DOCUMENT REVISION DISTRIBUTION SHEET - OFF NORMAL & EMERGENCY OPER. PROCEDURE

DOCUMENT TITLE WIDE RANGE Nuclear Instrumentation Channel Malfunction

DOCUMENT FILE NUMBER 12100.30

DOCUMENT REVISION NUMBER 3

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*Note: New distribution per instructions. Effective 9-12-79. D. L. Shamp D. L. Croft

FLORIDA POWER & LIGHT COMPANY
ST. LUCIE UNIT # 1
OFF NORMAL OPERATING PROCEDURE NO. 1-1210030
REVISION 3

1

1.0 TITLE:

Wide Range Nuclear Instrumentation Channel Malfunction

2.0 APPROVAL:

Reviewed by Plant Nuclear Safety Committee September 12 1975
Approved by J. H Baur For Plant Manager Sept 12 1975

Revision 3 Reviewed by FRG MARCH 31, 1982
Approved by C. M. Wethy Plant Manager April 20 - 1982

3.0 PURPOSE & DISCUSSION:

3.1 This procedure provides a guide for operator action in the event of a wide range nuclear instrument channel malfunction.

3.2 Since the wide range drawer provides pretrip, trip and logic signals to the reactor protection system (RPS) all indications should be assumed valid until proven otherwise.

4.0 SYMPTOMS:

Any of the following symptoms can indicate a wide range channel malfunction:

4.1 Actuated Annunciators:

Reactor power high rate of change pretrip. (L-25)

Reactor power high rate of change trip. (L-19)

Nuclear Instrumentation Channel Inoperative. (L-30)

4.2 Significant disagreement between channels as read on rate and level meters on the wide range drawer and/or RTGB 104.

4.3 Drift of bistable settings. (10^{-4}, 10^{-1})

4.4 Wide range drawer H.V. failure light on.

4.5 Failure of the wide range drawer to shift from the extended range to the wide range mode of operation when > 5×10^{3} CPS.

OFF NORMAL OPERATING PROCEDURE NO. 1-1210030
REVISION 3
WIDE RANGE NUCLEAR INSTRUMENTATION CHANNEL MANFUNCTION

5.0 INSTRUCTIONS:

5.1 Immediate automatic action

5.1.1 A Reactor trip is initiated by a two out of four coincidence logic if the rate of change of power exceeds 2.4 DPM when operating in the range of 10^{-4}% to 15% power.

5.1.2 A control withdrawal prohibit is initiated by a two out of four coincidence logic if the rate of change of power exceeds 1.3 DPM when operating above 10^{-4}% power.

5.2 Immediate operator action

5.2.1 Acknowledge alarm(s).

5.2.2 Compare meter indications on all channels to discern a valid alarm/indication from a channel malfunction.

5.3 Subsequent actions R3

5.3.1 Bypass the affected channel Hi Rate trip unit.

5.3.2 Switch the wide range recorder and audio count rate (if in the startup or shutdown modes) to the operable channel.

5.3.3 In the event of a drawer failure to shift the fission chamber detector mode of operate from extended to wide range: Place the wide range drawer level OPERATE/ CALIBRATE switch in the CALIBRATE one position. Observe the extended range light extinguish.

5.3.4 The balance of subsequent operator action is determined by the mode at which the reactor is operating and the number of inoperable channels. Refer to Tech Specs. Table 3.3-1.

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REVISION 3
WIDE RANGE NUCLEAR INSTRUMENTATION CHANNEL MALFUNCTION

5.0 INSTRUCTIONS: (Cont'd)

5.3 Subsequent operation action (Cont'd)

5.3.5 Notify I & C as soon as practical.

6.0 REFERENCES:

6.1 Technical Specifications

6.2 Wide Range Log Channel Model NLW-3 Operation and Maintenance Manual 8770-6860.

7.0 RECORDS:

7.1 Normal Log Entries

DOCUMENT REVISION DISTRIBUTION SHEET - OFF NORMAL & EMERGENCY OPER. PROCEDURE

DOCUMENT TITLE Blackout Operation

23
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DOCUMENT FILE NUMBER OO3O14C

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*Note: New distribution per instructions. Effective 9-12-79. P. L. Lewis
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FLORIDA POWER & LIGHT COMPANY
ST. LUCIE UNIT #1
EMERGENCY OPERATING PROCEDURE NO. 0030140
REVISION 25

1.0 Title:

BLACKOUT OPERATION

2.0 Approval:

Reviewed by Plant Nuclear Safety Committee [illegible] 19[illegible]
Approved by [illegible] Plant Manager [illegible] 19[illegible]

Revision 25 Reviewed by Facility Review Group [illegible] 19[illegible]
Approved by C M Wethy Plant Manager 4-25-- 1982

3.0 Purpose or Discussion:

3.1 This procedure provides the action to be taken in the event of a complete loss of off site electrical power concurrent with a turbine trip.

3.2 Discussion

3.2.1 A loss of power to the 4160 V buses, results in a loss of power to all 480 V load centers and motor control centers and to all instrumentation not fed directly or indirectly from the station battery. A reactor trip will occur from a low reactor coolant flow rate signal due to the loss of power to the 6900 V buses supplying the reactor coolant pumps and will be accompanied by a turbine trip and generator lockout.

3.2.2 Steam dump to atmosphere must be used to remove reactor decay heat. Initially, steam generator safety valves may actuate to augment the steam flow and to help control steam generator pressure immediately after the trip.

3.2.3 On site power will be supplied by Emergency Generators.

3.3 A rapid reduction in steam generator water levels will occur due to the reduction of the steam generator void fraction on the secondary side and also because steam flow will continue after normal feedwater flow stops. Auxiliary feedwater flow will automatically initiate 3 minutes after the first steam generator level reaches 34% (2/4 logic).

EMERGENCY OPERATING PROCEDURE NO. 0030140, REV 25
BLACKOUT OPERATION

3.0 Purpose or Discussion: (Cont'd)

3.4 Core decay heat removal is accomplished by natural circulation in the reactor coolant loops.

3.5 Core damage is not expected as a result of a loss of power condition as the steam generators are maintained as a heat sink and no loss of water occurs from the pressurizer.

3.6 If operating under blackout conditions and an engineered safety features actuation signal occurs, any non-emergency loads that are running will be automatically tripped and the required emergency loads will be automatically started.

4.0 Symptoms:

4.1 Alarms associated with the loss of operating plant components.

4.2 Loss of normal control room lighting and DC lighting energized.

4.3 Reactor and turbine trip.

4.4 Emergency diesel generators start.

4.5 Reactor coolant pump trip and steam generator feed pump trip.

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BLACKOUT OPERATION

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5.0 Instructions:

5.1 Immediate auto action

5.1.1 Reactor and turbine trip, generator lockout

5.1.2 Generator breakers open.

5.1.3 Incoming feeder breakers open to 4160 V and 6900 V buses.

5.1.4 Tie breakers between Normal 4160 buses (1A2 and 1B2) and the emergency 4160 V buses (1A3 and 1B3) open.

5.1.5 Ties between essential and non-essential sections of emergency 480 V MCC's open.

5.1.6 Breakers open for the following non-safety related loads which are normally fed from emergency buses.

NOTE: These loads can be manually reconnected to the emergency buses as needed.

5.1.6.1 Pressurizer heater transformers 1A and 1B.
5.1.6.2 Fire pump 1A and 1B.
5.1.6.3 CEA Drive M.G. 1A & 1B.
5.1.6.4 Fuel Handling 480 V MCC 1A8, 1B8/
5.1.6.5 Reactor cavity sump pump 1A
5.1.6.6 Reactor building elevator
5.1.6.7 Electrical equipment room hoist
5.1.6.8 120/208 power panel 121 transformer
5.1.6.9 Lighting panel transformers 110, 112, 114, 117, 125, 126
5.1.6.10 Incoming feeder from 1A2 & 1B2 4160V buses
5.1.6.11 RCP oil lift pumps (B pumps only - A pumps running)
5.1.6.12 Airborne radioactivity removal fans HVE-1&2
5.1.6.13 Pressurizer relief isol valves 1403 & 1405 /R22
5.1.6.14 CVCS heat tracing transformer 1A & 1B
5.1.6.15 480V Lighting panel 2A, 2B & 2C
5.1.6.16 Waste management heat tracing transformers 2A & 2B
5.1.6.17 Air conditioner HVA-4, ACC-4.
5.1.6.18 Power panel 120
5.1.6.19 Lighting panels 113, 116, 109, 115, 130
5.1.6.20 Refueling equipment
5.1.6.21 Refueling water to charging pumps V-2504
5.1.6.22 Boric Acid batching tank heaters
5.1.6.23 Fire siren

EMERGENCY OPERATING PROCEDURE NO. 0030140, REV 25
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5.0 Instructions: (cont)

5.1 (cont)

5.1.7 All loads on emergency buses are tripped except the following:

5.1.7.1 Boric Acid makeup pumps
5.1.7.2 Charging pumps
5.1.7.3 Emergency lighting
5.1.7.4 Class I power panels
5.1.7.5 RCP oil lift pumps (A pumps only - B pumps off)
5.1.7.6 Diesel fuel transfer pump.

5.1.8 Diesel generators A & B start and energize 4160 V emergency buses 1A3, 1B3, and 1AB and loads listed in step 5.1.7.

