Number:	Symptom/Title:	Revision No./Date
ES-2.3	SI TERMINATION FOLLOWING EXCESSIVE RCS COOLDOWN	HP - Basic 1 Nov. 1982

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

Caution

- *Following SI reset, automatic reinitiation of SI will not occur until reactor trip breakers are reset.*
- *If loss of offsite power occurs after SI reset, manual action may be required to restart safeguards equipment.*

NOTE *Foldout page should be open.*

1 **Reset SI**

2 **Stop Unnecessary SI Pumps and Place in Standby:**

a. Low-head SI pumps

b. High-head SI pumps

c. All but one charging/SI pump

3 **Establish Charging/SI Pump Miniflow:**

a. Verify CCW flow to seal water heat exchanger

b. Open miniflow isolation valves

4 **Isolate BIT:**

a. Close inlet isolation valves

b. Close outlet isolation valves

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
5	**Verify Offsite Power Available**	Try to restore offsite power: ● [Enter plant specific means] IF offsite power cannot be restored, THEN manually load following equipment on diesel generators: ● [Enter plant specific list]
6	**Reset Containment Isolation Phase A**	
7	**Establish Charging:** a. Close charging flow control valve b. Open charging line isolation valves c. Open charging flow control valve to establish desired flow	
8	**Verify SI Reinitiation NOT Required:**	
	a. RCS subcooling - GREATER THAN (1)°F	a. Manually operate SI pumps, as required. IF subcooling CANNOT be maintained, THEN manually reinitiate SI. Go to E-0, REACTOR TRIP OR SAFETY INJECTION, STEP 5.
	b. Pressurizer level - DOES NOT DECREASE 10% AFTER SI TERMINATION	b. Manually operate SI pumps, as required. IF level CANNOT be maintained, THEN manually reinitiate SI. Go to E-0, REACTOR TRIP OR SAFETY INJECTION, STEP 5.

(1) Enter sum of temperature and pressure measurement system errors translated into temperature using saturation tables.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
9	**Stablize RCS Hot Leg Temperature:**	
	a. RCS hot leg temperature - STABLE OR INCREASING	a. Throttle AFW flow and decrease dumping steam as necessary to establish a STABLE RCS hot leg temperature: • IF ANY SG is non-faulted, THEN throttle AFW flow to each non-faulted SG. *MAINTAIN MINIMUM AFW FLOW OF 25 GPM TO AT LEAST ONE SG.* • IF ALL SGS are faulted, THEN throttle AFW flow to all SGs. *MAINTAIN MINIMUM AFW FLOW OF 25 GPM TO (1) SG(s).*
	b. Control AFW flow and Steam dump as necessary to establish a STABLE RCS hot leg temperature: • IF ANY SG is non-faulted, THEN control AFW flow to each non-faulted SG • IF ALL SG's are faulted, THEN control AFW flow to (1) SGs	

(1) Enter minimum number of steam generators supplied by one AFW pump.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
10	**Check Containment Spray System:**	
	a. Spray pumps - RUNNING	a. IF pumps NOT running, THEN go to step 11.
	b. Containment pressure - LESS THAN (1) PSIG	b. Continue with step 11. WHEN containment pressure is less than (1) psig, THEN do steps 10c and d.
	c. Reset containment spray signal	
	d. Stop containment spray pumps and place in standby	
	1) [Enter plant specific steps]	
11	**Check RWST Level:**	
	a. RWST level - GREATER THAN (2)	a. IF less than (2), THEN align SI system for cold leg recirculation per ES-2.2, TRANSFER TO COLD LEG RECIRCULATION FOLLOWING LOSS OF SECONDARY COOLANT.
12	**Establish Letdown:**	
	a. Open letdown line containment isolation valves	
	b. Open letdown line isolation valves	
	c. Open letdown orifice isolation valves, as appropriate	
	d. Open seal return containment isolation valves	

(1) Enter plant specific value corresponding to containment HI-1 setpoint.
(2) Enter plant specific value corresponding to RWST switchover alarm in plant specific units.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
13	**Align Charging/SI Pump Suction to VCT:**	
	a. Open VCT outlet isolation valves	
	b. Close RWST outlet isolation valves	
14	**Check VCT Makeup Control System**	
	a. Makeup set for automatic control	a. Adjust controls, as appropriate.
	b. Makeup set for GREATER THAN RCS BORON CONCENTRATION	b. Adjust controls, as appropriate.
15	**Check SG Levels:**	
	a. Verify steam generator narrow range level LESS THAN 50%	a. Throttle AFW flow to maintain narrow range level below 50%.
16	**Check CST Level:**	
	a. CST Level - GREATER THAN (1)%	a. IF CST level low, THEN switch to alternate AFW water supply.
17	**Establish Pressurizer Level in Normal Operating Range:**	
	a. Open letdown orifice isolation valves, as necessary	
	b. Place charging flow control valve controller in automatic mode	

(1) Enter plant specific low level setpoint.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
18	**Control Pressurizer Pressure and Level:**	
	a. Verify RCS pressure - WITHIN TECH SPEC COOLDOWN LIMITS	a. Operate normal spray valves to reduce pressurizer pressure. IF normal sprays not available, THEN use auxiliary spray.
	b. Maintain existing RCS pressure	
	1) Adjust charging and letdown	
	2) Operate normal spray as necessary	2) Use auxiliary spray.
	c. Establish normal pressurizer level:	
	1) Adjust charging and letdown	
	d. Operate pressurizer heaters to establish a saturated pressurizer liquid temperature. Continue with Step 19	
19	**Check RCS Subcooling:**	
	a. RCS subcooling - GREATER THAN 50°F	a. Dump steam to establish 50°F subcooling:
		1) Limit RCS cooldown rate less than 50°F/hr
		2) Dump steam to condenser if available - OR - Dump steam to atmosphere.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
20	**Check RCS Cooldown Restrictions:** a. Refer to Step 4 of FR-P.2 to determine if additional RCS cooldown restrictions are required b. Perform subsequent actions of this guideline that do not violate cooldown restrictions	
21	**Check RCP Status:**	
	a. At least one RCP - RUNNING	a. IF no RCP running, THEN try to start one RCP: 1) Establish conditions for running an RCP: [Enter plant specific list] 2) Start one RCP. IF an RCP cannot be started, THEN monitor natural circulation from trended values: a) RCS subcooling - GREATER THAN 50°F b) RCS hot and cold leg temperature - STABLE OR DECREASING c) Core exit TCs - STABLE OR DECREASING

