LOUISIANA POWER AND LIGHT
WATERFORD-3 SES

TG-OP-902-008
TECHNICAL GUIDE

for

OP-902-008 Rev. 0
SAFETY FUNCTION RECOVERY PROCEDURE

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TECHNICAL GUIDE
for
SAFETY FUNCTION RECOVERY PROCEDURE

Table cf Contents

1.0 Procedure Step Guidelines

E_0. Recovery Actions: General Instructions

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_0. Recovery Actions: General Instructions

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_0. Recovery Actions: General Instructions

EOP Step Content:

Step 3. Refer to Foldout: Safety Function Status Checklist AND check ALL of the following Success Path-1 criteria to determine which safety functions are in jeopardy:

Objective:

The objective of this step is to initially assess all safety functions to determine which ones are in jeopardy.

Basis: (CEN-152, page 10-4, steps 2 and 3)

The primary purpose of this check is to provide an assessment of all relevant safety functions. Since the Safety Function Recovery Procedure may be used for a wide variety of events, it is not possible to know in advance which success path will be the primary one for each safety function or which safety function will be most affected. All the safety functions are assessed before any other actions are taken.

Operational Considerations:

If any Success Path-1 criteria are not satisfied, then the safety function is in jeopardy.

EPG Step Content: (CEN-152, page 10-103, steps 2 and 3)

Using the Safety Function Status Check, Figure 10-3, identify the status of safety functions. This is done by identifying the success path currently in use for each safety function and then checking the criteria for each path.

Assess all safety functions before going to resource assessment trees.

E_0. <u>Recovery Actions: General Instructions</u>
EOP Step 3 (Continued).

Justification of Differences:

The EPG step identifies which success path is currently in use. However, the basis says it is not possible to know in advance which success path will be the primary one for each safety function. Therefore it was decided that for the initial assessment, all safety functions would be checked against the Success Path-1 criteria, since this is the preferred success path. This also clearly defines which safety functions are in jeopardy, that is, not meeting the Success Path-1 criteria. This ensures that the operator consults the subprocedure for each safety function in jeopardy to verify alternate success paths are properly implemented instead of assuming the success path is properly implemented just because the criteria associated with that success path are being satisfied.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_0. Recovery Actions: General Instructions

EOP Step Content:

Step 4. Refer to Foldout: Safety Function Status Checklist AND check ALL criteria are being maintained for the success path in use.

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 for the success path in use.

Basis: (CEN-152, pages 10-4 and 10-10, steps 3 and 4)

The operator is required to continually verify that all relevant safety functions are being satisfied by comparing control board parameters to the criteria in the Foldout: Safety Function Status Checklist. This ensures that the status of all relevant safety functions is being monitored and that the appropriate success path criteria are being used as the plant lineup and conditions change. Since more than one success path for each safety function may be in use, the criteria associated with the lowest priority success path in use should be used. The criteria which are used to judge the status of each function are organized around the success paths for each function. Since each path uses or may use different technical means of achieving a function, the criteria for judging the success of that path are specific to the technical means. Also, in order to facilitate operator use, the criteria chosen are parameters which can be read directly from the control board. Thus, reactivity control criteria related to CEAs uses CEA bottom lights and that related to borating uses indications of reactor power and boron addition rate.

Operational Considerations:

Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading. Safety functions, as specified on Safety Function Status Checklist, shall be continuously monitored throughout the use of this procedure.

E_0. Recovery Actions: General Instructions

EOP Step 4 (Continued).

EPG Step Content: (CEN-152, page 10-103, step 4)

Whenever the Functional Recovery Guideline is in use, continuously assess the status of each safety function. Verify that all safety functions are being satisfied or identify those in jeopardy by comparing control board parameters to the criteria on Figure 10-3.

Justification of Differences:

The EOP step was expanded to check the criteria for the success path in use.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_0. Recovery Actions: General Instructions

EOP Step Content:

Step 5. For each safety function in jeopardy, refer to the appropriate subprocedure AND perform ALL the following Recovery Actions:

Objective:

The objective of this step is to identify available success paths for each safety function in jeopardy, and implement success paths until one is completed with its associated criteria being satisfied. This step also terminates lower priority success paths as higher priority success paths are implemented with associated criteria being satisfied.

Basis: (CEN-152, pages 10-10, 10-11, and 10-12, steps 5 and 7)

For each safety function not being satisfied, the operator can identify plant resources or success paths by referring to the resource assessment trees. The resource assessment trees provide information to the operator to assist in a determination of the availability of plant resources to be used to satisfy safety functions. The resource assessment trees provided are structured to show the intended priority (left to right) of implementation of success paths. Note that more than one success path may be employed for each safety function in order to satisfy the criteria of the last path (to the right) in use. Also note that the path with the highest priority is the path which corresponds to current plant conditions (e.g. the ECCS is designed to manage inventory control problems resulting from a LOCA). Each plant resource assessment tree pictorializes all the generic resources available for fulfilling a safety function. Limits have been developed for each component of the success path which permit the operator to interrogate the control board to decide if that success path is available. The operator performs the subprocedure recovery actions for the success paths to be implemented to satisfy the safety functions in jeopardy.

E_0. Recovery Actions: General Instructions

EOP Step 5 (Continued).

Basis: (Continued)

The subprocedure recovery actions provide step-by-step operational guidance, criteria for determining the successful control of a safety function, and associated precautions, all of which are necessary to implement the success paths identified on the resource assessment trees. Each subprocedure contains all the actions necessary to implement success paths recovering control of a jeopardized safety function. Criteria are included for determining the degree of success achieved in the attempt. Additional guidance is provided which aids the operator in determining the next course of action. For instance, if control of the safety function is achieved, the operator may be instructed to go on to the next safety function in jeopardy. Alternatively, the operator may be told to implement another success path in the case when the current path is inadequate.

Operational Considerations:

Each safety function in jeopardy should be treated one at a time, in order of priority, as they are listed on the Safety Function Status Checklist. On the Resource Assessment Trees, the order of priority for success paths is from left to right in descending order. More than one success path may be implemented at a time. When more than one success path is in use, then the success path criteria to be met are the criteria associated with the lowest priority success path in use.

EPG Step Content: (CEN-152, page 10-103, steps 5 and 7)

For each safety function that is not being satisfied, identify plant resources or success paths which can be used to fulfill them. Refer to Figures 10-4 through 10-9.

Perform the appropriate recovery action guidelines associated with the identified success paths.

E_0. Recovery Actions: General Instructions
EOP Step 5 (Continued).

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_0. Recovery Actions: General Instructions

EOP Step Content:

Step 6. When ALL safety functions are being controlled by satisfactorily maintaining the criteria associated with the implemented success path, go to OP-902-000, EMERGENCY ENTRY PROCEDURE, Section D. Diagnostics.

Objective:

The objective of this step is to diagnose and go to an optimal recovery procedure, if possible, and cooldown.

Basis: (CEN-152, page 10-12, step 8)

When all safety functions are satisfied, the operator shifts to the Emergency Entry Procedure and attempts to systematically evaluate the plant status to determine, if possible, what the cause of the emergency was, what course of action to take (e.g. proceed to cold shutdown) and what further emergency operating guidance is available.

Operational Considerations:

NA

EPG Step Content: (CEN-152, page 10-103, step 8)

Once each safety function is being satisfied, refer to Long Term Actions.

Justification of Differences:

The EPG Long Term Actions section was not used in the EOP. Most of the actions called for in the Long Term Actions section are already covered in the General Instructions. The only action not covered is deciding whether to cooldown. This decision will be made by the Technical Support Center and the shift supervisor, since it is dependent upon a variety of conditions which include Emergency Plan considerations. By our Administrative Procedures the Technical Support Center will be manned by 30-minute responders.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_1. <u>Recovery Actions: Subprocedure I. Vital Auxiliaries</u>

Success Path I-1

EOP Step Content:

Step 1. IF notified that electrical power is available to Startup Transformers AND Emergency Diesel Generators A AND B are NOT available, THEN restore electrical power with the Startup Transformers. Refer to OP-6-001, PLANT DISTRIBUTION (7KV, 4KV, and SSD) SYSTEMS, Section 6.1.

Objective:

The objective of this step to restore electrical distribution to a normal lineup.

Basis:

The preferred method of providing vital auxiliaries is from offsite power through the startup transformers. This step ensures offsite power is restored properly to the plant from a station blackout condition.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_1. Recovery Actions: Subprocedure I. Vital Auxiliaries
Success Path I-1

EOP Step Content:

Step 2. IF notified that electrical power is available to Startup Transformers AND Emergency Diesel Generators A AND B are operating, THEN restore electrical power to normal distribution lineup. Refer to OP-6-001, PLANT DISTRIBUTION (7KV, 4KV, and SSD) SYSTEMS, Section 6.6.3.

Objective:

The objective of this step is to restore electrical distribution to a normal lineup.

Basis:

The preferred method of providing vital auxiliaries is from offsite power through the startup transformers. This step ensures offsite power is restored properly to the plant from a loss of offsite power and that the emergency diesel generators are restored to normal standby lineup.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_1. Recovery Actions: Subprocedure I. Vital Auxiliaries
Success Path I-1

EOP Step Content:

Step 3. When electrical power is restored to normal distribution lineup, restore Main Turbine Lube Oil System to normal operation AND place Main Turbine on turning gear. Refer to OP-3-017, TURBINE LUBE OIL SYSTEM, Section 6.1.

Objective:

The objective of this step is to verify that turbine lube oil system is restored to normal lineup and placed on turning gear.

Basis:

This step is done to restore normal operating equipment to operation which was lost as a result of the loss of power.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_1. **Recovery Actions: Subprocedure I. Vital Auxiliaries**
Success Path I-1

EOP Step Content:

Step 4. IF Main Feed pump A is NOT operating AND electrical power is restored, THEN locally restore Main Feed Pump A Turbine Lube Oil System to normal operation AND place Main Feed Pump Turbine on turning gear. Refer to OP-3-003, CONDENSATE-FEEDWATER, Section 6.7.

Objective:

The objective of this step is to verify that main feed pump A turbine lube oil system is restored to normal lineup and placed on turning gear.

Basis:

This step is done to restore normal operating equipment to operation which was lost as a result of the loss of power.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_1. Recovery Actions: Subprocedure I. Vital Auxiliaries
Success Path I-1

EOP Step Content:

Step 5. IF Main Feed pump B is NOT operating AND electrical power is restored, THEN locally restore Main Feed Pump B Turbine Lube Oil System to normal operation AND place Main Feed Pump Turbine on turning gear. Refer to OP-3-003, CONDENSATE-FEEDWATER, Section 6.7.

Objective:

The objective of this step is to verify that main feed pump B turbine lube oil system is restored to normal lineup and placed on turning gear.

Basis:

This step is done to restore normal operating equipment to operation which was lost as a result of the loss of power.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_1. <u>Recovery Actions: Subprocedure I. Vital Auxiliaries</u>
Success Path I-1

EOP Step Content:

Step 6. When electrical power is restored to normal distribution lineup, locally perform the following:

Objective:

The objective of this step is to verify that seal oil system is restored to normal lineup.

Basis:

This step is done to restore normal operating equipment to operation which was lost as a result of the loss of power.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_1. Recovery Actions: Subprocedure I. Vital Auxiliaries
Success Path I-1

EOP Step Content:

Step 7. When electrical power is restored to normal distribution, start a Turbine Cooling Water pump. Refer to OP-3-027, TURBINE COOLING WATER SYSTEM.

Objective:

The objective of this step is to verify that turbine cooling water system is restored to normal lineup.

Basis:

This step is done to restore normal operating equipment to operation which was lost as a result of the loss of power.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_1. Recovery Actions: Subprocedure I. Vital Auxiliaries
Success Path I-1

EOP Step Content:

Step 8. IF a Turbine Cooling Water pump is operating AND Instrument Air Compressors have been aligned to Potable Water System, THEN locally align Seal Water Cooler to the Turbine Closed Cooling Water System by the following:

Objective:

The objective of this step is to ensure that cooling water for the instrument air compressors is aligned to the normal source of cooling.

Basis:

When turbine cooling water system is restored to normal lineup, the instrument air compressors are aligned to the normal source of cooling.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_1. Recovery Actions: Subprocedure I. Vital Auxiliaries

Success Path I-1

EOP Step Content:

Step 9. IF CIAS has occurred, THEN open CNTMT ISOLATION INSTRUMENT AIR (IA 908) valve.

Objective:

The objective of this step is to verify that instrument air is available to containment.

Basis:

If instrument air is isolated from containment, then it has to be aligned so that pneumatic valves can be operable.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_1. Recovery Actions: Subprocedure I. Vital Auxiliaries

Success Path I-1

EOP Step Content:

Step 10. IF Letdown has been isolated AND SIAS has NOT occurred, 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 and to restore reactor coolant pump bleedoff to normal lineup.

Basis:

The preferred means of controlling pressurizer level is by the chemical and volume control system. Since charging pumps will be started when power is restored, letdown needs to be placed in service to preclude a high inventory condition.

Operational Considerations:

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

NA

Justification of Differences:

NA

Source Document:

NA

E_1. Recovery Actions: Subprocedure I. Vital Auxiliaries

Success Path I-1

EOP Step Content:

Step 11. When BUS A3S is energized, verify Emergency Feedwater pump A operating.

Objective:

The objective of this step is to verify that emergency feedwater pump A is operating when power is restored.

Basis:

When the steam generators are being used for heat removal from the reactor coolant system, emergency feedwater has to be supplied to the steam generator to ensure a heat sink. For reliability, motor driven emergency feedwater pumps are verified operating when the appropriate electrical bus is energized.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_1. Recovery Actions: Subprocedure I. Vital Auxiliaries
Success Path I-1

EOP Step Content:

Step 12. When BUS B3S is energized, verify Emergency Feedwater pump B operating.

Objective:

The objective of this step is to verify that emergency feedwater pump B is operating when power is restored.

Basis:

When the steam generators are being used for heat removal from the reactor coolant system, emergency feedwater has to be supplied to the steam generator to ensure a heat sink. For reliability, motor driven emergency feedwater pumps are verified operating when the appropriate electrical bus is energized.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_1. <u>Recovery Actions: Subprocedure I. Vital Auxiliaries</u>
Success Path I-1

EOP Step Content:

Step 13. Restore Pressurizer Proportional heaters by the following:

Objective:

The objective of this step is to verify that pressurizer proportional heaters are available for pressure control.

Basis:

By ensuring pressure control, limits will be maintained on the post-accident pressure and temperature limits graph.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_1. <u>Recovery Actions: Subprocedure I. Vital Auxiliaries</u>
Success Path I-1

EOP Step Content:

Step 14. <u>IF</u> the following breakers are open <u>AND</u> <u>BOTH</u> A <u>AND</u> B safety busses are energized, <u>THEN</u> locally close the following breakers:

Objective:

The objective of this step is to restore electrical loads on distribution panels after electrical power is restored to normal distribution lineup.

Basis:

The action of this step is to ensure that electrical loads are restored to normal lineup so that all instrumentation is available to the control room operators.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E$_1$. Recovery Actions: Subprocedure I. Vital Auxiliaries

Success Path I-1

EOP Step Content:

Step 15. IF CSAS has occurred, AND Containment pressure <17.7 psia, AND RAS has NOT occurred, THEN realign Containment Spray for automatic initiation as follows:

Objective:

This step ensures that the containment spray system is available for operations.

Basis:

The containment spray system should be realigned for automatic operation when the CSAS relays are energized.

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:

PV-OP-902, Parameter Values Document. Table 5-4, Pressure.

E_1. Recovery Actions: Subprocedure I. Vital Auxiliaries

Success Path I-1

EOP Step Content:

Step 16. Check the following success path criteria:

Objective:

The objective of this step is to check the criteria associated with satisfactorily completing this success path.

Basis:

The basis for each individual criterion is given in Section 2.0 of the technical guide. The criteria are used to judge the status of each safety function. Since each safety function has multiple success paths which can be used to control that safety function, the criteria which are used to judge the status of each safety function are organized around the success paths for each safety function. Since each success path uses or may use different technical means of achieving a function, the criteria for judging the success of that path are specific to the technical means. Also, in order to facilitate operator use, the criteria chosen are parameters which can be read directly from the control board.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_1. Recovery Actions: Subprocedure I. Vital Auxiliaries

Success Path I-1

EOP Step Content:

Step 17. IF the success path criteria (step 16) are met, THEN go to the next safety function in jeopardy.

Objective:

The objective of this step is to instruct the operator what to do if this success path is satisfactorily completed.

Basis:

After checking the success path criteria, additional guidance is provided which aids the operator in determining the next course of action. In this step, if control of the safety function is achieved, the operator is instructed to go to the next safety function in jeopardy.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_1. <u>Recovery Actions: Subprocedure I. Vital Auxiliaries</u>

Success Path I-1

EOP Step Content:

Step 18. <u>IF</u> the success path criteria (step 16) are <u>NOT</u> met, <u>THEN</u> go to Success Path I-2.

Objective:

The objective of this step is to instruct the operator what to do if this success path is not satisfactorily completed.

Basis:

After checking the success path criteria, additional guidance is provided which aids the operator in determining the next course of action. In this step, if control of the safety function is not achieved, the operator is instructed to implement another success path for this safety function.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_1. <u>Recovery Actions: Subprocedure I. Vital Auxiliaries</u>
Success Path I-2

EOP Step Content:

Step 1. IF EITHER BUS A2 TO A3S TIE BKR OR BUS A3S TO A2 TIE BKR opens, THEN check the following:

Objective:

The objective of this step is to verify the emergency diesel generator A is providing electrical power to the A train safety busses.

Basis:

This step verifies that A safety busses are energized to provide power to safety related equipment. One train of safety related equipment operating is sufficient to verify adequate core cooling capability exists and that other safety functions are being satisfied.

Operational Considerations:

Emergency diesel generator load should not exceed 4840KW for two hours nor 4400KW for continuous loading.

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_1. <u>Recovery Actions: Subprocedure I. Vital Auxiliaries</u>
Success Path I-2

EOP Step Content:

Step 2. <u>IF</u> <u>EITHER</u> BUS B2 TO B3S TIE BKR <u>OR</u> BUS B3S TO B2 TIE BKR opens, <u>THEN</u> check the following:

Objective:

The objective of this step is to verify the emergency diesel generator B is providing electrical power to the B train safety busses.

Basis:

This step verifies that B safety busses are energized to provide power to safety related equipment. One train of safety related equipment operating is sufficient to verify adequate core cooling capability exists and that other safety functions are being satisfied.

Operational Considerations:

Emergency diesel generator load should not exceed 4840KW for two hours nor 4400KW for continuous loading.

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_1. Recovery Actions: Subprocedure I. Vital Auxiliaries
Success Path I-2

EOP Step Content:

Step 3. IF Emergency Diesel Generator A did NOT start AND Emergency Diesel Generator A breaker did NOT close, THEN perform EITHER of the following:

Objective:

The objective of this step is to attempt to start emergency diesel generator A in order to provide electrical power to the A train safety busses.

Basis:

This step attempts to energize A safety busses in order to provide power to safety related equipment. One train of safety related equipment operating is sufficient to verify adequate core cooling capability exists and that other safety functions are being satisfied.

Operational Considerations:

Emergency diesel generator load should not exceed 4840KW for two hours nor 4400KW for continuous loading.

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_1. Recovery Actions: Subprocedure I. Vital Auxiliaries
Success Path I-2

EOP Step Content:

Step 4. IF Emergency Diesel Generator B did NOT start AND Emergency Diesel Generator B breaker did NOT close, THEN perform EITHER of the following:

Objective:

The objective of this step is to attempt to start emergency diesel generator B in order to provide electrical power to the B train safety busses.

Basis:

This step attempts to energize B safety busses in order to provide power to safety related equipment. One train of safety related equipment operating is sufficient to verify adequate core cooling capability exists and that other safety functions are being satisfied.

Operational Considerations:

Emergency diesel generator load should not exceed 4840KW for two hours nor 4400KW for continuous loading.

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_1. Recovery Actions: Subprocedure I. Vital Auxiliaries
Success Path I-2

EOP Step Content:

Step 5. IF any Reactor Coolant Pump is operating AND Component Cooling Water is lost to Reactor Coolant Pumps for $\geq$3 minutes, THEN stop ALL Reactor Coolant Pumps.

Objective:

The objective of this step is to stop reactor coolant pump operation when component cooling water is lost.

Basis:

When component cooling water is lost to the reactor coolant pumps, damage to pump components could occur if the reactor coolant pumps are not secured.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_1. <u>Recovery Actions: Subprocedure I. Vital Auxiliaries</u>
Success Path I-2

EOP Step Content:

Step 6. IF BOTH Turbine Cooling Water pumps are NOT operating, THEN locally perform the following:

Objective:

The objective of this step is to ensure that cooling water is available to the instrument air compressors during a loss of offsite power.

Basis:

According to the Nash Engineering Company, the instrument air compressors can operate without a cooling water supply for a maximum time of 30 minutes and not have any damage to the compressor. When turbine cooling water is not operating, potable water is aligned for cooling of the air compressors.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

LW3-1666-83, dated December 12, 1983.

E_1. <u>Recovery Actions: Subprocedure I. Vital Auxiliaries</u>
Success Path I-2

EOP Step Content:

Step 7. <u>IF</u> CIAS has occurred, <u>THEN</u> open CNTMT ISOLATION INSTRUMENT AIR (IA 908).

Objective:

The objective of this step is to verify that instrument air is available to containment.

Basis:

If instrument air is isolated from containment, then it has to be aligned so that pneumatic valves can be operable.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_1. Recovery Actions: Subprocedure I. Vital Auxiliaries
Success Path I-2

EOP Step Content:

Step 8. IF Letdown has been isolated AND SIAS has NOT occurred, 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 and to restore reactor coolant pump bleedoff to normal lineup.

Basis:

The preferred means of controlling pressurizer level is by the chemical and volume control system. Since charging pumps will be started when power is restored, letdown needs to be placed in service to preclude a high inventory condition.

Operational Considerations:

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

NA

Justification of Differences:

NA

Source Document:

NA

E_1. <u>Recovery Actions: Subprocedure I. Vital Auxiliaries</u>
Success Path I-2

EOP Step Content:

Step 9. When BUS A3S is energized, verify Emergency Feedwater pump A operating.

Objective:

The objective of this step is to verify that emergency feedwater pump A is operating when power is restored.

Basis:

When the steam generators are being used for heat removal from the reactor coolant system, emergency feedwater has to be supplied to the steam generator to ensure a heat sink. For reliability, motor driven emergency feedwater pumps are verified operating when the appropriate electrical bus is energized.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_1. <u>Recovery Actions: Subprocedure I. Vital Auxiliaries</u>
Success Path I-2

EOP Step Content:

Step 10. When BUS B3S is energized, verify Emergency Feedwater pump B operating.

Objective:

The objective of this step is to verify that emergency feedwater pump B is operating when power is restored.

Basis:

When the steam generators are being used for heat removal from the reactor coolant system, emergency feedwater has to be supplied to the steam generator to ensure a heat sink. For reliability, motor driven emergency feedwater pumps are verified operating when the appropriate electrical bus is energized.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_1. <u>Recovery Actions: Subprocedure I. Vital Auxiliaries</u>
Success Path I-2

EOP Step Content:

Step 11. Restore Pressurizer Proportional heaters by the following:

Objective:

The objective of this step is to verify that pressurizer proportional heaters are available for pressure control.

Basis:

By ensuring pressure control, limits will be maintained on the post-accident pressure and temperature limits graph.

Operational Considerations:

If SIAS has occurred, then pressurizer heaters will be unavailable.

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_1. <u>Recovery Actions: Subprocedure I. Vital Auxiliaries</u>
Success Path I-2

EOP Step Content:

Step 12. <u>IF</u> the following breakers are open <u>AND</u> <u>BOTH</u> A <u>AND</u> B safety busses are energized, <u>THEN</u> locally close the following breakers:

Objective:

The objective of this step is to restore electrical loads on distribution panels after electrical power is restored to normal distribution lineup.

Basis:

The action of this step is to ensure that electrical loads are restored to normal lineup so that all instrumentation is available to the control room operators.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_1. Recovery Actions: Subprocedure I. Vital Auxiliaries
Success Path I-2

EOP Step Content:

Step 13. IF CSAS has occurred, AND Containment pressure <17.7 psia, AND RAS has NOT occurred, THEN realign Containment Spray for automatic initiation as follows:

Objective:

This step ensures that the containment spray system is available for operations.

Basis:

The containment spray system should be realigned for automatic operation when the CSAS relays are energized.

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:

PV-OP-902, Parameter Values Document. Table 5-4, Pressure.

E_1. Recovery Actions: Subprocedure I. Vital Auxiliaries

Success Path I-2

EOP Step Content:

Step 14. IF normal operating oil pumps are NOT operating, THEN verify the emergency oil pump operating for the following systems:

Objective:

The objective of this step is to verify that at least one oil pump is operating for the turbine, seal oil, main feed pump A, and main feed pump B.

Basis:

When nonsafety busses are deenergized, the normal supplying oil pumps are stopped. To protect equipment from damage, emergency oil pumps are automatically started. The emergency pump for the seal oil system is automatically started to prevent the hydrogen gas in the generator from leaking to the surrounding areas.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_1. Recovery Actions: Subprocedure I. Vital Auxiliaries
Success Path I-2

EOP Step Content:

Step 15. IF ALL nonsafety busses are deenergized, THEN locally open one of the following Main Condenser vacuum breaker valves:

Objective:

The objective of this step is to break vacuum for the main condenser.

Basis:

Since gland sealing steam is lost, this step will help prevent air leakage by the seals to the main condenser. Breaking the vacuum minimizes the time it takes for the turbines to stop rotating.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_1. Recovery Actions: Subprocedure I. Vital Auxiliaries
Success Path I-2

EOP Step Content:

Step 16. IF a Main Condenser vacuum breaker valve is open AND Main Condenser vacuum is 0.0"Hg, THEN secure Gland Sealing Steam by locally closing Main Steam to Gland Steam Isolation (MS 148) valve.