5.1.9 Subsequent loads are started at 3 second intervals. See Table 1, Emergency Diesel Generator Loading Sequence.

5.1.10 Auxiliary Feedwater auto start sequence initiates when the first steam generator level decreases to 34%.

NOTE: Pump start and flow initiation is delayed for 3 minutes. Pumps may be started by the operator AT ANY TIME.

5.2 Immediate Operator Actions

5.2.1 Trip turbine and reactor manually.

5.2.2 Check all full length CEA's are fully inserted and reactor trip breakers are open.

5.2.3 Check turbine valves are closed.

5.2.4 Check generator field and 240 KV breakers are open.

5.2.5 Place reheater control system in manual, close TCV's.

5.2.6 Check that diesel generators have started and are feeding only emergency buses.

5.2.7 Open start-up transformer breakers.

5.2.8 Reduce T_{avg} to reference set point by manual operation of the steam dump valves to atmosphere.

5.2.9 Isolate steam generator blowdown.

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5.0 Instruction: (Cont'd)

5.2 Immediate Operation Action (Cont'd)

5.2.10 Start steam driven aux. feed pump and establish flow to S.G.'s. If aux. feed pumps have started due to the auto start feature, the motor driven pumps may be secured 30 seconds after they start, if desired.

5.2.11 If all feedwater flow is stopped or lost and steam generator level is less than 42% then:

1. Reinitiate auxiliary feedwater flow as soon as possible; however, do not exceed a flow rate of 150 gpm per steam generator.
2. Limit feedwater flow rate to 150 gpm per steam generator until continuous feedwater flow to the SG has been maintained for five minutes.

5.2.12 If any of the automatic actions listed in 5.2.2 thru 5.2.9 do not occur automatically, then manually initiate that action.

5.2.13 Implement the Emergency Plan as necessary in accordance with EPIP 3100021E, "Duties of the Emergency Coordinator'.

5.3 Subsequent Action

5.3.1 Ensure adequate natural circulation flow by ensuring that hot and cold leg temperatures, pressurizer pressure and level stabilize within minutes. The core ΔT should be less than $\sim 46^{\circ}F$ (ΔT for full power).

5.3.1.1 If the above conditions are not established:

5.3.1.1.1 Check RCS temperature and pressure to ensure that the RCS is subcooled.

5.3.1.1.2 Ensure auxillary feed flow to the steam generators has been initiated and the steam dumps to atmosphere are in operation.

5.3.1.2 Return at least one RCP in each loop to operation as soon as offsite power is available.

5.3.2 Start equipment in Table 1 if required.

EMERGENCY OPERATING PROCEDURE NO. 0030140,
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5.0 Instruction: (Cont'd)

5.3 (cont'd)

5.3.3 If one diesel fails to start, attempt a manual start.

5.3.3.1 If manual start attempt is unsuccessful, an operator should be sent to the diesel local control station to inspect status of local alarm panel.

5.3.3.2 If no alarms are present on the local alarm panel, an inspection of the overspeed trip lever should be made to insure it has not tripped.

5.3.3.3 If the overspeed trip levers are latched, the normal isolate switches on the local control panel should be placed in the isolate position and a local start attempt should be made.

5.3.3.4 Refer to Operating Procedure 2200020, 2200050 Emergency Diesel Standby Line up and Periodic Test.

5.3.4 Locally open condenser vacuum breakers MV10-1A and MV10-1B. Locally close MSR main steam block valves MV08-4, MV08-6, MV08-8, and MV08-10.

5.3.5 Check MSR warm-up valves MV08-5, MV08-7, MV-9, and MV08-11 to be closed or close manually.

5.3.6 Send an operator to align and start emergency cooling water to the instrument air compressor, then reset local handswitch and manually start the instrument air compressor.

CAUTION: Do not overload the diesel generators when starting additional equipment. (3500 KW max. continuous rating).

5.3.7 When diesel generator power is available energize equipment as may be required for plant safety and to achieve an orderly shutdown within the diesel generator load limitations by:

5.3.7.1 Verify one set of cavity and support cooling fans operating. If not, start one set.

5.3.7.2 Locking out automatic starting equipment that is not in service.

5.3.7.3 Manually opening all breakers on any non-vital bus or motor control center that is to be re-energized.

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5.0 Instructions: (Cont)

5.3 (Cont)

5.3.7 (Cont)

5.3.7.4 Resetting lockout relays for each required bus to allow closing of feeder breakers.

5.3.8 Energize 4160 V buses 1A2, 1B2, 480 V load centers 1A1, 1B1 and 480 MCC's 1A1, 1B1, 1A4, 1B4, and 1C as follows:

	ACTION	LOCATION	
5.3.8.1	Strip non-vital 4.16 KV busses (All should be opened automatically)	1A2	1B2
5.3.8.2	Insert sync plug, close 4.16 KV non-vital breaker and hold control switch closed while closing 4.16 KV vital breaker.	1A2-20109 1A3-20209	1B2-20309 1B3-20411
5.3.8.3	Strip non-vital load center	1A1	1B1
5.3.8.4	Close 4.16KV feed breaker to non-vital load centers	1A2-20110	1B2-20310
5.3.8.5	Strip 480V MCC	1A1 1A4 1C	1B1 1B4
5.3.8.6	Close 480V load center feed breaker to MCC 1A1 & 1B1	1A1-40115	1B1-40411
5.3.8.7	Close 480V load center feed breaker to MCC 1A4 & 1B4	1A1-40113	1B1-40413
5.3.8.8	Close 480V load center feed breaker to MCC 1C	1A1-40119	1B1-40410

5.3.9 At MCC 1C, close breakers for turning gear, bearing oil pump, air side seal oil pump and hydrogen seal oil pump.

5.3.10 Place turbine plant cooling water pump in operation.

5.3.11 Align turbine cooling water system to the instrument air compressor back to normal alignment.

5.3.11.1 Open all Ckt's on PP-104 except Ckt's 21 & 23.

5.3.11.2 Close Breaker 40851 on MCC 1A1

5.3.11.3 Open all Ckt's on PP-146 except Ckt 1.

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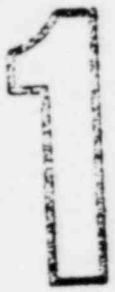

5.0 Instructions: (Cont)

5.3.11.3.1 Open all Ckt's on PP-150 except Ckt's 7,9 and 11.

NOTE: PP-146 is located on the wall of the new cold lab just west of MCC 1B1. PP-150 is located in the new cold lab closet.

5.3.11.4 Close Breaker 41634 on MCC 1B1.

5.3.12 Place turbine drain valve switch in the open position.

5.3.13 Start bearing oil pump before turbing bearing oil pressure reaches 12 psig. decreasing. Pump starts automatically at 12 psig decreasing turbine bearing oil pressure. NOTE: If bearing oil pump fails to start, the emergency DC oil pump will start at 10 psig decreasing bearing oil pressure. Operator should start pump before 10 psig is reached. Stop the DC oil pump if it is running in addition to the bearing oil pump.

5.3.14 Remove the following components from service:

5.3.14.1 Steam jet air ejectors
5.3.14.2 Priming ejector
5.3.14.3 Auxiliary priming ejector
5.3.14.4 Auxiliary steam to R.A.B.
5.3.14.5 Gland seal system

5.3.15 Start CEDM cooling fans A & B.

5.3.16 Start reactor support cooling fans A & B.

CAUTION: Consider equipment starting requirements. Alternate operation of equipment may be required to avoid overloading the diesel generators. (3500 KW Max. continuous rating).

5.3.17 Manually close breakers for pressurizer heater buses on 4150 V buses 1A3 and 1B3.

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5.0 Instructions: (cont)

5.3 (cont)

5.3.18 Check that the bearing oil lift pump starts automatically when turbine speed decreases to approximately 600 rpm.

5.3.19 Start turbine lube oil vapor extractor and generator oil vapor extractor.

5.3.20 Check that the turning gear engages and starts automatically when turbine speed decreases to zero rpm, or manually engage it.

5.3.21 Reduce the flow of cooling water to maintain the temperature of the oil leaving the turbine lube oil and the air side and hydrogen side oil coolers between 95 - 100°F.

5.3.22 Isolate cooling water supply to the generator hydrogen coolers.

5.3.23 If additional condensate storage tank water is required and sufficient power is available from the diesel generators, place the water treatment plant in service.

5.3.24 Place the spent fuel pit cooling pump in operation as necessary.

NOTE: With spent fuel elements from 3-1/3 cores present, the spent fuel pit can safely withstand 5 hours without cooling before reaching the boiling point.

5.3.25 Periodically check fuel oil levels in the diesel generator day tanks to confirm proper operation of the fuel oil transfer system and to ensure uninterrupted diesel generator operation.

5.3.26 Sample and analyze the reactor coolant to determine if fuel element clad failure has occurred.

5.3.27 Determine expected duration of power outage. If unable to do so or if outage is to be prolonged, borate RCS to cold shutdown concentration.

5.3.28 If the outage will exceed 4 hours and the RWT is available, proceed to cold shutdown conditions utilizing thermal circulation, atmospheric steam dump and feedwater addition. Place shutdown cooling in service when appropriate temperatures and pressures are reached. Proceed to step 5.3.32.

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BLACKOUT OPERATION

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5.0 Instructions: (cont)

5.3 (cont)

5.3.28 (cont)

NOTE: Do not begin plant cooldown until cold shutdown boron concentration is verified.

