAKEUP REQUIRED VS. TIME UNTIL RCS COOLDOWN IS COMMENCED

(1 FT. = 9636.78 GAL.)

COOM CR
88-1137

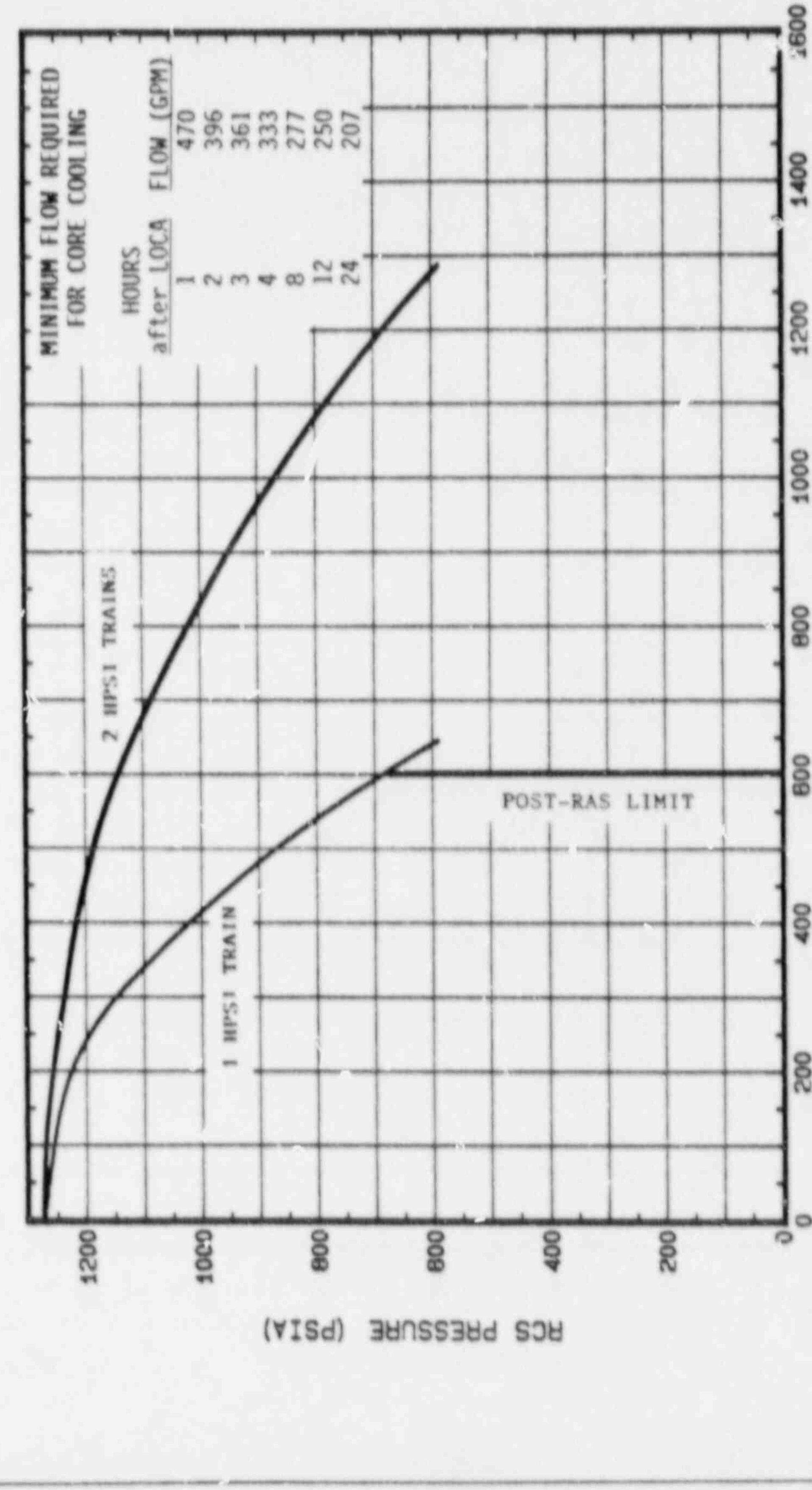


ATTACHMENT (1)

ATTACHMENT (12)