Objective:

The objective of this step is to verify the gland sealing steam is isolated.

Basis:

Because steam will not be available from main steam or auxiliary steam, this step ensures that the gland seal system is isolated from the main steam piping.

Operational Considerations:

Where mulitple 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:

NA

E_1. Recovery Actions: Subprocedure I. Vital Auxiliaries
Success Path I-2

EOP Step Content:

Step 17. IF Emergency Diesel Generator A is supplying power to Train A safety busses, THEN perform the following:

Objective:

The objective of this step is to remove all nonsafety loads from motor control center 314AS prior to energizing the sump pumps in the dry cooling tower.

Basis:

When emergency diesel generator A is supplying electrical power to safety busses, nonsafety load breakers are opened to prevent overloading the generator. Because motor control center 314AS supplies power to dry cooling tower A sump pumps, the tie breaker has to be closed. Energizing the sump pumps prevents possible flooding of area where motor control center 315AS is located.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

W3P82-0652C, dated March 30, 1982.

E_1. Recovery Actions: Subprocedure I. Vital Auxiliaries
Success Path I-2

EOP Step Content:

Step 18. IF nonsafety load breakers on MCC 314AS are open, THEN locally close the following Dry Tower Sump pump breakers:

Objective:

The objective of this step is to ensure that the dry cooling tower A sump pumps are energized.

Basis:

Because motor control center 315AS is located in area of dry cooling tower, sump pumps are energized to prevent possible flooding of area which would not allow operation of safety related equipment.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

W3P82-0652C, dated March 30, 1982.

E_1. <u>Recovery Actions: Subprocedure I. Vital Auxiliaries</u>
Success Path I-2

EOP Step Content:

Step 19. <u>IF</u> Emergency Diesel Generator B is supplying power to Train B safety busses, <u>THEN</u> perform the following:

Objective:

The objective of this step is to remove all nonsafety loads from motor control center 314BS prior to energizing the sump pumps in the dry cooling tower.

Basis:

When emergency diesel generator B is supplying electrical power to safety busses, nonsafety load breakers are opened to prevent overloading the generator. Because motor control center 314BS supplies power to dry cooling tower B sump pumps, the tie breaker has to be closed. Energizing the sump pumps prevents possible flooding of area where motor control center 315BS is located.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

W3P82-0652C, dated March 30, 1982.

E_1. <u>Recovery Actions: Subprocedure I. Vital Auxiliaries</u>
Success Path I-2

EOP Step Content:

Step 20. IF nonsafety load breakers on MCC 314BS are open, THEN locally close the following Dry Tower Sump pump breakers:

Objective:

The objective of this step is to ensure that the dry cooling tower B sump pumps are energized.

Basis:

Because motor control center 315BS is located in area of dry cooling tower, sump pumps are energized to prevent possible flooding of area which would not allow operation of safety related equipment.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

W3P82-0652C, dated March 30, 1982.

E_1. <u>Recovery Actions: Subprocedure I. Vital Auxiliaries</u>
Success Path I-2

EOP Step Content:

Step 21. Check the following success path criterion:

Objective:

The objective of this step is to check the criterion associated with satisfactorily completing this success path.

Basis:

The basis for each individual criterion is given in Section 2.0 of the technical guide. The criteria are used to judge the status of each safety function. Since each safety function has multiple success paths which can be used to control that safety function, the criteria which are used to judge the status of each safety function are organized around the success paths for each safety function. Since each success path uses or may use different technical means of achieving a function, the criteria for judging the success of that path are specific to the technical means. Also, in order to facilitate operator use, the criteria chosen are parameters which can be read directly from the control board.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_1. <u>Recovery Actions: Subprocedure I. Vital Auxiliaries</u>
Success Path I-2

EOP Step Content:

Step 22. <u>IF</u> the success path criterion (step 21) is met, <u>THEN</u> go to the next safety function in jeopardy.

Objective:

The objective of this step is to instruct the operator what to do if this success path is satisfactorily completed.

Basis:

After checking the success path criterion, additional guidance is provided which aids the operator in determining the next course of action. In this step, if control of the safety function is achieved, the operator is instructed to go to the next safety function in jeopardy.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_1. Recovery Actions: Subprocedure I. Vital Auxiliaries

Success Path I-2

EOP Step Content:

Step 23. IF the success path criterion (step 21) is NOT met, THEN go to Success Path I-3.

Objective:

The objective of this step is to instruct the operator what to do if this success path is not satisfactorily completed.

Basis:

After checking the success path criterion, additional guidance is provided which aids the operator in determining the next course of action. In this step, if control of the safety function is not achieved, the operator is instructed to implement another success path for this safety function.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_1. Recovery Actions: Subprocedure I. Vital Auxiliaries
Success Path I-3

EOP Step Content:

Step 1. Record the time of the loss of ALL safety AND nonsafety busses in the Control Room log.

Objective:

The objective of this step is to record the time that all AC busses are deenergized.

Basis:

The plant can be safely controlled with all AC busses deenergized for two hours without jeopardizing safety functions. The A and B battery duty cycles will be in excess of 2 hours when certain loads (specified in the source document) are removed from the batteries.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

LW3-1666-83, dated December 12, 1983.

E_1. **Recovery Actions: Subprocedure I. Vital Auxiliaries**
Success Path I-3

EOP Step Content:

Step 2. Verify BOTH CNTMT ISOL VLVS closed:

Objective:

The objective of this step is to verify that all sources of inventory loss are secured.

Basis:

When all methods of makeup to the reactor coolant system are lost, the sources of inventory removal have to be isolated.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

LW3-1666-83, dated December 12, 1983.

E_1. Recovery Actions: Subprocedure I. Vital Auxiliaries
Success Path I-3

EOP Step Content:

Step 3. Verify the following RCS SAMPLING ISOLATION valves closed:

Objective:

The objective of this step is to verify that all sources of inventory loss are secured.

Basis:

When all methods of makeup to the reactor coolant system are lost, the sources of inventory removal have to be isolated.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

LW3-1666-83, dated December 12, 1983.

E_1. Recovery Actions: Subprocedure I. Vital Auxiliaries
Success Path I-3

EOP Step Content:

Step 4. Verify the following valves closed:

Objective:

The objective of this step is to verify that all sources of inventory loss are secured.

Basis:

When all methods of makeup to the reactor coolant system are lost, the sources of inventory removal have to be isolated.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

LW3-1666-83, dated December 12, 1983.

E_1. Recovery Actions: Subprocedure I. Vital Auxiliaries
Success Path I-3

EOP Step Content:

Step 5. IF Containment pressure <17.7 psia AND RAS has NOT occurred, THEN place the following switches in "OFF" position:

Objective:

The objective of this step is to prevent containment spray flow to the containment.

Basis:

When the ESFAS relays are deenergized, the containment spray pumps are locked out. This will prevent containment spray flow when the safety busses are energized because the CSAS relays are in the actuate position.

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:

PV-OP-902, Parameter Values Document. Table 5-4, Pressure.

E_1. <u>Recovery Actions: Subprocedure I. Vital Auxiliaries</u>
Success Path I-3

EOP Step Content:

Step 6. Locally open the following breakers on PDP 3MA-S:

Objective:

The objective of this step is to secure unnecessary loads on the batteries.

Basis:

The plant can be safely controlled with all AC busses deenergized, but the time is restricted by the battery cycles. By opening the breakers for these loads, the battery duty cycles will be in excess of 2 hours. Within 2 hours, operability will be restored by offsite power or an emergency diesel generator.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

LW3-1666-83, dated December 12, 1983.

E_1. Recovery Actions: Subprocedure I. Vital Auxiliaries

Success Path I-3

EOP Step Content:

Step 7. Locally open the following breakers on PDP 3MB-S:

Objective:

The objective of this step is to secure unnecessary loads on the batteries.

Basis:

The plant can be safely controlled with all AC busses deenergized, but the time is restricted by the battery cycles. By opening the breakers for these loads, the battery duty cycles will be in excess of 2 hours. Within 2 hours, operability will be restored by offsite power or an emergency diesel generator.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

LW3-1666-83, dated December 12, 1983.

E_1. Recovery Actions: Subprocedure I. Vital Auxiliaries
Success Path I-3

EOP Step Content:

Step 8. Locally open the following breakers on PDP 3MC-S:

Objective:

The objective of this step is to secure unnecessary loads on the batteries.

Basis:

The plant can be safely controlled with all AC busses deenergized, but the time is restricted by the battery cycles. By opening the breakers for these loads, the battery duty cycles will be in excess of 2 hours. Within 2 hours, operability will be restored by offsite power or an emergency diesel generator.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

LW3-1666-83, dated December 12, 1983.

E_1. Recovery Actions: Subprocedure I. Vital Auxiliaries
Success Path I-3

EOP Step Content:

Step 9. Locally open the following breakers on PDP 3MD-S:

Objective:

The objective of this step is to secure unnecessary loads on the batteries.

Basis:

The plant can be safely controlled with all AC busses deenergized, but the time is restricted by the battery cycles. By opening the breakers for these loads, the battery duty cycles will be in excess of 2 hours. Within 2 hours, operability will be restored by offsite power or an emergency diesel generator.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

LW3-1666-83, dated December 12, 1983.

E_1. <u>Recovery Actions: Subprocedure I. Vital Auxiliaries</u>
Success Path I-3

EOP Step Content:

Step 10. IF EITHER of the following conditions exists, THEN throttle OR stop Emergency Feedwater flow to the Steam Generator:

Objective:

The objective of this step is to prevent excessive cooldown of the reactor coolant system.

Basis:

If either of the conditions exists, emergency feedwater is throttled or stopped to prevent pressurizer level from dropping to a critical point. This level drop could cause voids in the reactor vessel head. If a steam bubble forms in the vessel head, then adequate core cooling could not be verified.

Operational Considerations:

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

NA

Justification of Differences:

NA

Source Document:

PV-OP-902, Parameter Values Document. Table 5-1, Level.
LW3-1666-83, dated December 12, 1983.

E_1. **Recovery Actions: Subprocedure I. Vital Auxiliaries**
Success Path I-3

EOP Step Content:

Step 11. Verify Emergency Feedwater pump AB Turbine operating with EITHER of the following valves open:

Objective:

The objective of this step is to verify that both steam supply valves are open for the AB emergency feedwater pump.

Basis:

Since AB emergency feedwater pump is the only source of water to the steam generators, the steam supply valves to the turbine shall be verified open.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_1. Recovery Actions: Subprocedure I. Vital Auxiliaries
Success Path I-3

EOP Step Content:

Step 12. Perform ALL the following:

Objective:

The objective of this step is to verify that the emergency oil pumps are operating for the turbine, seal oil, main feed pump A, and main feed pump B.

Basis:

When nonsafety busses are deenergized, the normal supplying oil pumps are stopped. To protect equipment from damage, emergency oil pumps are automatically started. The emergency pump for the seal oil system is automatically started to prevent the hydrogen gas in the generator from leaking to the surrounding areas.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_1. <u>Recovery Actions: Subprocedure I. Vital Auxiliaries</u>
Success Path I-3

EOP Step Content:

Step 13. Locally open one of the following Main Condenser vacuum breaker valves:

Objective:

The objective of this step is to break vacuum for the main condenser.

Basis:

Since gland sealing steam is lost, this step will help prevent air leakage by the seals to the main condenser. Breaking the vacuum minimizes the time it takes for the turbines to stop rotating.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_1. Recovery Actions: Subprocedure I. Vital Auxiliaries
Success Path I-3

EOP Step Content:

Step 14. When a Main Condenser vacuum breaker valve is open AND Main Condenser vacuum is 0.0"Hg, secure Gland Sealing Steam by locally closing Main Steam to Gland Steam Isolation (MS 148) valve.

Objective:

The objective of this step is to verify the gland sealing steam is isolated.

Basis:

Because steam will not be available from main steam or auxiliary steam, this step ensures that the gland seal steam system is isolated from the main steam piping.

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:

NA

E_1. Recovery Actions: Subprocedure I. Vital Auxiliaries

Success Path I-3

EOP Step Content:

Step 15. Verify the following valves closed for BOTH Steam Generators:

Objective:

The objective of this step is to verify that the steam generators are isolated.

Basis:

Since inventory for emergency feedwater can be critical when station blackout is extended to two hours, the steam generators are isolated to help control heat removal.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_1. <u>Recovery Actions: Subprocedure I. Vital Auxiliaries</u>
Success Path I-3

EOP Step Content:

Step 16. Verify the following isolation valves closed:

Objective:

The objective of this step is to verify that the component cooling water isolation valves to the reactor coolant pumps are closed.

Basis:

During a station blackout, before electrical power is restored, component cooling water is isolated to the reactor coolant pumps. This action will prevent thermal shocking the reactor coolant pump seals which could cause seal failures.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_1. <u>Recovery Actions: Subprocedure I. Vital Auxiliaries</u>
Success Path I-3

EOP Step Content:

Step 17. Check the following success path criterion:

Objective:

The objective of this step is to check the criterion associated with satisfactorily completing this success path.

Basis:

The basis for each individual criterion is given in Section 2.0 of the technical guide. The criteria are used to judge the status of each safety function. Since each safety function has multiple success paths which can be used to control that safety function, the criteria which are used to judge the status of each safety function are organized around the success paths for each safety function. Since each success path uses or may use different technical means of achieving a function, the criteria for judging the success of that path are specific to the technical means. Also, in order to facilitate operator use, the criteria chosen are parameters which can be read directly from the control board.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_1. <u>Recovery Actions: Subprocedure I. Vital Auxiliaries</u>
Success Path I-3

EOP Step Content:

Step 18. <u>IF</u> the success path criterion (step 17) is met, <u>THEN</u> go to the next safety function in jeopardy.

Objective:

The objective of this step is to instruct the operator what to do if this success path is satisfactorily completed.

Basis:

After checking the success path criterion, additional guidance is provided which aids the operator in determining the next course of action. In this step, if control of the safety function is achieved, the operator is instructed to go to the next safety function in jeopardy.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_1. Recovery Actions: Subprocedure I. Vital Auxiliaries
Success Path I-3

EOP Step Content:

Step 19. IF the success path criterion (step 17) is NOT met, THEN continue with Subprocedure I. Vital Auxiliaries until a success path criterion is satisfactorily being maintained.

Objective:

The objective of this step is to instruct the operator what to do if this success path is not satisfactorily completed.

Basis:

If the criteria are not met, then Vital Auxiliaries is still in jeopardy. The operator should not leave Vital Auxiliaries until this function is fulfilled.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_1. Recovery Actions: Subprocedure I. Vital Auxiliaries

Success Path I-3

EOP Step Content:

Step 20. IF the Control Room Supervisor determines it is necessary to pursue other safety functions in jeopardy, THEN go to the next safety function in jeopardy AND implement its subprocedure concurrently with this subprocedure.

Objective:

The objective of this step is to allow the control room supervisor to pursue other safety functions in jeopardy while efforts are continued on Vital Auxiliaries.

Basis:

The operator may, if necessary, pursue other urgent safety functions but must continue to attempt to establish Vital Auxiliaries.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_2. Recovery Actions: Subprocedure II. Reactivity Control

Success Path II-1

EOP Step Content:

Step 1. IF ≤2 CEAS are NOT fully inserted, THEN go to Success Path II-2.

Objective:

The objective of this step is to direct the operator to the next success path if ≤2 CEAs are not fully inserted.

Basis:

Since Success Path II-1 only applies if >2 CEAs are not fully inserted, this step directs the operator to go to the next success path which deals with other causes for Reactivity Control being in jeopardy.

Operational Considerations:

Reactor coolant system temperature changes should be minimized anytime Reactivity Control is in jeopardy.

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_2. Recovery Actions: Subprocedure II. Reactivity Control
Success Path II-1

EOP Step Content:

Step 2. IF SST A32 FEEDER AND SST B32 FEEDER breakers were cycled in OP-902-000, EMERGENCY ENTRY PROCEDURE, Section C. Immediate Actions, THEN go to step 4.

Objective:

The objective of this step is to bypass step 3 if the operation has been performed.

Basis:

Since certain conditions require this operation to be performed in OP-902-000, Emergency Entry Procedure, Section C. Immediate Actions, it is not necessary to perform this operation again.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_2. Recovery Actions: Subprocedure II. Reactivity Control
Success Path II-1

EOP Step Content:

Step 3. Open BOTH of the following breakers for 5 seconds AND reclose:

Objective:

The objective of this step is to open the supply breakers to the busses, which supply the CEDM MG sets, in an attempt to insert the CEAs into the core.

Basis: (CEN-152, page 10-16, step 2)

An attempt is made to manually insert the CEAs into the core. This is done by performing as many of the following actions as necessary:

a) Manual trip buttons are pushed
b) CEA trip breakers are opened
c) Control rod drive motor generators are deenergized
d) [If other methods are available to insert CEAs, that information is inserted.]

These actions are performed to deenergize the CEAs.

Operational Considerations:

If possible, to prevent core power increases following the initial transient, reactor coolant system temperature is maintained constant until reactivity control is satisfied. Temperature is maintained constant instead of being reduced to prevent core power increases due to the negative moderator temperature coefficient.

EPG Step Content: (CEN-152, page 10-111, step 2)

Attempt to manually insert the CEAs into the core. Perform all of the following actions:

E_2. <u>Recovery Actions: Subprocedure II. Reactivity Control</u>

Success Path II-1

EOP Step 3 (Continued).

Justification of Differences:

In order to effectively attempt the CEA drive down of EPG Success Path RC-4, power must still be available to the CEDM MG sets. Therefore, EPG Success Path RC-4 was included in EOP Success Path II-1. The EPG step was divided into two EOP steps to include CEA drive down before deenergizing CEDM MG sets locally.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_2. Recovery Actions: Subprocedure II. Reactivity Control
Success Path II-1

EOP Step Content:

Step 4. IF >2 CEAs are still NOT fuly inserted, THEN perform the following:

Objective:

The objective of this step is to attempt other methods of inserting CEAs into the core if the previous methods have failed.

Basis: (CEN-152, page 10-16, step 2)

An attempt is made to manually insert the CEAs into the core. This is done by performing as many of the following actions as necessary:

a) Manual trip buttons are pushed
b) CEA trip breakers are cpened
c) Control rod drive motor generators are deenergized
d) [If other methods are available to insert CEAs, that information is inserted.]

These actions are performed to deenergize the CEAs.

Operational Considerations:

NA

E_2. Recovery Actions: Subprocedure II. Reactivity Control

Success Path II-1

EOP Step 4 (Continued).

EPG Step Content: (CEN-152, page 10-111, step 2)

Attempt to manually insert the CEAs into the core. Perform all of the following actions:

Justification of Differences:

In order to effectively attempt the CEA drive down of EPG Success Path RC-4, power must still be available to the CEDM MG sets. Therefore, EPG Success Path RC-4 was included in EOP Success Path II-1. The EPG step was divided into two EOP steps to include control element assembly drive down before deenergizing CEDM MG sets locally.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_2. Recovery Actions: Subprocedure II. Reactivity Control
Success Path II-1

EOP Step Content:

Step 5. IF Emergency Boration is in progress, THEN go to Success Path II-2.

Objective:

The objective of this step is to direct the operator to the appropriate procedure if emergency boration is in progress.

Basis:

Since this success path does not deal with emergency boration and since emergency boration may be in progress for Reactivity Control, the operator is directed to go to the success path which will deal with emergency boration.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_2. Recovery Actions: Subprocedure II. Reactivity Control
Success Path II-1

EOP Step Content:

Step 6. Check the following success path criterion:

Objective:

The objective of this step is to check the criterion associated with satisfactorily completinc .his success path.

Basis: (CEN-152, page 10-4, step 3)

The basis for each individual criterion is given in Section 2.0 of the technical guide. The criteria are used to judge the status of each safety function. Since each safety function has multiple success paths which can be used to control that safety function, the criteria which are used to judge the status of each safety function are organized around the success paths for each safety function. Since each success path uses or may use different technical means of achieving a function, the criteria for judging the success of that path are specific to the technical means. Also, in order to facilitate operator use, the criteria chosen are parameters which can be read directly from the control board.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_2. Recovery Actions: Subprocedure II. Reactivity Control

Success Path II-1

EOP Step Content:

Step 7. IF the success path criterion (step 6) is met, THEN go to the next safety function in jeopardy.

Objective:

The objective of this step is to instruct the operator what to do if this success path is satisfactorily completed.

Basis: (CEN-152, page 10-12, step 7)

After checking the success path criteria, additional guidance is provided which aids the operator in determining the next course of action. In this step, if control of the safety function is achieved, the operator is instructed to go to the next safety function in jeopardy.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_2. <u>Recovery Actions: Subprocedure II. Reactivity Control</u>
Success Path II-1

EOP Step Content:

Step 8. <u>IF</u> the success path criterion (step 6) is <u>NOT</u> met, <u>THEN</u> go to Success Path II-2.

Objective:

The objective of this step is to instruct the operator what to do if this success path is not satisfactorily completed.

Basis: (CEN-152, page 10-12, step 7)

After checking the success path criteria, additional guidance is provided which aids the operator in determining the next course of action. In this step, if control of the safety function is not achieved, the operator is instructed to implement another success path for this safety function.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_2. Recovery Actions: Subprocedure II. Reactivity Control
Success Path II-2

EOP Step Content:

Step 1. IF Emergency Boration is NOT in progress, THEN commence Emergency Boration as follows:

Objective:

The objective of this step is to ensure emergency boration is in progress if Reactivity Control is in jeopardy.

Basis: (CEN-152, page 10-18, step 2)

In the case where the control rods do not insert or where additional negative reactivity is needed to compensate for temperature defect, reactivity control can be accomplished by boron injection. Borated water can be added to the RCS using charging and the boric acid addition portions of the CVCS.

Maximum boration is commenced using the CVCS to achieve shutdown margin in accordance with Technical Specification Limits. The following actions are performed.

a) The charging pumps are aligned to take a suction from [boric acid makeup tanks using either gravity feed or the boric acid makeup pumps, or from the RWT using gravity feed].

b) The charging pumps are aligned to the normal charging header. If the normal charging lines are not available, line up to charge to the RCS through the HPSI header.

c) Charging pumps and letdown are manually operated to maintain pressurizer level between [35" and 245"].

E_2. <u>Recovery Actions: Subprocedure II. Reactivity Control</u>

Success Path II-2

EOP Step 1 (Continued).

Basis: (Continued)

The charging pumps are aligned to discharge the contents of the [boric acid makeup tanks (primary source of boric acid to the RCS and core)]. The [boric acid makeup tank] contents may reach the suction of the charging pumps via gravity feed or via the boric acid makeup pumps. These sources should usually not be used past [1 hour] after event initiation (unless required for reactivity control) to prevent boron precipitation. Boron precipitation is only a concern if charging from the concentrated source has been continuous since event initiation. This is the preferred method for boron addition. Alternative sources for boron are the RWT and the [spent fuel pool]. If the normal charging pathway is unavailable, the charging pumps may be lined up to discharge to the RCS through the HPSI header.

Operational Considerations:

If possible, to prevent core power increases following the initial transient, reactor coolant system temperature is maintained constant until Reactivity Control safety function is satisfied. Temperature is maintained constant instead of being reduced to prevent core power increases due to the negative moderator temperature coefficient.

EPG Step Content: (CEN-152, page 10-113, step 2)

Commence maximum boration to achieve shutdown margin in accordance with Technical Specification Limits using the CVCS. Perform the following actions:

Justification of Differences:

The EPG step was divided into several steps to cover all the suction sources and discharge paths available as well as all the required actions of each. The EOP also covers termination of emergency boration.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_2. Recovery Actions: Subprocedure II. Reactivity Control

Success Path II-2

EOP Step Content:

Step 2. IF Charging Header flow <40 gpm through the normal Charging pump discharge path, THEN align Charging pumps to discharge through HPSI Header A OR B as follows:

Objective:

The objective of this step is to realign the charging pump discharge to the high pressure safety injection header if the normal charging path is not available.

Basis: (CEN-152, page 10-18, step 2)

In the case where the control rods do not insert or where additional negative reactivity is needed to compensate for temperature defect, reactivity control can be accomplished by boron injection. Borated water can be added to the RCS using charging and the boric acid addition portions of the CVCS.

Maximum boration is commenced using the CVCS to achieve shutdown margin in accordance with Technical Specification Limits. The following actions are performed.

a) The charging pumps are aligned to take a suction from [boric acid makeup tanks using either gravity feed or the boric acid makeup pumps, or from the RWT using gravity feed].

b) The charging pumps are aligned to the normal charging header. If the normal charging lines are not available, line up to charge to the RCS through the HPSI header.

c) Charging pumps and letdown are manually operated to maintain pressurizer level between [35" and 245"].

E_2. Recovery Actions: Subprocedure II. Reactivity Control

Success Path II-2

EOP Step 2 (Continued).

Basis: (Continued)

The charging pumps are aligned to discharge the contents of the [boric acid makeup tanks (primary source of boric acid to the RCS and core)]. The [boric acid makeup tank] contents may reach the suction of the charging pumps via gravity feed or via the boric acid makeup pumps. These sources should usually not be used past [1 hour] after event initiation (unless required for reactivity control) to prevent boron precipitation. Boron precipitation is only a concern if charging from the concentrated source has been continuous since event initiation. This is the preferred method for boron addition. Alternative sources for boron are the RWT and the [spent fuel pool]. If the normal charging pathway is unavailable, the charging pumps may be lined up to discharge to the RCS through the HPSI header.

Operational Considerations:

If high pressure safety injection pumps are operating, the charging pumps should not be aligned to the high pressure safety injection header. The normal charging pump discharge path is through the charging header isolation valve (CVC 209). Charging header flow will not indicate with the charging header isolation valve (CVC 209) closed.