5.3.29 If the outage will exceed 4 hours and the RWT is not available, the Safety Injection tanks should be used for makeup to the RCS, if other sources are not available.

5.3.30 Make the following preparations:

5.3.30.1 Close either or both non-essential tie breakers for MCC 1A5 and MCC 1B5
1A5 - 41230
1B5 - 42027
This will provide power to the containment instrument air compressors.

5.3.30.2 If running of containment instrument air compressors is not desirable, insure that a turbine building instrument air compressor is running and containment instrument air pressure is normal.

5.3.30.3 Open the 480 V AC breakers for MOV-2501 and MOV-2504.
MOV-2501 - 42021
MOV-2504 - 42017

5.3.30.4 Open and lock the following valves:

V-07009 SIT test line return to RWT penetration #41
V-3463 SIT test line return to RWT penetration #41
V-03920 SIT test line tie to VCT inlet

5.3.30.5 Borate the RCS to cold shutdown boron concentration.

CAUTION: Insure that one BAMT tank ramains in service to use as a source of borated water while in mode 5.

EMERGENCY OPERATING PROCEDURE NO. 0030140, REV 25
BLACKOUT OPERATION

5.0 Instructions: (cont)

5.3 (cont)

5.3.31 Proceed to cold shutdown conditions utilizing thermal circulation, atmospheric steam dump and feedwater addition.

5.3.31.1 When makeup to VCT is necessary, select a S.I.T. to use as makeup source. Open the appropriate tanks, fill and drain valve.
1A1 - AOV-3621
1A2 - AOV-3611
1B1 - AOV-3631
1B2 - AOV-3641

5.3.31.2 Close the appropriate fill and drain valve when VCT is restored to normal level.

CAUTION: Use one SIT tank at a time. Insure RCS is 1750 psia before the second SIT tank is used.

5.3.31.3 Place shutdown cooling in service when appropriate temperatures and pressures are reached.

5.3.32 If pressurizer cooldown cannot be accomplished in a timely manner from the addition of cooler liquid (Aux. Spray) from the charging pump via the pressurizer spray line, proceed with the alternate positive means of depressurization as follows:

5.3.32.1 Place the switches for the power operated relief valves V1402 and V1404 in the override position.

5.3.32.2 Initiate a high pressurizer pressure trip signal on two RPS channel trip units.

5.3.32.3 Place the switch for either power operated relief valve (V1402 or V1404) in the normal range position and vent the pressurizer to the quench tank. Return the switch to override to close valve.

5.3.32.4 Control the rate of cooldown and depressurization by selective operation of the power operated relief valves in this mode until cooldown via the Auxiliary Spray valves can be initiated.

5.0 Instructions: (cont)

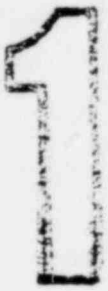
5.3 (cont)

5.3.33 When normal AC power is available:

5.3.33.1 Restore bus sections to their normal supplies.

5.3.33.2 Place the diesel generator system in standby lineup as per OP 2200020.

5.3.33.3 Restore all plant systems to normal.



6.0 References:

6.1 FSAR, Section 15

6.2 FSAR, Section 8

6.3 Operating Procedure #0030130, Shutdown Resulting From Reactor/Turbine Trip

6.4 Operating Procedure #0210020, Charging and Letdown

6.5 Operating Procedure #0330020, Turbine Cooling Water Operation

6.6 Operating Procedure #0250031, Boron Concentration Control, Off-Normal

6.7 Operating Procedure #1010040, Loss of Instrument Air

6.8 Operating Procedure #1540020, Water Plant Startup and Shutdown

6.9 Operating Procedure #2200020, Emergency Diesels - Standby Lineup

6.10 Operating Procedure #0700022, Aux. Feedwater System Operation

7.0 Records/Notification:

7.1 Normal Log Entries.

7.2 Notify Duty Call Supervisor.

7.3 AP 0010134 "Component Cycles and Transients"

TABLE I

EMERGENCY DIESEL GENERATOR LOADING SEQUENCE

Service	Qty	Nominal Load - Ea	Loss of Coolant Accident and Loss of Off-Site Power: Running Load - Kw	Timing* Starting	Running	Loss of Off-Site Power: Running Load - Kw
HPSI pump	1	400 HP	330	From 0.2 Sec	- Cont	-
Boric acid makeup pump	1	25 HP	22	From 0 Sec	- 4 hrs 1st	22
Charging pump	1	100 HP	80	From 0 Sec	- 4 hrs Block	80
Motor operated valves	Lot	60 HP	40	From 0 Sec	- 1 min	-
Emergency lighting	Lot	50 KW	50	From 0 Sec	- Cont	50
Class I power panels	4	45KVA	40	From 0 Sec	- Cont	40
Fuel Transfer Pump	1	5 HP	5	From 0 Sec	- Cont	5
LPSI pump	1	400 HP	330	From 3 Sec	- 90 min 2nd	330
Containmnet fan coolers	2	150 HP	245	From 3 Sec	- Cont Block	167
Component coolant pump	1	450 HP	376	From 6 Sec	- Cont	376
Shield bld vent fan	1	60 HP	54	From 6 Sec	- Cont 3rd	-
Shield Bld Vent Sys Elec Htr	1	30KW	30	From 6 Sec	- Cont Block	-
D-G Bld Exh. Fan	1	1HP	1	From 6 Sec	- Cont	1
Intake cooling pump	1	600 HP	492	From 9 Sec	- Cont 4th Block	492
Containment spray pump	1	500 HP	400	From 12 Sec	- Cont 5th Block	-
Auxiliary feedwater pump	1	350 HP	305	From 15 Sec	- 4 hrs 6th Block	305
Boric acid heating	1 Lot	51.75 KW	51.75	From 18 Sec	- 4 hrs	51.75
Auxiliary bld supply fan	1	60 HP	54	From 18 Sec	- Cont	54
ECCS Area exhaust system	1	50 HP	44	From 18 Sec	- Cont 7th	44
Control Room AC Outdoor Unit	1	50 HP	44	From 18 Sec	- Cont Block	44
Control room AC Indoor Unit	1	7.5 HP	8	From 18 Sec	- Cont	8
Control room booster fan	1	3 HP	3	From 18 Sec	- Cont	3
Reactor Support CLG Fan	1	40 HP	37	From 18 Sec	- Cont	37
Reactor Cavity CLG Fan	1	20 HP	19	From 18 Sec	- Cont	19
Battery Charger	1	68 KVA	68	From 30 Sec	- Cont 8th	68
Plant Security Inverter	1	20 KVA	20	From 30 Sec	- Cont Block	20
UPS Inverter	1	15 KVA	15	From 30 Sec	- Cont	15
Fire Pump	1	250 HP	**	From 35 Sec	- **	198
		Totals:	3163.75 kw (maximum, 18 Sec - 30 min)			2429.75 kw

* Counting from the time the D-G breaker closes
** Auto-start feature on fire pump is defeated if SIAS is present.

DOCUMENT REVISION DISTRIBUTION SHEET - OFF NORMAL & EMERGENCY OPER. PROCEDUR

DOCUMENT TITLE Steam Generator Tube Tear Failur

DOCUMENT FILE NUMBER 0120041

DOCUMENT REVISION NUMBER

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*Note: New distribution per instructions. Effective 9-12-79.

1

FLORIDA POWER & LIGHT COMPANY
ST. LUCIE UNIT NO. 1
EMERGENCY OPERATING PROCEDURE 0120041
REVISION NO. 13

1.0 Title:

STEAM GENERATOR TUBE LEAK/FAILURE

2.0 Approval:

Reviewed by: Plant Nuclear Safety Committee 6-9 1975
Approved by: G.V. Baum FOR Plant Manager 6-23 1975

Revision 7 Reviewed by FRG September 14 1979
Approved by: G H Baum for Plant Manager 10-2 1979

Revision 13 reviewed by FRG [illegible] 1982
Approved by C M Wethy Plant Manager 4-26- 1982.

3.0 Purpose and Discussion:

3.1 The purpose of this procedure is to list the indications that will enable the operator to identify a Steam Generator Tube failure and to provide the action to be taken to control the accident and minimize radioactive release to the environment.

3.2 Discussion:

3.2.1 A Steam Generator Tube Failure causes leakage of reactor coolant into the steam system. If the leakage exceeds the capacity of the charging pumps, pressurizer pressure will decrease rapidly, causing a thermal margin/low pressure trip. The subsequent cooldown following the reactor trip combined with the continued leakage of reactor coolant into the Steam Generator will cause a further reduction in pressurizer pressure and level, resulting in initiation of safety injection and containment isolation. The tube rupture will cause a reduction in reactor coolant system volume and due to reactor coolant leakage into the steam generator, the affected steam generator level will continue to increase after the feedwater block valves are closed by SIAS. The resulting decrease in RCS pressure and volume will result in the RCS briefly being at saturation conditions. The possibility then exists for void formation in the reactor coolant system.

EMERGENCY OPERATING PROCEDURE 0120041, REV. 13
STEAM GENERATOR TUBE LEAK/FAILURE

3.0 Purpose and Discussion: (Cont'd)

3.2 (Cont'd)

3.2.2 Operator action should be directed toward prompt isolation of the affected Steam Generator, to minimize contamination of the steam system and prevent possible radioactive release to the environment. With the exception of a compound accident in which loss of power accompanies the Steam Generator Tube failure, steam is dumped to the condenser, rather than the atmosphere, to prevent gross release of contamination to the environment. Action must be taken to identify the affected Steam Generator as soon as possible and to isolate its feedwater flow to prevent water slugging the steam lines.