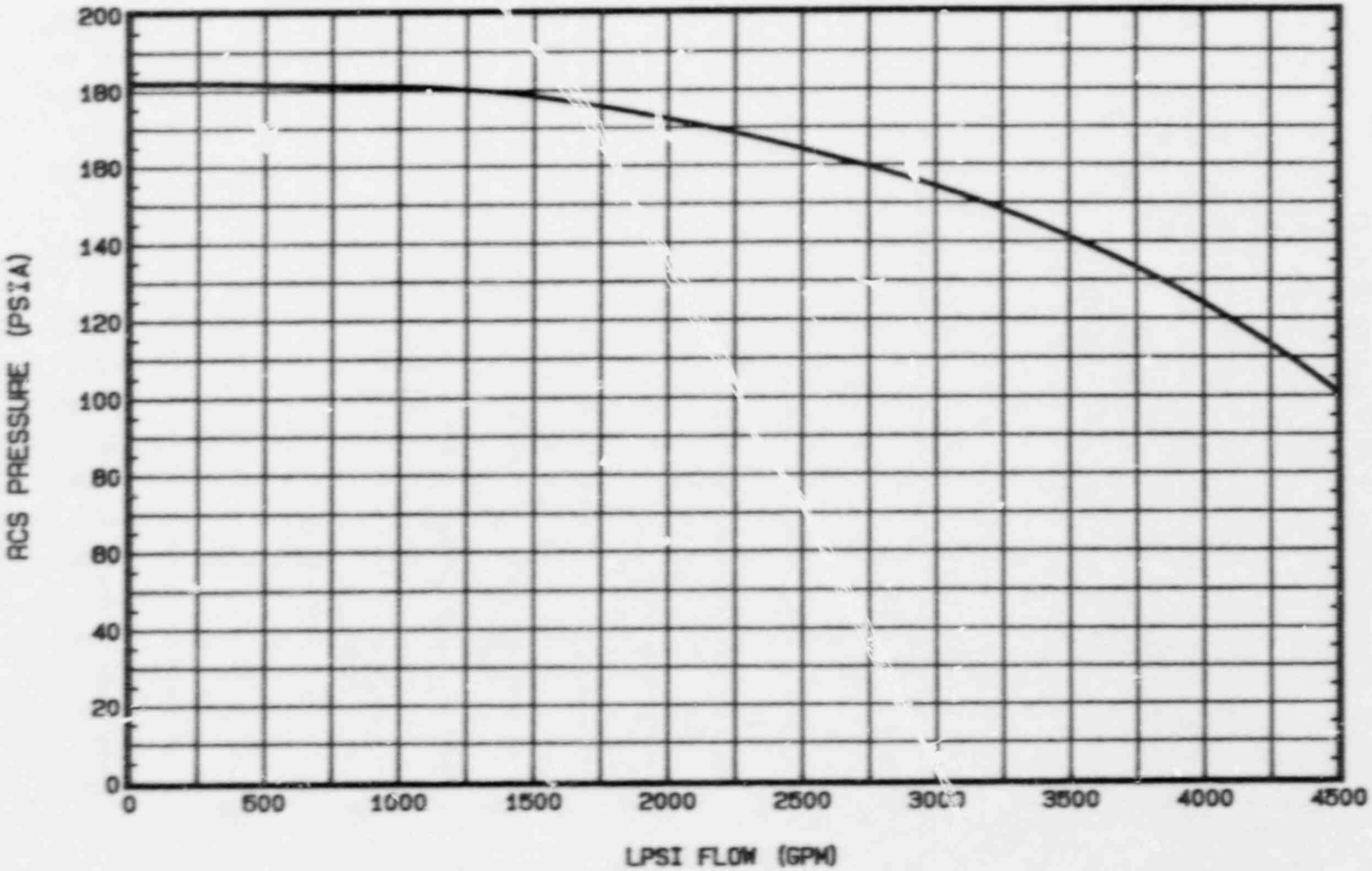
HIGH PRESSURE SAFETY INJECTION FLOW

RCS PRESSURE VS. FLOW



LOW PRESSURE SAFETY INJECTION FLOW

RCS PRESSURE VS. FLOW



ATTACHMENT (13)

ATTACHMENTS
REV.1 /UNIT 1
PAGE 1 OF 1

CALVERT CLIFFS NUCLEAR POWER PLANT

ATTACHMENTS

REVISION 1

	SIGNATURE	DATE
PREPARED BY;	[signature]	/ 12-10-87
VERIFIED BY;	J. V. Groves	/ 12/10/87
POSRC;	MEETING # 88-7	/ 2-10-88
APPROVED BY;	J R Lemons	/ 2-10-88

Manager-Nuclear Operations or General Supervisor-Operations if POSRC review is not required

