LOUISIANA POWER AND LIGHT
WATERFORD-3 SES

TG-OP-902-006
TECHNICAL GUIDE

for

OP-902-006 Rev. 1
LOSS OF MAIN FEEDWATER RECOVERY PROCEDURE

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TECHNICAL GUIDE
for
LOSS OF MAIN FEEDWATER RECOVERY PROCEDURE

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1.0 Procedure Step Guidelines

E. Recovery Actions

EOP Step Content:

Step 1. Using the Plant Paging System, announce the following two times:

Objective:

This step informs plant personnel of the event and gains additional personnel for the control room.

Basis:

This step gains additional support for the control room personnel and ensures that other site personnel are properly informed of the plant status.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E. Recovery Actions

EOP Step Content:

Step 2. Advise the Shift Supervisor to implement EP-1, EMERGENCY PLAN.

Objective:

The objective of this step is to direct entry into the Emergency Plan for classification of the event and required notifications.

Basis:

This step ensures that action is taken to implement the Emergency Plan to gain additional support for the control room personnel and to ensure the safety of the site personnel and general public.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NUREG-0654, Appendix 1.

E. Recovery Actions

EOP Step Content:

Step 3. Refer to Foldout: Safety Function Status Checklist AND check ALL criteria are being maintained.

Objective:

This step verifies that all safety functions are being satisfied by comparing control board parameters to the criteria of the Safety Function Status Checklist.

Basis: (CEN-152, page 8-7, step 2)

Verify that all safety functions are being satisfied by comparing control board parameters to the criteria in Figure 8-11, Safety Function Status Check.

Operational Considerations:

Where multiple indicators for one parameter exist, use more than one instrument to obtain a particular reading. The Safety Function Status Checklist shall be continuously monitored throughout the use of this procedure.

EPG Step Content: (CEN-152, page 9-29, step 2)

Verify that the safety functions are being satisfied by comparing control board parameters to the criteria in Figure 8-11 (Safety Function Status Check).

Justification of Differences:

NA

Source Document:

CEN-152, Section 8.0, Loss of Feedwater Recovery Guideline.

E. Recovery Actions

EOP Step Content:

Step 4. IF any criteria of the Foldout: Safety Function Status Checklist are NOT being satisfied, THEN go to OP-902-008, SAFETY FUNCTION RECOVERY PROCEDURE.

Objective:

The purpose of this step is to direct operator actions if the Steam Generator Tube Rupture Recovery Procedure is not adequately mitigating the event.

Basis: (CEN-152, page 8-8, step 3)

If a correct diagnosis is not confirmed, the operator is directed to implement the Functional Recovery Guideline. The Functional Recovery Guideline is functionally oriented and will ensure all safety functions are attended to regardless of what event(s) are occurring.

Operational Considerations:

NA

EPG Step Content: (CEN-152, page 8-29, step 3)

If all safety functions (Figure 8-11) are satisfied, then continue with the actions of this guideline. If not, implement the Functional Recovery Guideline.

Justification of Differences:

NA

Source Document:

CEN-152, Section 8.0, Loss of Feedwater Recovery Guideline.

E. Recovery Actions

EOP Step Content:

Step 5. IF either Main Feedwater pump is operating AND a steam flow/feed mismatch exists, THEN close BOTH MAIN FW ISOL VLVs:

Objective:

This step closes the main feedwater isolation valves if a feedwater line break is suspected.

Basis: (CEN-152, page 8-8, step 4)

If a main feedwater line break is suspected, the operator should try to isolate the feedwater line break from the steam generators by any plant-specific methods possible (i.e., closing main feedwater isolation valves, main feedwater regulating valves, etc.).

Operational Considerations:

Where multiple indications for one parameter exist, use more than one instrument to obtain a particular reading.

EPG Step Content: (CEN-152, page 8-29, step 4)

Determine whether the cause of the loss of feedwater is a result of a feedwater line break or a feedwater system abnormality by monitoring steam generator pressure and level. If a feedwater line break is suspected, attempt to isolate the break.

Justification of Differences:

NA

Source Document:

CEN-152, Section 8.0, Loss of Feedwater Recovery Guideline.

E. Recovery Actions

EOP Step Content:

Step 6. IF BOTH MAIN FW ISOL VLVs (FW 184A AND FW 184B) are closed, THEN verify BOTH Main Feed pumps tripped AND associated valves close:

Objective:

This step secures the main feed pumps which are not necessary with both main feedwater isolation valves closed.

Basis:

To exit this procedure under stable plant conditions and then enter the Plant Operating Procedure at a point where it will take over control of the plant, certain steps must first be performed. The steps that must be performed would normally be completed by the Plant Operating Procedure prior to the point of entry from this procedure.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

OP-10-001, General Plant Operations.

E. Recovery Actions

EOP Step Content:

Step 7. IF a Feedwater line break, which can NOT be isolated, has occurred as indicated by dropping Steam Generator level or pressure, THEN go to OP-902-004, EXCESS STEAM DEMAND RECOVERY PROCEDURE.

Objective:

This step directs the operator to go to the Excess Steam Demand Recovery Procedure if a feedwater line break which cannot be isolated from the steam generator has occurred.

Basis: (CEN-152, page 8-8, step 4)

If the feedwater line cannot be isolated from the steam generator, it will continue to blowdown water until the steam generator boils dry. This results in an uncontrolled cooldown of the RCS. When the operator determines that a feedwater line break is unisolable, the Steam Line Break Recovery Guideline should be immediately followed for all further actions.

Operational Considerations:

Where multiple indications for one parameter exist, use more than one instrument to obtain a particular reading.

EPG Step Content: (CEN-152, page 8-29, step 4a)

If a feedwater line break is unisolable from the steam generator, exit this guideline and implement the Steam Line Break Recovery Guideline.

Justification of Differences:

NA

Source Document:

CEN-152, Section 8.0, Loss of Feedwater Recovery Guideline.

E. Recovery Actions

EOP Step Content:

Step 8. IF EFAS-1 OR EFAS-2 has occurred, THEN complete Attachment 1: EFAS-1 Automatic Actions OR Attachment 2: EFAS-2 Automatic Actions.

Objective:

This step has the operator verify automatic actions when an EFAS 1 OR 2 should occur.

Basis:

This step ensures all EFAS automatic actions occur.

Operational Considerations:

NA

See Insert next page

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

Insert

EOP Step Content:

Step 8. IF any of the following occur, THEN complete associated attachment:

Objective:

The objective of this step is to verify all actions required by any automatic actuated signal have occurred.

Basis:

Due to the number of valves, pumps, fans, and other equipment actuated by automatic safety signals, the verification is done by use of a checklist. The actuation signals are verified in immediate actions only to ensure the actuation signal is valid. This step verifies all component actions required by SIAS, CIAS, EFAS-1, and EFAS-2.

Operational Considerations:

This step should be performed concurrently with this procedure and preferably by an operator not required for other duties.

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E. Recovery Actions

EOP Step Content:

Step ~~35~~ 9. IF SIAS has occurred, THEN check the following Safety Injection termination criteria:

Objective:

This step evaluates certain criteria associated with terminating safety injection flow.

Basis: (CEN-152, page 8-10)

If an SIAS has been initiated and the safety injection system is operating, it must continue to operate at full capacity until safety injection system termination criteria are met. Early termination may be desirable when the criteria are met to preclude pressurized thermal shock situations or high pressure safety injection pump damage (e.g., shaft seals).

Operational Considerations:

Where multiple indications for one parameter exist, use more than one instrument to obtain a particular reading.

EPG Step Content: (CEN-152, page ~~8-30 6-45~~, step ~~9 16~~)

If the SIS is operating, it may be throttled or stopped one train at a time if all of the following conditions are satisfied:

Justification of Differences:

The EPG step was divided into two steps, one step covering termination criteria and the other covering termination direction.

Source Document:

CEN-152, Section ~~8.0, Steam Generator Tube Rupture Recovery Guideline~~ 8.0, Loss of Feedwater Recovery Guideline.
PV-OP-902, Parameter Values Document. Table 1, Level; Table 2, Subcooling; and Table 6, Flow.

E. Recovery Actions

EOP Step Content:

Step ~~37~~ 10. IF SIAS has occurred AND ALL Safety Injection termination criteria (step ~~36~~ 9) are satisfied, THEN throttle OR stop Safety Injection FLOW one train at a time AND stop Charging pumps as necessary to control Pressurizer level 33% to 60%.

Objective:

The step maintains pressurizer level and prevents solid water operation.

Basis: (CEN-152, page ~~6-18~~ 8-11 and ~~6-17~~ 8-10)

If the criteria are all met, the operator may either terminate or throttle the SIS. The operator may decide to throttle rather than terminate if SIS is to be used to control pressurizer level or plant pressure. Termination of SIS should be sequenced by stopping one pump at a time while observing the termination criteria.