3.2.3 The Steam Generator Tube failure accident is most severe when it occurs at low power levels, due to the low inventory of water initially present in the pressurizer.

3.2.4 This procedure provides instructions for two cases, "Leak within the Capacity of the Charging Pumps" and "Tube failure" (exceeds Charging Pump Capacity).

4.0 Symptoms:

4.1 Unique to a Steam Generator Tube Failure/Leak:

4.1.1 Steam Generator Blowdown Monitor Alarm.

4.1.2 Condenser Air Ejector Monitor Alarm.

4.2 Possibly Caused by a Steam Generator Tube Failure:

4.2.1 Decreasing Pressurizer Level, Backup Charging Pumps Start, Pressurizer Low Level Alarm, Pressurizer Heaters Deenergize.

4.2.2 Decreasing Pressurizer Pressure, Backup Heaters Energize, Pressurizer Low Pressure Alarm.

4.2.3 Initial Increase in Affected Steam Generator Level, Followed by Return to Programmed Level Setpoint.

4.2.4 Feedwater Flow Less Than Steam Flow on Affected Steam Generator.

4.2.5 Letdown Flow Decreasing.

4.2.6 Charging Flow to Regenerative Heat Exchanger Increasing.

5.0 Instructions:

5.1 Leak Within Capacity of Charging Pumps

5.1.1 Immediate Automatic Action:

5.1.1.1 A Steam Generator blowdown monitor alarm will actuate a high radiation alarm in control and signals to trip closed the blowdown and sample valves.

5.1.1.2 Letdown Level Control Valves close to minimum value.

5.1.1.3 Backup charging pumps are started as pressurizer level decreases.

5.1.2 Immediate Operator Action:

5.1.2.1 Place additional charging pumps in operation, if not operating, to restore pressurizer level.

5.1.2.2 Notify System Dispatcher and reduce turbine load in preparation for Reactor Shutdown if:

5.1.2.2.1 Tube leakage exceeds 1 GPM or,

5.1.2.2.2 The specific activity of the secondary system is greater than 0.10 uc/gm Dose Eq I-131.

NOTE: If either of these conditions exist be in at least Hot Standby within 6 hours and in Cold Shutdown within the next 30 hours, per Standard Technical Specifications.

5.1.2.3 Determine affected steam generator, if possible, by:

5.1.2.3.1 Comparing Steam Generator levels.

5.1.2.3.2 Comparing Steam generators steam flow and feed flow.

5.1.2.4 Take manual control of atmospheric dump valve controller on affected steam generator, HIC-08-2A or HIC-08-2B and close atmospheric dump valve to zero percent valve position.

5.1.2.5 Check that the condenser air ejector vent is aligned to the plant vent.

5.1.2.6 Ensure that steam generator blowdown valves and sample isolation valves are closed.

EMERGENCY OPERATING PROCEDURE 0120041, REV. 13
STEAM GENERATOR TUBE LEAK/FAILURE

1

5.0 Instructions (cont.):

5.1 (cont)

5.1.3 Subsequent Action

5.1.3.1 Commence Turbine Shutdown. See OP #0030125, Turbine Shutdown Full Load to Zero Load.

5.1.3.2 Commence Reactor Shutdown. See OP #0030128, Reactor Shutdown.

5.1.3.3 Commence Reactor Plant Cooldown by dumping steam to the condenser manually using the steam dumps. See OP #0030127, Reactor Plant Cooldown Hot Standby to Cold Shutdown.

5.1.3.4 Implement the emergency plan as necessary in accordance with EPIP 3100021E, "Duties of the Emergency Coordinator".

5.1.3.5 Control Feedwater Flow to maintain steam generator no-load levels.

5.1.3.6 When RCS pressure is reduced to 900 psia:

5.1.3.6.1 Close the affected steam generators steam isolation valve. (HCV-08-1A or HCV-08-1B).

5.1.3.6.2 Ensure that the steam isolation bypass valve (MV-08-1A or MV-08-1B) is closed.

5.1.3.6.3 Isolate feedwater to the affected steam generator.

5.1.3.7 Continue reactor cooldown to a cold shutdown condition using the unaffected steam generator.

5.1.3.8 Sample the condensate system to determine activity levels.

5.1.3.9 Take air particulate and air gaseous samples in the following areas:

5.1.3.9.1 Air ejector after condenser and gland steam condenser combined vent.

5.1.3.9.2 Steam driven auxiliary feed pump exhaust.

5.1.3.10 Conduct radiation survey and post radiation areas as necessary.

EMERGENCY OPERATING PROCEDURE 0120041 REV. 13
STEAM GENERATOR TUBE LEAK/FAILURE

1

5.0 Instructions (Cont'd)

5.2 Tube Failure (Exceeds Capacity of Charging Pumps)

5.2.1 Immediate Automatic Action:

5.2.1.1 A Steam Generator blowdown monitor alarm will actuate a high radiation alarm in control and signals to trip closed the blowdown and sample valves.

5.2.1.2 Reactor trip if pressurizer pressure decreases to the TM/LP setpoint.

5.2.1.3 Initiation of safety injection if pressurizer pressure decreases to 1600 PSIA.

5.2.1.3.1 Initiation of SIAS will cause CIS actuation.

5.2.1.4 Letdown control valves close to a minimum value, the backup charging pumps are started as pressurizer level decreases.

5.2.1.5 Pressurizer low low level alarms, and pressurizer heaters deenergize.

5.2.1.6 Turbine Trip (if reactor trips)

NOTE: If turbine trip occurs the Main Feed Regulating valves will close and the 15% Bypass Valves will open to 5% flow position.

5.2.1.7 Initiation of AFW if steam generator levels decrease to 34%.

5.2.2 Immediate Operator Action:

5.2.2.1 Place additional charging pumps in operation, if not operating.

5.2.2.2 Start AFW pumps, if SIAS has occurred, and control S/G levels at no-load levels.

5.2.2.3 If all feedwater flow is stopped or lost and steam generator level is less than 42% then:

1. Reinitiate auxiliary feedwater flow as soon as possible; however, do not exceed a flow rate of 150 gpm per steam generator.
2. Limit feedwater flow rate to 150 gpm per steam generator until continuous feedwater flow to the SG has been maintained for five minutes.

5.0 Instructions (Cont'd)

5.2 Tube Failure (Excceds Capacity of Charging Pumps)

5.2.2 Immediate Operator Action: (continued)

5.2.2.4 Notify dispatcher and reduce turbine load in preparation for reactor shutdown.

5.2.2.5 Determine affected steam generator by:

5.2.2.5.1 Comparing steam generator levels.

5.2.2.5.2 Comparing steam generators feed flow and steam flow.

5.2.2.5.3 Comparing steam generator blowdown monitors.

EMERGENCY OPERATING PROCEDURE 0120041, REV. 13
STEAM GENERATOR TUBE LEAK/FAILURE

1

5.0 Instructions: (Cont)

5.2 (Cont'd)

5.2.2 (Cont'd)

5.2.2.6 Take manual control of atmospheric dump valve controllers HIC 08-2A and HIC 08-2B and close them.

5.2.2.7 Check condenser air ejector vent aligned to the plant vent.

5.2.2.8 Insure the reactor trips when pressurizer pressure decreases to TM/LP setpoint.

5.2.2.9 Carry out immediate operator action for reactor trip per OP 0030130.

5.2.2.10 After an SIAS caused by low reactor coolant system pressure and after it has been verified that all CEA's have been fully inserted for 5 seconds, stop all operating reactor coolant pumps.

5.2.2.11 Ensure safety injection and containment isolation actuation signals have occurred or initiate manually. Ensure HPSI flow to the core when pressure decreases below the pump's shut-off head (1250 psia).

5.2.3 Subsequent Action

5.2.3.1 Refer to Table I to ensure the proper operation of engineered safety features as time and conditions permit.

5.2.3.2 Control feedwater flow to maintain Steam Generator no-load levels.

5.2.3.2.1 If safety injection actuation has occurred the auxiliary feedwater system must be used to control the steam generator levels. /R13
When establishing auxiliary feed flow to the steam generator, use steam generator levels as well as header flow rates to ensure each steam generator is receiving auxiliary feedwater.

EMERGENCY OPERATING PROCEDURE 0120041, REV. 13
STEAM GENERATOR TUBE LEAK/FAILURE

1

5.0 Instructions: (Cont'd)

5.2 (Cont'd)

5.2.3 Subsequent Action (Cont'd)

5.2.3.2 (Cont'd)

NOTE: If possible, the electric driven auxiliary feedwater pumps should be used; however, if the steam driven pump is used, ensure steam supply is selected to the non-affected steam generator.

5.2.3.3 Ensure that HPSI pumps and charging pumps restore pressurizer level and pressure.

NOTE: Pressurizer pressure will stabilize at approximately 1175 PSIA and level at approximately 10%.

Implement the emergency plan as necessary in accordance with EPIP 3100071E, "Duties of the Emergency Coordinator".

5.2.3.4 Restore ICW to TCW Heat Exchangers by opening MV-21-2 and MV-21-3.

5.2.3.5 Stop emergency diesels if off site power is available.

5.2.3.6 Close condenser hotwell reject valve, LCV 12-5.

5.2.3.7 Commence RCS cooldown using SBCS if available. If the SBCS is unavailable, use steam dump to atmosphere on the non faulted steam generator.