EPG Step Content: (CEN-152, page 10-113, step 2)

Commence maximum boration to achieve shutdown margin in accordance with Technical Specification Limits using the CVCS. Perform the following actions:

Justification of Differences:

The EPG step was divided into several steps to cover all the suction sources and discharge paths available as well as all the required actions of each. The EOP also covers termination of emergency boration.

E_2. <u>Recovery Actions: Subprocedure II. Reactivity Control</u>

Success Path II-2

EOP Step 2 (Continued).

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_2. <u>Recovery Actions: Subprocedure II. Reactivity Control</u>
Success Path II-2

EOP Step Content:

Step 3. <u>IF</u> BORIC ACID MAKEUP TANK A LEVEL LO-LO (CP-4, H-6) alarm <u>OR</u> BORIC ACID MAKEUP TANK B LEVEL LO-LO (CP-4, H-7) alarm occurs with the associated Boric Acid pump operating, <u>THEN</u> perform the following:

Objective:

The objective of this step is to transfer to the opposite boric acid makeup tank if a low level occurs on the tank in service.

Basis: (CEN-152, page 10-18, step 2)

In the case where the control rods do not insert or where additional negative reactivity is needed to compensate for temperature defect, reactivity control can be accomplished by boron injection. Borated water can be added to the RCS using charging and the boric acid addition portions of the CVCS.

Maximum boration is commenced using the CVCS to achieve shutdown margin in accordance with Technical Specification Limits. The following actions are performed.

a) The charging pumps are aligned to take a suction from [boric acid makeup tanks using either gravity feed or the boric acid makeup pumps, or from the RWT using gravity feed].

b) The charging pumps are aligned to the normal charging header. If the normal charging lines are not available, line up to charge to the RCS through the HPSI header.

c) Charging pumps and letdown are manually operated to maintain pressurizer level between [35" and 245"].

E_2. Recovery Actions: Subprocedure II. Reactivity Control

Success Path II-2

EOP Step 3 (Continued).

Basis: (Continued)

The charging pumps are aligned to discharge the contents of the [boric acid makeup tanks (primary source of boric acid to the RCS and core)]. The [boric acid makeup tank] contents may reach the suction of the charging pumps via gravity feed or via the boric acid makeup pumps. These sources should usually not be used past [1 hour] after event initiation (unless required for reactivity control) to prevent boron precipitation. Boron precipitation is only a concern if charging from the concentrated source has been continuous since event initiation. This is the preferred method for boron addition. Alternative sources for boron are the RWT and the [spent fuel pool]. If the normal charging pathway is unavailable, the charging pumps may be lined up to discharge to the RCS through the HPSI header.

Operational Considerations:

NA

EPG Step Content: (CEN-152, page 10-113, step 2)

Commence maximum boration to achieve shutdown margin in accordance with Technical Specification Limits using the CVCS. Perform the following actions:

Justification of Differences:

The EPG step was divided into several steps to cover all the suction sources and discharge paths available as well as all the required actions of each. The EOP also covers termination of emergency boration.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_2. Recovery Actions: Subprocedure II. Reactivity Control
Success Path II-2

EOP Step Content:

Step 4. Evaluate Emergency Boration flow capacity as follows:

Objective:

The objective of this step is to determine if adequate emergency boration flow capacity exists from the boric acid makeup tanks.

Basis: (CEN-152, page 10-18, step 2)

In the case where the control rods do not insert or where additional negative reactivity is needed to compensate for temperature defect, reactivity control can be accomplished by boron injection. Borated water can be added to the RCS using charging and the boric acid addition portions of the CVCS.

Maximum boration is commenced using the CVCS to achieve shutdown margin in accordance with Technical Specification Limits. The following actions are performed.

a) The charging pumps are aligned to take a suction from [boric acid makeup tanks using either gravity feed or the boric acid makeup pumps, or from the RWT using gravity feed].

b) The charging pumps are aligned to the normal charging header. If the normal charging lines are not available, line up to charge to the RCS through the HPSI header.

c) Charging pumps and letdown are manually operated to maintain pressurizer level between [35" and 245"].

E_2. Recovery Actions: Subprocedure II. Reactivity Control

Success Path II-2

EOP Step 4 (Continued).

Basis: (Continued)

The charging pumps are aligned to discharge the contents of the [boric acid makeup tanks (primary source of boric acid to the RCS and core)]. The [boric acid makeup tank] contents may reach the suction of the charging pumps via gravity feed or via the boric acid makeup pumps. These sources should usually not be used past [1 hour] after event initiation (unless required for reactivity control) to prevent boron precipitation. Boron precipitation is only a concern if charging from the concentrated source has been continuous since event initiation. This is the preferred method for boron addition. Alternative sources for boron are the RWT and the [spent fuel pool]. If the normal charging pathway is unavailable, the charging pumps may be lined up to discharge to the RCS through the HPSI header.

Operational Considerations:

NA

EPG Step Content: (CEN-152, page 10-113, step 2)

Commence maximum boration to achieve shutdown margin in accordance with Technical Specification Limits using the CVCS. Perform the following actions:

Justification of Differences:

The EPG step was divided into several steps to cover all the suction sources and discharge paths available as well as all the required actions of each. The EOP also covers termination of emergency boration.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_2. <u>Recovery Actions: Subprocedure II. Reactivity Control</u>
Success Path II-2

EOP Step Content:

Step 5. <u>IF</u> Emergency Boration flow capacity is <u>NOT</u> within specified limits (step 4), <u>THEN</u> align the Charging pumps to take suction from the Refueling Water Storage Pool as follows:

Objective:

The objective of this step is to align the charging pump suction to the refueling water storage pool if adequate emergency boration flow does not exist from the boric acid makeup tanks.

Basis: (CEN-152, page 10-18, step 2)

In the case where the control rods do not insert or where additional negative reactivity is needed to compensate for temperature defect, reactivity control can be accomplished by boron injection. Borated water can be added to the RCS using charging and the boric acid addition portions of the CVCS.

Maximum boration is commenced using the CVCS to achieve shutdown margin in accordance with Technical Specification Limits. The following actions are performed.

a) The charging pumps are aligned to take a suction from [boric acid makeup tanks using either gravity feed or the boric acid makeup pumps, or from the RWT using gravity feed].

b) The charging pumps are aligned to the normal charging header. If the normal charging lines are not available, line up to charge to the RCS through the HPSI header.

c) Charging pumps and letdown are manually operated to maintain pressurizer level between [35" and 245"].

E_2. Recovery Actions: Subprocedure II. Reactivity Control

Success Path II-2

EOP Step 5 (Continued).

Basis: (Continued)

The charging pumps are aligned to discharge the contents of the [boric acid makeup tanks (primary source of boric acid to the RCS and core)]. The [boric acid makeup tank] contents may reach the suction of the charging pumps via gravity feed or via the boric acid makeup pumps. These sources should usually not be used past [1 hour] after event initiation (unless required for reactivity control) to prevent boron precipitation. Boron precipitation is only a concern if charging from the concentrated source has been continuous since event initiation. This is the preferred method for boron addition. Alternative sources for boron are the RWT and the [spent fuel pool]. If the normal charging pathway is unavailable, the charging pumps may be lined up to discharge to the RCS through the HPSI header.

Operational Considerations:

NA

EPG Step Content: (CEN-152, page 10-113, step 2)

Commence maximum boration to achieve shutdown margin in accordance with Technical Specification Limits using the CVCS. Perform the following actions:

Justification of Differences:

The EPG step was divided into several steps to cover all the suction sources and discharge paths available as well as all the required actions of each. The EOP also covers termination of emergency boration.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_2. <u>Recovery Actions: Subprocedure II. Reactivity Control</u>
Success Path II-2

EOP Step Content:

Step 6. Check the following Emergency Boration termination criteria:

Objective:

The objective of this step is to determine if emergency boration can be terminated.

Basis: (CEN-152, page 10-18, step 2)

In the case where the control rods do not insert or where additional negative reactivity is needed to compensate for temperature defect, reactivity control can be accomplished by boron injection. Borated water can be added to the RCS using charging and the boric acid addition portions of the CVCS.

Maximum boration is commenced using the CVCS to achieve shutdown margin in accordance with Technical Specification Limits. The following actions are performed.

a) The charging pumps are aligned to take a suction from [boric acid makeup tanks using either gravity feed or the boric acid makeup pumps, or from the RWT using gravity feed].

b) The charging pumps are aligned to the normal charging header. If the normal charging lines are not available, line up to charge to the RCS through the HPSI header.

c) Charging pumps and letdown are manually operated to maintain pressurizer level between [35" and 245"].

E_2. Recovery Actions: Subprocedure II. Reactivity Control

Success Path II-2

EOP Step 6 (Continued).

Basis: (Continued)

The charging pumps are aligned to discharge the contents of the [boric acid makeup tanks (primary source of boric acid to the RCS and core)]. The [boric acid makeup tank] contents may reach the suction of the charging pumps via gravity feed or via the boric acid makeup pumps. These sources should usually not be used past [1 hour] after event initiation (unless required for reactivity control) to prevent boron precipitation. Boron precipitation is only a concern if charging from the concentrated source has been continuous since event initiation. This is the preferred method for boron addition. Alternative sources for boron are the RWT and the [spent fuel pool]. If the normal charging pathway is unavailable, the charging pumps may be lined up to discharge to the RCS through the HPSI header.

Operational Considerations:

NA

EPG Step Content: (CEN-152, page 10-113, step 2)

Commence maximum boration to achieve shutdown margin in accordance with Technical Specification Limits using the CVCS. Perform the following actions:

Justification of Differences:

The EPG step was divided into several steps to cover all the suction sources and discharge paths available as well as all the required actions of each. The EOP also covers termination of emergency boration.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_2. <u>Recovery Actions: Subprocedure II. Reactivity Control</u>
Success Path II-2

EOP Step Content:

Step 7. <u>IF</u> the Emergency Boration termination criteria (step 6) are met <u>AND</u> Letdown is in operation, <u>THEN</u> terminate Emergency Boration as follows:

Objective:

The objective of this step is to terminate emergency boration if the criteria are met and letdown is in service.

Basis: (CEN-152, page 10-18, step 2)

In the case where the control rods do not insert or where additional negative reactivity is needed to compensate for temperature defect, reactivity control can be accomplished by boron injection. Borated water can be added to the RCS using charging and the boric acid addition portions of the CVCS.

Maximum boration is commenced using the CVCS to achieve shutdown margin in accordance with Technical Specification Limits. The following actions are performed.

a) The charging pumps are aligned to take a suction from [boric acid makeup tanks using either gravity feed or the boric acid makeup pumps, or from the RWT using gravity feed].

b) The charging pumps are aligned to the normal charging header. If the normal charging lines are not available, line up to charge to the RCS through the HPSI header.

c) Charging pumps and letdown are manually operated to maintain pressurizer level between [35" and 245"].

E_2. Recovery Actions: Subprocedure II. Reactivity Control

Success Path II-2

EOP Step 7 (Continued).

Basis: (Continued)

The charging pumps are aligned to discharge the contents of the [boric acid makeup tanks (primary source of boric acid to the RCS and core)]. The [boric acid makeup tank] contents may reach the suction of the charging pumps via gravity feed or via the boric acid makeup pumps. These sources should usually not be used past [1 hour] after event initiation (unless required for reactivity control) to prevent boron precipitation. Boron precipitation is only a concern if charging from the concentrated source has been continuous since event initiation. This is the preferred method for boron addition. Alternative sources for boron are the RWT and the [spent fuel pool]. If the normal charging pathway is unavailable, the charging pumps may be lined up to discharge to the RCS through the HPSI header.

Operational Considerations:

If possible, to prevent core power increases following the initial transient, reactor coolant system temperature is maintained constant until Reactivity Control safety function is satisfied. Temperature is maintained constant instead of being reduced to prevent core power increases due to the negative moderator temperature coefficient.

EPG Step Content: (CEN-152, page 10-113, step 2)

Commence maximum boration to achieve shutdown margin in accordance with Technical Specification Limits using the CVCS. Perform the following actions:

Justification of Differences:

The EPG step was divided into several steps to cover all the suction sources and discharge paths available as well as all the required actions of each. The EOP also covers termination of emergency boration.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_2. Recovery Actions: Subprocedure II. Reactivity Control
Success Path II-2

EOP Step Content:

Step 8. IF the Emergency Boration termination criteria (step 6) are met AND Letdown is NOT in operation, THEN terminate Emergency Boration as follows:

Objective:

The objective of this step is to terminate emergency boration if the criteria are met and letdown is not in service.

Basis: (CEN-152, page 10-18, step 2)

In the case where the control rods do not insert or where additional negative reactivity is needed to compensate for temperature defect, reactivity control can be accomplished by boron injection. Borated water can be added to the RCS using charging and the boric acid addition portions of the CVCS.

Maximum boration is commenced using the CVCS to achieve shutdown margin in accordance with Technical Specification Limits. The following actions are performed.

a) The charging pumps are aligned to take a suction from [boric acid makeup tanks using either gravity feed or the boric acid makeup pumps, or from the RWT using gravity feed].

b) The charging pumps are aligned to the normal charging header. If the normal charging lines are not available, line up to charge to the RCS through the HPSI header.

c) Charging pumps and letdown are manually operated to maintain pressurizer level between [35" and 245"].

E_2. Recovery Actions: Subprocedure II. Reactivity Control

Success Path II-2

EOP Step 8 (Continued).

Basis: (Continued)

The charging pumps are aligned to discharge the contents of the [boric acid makeup tanks (primary source of boric acid to the RCS and core)]. The [boric acid makeup tank] contents may reach the suction of the charging pumps via gravity feed or via the boric acid makeup pumps. These sources should usually not be used past [1 hour] after event initiation (unless required for reactivity control) to prevent boron precipitation. Boron precipitation is only a concern if charging from the concentrated source has been continuous since event initiation. This is the preferred method for boron addition. Alternative sources for boron are the RWT and the [spent fuel pool]. If the normal charging pathway is unavailable, the charging pumps may be lined up to discharge to the RCS through the HPSI header.

Operational Considerations:

If possible, to prevent core power increases following the initial transient, reactor coolant system temperature is maintained constant until Reactivity Control safety function is satisfied. Temperature is maintained constant instead of being reduced to prevent core power increases due to the negative moderator temperature coefficient.

EPG Step Content: (CEN-152, page 10-113, step 2)

Commence maximum boration to achieve shutdown margin in accordance with Technical Specification Limits using the CVCS. Perform the following actions:

Justification of Differences:

The EPG step was divided into several steps to cover all the suction sources and discharge paths available as well as all the required actions of each. The EOP also covers termination of emergency boration.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_2. Recovery Actions: Subprocedure II. Reactivity Control
Success Path II-2

EOP Step Content:

Step 9. Check the following success path criteria:

Objective:

The objective of this step is to check the criteria associated with satisfactorily completing this success path.

Basis: (CEN-152, page 10-4, step 3)

The basis for each individual criterion is given in Section 2.0 of the technical guide. The criteria are used to judge the status of each safety function. Since each safety function has multiple success paths which can be used to control that safety function, the criteria which are used to judge the status of each safety function are organized around the success paths for each safety function. Since each success path uses or may use different technical means of achieving a function, the criteria for judging the success of that path are specific to the technical means. Also, in order to facilitate operator use, the criteria chosen are parameters which can be read directly from the control board.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_2. Recovery Actions: Subprocedure II. Reactivity Control

Success Path II-2

EOP Step Content:

Step 10. IF the success path criteria (step 9) are met, THEN go to the next safety function in jeopardy.

Objective:

The objective of this step is to instruct the operator what to do if this success path is satisfactorily completed.

Basis: (CEN-152, page 10-12, step 7)

After checking the success path criteria, additional guidance is provided which aids the operator in determining the next course of action. In this step, if control of the safety function is achieved, the operator is instructed to go to the next safety function in jeopardy.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_2. Recovery Actions: Subprocedure II. Reactivity Control
Success Path II-2

EOP Step Content:

Step 11. IF the success path criteria (step 9) are NOT met, THEN go to Success Path II-3.

Objective:

The objective of this step is to instruct the operator what to do if this success path is not satisfactorily completed.

Basis: (CEN-152, page 10-12, step 7)

After checking the success path criteria, additional guidance is provided which aids the operator in determining the next course of action. In this step, if control of the safety function is not achieved, the operator is instructed to implement another success path for this safety function.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_2. <u>Recovery Actions: Subprocedure II. Reactivity Control</u>
Success Path II-3

EOP Step Content:

Step 1. <u>IF</u> Pressurizer pressure drops to $\leq$1684 psia <u>OR</u> Containment pressure rises to $\geq$17.4 psia, <u>THEN</u> verify SIAS occurs as follows:

Objective:

The objective of this step is to verify SIAS occurs when required.

Basis: (CEN-152, page 10-21, step 2)

If pressurizer pressure decreases to 1684 psia or if containment pressure increases to 17.4 psia, initiation of an SIAS must be verified. If necessary, SIAS is manually initiated. This action is primarily to ensure that RCS inventory, pressure, and heat removal are being maintained. However, this will also provide another method of boration at reduced RCS pressure:

a) If RCS pressure <1385 psia then the HPSI pumps may be effective
b) If RCS pressure <250 psia then the CS pumps may be effective
c) If RCS pressure <183 psia then the LPSI pumps may be effective.

Operational Considerations:

Hot leg temperatures and cold leg temperatures may be influenced by safety injection flow. Multiple indications and core temperatures should be used to determine the reactor coolant system temperature. If possible, to prevent core power increases following the initial transient, reactor coolant system temperature is maintained constant until Reactivity Control safety function is satisfied. Temperature is maintained constant instead of reduced to prevent core power increases due to the negative moderator temperature coefficient. Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading.

E_2. Recovery Actions: Subprocedure II. Reactivity Control

Success Path II-3

EOP Step 1 (Continued).

EPG Step Content: (CEN-152, page 10-117, step 2)

If pressurizer pressure decreases to [1600 psia] [or if containment pressure increases to 4 psig] verify initiation of an SIAS. If necessary manually initiate an SIAS and/or depressurize the RCS to permit ECCS injection. This action is primarily to ensure that RCS inventory, pressure, and heat removal are being maintained. However, this will also provide another method of boration at reduced RCS pressures:

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. TAble 5-4, Pressure.

E_2. Recovery Actions: Subprocedure II. Reactivity Control
Success Path II-3

EOP Step Content:

Step 2. IF either of the following conditions occur, THEN stop ALL Reactor Coolant Pumps:

Objective:

The objective of this step is to stop reactor coolant pump operation when pressurizer pressure $\leq$1621 psia following an SIAS or when component cooling water is lost.

Basis:

This step serves to prevent continued reactor coolant pump operation when reactor coolant system pressure is $\leq$1621 psia during a Loss of Coolant Accident. Continued reactor coolant pump operation at reactor coolant system pressures below 1621 psia during a Loss of Coolant Accident may result in more severe reactor coolant system conditions. When component cooling water is lost to the reactor coolant pumps, damage to pump components could occur if the reactor coolant pumps are not secured.

Operational Considerations:

Since other events could cause rapid depressurization, anytime pressurizer pressure drops below 1621 psia following an SIAS, all reactor coolant pump operation is terminated. 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:

PV-OP-902, Parameter Values Document. Table 5-4, Pressure.

E_2. Recovery Actions: Subprocedure II. Reactivity Control
Success Path II-3

EOP Step Content:

Step 3. IF SIAS has occurred, THEN complete Attachment 1: SIAS Automatic Actions.

Objective:

The objective of this step is to verify all actions required by an SIAS.

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.

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_2. Recovery Actions: Subprocedure II. Reactivity Control
Success Path II-3

EOP Step Content:

Step 4. Check the following Safety Injection termination criteria:

Objective:

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

Basis: (CEN-152, page 10-21, step 3)

If an SIAS has been initiated and the SIS is operating, it must continue to operate at full capacity until SIS termination criteria are met. Early termination may be desirable when the criteria are met to preclude PTS situations or HPSI pump damage (e.g., shaft seals).

Operational Considerations:

Below 1000 psia, subcooling margin shall be determined by subtracting hot leg temperature from Pressurizer Temperature Water (TI 101). Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading.

EPG Step Content: (CEN-152, page 10-117, step 3)

If the Technical Specification shutdown margin is achieved, the ECCS 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.

Control board indications of subcriticality were used instead of shutdown margin due to the time considerations of sampling reactor coolant system boron and calculating shutdown margin. This is more consistent with the success path criteria and the emergency boration termination criteria.

E_2. Recovery Actions: Subprocedure II. Reactivity Control

Success Path II-3

EOP Step 4 (Continued).

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-1, Level and Table 5-4, Pressure.

E_2. Recovery Actions: Subprocedure II. Reactivity Control
Success Path II-3

EOP Step Content:

Step 5. IF ALL Safety Injection termination criteria (step 4) 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 10-21, step 3)

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 10-117, step 3)

If the Technical Specification shutdown margin is achieved, the ECCS may be throttled or stopped one train at a time if all of the following conditions are satisfied:

E_2. <u>Recovery Actions: Subprocedure II. Reactivity Control</u>

Success Path II-3

EOP Step 5 (Continued).

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.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

[illegible] Recovery Actions: Subprocedure II. Reactivity Control

[illegible]ccess Path II-3

EOP Step Content:

Step 6. IF ALL Safety Injection termination criteria (step 4) can NOT be maintained after throttling OR stopping Safety Injection flow, THEN reinitiate Safety Injection flow.

Objective:

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

Basis: (CEN-152, page 10-22, step 4)

If any of the criteria of step 4 cannot be maintained, the safety injection pumps must be restarted whenever necessary to satisfy all the criteria.

Operational Considerations:

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

EPG Step Content: (CEN-152, page 10-117, step 4)

If all the criteria of step 3 cannot be maintained after the ECCS has been stopped, the ECCS must be restarted.

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_2. Recovery Actions: Subprocedure II. Reactivity Control
Success Path II-3

EOP Step Content:

Step 7. IF Pressurizer pressure drops to ≤1385 psia, THEN verify proper HPSI Header flow exists. Refer to Attachment 2: HPSI and LPSI Flow versus Pressurizer Pressure.

Objective:

The objective of this step is to verify that inventory is provided to the reactor coolant system during a Loss of Coolant Accident.

Basis:

A Loss of Coolant Accident will result in actuation of safety injection. The reactor coolant system pressure will respond during the accident according to the break size. Safety injection system flow rate will follow the reactor coolant system pressure according to the safety injection system delivery curves. The safety injection system and charging flow rates should be checked and maximized relative to reactor coolant system pressure to enhance reactor coolant system inventory replenishment and/or core heat removal.

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:

PV-OP-902, Parameter Values Document. Table 5-4, Pressure.

E_2. Recovery Actions: Subprocedure II. Reactivity Control
Success Path II-3

EOP Step Content:

Step 8. IF Pressurizer pressure drops to ≤183 psia, THEN verify proper LPSI Header flow exists. Refer to Attachment 2: HPSI and LPSI Flow versus Pressurizer Pressure.

Objective:

The objective of this step is to verify that inventory is provided to the reactor coolant system during a Loss of Coolant Accident.

Basis: (CEN-152, page 5-18, step 8)

A LOCA will result in actuation of safety injection. The RCS pressure will respond during the accident according to the break size. Safety injection system flow rate will follow the RCS pressure according to the SIS delivery curves (see Figures 5-8 and 5-9). The SIS and charging flow rates should be checked and maximized relative to RCS pressure to enhance RCS inventory replenishment and/or core heat removal.

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:

PV-OP-902, Parameter Values Document. Table 5-4, Pressure.

E_2. Recovery Actions: Subprocedure II. Reactivity Control
Success Path II-3

EOP Step Content:

Step 9. IF BOTH LPSI pumps A AND B are NOT available AND Pressurizer pressure <250 psia, THEN align one Containment Spray pump to the LPSI Header as follows:

Objective:

This step ensures safety injection flow to the reactor coolant system if both low pressure safety injection pumps are unavailable by using a containment spray pump to inject water.

Basis: (CEN-152, page 10-21, step 2)

This step provides another method of boration at reduced RCS pressure. If Pressurizer pressure <250 psia then the containment spray pumps may be effective.

Operational Considerations:

If CSAS has occurred, then this step should not be performed. 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:

PV-OP-902, Parameter Values Document. Table 5-4, Pressure.

E_2. Recovery Actions: Subprocedure II. Reactivity Control
Success Path II-3

EOP Step Content:

Step 10. Check the following success path criteria:

Objective:

The objective of this step is to check the criteria associated with satisfactorily completing this success path.

Basis: (CEN-152, page 10-4, step 3)

The basis for each individual criterion is given in Section 2.0 of the technical guide. The criteria are used to judge the status of each safety function. Since each safety function has multiple success paths which can be used to control that safety function, the criteria which are used to judge the status of each safety function are organized around the success paths for each safety function. Since each success path uses or may use different technical means of achieving a function, the criteria for judging the success of that path are specific to the technical means. Also, in order to facilitate operator use, the criteria chosen are parameters which can be read directly from the control board.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_2. Recovery Actions: Subprocedure II. Reactivity Control
Success Path II-3

EOP Step Content:

Step 11. IF the success path criteria (step 10) are met, THEN go to the next safety function in jeopardy.

Objective:

The objective of this step is to instruct the operator what to do if this success path is satisfactorily completed.

Basis: (CEN-152, page 10-12, step 7)

After checking the success path criteria, additional guidance is provided which aids the operator in determining the next course of action. In this step, if control of the safety function is achieved, the operator is instructed to go to the next safety function in jeopardy.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_2. Recovery Actions: Subprocedure II. Reactivity Control
Success Path II-3

EOP Step Content:

Step 12. IF the success path criteria (step 10) are NOT met, THEN continue with Subprocedure II. Reactivity Control until a success path criterion is satisfactorily being maintained.

Objective:

The objective of this step is to instruct the operator what to do if this success path is not satisfactorily completed.