Operational Considerations:

Solid water operation is permissible only when reactor coolant system subcooling margin is <28°F. To throttle cold leg injection valves, the switch must be taken to the "MORE" position which places them in SIAS override.

EPG Step Content: (CEN-152, page ~~6-45~~ 8-30, step ~~16~~ 9)

If the SIS is operating, it may be throttled or stopped one train at a time if all of the following conditions are satisfied:

Justification of Differences:

The EPG step was divided into two steps, one covering termination criteria and the other covering termination direction. Specific direction to maintain pressurizer level is given since the safety injection system is providing inventory control until SIAS and CIAS are reset. This allows letdown and charging to be placed back into normal service.

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E. Recovery Actions

EOP Step 10 (Continued).

Source Document:

CEN-152, Section ~~6.0~~ 3.0, Loss of Feedwater Recovery Guideline; ~~Steam Generator Tube Rupture Recovery Guideline~~

PV-OP-902, Parameter Values Document. Table 2, Subcooling.

E. Recovery Actions

EOP Step Content:

Step ~~30.~~ 11. IF the following conditions exist, THEN reinitiate Safety Injection flow:

Objective:

This step allows initiation of safety injection system flow should conditions warrant the need.

Basis: (CEN-152, page ~~6-18~~ 8-11)

If ~~any~~ all of the criteria of step ~~31~~ 9 cannot be maintained, the ~~safety injection pumps~~ SIS must be ~~re~~started whenever necessary to satisfy all the criteria.

Operational Considerations:

Where multiple indications for one parameter exist, use more than one instrument to obtain a particular reading.

EPG Step Content: (CEN-152, page ~~6-45~~ 8-30, step ~~17~~ 10)

If all the criteria of step ~~16~~ 9 cannot be maintained after the SIS has been stopped, the SIS must be restarted.

Justification of Differences:

NA

Source Document:

CEN-152, Section ~~6.0, Steam Generator Tube Rupture Recovery Guideline.~~ 8.0, Loss of Feedwater Recovery Guideline.

E. Recovery Actions

EOP Step Content:

Step 13. Verify Reactor Coolant System temperature is being controlled as follows:

Objective:

The objective of this step is to verify that the reactor coolant system temperature is being controlled at the desired value.

Basis:

Steam generator pressure should be controlled by the turbine bypass system at [900 psig] or less depending on current reactor coolant system temperature. The goal is to stabilize reactor coolant system temperature and remove decay heat. If condenser vacuum is lost, the turbine bypass system is not available, or if the MSIVs have closed, the atmospheric dump valves must be used to control steam generator pressure. This action is performed to maintain steam generator pressure below the secondary safety valve setpoints, preventing them from opening, and allow a controlled reactor coolant system heat removal process using the steam generators.

Operational Considerations:

If the automatic function is not operating properly, then systems should be placed in manual. Systems in manual should be monitored for proper operation. Where multiple indications for one parameter exist, use more than one instrument to obtain a particular reading.

EPG Step Content:

Verify turbine bypass valves are controlling steam generator pressure at [900 psig] or lower depending on reactor coolant system conditions. If condenser vacuum is lost or the turbine bypass system is unavailable, or if the MSIVs are closed, the atmospheric dump valves must be used to control steam generator pressure.

E. Recovery Actions

EOP Step 8/12 (Continued).

Justification of Differences:

NA

Source Document:

CEN-152, Section 8.0, Loss of Feedwater Recovery Guideline.

E. Recovery Actions

EOP Step Content:

Step ~~10.~~ 13 When Pressurizer level >28%, verify Pressurizer Pressure Control System is automatically maintaining OR restoring pressure at 2250 psia.

Objective:

This step verifies reactor coolant system pressure control when reactor coolant system inventory is restored.

Basis: (CEN-152, page 8-16, step 18)

The PPCS is verified to be automatically controlling or restoring RCS pressure within the limits of Figure 8-7.

Operational Considerations:

If the automatic function is not operating properly, then systems should be placed in manual. Systems in manual should be monitored for proper operation.

EPG Step Content: (CEN-152, page 8-32, step 18)

Verify that the PPCS is automatically maintaining or restoring RCS pressure within the limits of Figure 8-7. If not, manually control heaters or main spray (preferred) or auxiliary spray to restore pressurizer pressure.

Justification of Differences:

The EPG step deals only with pressure control. The safety function status checklist continuously monitors inventory control.

Source Document:

CEN-152, Section 8.0, Loss of Feedwater Recovery Guideline.
PV-OP-902, Parameter Values Document. Table 1, Level.

E. Recovery Actions

EOP Step Content:

Step ~~11~~ 14. Verify the Pressurizer Level Control System is automatically maintaining OR restoring Pressurizer level at 33%.

Objective:

This step verifies the restoration of pressurizer level by the pressurizer level control system.

Basis: (CEN-152, page 8-16, step 19)

The PLCS is verified to be automatically controlling or restoring pressurizer level in the hot zero power reference band. If not, charging and letdown are operated manually to ensure pressurizer level is being maintained. This action verifies that the RCS inventory safety function is being controlled.

Operational Considerations:

If the automatic function is not operating properly, then the system should be placed in manual. Systems in manual should be monitored for proper operation.

EPG Step Content: (CEN-152, page 8-32, step 19)

Verify that the PLCS is automatically maintaining or restoring pressurizer level in the hot zero power reference band. If not, manually operate charging and letdown to restore and maintain normal pressurizer level.

Justification of Differences:

NA

Source Document:

CEN-152, Section 8.0, Loss of Feedwater Recovery Guideline.

E. Recovery Actions

EOP Step Content:

Step ~~12~~ 15. Maintain Steam Generator level between 68% to 71% Wide Range utilizing Emergency Feedwater.

Objective:

The objective of this step is to provide guidance for steam generator level control with emergency feedwater.

Basis: (CEN-152, page 8-31, step 16)

Steam generator level is controlled in the hot zero power band using [main or auxiliary] feedwater to provide for RCS heat removal.

Operational Considerations:

If the automatic function is not operating properly, then the system should be monitored for proper operation.

EPG Step Content: (CEN-152, page 8-31, step 16)

Continue to maintain or restore steam generator level in the hot zero power band using [main or auxiliary] feedwater.

Justification of Differences:

At this point in the procedure main feedwater is lost and emergency feedwater is supplying feedwater needs.

Source Document:

CEN-152, Section 8.0, Loss of Feedwater Recovery Guideline.

E. Recovery Actions

EOP Step Content:

Step ~~13~~ 16. IF Main Feedwater is completely lost for ≥30 minutes, THEN stop ALL Reactor Coolant Pumps.

Objective:

This step secures the reactor coolant pumps (a significant heat load) if main feedwater is completely lost.

Basis: (FASR, page 10.4.9B-2, step 10.4.9B.2.1 LMFW)

It is assumed that the operator will trip the Reactor Coolant Pumps (RCPs) 30 minutes after the reactor trip brought on by the LMFW. This is a required operating procedure action intended to reduce the heat load on the primary system. If both steam generators (SGs) are available, 450 gpm of EFS flow (225 per SG)* is needed to maintain the level required for the SGs to be adequate heat sinks. If only one SG is available, 400 gpm to that SG is adequate to maintain the level required for the SG to be an adequate heat sink (required EFS flow when one SG is available is less than for two SGs because of the RCS energy dissipated as the unfed SG boils away its inventory).

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

Final Safety Analysis Report, Appendix 10.4.9.B, Emergency Feedwater Reliability Analysis.

E. Recovery Actions

EOP Step Content:

Step ~~14~~ 17. IF NO Reactor Coolant Pumps are operating, THEN check Natural Circulation by ALL the following:

Objective:

The objective of this step is to check the conditions that indicate natural circulation flow exists.

Basis: (CEN-152, page 8-14, step 12)

When single phase circulation is established in at least one loop, the RCS indicates all of the following:

a) Loop ΔT (T_H-T_C) less than full power ΔT
b) Cold leg temperature constant or dropping
c) Hot leg temperatures stable (i.e., not steadily rising) or dropping
d) No abnormal differences between T_H RTDs and core exit thermocouples. Hot leg RTD temperature should be consistent with the core exit thermocouples. Adequate natural circulation flow ensures that core exit thermocouples temperatures will be approximately equal to the hot leg RTDs temperature within the bounds of the instrument's inaccuracies. An abnormal difference between T_H and the CETs is greater than (10)°F.

Operational Considerations:

This step is performed only if all reactor coolant pumps have been stopped. Where multiple indications for one parameter exist, use more than one instrument to obtain a particular reading.