5.2.3.8 Stabilize RCS cold leg temperature at 505°F.

NOTE: This temperature will ensure adequate NPSH for four pump operation with RCS pressure at 900 PSIA.

5.2.3.9 When pressurizer level increases above 30%, energize pressurizer heaters.

5.3.2.10 De-pressurize RCS to 900 PSIA using pressurizer sprays. Throttle HPSI pumps discharge valves as required to maintain pressurizer level approximately 35%.

5.2.3.11 When RCS pressure is 900 PSIA, isolate the affected steam generator by closing its MSIV and bypass valve.

1

EMERGENCY OPERATING PROCEDURE 0120041, REV. 13
STEAM GENERATOR TUBE LEAK/FAILURE

5.0 Instructions: (Cont)

5.2 (Cont)

5.2.3 Subsequent Action (Cont)

5.2.3.12 Ensure feedwater is isolated to the affected steam generator.

5.2.3.13 To allow potential ECCS area radioactive leakage and RCS sample water, collected in the ECCS area sumps to be pumped to the Reactor Coolant Drain Tank inside containment, perform the following:

1. At the C.R.A.C. panel place the "ECCS Area Leakage System" control switch to the "RDT" position and ensure that:

   HCV-06-9 "R.D. Pump Suction" closes
   HCV-06-7 "Sump Pump to EDT" closes
   HCV-06-8 "Sump Pump to RDT" opens

2. At RTGB 105 open AOV-6301 and AOV-6302 "RDT Contmt Isol" valves by placing the switches in reset, then open positons.

3. Ensure the C.R.A.C. panel annunciator "ECCS Pump Room Leakage Valves Misaligned" is not lit.

   NOTE: The following valves are provided with "CIS-OVERRIDE" capability:
   AOV-5200, 5203 "Reactor Coolant Sample"
   FCV-26-1, 3 "Containment Sample Supply"
   FCV-26-2, 4 "Containment Sample Return"
   AOV-6301, 6302 "RDT Containment Isolation"

5.2.3.14 Re-commence RCS cooldown using the non-affected steam generator.

NOTE: Do not exceed 75°F cooldown in any one hour.

5.2.3.15 Block MSIS at 700 PSIA Steam Generator pressure.

1

5.0 Instructions: (cont)

5.2 (cont)

5.2.3 Subsequent Action (cont)

5.2.3.16 Establish and maintain 50°F sub-cooling in the reactor coolant system. With the Subcooling Margin Monitor (SMM) operating normally, use the nomograph on RTGB 104 in conjunction with the SMM to eliminate dependence on a single instrument. With the SMM inoperable, refer to the nomograph utilizing control room indicators such as THOT, pressurizer pressure, and incore thermocouples to determine the margin to saturation. Sub-cooling margin can also be determined by subtracting hot leg temperature from pressurizer temperature (TE-1101).

5.2.3.17 Sample each steam generator for activity.

5.2.3.18 Sample the RCS to determine if there has been fuel failure.

5.2.3.19 Sample the condensate system to determine radioactivity levels.

5.2.3.20 Take air particulate and air gaseous samples in the area of the steam driven feed pump exhaust.

5.2.3.21 Conduct radiation surveys and post areas as required.

6.0 References:

6.1 Instruction Manual - Steam Generators, St. Lucie Unit No. 1 877-=5008.

6.2 EBASCO Prints 8770-G-079, 080.

6.3 Accident Analysis, FSAR, Section 15.4.4, Steam Generator Tube Failure.

7.0 Records Required:

7.1 Normal Log Entries.

1

TABLE I

1.0 Safety Injection Actuation Signal

1.1 Two HPSI Pumps	ON
1.2 Two LPSI Pumps	ON
1.3 Eight HPSI Discharge Valves (HCV-3617, 3627, 3637, 3647)	OPEN
1.4 Four LPSI Discharge Valves (HCV-3615, 3625, 3635, 3645)	OPEN
1.5 Check proper operation of the Safety Injection System by the following means. 1.5.1 Check HPSI flow rates on: FI-3311, 3321, 3331, 3341. 1.5.2 Check LPSI flow rates on: FI-3312, 3322, 3332, 3342. 1.5.3 Check decreasing Safety Injection Tank Levels on: L1A-3311, 3321, 3331, 3341.	
1.6 Two CCW Pumps	ON
1.7 Two CCW Valves from SDC HX's (HCV 14-3A, HCV 14-3B).	OPEN
1.8 Four Containment Cooling Fans	ON
1.9 Four CCW "N-Header" Isolation Valves (HCV-14-8A, 14-9, 14-8B, 14-10).	SHUT
1.10 Four SIT Check Valve Leakoff Valves (V-3618, 3628, 3638, 3648).	SHUT
1.11 Two R.A.B. Main Supply Fans (HVS-4A, 4B)	ON
1.12 Two ECCS Area Exhaust Fans (HVE 9A, 9B)	ON*
1.13 Eight Aux Bldg Dampers (D-5A, 6A, 9A, 12A, 5B, 6B, 9B, 12B)	SHUT
1.14 Four Aux Bldg/ECCS Pump Room Dampers (D-13, 14, 15, 16)	OPEN
1.15 Four Reactor Coolant Pump CCW Isolation Valves (HCV-14-1, 14-2, 14-6, 14-7).	SHUT
1.16 Two FWP Discharge Valves (MV-09-1; MV-09-2)	SHUT
1.17 Two Feedwater Block Valves (MV-09-7; MV-09-8)	SHUT
1.18 Two Charging Pumps	ON
1.19 Two Boric Acid Makeup Pumps	ON
1.20 Two Letdown Isolation Valves (V-2515; V-2516)	SHUT
1.21 VCT Outlet Valve (V-2501)	SHUT
1.22 Two Gravity Feed Valves (V-2508; V-2509)	OPEN
1.23 Emergency Borate Valve (MV-2514)	OPEN
1.24 Two Bam Pump Recirc Valves (V-2510, V-2511)	SHUT
1.25 Blender Outlet Valve to VCT (V-2512)	SHUT
1.26 Load Control Valve (MV-2525)	SHUT
1.27 Boric Acid Header Discharge Valve (MV-2161)	SHUT
1.28 Two Rx Cavity Sump Isol Valves (LCV 07-11A; LCV 07-11B)	SHUT
1.29 Two Intake Cooling Water Pumps	ON
1.30 Two ICW to TCW Hx Isol Valves (MV-21-2; MV-21-3)	SHUT
1.31 'A' ICW Lube Wtr. Supply to CW Pumps (FSU-21-3A)	SHUT
1.32 'B' ICW Lube Wtr. Supply to CW Pumps (FSU-21-3B)	SHUT

*NOTE: Only one ECCS area exhaust fan is required, the other fan should be shutdown and kept in standby.

EMERGENCY OPERATING PROCEDURE 0120041, REV 13
STEAM GENERATOR TUBE LEAK/FAILURE

1

TABLE 1

2.0 Containment Isolation Actuation Signal

2.1	Two Shield Building Vent Fans (HVE-6A, HVE-6B)	ON*
2.2	Two Control Room Vent Booster Fans (HVE-13A, HVE-13B)	ON
2.3	Two Letdown Isolation Valves (V-2516, V2515)	SHUT
2.4	Two RCS Sample Isolation Valves (V-5200, V-5203)	SHUT
2.5	Four Pressurizer Sample Valves (V-5201, V-5202, V-5204, V-5205)	SHUT
2.6	One Instrument Air To Containment Isolation Valve (MV-18-1)	SHUT
2.7	Six Containment Purge Valves (FCV-25-1, 25-3, 25-5, 25-6, 25-4, 25-2)	SHUT
2.8	Two Containment Purge Exhaust Fans (HVE-8A, HVE-8B)	OFF
2.9	One Nitrogen to Containment Supply Valve (V-6741)	SHUT
2.10	Two Containment Waste Gas Header Isolation Valves (V-6554, V-6555)	SHUT
2.11	Two Containment Sump Pump Discharge Valves (LCV-07-11A, LCV-07-11B)	SHUT
2.12	Four Steam Generator Blowdown Isolation Valves (FCV-23-3, FCV-23-5, FCV-23-4, FCV-23-6)	SHUT
2.13	Two Steam Generator Blowdown Sample Isolation Valves (FCV-23-7 and 9)	SHUT
2.14	Two Reactor Drain Tank Discharge Isolation Valves (V-6301, V-6302)	SHUT
2.15	Four Control Room Air Inlet Valves (FCV-25-16, FCV-25-17, FCV-25-14, FCV-25-15)	SHUT
2.16	Two Control Room Kitchen Air Exhaust Valves (FCV-25-24, FCV-25-25)	SHUT
2.17	Two Control Room Toilet Air Exhaust Valves (FCV-25-18, FCV-25-19)	SHUT
2.18	Six Containment Radiation Sample Suction and Return Valves (FCV-26-2, 4, 6, FCV-26-1, 3, 5)	SHUT
2.19	Primary Makeup Water Isol Valve (MV-15-1)	SHUT
2.20	Two RCP Controlled Bleedoff Isol Valves (V-2505 and ISE-01-1)	SHUT

*NOTE: Only one shield building vent fan is required, the other should be shutdown and kept in standby.