Basis: (CEN-152, page 10-123)

If the criteria are not met, then Reactivity Control is still in jeopardy. The operator should not leave Reactivity Control until this function is fulfilled.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_2. Recovery Actions: Subprocedure II. Reactivity Control
Success Path II-3

EOP Step Content:

Step 13. IF the Control Room Supervisor determines it is necessary to pursue other safety functions in jeopardy, THEN go to the next safety function in jeopardy AND implement its subprocedure concurrently with this subprocedure.

Objective:

The objective of this step is to allow the control room supervisor to pursue other safety functions in jeopardy while efforts are continued on Reactivity Control.

Basis: (CEN-152, page 10-123)

The operator may, if necessary, pursue other urgent safety functions but must continue to attempt to establish Reactivity Control.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_3. <u>Recovery Actions: Subprocedure III. RCS Inventory Control</u>

Success Path III-1

EOP Step Content:

Step 1: <u>IF</u> SIAS has occurred, <u>THEN</u> go to Success Path III-2.

Objective:

This step directs the operator to the next success path if SIAS has occurred.

Basis:

Since charging pumps are actuated by SIAS, the operator may have selected this success path on the resource assessment tree because it is a higher priority success path. If SIAS has occurred, the operator needs to read the actions associated with it. Therefore this step directs the operator to the appropriate success path.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_3. Recovery Actions. Subprocedure III. RCS Inventory Control
Success Path III-1

EOP Step Content:

Step 2. Verify Pressurizer Level Control System is maintaining OR restoring Pressurizer level to 33%.

Objective:

This step verifies pressurizer level control system is functioning to maintain or restore pressurizer level.

Basis: (CEN-152, page 10-26, step 1)

The PLCS is verified to be functioning to restore pressurizer level to the hot zero power band. If not, charging and letdown are operated manually to restore and maintain pressurizer level.

Limiting letdown while maximizing charging flow may be adequate to make up an insufficient RCS inventory condition. Conversely, maximizing letdown and minimizing charging flow may suffice in lowering a high RCS inventory condition.

In this mode, it is necessary that the operator check that pressurizer level is within the hot zero power range and to verify adequate RCS subcooling to verify that RCS inventory is being controlled. If pressurizer level is not being maintained automatically, the operator has an alternate means of control by manually operating the charging pumps and letdown flowrate to regulate inventory into and out of the RCS.

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 10-124, step 1)

Verify that the PLCS is functioning to restore proper pressurizer level to the hot zero power band. If not, manually operate charging and letdown to restore and maintain pressurizer level between [35"] and [245"].

E_3. Recovery Actions: Subprocedure III. RCS Inventory Control

Success Path III-1

EOP Step 2 (Continued).

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_3. <u>Recovery Actions: Subprocedure III. RCS Inventory Control</u>
Success Path III-1

EOP Step Content:

Step 3. Verify Charging pumps aligned to take suction from one of the following sources as follows:

Objective:

This step ensures the charging pumps have an adequate suction source.

Basis: (CEN-152, page 10-26, step 2)

Adequate suction sources to the charging pumps are verified. If necessary, the VCT, boric acid storage tanks and RWSP are used.

The source(s) of water for use in controlling RCS inventory depend on the total amount of fluid necessary for makeup to the RCS and the time frame over which the fluid must be introduced. The volume control tank is the primary source of fluid for RCS makeup. If necessary, for the cases where RCS inventory losses are being incurred, the contents of the boric acid makeup tanks and the refueling water tank may be used as backup sources of makeup water.

Operational Considerations:

If SIAS has occurred, then the charging pumps suction may be aligned to both boric acid makeup tanks. If volume control tank level <6%, then the volume control tank cannot be used to supply the charging pumps.

EPG Step Content: (CEN-152, page 10-124, step 2)

If operating charging pumps, verify adequate suction sources to the charging pumps. If necessary, use the [VCT, boric acid storage tanks, spent fuel pool and RWT].

Justification of Differences:

NA

E_3. <u>Recovery Actions: Subprocedure III. RCS Inventory Control</u>

Success Path III-1

EOP Step 3 (Continued).

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_3. Recovery Actions: Subprocedure III. RCS Inventory Control
Success Path III-1

EOP Step Content:

Step 4. Verify at least one Charging pump operating AND Charging Header flow >40 gpm.

Objective:

This step verifies a charging pump operating with proper flow.

Basis:

Once a charging pump suction path is verified, then charging header flow to the reactor coolant system is verified.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_3. Recovery Actions: Subprocedure III. RCS Inventory Control

Success Path III-1

EOP Step Content:

Step 5. IF Charging Header flow <40 gpm through the normal Charging pump discharge path, THEN align Charging pumps to discharge through HPSI Header A OR B as follows:

Objective:

The objective of this step is to realign the charging pump discharge to the high pressure safety injection header if the normal charging path is not available.

Basis:

If the normal charging pathway is unavailable, the charging pumps may be lined up to discharge to the reactor coolant system through the high pressure safety injection header.

Operational Considerations:

If high pressure safety injection pumps are operating, the charging pumps should not be aligned to the high pressure safety injection header. The normal charging pump discharge path is through the charging header isolation valve (CVC 209). Charging header flow will not indicate with the charging header isolation valve (CVC 209) closed.

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_3. Recovery Actions: Subprocedure III. RCS Inventory Control
Success Path III-1

EOP Step Content:

Step 6. IF Charging pumps are aligned to the Boric Acid Makeup Tanks AND Letdown is in operation, THEN within 30 minutes to 1 hour from the time the Charging pumps were aligned to the Boric Acid Makeup Tanks, realign them as follows:

Objective:

This step terminates charging from a concentrated boron source within 1 hour if letd n is in service.

Basis: (CEN-152, page 10-126, precaution 5)

Charging from the concentrated boron source should not continue past [1] hour after event initiation unless required for activity control. This is to preclude boron precipitation. Charging pump suction should be shifted to the lower concentration source.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_3. Recovery Actions: Subprocedure III. RCS Inventory Control

Success Path III-1

EOP Step Content:

Step 7. IF Charging pumps are aligned to the Boric Acid Makeup Tanks AND Letdown is NOT in operation, THEN within 30 minutes to 1 hour from the time the Charging pumps were aligned to the Boric Acid Makeup Tanks, realign them as follows:

Objective:

This step terminates charging from a concentrated boron source within 1 hour if letdown is not in service.

Basis: (CEN-152, page 10-126, precaution 5)

Charging from the concentrated boron source should not continue past [1] hour after event initiation unless required for reactivity control. This is to preclude boron precipitation. Charging pump suction should be shifted to the lower concentration source.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_3. <u>Recovery Actions: Subprocedure III. RCS Inventory Control</u>
Success Path III-1

EOP Step Content:

Step 8. IF Reactor Coolant Pumps are NOT operating, THEN monitor for Reactor Coolant System voiding as indicated by:

Objective:

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

Basis: (CEN-152, page 10-27, step 3)

Since there are certain reactor coolant system conditions for which the presence of voids is acceptable, then voids are not a problem as long as the core and reactor coolant system heat removal and the reactor coolant system inventory safety functions are being satisfied. If these safety functions are not being satisfied or voiding is causing the reactor coolant system to remain pressurized above the shutdown cooling entry conditions, then this step will indicate voids. If voids are indicated, then step 9 will be performed.

Operational Considerations:

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

EPG Step Content: (CEN-152, page 10-124, step 3)

Monitor for RCS voiding. Indications of voiding are any of the following parameter changes or trends:

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_3. **Recovery Actions: Subprocedure III. RCS Inventory Control**
Success Path III-1

EOP Step Content:

Step 9. 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: (CEN-152, page 10-28, step 4)

Void elimination proceeds as follows:

a) Letdown is isolated or verified to be isolated to minimize further inventory loss
b) The depressurization is stopped to prevent further growth of the void
c) Repressurizing and depressurizing the RCS within the limits of Figure 10-10 may condense the void. Repressurizing has the effect of filling the voided portion of the RCS with cooler fluid which will remove heat from this region. Depressurizing and repeating this process several times will cool and condense the steam void. The pressurizing and depressurizing may be accomplished using the pressurizer (heaters and auxiliary spray (preferred method)) or the ECCS/charging (starting and stopping pumps or throttling HPSI pumps) system (alternative method).

E_3. Recovery Actions: Subprocedure III. RCS Inventory Control

Success Path III-1

EOP Step 9 (Continued).

Basis: (Continued)

d) The [RV head vent system] may be operated to clear voids in the RV head. This system will clear gas voids withint minutes. If the RV head void is not cleared quickly with the [RV head vent system], steam voiding should be suspected. The best method for condensing steam voids or for removing noncondensible gases from the S/G tube bundle is to run RCPs (if available). If that is not possible, cooling the generator by feeding and draining or by steaming will also be effective for condensing steam voids in the tube bundle. Cooling the steam generators will not have an effect on noncondensibles trapped in the tube bundle. A buildup of noncondensibles in the tube bundles will not hinder natural circulation even with a large number of the tubes blocked. This is because of the small amount of steam generator heat transfer area required for the removal of decay heat.

Operational Considerations:

NA

EPG Step Content: (CEN-152, page 10-124, step 4)

Void elimination is performed as follows:

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_3. Recovery Actions: Subprocedure III. RCS Inventory Control

Success Path III-1

EOP Step Content:

Step 10. Check the following success path criteria:

Objective:

The objective of this step is to check the criteria associated with satisfactorily completing this success path.

Basis: (CEN-152, page 10-4, step 3)

The basis for each individual criterion is given in Section 2.0 of the technical guide. The criteria are used to judge the status of each safety function. Since each safety function has multiple success paths which can be used to control that safety function, the criteria which are used to judge the status of each safety function are organized around the success paths for each safety function. Since each success path uses or may use different technical means of achieving a function, the criteria for judging the success of that path are specific to the technical means. Also, in order to facilitate operator use, the criteria chosen are parameters which can be read directly from the control board.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_3. Recovery Actions: Subprocedure III. RCS Inventory Control
Success Path III-1

EOP Step Content:

Step 11. IF the success path criteria (step 10) are met, THEN go to the next safety function in jeopardy.

Objective:

The objective of this step is to instruct the operator what to do if this success path is satisfactorily completed.

Basis: (CEN-152, page 10-12, step 7)

After checking the success path criteria, additional guidance is provided which aids the operator in determining the next course of action. In this step, if control of the safety function is achieved, the operator is instructed to go to the next safety function in jeopardy.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_3. Recovery Actions: Subprocedure III. RCS Inventory Control
Success Path III-1

EOP Step Content:

Step 12. IF the success path criteria (step 10) are NOT met, THEN go to Success Path III-2.

Objective:

The objective of this step is to instruct the operator what to do if this success path is not satisfactorily completed.

Basis: (CEN-152, page 10-12, step 7)

After checking the success path criteria, additional guidance is provided which aids the operator in determining the next course of action. In this step, if control of the safety function is not achieved, the operator is instructed to implement another success path for this safety function.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_3. Recovery Actions: Subprocedure III. RCS Inventory Control
Success Path III-2

EOP Step Content:

Step 1. IF Pressurizer pressure drops to ≤1684 psia OR Containment pressure rises to ≥17.4 psia, THEN verify SIAS occurs as follows:

Objective:

The objective of this step is to verify SIAS occurs when required.

Basis: (CEN-152, page 10-31, step 1)

SIS operation must be verified if pressurizer pressure decreases to 1684 psia or if containment pressure increases to 17.4 psia. If safety injection system operation has not commenced automatically when RCS pressure is below 1684 psia, it must be manually actuated. This action allows the RWSP inventory to discharge into the RCS. An insufficient RCS inventory may be associated with a loss of coolant accident, a steam generator tube rupture, a control system malfunction or an excessive heat removal event. Of course, operation of the SIS also affects RCS pressure. When operating the SIS the operator must maintain or restore pressure to within the limits of Attachment 5: Post-Accident Pressure and Temperature Limits Graph unless 28°F subcooling cannot be maintained. If 28°F subcooling cannot be maintained, the SIS is kept running for core cooling considerations regardless of pressurizer level.

Operational Considerations:

Hot leg temperatures and cold leg temperatures may be influenced by safety injection flow. Multiple indications and core temperatures should be used to determine the reactor coolant system temperature. Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading.

EPG Step Content: (CEN-152, page 10-127, step 1)

If pressurizer pressure decreases to [1600] psia [or if containment pressure increases to 4 psig], verify that an SIAS has been initiated. If it has not, manually initiate SIS operation.

E_3. Recovery Actions: Subprocedure III. RCS Inventory Control

Success Path III-2

EOP Step 1 (Continued).

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-4, Pressure.

E_3. <u>Recovery Actions: Subprocedure III. RCS Inventory Control</u>

Success Path III-2

EOP Step Content:

Step 2. <u>IF</u> either of the following conditions occurs, <u>THEN</u> stop <u>ALL</u> Reactor Coolant Pumps:

Objective:

The objective of this step is to stop reactor coolant pump operation when pressurizer pressure $\leq$1621 psia following an SIAS or when component cooling water is lost.

Basis: (CEN-152, page 10-31, step 2)

This step serves to prevent continued RCP operation when RCS pressure is $\leq$1621 psia during a Loss of Coolant Accident. Continued RCP operation at RCS pressures below 1621 psia during a Loss of Coolant Accident may result in more severe RCS conditions. When component cooling water is lost to the reactor coolant pumps, damage to pump components could occur if the RCPs are not secured.

Operational Considerations:

Since other events could cause rapid depressurization, anytime pressurizer pressure drops below 1621 psia following an SIAS, all reactor coolant pump operation is terminated. Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading.

EPG Step Content: (CEN-152, page 10-127, step 2)

If pressurizer pressure decreases to (1300 psia) following an SIAS, stop all operating reactor coolant pumps.

Justification of Differences:

Loss of component cooling water to reactor coolant pumps is added to this step because component cooling water is isolated to the reactor coolant pumps when an SIAS occurs.

E_3. **Recovery Actions: Subprocedure III. RCS Inventory Control**

Success Path III-2

EOP Step 2 (Continued).

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-4, Pressure.

E_3. <u>Recovery Actions: Subprocedure III. RCS Inventory Control</u>
Success Path III-2

EOP Step Content:

Step 3. IF SIAS has occurred, THEN complete Attachment 1: SIAS Automatic Actions.

Objective:

The objective of this step is to verify all actions required by an SIAS.

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.

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_3. Recovery Actions: Subprocedure III. RCS Inventory Control
Success Path III-2

EOP Step Content:

Step 4. Check the following Safety Injection termination criteria:

Objective:

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

Basis: (CEN-152, page 10-32, step 3)

If an SIAS has been initiated and the SIS is operating, it must continue to operate at full capacity until SIS termination criteria are met. Early termination may be desirable when the criteria are met to preclude PTS situations or HPSI pump damage (e.g., shaft seals).

Operational Considerations:

Below 1000 psia, subcooling margin shall be determined by subtracting hot leg temperature from Pressurizer Temperature Water (TI 101). Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading.

EPG Step Content: (CEN-152, page 10-127, step 3)

If the inventory success criteria are met, the ECCS 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 10.0, Functional Recovery Guideline.
PV-OP-902, Parameter Values Document. Table 5-4, Pressure.

E_3. Recovery Actions: Subprocedure III. RCS Inventory Control

Success Path III-2

EOP Step Content:

Step 5. IF ALL Safety Injection termination criteria (step 4) 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 10-33, step 3)

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 10-127, step 3)

If the inventory success criteria are met, the ECCS may be throttled or stopped one train at a time if all of the following conditions or satisfied:

E_3. Recovery Actions: Subprocedure III. RCS Inventory Control

Success Path III-2

EOP Step 5 (Continued).

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.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_3. Recovery Actions: Subprocedure III. RCS Inventory Control
Success Path III-2

EOP Step Content:

Step 6. IF ALL Safety Injection termination criteria (step 4) can NOT be maintained after throttling OR stopping Safety Injection flow, THEN reinitiate Safety Injection flow.

Objective:

This step allows initiation of SIS flow should conditions warrant the need.

Basis: (CEN-152, page 10-33, step 4)

If all of the criteria of step 4 cannot be maintained, the safety injection pumps must be restarted whenever necessary to satisfy all the criteria.

Operational Considerations:

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

EPG Step Content: (CEN-152, page 10-127, step 4)

If all the criteria of step 3 cannot be maintained after the ECCS has been stopped, the ECCS must be restarted.

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_3. Recovery Actions: Subprocedure III. RCS Inventory Control

Success Path III-2

EOP Step Content:

Step 7. IF Pressurizer level >28%, THEN verify Pressurizer pressure is being restored by Pressurizer heaters.

Objective:

The objective of this step is to verify pressurizer heaters restored when inventory is restored.

Basis:

The preferred method of pressure control is using pressurizer heaters. Pressurizer heaters are deenergized when pressurizer level is low to prevent damage to the heaters. When inventory is restored, pressurizer heaters should be reenergized for pressure control.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

PV-OP-902, Parameter Values Document. Table 5-1, Level.

E_3. <u>Recovery Actions: Subprocedure III. RCS Inventory Control</u>
Success Path III-2

EOP Step Content:

Step 8. <u>IF</u> Reactor Coolant Pumps are <u>NOT</u> operating, <u>THEN</u> monitor for Reactor Coolant System voiding as indicated by:

Objective:

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

Basis: (CEN-152, page 10-34, step 6)

Since there are certain reactor coolant system conditions for which the presence of voids is acceptable, then voids are not a problem as long as the core and reactor coolant system heat removal and the reactor coolant system inventory safety functions are being satisfied. If these safety functions are not being satisfied or voiding is causing the reactor coolant system to remain pressurized above the shutdown cooling entry conditions, then this step will indicate voids. If voids are indicated, then step 9 will be performed.

Operational Considerations:

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

EPG Step Content: (CEN-152, page 10-128, step 6)

Monitor for RCS voiding. Indications of voiding are any of the following parameter changes or trends:

Justification of Differences:

This step was placed before RAS actions to place steps more in the order they should occur.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_3. <u>Recovery Actions: Subprocedure III. RCS Inventory Control</u>
Success Path III-2

EOP Step Content:

Step 9. 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: (CEN-152, page 10-35, step 7)

Void elimination proceeds as follows:

a) Letdown is isolated or verified to be isolated to minimize further inventory loss
b) The depressurization is stopped to prevent further growth of the void
c) Repressurizing and depressurizing the RCS within the limits of Figure 10-10 may condense the void. Repressurizing has the effect of filling the voided portion of the RCS with cooler fluid which will remove heat from this region. Depressurizing and repeating this process several times will cool and condense the steam void. The pressurizing and depressurizing may be accomplished using the pressurizer (heaters and auxiliary spray (preferred method)) or the ECCS/charging (starting and stopping pumps or throttling HPSI pumps) system (alternative method).

E_3. <u>Recovery Actions: Subprocedure III. RCS Inventory Control</u>

Success Path III-2

EOP Step 9 (Continued).

Basis: (Continued)

d) The [RV head vent system] may be operated to clear voids in the RV head. This system will clear gas voids within minutes. If the RV void is not cleared quickly with the [RV head vent system], steam voiding should be suspected. The best method for condensing steam voids or for removing noncondensible gases from the S/G tube bundle is to run RCPs (if available). If that is not possible, cooling the generator by feeding and draining or by steaming will also be effective for condensing steam voids in the tube bundle. Cooling the steam generators will not have an effect on noncondensibles trapped in the tube bundle. A buildup of noncondensibles in the tube bundles will not hinder natural circulation even with a large number of the tubes blocked. This is because of the small amount of steam generator heat transfer area required for the removal of decay heat.

Operational Considerations:

NA

EPG Step Content: (CEN-152, page 10-128, step 7)

Void elimination is performed as follows:

Justification of Differences:

This step was placed before RAS actions to place steps more in the order they should occur.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_3. Recovery Actions: Subprocedure III. RCS Inventory Control
Success Path III-2

EOP Step Content:

Step 10. IF Pressurizer pressure drops to ≤1385 psia, THEN verify proper HPSI Header flow exists. Refer to Attachment 2: HPSI and LPSI Flow versus Pressurizer Pressure.

Objective:

The objective of this step is to verify that inventory is provided to the reactor coolant system during a Loss of Coolant Accident.

Basis:

A Loss of Coolant Accident will result in actuation of safety injection. The reactor coolant system pressure will respond during the accident according to the break size. Safety injection system flow rate will follow the reactor coolant system pressure according to the safety injection system delivery curves. The safety injection system and charging flow rates should be checked and maximized relative to reactor coolant system pressure to enhance reactor coolant system inventory replenishment and/or core heat removal.

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:

PV-OP-902, Parameter Values Document. Table 5-4, Pressure.

E_3. Recovery Actions: Subprocedure III. RCS Inventory Control
Success Path III-2

EOP Step Content:

Step 11. IF Pressurizer pressure <600 psia, THEN verify Safety Injection Tank levels dropping.

Objective:

The objective of this step is to verify that inventory is provided to the reactor coolant system during a large Loss of Coolant Accident.

Basis:

On the larger break Loss of Coolant Accidents, the safety injection tanks are required for reactor coolant system inventory and heat removal until the safety injection pumps supply inventory to the reactor coolant system.

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:

NA

E_3. Recovery Actions: Subprocedure III. RCS Inventory Control
Success Path III-2

EOP Step Content:

Step 12. When Pressurizer pressure is between 392 psia AND 350 psia, perform the following:

Objective:

This step isolates the safety injection tanks.

Basis:

The safety injection tanks should be isolated, vented, and drained at 250 psig to avoid introducing their nitrogen cover gas into the reactor coolant system and increasing the severity of the event.

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:

NA

E_3. <u>Recovery Actions: Subprocedure III. RCS Inventory Control</u>

Success Path III-2

EOP Step Content:

Step 13. <u>IF</u> Pressurizer pressure drops to ≤183 psia, <u>THEN</u> verify proper LPSI Header flow exists. Refer to Attachment 2: HPSI and LPSI Flow versus Pressurizer Pressure.

Objective:

The objective of this step is to verify that inventory is provided to the reactor coolant system during a Loss of Coolant Accident.

Basis:

A Loss of Coolant Accident will result in actuation of safety injection. The reactor coolant system pressure will respond during the accident according to the break size. Safety injection system flow rate will follow the reactor coolant system pressure according to the safety injection system delivery curves. The safety injection system and charging flow rates should be checked and maximized relative to reactor coolant system pressure to enhance reactor coolant system inventory replenishment and/or core heat removal.

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:

PV-OP-902, Parameter Values Document. Table 5-4, Pressure.

E_3. Recovery Actions: Subprocedure III. RCS Inventory Control
Success Path III-2

EOP Step Content:

Step 14. IF BOTH LPSI pumps A AND B are NOT available AND Pressurizer pressure <250 psia, THEN align one Containment Spray pump to the LPSI Header as follows:

Objective:

This step ensures safety injection flow to the reactor coolant system if both low pressure safety injection pumps are unavailable by using a containment spray pump to inject water.

Basis:

If both low pressure safety injection pumps are unavailable and pressurizer pressure is <250 psia, then a containment spray pump may be aligned to inject water through the low pressure safety injection header to the reactor coolant system.

Operational Considerations:

If the CSAS has occurred, then this step should not be performed. 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:

PV-OP-902, Parameter Values Document. Table 5-4, Pressure.

E_3. Recovery Actions: Subprocedure III. RCS Inventory Control
Success Path III-2

ECP Step Content:

Step 15. IF SIAS has occurred AND Letdown is in operation, THEN within 30 minutes to 1 hour from the time the SIAS occurred, terminate Emergency Boration as follows:

Objective:

This step terminates charging from a concentrated boron source within 1 hour if letdown is in service.

Basis:

Charging from the concentrated boron source should not continue past 1 hour after event initiation unless required for reactivity control. This is to preclude boron precipitation. Charging pump suction should be shifted to the lower concentration source.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_3. Recovery Actions: Subprocedure III. RCS Inventory Control

Success Path III-2

EOP Step Content:

Step 16. IF SIAS has occurred AND Letdown is NOT in operation, THEN within 30 minutes to 1 hour from the time the SIAS occurred, terminate Emergency Boration as follows:

Objective:

This step terminates charging from a concentrated boron source within 1 hour if letdown is not in service.

Basis:

Charging from the concentrated boron source should not continue past 1 hour after event initiation unless required for reactivity control. This is to preclude boron precipitation. Charging pump suction should be shifted to the lower concentration source.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_3. Recovery Actions: Subprocedure III. RCS Inventory Control
Success Path III-2

EOP Step Content:

Step 17. IF Containment pressure <17.4 psia THEN reset SIAS AND CIAS. Refer to Attachment 3: SIAS and CIAS Reset Procedure.

Objective:

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

Basis:

When containment pressure is ≥17.4 psia, SIAS and CIAS cannot be reset. Because 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:

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:

PV-OP-902, Parameter Values Document. Table 5-4, Pressure.

E_3. Recovery Actions: Subprocedure III. RCS Inventory Control
Success Path III-2

EOP Step Content:

Step 18. IF SIAS AND CIAS are reset AND Chemical and Volume Control System is available for operation, 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:

If safety injection flow has not been throttled or terminated, then letdown should not be placed in operation. Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading. 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:

NA

Justification of Differences:

NA

Source Document:

NA

E_3. Recovery Actions: Subprocedure III. RCS Inventory Control

Success Path III-2

EOP Step Content:

Step 19. IF Refueling Water Storage Pool level drops to 10%, THEN verify that Recirculation Actuation Signal occurs AND check ALL the following:

Objective:

This step ensures that an RAS occurs to provide a suction source to the safety injection pumps.

Basis: (CEN-152, page 10-33, step 5)

If the Refueling Water Storage Pool level falls to 10%, initiation of recirculation should be verified. Recirculation is actuated in order to maintain a continuous flow of safety injection fluid to the RCS and a continuous flow of containment spray water. The operator should be cautioned against prematurely initiating an RAS. An inadequate amount of level in the safety injection sump may cause air binding of safety injection pumps and loosing both heat removal loops.