EPG Step Content: (CEN-152, page 8-31, step 12)

If all RCPs have been stopped, continually verify natural circulation flow in at least one loop. All of the following criteria must be met to demonstrate adequate natural circulation flow:

E. Recovery Actions

EOP Step ~~14~~ 17 (Continued).

Justification of Differences:

The EPG step was divided into two steps and expanded to include criteria for steam generator heat removal.

Source Document:

CEN-152, Section 8.0, Loss of Feedwater Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 1, Level; Table 3, Temperature; and Table 6, Flow.

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E. Recovery Actions

EOP Step Content:

Step ~~29~~ 18. IF SIAS has occurred, THEN within 30 minutes to 1 hour from the time SIAS occurred, terminate Emergency Boration as follows:

Objective:

This step terminates emergency boration after an SIAS.

Basis:

Suction of the charging pumps should be realigned within thirty minutes to one hour for operational considerations.

Operational Considerations:

Thirty minutes to one hour time frame ensures adequate shutdown margin.

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E. Recovery Actions

EOP Step Content:

Step ~~15~~ 19. IF Emergency Boration is in progress, AND SIAS has NOT occurred, THEN check for either of the following Emergency Boration termination criteria:

Objective:

This step provides criteria for Emergency Boration termination, if SIAS has not occurred.

Basis:

When emergency boration is in progress because two CEAs are not fully inserted, the criteria specified ensure sufficient negative reactivity has been added to provide an adequate shutdown margin.

Operational Considerations:

Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading.

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

LPL Letter W3484-0550

E. Recovery Actions

EOP Step Content:

Step ~~16~~ 20. IF Emergency Boration termination criteria have been satisfied AND SIAS has NOT occurred,
THEN perform the following:

Objective:

This step directs the operator actions in securing emergency boration if SIAS has not occurred.

Basis:

When sufficient boron has been added to the reactor coolant system to ensure sufficient shutdown margin, the emergency boration lineup can be secured and the chemical volume and control system restored to a normal lineup.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

OP-901-013, Emergency Boration.

E. Recovery Actions

EOP Step Content:

Step ~~17~~ 21. Stop ALL Heater Drain pumps.

Objective:

This step secures heater drain pumps which are no longer required below 30% power.

Basis:

To exit this procedure under stable plant conditions and then enter the Plant Operating Procedure at a point where it will take over control of the plant, certain steps must first be performed. The steps that must be performed would normally be completed by the Plant Operating Procedure prior to the point of entry from this procedure.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

OP-10-001, General Plant Operations.

E. Recovery Actions

EOP Step Content:

Step ~~18~~ 22. Verify one Condensate pump is operating.

Objective:

This step directs the operator to verify at least one condensate pump is operating, but no more.

Basis:

An operating condensate pump provides for continuous recirculation of the hotwell and cooling for the gland steam condenser.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E. Recovery Actions

EOP Step Content:

Step ~~19~~ 23. Verify TURB & EXTR LINES DRAIN VALVES open.

Objective:

This step verifies the automatic opening of the turbine and extraction line drain valves.

Basis:

To exit this procedure under stable plant conditions and then enter the Plant Operating Procedure at a point where it will take over control of the plant, certain steps must first be performed. The steps that must be performed would normally be completed by the Plant Operating Procedure prior to the point of entry from this procedure.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

OP-10-001, General Plant Operations.

E. Recovery Actions

EOP Step Content:

Step ~~20~~ 24. Verify following Turbine control switches in "AUTO":

Objective:

Verify turbine oil pumps and turning gear are ready for AUTO actuation.

Basis:

To exit this procedure under stable plant conditions and then enter the Plant Operating Procedure at a point where it will take over control of the plant, certain steps must first be performed. The steps that must be performed would normally be completed by the Plant Operating Procedure prior to the point of entry from this procedure.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

OP-10-001, General Plant Operations.

E. Recovery Actions

EOP Step Content:

Step ~~21~~ 25. Start Auxiliary Boiler. Refer to OP-5-001, AUXILIARY BOILER, Section 6.3.

Objective:

The objective of this step is to start the auxiliary boiler to supply steam loads, and to permit removal of steam loads from the steam generators.

Basis:

To exit this procedure under stable plant conditions and then enter the Plant Operating Procedure at a point where it will take over control of the plant, certain steps must first be performed. The steps that must be performed would normally be completed by the Plant Operating Procedure prior to the point of entry from this procedure.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

OP-10-001, General Plant Operations.

E. Recovery Actions

EOP Step Content:

Step ~~22~~ 26. When Neutron Flux Log Power is $\leq 10^{-4}$%, THEN perform the following:

Objective:

This step directs the operator to observe automatic actions at 10^{-4}% power and remove core protection calculator trips.

Basis:

To exit this procedure under stable plant conditions and then enter the Plant Operating Procedure at a point where it will take over control of the plant, certain steps must first be performed. The steps that must be performed would normally be completed by the Plant Operating Procedure prior to the point of entry from this procedure.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

OP-10-001, General Plant Operations.

E. Recovery Actions

EOP Step Content:

Step ~~28~~ 27. When NEUTRON FLUX LOG POWER (ENI-IJR-0001) is $\leq 10^{-6}$%, perform the following:

Objective:

The operator verifies automatic energization of startup channels and then adjusts the setpoint for both boron dilution monitors.

Basis:

To exit this procedure under stable plant conditions and then enter the Plant Operating Procedure at a point where it will take over control of the plant, certain steps must first be performed. The steps that must be performed would normally be completed by the Plant Operating Procedure prior to the point of entry from this procedure.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

OP-10-001, General Plant Operations.

CE Specification 9270-ICE-6618.

E. Recovery Actions

EOP Step Content:

Step ~~24~~ 28. Transfer Gland Sealing Steam to Auxiliary Boiler as follows:

Objective:

The objective of this step is to transfer the steam load of gland sealing steam to the auxiliary boiler to remove steam loads from the steam generators.

Basis:

To exit this procedure under stable plant conditions and then enter the Plant Operating Procedure at a point where it will take over control of the plant, certain steps must first be performed. The steps that must be performed would normally be completed by the Plant Operating Procedure prior to the point of entry from this procedure.

Operational Considerations:

Where multiple indications for one parameter exist, use more than one instrument to obtain a particular reading.

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

OP-10-001, General Plant Operations.

E. Recovery Actions

EOP Step Content:

Step 28. 29. IF Main Feedwater System is determined to be operable, THEN restore Main Feedwater as follows:

Objective:

This step directs the operator actions for restoring main feedwater which is the preferred source of feedwater.

Basis: (CEN-152, page 8-9, step 7)

The operator should attempt to restore the correct operation of the [main or auxiliary] feedwater system by restoring electrical power, operating valves, starting pumps or restoring other important auxiliary systems in order to provide a primary decay heat sink for a controlled reactor cooldown.

Operational Considerations:

NA

EPG Step Content: (CEN-152, page 8-29, step 7)

Take actions to restore [main or auxiliary] feedwater system to operation.

Justification of Differences:

This procedure addresses a loss of main feedwater only. Emergency feedwater will be in operation for this procedure.

Source Document:

CEN-152, Section 8.0, Loss of Feedwater Recovery Guideline.

E. Recovery Actions

EOP Step Content:

Step ~~26~~ 30. IF Main Feedwater is feeding Steam Generator 1, THEN perform the following:

Objective:

This step resets EFAS-1 and aligns the emergency feedwater valves for steam generator 1 to a standby condition.

Basis:

With main feedwater feeding steam generator 1, emergency feedwater is not required for steam generator 1, EFAS-1 may be reset and associated emergency feedwater valves placed in standby alignment.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

OP-9-003, Emergency Feedwater, Section 6.4.

E. Recovery Actions

EOP Step Content:

Step ~~27~~ 31. IF Main Feedwater is feeding Steam Generator 2, THEN perform the following:

Objective:

This step resets EFAS-2 and aligns the emergency feedwater valves for steam generator 2 to a standby condition.

Basis:

With main feedwater feeding steam generator 2, emergency feedwater is not required for steam generator 2, EFAS-2 may be reset and associated emergency feedwater valves placed in standby alignment.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

OP-9-003, Emergency Feedwater, Section 6.4.

E. Recovery Actions

EOP Step Content:

Step ~~28~~ 32. IF EFAS-1 AND EFAS-2 have been reset AND Main Feedwater is feeding BOTH Steam Generators, THEN stop Emergency Feedwater pumps as follows:

Objective:

This step secures emergency feedwater pumps which are not necessary.

Basis:

With EFAS-1 and EFAS-2 reset and main feedwater supplying both steam generators, there is not a need to have emergency feedwater operating and the pumps may be restored to a standby lineup.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

OP-9-003, Emergency Feedwater, Section 6.4.