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
22	**Check Intermediate Range Flux:**	
	a. Flux - BELOW (1)	a. Continue with Step 23. WHEN flux below (1), THEN do Steps 22b and c.
	b. Verify source range detectors re-energized	b. Manually re-energize source range detectors.
	c. Transfer nuclear recorders to source range scale	
23	**Maintain Stable Plant Cooldown Conditions:**	
	a. Pressurizer pressure - LESS THAN TECH SPEC PRESSURE - TEMPERATURE LIMITS	a. Return to Step 9.
	b. Pressurizer level - GREATER THAN 10%	b. Return to Step 9.
	c. RCS Subcooling - GREATER THAN 50°F	c. Return to Step 9.
	d. Steam generator narrow range levels - LESS THAN 50%	d. Return to Step 9
24	**Shutdown Unnecessary Plant Equipment:**	
	a. [Enter plant specific list]	

(1) Enter plant specific value for intermediate range permissive to block source range high flux trip (P-6).

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
25	**Verify SI Reinitiation NOT Required:**	
	a. RCS pressure - STABLE OR DECREASING IN A CONTROLLED MANNER	a. Manually operate SI pumps, as required. IF RCS pressure CANNOT be controlled, THEN manually reinitiate SI. Go to E-0, REACTOR TRIP OR SAFETY INJECTION, Step 5.
	b. Pressurizer level - GREATER THAN 10%	b. Manually operate SI pumps, as required. IF level CANNOT be maintained, THEN manually reinitiate SI. Go to E-0, REACTOR TRIP OR SAFETY INJECTION, Step 5.
	c. RCS subcooling - GREATER THAN 50°F	c. Manually operate SI pumps, as required. IF subcooling CANNOT be maintained, THEN manually reinitiate SI. Go to E-0, REACTOR TRIP OR SAFETY INJECTION, Step 5.
26	**Isolate SI Accumulators:**	
	a. All accumulator isolation valves - CLOSED	a. Vent any accumulators not isolated.
27	**Check RCS Hot Leg Temperatures:**	
	a. RCS hot leg temperatures - LESS THAN 350°F	a. Dump steam to establish a 50°F/hr. cooldown rate. IF steam dump is not available, THEN control AFW flow to establish a 50°F/hr. cooldown rate.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

Caution *Maintain 50°F subcooling during any RCS depressurization.*

28	**Check RCS Pressure:**	
	a. RCS pressure - LESS THAN 400 PSIG	a. Use normal pressurizer spray. IF normal spray is not available, THEN use auxiliary spray.
29	**Check if RHR System Can Be Placed in Service:**	
	a. RCS hot leg temperatures - LESS THAN 350°F	a. Return to Step 27.
	b. RCS pressure - LESS THAN 400 PSIG	b. Return to Step 28.
	c. Place RHR system in service per [enter plant specific procedure]	
	d. Verify that RHR system can remove heat load	
30	**Investigate Cause of SI:**	
	a. Go to appropriate plant procedure.	

- END -

FOLDOUT FOR E-2 AND ES-2 GUIDELINES

1. **RCP TRIP CRITERIA**
   - Trip any RCP if component cooling water to that pump is lost.
   - Then trip all RCPs when BOTH conditions listed below are met:
     a. SI is ON
     b. RCS pressure - EQUAL TO OR LESS THAN (1) PSIG

2. **SI REINITIATION CRITERIA FOLLOWING LOSS OF SECONDARY COOLANT**
   Reinitiate SI if ANY ONE of the parameters listed below occurs:
   (1) RCS Pressure - DECREASES BY 200 PSI AFTER SI TERMINATION
   (2) RCS Subcooling - LESS THAN (2) °F
   (3) Pressurizer level drops by 10% after SI termination.

3. **AFW SUPPLY SWITCHOVER CRITERION**
   IF CST level less than (3) %, THEN switch to alternate AFW water supply.

4. **COLD LEG RECIRCULATION SWITCHOVER CRITERION**
   IF RWST level less than (4) THAN align SI system for cold leg recirculation per ES-2.2, COLD LEG RECIRCULATION FOLLOWING LOSS OF SECONDARY COOLANT.

5. **SYMPTOMS FOR FR-C.1, RESPONSE TO INADEQUATE CORE COOLING**
   Go to FR-C.1, RESPONSE TO INADEQUATE CORE COOLING, when ALL symptoms in ANY ONE symptom set occur:

PARAMETER:	SYMPTOM SET		
	I	II	III
1. TCs	> 1200°F	—	> 700°F
2. Containment Condition	—	ABNORMAL	ABNORMAL
3. RCP Status	—	ANY ON	ALL OFF
4. RVLIS	—	< 100% NR	< (5) % NR

6. **SYMPTOMS FOR FR-H.1, RESPONSE TO LOSS OF SECONDARY HEAT SINK**
   Go to FR-H.1, RESPONSE TO LOSS OF SECONDARY HEAT SINK, If AFW Flow is NOT AVAILABLE.

(1) Enter plant specific value derived from background document to E-0.

(2) Enter sum of temperature and pressure measurement system errors translated into temperature using saturation tables.

(3) Enter plant specific low level setpoint.

(4) Enter plant specific value corresponding to RWST switchover alarm in plant specific units.

(5) Enter plant specific value which is 3½ feet above bottom of active fuel in core with zero void fraction, plus uncertainties.