Operational Considerations:

When a RAS occurs and safety injection sump level is <10 feet, monitor safety injection pumps should be monitored for potential air binding. Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading.

EPG Step Content: (CEN-152, page 10-127, step 5)

Monitor the refueling water tank level. If the refueling water tank level falls to [10%], verify automatic actuation of recirculation. If necessary, manually actuate recirculation one ECCS train at a time [and close RWT outlet valves to the safety injection system].

Justification of Differences:

This EPG step was divided into several steps to include plant specific information.

E_3. Recovery Actions: Subprocedure III. RCS Inventory Control

Success Path III-2

EOP Step 19 (Continued).

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-1, Level.

E_3. **Recovery Actions: Subprocedure III. RCS Inventory Control**
Success Path III-2

EOP Step Content:

Step 20. When the RAS actions (step 19) have been verified, close the following valves:

Objective:

This step directs the operator actions after an RAS.

Basis: (CEN-152, page 10-33, step 5)

Manually closing the outlet valves from the Refueling Water Storage Pool will isolate the RWSP from the safety injection pumps. The pumps recirculation valves are closed to prevent inventory loss from the safety injection sump to the RWSP.

Operational Considerations:

NA

EPG Step Content: (CEN-152, page 10-127, step 5)

Monitor the refueling water tank level. If the refueling water tank level falls to [10%], verify automatic actuation of recirculation. If necessary, manually actuate recirculation one ECCS train at a time [and close RWT outlet valves to the safety injection system].

Justification of Differences:

This EPG step was divided into several steps to include plant specific information.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_3. Recovery Actions: Subprocedure III. RCS Inventory Control

Success Path III-2

EOP Step Content:

Step 21. IF RAS occurs, THEN on Attachment 4: HPSI and CS Pump Flow, record the HPSI AND Containment Spray pumps flow at the following time intervals:

Objective:

This step monitors the high pressure safety injection and containment spray pumps for performance requirements.

Basis: (CEN-152, page 10-36, step 8)

After the switch to recirculation, the HPSI and CS Pumps are monitored in order to ensure that the Emergency Core Coolant System performance requirements are maintained. This action helps to avert any possible permanent pump damage.

Operational Considerations:

NA

EPG Step Content: (CEN-152, page 10-128, step 8)

If the HPSI pumps are delivering less than [30 gpm] per pump during recirculation, turn off one charging pump and one HPSI pump (turn off the HPSI pump with the lower indicated flow) at a time until the HPSI pumps are delivering more than [30 gpm] per pump.

Justification of Differences:

The EPG step was divided into several steps to include plant specific information.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_3. Recovery Actions: Subprocedure III. RCS Inventory Control
Success Path III-2

EOP Step Content:

Step 22. IF HPSI flow is NOT >25 gpm per operating HPSI pump, THEN sequentially perform the following until operating HPSI pump flow ≥25 gpm:

Objective:

This step ensures that each operating high pressure safety injection pump has a minimum flow ≥25 gpm.

Basis: (CEN-152, page 10-36, step 8)

After the switch to recirculation, the HPSI flows are monitored in order to ensure that the HPSI miniflow requirements for pump protection are met to avert any possible permanent HPSI pump damage. If they are not met, the operator should turn off the charging pumps one at a time until the miniflow requirements are met. If they are still not met with all the charging pumps off and two HPSI pumps are operating, the operator turns off the HPSI pump with the lower flow. One HPSI pump should be left operating at all times, unless the criteria of step 4 are met.

Operational Considerations:

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

EPG Step Content: (CEN-152, page 10-128, step 8)

If the HPSI pumps are delivering less than [30 gpm] per pump during recirculation, turn off one charging pump and one HPSI pump (turn off the HPSI pump with the lower indicated flow) at a time until the HPSI pumps are delivering more than [30 gpm] per pump.

Justification of Differences:

The EPG step was divided into several steps to include plant specific information.

E_3. **Recovery Actions: Subprocedure III. RCS Inventory Control**

Success Path III-2

EOP Step 22 (Continued).

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_3. Recovery Actions: Subprocedure III. RCS Inventory Control
Success Path III-2

EOP Step Content:

Step 23. Between two hours AND four hours post-LOCA, realign Safety Injection pumps discharge for equal flow to the Hot Legs AND Cold Legs as follows:

Objective:

This step aligns safety injection pump discharge to both hot and cold leg injection.

Basis:

Simultaneous hot and cold leg injection is used for both small break and large break Loss of Coolant Accidents at 2-4 hours after the start of the Loss of Coolant Accident. In this mode, the high pressure safety injection pumps discharge lines are realigned so that the total injection flow is divided equally between the hot and cold legs. Simultaneous injection into the hot and cold legs is used as the mechanism to prevent the precipitation of boric acid in the reactor vessel following a break that is too large to allow the reactor coolant system to refill. Injecting to both sides of the reactor vessel ensures that fluid from the reactor vessel (when the boric acid is being concentrated) flows out the break regardless of the break location and is replenished with a dilute solution of borated water from the other side of the reactor vessel. The action is taken no sooner than 2 hours after the Loss of Coolant Accident since the fluid injected to the hot leg may be entrained in the steam being released from the core and hence possibly diverted from reaching the reactor vessel. After 2 hours, the core decay heat has dropped sufficiently so that there is insufficient steam velocity to entrain the fluid being injected to the hot leg. The action is taken no later than 4 hours after the Loss of Coolant Accident in order to ensure that the buildup of boric acid is terminated well before the potential for boric acid precipitation occurs. Even though the action is required only for large breaks, it is taken for any Loss of Coolant Accident so that the operator need not be required to distinguish between large and small breaks so early in the transient.

E_3. Recovery Actions: Subprocedure III. RCS Inventory Control

Success Path III-2

EOP Step 23 (Continued).

Basis: (Continued)

Simultaneous hot and cold leg injection is not required for small breaks, because for them the buildup of boric acid is terminated when the reactor coolant system is refilled. Once the reactor coolant system is refilled, the boric acid is dispersed throughout the reactor coolant system via natural circulation.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

PV-OP-902, Parameter Values Document. Table 5-5, Time.

E_3. <u>Recovery Actions: Subprocedure III. RCS Inventory Control</u>
Success Path III-2

EOP Step Content:

Step 24. Check the following success path criteria:

Objective:

The objective of this step is to check the criteria associated with satisfactorily completing this success path.

Basis: (CEN-152, page 10-4, step 3)

The basis for each individual criterion is given in Section 2.0 of the technical guide. The criteria are used to judge the status of each safety function. Since each safety function has multiple success paths which can be used to control that safety function, the criteria which are used to judge the status of each safety function are organized around the success paths for each safety function. Since each success path uses or may use different technical means of achieving a function, the criteria for judging the success of that path are specific to the technical means. Also, in order to facilitate operator use, the criteria chosen are parameters which can be read directly from the control board.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_3. Recovery Actions: Subprocedure III. RCS Inventory Control

Success Path III-2

EOP Step Content:

Step 25. IF the success path criteria (step 24) are met, THEN go to the next safety function in jeopardy.

Objective:

The objective of this step is to instruct the operator what to do if this success path is satisfactorily completed.

Basis: (CEN-152, page 10-12, step 7)

After checking the success path criteria, additional guidance is provided which aids the operator in determining the next course of action. In this step, if control of the safety function is achieved, the operator is instructed to go to the next safety function in jeopardy.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_3. Recovery Actions: Subprocedure III. RCS Inventory Control
Success Path III-2

EOP Step Content:

Step 26. IF the success path criteria (step 24) are NOT met, THEN continue with Subprocedure III. RCS Inventory Control until a success path criterion is satisfactorily being maintained.

Objective:

The objective of this step is to instruct the operator what to do if this success path is not satisfactorily completed.

Basis: (CEN-152, page 10-38)

If the criteria are not met, then RCS Inventory Control is still in jeopardy. The operator should not leave RCS Inventory Control until this function is fulfilled.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_3. <u>Recovery Actions: Subprocedure III. RCS Inventory Control</u>

Success Path III-2

EOP Step Content:

Step 27. <u>IF</u> the Control Room Supervisor determines it is necessary to pursue other safety functions in jeopardy, <u>THEN</u> go to the next safety function in jeopardy <u>AND</u> implement its subprocedure concurrently with this subprocedure.

Objective:

The objective of this step is to allow the control room supervisor to pursue other safety functions in jeopardy while efforts are continued on RCS Inventory Control.

Basis: (CEN-152, page 10-38)

The operator may, if necessary, pursue other urgent safety functions but must continue to attempt to establish RCS Inventory Control.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery G[illegible]

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-1 Low/High Pressure

EOP Step Content:

Step 1. Verify Pressurizer Pressure Control System is maintaining OR restoring pressure within the limits of Attachment 5: Post-Accident Pressure and Temperature Limits Graph.

Objective:

This step verifies pressurizer pressure control system is functioning to maintain or restore pressurizer pressure.

Basis: (CEN-152, page 10-44, step 1, and page 10-49, step 1)

Pressurizer heaters and/or main (preferred) or auxiliary spray are operated manually to restore and maintain pressure within the limits of Attachment 5: Post-Accident Pressure and Temperature Limits Graph. Automatic PPCS operation is instituted if desired. This action ensures the RCS pressure control is being restored.

Operational Considerations:

Subcooling margin 28°F to 200°F shall be maintained. Below 1000 psia, subcooling margin shall be determined by subtracting hot leg temperature from Pressurizer Temperature Water (TI 101). Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading. 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 10-132, step 1, and page 10-140, step 1)

Manually control heaters or main spray (preferred) or auxiliary spray to restore pressurizer pressure within the limits of Figure 10-10. If the normal pressure based is desired and if the PPCS if functioning, shift to automatic PPCS.

E_4. <u>Recovery Actions: Subprocedure IV. RCS Pressure Control</u>

Success Path IV-1 Low/High Pressure

EOP Step 1 (Continued).

Justification of Differences:

EPG Success Paths PC-1 and PC-4 were combined in the EOP Success Path IV-1. Both involve basically the same actions. Also, the EPG step was divided into several steps to include plant specific information.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-2, Subcooling.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-1 Low/High Pressure

EOP Step Content:

Step 2. IF Pressurizer level >28%, THEN verify Pressurizer heaters restored.

Objective:

The objective of this step is to verify pressurizer heaters restored when inventory is restored.

Basis: (CEN-152, page 10-41, step 1, and page 10-49, step 1)

Pressurizer heaters and/or main (preferred) or auxiliary spray are operated manually to restore and maintain pressure within the limits of Figure 10-10. Automatic PPCS operation is instituted if desired. This action ensures the RCS pressure control is being restored.

Operational Considerations:

If SIAS and loss of offsite power exist, then pressurizer heaters will not be available for use. Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading.

EPG Step Content: (CEN-152, page 10-132, step 1, and page 10-140, step 1)

Manually control heaters or main spray (preferred) or auxiliary spray to restore pressurizer pressure within the limits of Figure 10-10. If the normal pressure based is desired and if the PPCS is functioning, shift to automatic PPCS.

Justification of Differences:

EPG Success Paths PC-1 and PC-4 were combined in the EOP Success Path IV-1. Both involve basically the same actions. Also, the EPG step was divided into several steps to include plant specific information.

E_4. <u>Recovery Actions: Subprocedure IV. RCS Pressure Control</u>

Success Path IV-1 Low/High Pressure

EOP Step 2 (Continued).

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-2, Subcooling.

E_4. <u>Recovery Actions: Subprocedure IV. RCS Pressure Control</u>

Success Path IV-1 Low/High Pressure

EOP Step Content:

Step 3. IF Reactor Coolant Pump 1A OR 1B is 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: (CEN-152, page 10-41, step 1, and page 10-49, step 1)

Pressurizer heaters and/or main (preferred) or auxiliary spray are operated manually to restore and maintain pressure within the limits of Attachment 5: Post-Accident Pressure and Temperature Limits Graph. Automatic PPCS operation is instituted if desired. This action ensures the RCS pressure control is being restored.

Operational Considerations:

NA

EPG Step Content: (CEN-152, page 10-132, step 1, and page 10-140, step 1)

Manually control heaters or main spray (preferred) or auxiliary spray to restore pressurizer pressure within the limits of Figure 10-10. If the normal pressure based is desired and if the PPCS is functioning, shift to automatic PPCS.

Justification of Differences:

EPG Success Paths PC-1 and PC-4 were combined in the EOP Success Path IV-1. Both involve basically the same actions. Also, the EPG step was divided into several steps to include plant specific information.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-2, Subcooling.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-1 Low/High Pressure

EOP Step Content:

Step 4. IF Reactor Coolant Pumps 1A AND 1B are NOT operating, THEN align Pressurizer Auxiliary Spray as follows:

Objective:

This step aligns charging pumps for auxiliary spray when normal spray is not available.

Basis: (CEN-152, page 10-41, step 1, and page 10-49, step 1)

Pressurizer heaters and/or main (preferred) or auxiliary spray are operated manually to restore and maintain pressure within the limits of Attachment 5: Post-Accident Pressure and Temperature Limits Graph. Automatic PPCS operation is instituted if desired. This action ensures the RCS pressure control is being restored.

Operational Considerations:

Pressurizer pressure control with pressurizer auxiliary spray raises the pressurizer level when letdown is not in operation.

EPG Step Content: (CEN-152, page 10-132, step 1, and page 10-140, step 1)

Manually control heaters or main spray (preferred) or auxiliary spray to restore pressurizer pressure within the limits of Figure 10-10. If the normal pressure based is desired and if the PPCS is functioning, shift to automatic PPCS.

Justification of Differences:

EPG Success Paths PC-1 and PC-4 were combined in the EOP Success Path IV-1. Both involve basically the same actions. Also, the EPG step was divided into several steps to include plant specific information.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-2, Subcooling.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-1 Low/High Pressure

EOP Step Content:

Step 5. Check the following success path criteria:

Objective:

The objective of this step is to check the criteria associated with satisfactorily completing this success path.

Basis: (CEN-152, page 10-4, step 3)

The basis for each individual criterion is given in Section 2.0 of the technical guide. The criteria are used to judge the status of each safety function. Since each safety function has multiple success paths which can be used to control that safety function, the criteria which are used to judge the status of each safety function are organized around the success paths for each safety function. Since each success path uses or may use different technical means of achieving a function, the criteria for judging the success of that path are specific to the technical means. Also, in order to facilitate operator use, the criteria chosen are parameters which can be read directly from the control board.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-1 Low/High Pressure

EOP Step Content:

Step 6. IF the success path criteria (step 5) are met, THEN go to the next safety function in jeopardy.

Objective:

The objective of this step is to instruct the operator what to do if this success path is satisfactorily completed.

Basis: (CEN-152, page 10-12, step 7)

After checking the success path criteria, additional guidance is provided which aids the operator in determining the next course of action. In this step, if control of the safety function is achieved, the operator is instructed to go to the next safety function in jeopardy.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-1 Low/High Pressure

EOP Step Content:

Step 7. IF the success path criteria (step 5) are NOT met due to low Pressurizer pressure, THEN go the Success Path IV-2, Low Pressure.

Objective:

The objective of this step is to instruct the operator what to do if this success path is not satisfactorily completed.

Basis: (CEN-152, page 10-12, step 7)

After checking the success path criteria, additional guidance is provided which aids the operator in determining the next course of action. In this step, if control of the safety function is not achieved, the operator is instructed to implement another success path for this safety function.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-1 Low/High Pressure

EOP Step Content:

Step 8. IF the success path criteria (step 5) are NOT met due to high Pressurizer pressure, THEN go to Success Path IV-4, High Pressure.

Objective:

The objective of this step is to instruct the operator what to do if this success path is not satisfactorily completed.

Basis: (CEN-152, page 10-12, step 7)

After checking the success path criteria, additional guidance is provided which aids the operator in determining the next course of action. In this step, if control of the safety function is not achieved, the operator is instructed to implement another success path for this safety function.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-2 Low Pressure

EOP Step Content:

Step 1. IF Pressurizer pressure ≤1385 psia, THEN go to Success Path IV-3.

Objective:

This step directs the operator to the next success path if SIAS has occurred.

Basis:

Since charging pumps are actuated by SIAS, the operator may have selected this success path on the resource assessment tree because it is a higher priority success path. If SIAS has occurred, the operator needs to read the actions associated with SIAS, therefore this step directs the operator to the appropriate success path.

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:

PV-OP-902, Parameter Values Document. Table 5-4, Pressure.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-2 Low Pressure

EOP Step Content:

Step 2. Verify Charging pumps aligned to take suction from one of the following sources as follows:

Objective:

This step ensures the charging pumps have an adequate suction source.

Basis: (CEN-152, page 10-42, step 2)

Adequate suction sources to the charging pumps are verified. If necessary, the VCT, boric acid storage tanks and RWSP may be used. The source(s) of water for use in controlling RCS inventory depend on the total amount of fluid necessary for make up to the RCS and the time frame over which the fluid must be introduced. The volume control tank is the primary source of fluid for RCS makeup. If necessary, for the cases where RCS inventory losses are being incurred, the contents of the boric acid makeup tanks and the refueling water tank may be used as backup sources of makeup water.

Operational Considerations:

If SIAS has occurred, then the charging pumps suction may be aligned to both boric acid makeup tanks. If volume control tank level <6%, then the volume control tank cannot be used to supply the charging pumps.

EPG Step Content: (CEN-152, page 10-134, step 2)

Verify adequate suction sources from the (listed in order of priority) [VCT, BAMT, RWT or spent fuel pool] to the charging pumps.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-2 Low Pressure

EOP Step 2 (Continued).

Justification of Differences:

The EPG step was placed before the step for taking the pressurizer solid. Since inventory control is a higher priority success path, pressurizer level control should have already been verified. Depending on which suction source the charging pumps were aligned to in inventory control, the operator may need to verify the adequacy of that suction source for taking the pressurizer solid.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-2 Low Pressure

EOP Step Content:

Step 3. IF SIAS OR CIAS has occurred, THEN place Letdown in service as follows:

Objective:

This step places letdown back in service, following an SIAS or CIAS, in preparation for taking the pressurizer solid with the charging pumps.

Basis:

Since pressurizer pressure is greater than the shutoff head of the high pressure safety injection pumps, the pressurizer is taken solid using charging pumps. Since the charging pumps are positive displacement pumps, letdown is used to regulate pressure when the pressurizer is solid. This provides smoother control of pressure and also prevents having to cycle charging pumps to maintain pressure. A charging pump may be left running instead and letdown is throttled to maintain pressure. Since SIAS and CIAS isolates letdown, this step will place letdown back in service using the override capability of the valves. This success path is only used if pressurizer pressure is >1385 psia. If pressurizer pressure is ≤1385 psia the high pressure safety injection pumps should be used to take the pressurizer solid which is covered in the next success path.

Operational Considerations:

Letdown should not be placed in service unless pressurizer level is being maintained >28%. If CSAS has occurred, then letdown should not be placed in service, since component cooling water will not be supplied to the letdown heat exchanger. Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading.

EPG Step Content:

NA

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-2 Low Pressure

EOP Step 3 (Continued).

Justification of Differences:

NA

Source Document:

PV-OP-902, Parameter Values Document. Table 5-1, Level.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-2 Low Pressure

EOP Step Content:

Step 4. IF Charging AND Letdown Systems are maintaining level 33% to 60%, THEN perform the following:

Objective:

This step takes the pressurizer solid to restore pressurizer pressure.

Basis: (CEN-152, page 10-42, step 1)

Raising pressurizer level with a steam bubble in the pressurizer will tend to increase pressure. If pressurizer heaters are not available the pressurizer may be taken solid to control pressure with the charging pumps. This should not be done unless 28°F minimum subcooling cannot be maintained.

Operational Considerations:

Solid water operation is permissible only when reactor coolant system subcooling margin <28°F. Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading.

EPG Step Content: (CEN-152, page 10-134, step 1)

Verify that the PLCS is automatically maintaining or restoring pressurizer level. If not, manually operate charging and letdown to restore and maintain pressurizer level. The operator may take the pressurizer solid if [20]°F subcooling cannot be maintained.

Justification of Differences:

The EOP step addresses taking the pressurizer solid. It does not mention pressurizer level control since this was done in inventory control. The step was expanded to provide explicit instructions for taking the pressurizer solid.

E_4. **Recovery Actions: Subprocedure IV. RCS Pressure Control**

Success Path IV-2 Low Pressure

EOP Step 4 (Continued).

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-2, Subcooling.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-2 Low Pressure

EOP Step Content:

Step 5. IF Charging pumps are aligned to the Boric Acid Makeup Tanks AND Letdown is in operation, THEN within 30 minutes to 1 hour from the time the Charging pumps were aligned to the Boric Acid Makeup Tanks, realign them as follows:

Objective:

This step terminates charging from a concentrated boron source within 1 hour if letdown is in service.

Basis:

Charging from the concentrated boron source should not continue past 1 hour after event initiation unless required for reactivity control. This is to preclude boron precipitation. Charging pump suction should be shifted to the lower concentration source.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-2 Low Pressure

EOP Step Content:

Step 6. IF Charging pumps are aligned to the Boric Acid Makeup Tanks AND Letdown is NOT in operation, THEN within 30 minutes to 1 hour from the time the Charging pumps were aligned to the Boric Acid Makeup Tanks, realign them as follows:

Objective:

This step terminates charging from a concentrated boron source within 1 hour if letdown is not in service.

Basis:

Charging from the concentrated boron source should not continue past 1 hour after event initiation unless required for reactivity control. This is to preclude boron precipitation. Charging pump suction should be shifted to the lower concentration source.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-2 Low Pressure

EOP Step Content:

Step 7. Check the following success path criteria:

Objective:

The objective of this step is to check the criteria associated with satisfactorily completing this success path.

Basis: (CEN-152, page 10-4, step 3)

The basis for each individual criterion is given in Section 2.0 of the technical guide. The criteria are used to judge the status of each safety function. Since each safety function has multiple success paths which can be used to control that safety function, the criteria which are used to judge the status of each safety function are organized around the success paths for each safety function. Since each success path uses or may use different technical means of achieving a function, the criteria for judging the success of that path are specific to the technical means. Also, in order to facilitate operator use, the criteria chosen are parameters which can be read directly from the control board.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-2 Low Pressure

EOP Step Content:

Step 8. IF the success path criteria (step 7) are met, THEN go to the next safety function in jeopardy.

Objective:

The objective of this step is to instruct the operator what to do if this success path is satisfactorily completed.

Basis: (CEN-152, page 10-12, step 7)

After checking the success path criteria, additional guidance is provided which aids the operator in determining the next course of action. In this step, if control of the safety function is achieved, the operator is instructed to go to the next safety function in jeopardy.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_4. <u>Recovery Actions: Subprocedure IV. RCS Pressure Control</u>

Success Path IV-2 Low Pressure

EOP Step Content:

Step 9. IF the success path criteria (step 7) are NOT met, THEN go to Success Path IV-3, Low Pressure.

Objective:

The objective of this step is to instruct the operator what to do if this success path is not satisfactorily completed.

Basis: (CEN-152, page 10-12, step 7)

After checking the success path criteria, additional guidance is provided which aids the operator in determining the next course of action. In this step, if control of the safety function is not achieved, the operator is instructed to implement another success path for this safety function.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-3 Low Pressure

EOP Step Content:

Step 1. IF Pressurizer pressure drops to ≤1684 psia OR Containment pressure rises to ≥17.4 psia, THEN verify SIAS occurs as follows:

Objective:

The objective of this step is to verify SIAS occurs when required.

Basis: (CEN-152, page 10-44, step 1)

ECCS operation must be verified if pressurizer pressure decreases to 1684 psia or if containment pressure increases to 17.4 psia. If safety injection system operation has not commenced automatically on high containment pressure 17.4 psia or when RCS pressure is below 1684 psia, it must be manually actuated. This action restores inventory so that pressure can be controlled by use of either pressurizer heaters and spray or by using the discharge head of the ECCS pumps to control pressure.

Operational Considerations:

Hot leg temperatures and cold leg temperatures may be influenced by safety injection flow. Multiple indications and core temperatures should be used to determine the reactor coolant system temperature. Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading.

EPG Step Content: (CEN-152, page 10-136, step 1)

If pressurizer pressure decreased to [1600 psia], [or if containment pressure increases to 4 psig], verify that an SIAS has been initiated. If it has not, manually initiate an SIAS.

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-4, Pressure.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-3 Low Pressure

EOP Step Content:

Step 2. IF either of the following conditions occur, THEN stop ALL Reactor Coolant Pumps:

Objective:

The objective of this step is to stop reactor coolant pump operation when pressurizer pressure ≤1621 psia following a SIAS or when component cooling water is lost.

Basis: (CEN-152, page 10-44, step 2)

This step serves to prevent continued RCP operation when RCS pressure is ≤1621 psia during a Loss of Coolant Accident. Continued RCP operation at RCS pressures below 1621 psia during a Loss of Coolant Accident may result in more severe RCS conditions. When component cooling water is lost to the reactor coolant pumps, damage to pump components could occur if the RCPs are not secured.

Operational Considerations:

Since other events could cause rapid depressurization, anytime pressurizer pressure drops below 1621 psia following a SIAS, all reactor coolant pump operation is terminated. Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading.

EPG Step Content: (CEN-152, page 10-136, step 2)

If pressurizer pressure decreases to (1300 psia) following an SIAS, stop all reactor coolant pumps.

Justification of Differences:

Loss of component cooling water to reactor coolant pumps is added to this step because component cooling water is isolated to the reactor coolant pumps when an SIAS actuation occurs.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-3 Low Pressure

EOP Step 2 (Continued).

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-4, Pressure.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-3 Low Pressure

EOP Step Content:

Step 3. IF SIAS has occurred, THEN complete Attachment 1: SIAS Automatic Actions.

Objective:

The objective of this step is to verify all actions required by an SIAS.

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.