E. Recovery Actions

EOP Step Content:

Step ~~29~~ 33. IF Main Feedwater System is NOT immediately available, THEN evaluate Condensate inventory to determine when to commence plant cooldown. Refer to Attachment ~~8~~ 7: Feedwater Required for Heat Removal to T_c (Final) versus T_c (Initial), AND Attachment ~~9~~ 8: Feedwater Capacity versus Time Remaining to Initiate Shutdown Cooling.

Objective:

The control room supervisor determines the amount of water necessary for cooldown and time remaining before cooldown must be commenced.

Basis: (CEN-152, page 8-16, step 20)

The plant should be maintained in a stable condition based on auxiliary systems availability. One concern the operator must have is the remaining supply of feedwater. Condensate inventory adequacy is determined according to Figures 8-9 and 8-10. The operator will monitor required tank levels with the Plant Data Book.

Operational Considerations:

Without main feedwater, cooldown to shutdown cooling entry conditions must begin as soon as possible to ensure adequate condensate inventory to avoid usage of auxiliary component cooling water.

EPG Step Content: (CEN-152, page 8-32, step 20)

Maintain the plant in a stabilized condition and evaluate the need for a plant cooldown based on plant conditions, auxiliary systems availability and condensate inventory (Figures 8-9 and 8-10). If conditions require a cooldown, conduct a cooldown to SCS initiation conditions per normal operating instructions.

E. Recovery Actions

EOP Step ~~29~~ 33 (Continued).

Justification of Differences:

NA

Source Document:

CEN-152, Section 8.0, Loss of Feedwater Recovery Guideline.

Plant Data Book.

TG-OP-902-006
Revision 1
4-7-84

E. Recovery Actions

EOP Step Content:

Step ~~42~~ 34. If SIAS AND CIAS have occurred, THEN reset SIAS AND CIAS. Refer to Attachment 9: SIAS and CIAS Reset Procedure.

Objective:

The objective of this step is to ensure that automatic actuation of SIAS and CIAS is available.

Basis:

Before component statuses are changed in this procedure, as the cooldown progresses, automatic engineered safeguards protection shall remain available until the reactor coolant system is cooled down and depressurized.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

TG-OP-702-006
Revision 1
4-7-84

E. Recovery Actions

EOP Step Content:

Step ~~45~~ 35. IF SIAS occurred AND has been reset, THEN restore normal Charging AND Letdown to maintain Pressurizer level as follows:

Objective:

The objective of this step is to restore normal pressurizer level control.

Basis:

The preferred means of controlling pressurizer level is by the chemical and volume control system. To exit this procedure under stable plant conditions and enter the plant operating procedure at a point where it will take over control of the plant, certain steps must be performed which would ensure that the plant controlling systems are in proper alignment.

Operational Considerations:

Where multiple indications for one parameter exist, use more than one instrument to obtain a particular reading. If the automatic function is not operating properly, then the system should be placed in manual. Systems in manual should be monitored for proper operation. If safety injection flow has not been throttled or terminated, then letdown should not be placed in operation.

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

OP-10-001, General Plant Operations.

E. Recovery Actions

EOP Step Content:

Step ~~30~~ 36. IF ALL Reactor Coolant Pumps have been stopped AND Main Feedwater is feeding at least one Steam Generator, THEN check the following Reactor Coolant Pump restart criteria:

Objective:

This step provides guidelines for restoring reactor coolant pumps to operation.

Basis: (CEN-152, page 8-11, step 11)

If RCP operation has been terminated, restarting of the reactor coolant pumps should be attempted if feedwater can be restored to at least one SG to ensure continued forced circulation of coolant through the core and to provide the capability for the normal mode of pressurizer spray.

Operational Considerations:

If component cooling water to reactor coolant pumps has been lost for $\geq$10 minutes, then reactor coolant pumps should not be restarted.

EPG Step Content: (CEN-152, page 8-31, step 11)

If at any time the RCPs were stopped, one RCP in each loop may be restarted if all of the following criteria are satisfied:

Justification of Differences:

NA

Source Document:

CEN-152, Section 8.0, Loss of Feedwater Recovery Guideline.

PV-OP-902, Faramater Values Document. Table 1, Level; Table 2, Subcooling; and Table 6, Flow.

E. Recovery Actions

EOP Step Content:

Step ~~31~~ 37. IF ALL Reactor Coolant Pump restart criteria (step ~~30~~ 36) are satisfied, THEN restart one Reactor Coolant Pump in each loop. Refer to OP-1-002, REACTOR COOLANT PUMP OPERATION, Sections 4.0 AND 6.1.

Objective:

This step directs the operator to start one reactor coolant pump in each loop if the guidelines for restart are satisfied.

Basis: (CEN-152, page 8-11, step 11)

If RCP operation has been terminated, restarting of the reactor coolant pumps should be attempted if feedwater can be restored to at least one SG to ensure continued forced circulation of coolant through the core and to provide the capability for the normal mode of pressurizer spray.

Operational Considerations:

If component cooling water to reactor coolant pumps has been lost for $\geq$10 minutes, then reactor coolant pumps should not be restarted.

EPG Step Content: (CEN-152, page 8-31, step 11)

If at any time the RCPs were stopped, one RCP in each loop may be restarted if all of the following criteria are satisfied:

Justification of Differences:

NA

Source Document:

CEN-152, Section 8.0, Loss of Feedwater Recovery Guideline.
PV-OP-902, Parameter Values Document. Table 1, Level; Table 2, Subcooling; and Table 6, Flow.

E. Recovery Actions

EOP Step Content:

Step ~~37~~ 38. IF Reactor Coolant Pumps are operating, THEN verify Spray Valves selector switch is selected to the loop with the operating Reactor Coolant Pump.

Objective:

The objective of this step is to verify that normal spray is available.

Basis:

With forced circulation of coolant through the core, this action ensures that the normal mode of pressurizer spray is available.

Operational Considerations:

If the pressurizer auxiliary spray was being used, then charging shall be returned to normal lineup. If the automatic function is not operating properly, then the system should be placed in manual. Systems in manual should be monitored for proper operation.

EPG Step Content:

NA

Justification of Differences:

NA

Justification of Differences:

NA

E. Recovery Actions

EOP Step Content:

Step ~~33~~ 39. Prior to Plant startup, complete OP-10-001, GENERAL PLANT OPERATIONS, Attachment 8.17: Post Reactor Trip Review.

Objective:

This step reminds the operator to complete the post reactor trip review as soon as possible. Therefore information concerning the reactor trip is recorded as soon as possible.

Basis:

The operator is directed to complete the Post Reactor Trip Review when either personnel are available or time is available. However, emphasis is placed on completing the review as soon as possible.

Operational Considerations:

Prior to closing Reactor Trip Breakers, OP-10-001, General Plant Operations, Attachment 8:17: Post Reactor Trip Review, shall be completed.

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

OP-10-001, General Plant Operations.

E. Recovery Actions

EOP Step Content:

Step ~~34~~ 40. IF Plant startup is planned AND ALL of the following conditions are satisfied, THEN go to OP-10-001, GENERAL PLANT OPERATIONS, Section 6.3.

Objective:

This step directs the operator to the startup section in OP-10-001, General Plant Operations, and provides system parameters to be maintained.

Basis: (CEN-152, page 8-20, step 26)

The Plant should be maintained in a stable condition. Based on auxiliary systems availability and plant conditions, and, if feedwater is regained, condensate inventory, evaluate the need for a plant cooldown.

Operational Considerations:

Before startup can commence, the Post Reactor Trip Review must be completed. Main Feedwater must be available for startup.

EPG Step Content: (CEN-152, page 8-33, step 26)

Maintain the plant in a stabilized condition and evaluate the need for a plant cooldown based on plant conditions systems availability and, if feedwater is regained, condensate inventory (per Figures 8-9 and 8-10).

Justification of Differences:

NA

Source Document:

CEN-152, Section 8.0, Loss of Feedwater Recovery Guideline.

E. Recovery Actions

EOP Step Content:

Step ~~35~~ 41. IF Plant cooldown is planned AND BOTH of the following conditions are satisfied, THEN go to OP-10-001, GENERAL PLANT OPERATIONS, Section 6.8.

Objective:

This step directs the operator to the procedure for a normal cooldown with main feedwater available.

Basis: (CEN-152, page 8-20, step 26)

If required, conduct a plant cooldown within Technical Specification Limits and enter shutdown cooling.

Operational Considerations:

If main feedwater is not available, a cooldown must be done using the remainder of this procedure.

EPG Step Content: (CEN-152, page 8-33, step 26)

Maintain the plant in a stabilized condition and evaluate the need for a plant cooldown based on plant conditions systems availability and, if feedwater is regained, condensate inventory (per Figures 8-9 and 8-10). If required, conduct a plant cooldown within Technical Specification Limits and enter shutdown cooling.