BACKGROUND INFORMATION

FOR

WESTINGHOUSE

EMERGENCY RESPONSE GUIDELINES

ES-2.3

SI TERMINATION FOLLOWING EXCESSIVE RCS COOLDOWN

BASIC REVISION

NOVEMBER 1, 1982

INTRODUCTION

The safety injection termination subprocedures provide the necessary guidance for reestablishing normal charging and letdown and securing safety injection pumps once the safety injection termination criteria are met. If controlled plant conditions cannot be maintained then safety injection actuation is again required.

Basis for action in SI termination subprocedures.

Step 1

A Caution is provided reminding the operator that automatic safety injection initiation is not available following SI reset since the reactor trip breakers are not reset. Another caution relating to loss of offsite power after safety injection is reset relates to the fact that thereafter normal blackout loads are loaded on the emergency electrical buses rather than safeguards loads. The safeguards loads must be loaded manually on the diesel-powered emergency buses if a loss of offsite power occurs in this plant condition.

Step 2

All unnecessary SI pumps are stopped and placed in standby to assure future operability of the system. One charging/SI is left in service to provide seal injection to the reactor coolant pumps.

Steps 3 and 4

The miniflow valves on the charging/SI pumps are reopened to provide for pump protection when the safety injection flow path through the BIT is isolated. Component cooling water to the seal water heat exchanger is necessary to prevent overheating of the recirculating miniflow stream and potential damage to the charging/SI pump. The BIT inlet valves should be closed before the outlet valves to minimize the pressure transient on the BIT.

Step 5

Certain equipment important to plant control has not, on older plants, been required to be directly powered from an ESF bus. If offsite power is not available, it will be necessary to reestablish the power supply to pressurizer heaters and to the control air compressors. Other equipment may be required to assure coolant inventory maintenance and reactivity control. This equipment is plant specific, and such equipment must be identified by each utility when plant procedures are written.

Steps 6, 7, 12

The CVCS is aligned for normal charging and letdown operations. The charging flow control valve is closed before the charging line isolation valve is opened to avoid an unnecessary surge of flow through the charging line. Once the isolation valve is open, charging flow can be increased to a normal value and letdown established. Charging flow should be established before letdown to provide cooling to the regenerative heat exchanger and prevent flashing downstream of the letdown orifices upon reestablishment of letdown flow.

Step 8

After the safety injection flowpath is shut off, the operator should check if the RCS remains in a stable conditions. If the RCS is not in a stable condition, then safety injection should be manually reinitiated at this point either by depressing the SI pushbutton or manually starting individual SI pumps and realigning valves. Safety injection should be reinitiated if pressurizer level drops unexpectedly by 10 percent of full span. Loss of minimum subcooling also indicates loss of RCS control by the operator and safety injection should be reinitiated.

Step 9

The operator stabilizes the RCS hot leg temperatures by controlling the auxiliary feedwater flowrate. This prevents further cooldown which would result in additional thermal stresses to RCS components. Since this procedure can be

entered from either E-2, Loss of Secondary Coolant, or ECA-4, Multiple Steam Generator Depressurization, different steam generator conditions can exist. If the operator is in this procedure from E-2, feedwater flow will be isolated to the faulted steam generator and flow controlled to the non-faulted steam generators. If the operator is in this procedure from ECA-4, then all steam generators are faulted and auxiliary feedwater flow is controlled to all the faulted steam generators to control the RCS hot leg temperature. In addition, if all steam generators are faulted, a minimum flow of 25 gpm is required to the minimum number of steam generators supplied by one AFW (motor driven) pump to prevent steam generator tube dryout.

Step 10

After verifying that the containment pressure is below the Hi-1 setpoint, the containment spray pumps (if running) are stopped and then placed in standby to assure future operability of the system.

Step 11

The RWST level is checked to ensure an adequate water supply for the safety injection and containment spray pumps. If the RWST level has dropped to the RWST switchover alarm setpoint, then cold leg recirculation is initiated per ES-2.2.

Steps 13, 14

Suction to the charging pumps should be transferred to the VCT and normal reactor makeup restored. Care should be taken during this operation to keep the VCT level within its normal operating range and to avoid dilution of the RCS boron concentration.

Step 15

Any steam generator(s) with a narrow range level indication of 50 percent or more will ensure that the steam generator tubes are covered. Auxiliary feedwater flow may be throttled to less than 25 gpm to the subject steam generator(s) to control level as long as level is maintained in the narrow range

including allowances for normal channel accuracy, post accident transmitter errors and reference leg process errors. If level increases uncontrollably, the possibility of steam generator tube rupture/leakage should be investigated.

Step 16

The primary source for auxiliary feedwater must be monitored to assure an adequate supply for cooldown purposes. Upon indication of an inadequate supply, efforts should be made to switch over to a secondary source which will guarantee long-term secondary heat sink capability.

Steps 17, 18

Normal pressurizer level is established and RCS pressure is brought to within Technical Specification limits. After restoration, the control systems can be set for automatic operation. Since the pressurizer may have emptied during the transient and subsequently refilled from the hot leg, the pressurizer heaters are used to reestablish saturated conditions in the pressurizer.

Step 19

A subcooling margin of 50°F is sufficient to assure that the core is being adequately cooled with either forced flow or by natural circulation.

Step 20

FR-P.2 is checked to determine soak time requirements (if any) that exist for the cooldown experienced. The soak time requirements provide adequate time to relieve thermal stresses that have been generated in the RCS. For the duration of the soak time where cooldown is restricted, subsequent actions of ES-2.3 can be performed only if it will not violate the requirements set. When the soak time has been completed, then RCS cooldown is permitted as per Technical Specification Limits.

Step 21

All efforts should be made to establish conditions allowing the restart of a reactor coolant pump (if forced flow has been lost) to allow for normal RCS heat transport conditions and assure pressurizer spray. If no reactor coolant pump can be started, the operator should assure that heat is being removed by natural circulation.