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_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-3 Low Pressure

EOP Step Content:

Step 4. Check the following Safety Injection termination criteria:

Objective:

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

Basis: (CEN-152, page 10-45, step 3)

If an SIAS has been initiated and the SIS is operating, it must continue to operate at full capacity until SIS termination criteria are met. Early termination may be desirable when the criteria are met to preclude PTS situations or HPSI pump damage (e.g., shaft seals).

Operational Considerations:

Below 1000 psia, subcooling margin shall be determined by subtracting hot leg temperature from Pressurizer Temperature Water (TI 101). Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading.

EPG Step Content: (CEN-152, page 10-136, step 3)

If the ECCS is operating, it may be throttle stopped one train at a time if 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 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-1, Level and Table 5-2, Subcooling.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-3 Low Pressure

EOP Step Content:

Step 5. IF ALL Safety Injection termination criteria (step 4) 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, unless 28°F subcooling margin cannot be maintained. If 28°F subcooling margin cannot be maintained, then the pressurizer is taken solid with high pressure safety injection pumps.

Basis: (CEN-152, page 10-46, step 3)

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 10-136, step 3)

If the ECCS is operating, it may be throttle stopped one train at a time if 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.

E_4. <u>Recovery Actions: Subprocedure IV. RCS Pressure Control</u>

Success Path IV-3 Low Pressure

EOP Step 5 (Continued).

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-1, Level.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-3 Low Pressure

EOP Step Content:

Step 6. IF ALL Safety Injection termination criteria (step 4) can NOT be maintained after throttling OR stopping Safety Injection flow, THEN reinitiate Safety Injection flow.

Objective:

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

Basis: (CEN-152, page 10-46, step 4)

If all of the criteria of step 3 cannot be maintained, the safety injection pumps must be restarted whenever necessary to satisfy all the criteria.

Operational Considerations:

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

EPG Step Content: (CEN-152, page 10-136, step 4)

If all the criteria of step 3 cannot be maintained after the ECCS has been stopped, the ECCS must be restarted.

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-3 Low Pressure

EOP Step Content:

Step 7. IF Pressurizer pressure drops to ≤1385 psia, THEN verify proper HPSI Header flow exists. Refer to Attachment 2: HPSI and LPSI Flow versus Pressurizer Pressure.

Objective:

The objective of this step is to verify that inventory is provided to the reactor coolant system during a Loss of Coolant Accident.

Basis:

A Loss of Coolant Accident will result in actuation of safety injection. The reactor coolant system pressure will respond during the accident according to the break size. Safety injection system flow rate will follow the reactor coolant system pressure according to the safety injection system delivery curves. The safety injection system and charging flow rate should be checked and maximized relative to reactor coolant system pressure to enhance reactor coolant system inventory replenishment and/or core heat removal.

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:

PV-OP-902, Parameter Values Document. Table 5-4, Pressure.

E_4. <u>Recovery Actions: Subprocedure IV. RCS Pressure Control</u>

Success Path IV-3 Low Pressure

EOP Step Content:

Step 8. <u>IF</u> Pressurizer pressure drops to ≤183 psia, <u>THEN</u> verify proper LPSI Header flow exists. Refer to Attachment 2: HPSI and LPSI Flow versus Pressurizer Pressure.

Objective:

The objective of this step is to verify that inventory is provided to the reactor coolant system during a Loss of Coolant Accident.

Basis:

A Loss of Coolant Accident will result in actuation of safety injection. The reactor coolant system pressure will respond during the accident according to the break size. Safety injection system flow rate will follow the reactor coolant system pressure according to the safety injection system delivery curves. The safety injection system and charging flow rate should be checked and maximized relative to reactor coolant system pressure to enhance reactor coolant system inventory replenishment and/or core heat removal.

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:

PV-OP-902, Parameter Values Document. Table 5-4, Pressure.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-3 Low Pressure

EOP Step Content:

Step 9. IF BOTH LPSI pumps A AND B are NOT available AND Pressurizer pressure is <250 psia, THEN align one Containment Spray pump to the LPSI Header as follows:

Objective:

This step ensures safety injection flow to the reactor coolant system if both low pressure safety injection pumps are unavailable by using a containment spray pump to inject water.

Basis:

If both low pressure safety injection pumps are unavailable and pressurizer pressure is <250 psia, then a containment spray pump may be aligned to inject water through the low pressure safety injection header to the reactor coolant system.

Operational Considerations:

If CSAS has occurred, then this step should not be performed. Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading.

EPG Step Content:

Technical Guideline, Section 5.10, Parameter Values Document. Table 5-4, Pressure.

Justification of Differences:

NA

Source Document:

NA

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-3 Low Pressure

EOP Step Content:

Step 10. IF SIAS has occurred AND Letdown is in operation, THEN within 30 minutes to 1 hour from the time the SIAS occurred, terminate Emergency Boration as follows:

Objective:

This step terminates charging from a concentrated boron source within 1 hour if letdown is in service.

Basis:

Charging from the concentrated boron source should not continue past 1 hour after event initiation unless required for reactivity control. This is to preclude boron precipitation. Charging pump suction should be shifted to the lower concentration source.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-3 Low Pressure

EOP Step Content:

Step 11. IF SIAS has occurred AND Letdown is NOT in operation, THEN within 30 minutes to 1 hour from the time the SIAS occurred, terminate Emergency Boration as follows:

Objective:

This step terminates charging from a concentrated boron source within 1 hour if letdown is not in service.

Basis:

Charging from the concentrated boron source should not continue past 1 hour after event initiation unless required for reactivity control. This is to preclude boron precipitation. Charging pump suction should be shifted to the lower concentration source.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-3 Low Pressure

EOP Step Content:

Step 12. IF Containment pressure <17.4 psia, THEN reset SIAS AND CIAS. Refer to Attachment 3: SIAS and CIAS Reset Procedure.

Objective:

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

Basis:

When containment pressure is ≥17.4 psia, SIAS and CIAS cannot be reset. Because 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:

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:

PV-OP-902, Parameter Values Document. Table 5-4, Pressure.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-3 Low Pressure

EOP Step Content:

Step 13. IF SIAS AND CIAS are reset AND Chemical and Volume Control System is available for operation, 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:

If safety injection flow has not been throttled or terminated, then letdown should not be placed in operation. Where multiple indications for one parameter exist, more than one instrument should be used 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.

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-3 Low Pressure

EOP Step Content:

Step 14. IF Refueling Water Storage Pool level drops to 10%, THEN verify that Recirculation Actuation Signal occurs AND check ALL the following:

Objective:

This step ensures that RAS occurs to provide a suction source to the safety injection pumps.

Basis: (CEN-152, page 10-46, step 5)

If the Refueling Water Storage Pool level falls to 10%, initiation of recirculation should be verified. Recirculation is actuated in order to maintain a continuous flow of safety injection fluid to the RCS and a continuous flow of containment spray water. The operator should be cautioned against prematurely initiating an RAS. An inadequate amount of level in the safety injection sump may cause air binding of safety injection pumps and loosing both heat removal loops.

Operational Considerations:

When RAS occurs and safety injection sump level is <10 feet, safety injection pumps should be monitored for potential air binding. Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading.

EPG Step Content: (CEN-152, page 10-136, step 5)

Monitor the refueling water tank level. If the refueling water tank level falls to [10%], verify automatic actuation of recirculation. If necessary, manually actuate recirculation one ECCS train at a time [and close RWT outlet valves to the safety injection system].

Justification of Differences:

This EPG step was divided into several steps to include plant specific information.

E_4. **Recovery Actions: Subprocedure IV. RCS Pressure Control**

Success Path IV-3 Low Pressure

EOP Step 14 (Continued).

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-1, Level.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-3 Low Pressure

EOP Step Content:

Step 15. When the RAS actions (step 14) have been verified, close the following valves:

Objective:

This step directs the operators action after a RAS.

Basis: (CEN-152, page 10-46, step 5)

Manually closing the outlet valves from the Pefueling Water Storage Pool will isolate the RWSP from the safety injection pumps. The pumps recirculation valves are closed to prevent inventory loss from the safety injection sump to the RWSP.

Operational Considerations:

NA

EPG Step Content: (CEN-152, page 10-136, step 5)

Monitor the refueling water tank level. If the refueling water tank level falls to [10%], verify automatic actuation of recirculation. If necessary, manually actuate recirculation one ECCS train at a time [and close RWT outlet valves to the safety injection system].

Justification of Differences:

This EPG step was divided into several steps to include plant specific information.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control
Success Path IV-3 Low Pressure

EOP Step Content:

Step 16. IF RAS occurs, THEN on Attachment 4: HPSI and CS Pump Flow, record the HPSI AND Containment Spray pumps flow at the following time intervals:

Objective:

This step monitors the high pressure safety injection and containment spray pumps for performance requirements.

Basis: (CEN-152, page 10-47, step 6)

After the switch to recirculation, the HPSI and CS Pumps are monitored in order to ensure that the Emergency Core Coolant System performance requirements are maintained. This action helps to avert any possible permanent pump damage.

Operational Considerations:

NA

EPG Step Content: (CEN-152, page 10-136, step 6)

If the HPSI pumps are delivering less than [30 gpm] per pump during recirculation, turn off one charging pump and one HPSI pump (turn off the HPSI pump with the lower indicated flow) at a time until the HPSI pumps are delivering more than [30 gpm] per pump.

Justification of Differences:

The EPG step was divided into several steps to include plant specific information.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-3 Low Pressure

EOP Step Content:

Step 17. IF HPSI flow is NOT ≥25 gpm per operating HPSI pump AND RAS has occurred, THEN sequentially perform the following until operating HPSI pump flow ≥25 gpm:

Objective:

This step ensures that each operating high pressure safety injection pump has a minimum flow ≥25 gpm.

Basis: (CEN-152, page 10-47, step 6)

After the switch to recirculation, the HPSI flows are monitored in order to ensure that the HPSI miniflow requirements for pump protection are met to avert any possible permanent HPSI pump damage. If they are not met, the operator should turn off the charging pumps one at a time until the miniflow requirements are met. If they are still not met with all the charging pumps off and two HPSI pumps are operating, the operator turns off the HPSI pump with the lower flow. One HPSI pump should be left operating at all times, unless the criteria of step 3 are met.

Operational Considerations:

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

EPG Step Content: (CEN-152, page 10-136, step 7)

If the HPSI pumps are delivering less than [30 gpm] per pump during recirculation, turn off one charging pump and one HPSI pump (turn off the HPSI pump with the lower indicated flow) at a time until the HPSI pumps are delivering more than [30 gpm] per pump.

Justification of Differences:

The EPG step was divided into several steps to include plant specific information.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-3 Low Pressure

EOP Step 17 (Continued).

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-3 Low Pressure

EOP Step Content:

Step 18. Between two hours AND four hours post-LOCA, realign Safety Injection pumps discharge for equal flow to the Hot Legs AND Cold Legs as follows:

Objective:

This step aligns safety injection pump discharge to both hot and cold leg injection.

Basis:

Simultaneous hot and cold leg injection is used for both small break and large break Loss of Coolant Accidents at 2-4 hours after the start of the Loss of Coolant Accident. In this mode, the high pressure safety injection pumps discharge lines are realigned so that the total injection flow is divided equally between the hot and cold legs. Simultaneous injection into the hot and cold legs is used as the mechanism to prevent the precipitation of boric acid in the reactor vessel following a break that is too large to allow the reactor coolant system to refill. Injecting to both sides of the reactor vessel ensures that fluid from the reactor vessel (when the boric acid is being concentrated) flows out the break regardless of the break location and is replenished with a dilute solution of borated water from the other side of the reactor vessel. The action is taken no sooner than 2 hours after the Loss of Coolant Accident since the fluid injected to the hot leg may be entrained in the steam being released from the core and hence possibly diverted from reaching the reactor vessel. After 2 hours, the core decay heat has dropped sufficiently so that there is insufficient steam velocity to entrain the fluid being injected to the hot leg. The action is taken no later than 4 hours after the Loss of Coolant Accident in order to ensure that the buildup of boric acid is terminated well before the potential for boric acid precipitation occurs. Even though the action is required only for large breaks, it is taken for any Loss of Coolant Accident so that the operator need not be required to distinguish between large and small breaks so early in the transient.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-3 Low Pressure

EOP Step 18 (Continued).

Basis: (Continued)

Simultaneous hot and cold leg injection is not required for small breaks, because for them the buildup of boric acid is terminated when the reactor coolant system is refilled. Once the reactor coolant system is refilled, the boric acid is dispersed throughout the reactor coolant system via natural circulation.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

PV-OP-902, Parameter Values Document. Table 5-5, Time.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-3 Low Pressure

EOP Step Content:

Step 19. Check the following success path criteria:

Objective:

The objective of this step is to check the criteria associated with satisfactorily completing this success path.

Basis: (CEN-152, page 10-4, step 3)

The basis for each individual criterion is given in Section 2.0 of the technical guide. The criteria are used to judge the status of each safety function. Since each safety function has multiple success paths which can be used to control that safety function, the criteria which are used to judge the status of each safety function are organized around the success paths for each safety function. Since each success path uses or may use different technical means of achieving a function, the criteria for judging the success of that path are specific to the technical means. Also, in order to facilitate operator use, the criteria chosen are parameters which can be read directly from the control board.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-3 Low Pressure

EOP Step Content:

Step 20. IF the success path criteria (step 19) are met, THEN go to the next safety function in jeopardy.

Objective:

The objective of this step is to instruct the operator what to do if this success path is satisfactorily completed.

Basis: (CEN-152, page 10-12, step 7)

After checking the success path criteria, additional guidance is provided which aids the operator in determining the next course of action. In this step, if control of the safety function is achieved, the operator is instructed to go to the next safety function in jeopardy.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-3 Low Pressure

EOP Step Content:

Step 21. IF the success path criteria (step 19) are NOT met, THEN continue with Subprocedure IV. RCS Pressure Control until a success path criterion is satisfactorily being maintained.

Objective:

The objective of this step is to instruct the operator what to do if this success path is not satisfactorily completed.

Basis: (CEN-152, page 10-48)

If the criteria are not met, then RCS Pressure Control is still in jeopardy. The operator should not leave RCS Pressure Control until this function is fulfilled.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-3 Low Pressure

EOP Step Content:

Step 22. IF the Control Room Supervisor determines it is necessary to pursue other safety functions in jeopardy, THEN go to the next safety function in jeopardy AND implement its subprocedure concurrently with this subprocedure.

Objective:

The objective of this step is to allow the control room supervisor to pursue other safety functions in jeopardy while efforts are continued on RAS Pressure Control.

Basis: (CEN-152, page 10-48)

The operator may, if necessary, pursue other urgent safety functions but must continue to attempt to establish RCS Pressure Control.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-4 High Pressure

EOP Step Content:

Step 1. Verify Pressurizer heaters are deenergized.

Objective:

This step verifies pressurizer heaters are deenergized.

Basis:

Pressurizer heaters add heat to the pressurizer which raises pressurizer pressure. If pressure is too high the heaters should be deenergized to prevent raising pressure higher.

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:

NA

Justification of Differences:

NA

Source Document:

NA

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-4 High Pressure

EOP Step Content:

Step 2. IF ALL Reactor Coolant Pumps are operating, THEN stop Reactor Coolant Pumps 1A AND 2A as follows:

Objective:

The objective of this step is to secure one reactor coolant pump in each loop to reduce reactor coolant system heat input.

Basis: (CEN-152, page 10-50, step 3)

Only one reactor coolant pump in each loop should be operated in order to minimize heat input to the RCS. If all reactor coolant pumps are operating, then one reactor coolant pump in each loop should be stopped.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_4. <u>Recovery Actions: Subprocedure IV. RCS Pressure Control</u>

Success Path IV-4 High Pressure

EOP Step Content:

Step 3. Verify Shutdown Margin in accordance with Technical Specifications. Refer to OP-903-090, SHUTDOWN MARGIN.

Objective:

This step verifies shutdown margin before plant cooldown is commenced.

Basis: (CEN-152, page 10-50, step 1)

During any cooldown, the RCS is borated as necessary to maintain shutdown margin per Technical Specifications.

Operational Considerations:

NA

EPG Step Content: (CEN-152, page 10-142, step 1)

Borate as necessary to maintain shutdown margin per Technical Specifications Limits (see RC-2 and RC-3).

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_4. <u>Recovery Actions: Subprocedure IV. RCS Pressure Control</u>

Success Path IV-4 High Pressure

EOP Step Content:

Step 4. IF ALL Reactor Coolant Pumps have been stopped, THEN check the following Reactor Coolant Pump restart criteria:

Objective:

The objective of this step is to ensure the reactor coolant system employs the preferred means of coolant circulation.

Basis: (CEN-152, page 10-50, step 3)

If RCP operation has been terminated, restarting of the reactor coolant pumps should be attempted to ensure continued forced circulation of coolant to the core for heat removal purposes. However, only one reactor coolant pump in each loop should be operated in order to minimize heat input to the RCS. Running any single RCP is adequate for heat removal purposes.

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

EPG Step Content: (CEN-152, page 10-142, step 3)

If RCP operation has been terminated, one RCP in each loop may be restarted if the following criteria are satisfied:

Justification of Differences:

The EPG was placed before the step allowing pressurzier level to drop during cooldown to ensure the motive for coolant circulation used in this success path is in effect prior to commencing cooldown.

E_4. <u>Recovery Actions: Subprocedure IV. RCS Pressure Control</u>

Success Path IV-4 High Pressure

EOP Step 4 (Continued).

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-1, Level and Table 5-2, Subcooling.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-4 High Pressure

EOP Step Content:

Step 5. IF ALL Reactor Coolant Pump restart criteria (step 4) 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:

The objective of this step is to ensure the reactor coolant system employs the preferred means of coolant circulation.

Basis: (CEN-152, page 10-51, step 4)

If the RCPs have been stopped, operation of the reactor coolant pumps should be attempted to ensure continued forced circulation of coolant through the core and to permit the use of pressurizer sprays (if available). However, only one reactor coolant pump in each loop should be operated in an effort to minimize heat input to the RCS.

Operational Considerations:

NA

EPG Step Content: (CEN-152, page 10-143, step 4)

If RCP operation has been terminated and the criteria of Step 3 are met:

Justification of Differences:

The EPG step was divided up into two steps, one which deals with restarting reactor coolant pumps and one which deals with cooldown.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_4. <u>Recovery Actions: Subprocedure IV. RCS Pressure Control</u>

Success Path IV-4 High Pressure

EOP Step Content:

Step 6. 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 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:

NA

E_4. <u>Recovery Actions: Subprocedure IV. RCS Pressure Control</u>

Success Path IV-4 High Pressure

EOP Step Content:

Step 7. <u>IF</u> <u>NO</u> Reactor Coolant Pumps are operating, <u>THEN</u> go to Success Path IV-5.

Objective:

This step directs the operator to the next success path if no reactor coolant pumps are operating.

Basis:

If no reactor coolant pumps are operating, then the cooldown will be by natural circulation. This is covered in Success Path IV-5, High Pressure.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_4. <u>Recovery Actions: Subprocedure IV. RCS Pressure Control</u>

Success Path IV-4 High Pressure

EOP Step Content:

Step 8. Maintain level in at least one Steam Generator as follows:

Objective:

The objective of this step is to ensure that the steam generator level is maintained in at least one steam generator.

Basis:

When the steam generators are being used for heat removal from the reactor coolant system, main or emergency feedwater has to be supplied to the steam generator to ensure a heat sink.

Operational Considerations:

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

NA

Justification of Differences:

NA

Source Document:

NA

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-4 High Pressure

EOP Step Content:

Step 9. IF a Steam Generator Low Pressure Pretrip alarm occurs, THEN reset the setpoint.

Objective:

The objective of this step is to prevent an MSIS from occurring and inhibiting cooldown.

Basis:

During a controlled cooldown and depressurization the automatic operation of certain safeguard systems is undesirable. Therefore, the MSIS setpoint must be manually reset (lowered) as the cooldown progresses to ensure that automatic engineered safeguards protection remains 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

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-4 High Pressure

EOP Step Content:

Step 10. Commence a Plant cooldown by EITHER of the following:

Objective:

The objective of this step is to cooldown the plant to effect a depressurization.

Basis: (CEN-152, page 10-51, step 4)

RCS depressurization should occur by feeding the steam generators with main or auxiliary feedwater and dumping steam to the condenser via the turbine bypass system. If the condenser or turbine bypass system is not available, steam should be discharged through the atmospheric dump valves. The use of atmospheric dump valves may have the potential for an unmonitored release of activity to the environment. If it is suspected that a steam generator(s) has tube leaks, then depressurization should be performed using the unaffected or least affected generator.

Operational Considerations:

Cooldown rate shall be limited for reactor coolant system $\leq$100°F/hr and for pressurizer $\leq$200°F/hr. If a steam generator is isolated due to activity in the steam plant, then the use of the atmospheric dump valve on the isolated steam generator should be minimized.

EPG Step Content: (CEN-152, page 10-143, step 4)

If RCP operation has been terminated and the criteria of Step 3 are met:

Justification of Differences:

The EPG step was divided up into two steps, one which deals with restarting reactor coolant pumps and one which deals with cooldown.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_4. <u>Recovery Actions: Subprocedure IV. RCS Pressure Control</u>
Success Path IV-4 High Pressure

EOP Step Content:

Step 11. During Plant cooldown, allow Pressurizer level to drop as follows:

Objective:

This step allows pressurizer level to drop during the cooldown which reduces pressurizer pressure.

Basis: (CEN-152, page 10-50, step 2)

RCS inventory is controlled so as to permit pressurizer level to drop during RCS fluid contraction. This drop in level results in pressurizer bubble decompression which in turn results in RCS depressurization. It is also possible to cool the pressurizer gradually by filling the pressurizer with cooler loop fluid by charging to the loop. The level is then allowed to drop due to cooldown contraction and then refilled with cooler loop fluid. Repeated fillings will cool the pressurizer metal and steam bubble resulting in gradual depressurization.

Operational Considerations:

Minimum acceptable pressurizer level is 7%. Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading.

EPG Step Content: (CEN-152, page 10-142, step 2)

Control RCS inventory so as to allow pressurizer level to drop while cooling down in order to effect depressurization. Observe the limits of IC-1.

Justification of Differences:

This step was placed after the step for commencing cooldown to place the steps in the order they would be done.

E_4. <u>Recovery Actions: Subprocedure IV. RCS Pressure Control</u>

Success Path IV-4 High Pressure

EOP Step 11 (Continued).

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-1, Level.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-4 High Pressure

EOP Step Content:

Step 12. When Pressurizer pressure is within the limits of Attachment 5: Post-Accident Pressure and Temperature Limits Graph, stabilize Reactor Coolant System temperature.

Objective:

This step stops the cooldown and depressurization when pressurizer pressure is restored to within limits.

Basis:

Once pressure is restored to within the limits of Attachment 5: Post-Accident Pressure and Temperature Limits Graph, the cooldown may be stopped and pressure and temperature stabilized.

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:

NA

E_4. <u>Recovery Actions: Subprocedure IV. RCS Pressure Control</u>

Success Path IV-4 High Pressure

EOP Step Content:

Step 13. 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:

If cold leg temperature is ≤450°F then the condensate pumps can adequately supply water to the steam generators. This action feeds the steam generators through normal system lineup at these conditions.

Operational Considerations:

Main feedwater pumps need not be operable. 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:

NA

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-4 High Pressure

EOP Step Content:

Step 14. IF BOTH Main Feedwater AND Emergency Feedwater are lost, THEN perform the following:

Objective:

This step provides guidance for a total loss of feedwater.

Basis: (CEN-152, page 10-52, step 6)

If all feedwater is lost (both main and emergency) certain activities should be performed to keep the plant in a stable condition. These activities are listed below.

a) Stop all RCPs

b) Any cooldown is stopped to minimize steam discharge and conserve S/G inventories.

c) If in operation, the steam generator blowdown system, secondary sampling system or any other nonvital secondary discharge must be secured. Until feedwater is reestablished, the steam generator water inventories must be conserved.

d) The operator should attempt to restore the operation of the main or auxiliary feedwater system to provide a primary decay heat sink for a controlled depressurization to meet the success criteria of this recovery action guideline.

A moderate rate of increase in steam generator water level is sufficient to restore S/G level. If the refill rate is too fast, excessive cooldown of the RCS and shrinkage of RCS inventory may result. Consequently, pressurizer level may fall below that required to maintain a bubble for pressure control. An adequate feed rate for restoring steam generator level is determined by operating experience.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-4 High Pressure

EOP Step 14 (Continued).

Basis: (Continued)

e) If both main and auxiliary feedwater cannot be restored, all plant specific sources of feedwater which could be made available to replace steam generator boil-off should be implemented. Examples of alternate sources of feedwater are fire pumps, condensate pumps, portable pumps, etc. When developing plant specific procedures, alternate sources of feedwater should be identified and their use should be indicated in the procedures. Guidelines on steam generator depressurization should be developed for those cases when the operator is relying on low pressure sources of feedwater as a backup feedwater supply.

Operational Considerations:

Feedwater should not be restored to an empty steam generator. If both steam generators are empty, then feedwater should be restored to one steam generator only.

EPG Step Content: (CEN-152, page 10-144, step 6)

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

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control
Success Path IV-4 High Pressure

EOP Step Content:

Step 15. IF using Emergency Feedwater to feed Steam Generators, THEN perform the following:

Objective:

This step ensures continuous suction supply to emergency feed pumps.

Basis: (CEN-152, page 10-53, step 8)

The available condensate inventory should be monitored and replenished from available sources as necessary to continually provide a source for a secondary heat sink. Example of alternate sources of condensate are nonseismic tanks, fire mains, lake water supplies, potable tanks, etc. Plant specific alternate sources of feedwater should be identified and cited in the plant specific procedure.

Operational Considerations:

Permission shall be obtained from control room supervisor prior to aligning auxiliary component cooling system to the emergency feedwater system. Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading. 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 10-144, step 8)

If the auxiliary feedwater system is being used, ensure an adequate supply of condensate.