Justification of Differences:

NA

Source Document:

CEN-152, Section 8.0, Loss of Feedwater Recovery Guideline.

E. Recovery Actions

EOP Step Content:

Step ~~36~~ 42. IF using Emergency Feedwater to feed EITHER Steam Generator, THEN perform the following:

Objective:

This step ensures the operator verifies actuation of automatic makeup to condensate storage pool and a continued source of water to emergency feedwater system when condensate storage pool level drops.

Basis:

When condensate storage pool level drops to 97.7%, the automatic makeup valve should start opening. When condensate storage pool level drops to the Condensate Storage Pool Level LO-LO alarm, auxiliary component cooling water is lined up to the emergency feedwater pump suction to ensure a source of water to the emergency feedwater pumps.

Operational Considerations:

Bypassing the condensate storage pool makeup valve will require close monitoring to prevent overfill. Control room supervisor permission is required prior to aligning auxiliary component cooling water to the emergency feedwater system. If the automatic action is not operating properly, then systems should be placed in manual. Systems in manual should be monitored for proper operation.

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

PV-OP-902, Parameter Values Document. Table 1, Level.

E. Recovery Actions

EOP Step Content:

Step ~~37~~. 43. Stop BOTH CEDM Motor Generator sets. Refer to OP-4-004, CONTROL ELEMENT DRIVE, Section 6.2.

Objective:

This step secures the control element drive mechanism motor generator sets which are no longer required.

Basis:

To exit this procedure under stable plant conditions and then enter the Plant Operating Procedure at a point where it will take over control of the plant, certain steps must first be performed. The steps that must be performed would normally be completed by the Plant Operating Procedure prior to the point of entry from this procedure.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

OP-10-001, General Plant Operations.

E. Recovery Actions

EOP Step Content:

Step ~~38~~ 44. Direct Chemistry Department to sample Reactor Coolant System AND Pressurizer for boron concentration.

Objective:

This step has chemistry department verify boron concentration in both pressurizer and reactor coolant system.

Basis:

To exit this procedure under stable plant conditions and then enter the Plant Operating Procedure at a point where it will take over control of the plant, certain steps must first be performed. The steps that must be performed would normally be completed by the Plant Operating Procedure prior to the point of entry from this procedure.

Operational Considerations:

This step will be performed again if the reactor coolant system must be borated.

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

OP-10-001, General Plant Operations.

E. Recovery Actions

EOP Step Content:

Step ~~39~~ 46. Verify Shutdown Margin in accordance with Technical Specifications. Refer to OP-903-090, SHUTDOWN MARGIN.

Objective:

The operator will determine adequate shutdown margin available for a cooldown to a reactor coolant system temperature <200°F.

Basis:

To exit this procedure under stable plant conditions and then enter the Plant Operating Procedure at a point where it will take over control of the plant, certain steps must first be performed. The steps that must be performed would normally be completed by the Plant Operating Procedure prior to the point of entry from this procedure.

Operational Considerations:

If shutdown margin is not adequate, the operator will borate as necessary.

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

OP-10-001, General Plant Operations.

E. Recovery Actions

EOP Step Content:

Step ~~40.~~ 46. IF the difference between Reactor Coolant System AND Pressurizer boron concentration >50 ppm, THEN equalize boron concentration.

Objective:

This step ensures the boron concentration in the reactor coolant system and the pressurizer are equal and preclude a boron dilution incident due to pressurizer outsurge into the reactor coolant system.

Basis:

To exit this procedure under stable plant conditions and then enter the Plant Operating Procedure at a point where it will take over control of the plant, certain steps must first be performed. The steps that must be performed would normally be completed by the Plant Operating Procedure prior to the point of entry from this procedure.

Operational Considerations:

This step requires a large amount of time even with four reactor coolant pumps operating. When reactor coolant pump combination is reduced to one pump in each loop the time requirement will increase. With natural circulation, methods other than increasing spray flow may be necessary.

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

OP-10-001, General Plant Operations.

E. Recovery Actions

EOP Step Content:

Step ~~41~~ 47. IF Reactor Coolant Pumps are operating, THEN go to step ~~50~~ 56.

Objective:

The objective of this step is to ensure the preferred method of cooldown is used if the reactor coolant pumps are available.

Basis:

When the reactor coolant pumps are operating, then this step directs the operator to step 43 to perform a forced circulation cooldown. Natural circulation is not as efficient as forced circulation for cooling the isolated steam generator. Therefore, if possible, the forced circulation cooldown should be utilized.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E. Recovery Actions

EOP Step Content:

Step ~~42.~~ 48. IF NO Reactor Coolant Pumps are operating, THEN check Natural Circulation by ALL the following:

Objective:

The objective of this step is to check the conditions that indicate natural circulation flow exists.

Basis: (CEN-152, page 8-14, step 12)

When single phase circulation is established in at least one loop, the RCS indicates all of the following:

a) Loop ΔT (T_H-T_C) less than full power ΔT
b) Cold leg temperatures constant or dropping
c) Hot leg temperatures stable (i.e., not steadily rising) or dropping
d) No abnormal differences between T_H RTDs and core exit thermocouples. Hot leg RTD temperature should be consistent with the core exit thermocouples. Adequate natural circulation flow ensures that core exit thermocouples temperatures will be approximately equal to the hot leg RTDs temperature within the bounds of the instrument's inaccuracies. An abnormal difference between T_H and the CETs is greater then (10)°F.

Operational Considerations:

Where multiple indications for one parameter exist, use more than one instrument to obtain a particular reading.

EPG Step Content: (CEN-152, page 8-31, step 12)

If all RCPs have been stopped, continually verify natural circulation flow in at least one loop. All of the following criteria must be met to demonstrate adequate natural circulation flow:

E. Recovery Actions

EOP Step ~~42~~ 48 (Continued).

Justification of Differences:

NA

Source Document:

CEN-152, Section 8.0, Loss of Feedwater Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 1, Level, Table 3, Temperature; and Table 6, Flow.

E. Recovery Actions

EOP Step Content:

Step ~~43.~~ 49. When a Steam Generator Low Pressure Pretrip alarm occurs, reset the setpoint.

Objective:

This step prevents a main steam isolation signal from occurring and inhibiting cooldown.

Basis:

To exit this procedure under stable plant conditions and then enter the Plant Operating Procedure at a point where it will take over control of the plant, certain steps must first be performed. The steps that must be performed would normally be completed by the Plant Operating Procedure prior to the point of entry from this procedure.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

OP-10-001, General Plant Operations.

E. Recovery Actions

EOP Step Content:

Step ~~44~~ 50. Commence a Plant cooldown to obtain a Cold Leg temperature of 350°F by either of the following:

Objective:

This step starts the cooldown to shutdown cooling entry temperature.

Basis:

To exit this procedure under stable plant conditions and then enter the Plant Operating Procedure at a point where it will take over control of the plant, certain steps must first be performed. The steps that must be performed would normally be completed by the Plant Operating Procedure prior to the point of entry from this procedure.

Operational Considerations:

~~NA~~ Cooldown ~~Rate~~ rate shall be limited to ≤ 50°F/hr for Reactor Coolant System and ≤ 100°F/hr for Pressurizer.

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

OP-10-001, General Plant Operations.

E. Recovery Actions

EOP Step Content:

Step ~~45~~ 51. When a Low Pressurizer Pressure Pretrip alarm occurs, reset the setpoint.

Objective:

This step prevents a containment isolation or safety injection from occurring.

Basis:

To exit this procedure under stable plant conditions and then enter the Plant Operating Procedure at a point where it will take over control of the plant, certain steps must first be performed. The steps that must be performed would normally be completed by the Plant Operating Procedure prior to the point of entry from this procedure.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

OP-10-001, General Plant Operations.

E. Recovery Actions

EOP Step Content:

Step ~~46~~ 52. Commence Plant depressurization to 375 psia using Pressurizer Auxiliary Spray.

Objective:

The objective of this step is to depressurize the reactor coolant system to shutdown cooling entry conditions.

Basis:

To exit this procedure under stable plant conditions and then enter the Plant Operating Procedure at a point where it will take over control of the plant, certain steps must first be performed. The steps that must be performed would normally be completed by the Plant Operating Procedure prior to the point of entry from this procedure.

Operational Considerations:

During plant cooldown and depressurization, maintain subcooling margin 28°F to 200°F. Refer to Attachment 7: Post-Accident Pressure and Temperature Limits Graph. Below 1000 psia, subcooling margin shall be determined by subtracting hot leg temperature from Pressurizer Temperature Water (TI 101).

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

OP-10-001, General Plant Operations.