Step 22

Approximately 15 minutes after the reactor trip, the core neutron flux should decrease below the P-6 permissive setpoint on the Intermediate Range detector and the Source Range detectors will automatically energize. The operator should verify this.

Steps 23, 24, 25

The operator should maintain stable plant conditions until a decision is made to either start or to cool down the plant. Certain plant equipment that was running when at power may not be necessary at this time and may be shut down, e.g., more than one condensate pump is not required for hot standby or for cooldown. Prior to leaving this SI termination subprocedure, the operator is reminded of the SI reinitiation criteria (Step 8 of this background document). The subcooling requirement is not 50° subcooling since this value should have been previously established in Step 19. 50°F subcooling margin should be easily maintained at this time, and if it cannot be maintained, the operator does not yet have adequate control of the plant.

Step 26

After the water level has been returned to the pressurizer, the heaters have developed a differential temperature of 50°F and the combined action of the leak flow and injection flow are maintaining a reactor coolant pressure above 400 psig, the system depressurization action can begin. To avoid the unnecessary injection of the contents (in particular the compressed gas) of the SI accumulators for certain small breaks as the system pressure is deliberately

reduced, the SI accumulators should be isolated by closing the outlet isolation valves. If for some reason the isolation valves cannot be utilized, the gas should be vented off to the containment to reduce the gas pressure to about 400 psig. Some residual gas pressure should remain in the accumulators so they will remain available as a source of borated cooling water. The exact final pressure can be calculated for each plant, considering the accumulator volume, normal nitrogen volume, and normal accumulator pressure.

Steps 27, 28, 29

RCS conditions for placing the RHR in service are established and verified. The RHR system is placed in service and verified that it is capable of removing the RCS generated heat load.

Figure BD-1

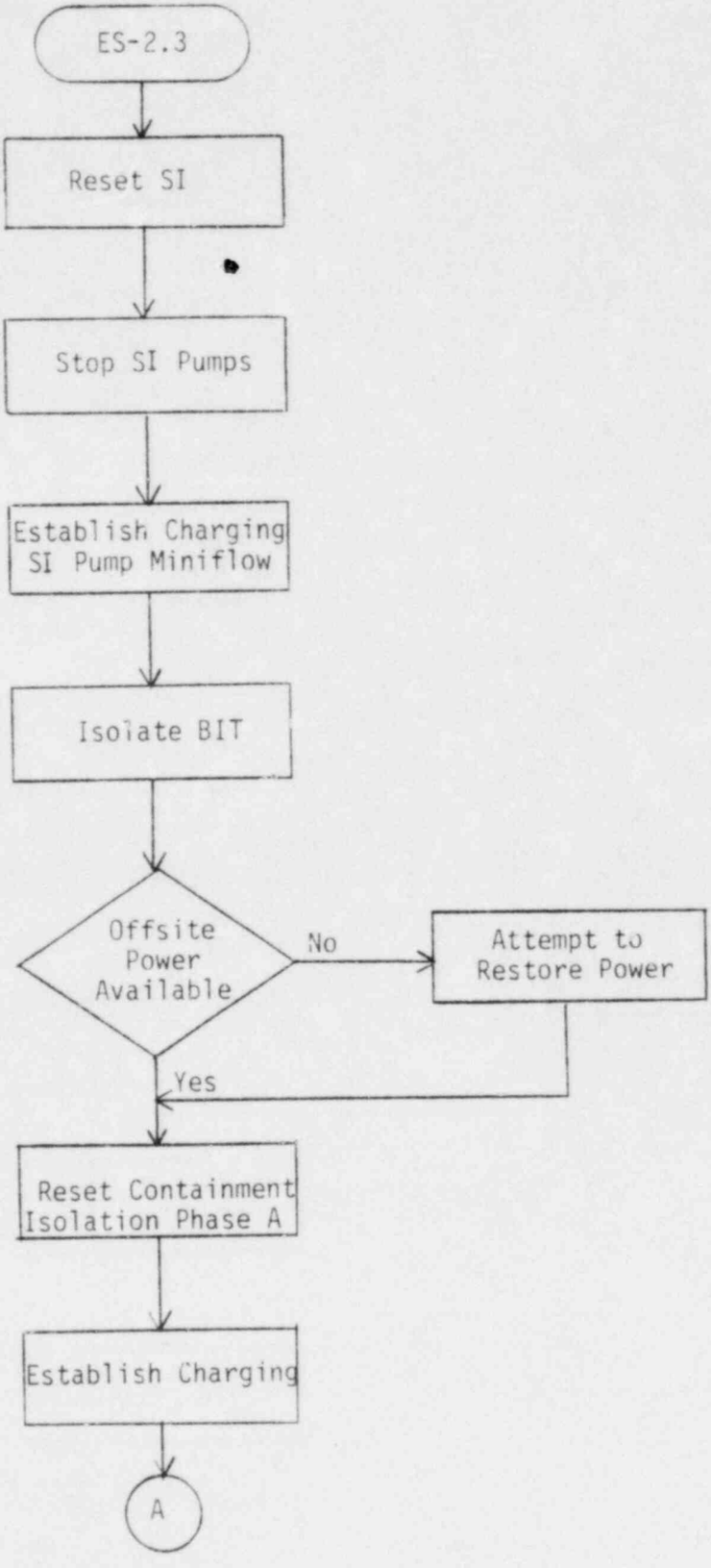
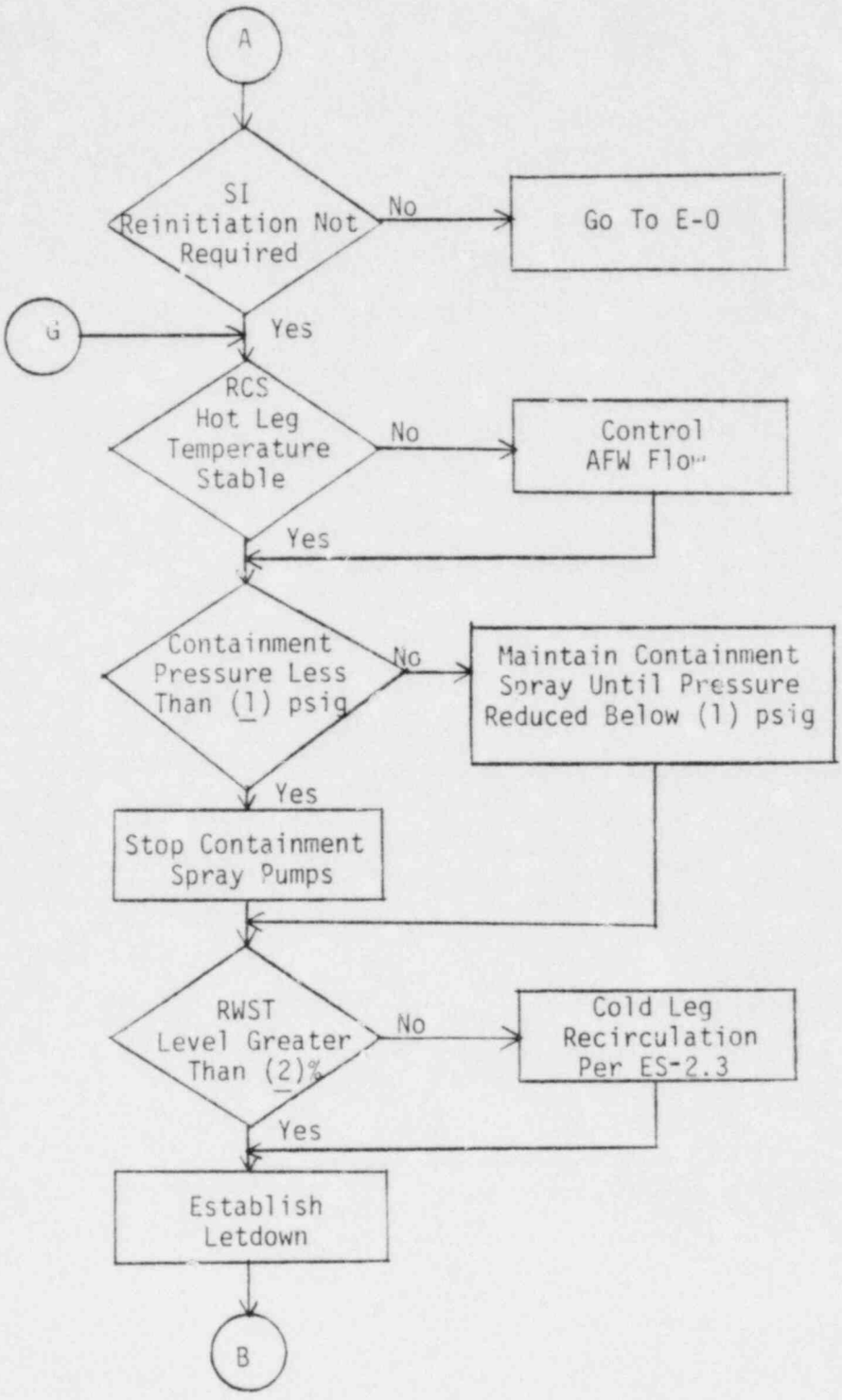