Justification of Differences:

The EOP step was expanded to include setpoints and plant specific information.

E_4. <u>Recovery Actions: Subprocedure IV. RCS Pressure Control</u>

Success Path IV-4 High Pressure

EOP Step 15 (Continued).

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-1, Level.

E_4. **Recovery Actions: Subprocedure IV. RCS Pressure Control**

Success Path IV-4 High Pressure

EOP Step Content:

Step 16. Check the following success path criteria:

Objective:

The objective of this step is to check the criteria associated with satisfactorily completing this success path.

Basis: (CEN-152, page 10-4, step 3)

The basis for each individual criterion is given in Section 2.0 of the technical guide. The criteria are used to judge the status of each safety function. Since each safety function has multiple success paths which can be used to control that safety function, the criteria which are used to judge the status of each safety function are organized around the success paths for each safety function. Since each success path uses or may use different technical means of achieving a function, the criteria for judging the success of that path are specific to the technical means. Also, in order to facilitate operator use, the criteria chosen are parameters which can be read directly from the control board.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-4 High Pressure

EOP Step Content:

Step 17. IF the success path criteria (step 16) are met, THEN go to the next safety function in jeopardy.

Objective:

The objective of this step is to instruct the operator what to do if this success path is satisfactorily completed.

Basis: (CEN-152, page 10-12, step 7)

After checking the success path criteria, additional guidance is provided which aids the operator in determining the next course of action. In this step, if control of the safety function is achieved, the operator is instructed to go to the next safety function in jeopardy.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-4 High Pressure

EOP Step Content:

Step 18. IF the success path criteria (step 16) are NOT met, THEN continue with Subprocedure IV. RCS Pressure Control until a success path criterion is satisfactorily being maintained.

Objective:

The objective of this step is to instruct the operator what to do if this success path is not satisfactorily completed.

Basis: (CEN-152, page 10-64)

If the criteria are not met, then RCS Pressure Control is still in jeopardy. The operator should not leave RCS Pressure Control until this function is fulfilled.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E$_4$. Recovery Actions: Subprocedure IV. RCS Pressure Control
Success Path IV-4 High Pressure

EOP Step Content:

Step 19. IF the Control Room Supervisor determines it is necessary to pursue other safety functions in jeopardy, THEN go to the next safety function in jeopardy AND implement its subprocedure concurrently with this subprocedure.

Objective:

The objective of this step is to allow the control room supervisor to pursue other safety functions in jeopardy while efforts are continued on RCS Pressure Control.

Basis: (CEN-152, page 10-64)

The operator may, if necessary, pursue other urgent safety functions but must continue to attempt to establish RCS Pressure Control.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-5 High Pressure

EOP Step Content:

Step 1. Verify Pressurizer heaters are deenergized.

Objective:

This step verifies pressurizer heaters are deenergized.

Basis:

Pressurizer heaters add heat to the pressurizer which raises pressurizer pressure. If pressure is too high the heaters should be deenergized to prevent raising pressure higher.

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:

NA

Justification of Differences:

NA

Source Document:

NA

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-5 High Pressure

EOP Step Content:

Step 2. Verify Shutdown Margin in accordance with Technical Specifications. Refer to OP-903-090, SHUTDOWN MARGIN.

Objective:

This step verifies shutdown margin before plant cooldown is commenced.

Basis: (CEN-152, page 10-55, step 1)

During any cooldown, the RCS is borated as necessary to maintain shutdown margin per Technical Specifications.

Operational Considerations:

NA

EPG Step Content: (CEN-152, page 10-146, step 1)

Borate as necessary to maintain shutdown margin per Techncial Specifications Limits (see RC-2 and RC-3).

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-5 High Pressure

EOP Step Content:

Step 3. IF a Steam Generator is isolated due to activity in the Steam Plant, THEN go to step 9.

Objective:

This step directs the operator to the applicable cooldown steps for an isolated steam generator.

Basis:

If a steam generator is isolated, then certain precautions must be taken to ensure the isolated steam generator is cooled down also at a rate consistent with the plant.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_4. <u>Recovery Actions: Subprocedure IV. RCS Pressure Control</u>

Success Path IV-5 High Pressure

EOP Step Content:

Step 4. Maintain level in at least one Steam Generator as follows:

Objective:

The objective of this step is to ensure that the steam generator level is maintained in at least one steam generator.

Basis:

When the steam generators are being used for heat removal from the reactor coolant system, main or emergency feedwater has to be supplied to the steam generator to ensure a heat sink.

Operational Considerations:

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

NA

Justification of Differences:

NA

Source Document:

NA

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-5 High Pressure

EOP Step Content:

Step 5. Check AND continuously monitor 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 10-56, step 3)

If all RCP operation is terminated and when inventory and pressure are controlled, natural circulation is monitored by heat removal via at least one steam generator. Natural circulation flow should occur within 5-15 minutes after the RCPs were tripped if there is adequate inventory in the RCS. The RCS temperature response during natural circulation will usually be slow (5-15 minutes) as compared to a normal forced flow system response time of 6-12 seconds, since the coolant loop cycle time will be significantly larger.

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

a) Loop ΔT (T_H - T_C) less than normal full power ΔT;
b) Cold leg temperatures constant or decreasing;
c) Hot leg temperatures stable (i.e. not steadily increasing) or slowly decreasing;
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].

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-5 High Pressure

EOP Step 5 (Continued).

Basis: (Continued)

Natural circulation is governed by decay heat, component elevations, primary to secondary heat transfer, loop flow resistance, and voiding. Component elevations on C-E plants are such that satisfactory natural circulation decay heat removal is obtained by fluid density differences between the core region and the steam generator tubes.

Operational Considerations:

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

EPG Step Content: (CEN-152, page 10-146, step 3)

If all RCPs have tripped and inventory and pressure are being controlled, verify by all the following indications that natural circulation flow has been established in at least one loop:

Justification of Differences:

This EPG step was combined with EPG step 5 to continuously monitor.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-1, Level and Table 5-3, Temperature.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-5 High Pressure

EOP Step Content:

Step 6. IF a Steam Generator Low Pressure Setrip alarm occurs, THEN reset the setpoint.

Objective:

The objective of this step is to prevent an MSIS from occurring and inhibiting cooldown.

Basis:

During a controlled cooldown and depressurization the automatic operation of certain safeguard systems is undesirable. Therefore, the MSIS setpoint must be manually reset (lowered) as the cooldown progresses to ensure that automatic engineered safeguards protection remains 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

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-5 High Pressure

EOP Step Content:

Step 7. Commence a Plant cooldown by EITHER of the following:

Objective:

The objective of this step is to cool down the plant to effect a depressurization.

Basis: (CEN-152, page 10-55, step 4)

Reactor plant depressurization should be performed preferentially by feeding the steam generators with main or auxiliary feedwater and dumping steam to the condenser via the turbine bypass system. If the condenser or turbine bypass system is not available, steam should be discharged through the atmospheric dump valves. The use of atmospheric dump valves may have the potential for release of activity to the environment. If it is suspected that a steam generator may be affected by a tube rupture, the natural circulation cooldown and depressurization should be performed using the unaffected or least affected generator.

Operational Considerations:

Cooldown rate shall be limited for reactor coolant system $\leq 50^\circ F/hr$ and for pressurizer $\leq 100^\circ F/hr$.

EPG Step Content: (CEN-152, page 10-146, step 4)

Resume/commence an orderly reactor plant depressurization to meet the success criteria of this recovery action and to place RCS conditions within the limits of Figure 10-10 by conducting one of the following activities:

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-5 High Pressure

EOP Step Content:

Step 8. IF ALL required actions of step 4 - 7 were completed, THEN go to step 17.

Objective:

The objective of this step is to direct the operator to the correct step after completing steps for cooldown with no steam generator isolated.

Basis:

The next 8 steps deal with cooldown of the plant with a steam generator isolated due to steam plant activity. If a steam generator is not isolated the operator skips these steps.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-5 High Pressure

EOP Step Content:

Step 9. Maintain isolated Steam Generator level 77% to 94% Wide Range as follows:

Objective:

The objective of this step is to ensure that the isolated steam generator level is maintained 77% to 94% wide range.

Basis:

By ensuring the isolated steam generator level is being controlled, overfilling should be prevented. If overfilled, then the steam generator steam space and the main steam piping to the main steam isolation valves filling could present additional problems. Through use of the blowdown systems as the preferred means, the spread of contamination is minimized. If the blowdown system is not available, then steaming the affected steam generator will minimize radioactive release through the steam generator safeties. The minimum level ensures that the steam generator tubes are covered with water.

Operational Considerations:

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

NA

Justification of Differences:

NA

Source Document:

PV-OP-902, Parameter Values Document. Table 5-1, Level.

E_4. <u>Recovery Actions: Subprocedure IV. RCS Pressure Control</u>

Success Path IV-5 High Pressure

EOP Step Content:

Step 10. Maintain level in the Steam Generator which is NOT isolated as follows:

Objective:

The objective of this step is to ensure that the steam generator level is maintained in the operable steam generator.

Basis:

When the steam generators are being used for heat removal from the reactor coolant system, main or emergency feedwater has to be supplied to the steam generator to ensure a heat sink.

Operational Considerations:

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

NA

Justification of Differences:

NA

Source Document:

NA

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-5 High Pressure

EOP Step Content:

Step 11. Check AND continuously monitor Natural Circulation by ALL the following:

Objective:

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

Basis:

During cooldown and depressurization to shutdown cooling initiating conditions, indications of natural circulation have to be verified. When single phase circulation is established in at least one loop, the reactor coolant system 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 resistance temperature detectors and core exit thermocouples. Hot leg resistance temperature detector 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 resistance temperature detectors temperature within the bounds of the instrument's inaccuracies. An abnormal difference between T_H and the core exit thermocouples is greater than (10)°F.

If all reactor coolant pump operation is terminated, and when inventory and pressure are controlled, then natural circulation is monitored by heat removal via at least one steam generator.

Operational Considerations:

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

E_4. <u>Recovery Actions: Subprocedure IV. RCS Pressure Control</u>

Success Path IV-5 High Pressure

EOP Step 11 (Continued).

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

PV-OP-902, Parameter Values Document. Table 5-1, Level and Table 5-3, Temperature.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-5 High Pressure

EOP Step Content:

Step 12. When a Steam Generator Low Pressure Pretrip alarm occurs, reset the setpoint.

Objective:

The objective of this step is to prevent an MSIS from occurring and inhibiting cooldown.

Basis:

During a controlled cooldown and depressurization the automatic operation of certain safeguard systems is undesirable. Therefore, the setpoint of MSIS must be manually reset (lowered) as the cooldown progresses to ensure that automatic engineered safeguards protection remains 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

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-5 High Pressure

EOP Step Content:

Step 13. Determine the optimum ΔT to be maintained between Steam Generators during cooldown as indicated on STEAM GENERATOR OUTLET TEMP (MS-ITR-301A/B) recorder. Refer to Attachment 7: Steam Generators Optimum ΔT Curve.

Objective:

The objective of this step is to provide the temperature difference allowed between steam generators when utilizing circulation for cooldown of the reactor coolant system.

Basis:

Natural circulation will occur in the isolated steam generator even if its temperature is slightly above reactor hot leg temperature. As the ΔT increases, more heat is tranferred to the primary coolant in the isolated steam generator, but natural circulation flow decreases. The optimum ΔT between steam generators to achieve maximum heat transfer is given in Attachment 7. Maintain this ΔT by bleeding steam from the steam generator not isolated, and cooling the isolated steam generator according to step 15.

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:

FSAR, question 211-94.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-5 High Pressure

EOP Step Content:

Step 14. IF the Control Room Supervisor determines that cooldown of the isolated Steam Generator is required, THEN feed AND drain as follows:

Objective:

This step ensures that the isolated steam generator is cooled down while the reactor coolant system is being cooled down.

Basis:

With no reactor coolant pumps operating, there usually will be little flow through the isolated steam generator, which would limit the plant cooldown rate. The isolated steam generator may be cooled, if necessary, to accelerate plant cooldown.

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:

NA

Justification of Differences:

NA

Source Document:

NA

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-5 High Pressure

EOP Step Content:

Step 15. Commence Plant cooldown AND maintain optimum ΔT by either of the following:

Objective:

The objective of this step is to cool down the plant to effect a depressurization.

Basis:

An orderly cooldown and depressurization is resumed with the steam generator not isolated. These methods are presented in order, with the most preferred method listed first, to minimize radiological releases.

Operational Considerations:

Cooldown rate shall be limited for reactor coolant system ≤50°F/hr and for pressurizer ≤100°F/hr. If maintaining the optimum ΔT slows down the cooldown rate of the isolated steam generator, then a slightly lower ΔT should be maintained. 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:

NA

Justification of Differences:

NA

Source Document:

NA

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-5 High Pressure

EOP Step Content:

Step 16. At the following time intervals, determine the optimum T. Refer to Attachment 7: Steam Generators Optimum T Curve.

Objective:

This step determines the amount of decay power remaining for the time after reactor trip.

Basis:

As time elapses, the amount of decay power remaining shall be determined. This decay power is used to determine the optimum T between the steam generators in the following step so that the maximum heat transfer to the reactor coolant system can be maintained.

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:

FSAR, question 211-94.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-5 High Pressure

EOP Step Content:

Step 17. During Plant cooldown, allow Pressurizer level to drop as follows:

Objective:

This step allows pressurizer level to drop during the cooldown which reduces pressurizer pressure.

Basis: (CEN-152, page 10-55, step 2)

RCS inventory is controlled so as to permit pressurizer level to drop during RCS fluid contraction. This drop in level results in pressurizer bubble decompression which in turn results in RCS depressurization. It is also possible to cool the pressurizer gradually by filling the pressurizer with cooler loop fluid by charging to the loop. The level is then allowed to drop due to cooldown contraction and then refilled with cooler loop fluid. Repeated fillings will cool the pressurizer metal and steam bubble resulting in gradual depressurization.

Operational Considerations:

Minimum acceptable pressurizer level is 7%. Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading.

EPG Step Content: (CEN-152, page 10-146, step 2)

Control RCS inventory so as to allow pressurizer level to drop while cooling down in order to effect depressurization. Observe the limits of IC-1.

Justification of Differences:

This step was placed after the step for commencing cooldown to place the steps in the order they would be done.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-5 High Pressure

EOP Step 17 (Continued).

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-1, Level.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-5 High Pressure

EOP Step Content:

Step 18. When Pressurizer pressure is within the limits of Attachment 5: Post-Accident Pressure and Temperature Limits Graph, stabilize Reactor Coolant System temperature.

Objective:

This step stops the cooldown and depressurization when pressurizer pressure is restored to within limits.

Basis:

Once pressure is restored to within the limits of Attachment 5: Post-Accident Pressure and Temperature Limits Graph, the cooldown may be stopped and pressure and temperature stabilized.

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:

NA

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-5 High Pressure

EOP Step Content:

Step 19. IF ALL Reactor Coolant Pumps have been stopped, THEN check the following Reactor Coolant Pump restart criteria:

Objective:

The objective of this step is to ensure the reactor coolant system employs the preferred means of coolant circulation.

Basis: (CEN-152, page 10-59 thru 10-61, step 8)

During forced flow cooldowns of the RCS, with one steam generator isolated, sufficient reverse (secondary to primary) heat transfer occurs to maintain the isolated steam generator at the same relative temperature as the operating RCS loop. However, with no RCPs operating natural circulation flow through the isolated steam generator and RCS loop will stop, leaving those components in a hot stagnant condition.

This condition by itself will not necessarily affect core cooling via natural circulation in the unisolated steam generator. As long as RCS pressure control, RCS inventory control, and RCS heat removal are properly maintained in the operating loop, sufficient natural circulation flow will be maintained through the core and operating loop.

The preferred method of cooling an isolated steam generator is to start any RCP, if one is available. Forced reactor coolant circulation through an isolated steam generator will provide adequate heat transfer to maintain the isolated steam generator's temperature approximately the same as the operating steam generator's temperature.

Operational Considerations:

If component cooling water to reactor coolant pumps has been lost for ≥10 minutes, then reactor coolant pumps should not be restarted. Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-5 High Pressure

EOP Step 19 (Continued).

EPG Step Content: (CEN-152, page 10-148, step 8)

If one steam generator was isolated, continue circulation by performing the following activities (listed in order of preference):

Justification of Differences:

The EOP step only deals with restarting reactor coolant pumps. The additional guidance for cooldown of an isolated steam generator and preventing overfill of an isolated steam generator is given in the steps for isolated steam generator in the same sequence and format as they are listed in OP-902-007, Steam Generator Tube Rupture Recovery Procedure

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-1, Level and Table 5-2, Subcooling.

E$_4$. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-5 High Pressure

EOP Step Content:

Step 20. IF ALL Reactor Coolant Pump restart criteria (step 19) 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:

The objective of this step is to ensure the reactor coolant system employs the preferred means of coolant circulation.

Basis: (CEN-152, page 10-59 thru 10-61, step 8)

During forced flow cooldowns of the RCS, with one steam generator isolated, sufficient reverse (secondary to primary) heat transfer occurs to maintain the isolated steam generator at the same relative temperature as the operating RCS loop. However, with no RCPs operating natural circulation flow through the isolated steam generator and RCS loop will stop, leaving those components in a hot stagnant condition.

This condition by itself will not necessarily affect core cooling via natural circulation in the unisolated steam generator. As long as RCS pressure control, RCS inventory control, and RCS heat removal are properly maintained in the operating loop, sufficient natural circulation flow will be maintained through the core and operating loop.

The preferred method of cooling an isolated steam generator is to start any RCP, if one is available. Forced reactor coolant circulation through an isolated steam generator will provide adequate heat transfer to maintain the isolated steam generator's temperature approximately the same as the operating steam generator's temperature.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-5 High Pressure

EOP Step 20 (Continued).

Operational Considerations:

If component cooling water to reactor coolant pumps has been lost for ≥10 minutes, then reactor coolant pumps should not be restarted. Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading.

EPG Step Content: (CEN-152, page 10-148, step 8)

If one steam generator was isolated, continue circulation by performing the following activities (listed in order of preference):

Justification of Differences:

The EPG step was divided into two steps, one which deals with restarting reactor coolant pumps and one which deals with cooldown.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-5 High Pressure

EOP Step Content:

Step 21. 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 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:

NA

E_4. <u>Recovery Actions: Subprocedure IV. RCS Pressure Control</u>

Success Path IV-5 High Pressure

EOP Step Content:

Step 22. 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 at the steam generators.

Basis:

If cold leg temperature is ≤450°F then the condensate pumps can adequately supply water to the steam generators. This action feeds the steam generators through normal system lineup at these conditions.

Operational Considerations:

Main feedwater pumps need not be operable. 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:

NA

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-5 High Pressure

EOP Step Content:

Step 23. IF BOTH Main Feedwater AND Emergency Feedwater are lost, THEN perform the following:

Objective:

This step provides guidance for a total loss of feedwater.

Basis: (CEN-152, page 10-58, step 7)

If all feedwater is lost (both main and emergency) certain activities should be performed to keep the plant in a stable condition. These activities are listed below.

a) Stop all RCPs
b) Any cooldown is stopped to minimize steam discharge and conserve S/G inventories.
c) If in operation, the system generator blowdown system, secondary sampling system or any other nonvital secondary discharge must be secured. Until feedwater is reestablished, the steam generator water inventories must be conserved.
d) The operator should attempt to restore the operation of the main or auxiliary feedwater system to provide a primary decay heat sink for a controlled depressurization to meet the success criteria of this recovery action guideline.

A moderate rate of increase in steam generator water level is sufficient to restore S/G level. If the refill rate is too fast, excessive cooldown of the RCS and shrinkage of RCS inventory may result. Consequently, pressurizer level may fall below that required to maintain a bubble for pressure control. An adequate feed rate for restoring steam generator level is determined by operating experience.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-5 High Pressure

EOP Step 23 (Continued).

Basis: (Continued)

e) If both main and auxiliary feedwater cannot be restored, all plant specific sources of feedwater which could be made available to replace steam generator boil-off should be implemented. Examples of alternate sources of feedwater are fire pumps, condensate pumps, portable pumps, etc. When developing plant specific procedures, alternate sources of feedwater should be identified and their use should be indicated in the procedures. Guidelines on steam generator depressurization should be developed for those cases when the operator is relying on low pressure sources of feedwater as a backup feedwater supply.

Operational Considerations:

Feedwater should not be restored to an empty steam generator. If both steam generators are empty, then feedwater should be returned to one steam generator only.

EPG Step Content: (CEN-152, page 10-147, step 7)

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

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-5 High Pressure

EOP Step Content:

Step 24. IF using Emergency Feedwater to feed Steam Generators, THEN perform the following:

Objective:

This step ensures continuous suction supply to emergency feed pumps.

Basis: (CEN-152, page 10-62, step 9)

The available condensate inventory should be monitored and replenished from available sources as necessary to continually provide a source for a secondary heat sink. Example of alternate sources of condensate are nonseismic tanks, fire mains, lake water supplies, potable tanks, etc. Plant specific alternate sources of feedwater should be identified and cited in the plant specific procedure.

Operational Considerations:

Permission shall be obtained from control room supervisor prior to aligning auxiliary component cooling system to the emergency feedwater system. Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading. 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 10-148, step 9)

If the auxiliary feedwater system is being used, ensure an adequate supply of condensate.

Justification of Differences:

The EOP step was expanded to include setpoints and plant specific information.

E_4. **Recovery Actions: Subprocedure IV. RCS Pressure Control**

Success Path IV-5 High Pressure

EOP Step 24 (Continued).

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-1, Level.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-5 High Pressure

EOP Step Content:

Step 25. Check the following success path criteria:

Objective:

The objective of this step is to check the criteria associated with satisfactorily completing this success path.

Basis: (CEN-152, page 10-4, step 3)

The basis for each individual criterion is given in Section 2.0 of the technical guide. The criteria are used to judge the status of each safety function. Since each safety function has multiple success paths which can be used to control that safety function, the criteria which are used to judge the status of each safety function are organized around the success paths for each safety function. Since each success path uses or may use different technical means of achieving a function, the criteria for judging the success of that path are specific to the technical means. Also, in order to facilitate operator use, the criteria chosen are parameters which can be read directly from the control board.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-5 High Pressure

EOP Step Content:

Step 26. IF the success path criteria (step 25) are met, THEN go to the next safety function in jeopardy.

Objective:

The objective of this step is to instruct the operator what to do if this success path is satisfactorily completed.

Basis: (CEN-152, page 10-12, step 7)

After checking the success path criteria, additional guidance is provided which aids the operator in determining the next course of action. In this step, if control of the safety function is achieved, the operator is instructed to go to the next safety function in jeopardy.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path IV-5 High Pressure

EOP Step Content:

Step 27. IF the success path criteria (step 25) are NOT met, THEN continue with Subprocedure IV. RCS Pressure Control until a success path criterion is satisfactorily being maintained.

Objective:

The objective of this step is to instruct the operator what to do if this success path is not satisfactorily completed.

Basis: (CEN-152, page 10-64)

If the criteria are not met, then RCS Pressure Control is still in jeopardy. The operator should not leave RCS Pressure Control until this function is fulfilled.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_4. <u>Recovery Actions: Subprocedure IV. RCS Pressure Control</u>

Success Path IV-5 High Pressure

EOP Step Content:

Step 28. IF the Control Room Supervisor determines it is necessary to pursue other safety functions in jeopardy, THEN go to the next safety function in jeopardy AND implement its subprocedure concurrently with this subprocedure.

Objective:

The objective of this step is to allow the control room supervisor to pursue other safety functions in jeopardy while efforts are continued on RCS Pressure Control.

Basis: (CEN-152, page 10-64)

The operator may, if necessary, pursue other urgent safety functions but must continue to attempt to establish RCS Pressure Control.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>
Success Path V-1

EOP Step Content:

Step 1. IF ALL Reactor Coolant Pumps are operating, THEN stop Reactor Coolant Pumps 1A AND 2A as follows:

Objective:

The objective of this step is to secure one reactor coolant pump in each loop to reduce reactor coolant system heat input.

Basis: (CEN-152, page 10-66, step 1)

Only one reactor coolant pump in each loop should be operated in order to minimize heat input to the RCS. If all reactor coolant pumps are operating, then one reactor coolant pump in each loop should be stopped.

Operational Considerations:

NA

EPG Step Content: (CEN-152, page 10-154, step 2)

Start one RCP in each loop (or reduce the number to one in each loop).

Justification of Differences:

The EPG step was divided into two EOP steps. One step starts a reactor coolant pump in each loop. The other step reduces to one reactor coolant pump operating in each loop.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>
Success Path V-1

EOP Step Content:

Step 2. <u>IF</u> <u>ALL</u> Reactor Coolant Pumps have been stopped, <u>THEN</u> check the following Reactor Coolant Pump restart criteria:

Objective:

The objective of this step is to ensure the reactor coolant system employs the preferred means of coolant circulation.

Basis: (CEN-152, page 10-66, step 1)

If RCP operation has been terminated, restarting of the reactor coolant pumps should be attempted to ensure continued forced circulation of coolant to the core for heat removal purposes. However, only one reactor coolant pump in each loop should be operated in order to minimize heat input to the RCS. Running any single RCP is adequate for heat removal purposes.

Operational Considerations:

If component cooling water to reactor coolant pumps has been lost for ≥10 minutes, then reactor coolant pumps should not be restarted. Below 1000 psia, subcooling margin shall be determined by subtracting hot leg temperature from Pressurizer Temperature Water (TI 101). Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading.

EPG Step Content: (CEN-152, page 10-154, step 1)

If the RCPs are operating or operation has been terminated and the following criteria are satisfied go to step 2. If the criteria cannot be met, go to HR-2.

Justification of Differences:

NA

E_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>

Success Path V-1

EOP Step 2 (Continued).

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-1, Level and Table 5-2, Subcooling.