E. Recovery Actions

EOP Step Content:

Step ~~47~~ 53. During Plant depressurization, monitor for Reactor Coolant System voiding as indicated by:

Objective:

This step provides guidance for detecting voids in the reactor coolant system.

Basis:

To exit this procedure under stable plant conditions and then enter the Plant Operating Procedure at a point where it will take over control of the plant, certain steps must first be performed. The steps that must be performed would normally be completed by the Plant Operating Procedure prior to the point of entry from this procedure.

Operational Considerations:

Where multiple indications for one parameter exist, use more than one instrument to obtain a particular reading.

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E. Recovery Actions

EOP Step Content:

Step ~~48~~ 54. IF Reactor Coolant System voiding is indicated, THEN perform the following:

Objective:

This step provides methods to eliminate voids of the reactor coolant system.

Basis:

To exit this procedure under stable plant conditions and then enter the Plant Operating Procedure at a point where it will take over control of the plant, certain steps must first be performed. The steps that must be performed would normally be completed by the Plant Operating Procedure prior to the point of entry from this procedure.

Operational Considerations:

If the automatic function is not operating properly, then the system should be placed in manual. Systems in manual should be monitored for proper operation. Where multiple indications for one parameter exist, use more than one instrument to obtain a particular reading.

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E. Recovery Actions

EOP Step Content:

Step ~~49~~ 55. IF ALL required actions of Natural Circulation cooldown (steps 42-48) were completed, THEN go to step ~~54~~ 60.

Objective:

This step ensures that the operator continues this procedure to the shutdown cooling entry conditions.

Basis:

This step directs the operator to bypass the portion of this procedure which pertains to forced circulation cooldown. The remainder of this procedure would then be utilized to ensure that the shutdown cooling entry conditions are satisfied.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E. Recovery Actions

EOP Step Content:

Step ~~50~~ 56. When a Steam Generator Low Pressure Pretrip alarm occurs, reset the setpoint.

Objective:

This objective of this step is to prevent a MSIS from occurring and inhibiting cooldown.

Basis:

To exit this procedure under stable plant conditions and then enter the Plant Operating Procedure at a point where it will take over control of the plant, certain steps must first be performed. The steps that must be performed would normally be completed by the Plant Operating Procedure prior to the point of entry from this procedure.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

OP-10-001, General Plant Operations.

E. Recovery Actions

EOP Step Content:

Step ~~51~~ 57. Commence a Plant cooldown to obtain a Cold Leg temperature of 350°F by either of the following:

Objective:

This step starts the cooldown to shutdown cooling entry temperature.

Basis:

To exit this procedure under stable plant conditions and then enter the Plant Operating Procedure at a point where it will take over control of the plant, certain steps must first be performed. The steps that must be performed would normally be completed by the Plant Operating Procedure prior to the point of entry from this procedure.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

OP-10-001, General Plant Operations.

E. Recovery Actions

EOP Step Content:

Step ~~52~~ 58. When a Low Pressurizer Pressure Pretrip alarm occurs, reset the setpoint.

Objective:

The objective of this step is to prevent a containment isolation or safety injection from occurring.

Basis:

To exit this procedure under stable plant conditions and then enter the Plant Operating Procedure at a point where it will take over control of the plant, certain steps must first be performed. The steps that must be performed would normally be completed by the Plant Operating Procedure prior to the point of entry from this procedure.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

OP-10-001, General Plant Operations.

E. Recovery Actions

EOP Step Content:

Step ~~53~~ 51. Commence Plant depressurization to 375 psia using Normal Spray.

Objective:

The objective of this step is to depressurize the reactor coolant system to shutdown cooling entry conditions.

Basis:

To exit this procedure under stable plant conditions and then enter the Plant Operating Procedure at a point where it will take over control of the plant, certain steps must first be performed. The steps that must be performed would normally be completed by the Plant Operating Procedure prior to the point of entry from this procedure.

Operational Considerations:

During plant cooldown and depressurization, maintain subcooling margin 28°F to 200°F. Refer to Attachment 7: Post-Accident Pressure and Temperature Limits Graph. Where multiple indications for one parameter exist, use more than one instrument to obtain a particular reading. Below 1000 psia, subcooling margin shall be determined by subtracting hot leg temperature from Pressurizer Temperature Water (TI 101).

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

OP-10-001, General Plant Operations.

E. Recovery Actions

EOP Step Content:

Step ~~54~~ 60. IF Feedwater AND Condensate Systems can feed at least one Steam Generator AND Cold Leg temperature ≤450°F, THEN perform the following:

Objective:

This step aligns condensate and feedwater systems for condensate pump feed of the steam generators.

Basis:

To exit this procedure under stable plant conditions and then enter the Plant Operating Procedure at a point where it will take over control of the plant, certain steps must first be performed. The steps that must be performed would normally be completed by the Plant Operating Procedure prior to the point of entry from this procedure.

Operational Considerations:

The main feedwater pumps need not be operable to perform this step.

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

OP-10-001, General Plant Operations.

E. Recovery Actions

EOP Step Content:

Step ~~55~~ 61. IF Condensate OR Main Feedwater is feeding Steam Generator 1, THEN perform the following:

Objective:

This step secures emergency feedwater to steam generator 1 and aligns the associated emergency feedwater valves in a standby alignment.

Basis:

With condensate feeding steam generator 1, EFAS-1 may be reset and the emergency feedwater valves for steam generator 1 placed in a standby alignment.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

OP-9-003, Emergency Feedwater, Section 6.4.

E. Recovery Actions

EOP Step Content:

Step ~~56~~ 62. IF Condensate OR Main Feedwater is feeding Steam Generator 2, THEN perform the following:

Objective:

This step secures emergency feedwater to steam generator 2 and aligns the associated emergency feedwater valves in a standby alignment.

Basis:

With condensate feeding steam generator 2, EFAS-2 may be reset and the emergency feedwater valves for steam generator 2 placed in a standby alignment.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

OP-9-003, Emergency Feedwater, Section 6.4.

E. Recovery Actions

EOP Step Content:

Step ~~57~~ 63. IF EFAS-1 AND EFAS-2 have been reset AND Condensate System is feeding BOTH Steam Generators, THEN stop Emergency Feedwater pumps as follows:

Objective:

This step secures emergency feedwater pumps which are not necessary.

Basis:

With EFAS-1 and EFAS-2 reset and condensate system supplying both steam generators, there is not a need to have emergency feedwater operating and the pumps may be restored to a standby alignment.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

OP-9-003, Emergency Feedwater, Section 6.4.

E. Recovery Actions

EOP Step Content:

Step ~~58.~~ 64. When Pressurizer pressure ≤1700 psia, locally open AND rack out the supply breaker for one operable High Pressure Safety Injection pump.

Objective:

This step has the operator remove one high pressure safety injection pump from service.

Basis:

To exit this procedure under stable plant conditions and then enter the Plant Operating Procedure at a point where it will take over control of the plant, certain steps must first be performed. The steps that must be performed would normally be completed by the Plant Operating Procedure prior to the point of entry from this procedure. Prevent overpressure condition at low temperature due to high pressure safety injection pump flow.

Operational Considerations:

Where multiple indications for one parameter exist, use more than one instrument to obtain a particular reading.

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

OP-10-001, General Plant Operations.

E. Recovery Actions

EOP Step Content:

Step ~~59.~~ 65. When Pressurizer pressure is lowered to 650 psia, lower Safety Injection Tank pressure to between 300 psig AND 235 psig by operating the following SAFETY INJECTION TANKS vent valves:

Objective:

This step reduces safety injection tank pressure to prevent dumping tanks into the reactor coolant system.

Basis:

To exit this procedure under stable plant conditions and then enter the Plant Operating Procedure at a point where it will take over control of the plant, certain steps must first be performed. The steps that must be performed would normally be completed by the Plant Operating Procedure prior to the point of entry from this procedure.

Operational Considerations:

Where multiple indications for one parameter exist, use more than one instrument to obtain a particular reading.

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

OP-10-C01, General Plant Operations.

E. Recovery Actions

EOP Step Content:

Step ~~60~~ 66. When Pressurizer pressure <400 psia, place the RPS/ESFAS PZR PRESS BYPASS switch to "BYPASS" on ALL four channels of Plant Protection System.

Objective:

This step prevents SIAS and CIAS below minimum reset setpoint for low pressurizer pressure.

Basis:

To exit this procedure under stable plant conditions and then enter the Plant Operating Procedure at a point where it will take over control of the plant, certain steps must first be performed. The steps that must be performed would normally be completed by the Plant Operating Procedure prior to the point of entry from this procedure.

Operational Considerations:

Where multiple indications for one parameter exist, use more than one instrument to obtain a particular reading.

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

OP-10-001, General Plant Operations.