ES-2.3
Reset SI
Stop SI Pumps
Establish Charging SI Pump Miniflow
Isolate BIT
Offsite Power Available
No
Attempt to Restore Power
Yes
Reset Containment Isolation Phase A
Establish Charging
A

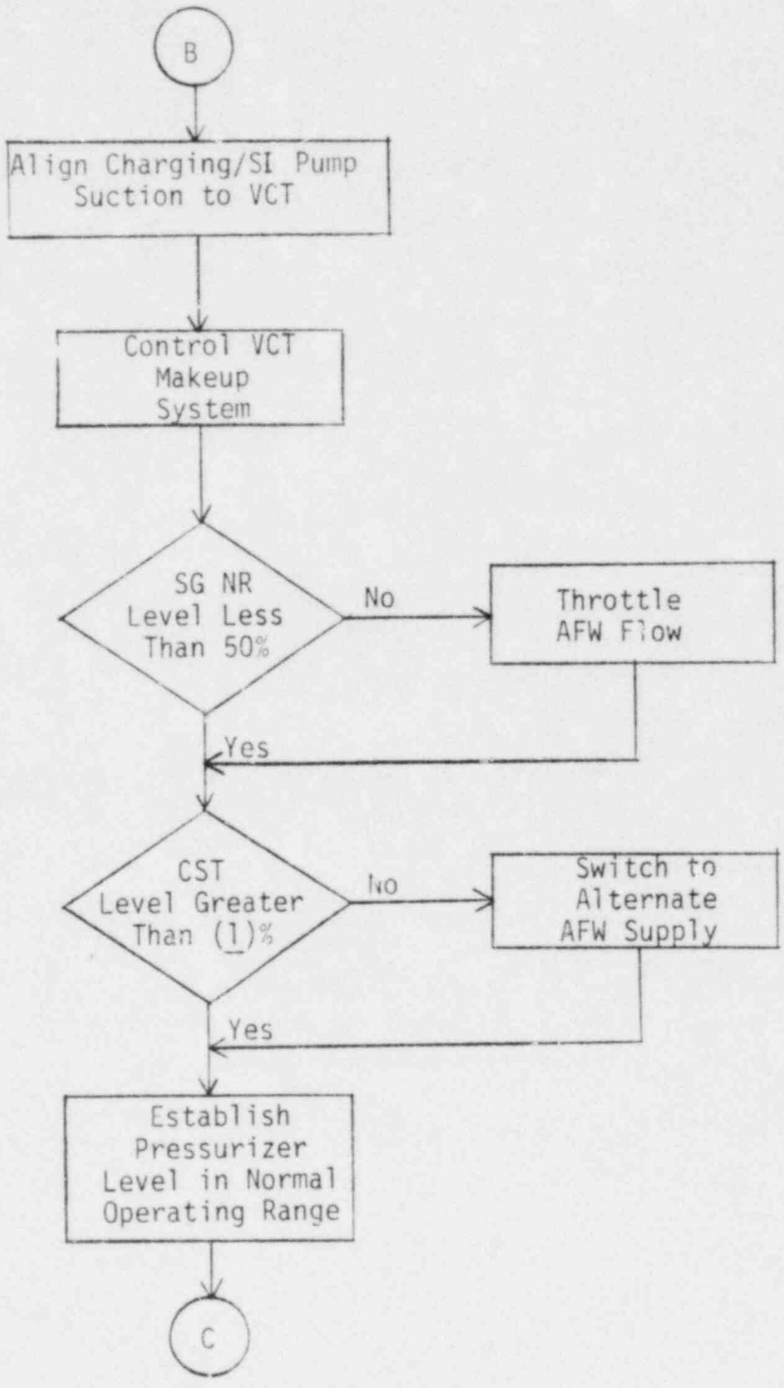
Figure BD-2