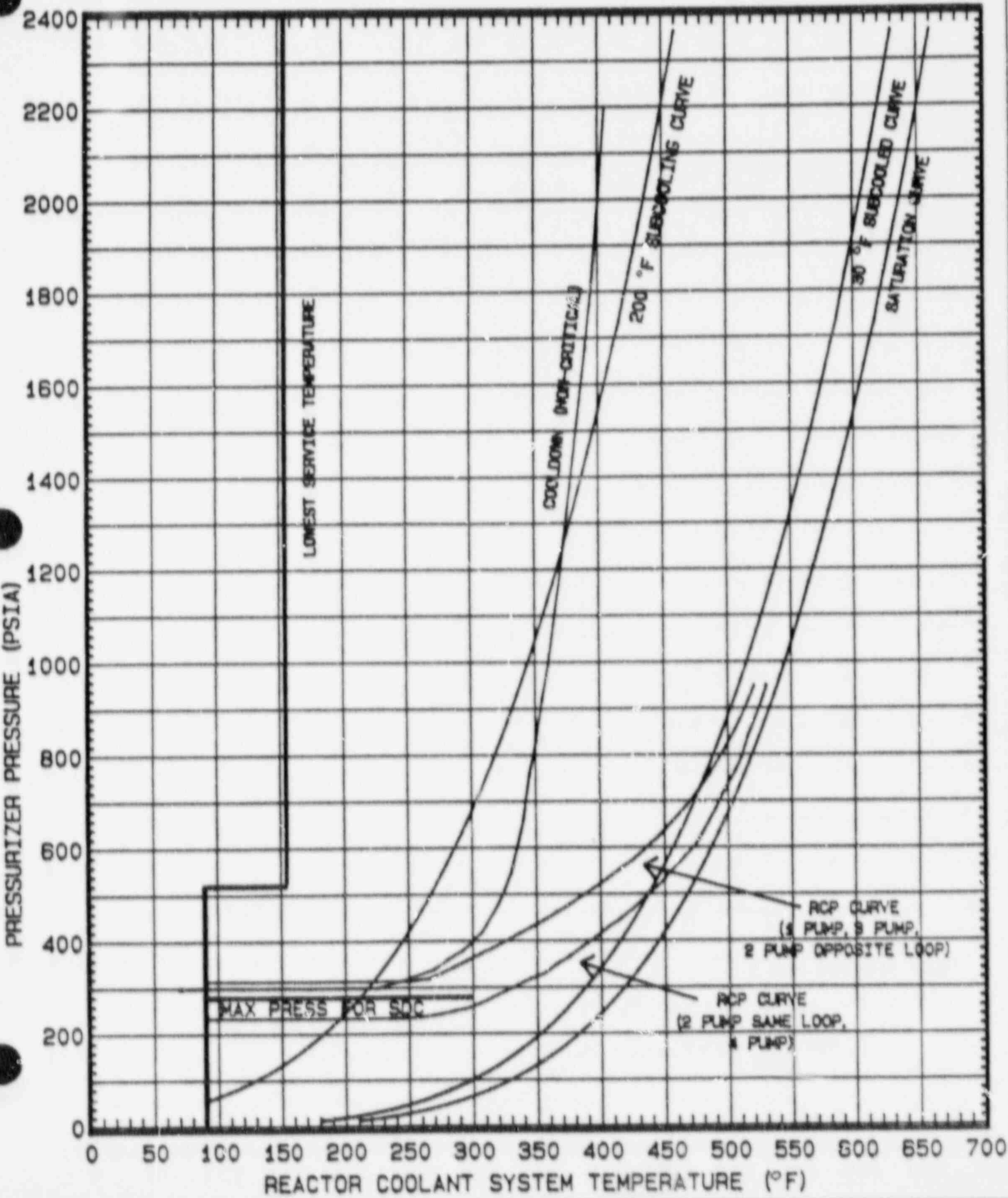
LIST OF EFFECTIVE PAGES

ATTACHMENT	PAGE	REVISION
1	1	1
2	1	1
2	2	1
2	3	1
2	4	1
2	5	1
3	1	1
4	1	1
5	1	1
6	1	1
7	1	1
8	1	1
8	2	1
9	1	1
10	1	1
11	1	1
12	1	1
13	1	1

ATTACHMENT (1)

RCS PRESSURE TEMPERATURE LIMITS

10-40 YEAR CURVE



ATTACHMENT (2)

SIAS VERIFICATION CHECKLIST

2C08, 2C09, 2C10

a. 21 and 23 HPSI Pumps .... Running

b. 21 and 22 LPSI Pumps .... Running

c. HPSI Aux Header Isolation Valve, 2-SI-656-MOV .... Open

d. 4 Main HPSI Header Valves:

2-SI-616-MOV
2-SI-626-MOV
2-SI-636-MOV
2-SI-646-MOV .... Open

e. 4 Aux HPSI Header Valves:

2-SI-617-MOV
2-SI-627-MOV
2-SI-637-MOV
2-SI-647-MOV .... Open

f. 4 LPSI Header Valves:

2-SI-615-MOV
2-SI-625-MOV
2-SI-635-MOV
2-SI-645-MOV .... Open

g. 4 SI Tank Check Valve Leakage Drain Valves:

2-SI-618-CV
2-SI-628-CV
2-SI-638-CV
2-SI-648-CV .... Shut*

h. 4 SI Tank Outlet Valves:

2-SI-614-MOV
2-SI-624-MOV
2-SI-634-MOV
2-SI-644-MOV .... Open

i. SI Tank Recirc to RCDT Isolation Valve, 2-SI-661-CV ..... Shut*

* HANDSWITCH MUST BE PLACED IN POST-ACCIDENT POSITION BEFORE RESET OF SIAS CAN BE ACCOMPLISHED FROM THE CONTROL ROOM.

ATTACHMENT (2)

SIAS VERIFICATION CHECKLIST

j. 2 Cntmt Spray Header CVs:

2-SI-4150-CV
2-SI-4151-CV .... Open

k. 2 Cntmt Purge Supply Valves:

2-CPA-1410-CV
2-CPA-1411-CV .... Shut*

l. 2 Cntmt Purge Exhaust Valves:

2-CPA-1412-CV
2-CPA-1413-CV .... Shut*

m. RCDT Pump Containment Isolation Valve, 2-RCW-4260-CV .... Shut*

n. 2 Waste Gas Cntmt Isolation Valves:

2-WGS-2180-CV
2-WGS-2181-CV .... Shut*

o. 2 Containment RMS Isolation Valves:

2-CRM-5291-CV
2-CRM-5292-CV .... Shut*

p. 2 Containment Normal Sump Drain Isolation Valves:

2-EAD-5462-MOV
2-EAD-5463-MOV .... Shut*

q. RCS Sample Isolation Valve, 2-PS-5464-CV .... Shut*

r. Containment Heating Water Isolation Valve, 2-PH-6579-MOV. Shut*

s. 2 Hydrogen Purge Cntmt Isolation Valves:

2-HP-6900-MOV
2-HP-6901-MOV .... Shut*

* HANDSWITCH MUST BE PLACED IN POST-ACCIDENT POSITION BEFORE RESET OF SIAS CAN BE ACCOMPLISHED FROM THE CONTROL ROOM.