EMERGENCY OPERATING PROCEDURE 0120041, REV 13
STEAM GENERATOR TUBE LEAK/FAILURE

1

TABLE 1

3.0 Containment Spray Actuation Signal

3.1	Two Containment Spray Pumps	ON
3.2	Two Containment Spray Header Inlet Valves (FCV-07-1A, FCV-07-1B)	OPEN
3.3	Four NAOH (Caustic) Admission Valves (FSE-07-1A, FSE-07-2A, FSE-07-1B, FSE-07-2B)	OPEN
3.4	Verify Containment Spray Flow in FI-07-1A and FI-07-1B.	
3.5	Verify NAOH (Caustic) Flow on Post Accident Panel "A" (FI-07-2, FR-07-2)	

EMERGENCY OPERATING PROCEDURE 0120041, REV 13
STEAM GENERATOR TUBE LEAK/FAILURE

1

TABLE 1

4.0 Recirculation Actuation Signal

4.1	Two LPSI Pumps	OFF
4.2	Two Safety Injection Miniflow Recirc. Valves (V-3659, V-3660)	SHUT
4.3	Two Containment Sump Outlet Valves (MV-07-2A, MV-07-2B)	OPEN
4.4	Two RWT Outlet Valves (MV-07-1A, MV-07-1B)	SHUT
4.5	Verify HPSI flow to core continues after RAS on FI-3321, FI-3341, FI-3311, FI-3331.	

TABLE I

5.0 Main Steam Isolation Signal

5.1 Two Main Steam Isolation Valves (HCV-08-1A, HCV-08-1B)	SHUT
5.2 Two Main Steam Isolation Bypass Valves (MV-08-1A, MV-08-1B)	SHUT
5.3 Two Main Feedwater Pump Discharge Valves (MV-09-1, MV-09-2)	SHUT
5.4 Two Main Feedwater Block Valves (MV-09-7, MV-09-8)	SHUT

DOCUMENT REVISION DISTRIBUTION SHEET - OFF NORMAL & EMERGENCY OPER. PROCEDURE

DOCUMENT TITLE Loss of Reactor Coolant

DOCUMENT FILE NUMBER 0120042

DOCUMENT REVISION NUMBER 22

DOCUMENT DISTRIBUTED ON 4-22-82
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PROCESSED BY: [signature] DATE 4-22-82

*Note: New distribution per instructions. Effective 9-12-79.

FLORIDA POWER & LIGHT COMPANY
ST. LUCIE UNIT NO. 1
EMERGENCY PROCEDURE 0120042
REVISION 22

1

1.0 Title:

LOSS OF REACTOR COOLANT

2.0 Approval:

Reviewed by Plant Nuclear Safety Committee _____ 19__
Approved by _____ Plant Supt., _____ 19__

Revision 12 Reviewed by Facility Review Group DEC. 10 1979
Approved by J. H. Barrow Plant Manager Dec 13 19 79
Revision 13 Reviewed by Facility Review Group _____ 19__
Approved by C. M. Wethy Plant Manger Feb. 28 - 1980

Revision 22 Reviewed by Facility Review Group _____ 19__
Approved by C. M. Wethy Plant Manager April 20 - 1982

3.0 Purpose and Discussion:

3.1 Purpose:

This procedure provides instructions to be followed in the event that leakage from the Reactor Coolant System is in excess of operable charging pump capacity.

3.2 A loss of coolant accident is defined as any mechanism where the loss of coolant from the Reactor Coolant System exceeds the capacity of the operable charging pumps. When conditions in the Reactor Coolant System degrade to the point that a Limiting Safety System Setting is approached the Reactor Protective System will initiate a reactor trip, making the reactor subcritical. This will stop the production of power in the core. Cooling of the core however, must continue to remove the considerable decay heat that remains. the Safety Injection System automatically provides a flow of subcooled water to the core for decay heat removal. Failure to keep the core covered will result in overheating of the fuel, failure of the cladding, and a release of gross amounts of fission products to the containment atmosphere.

The spectrum of breaks which would cause a LOCA is from approximately a .2 inch diameter break up to a double-ended hot leg rupture. For an example: Analysis show that the flow from an unrestricted .3 inch diameter break is approximately 180 gpm at 2250 psia. A major concern for these small breaks is that the flow through the break may not be sufficient for decay heat removal. In those circumstances it is imperative that a secondary heat sink be available. This in turn dictates the use of the Auxiliary Feedwater System as the main feedwater system is disabled due to an SLAS.

EMERGENCY PROCEDURE 0120042, REV. 22
LOSS OF REACTOR COOLANT

1

3.0 Purpose and Discussion (Cont'd)

3.2 (Cont'd)

Operator actions should be directed toward ensuring proper operation of the Safety Injection and Containment Isolation Systems, ensuring all automatic functions have initiated properly, and taking action to protect plant personnel. Long term action is directed toward placing the plant in a cold shutdown condition. For small breaks where the ECCS will maintain RCS volume and pressure, operator action must be directed toward establishing and maintaining subcooled conditions in the RCS during the cooldown to prevent void formation.

4.0 Symptoms/Precautions:

Pressurizer level may not always be a true indicator of RCS fluid inventory. Pressurizer steam space ruptures, reference leg failures, and reference leg flashing may cause indications which are contrary to true conditions.

All available indications should be used to aid in diagnosing the event since the accident may cause irregularities in a particular instrument reading. Critical parameters must be verified when one or more confirmatory indications are available. With the Subcooling Margin Monitor (SMM) operating normally, use the nomograph on RTGB 104 in conjunction with the SMM to eliminate dependence on a single instrument. With the SMM inoperable, refer to the nomograph utilizing control room indicators such as THOT, pressurizer pressure, and incore thermocouples to determine the margin to saturation. Subcooling margin can also be determined by subtracting hot leg temperature from pressurizer temperature (TE-1101).

When establishing auxiliary feed flow to the steam generators, use steam generator levels as well as header flow rates to ensure each steam generator is receiving auxiliary feedwater.

The diagnostic chart on Page 20 may be of some value in analyzing parameters.

4.1 Reactor coolant system leak exceeds the capacity of the operable charging pumps.

4.2 Reactor trip (Thermal Margin/Low Pressure)

4.3 Safety Injection Actuation Signal and Containment Isolation Actuation signal.

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4.0 Symptoms/Precautions:

4.4 Any one or more of the following indications or alarms may be present:

4.4.1 Decreasing pressurizer pressure.

4.4.2 Increasing containment pressure and temperature.

4.4.3 Rising water level in the reactor cavity sump.

4.4.4 High containment radiation.

4.4.5 Decreasing or increasing pressurizer level.

4.4.6 Quench tank high level.

4.4.7 Quench tank high temperature.

4.4.8 Quench tank high pressure.

4.4.9 Tavg decreasing or at saturation temperature for RCS pressure.

REV 16 4.4.10 Safety or relief valve(s) open alarm H-11.

CAUTION: Some instruments (valve position, temperature pressure, level indication, etc.) specified for use in this procedure have not been designed for long term post LOCA conditions inside the containment. Therefore, the operator should be especially alert that the potential exists for erroneous indication after >15 minutes have elapsed following a LOCA event.

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5.0 Instructions:

5.1 Immediate Automatic Actions

5.1.1 Reactor trip/turbine trip

5.1.2 Safety injection actuation signal

5.1.3 Containment isolation actuation signal

5.1.4 Containment spray actuation signal

5.2 Immediate Operator Action

5.2.1 Carry out immediate operator actions for reactor trip per OP 0030130.

5.2.2 After an SIAS caused by low reactor coolant system pressure and after it has been verified that all CEA's have been fully inserted for 5 seconds, stop all operating reactor coolant pumps.

5.2.3 Ensure safety injection and containment isolation actuation signals have occurred or initiate manually. Ensure HPSI flow to the core when pressure decreases below the pump's shut-off head (~1250 psia).

5.2.4 Establish and maintain steam generator levels at 65% with auxiliary feedwater system.

CAUTION: Do not exceed 75°F/hr cooldown rate.

5.2.5 If all feedwater flow is stopped or lost and steam generator level is less than 42% then: R22

1) Reinitiate auxiliary feedwater flow as soon as possible; however, do not exceed a flow rate of 150 gpm per steam generator.

2) Limit feedwater flow rate to 150 gpm per steam generator until continuous feedwater flow to the SG has been maintained for five minutes.

5.2.6 If conditions permit, attempt to locate and isolate the source of the leak. Possible leak locations include, but are not limited to the PORV's, the letdown line, and sample lines.

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5.0 Instructions: (Cont'd)

5.3 Subsequent Actions

Observe all available indications to determine conditions within the RCS. Use SMM display, RCS hot leg temperature, RCS cold leg temperature, incore thermocouple temperature, and RCS pressure to determine if the RCS is subcooled or saturated. An increase in temperature above the saturation temperature for the existing pressure is an indication of voiding in the RCS. If this occurs the operator must ensure that the RCP's are turned off, the SIS is providing makeup to the RCS, and that the steam generators are removing heat from the RCS. The operator may be assured that a heat sink is available by observing steam generator feedflow and steamflow, by indications that steam generator levels and pressures are being controlled, and by observing that operation of the steam generators is maintaining or decreasing RCS temperature and pressure.