(1) Plant specific value corresponding to containment HI - 1 setpoint

(2) Plant specific value corresponding to RWST switchover alarm

Figure BD-3



(1) Plant specific low level setpoint

Figure BD-4

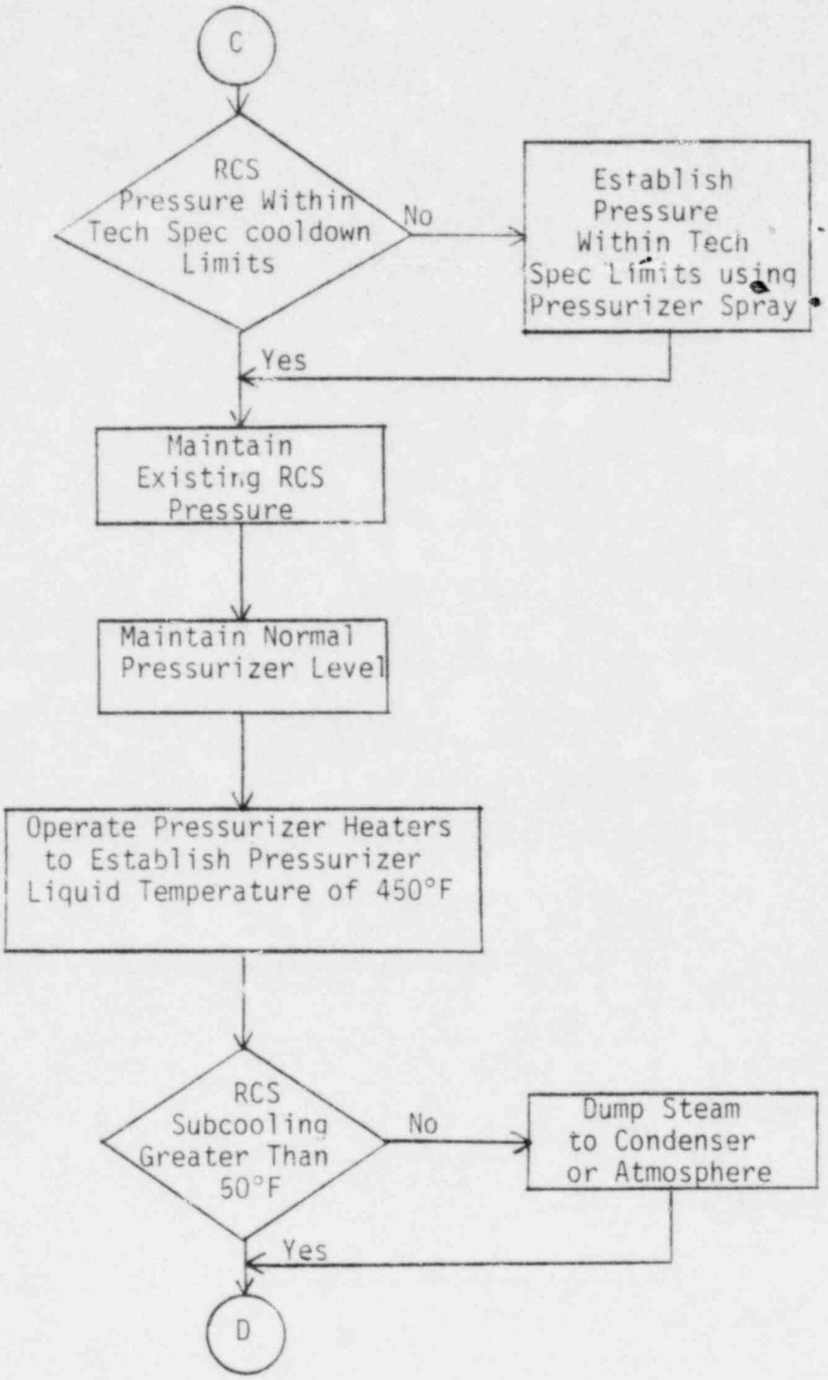
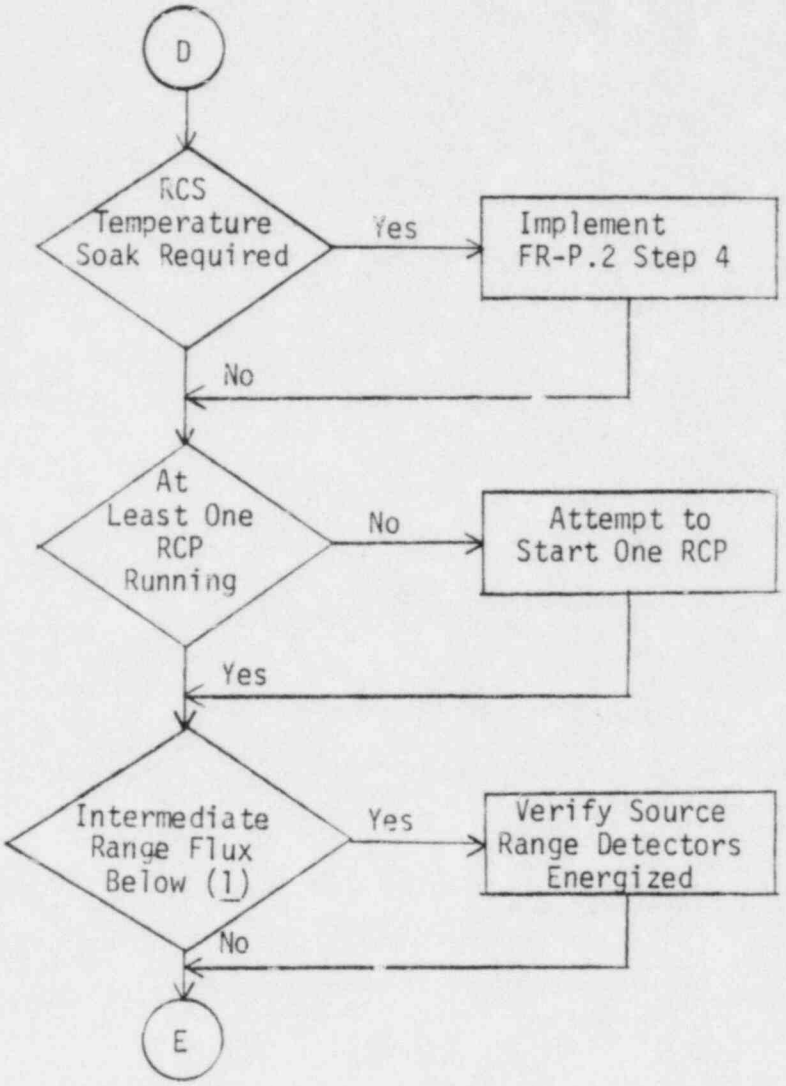