ATTACHMENT (2)

SIAS VERIFICATION CHECKLIST

2C07

a. 2 Letdown Isolation Valves:

2-CVC-515-CV
2-CVC-516-CV .... Shut*

b. 21, 22, and 23 Charging Pumps .... Running

c. VCT Outlet Valve, 2-CVC-501-MOV .... Shut

d. VCT Makeup Valve, 2-CVC-512-CV .... Shut

e. Boric Acid Direct Makeup Valve, 2-CVC-514-MOV .... Open

f. 21 and 22 Boric Acid Pumps .... Running

g. 2 BAST Gravity Feed Valves:

2-CVC-508-MOV
2-CVC-509-MOV .... Open

h. 2 Boric Acid Recirculation Valves:

2-CVC-510-CV
2-CVC-511-CV .... Shut

i. 2 RCP Bleedoff Isolation Valves:

2-CVC-505-CV
2-CVC-506-CV .... Shut*

2C06

a. 21 and 23 Pressurizer Backup Heaters .... Off

2C13

a. 21 and 22 Component Cooling Pumps .... Running

b. 21 and 22 Saltwater Pumps .... Running

* HANDSWITCH MUST BE PLACED IN POST-ACCIDENT POSITION BEFORE RESET OF SIAS CAN BE ACCOMPLISHED FROM THE CONTROL ROOM.

ATTACHMENT (2)

SIAS VERIFICATION CHECKLIST

c. 21 and 22 Service Water Pumps .... Running

d. 2 SDC HX Component Cooling Outlet Valves:

2-CC-3828-CV
2-CC-3830-CV .... Open

e. 4 SRW Turbine Building Header Isolation Valves:

2-SRW-1600-CV
2-SRW-1637-CV
2-SRW-1638-CV
2-SRW-1639-CV .... Shut

f. 2 Circulating Water Pump Room Air Cooler Isolation Valves:

2-SW-5250-MOV
2-SW-5251-MOV .... Shut

g. 21 and 22 Saltwater Air Compressors .... Running

2C24A

a. 21 Component Cooling HX Saltwater Inlet and Outlet Valves:

2-SW-5160-CV
2-SW-5206-CV .... **DO NOT MATCH HANDSWITCH** .... Shut

b. 22 Component Cooling HX Saltwater Inlet Valve,
2-SW-5162-CV .... **DO NOT MATCH HANDSWITCH** .... Shut

c. 22 Component Cooling HX Saltwater Outlet Valves:

2-SW-5208-CV
2-SW-5163-CV .... **DO NOT MATCH HANDSWITCH** .... Shut

d. 21 SRW HX Saltwater Outlet Valve, 2-SW-5210-CV ....Full Open

e. 22 SRW HX Saltwater Outlet Valve, 2-SW-5212-CV ....Full Open

ATTACHMENT (2)

SIAS VERIFICATION CHECKLIST

1C18, 1C19, 1C20

a. 11 Diesel Generator .... Running

b. 12 Diesel Generator .... Running

c. 21 Diesel Generator .... Running

1C34

a. 21 Containment Purge Exhaust Fan .... Off

b. 21 Containemnt Purge Supply Fan .... Off

2C90 (45 ft S/G B/D Sample Panel)

a. Pressurizer Vapor Sample Valve, 2-PS-5465-CV .... Shut

b. Pressurizer Liquid Sample Valve, 2-PS-5466-CV .... Shut

c. RCS Hot Leg Sample Valve, 2-PS-5467-CV .... Shut

1C102 (45 ft Solid Waste)

a. Quench Tank O_2 Sample Valve, 2-PS-6531-SV .... Shut

ATTACHMENT (3)

CSAS VERIFICATION CHECKLIST

2C03

a. 21 and 22 Main Steam Isolation Valves:

2-MS-4043-CV
2-MS-4048-CV .... Shut*

b. 21 and 22 S/G Feedwater Isolation Valves:

2-FW-4516-MOV
2-FW-4517-MOV .... Shut*

c. 21 and 22 S/G Feed Pumps .... Tripped

d. 21 and 22 Heater Drain Pumps .... Off

e. 21, 22, and 23 Condensate Booster Pumps .... Off

2C08, 2C09, 2C10

a. 21 and 22 Containment Spray Pumps .... Running

b. 4 Containment Air Cooler 8 Inch Outlet Valves:

2-SRW-1582-CV
2-SRW-1585-CV
2-SRW-1590-CV
2-SRW-1593-CV .... Open

c. 21, 22, 23, and 24 Containment Air Coolers ...... Running in low

1C13

a. 12 SFP Cooler Service Water Isolation Valves:

2-SRW-1598-CV
2-SRW-1599-CV .... Shut

* HANDSWITCH MUST BE PLACED IN POST-ACCIDENT POSITION BEFORE RESET OF CSAS CAN BE ACCOMPLISHED FROM THE CONTROL ROOM.

ATTACHMENT (4)

CIS VERIFICATION CHECKLIST

2C09, 2C10

a. 21, 22, and 23 Iodine Filter Fans .... Running

b. 21 and 22 Penetration Room Vent Fans .... Running

c. 21 and 22 Penetration Room Vent Filters Isolation Dampers Open

d. Component Cooling Containment Isolation Valves:

2-CC-3832-CV
2-CC-3833-CV .... Shut*

e. Containment Instrument Air Isolation MOV, 2-IA-2080-MOV . Shut*

f. Instrument Air CIS Override, 2-HS-2080A .... Normal*

2C13

a. Component Cooling Supply To Liquid Waste Evaporator Isolation Valves:

2-CC-3840-CV
2-CC-3842-CV .... Shut

* HANDSWITCH MUST BE PLACED IN POST-ACCIDENT POSITION BEFORE RESET OF CIS CAN BE ACCOMPLISHED FROM THE CONTROL ROOM.