5.3.1 Refer to Table I to ensure the proper operation of engineered safety features as time and conditions permit.

5.3.2 Implement the emergency plan as necessary in accordance with EPIP 3100021E, "Duties of the Emergency Coordinator".

5.3.3 Ensure that containment spray is actuated if containment pressure exceeds 10 psig, and check the following:

_____	2 containment spray pumps	ON
_____	2 spray header inlet valves	OPEN
_____	4 NaOH admission valves	OPEN
_____	NaOH flow indication in control room on post accident panel	~30 gpm

5.3.4 When containment pressure decreases to less than 10 psig, stop 1A and 1B containment spray pumps, close FCV 07-1A and FCV 07-1B, reset CSAS channels A and B, and return containment spray pumps and FCV switches to the "auto" position.

5.3.5 Within one (1) hour, but without exception no later than one (1) hour stop RCS/BAMT boration via the charging pumps.

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5.0 Instructions: (Cont'd)

5.3 (Cont'd)

5.3.6 Continue to ensure proper operation of the safety injection system by checking flow rates and S.I.T. levels.

After any SIAS, operate the SIS until RCS hot and cold leg temperatures are at least 50°F below saturation temperature for the RCS pressure and a pressurizer level is indicated, unless the cause of the SIAS has been verified to be an inadvertent actuation. If 50°F subcooling cannot be maintained after the system has been stopped, the high pressure injection system must be started.

CAUTION: Minimum pressure - temperature operating restrictions take precedence over requirements for operation of the high pressure injection or charging system to achieve 50° subcooling during operation of the shutdown cooling system.

5.3.7 Implement the Emergency Plan as necessary in accordance with EP 3100021E, "Duties of Emergency Coordinator".

5.3.8 To allow potential ECCS area radioactive leakage and RCS sample water, collected in the ECCS area sumps to be pumped to the Reactor Coolant Drain Tank inside containment, perform the following:

1. At the C.R.A.C. panel place the "ECCS Area Leakage System" control switch to the "RDT" position and ensure that:

   HCV-06-9 "R.D. Pump Suction" closes
   HCV-06-7 "Sump Pump to EDT" closes
   HCV-06-8 "Sump Pump to RDT" opens

2. At RTGB 105 open AOV-6301 and AOV-6302 "RDT Contmt Isol" valves by placing the switches in reset, then open positions.

3. Ensure the C.R.A.C. Panel Annunciator "ECCS Pump Room Leakage Valves Misaligned" is not lit.

   NOTE: The following vlaves are provided with "CIS-OVERRIDE" capability:

   AOV-5200, 5203 "Reactor Coolant Sample"
   FCV-26-1, 3 "Containment Sample Supply"
   FCV-26-2, 4 "Containment Sample Return"
   AOV-6301, 6302 "RDT Containment Isolation"

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5.0 Instructions (cont)

5.3 (cont)

5.3.9 Immediately prior to the receipt of the Recirculation Actuation Signal restore power to V3659 and V3660.

5.3.10 Commence RCS cooldown as soon as possible and in any case, within one (1) hour. Reduce steam generator pressure to <985 psig. (safety setting). Refer to OP 0030127, Reactor Plant Cooldown.

CAUTION: Ensure RCS is maintained in a subcooled condition.

5.3.10A If steam dump to condenser is available, close the Atmospheric Steam Dumps, and begin dumping steam to condenser.

5.3.10B If offsite power is lost, steam dump to atmosphere must be used for cooldown.

5.3.10C Continue auxiliary feedwater flow to the steam generators during cooldown.

5.3.10D Do not exceed the 75°F/hour cooldown rate.

5.3.10E If the RCS pressure remains greater (after stabilization) than the shutoff head of the LPSI pumps, stop both pumps.

CAUTION: Feedwater is normally provided to both steam generators. Isolation of a single steam generator per OP0120041 (Steam Generator Tube Leak/Failure) is mandatory if a steam generator tube rupture is detected in that generator to prevent lifting of the safety valves or reseat them if they have lifted. This action will also reduce the amount of radioactivity released. For small breaks in the RCS where steam generators are important for heat removal one steam generator must be used for this purpose even if primary to secondary leaks are detected.

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5.0 Instructions (cont.)

5.3 (cont.)

5.3.10 When the RWT level reaches 6 ft., ensure that at least one (1) containment spray pump is running. Open the necessary valve(s) as indicated by pump conditions to provide cooled water from the shutdown cooling heat exchanger(s) to the HPSI pump(s) during recirculation.

_____MV-3662 S.D.C. to 1B and 1C HPSI pumps

_____MV-3663 S.D.C. to 1A HPSI pump

This is the preferred line-up for long term cooling.

5.3.11 Ensure that Recirculation Actuation (RAS) occurs when the RWT level decreases to 3 ft. indicated - (4 ft. from the bottom of the tank) and check the following:

2 LPSI pumps	TRIP
2 Miniflow recirc valves	SHUT
2 Containment sump outlet valves	OPEN

CAUTION: Ensure HPSI flow to the core continues after RAS. Do not allow the HPSI pumps to operate "dead-headed". HPSI shutoff head (no flow) 1250 psig.

5.3.12 Ensure V3659 and V3660 are closed, then de-energize the valves using key operated switches on RTGB 106.

5.3.13 If all HPSI pumps and charging pumps are operating and the HPSI pumps are delivering less than 75 gpm per pump, turn off the charging pumps one at a time and then HPSI pumps one at a time until only one HPSI pump remains operating. This will ensure that minimum flow requirements will be met by the flow through the pump to the RCS for the smallest break size that results in a SIAS.

5.3.14 Monitor R.A.B. radiation levels and sump levels after RAS to detect safety injection system leakage. Even if leaks are detected at least one HPSI pump must remain in operation to provide flow to the RCS.

5.3.15 As soon as possible, but without exception, within ten (10) hours, hot leg injection shall be initiated to the core in conjunction with the existing cold leg injection being sustained by the HPSI pumps per Appendix A.

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5.0 Instructions (cont.)

5.3 (cont.)

5.3.16 If the pressure and inventory control with the SIS cannot be established after eight hours and RCS pressure is less than 300 psig, continue the hot and cold leg injection.

NOTE: It may be necessary to fill the pressurizer solid to regain pressure control and to achieve 50°F subcooling. If this is the case the HPSI discharge valves will have to be carefully throttled during the cooldown to reduce system pressure.

5.3.17 If pressure and inventory control with the SIS are established after eight hours and RCS pressure is greater than 300 psig, conduct one of the following activities. The activities are listed in order of decreasing preference.

5.3.17A RCS pressure above 300 psig indicates that the system has refilled and subcooling has occurred. Verify this by checking the saturation pressure for the existing temperature. Realign the safety injection system for cold leg injection. Continue to maintain subcooling and reduce RCS pressure to <268 psia for shutdown cooling by reducing the flow delivered by the high pressure injection and charging pumps. While reducing pressure and after shutdown cooling is initiated, maintain RCS pressure with the charging pumps and/or the HPSI pumps to continue to maintain at least 50° subcooling, or

CAUTION: If there is a high radioactivity level in the reactor coolant system, circulation of this fluid in SDC may result in high area radioactivity readings in the auxiliary building. The activity level of the RCS should be determined prior to initiating SDC flow.

5.3.17B Continue to remove decay heat using auxiliary feedwater and steam dumps if adequate condensate is available and (A) cannot be implemented, or

5.3.17C Open pressurizer power operated relief valves and align the safety injection system for cold leg injection if (A) or (B) cannot be implemented. To open the PORV's, pull two RPS pressurizer high pressure trip unit bistables.

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5.0 Instructions (cont.)

5.3 (cont.)

5.3.18 Place both Hydrogen Recombiners in service per Appendix B.

5.3.19 If containment hydrogen concentration cannot be maintained below 3.5% as indicated on the containment hydrogen sample system by two (2) hydrogen recombiners, then place the containment hydrogen purge system into operation per Appendix B.

6.0 References:

6.1 FSAR Chapters 4, 6, Appendix 6C, 7, 8, 9, 15.

7.0 Records Required:

7.1 Normal Log Entries

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APPENDIX A
HOT LEG INJECTION

1. Prerequisite

   a) Recirculation actuation signal has been initiated and required automatic functions have occured.

   b) RCS pressure <250 psia. If RCS pressure is greater than 250 psia, continue cool-down until less than 250 psia.

2. Precautions

   a) Observe suitable radiological precautions at manual operating stations.

   b) Ensure a minimum flow path to avoid dead-heading the HPSI, containment spray, and LPSI pumps.

   c) Containment spray pump flow shall not exceed 1500 GPM.

   d) LPSI pump flow shall not exceed 3500 GPM.

3. Primary method of hot leg injection using LPSI pumps via hot leg suction line.

   a) Ensure RCS/containment ΔP less than 150 psid.

   b) Select operable LPSI pump and use applicable valve lineup

		A LPSI operable	B LPSI operable
c)	Shut	V3207 and 3432	3206 and 3444
d)	Open	V3400	V3484
e)	Shut	HCV 3615, 3625 3635, 3645	HCV 3615, 3625 3635, 3645
f)	Open	V3651 and 3652	V3481 and 3480
g)	Start	LPSI 1A	LPSI 1B
h)	Monitor flow	FT3306 & 3332	FT3306 & 3322
i)	Maintain minimum flow of 250 gpm		

   NOTE: If power is lost to one set of SDC hot leg suction valves, notify electrical department to install jumpers.