C
RCS Pressure Within Tech Spec cooldown Limits
No
Establish Pressure Within Tech Spec Limits using Pressurizer Spray
Yes
Maintain Existing RCS Pressure
Maintain Normal Pressurizer Level
Operate Pressurizer Heaters to Establish Pressurizer Liquid Temperature of 450°F
RCS Subcooling Greater Than 50°F
No
Dump Steam to Condenser or Atmosphere
Yes
D

FIGURE BD-5



(1) Plant specific value for intermediate range permissive to block source range high flux trip (P - 6)

FIGURE BD-6

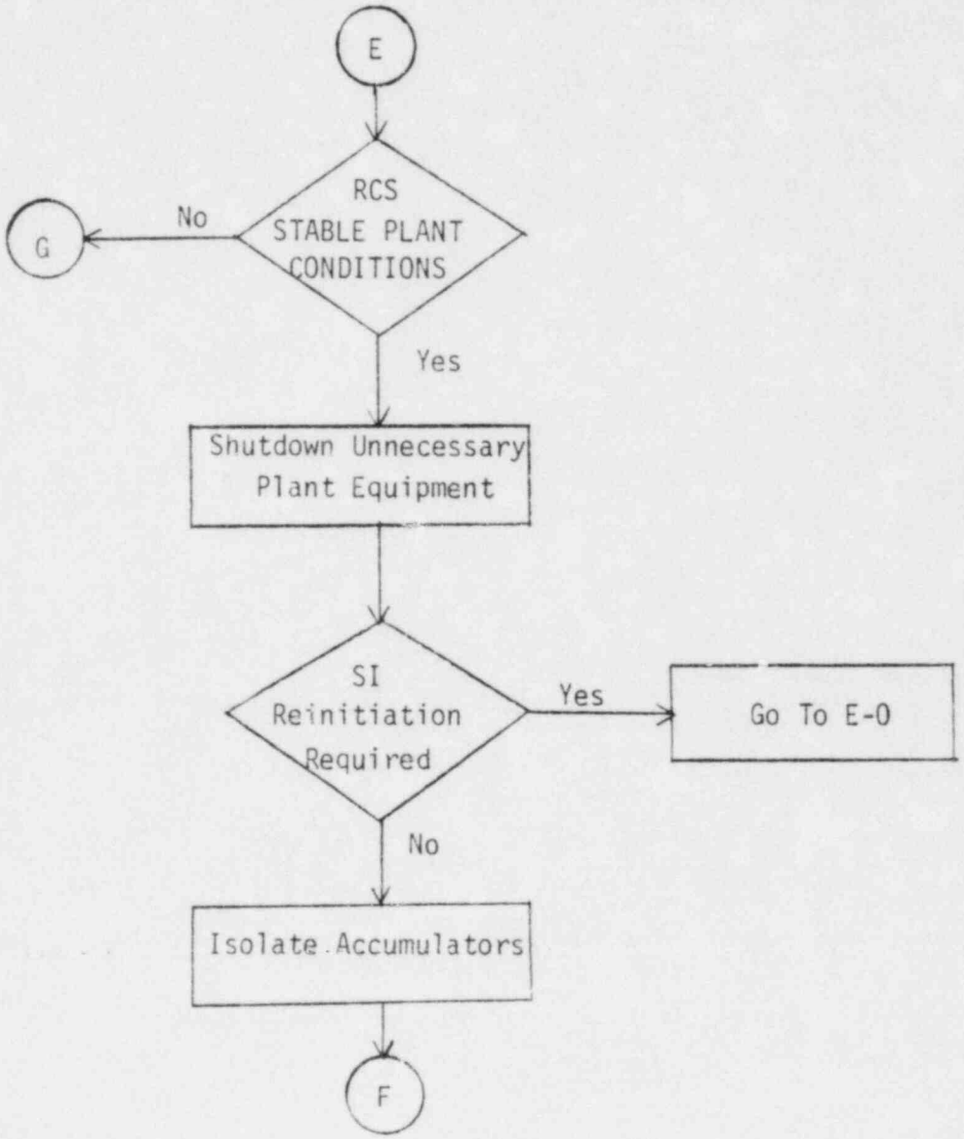
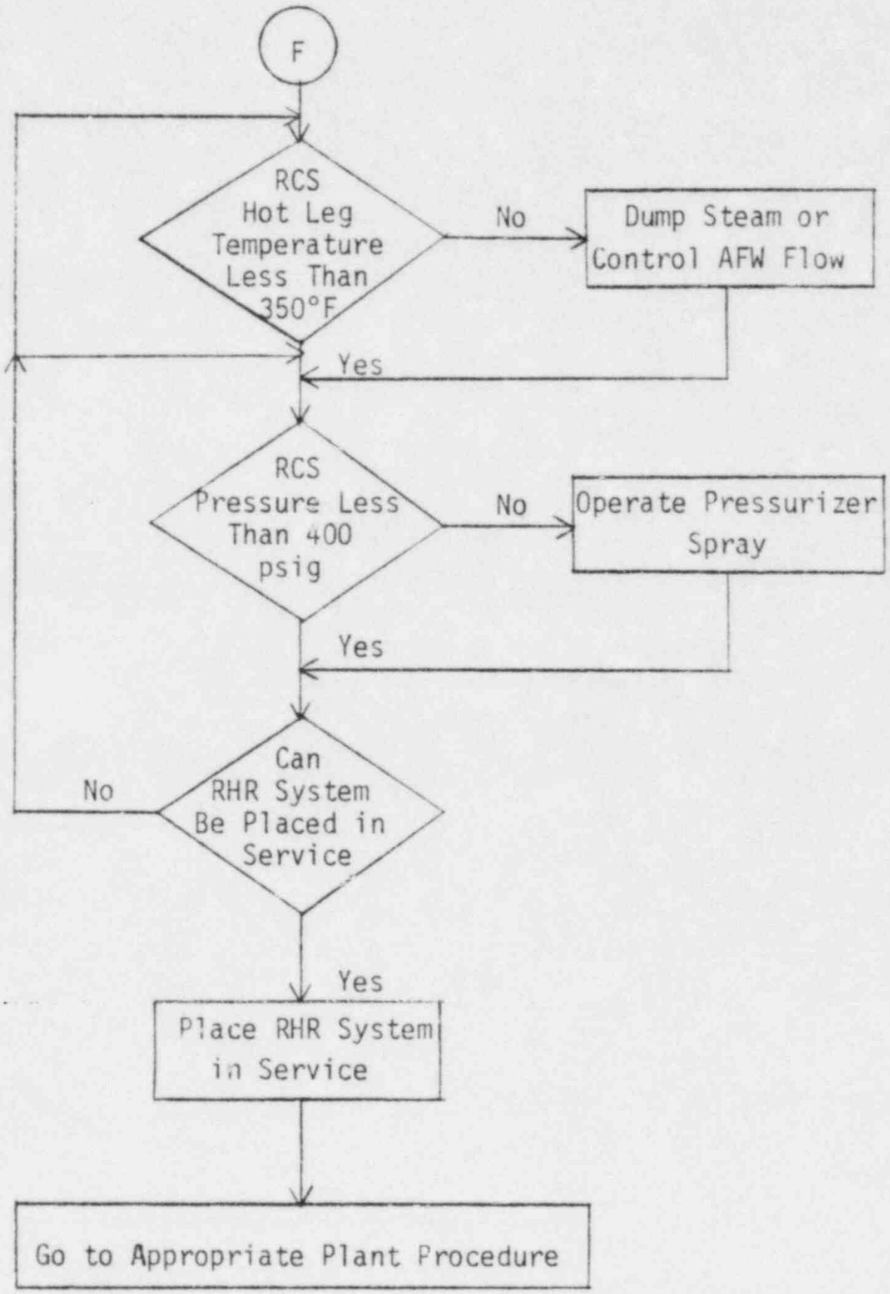

E
RCS
STABLE PLANT
CONDITIONS
No
G
Yes
Shutdown Unnecessary
Plant Equipment
SI
Reinitiation
Required
Yes
Go To E-0
No
Isolate Accumulators
F

FIGURE BD-7


F
RCS Hot Leg Temperature Less Than 350°F
No
Dump Steam or Control AFW Flow
Yes
RCS Pressure Less Than 400 psig
No
Operate Pressurizer Spray
Yes
Can RHR System Be Placed in Service
No
Yes
Place RHR System in Service
Go to Appropriate Plant Procedure

WESTINGHOUSE OWNERS GROUP
EMERGENCY RESPONSE GUIDELINES
CONFIGURATION CONTROL SHEET

GUIDELINE DESIGNATOR: ES-2.3

GUIDELINE TITLE: SI Termination Following Excessive RCS Cooldown

REVISION: HP-Basic

DATE: November 1, 1982

The guideline described above has been reviewed and approved for implementation by the Westinghouse Owners Group Procedures Subcommittee and the Westinghouse Nuclear Technology Division.

NOTICE: THIS EMERGENCY RESPONSE GUIDELINE SET REVISION (HP-BASIC) IS THE ORIGINAL ISSUE OF GENERIC GUIDANCE ON ITS SUBJECT MATTER FOR PLANTS WITH HIGH-PRESSURE SI SYSTEMS AND SUPERSEDES ANY GENERIC GUIDANCE ON THIS SUBJECT BEARING AN ISSUE DATE EARLIER THAN NOVEMBER 1, 1982.

File this sheet with the approved version of this guideline in your Emergency Response Guideline set.

Chairman, Procedures Subcommittee
Westinghouse Owners Group

Manager, Standard Plant Engineering
Westinghouse Nuclear Technology Division