ATTACHMENT (5)

CRS VERIFICATION CHECKLIST

2C10

a. 2 Cntmt Purge Supply Valves:

2-CPA-1410-CV
2-CPA-1411-CV .... Shut*

b. 2 Cntmt Purge Exhaust Valves:

2-CPA-1412-CV
2-CPA-1413-CV .... Shut*

c. 2 Hydrogen Purge Cntmt Isolation Valves.

2-HP-6900-MOV
2-HP-6901-MOV .... Shut*

1C34

a. 21 Containment Purge Exhaust Fan .... Off

b. 21 Containment Purge Supply Fan .... Off

* HANDSWITCH MUST BE PLACED IN POST-ACCIDENT POSITION BEFORE RESET OF CRS CAN BE ACCOMPLISHED FROM THE CONTROL ROOM.

ATTACHMENT (6)

RAS VERIFICATION CHECKLIST

2C08, 2C09, 2C10

a. 21 and 22 LPSI Pumps .... Off

b. SI Pump Mini Flow Isolation Valves:

2-SI-659-MOV
2-SI-660-MOV .... Shut

c. Containment Sump Discharge Valves:

2-SI-4144-MOV
2-SI-4145-MOV .... Open

2C24A

a. 21 Component Cooling HX Saltwater Inlet Valve,
2-SW-5160-CV .... Open

b. 21 Component Cooling HX Saltwater Outlet Valve,
2-SW-5206-CV .... Auto

c. 22 Component Cooling HX Saltwater Inlet Valve,
2-SW-5162-CV .... Open

d. 22 Component Cooling HX Saltwater Outlet Valves:

2-SW-5208-CV
2-SW-5163-CV . ... Auto

e. 21 SRW HX Saltwater Outlet Valve, 2-SW-5210-CV .... Auto

f. 22 SRW HX Saltwater Outlet Valve, 2-SW-5212-CV .... Auto

ATTACHMENT (7)

SGIS VERIFICATION CHECKLIST

2C03

a. 21 and 22 Main Steam Isolation Valves:

2-MS-4043-CV
2-MS-4048-CV .... Shut*

b. 21 and 22 S/G Feedwater Isolation Valves:

2-FW-4516-MOV
2-FW-4517-MOV .... Shut*

c. 21 and 22 S/G Feed Pumps .... Tripped

d. 21 and 22 Heater Drain Pumps .... Off

e. 21, 22, and 23 Condensate Booster Pumps .... Off

* HANDSWITCH MUST BE PLACED IN POST-ACCIDENT POSITION BEFORE RESET OF SGIS CAN BE ACCOMPLISHED FROM THE CONTROL ROOM.

ATTACHMENT (8)

WIDE RANGE STEAM GENERATOR LEVEL TABLE FOR VARIABLE STEAM GENERATOR PRESSURES & VARIABLE CONTAINMENT TEMPERATURES

ACTUAL LEVEL	INDICATED LEVEL FOR AMBIENT CNTMT TEMP 120°F — S/G PRESSURE (PSIA) 900	500	100	INDICATED LEVEL FOR AMBIENT CNTMT TEMP 200°F — S/G PRESSURE (PSIA) 900	500	100	INDICATED LEVEL FOR AMBIENT CNTMT TEMP 300°F — S/G PRESSURE (PSIA) 900	500	100
-400	-400	-401	-401	-386	-387	-398	-353	-361	-369
-390	-390	-395	-400	-371	-376	-386	-344	-350	-357
-380	-380	-383	-388	-361	-366	-373	-334	-340	-345
-370	-370	-372	-376	-351	-355	-361	-324	-329	-333
-360	-360	-361	-364	-341	-344	-349	-314	-318	-320
-350	-350	-350	-351	-331	-333	-337	-304	-307	-308
-340	-340	-340	-339	-321	-323	-324	-294	-296	-296
-330	-330	-329	-327	-311	-312	-312	-284	-285	-283
-320	-320	-318	-315	-300	-301	-300	-274	-275	-271
-310	-310	-308	-302	-290	-290	-287	-265	-263	-259
-300	-300	-297	-291	-280	-280	-275	-255	-253	-247
-290	-290	-286	-278	-273	-269	-262	-245	-242	-234
-280	-280	-275	-266	-264	-258	-250	-235	-231	-222
-270	-270	-265	-253	-258	-247	-238	-225	-220	-210
-260	-260	-254	-242	-244	-237	-226	-215	-210	-197
-250	-250	-243	-230	-234	-226	-214	-201	-199	-185
-240	-240	-233	-216	-224	-215	-201	-195	-188	-173
-230	-230	-222	-204	-214	-204	-189	-185	-177	-161
-220	-220	-211	-192	-204	-194	-176	-176	-166	-148
-210	-210	-200	-180	-194	-183	-164	-166	-156	-136
-200	-200	-190	-168	-184	-172	-151	-156	-145	-124
-190	-190	-179	-155	-1[illegible]4	-160	-139	-146	-134	-111
-180	-180	-168	-143	-164	-160	-127	-136	-123	-99
-170	-170	-157	-132	-154	-139	-115	-126	-112	-87

ATTACHMENT (8)

WIDE RANGE STEAM GENERATOR LEVEL TABLE FOR VARIABLE STEAM GENERATOR PRESSURES & VARIABLE CONTAINMENT TEMPERATURES (cont'd)