E. Recovery Actions

EOP Step Content:

Step ~~61.~~ 67. When Pressurizer pressure is between 392 psia AND 350 psia, perform the following:

Objective:

This step prevents unnecessary injection of safety injection tank contents into the reactor coolant system.

Basis:

To exit this procedure under stable plant conditions and then enter the Plant Operating Procedure at a point where it will take over control of the plant, certain steps must first be performed. The steps that must be performed would normally be completed by the Plant Operating Procedure prior to the point of entry from this procedure.

Operational Considerations:

Where multiple indications for one parameter exist, use more than one instrument to obtain a particular reading.

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

OP-10-001, General Plant Operations.

E. Recovery Actions

EOP Step Content:

Step ~~62~~ 68. When the following conditions are established, maintain them as follows:

Objective:

This step directs the operator to attain the listed parameters.

Basis:

To exit this procedure under stable plant conditions and then enter the Plant Operating Procedure at a point where it will take over control of the plant, certain steps must first be performed. The steps that must be performed would normally be completed by the Plant Operating Procedure prior to the point of entry from this procedure.

Operational Considerations:

Where multiple indications for one parameter exist, use more than one instrument to obtain a particular reading.

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

OP-10-001, General Plant Operations.

E. Recovery Actions

EOP Step Content:

Step ~~63~~ 69. Record Pressurizer Spray Cycles.

Objective:

This step documents the number of pressurizer spray cycles.

Basis: (Technical Specification 5.7)

The components identified in Table 5.7-1 are designed and shall be maintained within the cycle or transient limits of Table 5.7-1.

Operational Considerations:

The number of cycles is determined by comparing the pressurizer pressure recorder to the time frame of the event.

EPG Step Content: (CEN-152, page 8-35, precaution 7)

Minimize the number of cycles of pressurizer auxiliary spray whenever the temperature differential between the spray water and the pressurizer is greater than [200°F] in order to minimize the increase in the spray nozzle thermal stress accumulation factor. Every such cycle must be recorded in accordance with Technical Specification limitations.

Justification of Differences:

The EPG precaution was made a step to ensure positive action by the operator.

Source Document:

CEN-152, Section 8.0, Loss of Feedwater Recovery Guideline.

E. Recovery Actions

EOP Step Content:

Step ~~64~~ 70. Go to OP-10-001, GENERAL PLANT OPERATING PROCEDURE, Section 6.9 AND continue cooldown as directed by the Control Room Supervisor.

Objective:

The objective of this step is to exit the emergency procedures and enter normal plant operating procedures.

Basis:

This step allows operational personnel to continue operating or cooldown further in accordance with normal Operating Procedures rather than EOPs. This also serves to limit the length of EOPs.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

OP-10-001, General Plant Operations.

2.0 Guidelines for Safety Function Status Checklist

Safety Functions	Criteria	Bases
Reactivity Control	a. Reactor power dropping $<10^{-4}$%	(CEN-152, page 8-22) For all emergency events, the reactor must be shutdown.
	b. Negative SUR	
	c. ≤2 CEAs NOT fully inserted	
	d. For >1 CEA NOT fully inserted, Emergency Boration in progress OR has occurred.	The criterion of ≤2 CEAs NOT fully inserted is based on ATWS. The criterion that all except one CEA fully inserted or emergency boration is in progress observes Technical Specification limits.
RCS Inventory Control	a. Pressurizer level between 7% AND 40% b. RCS ≥28°F subcooled c. Pressurizer Level Control System functioning to maintain OR restore Pressurizer level. See Insert 1 next page	(CEN-152, page 8-22) A value of 40% was chosen as an upper limit to prevent water from reaching the safeties and to account for instrument inaccuracies. A value of 7% was chosen as a lower limit to account for instrument inaccuracy. A 28°F subcooling margin coexisting with a pressurizer level between 7% to 40% indicates adequate RCS inventory control via a saturated bubble in the pressurizer.
RCS Pressure Control	a. Pressurizer pressure <2300 psia b. Pressurizer Pressure Control System functioning to maintain OR restore Pressurizer pressure c. RCS Subcooling Margin between 28°F AND 200°F. See Insert 2 2nd page	2300 psia pressurizer pressure is the maximum expected pressure following a loss of main feedwater, which is based on operational experience of similar NSSS System and engineering judgement. The acceptance criteria is written to cover the expected range which may result from the event.

Insert 1

(To replace RCS Inventory Control Criteria + Bases)

Criteria

a. Pressurizer level between 7% AND 40%
b. RCS ≥28°F subcooled
c. Pressurizer Level Control System functioning to maintain OR restore Pressurizer level.

OR

d. At least one Charging pump operating with ≥40 gpm flow
e. At least one HPSI pump operating with Cold Leg Injection valves open:
   1) Train A Cold Leg Injection valves (SI 225A, SI 226A, SI 227A, SI 228A)
   2) Train B Cold Leg Injection valves (SI 225B, SI 226B, SI 227B, SI 228B).

Bases

(CEN-152, page 8-22) A value of 40% was chosen as an upper limit to prevent water from reaching the safeties and to account for instrument inaccuracies. A value of 7% was chosen as a lower limit to account for instrument inaccuracy.

A 28°F subcooling margin co-existing with a pressurizer level between 7% to 40% indicates adequate RCS inventory control via a saturated bubble in the pressurizer.

For cases where RCS inventory is badly degraded, the ECC operation provides assurance that control is being regained.

Insert 2

(To replace RCS Pressure Control Criteria + Bases)

Criteria

a. Pressurizer pressure <2300 psia
b. Pressurizer Pressure Control System functioning to maintain OR restore Pressurizer pressure
c. RCS Subcooling Margin between 28°F AND 200°F.

OR

d. At least one Charging pump operating with ≥40 gpm flow
e. At least one HPSI pump operating with Cold Leg Injection valves open:
   1) Train A Cold Leg Injection valves (SI 225A, SI 226A, SI 227A, SI 228A)
   2) Train B Cold Leg Injection valves (SI 225B, SI 226B, SI 227B, SI 228B).

Bases

No change to bases

Safety Functions	Criteria	Bases
RCS AND Core Heat Removal	a. CET temperatures satisfy BOTH of the following: 1) <600°F 2) NOT steadily rising for more than 15 minutes b. At least one Steam Generator is satisfying either: 1) Level is BOTH: a) >50% Wide Range b) Constant OR rising OR 2) Level is being restored by either: a) >.378 X 10^6 lbm/hr MFW flow OR b) >150 gpm EFW flow c. T_C ≤550°F.	Since the Saturation Temperature corresponding to the RCS safety setpoints is 558°F, 600°F represents a superheat condition at high pressure in the RCS which can only occur with core uncovery. Core uncovery results from a loss of RCS inventory. While 600°F bounds all anticipated events, loss of Main Feedwater should result in no core uncovery and, therefore, no indicated superheat on the CETs. 600°F is a plant-specific temperature based on engineering judgement. Best estimate analysis have shown that 600°F CET temperature will not gnerally be exceeded without multiple equipment failures or coincident other accidents. The acceptance criteria that CET temperature not show an increasing trend for more than 15 minutes is based on analysis. CET temperature greater than 600°F can result in significant fuel clad oxidation over extended time periods, i.e., 15 minutes. An increasing trend for a short period of time is possible and acceptable. When one steam generator level is returned to the zero power level band and feedwater remains available to maintain that level, then the SG contribution to RCS heat removal is being satisfied. (CEN-152,page 8-23) 550°F is based on control program for ADVs and steam dump bypass, and best estimate analysis values.

Completely redo criteria and bases on this page. See Insert next 2 pages.

Insert

(To replace RCS + Core Heat Removal Criteria)

a. At least one Reactor Coolant Loop ΔT is satisfying either of the following:

1) IF Reactor Coolant Pumps are operating, THEN Loop $\Delta T < 13°F$

OR

2) IF NO Reactor Coolant Pumps are operating, THEN Loop $\Delta T < 64°F$

b. RCS $\geq 28°F$ subcooled

c. At least one Steam Generator is satisfying either:

1) Level is BOTH:

a) $\geq 50\%$ Wide Range

b) Constant OR rising

OR

2) Level is being restored by either:

a) $\geq .378 \times 10^6$ lbm/hr MFW flow

OR

b) ≥ 150 gpm EFW flow

d. $T_c \leq 550°F$

Insert
(To replace RCS + Core Heat Removal Bases)

(CEN-152, pages 8-23 and 8-24)

550°F ~~[545°F]~~ is based on control program for ADVs and steam dump bypass, and best estimate analysis values. ~~25°F [20°F]~~ subcooled margin is based on engineering judgement to assure adequate core cooling accounting for temperature variations in the RCS. Best estimate analysis shows that the noted events will fall in the selected ranges.