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APPENDIX A (cont)

4. Alternate Method: Hot leg injection using HPSI pumps via pressurizer auxiliary spray.

   a) Stop charging pumps and shut V-2336, 2337, 2339.

   b) Open V-2340 CV to HPSI Auxiliary header X connect.

   c) Shut ISE-02-01 and I-SE-02-02, 1B1 and 1A2 loop chargine isolation valves.

   d) Shut PCV-1100E and F, pressurizer spray valves.

   e) Unlock and open I-SE-02-03 and I-SE-02-04 auxiliary spray valves.

   f) One HPSI pump (B or C) must remain available to recirculate water from containment sump to HPSI header.

      1) To use A HPSI pump for hot leg injection, shut valves HCV 3617, 3627, 3637 and 3647 and maintain minimum flow of 200 gpm through auxiliary spray by monitoring charging flow indicator FT 2212.

      2) To use C HPSI pump for hot let injection (A pump not available), unlock and shut MV3653 and open MV3655. Shut HCV 3617, 3627, 3637 and 3647 and maintain flow of 200 gpm through auxiliary spray by monitoring charging flow indicator FT 2212.

5. Secondary Alternate Method: Hot leg injection using CS pump via hot leg suction line

   a) Condition, RCS/containment ΔP <150 psid.

   b) With 1 B containment spray pump running; open or check to be open V-3457.

   c) Place HIC-3306 Keyswitch in the Auto position.

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APPENDIX B
PLACING H_2 RECOMBINER AND
CONTAINMENT H_2 PURGE IN SERVICE

1. Place recombiners in service as follows:

1A	1B		
____	____	1.	Close breakers #41251 in 480V MCC 1A5 (1A) and #42103 in 480V MCC 1B6 (1B).
____	____	2.	Set the power adjust potentiometer at zero (ooo)
____	____	3.	Check that power is available to the power supply panel by observing the "power available" white light on the control panel is illuminated.
____	____	4.	Set the Power Out Switch on the control panel to the "ON" position. The red light on the switch will illiminate.
____	____	5.	Gradually turn the Power Adjust potentiometer to 70 KW as indicated on the Power Out Wattmeter.

CAUTION: There is a lag in the meter reading, so turn the potentiometer know slowly. Do not exceed 75 KW.

____	____	6.	Periodically check the temperature of the three thermocouples using the temperature channel selector switch. And, when the temperature reaches 1250°F, adjust the power adjust potentiometer to maintain temperature between 1250°F and 1400°F.

CAUTION: Do not let the temperature exceed 1400°F as indicated by the thermocouple readout.

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TABLE 1

2.0 Containment Isolation Actuation Signal

	2.1	Two Shield Building Vent Fans (HVE-6A, HVE-6B)	ON*
	2.2	Two Control Room Vent Booster Fans (HVE-13A, HVE-13B)	ON
**a	2.3	Two Letdown Isolation Valves (V-2516, V2515)	SHUT
	2.4	Two RCS Sample Isolation Valves (V-5200, V-5203)	SHUT
	2.5	Four Pressurizer Sample Valves (V-5201, V-5202, V-5204, V-5205)	SHUT
	2.6	One Instrument Air To Containment Isolation Valve (MV-18-1)	SHUT
**b	2.7	Six Containment Purge Valves (FCV-25-1, 25-3, 25-5, 25-6, 25-4, 25-2)	SHUT
	2.8	Two Containment Purge Exhaust Fans (HVE-8A, HVE-8B)	OFF
	2.9	One Nitrogen to Containment Supply Valve (V-6741)	SHUT
	2.10	Two Containment Waste Gas Header Isolation Valves (V-6554, V-6555)	SHUT
	2.11	Two Containment Sump Pump Discharge Valves (LCV-07-11A, LCV-07-11B)	SHUT
	2.12	Four Steam Generator Blowdown Isolation Valves (FCV-23-3, FCV-23-5, FCV-23-4, FCV-23-6)	SHUT
	2.13	Two Steam Generator Blowdown Sample Isolation Valves (FCV-23-7 and 9)	SHUT
	2.14	Two Reactor Drain Tank Discharge Isolation Valves (V-6301, V-6302)	SHUT
	2.15	Four Control Room Air Inlet Valves (FCV-25-16, FCV-25-17, FCV-25-14, FCV-25-15)	SHUT
	2.16	Two Control Room Kitchen Air Exhaust Valves (FCV-25-24, FCV-25-25)	SHUT
	2.17	Two Control Room Toilet Air Exhaust Valves (FCV-25-18, FCV-25-19)	SHUT
**c	2.18	Six Containment Radiation Sample Suction and Return Valves (FCV-26-2, 4, 6, FCV-26-1, 3, 5)	SHUT
	2.19	Primary Makeup Water Isol Valve (MV-15-1)	SHUT
	2.20	Two RCP Controlled Bleedoff Isol Valves (V-2505 and ISE-01-1)	SHUT

*NOTE: Only one shield building vent fan is required, the other should be shutdown and kept in standby. Open FCV-25-13, Cross connect valve.

** NOTE: Due to the possibility of NAMCO position indication switch failure on the letdown isolation valves, V2515, V-2516, containment purge valves FCV25-3, FCV25-4, and radiation monitor isolation valves FCV26-1, FCV26-3, FCV26-5, perform the following on receipt of valid CIS.

a. V2515, V2516: Close valves using switch on RTGB, ensure valves closed by observing letdown flow, press, etc.
b. FCV25-3, FCV25-4: Ensure other valves in the line are closed (FCV25-1, FCV25-2, FCV25-5, FCV25-6)
c. FCV26-1, FCV26-3, FCV26-5: Close valves using RTGB switch, close manual valves at monitor cabinet, ensure no flow indication on monitor.

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TABLE 1

4.0 Recirculation Actuation Signal

4.1	Two LPSI Pumps	OFF
4.2	Two Safety Injection Miniflow Recirc. Valves (V-3659, V-3660)	SHUT
4.3	Two Containment Sump Outlet Valves (MV-07-2A, MV-07-2B)	OPEN
4.4	Two RWT Outlet Valves (MV-07-1A, MV-07-1B)	SHUT
4.5	Verify HPSI flow to core continues after RAS on FI-3321, FI-3341, FI-3311, FI-3331.	

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TABLE I

1.0 Safety Injection Actuation Signal

1.1	Two HPSI Pumps	ON
1.2	Two LPSI Pumps	ON
1.3	Four AUX HPSI Discharge Valves (HCV-3617, 3627, 3637, 3647)	OPEN
1.4	Four HPSI Discharge Valves (HCV 3616, 3626, 3636, 3646)	OPEN
1.5	Four LPSI Discharge Valves (HCV-3615, 3625, 3635, 3645)	OPEN
1.6	Check proper operation of the Safety Injection System by the following means. 1.5.1 Check HPSI flow rates on: FI-3311, 3321, 3331, 3341. 1.5.2 Check LPSI flow rates on: FI-3312, 3322, 3332, 3342. 1.5.3 Check decreasing Safety Injection Tank Levels on: LIA-3311, 3321, 3331, 3341.	
1.7	Two CCW Pumps	ON
1.8	Two CCW Valves from SDC HX's (HCV 14-3A, HCV 14-3B).	OPEN
1.9	Four Containment Cooling Fans	ON
1.10	Four CCW "N-Header" Isolation Valves (HCV-14-8A, 14-9, 14-8B, 14-10).	SHUT
1.11	Four SIT Check Valve Leakoff Valves (V-3618, 3628, 3638, 3648).	SHUT
1.12	Two R.A.B. Main Supply Fans (HVS-4A, 4B)	ON
1.13	Two ECCS Area Exhaust Fans (HVE 9A, 9B)	ON*
1.14	Eight Aux Bldg Dampers (D-5A, 6A, 9A, 12A, 5B, 6B, 9B, 12B)	SHUT
1.15	Four Aux Bldg/ECCS Pump Room Dampers (D-13, 14, 15, 16)	OPEN
1.16	Four Reactor Coolant Pump CCW Isolation Valves (HCV-14-1, 14-2, 14-6, 14-7).	SHUT
1.17	Two FWP Discharge Valves (MV-09-1; MV-09-2)	SHUT
1.18	Two Feedwater Block Valves (MV-09-7; MV-09-8)	SHUT
1.19	Two Charging Pumps	ON
1.20	Two Boric Acid Makeup Pumps	ON
1.21	Two Letdown Isolation Valves (V-2515; V-2516)	SHUT
1.22	VCT Outlet Valve (V-2501)	SHUT
1.23	Two Gravity Feed Valves (V-2508; V-2509)	OPEN
1.24	Emergency Borate Valve (MV-2514)	OPEN
1.25	Two Bam Pump Recirc Valves (V-2510, V-2511)	SHUT
1.26	Blender Outlet Valve to VCT (V-2512)	SHUT
1.27	Load Control Valve (MV-2525)	SHUT
1.28	Boric Acid Header Discharge Valve (MV-2161)	SHUT
1.29	Two Rx Cavity Sump Isol Valves (LCV 07-11A; LCV 07-11B)	SHUT
1.30	Two Intake Cooling Water Pumps	ON
1.31	Two ICW to TCW Hx Isol Valves (MV-21-2; MV-21-3)	SHUT
1.32	'A' ICW Lube WTR Supply to CW Pumps (FLV-21-3A)	SHUT
1.33	'B' ICW Lube WTR Supply to CW Pumps (FLV-21-3B)	SHUT

*NOTE: Only one ECCS area exhaust fan is required, the other fan should be shutdown and kept in standby.

/R18

BREAK IDENTIFICATION