ACTUAL LEVEL	INDICATED LEVEL FOR AMBIENT CNTMT TEMP 120°F			INDICATED LEVEL FOR AMBIENT CNTMT TEMP 200°F			INDICATED LEVEL FOR AMBIENT CNTMT TEMP 300°F		
	S/G PRESSURE (PSIA)			S/G PRESSURE (PSIA)			S/G PRESSURE (PSIA)		
	900	500	100	900	500	100	900	500	100
-160	-160	-146	-119	-144	-129	-103	-116	-101	-75
-150	-150	-135	-107	-134	-118	-91	-106	-91	-62
-140	-140	-124	-95	-125	-107	-79	-97	-80	-50
-130	-130	-114	-83	-115	-92	-66	-87	-69	-38
-120	-120	-103	-70	-105	-86	-54	-77	-58	-25
-110	-110	-92	-58	-95	-75	-42	-67	-47	-13
-100	-100	-81	-46	-86	-64	-30	-57	-37	-1
-90	-90	-70	-33	-76	-53	-18	-47	-26	+12
-80	-80	-59	-21	-66	-43	-6	-37	-15	+24
-70	-70	-49	-9	-76	-32	+7	-27	-4	+36
-60	-60	-38	+3	-46	-21	+19	-18	+7	+48
-50	-50	-27	+15	-36	-11	+31	-8	+18	+61
-40	-40	-16	+28	-26	0	+44	+2	+28	+63.5
-30	-30	-5	+41	-16	+11	+56	+12	+39	+63.5
-20	-20	+6	+53	-7	+22	+63.5	+22	+50	+63.5
-10	-10	+16	+63.5	+3	+32	+63.5	+32	+61	+63.5
0	0	+27	+63.5	+13	+43	+63.5	+42	+63.5	+63.5
10	+10	+38	+63.5	+23	+54	+63.5	+52	+63.5	+63.5
20	+20	+49	+63.5	+33	+63.5	+63.5	+62	+63.5	+63.5
30	+30	+60	+63.5	+43	+63.5	+63.5	+63.5	+63.5	+63.5
40	+40	+63.5	+63.5	+53	+63.5	+63.5	+63.5	+63.5	+63.5
50	+50	+63.5	+63.5	+63.5	+63.5	+63.5	+63.5	+63.5	+63.5
60	+60	+63.5	+63.5	+63.5	+63.5	+63.5	+63.5	+63.5	+63.5

ATTACHMENT (9)

PRESSURIZER LEVEL TABLE FOR VARIABLE PRESSURIZER

PRESSURES & VARIABLE CONTAINMENT TEMPERATURES

	INDICATED LEVEL FOR AMBIENT CNTMT TEMP 120°F			INDICATED LEVEL FOR AMBIENT CNTMT TEMP 200°F			INDICATED LEVEL FOR AMBIENT CNTMT TEMP 250°F		
	PRESSURIZER PRESSURE (PSIA)			PRESSURIZER PRESSURE (PSIA)			PRESSURIZER PRESSURE (PSIA)		
ACTUAL LEVEL	300	1000	2250	300	1000	2250	300	1000	2250
50	25	29	50	39	44	68	53	57	82
75	65	61	75	84	80	94	99	95	109
100	107	96	100	128	116	119	140	128	134
125	149	131	125	167	152	143	183	167	159
150	191	167	150	211	188	168	228	201	183
175	236	205	175	248	222	192	270	237	208
200	278	240	200	294	259	216	310	274	233
250	362	308	250	370	332	267	370	344	274
300	370	370	300	370	370	318	370	370	334
350	370	370	350	370	370	368	370	370	370
370	370	370	370	370	370	370	370	370	370

ATTACHMENT (10)

PROCEDURE TO READ Thot ON SUBCOOLED MARGIN MONITOR

1. a) If in Press Mode: Depress control switch 3 times within 3 seconds.
   This will illuminate temperature and start testing sequence.
   When the unit is in the test mode, the decimal indicator furthest to the right flashes every 1/2 second.

   b) If in Temperature Mode: Depress control switch 4 times within 3 seconds.
   This will start testing sequence.
   When the Unit is in the test mode, the decimal indicator furthest to the right flashes every 1/2 second.