Loop ΔT on at least one operable steam generator which is appropriate for the existing RCS flow mode is indicative of adequate S/G heat removal.

(Telecon W3084-0277) The criteria for at least one Steam Generator operable, although a deviation from CEN-152, has been verbally accepted by Cumbustion Engineering as a positive kickout to the Safety Function Recovery Procedure in the event of a total loss of feedwater. This criteria establishes bounds for the Loss of Main Feedwater Recovery Procedure such that Main or Emergency Feedwater must remain available to at least one Steam Generator.

Safety Functions	Criteria	Bases
Containment Temperature AND Pressure Control	a. Containment pressure <17.1 psia AND NO CSAS.	17.1 psia is based on high containment pressure setpoint. It is not expected for selected events that containment pressure will increase to the setpoint.
Containment Isolation	a. NO Containment area radiation monitors alarming b. NO Steam plant radiation monitors alarming.	No radiation is anticipated in the containment for a loss of main feedwater event. No radiation is anticipated in the steam plant for a loss of main feedwater event.
Containment Combustible Gas Control	a. Hydrogen concentration <0.5%.	Hydrogen concentration in the containment should not rise for a loss of main feedwater.
Vital Auxiliaries	a. BOTH of the following exist: 1) A AND B 6.9KV busses energized 2) A AND B 4.16KV nonsafety busses energized b. A AND B 4.16KV safety busses energized.	Having both A and B trains of non-safety busses energized ensures that all required auxiliaries are available and that the operator remains within the bounds of the Loss of Main Feedwater Procedure which does not include degraded electrical distribution system.

3.0 Generic Steps not included in the Waterford-3 EOP

In the items cited below, step, precaution, and page numbers refer to the appropriate sections of CEN-152.

E. Recovery Actions

Step 8 (page 8-30):

[If the Auxiliary Feedwater System (AFW) is started, perform the following to prevent steam generator feedring damage:

Justification:

Due to plant design this step is not required. In letter C-CE-8998, dated January 31, 1984, combustion engineer states the conditions necessary for waterhammer event do not exist at Waterford-3.

E. Recovery Actions

Step 9 (page 8-30):

If the SIS is operating, it may be throttled or stopped one train at a time if all of the following conditions are satisfied:

Justification:

The EOP does not assume a total loss of Feedwater. The Safety Function Status Checklist criteria states that at least one Steam Generator must remain available with Feedwater being supplied. A total loss of Feedwater will result in the operator going to the Safety Function Recovery Procedure. The Feedwater Control System and the Emergency Feedwater System control logic is designed to prevent an Safety Injection actuation following a reactor trip. Therefore the criteria for RCS Inventory Control and RCS Pressure Control are written assuming normal Inventory and Pressure Control. If Safety Injection is required then the operator would be required to go to the Safety Function Recovery Procedure.

Delete

E. **Recovery Actions**

Step 10 (page 8-30):

If all the criteria of step 9 cannot be maintained after the SIS has been stopped, the SIS must be restarted.

Justification:

This step is a followup to step 9 which is not used.

Delete

E. Recovery Actions

Step 21 (page 8-32):

If all feedwater (main and auxiliary) is lost, conduct the following activities:

Justification:

The EOP does not assume a total loss of Feedwater. The Safety Function Status Checklist criteria states that at least one Steam Generator must remain available with Feedwater being supplied. A total loss of Feedwater will result in the operator going to the Safety Function Recovery Procedure.

E. Recovery Actions

Step 22 (page 8-33):

[If feed to at least one steam generator cannot be restored, establish once through cooling by:]

Justification:

The EOP does not assume a total loss of Feedwater. The Safety Function Status Checklist criteria states that at least one Steam Generator must remain available with Feedwater being supplied. A total loss of Feedwater will result in the operator going to the Safety Function Recovery Procedure.

E. Recovery Actions

Step 23 (page 8-33):

[If other methods are available for heat removal from the RCS, insert that information here.]

Justification:

The EOP does not assume a total loss of Feedwater. The Safety Function Status Checklist criteria states that at least one Steam Generator must remain available with Feedwater being supplied. A total loss of Feedwater will result in the operator going to the Safety Function Recovery Procedure.

E. Recovery Actions

Step 24 (page 8-33):

If feedwater is regained, use either bypass or atmospheric dump valves to dump steam. Stop once-through-cooling if in use.

Justification:

The EOP does not assume a total loss of Feedwater. The Safety Function Status Checklist criteria states that at least one Steam Generator must must remain available with Feedwater being supplied. A total loss of Feedwater will result in the operator going to the Safety Function Recovery Procedure.

E. Recovery Actions

Step 25 (page 8-33):

Throughout the event attempt to maintain the RCS within the acceptable Post/Accident Pressure/Temperature Limits of Figure 8-7 by using the following:

Justification:

The EOP does not assume a total loss of Feedwater. The Safety Function Status Checklist criteria states that at least one Steam Generator must remain available with Feedwater being supplied. A total loss of Feedwater will result in the operator going to the Safety Function Recovery Procedure.

E. Recovery Actions

Step 26 (page 8-33):

Maintain the plant in a stabilized condition and evaluate the need for a plant cooldown based on plant conditions, systems availability and, if feedwater is regained, condensate inventory (per Figures 8-9 and 8-10).

Justification:

The EOP does not assume a total loss of Feedwater. The Safety Function Status Checklist criteria states that at least one Steam Generator must remain available with Feedwater being supplied. A total loss of Feedwater will result in the operator going to the Safety Function Recovery Procedure.

E. Recovery Actions

Precaution 1 (page 8-34):

The operator should not add feedwater to dry steam generator if another steam generator still contains water. Re-establish feedwater only to the steam generator that is not dry. If both steam generators become dry, refill only one steam generator to reinitiate core cooling.

Justification:

The occurrence of a dry steam generator would require multiple failures which is not covered in this procedure.

E. Recovery Actions

Precaution 6 (page 8-34):

Solid water operation of the pressurizer should be avoided unless [20°F] of subcooling cannot be maintained in the RCS (Figure 8-7). If the RCS is solid, closely monitor any makeup or draining and any steam heatup or cooldown to avoid any unfavorable rapid pressure excursions.

Justification:

This step applies to operation of safety injection for once-through cooling which is not covered in this procedure.

Delete

E. Recovery Actions

Precaution 8 (page 8-35):

[Monitor quench tank parameters since any sustained operation of the PORVs may burst the tank's rupture disc.]

Justification:

Waterford-3 does not have power operated relief valves.

E. Recovery Actions

Figure 8-8 (page 8-37):

Minimum Acceptable SIS Flos vs RCS Pressure Injection Mode.

Justification:

~~This figure applies to safety injection flow which is not used in this procedure~~.

This curve was not used since the only cause for an SIAS during a loss of Main feedwater would be overfeeding of the steam generators with resulting cooldown of the RCS. If this were to occur it would be for a relatively short duration. Inventory would be restored in a short period of time. This curve is more applicable to a LOCA.

4.0 List of Instruments and Ranges

Parameter and Ranges

Loss of Main Feedwater Recovery Procedure

Parameters	Required Range	Available Range
1. Pressurizer pressure	350 to 2365 psia	0 to 3000 psia
2. Pressurizer level	5 to 40%	0 to 100%
3. Pressurizer temperature	430 to 652°F	0 to 700°F
4. Average temperature	544 to 582°F	525 to 625°F
5. Cold leg temperature	350 to 550°F	0 to 600°F
6. Hot leg temperature	350 to 611°F	50 to 750°F
7. Subcooling margin	28 to 200°F	-200 to 200°F
8. Steam generator pressure	67 to 1050 psia	0 to 1200 psia
9. Steam generator level		
a. Wide range	50 to 71%	0 to 100%
b. Narrow range	60 to 70%	0 to 100%
10. Condensate storage pool level	27.7 to 97.7%	0 to 100%
11. Steam flow	0 to 7.5 x 10^6 lbm/hr	0 to 8 x 10^6 lbm/hr
12. Feed flow	0 to 7.5 x 10^6 lbm/hr	0 to 8 x 10^6 lbm/hr
13. Emergency feedwater flow	0 to 400 gpm	0 to 800 gpm
14. High pressure turbine gland sealing steam (local)	1.5 to 3 psig	0 to 15 psig
15. Low pressure turbine gland sealing steam (local)	1.5 to 3 psig	-30 in Hg Vac to 15 psig
16. Main feed pump gland sealing steam (local)	4 psig	-30 in Hg Vac to 60 psig
17. Gland steam pressure	140 psig	0 to 150 psig
18. Containment pressure	0 to 17.4 psig	0 to 30 psig
19. Safety injection tank pressure	235 to 625 psig	0 to 700 psig