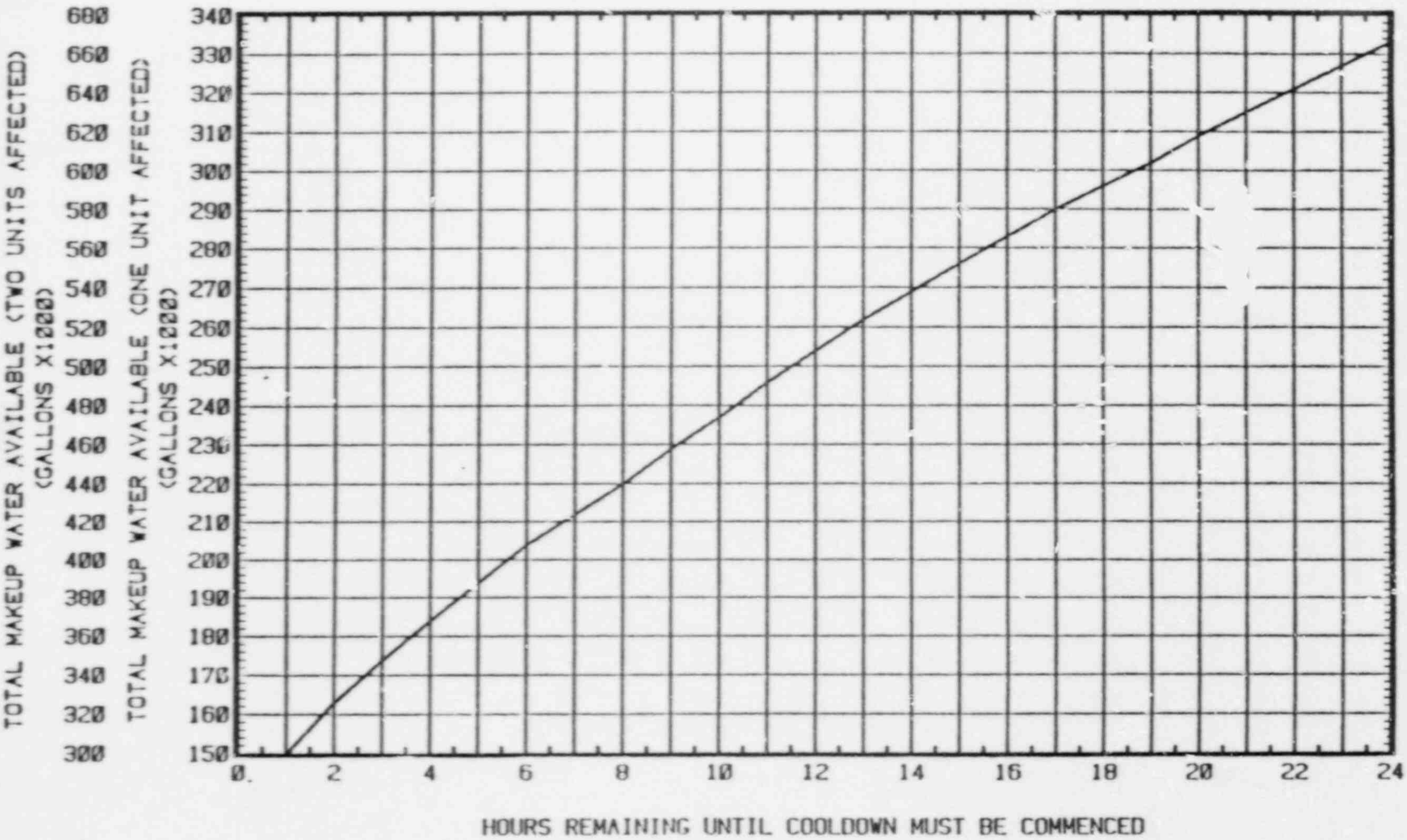
2. Test #0 has started (number sequencing - fast speed). To advance the Test #, depress the control switch. This will illuminate PRESS and the display will count from 1 to 16 (in slow speed). When number "5" is displayed, depress the control switch. This will illuminate TEMP and indicate Thot on the display. Thot will be displayed for a maximum of 20 minutes at which point it automatically returns to normal operation (Press Margin Display). To return to normal operation prior to this 20 minute delay, depress the control switch. This will illuminate PRESS, count to 16, and automatically return to pressure margin display. To read temp margin, depress the control switch once to illuminate TEMP.

MAKEUP WATER REQUIRED FOR RCS COOLDOWN

MAKEUP REQUIRED VS. TIME UNTIL RCS COOLDOWN IS COMMENCED

(1 FT. = 9636.78 GAL.)

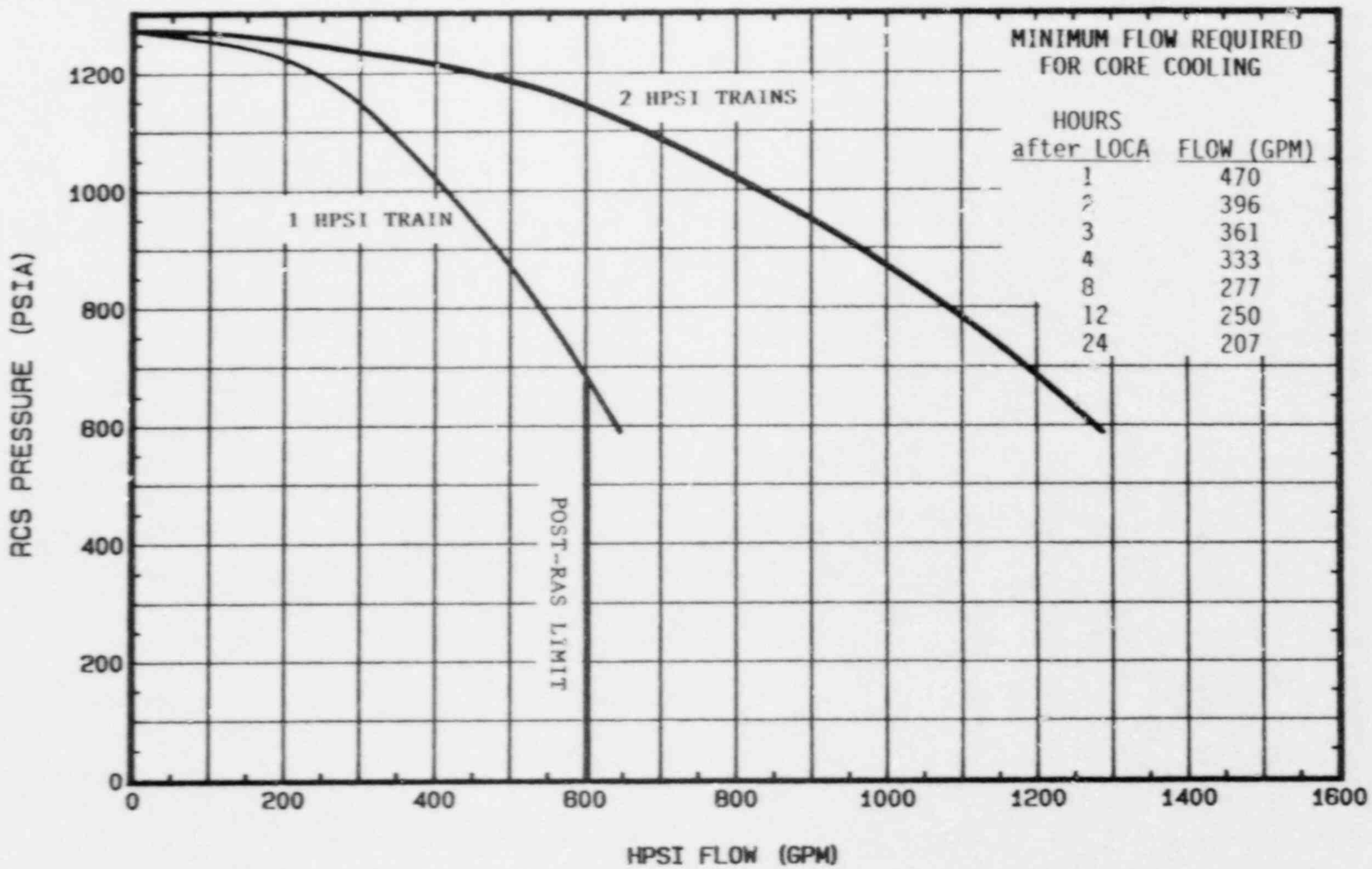
CCOM CR
88-1137



ATTACHMENT (11)

HIGH PRESSURE SAFETY INJECTION FLOW

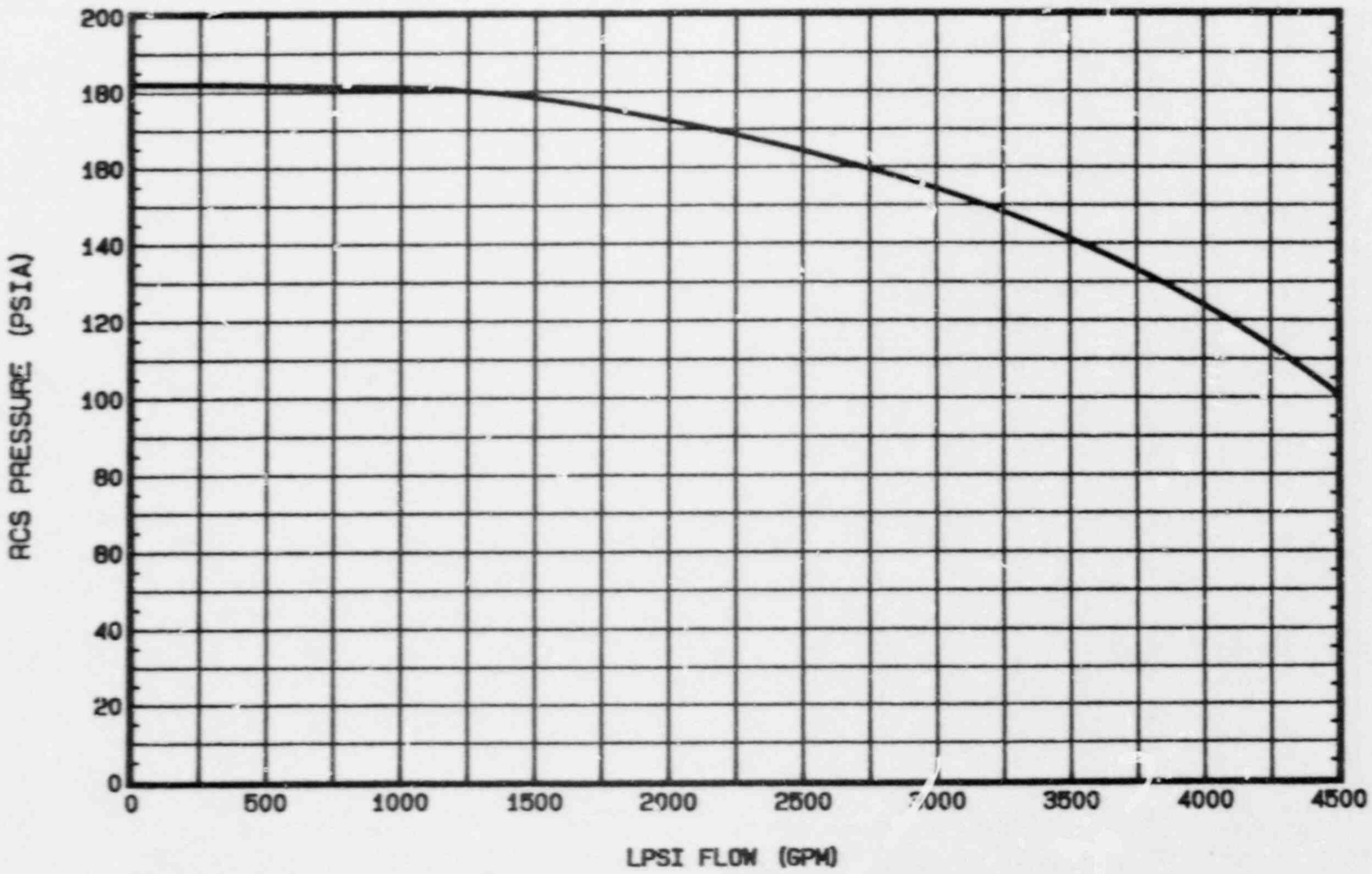
RCS PRESSURE VS. FLOW



ATTACHMENT (12)

LOW PRESSURE SAFETY INJECTION FLOW

RCS PRESSURE VS. FLOW



ATTACHMENT (13)

ATTACHMENTS
REV.1 /UNIT 2
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