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**
Success Path V-1

EOP Step Content:

Step 3. IF ALL Reactor Coolant Pump restart criteria (step 2) 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:

The objective of this step is to ensure the reactor coolant system employs the preferred means of coolant circulation.

Basis: (CEN-152, page 10-67, step 2)

If the RCPs have been stopped, operation of the reactor coolant pumps should be attempted to ensure continued forced circulation of coolant through the core and to permit the use of pressurizer sprays (if available). However, only one reactor coolant pump in each loop should be operated in an effort to minimize heat input to the RCS.

Operational Considerations:

NA

EPG Step Content: (CEN-152, page 10-154, step 2)

Start one RCP in each loop (or reduce the number to one in each loop).

Justification of Differences:

The EPG step was divided into two EOP steps. One step starts a reactor coolant pump in each loop. The other step reduces to one reactor coolant pump operating in each loop.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal

Success Path V-1

EOP Step Content:

Step 4. 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 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:

NA

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**

Success Path V-1

EOP Step Content:

Step 5. IF NO Reactor Coolant Pumps are operating, THEN go to Success Path V-2.

Objective:

This step directs the operator to the next success path if no reactor coolant pumps are operating.

Basis:

If no reactor coolant pumps are operating, then the cooldown will be by natural circulation. This is covered in Success Path V-2.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal

Success Path V-1

EOP Step Content:

Step 6. IF any of the following occur, THEN complete the 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 so far as to ensure the actuation signal is valid. This step verifies all component actions required by MSIS, 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_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal

Success Path V-1

EOP Step Content:

Step 7. IF MSIS has NOT occurred, THEN trip one Main Feed pump AND verify the associated valves closed:

Objective:

When a MSIS has not occurred, this step secures one of the two main feed pumps since only one is required below 50% power.

Basis:

To exit the Emergency Procedures 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_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal

Success Path V-1

EOP Step Content:

Step 8. IF MSIS has occurred, THEN verify BOTH Main Feed pumps tripped AND the associated valves closed:

Objective:

This step secures both main feed pumps since the main steam isolation valves are closed on a MSIS.

Basis:

To exit the Emergency Procedures 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_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>
Success Path V-1

EOP Step Content:

Step 9. Verify ALL Heater Drain pumps stopped.

Objective:

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

Basis:

To exit the Emergency Procedures 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_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal
Success Path V-1

EOP Step Content:

Step 10. Verify one Condensate pump is operating.

Objective:

This step secures all condensate pumps which are not required to support the running main feed pump.

Basis:

To exit the Emergency Procedures 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_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal

Success Path V-1

EOP Step Content:

Step 11. IF MSIS has occurred, THEN verify Main Condenser vacuum is 0.0" Hg.

Objective:

This step ensures condenser vacuum is 0.0" Hg if MSIS has occurred.

Basis:

If MSIS occurs, then vacuum is no longer required for secondary equipment since equipment will not be operating due to a loss of supply steam. Therefore vacuum is verified to be 0.0" Hg to prevent any damage to turbine seals. If vacuum is not 0.0" Hg, then the operator manually lowers vacuum to 0.0" Hg.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>

Success Path V-1

EOP Step Content:

Step 12. IF MSIS has NOT occurred, THEN start the 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 the Emergency Procedures 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_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**

Success Path V-1

EOP Step Content:

Step 13. When the Auxiliary Boiler is operating, 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 the Emergency Procedures 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, more than one instrument should be used to obtain a particular reading.

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

OP-10-001, General Plant Operations.

E_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>

Success Path V-1

EOP Step Content:

Step 14. IF EITHER Main Feed pump is operating, THEN align it to the Auxiliary Boiler as follows:

Objective:

The objective of this step is to transfer the steam load of the main feed pump to the auxiliary boiler to permit removal of loads from the steam generators.

Basis:

To exit the Emergency Procedures 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_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal

Success Path V-1

EOP Step Content:

Step 15. Maintain level in at least one Steam Generator as follows:

Objective:

The objective of this step is to ensure that the steam generator level in maintained in at least one steam generator.

Basis:

When the steam generators are being used for heat removal from the reactor coolant system, main or emergency feedwater has to be supplied to the steam generator to ensure a heat sink.

Operational Considerations:

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

NA

Justification of Differences:

NA

Source Document:

NA

E_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>

Success Path V-1

EOP Step Content:

Step 16. Maintain Reactor Coolant System temperature AND pressure within the limits of Attachment 5: Post-Accident Pressure and Temperature Limits Graph by either of the following:

Objective:

This step maintains temperature and pressure within the limits of Attachment 5: Post-Accident Pressure and Temperature Limits Graph.

Basis: (CEN-152, page 10-67, step 3)

RCS and core heat removal should be performed by feeding at least one steam generator with main or auxiliary feedwater and dumping steam to the condenser via the turbine bypass system. If the condenser or turbine bypass system is not available, the next order of priority for discharging steam would be to use the atmospheric dump valves.

The use of atmospheric dump valves may have the potential for release of activity to the environment. If it is suspected that a steam generator(s) may be affected by a tube rupture, as indicated by area radiation monitor and/or other symptoms, S/G cooling should be performed using the unaffected or least affected generator.

Operational Considerations:

Subcooling margin shall be maintained 28°F to 200°F. Below 1000 psia, subcooling margin shall be termined by subtracting hot leg temperature from Pressurizer Temperature Water (TI 101). Cooldown rate shall be limited for reactor coolant system <50°F/hr and for pressurizer ≤100°F/hr. If a steam generator is isolated due to activity in the steam plant, then the use of the atmospheric dump valve on the isolated steam generator should be minimized. Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading.

E_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>

Success Path V-1

EOP Step 16 (Continued).

EPG Step Content: (CEN-152, page 10-154, step 3)

Maintain RCS temperature and pressure by conducting one of the following activities:

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal

Success Path V-1

EOP Step Content:

Step 17. Evaluate Condensate inventory. Refer to Attachment 11: Feedwater Required for Heat Removal to Tc (Final) versus Tc (Initial), AND Attachment 12: Feedwater Capacity versus Time Remaining to Initiate Shutdown Cooling.

Objective:

This step evaluates the available condensate inventory and determines the amount of time the operator may remain at present conditions before needing to commence a plant cooldown.

Basis: (CEN-152, page 10-69, step 6)

The available condensate inventory should be monitored and replenished from available sources as necessary to continually provide a source for a secondary heat sink. Example of alternate sources of condensate are nonseismic tanks, fire mains, lake water supplies, potable tanks, etc. Plant specific alternate sources of feedwater should be identified and cited in the plant specific procedure.

Operational Considerations:

NA

EPG Step Content: (CEN-152, page 10-155, step 6)

If the auxiliary feedwater system is being used, ensure an adequate supply of condensate.

Justification of Differences:

The EPG step was divided into two EOP steps. One evaluates the present available condensate inventory. The other deals with condensate makeup and alternate sources.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**

Success Path V-1

EOP Step Content:

Step 18. 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:

If cold leg temperature is ≤450°F then the condensate pumps can adequately supply water to the steam generators. This action feeds the steam generators through normal system lineup at these conditions.

Operational Considerations:

Main feedwater pumps need not be operable. 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:

NA

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**

Success Path V-1

EOP Step Content:

Step 19. IF BOTH Main Feedwater AND Emergency Feedwater are lost, THEN perform the following:

Objective:

This step provides guidance for a total loss of feedwater.

Basis: (CEN-152, page 10-68, step 5)

If all feedwater is lost (both main and emergency) certain activities should be performed to keep the plant in a stable condition. These activities are listed below.

a) Stop all RCPs
b) Any cooldown is stopped to minimize steam discharge and conserve S/G inventories.
c) If in operation, the steam generator blowdown system, secondary sampling system or any other nonvital secondary discharge must be secured. Until feedwater is reestablished, the steam generator water inventories must be conserved.
d) The operator should attempt to restore the operation of the main or auxiliary feedwater system to provide a primary decay heat sink for a controlled depressurization to meet the success criteria of this recovery action guideline.

A moderate rate of increase in steam generator water level is sufficient to restore S/G level. If the refill rate is too fast, excessive cooldown of the RCS and shrinkage of RCS inventory may result. Consequently, pressurizer level may fall below that required to maintain a bubble for pressure control. An adequate feed rate for restoring steam generator level is determined by operating experience.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal

Success Path V-1

EOP Step 19 (Continued).

Basis: (Continued)

e) If both main and auxiliary feedwater cannot be restored, all plant specific sources of feedwater which could be made available to replace steam generator boil-off should be implemented. Examples of alternate sources of feedwater are fire pumps, condensate pumps, portable pumps, etc. When developing plant specific procedures, alternate sources of feedwater should be identified and their use should be indicated in the procedures. Guidelines on steam geneator depressurization should be developed for those cases when the operator is relying on low pressure sources of feedwater as a backup feedwater supply.

Operational Considerations:

Feedwater should not be restored to an empty steam generator. If both steam generators are empty, then feedwater should be restored to one steam generator only.

EPG Step Content: (CEN-152, page 10-155, step 5)

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

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>

Success Path V-1

EOP Step Content:

Step 20. IF using Emergency Feedwater to feed Steam Generators, THEN perform the following:

Objective:

This step ensures continuous suction supply to emergency feed pumps.

Basis: (CEN-152, page 10-69, step 6)

The available condensate inventory should be monitored and replenished from available sources as necessary to continually provide a source for a secondary heat sink. Example of alternate sources of condensate are nonseismic tanks, fire mains, lake water supplies, potable tanks, etc. Plant specific alternate sources of feedwater should be identified and cited in the plant specific procedure.

Operational Considerations:

Permission shall be obtained from control room supervisor prior to aligning auxiliary component cooling system to the emergency feedwater system. Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading. 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 10-155, step 6)

If the auxiliary feedwater system is being used, ensure an adequate supply of condensate.

Justification of Differences:

The EOP step was expanded to include setpoints and plant specific information. The EPG step was divided up into two EOP steps. One evaluates the present available condensate inventory. The other deals with condensate makeup and alternate sources.

E_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>

Success Path V-1

EOP Step 20 (Continued).

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-1, Level.

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**

Success Path V-1

EOP Step Content:

Step 21. Check the following success path criteria:

Objective:

The objective of this step is to check the criteria associated with satisfactorily completing this success path.

Basis: (CEN-152, page 10-4, step 3)

The basis for each individual criterion is given in Section 2.0 of the technical guide. The criteria are used to judge the status of each safety function. Since each safety function has multiple success paths which can be used to control that safety function, the criteria which are used to judge the status of each safety function are organized around the success paths for each safety function. Since each success path uses or may use different technical means of achieving a function, the criteria for judging the success of that path are specific to the technical means. Also, in order to facilitate operator use, the criteria chosen are parameters which can be read directly from the control board.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>
Success Path V-1

EOP Step Content:

Step 22. <u>IF</u> the success path criteria (step 21) are met, <u>THEN</u> go to the next safety function in jeopardy.

Objective:

The objective of this step is to instruct the operator what to do if this success path is satisfactorily completed.

Basis: (CEN-152, page 10-12, step 7)

After checking the success path criteria, additional guidance is provided which aids the operator in determining the next course of action. In this step, if control of the safety function is achieved, the operator is instructed to go to the next safety function in jeopardy.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal
Success Path V-1

EOP Step Content:

Step 23. IF the success path criteria (step 21) are NOT met, THEN go to Success Path V-2.

Objective:

The objective of this step is to instruct the operator what to do if this success path is not satisfactorily completed.

Basis: (CEN-152, page 10-12, step 7)

After checking the success path criteria, additional guidance is provided which aids the operator in determining the next course of action. In this step, if control of the safety function is not achieved, the operator is instructed to implement another success path for this safety function.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal

Success Path V-2

EOP Step Content:

Step 1. IF any of the following occur, THEN complete the 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 so far as to ensure the actuation signal is valid. This step verifies all component actions required by MSIS, 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_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**

Success Path V-2

EOP Step Content:

Step 2. IF MSIS has NOT occurred, THEN trip one Main Feed pump AND verify the associated valves closed:

Objective:

When a MSIS has not occurred, this step secures one of the two main feed pumps since only one is required below 50% power.

Basis:

To exit the Emergency Procedures 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_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal
Success Path V-2

EOP Step Content:

Step 3. IF MSIS has occurred, THEN verify BOTH Main Feed pumps tripped AND the associated valves closed:

Objective:

This step secures both main feed pumps since the main steam isolation valves are closed on a MSIS.

Basis:

To exit the Emergency Procedures 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_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal

Success Path V-2

EOP Step Content:

Step 4. Verify ALL Heater Drain pumps stopped.

Objective:

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

Basis:

To exit the Emergency Procedures 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_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**

Success Path V-2

EOP Step Content:

Step 5. Verify one Condensate pump is operating.

Objective:

This step secures all condensate pumps which are not required to support the running main feed pump.

Basis:

To exit the Emergency Procedures 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_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>
Success Path V-2

EOP Step Content:

Step 6. IF MSIS has occurred, THEN verify Main Condenser vacuum is 0.0" Hg.

Objective:

This step ensures condenser vacuum is 0.0" Hg if MSIS has occurred.

Basis:

If MSIS occurs, then vacuum is no longer required for secondary equipment since equipment will not be operating due to a loss of supply steam. Therefore vacuum is verified to be 0.0" Hg to prevent any damage to turbine seals. If vacuum is not 0.0" Hg, then the operator manually lowers vacuum to 0.0" Hg.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal

Success Path V-2

EOP Step Content:

Step 7. IF MSIS has NOT occurred, THEN start the 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 the Emergency Procedures 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_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal
Success Path V-2

EOP Step Content:

Step 8. When the Auxiliary Boiler is operating, 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 the Emergency Procedures 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, more than one instrument should be used to obtain a particular reading.

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

OP-10-001, General Plant Operations.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal
Success Path V-2

EOP Step Content:

Step 9. IF EITHER Main Feed pump is operating, THEN align it to the Auxiliary Boiler as follows:

Objective:

The objective of this step is to transfer the steam load of the main feed pump to the auxiliary boiler to permit removal of loads from the steam generators.

Basis:

To exit the Emergency Procedures 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_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal

Success Path V-2

EOP Step Content:

Step 10. IF a Steam Generator is isolated due to activity in the Steam Plant, THEN go to step 15.

Objective:

This step directs the operator to the applicable cooldown steps for an isolated steam generator.

Basis:

If a steam generator is isolated, then certain precautions must be taken to ensure the isolated steam generator is cooled down at a rate consistent with the plant.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal
Success Path V-2

EOP Step Content:

Step 11. Maintain level in at least one Steam Generator as follows:

Objective:

The objective of this step is to ensure that the steam generator level is maintained in at least one steam generator.

Basis:

When the steam generators are being used for heat removal from the reactor coolant system, main or emergency feedwater has to be supplied to the steam generators to ensure a heat sink.

Operational Considerations:

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

NA

Justification of Differences:

NA

Source Document:

NA

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**
Success Path V-2

EOP Step Content:

Step 12. Check AND continuously monitor 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 10-71, step 1)

If all RCP operation is terminated and when inventory and pressure are controlled, natural circulation is monitored by heat removal via at least one steam generator. Natural circulation flow should occur within 5-15 minutes after the RCPs were tripped if there is adequate inventory in the RCS.

The RCS temperature response during natural circulation will usually be slow (5-15 minutes) as compared to a normal forced flow system response time of 6-12 seconds, since the coolant loop cycle time will be significantly larger.

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

a) Loop ΔT (T_H - T_C) less than normal full power ΔT;
b) Cold leg temperatures constant or decreasing;
c) Hot leg temperatures stable (i.e. not steadily increasing) or slowly decreasing;
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].

E_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>

Success Path V-2

EOP Step 12 (Continued).

Basis: (Continued)

Natural circulation is governed by decay heat, component elevations, primary to secondary heat transfer, loop flow resistance, and voiding. Component elevations on C-E plants are such that satisfactorily natural circulation decay heat removal is obtained by fluid density differences between the core region and the steam generator tubes.

Operational Considerations:

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

EPG Step Content: (CEN-152, page 10-158, step 1)

If all RCPs have tripped, and inventory and pressure are being controlled, verify that natural circulation flow has been established in at least one loop by all the following indications:

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 1, Level and Table 5-3, Temperature.

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**

Success Path V-2

EOP Step Content:

Step 13. Maintain Reactor Coolant System temperature AND pressure within the limits of Attachment 5: Post-Accident Pressure and Temperature Limits Graph by either of the following:

Objective:

This step maintains temperature and pressure within the limits of Attachment 5: Post-Accident Pressure and Temperature Limits Graph.

Basis: (CEN-152, page 10-72, step 2)

RCS and core heat removal should be performed by feeding at least one steam generator with main or auxiliary feedwater and dumping steam to the condenser via the turbine bypass system. If the condenser or turbine bypass system is not available, the next order of priority for discharging steam would be to use the atmospheric dump valves.

The use of atmospheric dump valves may have the potential for release of activity to the environment. If it is suspected that a steam generator(s) may be affected by a tube rupture, as indicated by area radiation monitor and/or other symptoms, S/G cooling should be performed using the unaffected or least affected generator.

Operational Considerations:

Subcooling margin shall be maintained 28°F to 200°F. Cooldown rate shall be limited for reactor coolant system <50°F/hr and for pressurizer ≤100°F/hr. If a steam generator is isolated due to activity in the steam plant, then the use of the atmospheric dump valve on the isolated steam generator should be minimized. Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading.

EPG Step Content: (CEN-152, page 10-158, step 2)

Resume/commence RCS heat removal and depressurization to meet the success criteria of this recovery action by conducting one of the following activities:

W3101400

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**

Success Path V-2

EOP Step 13 (Continued).

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**

Success Path V-2

EOP Step Content:

Step 14. IF ALL required actions of steps 11-13 were completed, THEN go to step 22.

Objective:

The objective of this step is to direct the operator to the correct step after completing steps for cooldown with no steam generator isolated.

Basis:

The next 7 steps deal with cooldown of the plant with a steam generator isolated due to steam plant activity. If a steam generator is not isolated the operator skips these steps.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal

Success Path V-2

EOP Step Content:

Step 15. Maintain isolated Steam Generator level 77% to 94% Wide Range as follows:

Objective:

The objective of this step is to ensure that the isolated steam generator level is maintained 77% to 94% wide range.

Basis:

By ensuring the isolated steam generator level is being controlled, overfilling should be prevented. If overfilled, then the steam generator steam space and the main steam piping to the main steam isolation valve filling could present additional problems. Through use of the blowdown system as the preferred means, the spread of contamination is minimized. If the blowdown system is not available, then steaming the affected steam generator will minimize radioactive release through the steam generator safeties. The minimum level ensures that the steam generator tubes are covered with water.

Operational Considerations:

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

NA

Justification of Differences:

NA

Source Document:

PV-OP-902, Parameter Values Document. Table 5-1, Level.

E_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>

Success Path V-2

EOP Step Content:

Step 16. Maintain level in the Steam Generator which is <u>NOT</u> isolated as follows:

Objective:

The objective of this step is to ensure that the steam generator level is maintained in the operable steam generator.

Basis:

When the steam generators are being used for heat removal from the reactor coolant system, main or emergency feedwater has to be supplied to the steam generator to ensure a heat sink.

Operational Considerations:

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

NA

Justification of Differences:

NA

Source Document:

NA

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal
Success Path V-2

EOP Step Content:

Step 17. Check AND continuously monitor Natural Circulation by ALL the following:

Objective:

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

Basis:

During cooldown and depressurization to shutdown cooling initiating conditions, indications of natural circulation have to be verified. When single phase circulation is established in at least one loop, the reactor coolant system 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 resistance temperature detectors and CETs. Hot leg resistance temperature detector temperature should be consistent with the CETs. Adequate natural circulation flow ensures that CETs temperatures will be approximately equal to the hot leg resistance temperature detectors temperature within the bounds of the instrument's inaccuracies. An abnormal difference between T_H and the CETs is greater than (10)°F.

If all reactor coolant pump operation is terminated, and when inventory and pressure are controlled, then natural circulation is monitored by heat removal via at least one steam generator.

Operational Considerations:

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

E_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>

Success Path V-2

EOP Step 17 (Continued).

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

PV-OP-902, Parameter Values Document. Table 5-1, Level and Table 5-3, Temperature.

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**

Success Path V-2

EOP Step Content:

Step 18. Determine the optimum ΔT to be maintained between Steam Generators during cooldown as indicated on STEAM GENERATOR OUTLET TEMP (MS-ITR-301A/B) recorder. Refer to Attachment 7: Steam Generators Optimum ΔT Curve.

Objective:

The objective of this step is to provide the temperature difference allowed between steam generators when utilizing circulation for cooldown of the reactor coolant system.

Basis:

Natural circulation will occur in the isolated steam generator even if its temperature is slightly above reactor hot leg temperature. As the ΔT increases, more heat is transferred to the primary coolant in the isolated steam generator, but natural circulation flow decreases. The optimum ΔT between steam generators to achieve maximum heat transfer is given in Attachment 7. Maintain this ΔT by bleeding steam from the steam generator not isolated, and cooling the isolated steam generator as per step 20.

Operational Considerations:

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

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

FSAR, question 211-94.

E_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>

Success Path V-2

EOP Step Content:

Step 19. <u>IF</u> the Control Room Supervisor determines that cooldown of the isolated Steam Generator is required, <u>THEN</u> feed <u>AND</u> drain as follows:

Objective:

This step ensures that the isolated steam generator is cooled down while the reactor coolant system is being cooled down.

Basis:

With no reactor coolant pumps operating, there usually will be little flow through the isolated steam generator, which would limit the plant cooldown rate. The isolated steam generator may be cooled, if necessary, to accelerate plant cooldown.

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:

NA

Justification of Differences:

NA

Source Document:

NA

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal
Success Path V-2

EOP Step Content:

Step 20. Maintain Reactor Coolant System temperature AND pressure within the limits of Attachment 5: Post-Accident Pressure and Temperature Limits Graph by either of the following:

Objective:

The objective of this step is to cool down the plant to effect a depressurization.

Basis:

Maintain reactor coolant system temperature and pressure with the steam generator not isolated. These methods are presented in order, with the most preferred method listed first, to minimize radiological releases.

Operational Considerations:

Subcooling margin shall be maintained 28°F to 200°F. Cooldown rate for reactor coolant system $\leq$50°F/hr and for pressurizer $\leq$100°F/hr. If maintaining the optimum ΔT slows down the cooldown rate of the isolated steam generator, then a slightly lower ΔT should be maintained. 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:

NA

Justification of Differences:

NA

Source Document:

NA

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal

Success Path V-2

EOP Step Content:

Step 21. At the following time intervals, determine the optimum T. Refer to Attachment 7: Steam Generators Optimum T Curve.

Objective:

This step determines the amount of decay power remaining for the time after reactor trip.

Basis:

As time elapses, the amount of decay power remaining shall be determined. This decay power is used to determine the optimum T between the steam generators in the following step so that the maximum heat transfer to the reactor coolant system can be maintained.

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:

FSAR, question 211-94.

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**
Success Path V-2

EOP Step Content:

Step 22. IF ALL Reactor Coolant Pumps have been stopped, THEN check the following Reactor Coolant Pump restart criteria:

Objective:

NA

Basis: (CEN-152, page 10-72, step 3)

RCPs may be restarted if all of the following criteria are satisfied:

a) At least one steam generator is available for removing heat from the RCS, thus providing an RCS heat removal function. This includes feedwater available for removing heat from the generator and a method for removing steam (e.g. atmospheric dump valves, etc.).
b) Pressurizer level is greater than [100"] and constant or increasing. This assures that pressurizer level is above pressurizer heat cutoff level and is an indication that RCS primary inventory and pressure are being controlled.
c) The RCS is greater than or equal to [20°F] subcooled. A subcooled condition in the RCS in conjunction with (b) above indicates that pressure and inventory are being controlled.
d) [All plant specific RCP operating criteria are satisfied before the RCPs are restarted to prevent damage to RCPs].

Operational Considerations:

If component cooling water to reactor coolant pumps has been lost for ≥10 minutes, then reactor coolant pumps should not be restarted. Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading.

EPG Step Content: (CEN-152, page 10-159, step 3)

One RCP in each loop may be restarted if all of the following criteria are satisfied:

E_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>

Success Path V-2

EOP Step 22 (Continued).

Justification of Differences:

The EPG step was divided up into two EOP steps. One deals with the restart criteria. The other deals with the restart of one reactor coolant pump in each loop.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-1, Level and Table 5-2, Subcooling.

E_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>

Success Path V-2

EOP Step Content:

Step 23. <u>IF</u> <u>ALL</u> Reactor Coolant Pump restart criteria (step 22) are satisfied, <u>THEN</u> restart one Reactor Coolant Pump in each loop. Refer to OP-1-002, REACTOR COOLANT PUMP OPERATION, Sections 4.0 <u>AND</u> 6.1.

Objective:

NA

Basis: (CEN-152, page 10-72, step 3)

RCPs may be restarted if all of the following criteria are satisfied:

a) At least one steam generator is available for removing heat from the RCS, thus providing an RCS heat removal function. This includes feedwater available for removing heat from the generator and a method for removing steam (e.g. atmospheric dump valves, etc.).

b) Pressurizer level is greater than [100"] and constant or increasing. This assures that pressurizer level is above pressurizer heat cutoff level and is an indication that RCS primary inventory and pressure are being controlled.

c) The RCS is greater than or equal to [20°F] subcooled. A subcooled condition in the RCS in conjunction with (b) above indicates that pressure and inventory are being controlled.

d) [All plant specific RCP operating criteria are satisfied before the RCPs are restarted to prevent damage to RCPs].

Operational Considerations:

If component cooling water to reactor coolant pumps has been lost for ≥10 minutes, then reactor coolant pumps should not be restarted. Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal

Success Path V-2

EOP Step 23 (Continued).

EPG Step Content: (CEN-152, page 10-159, step 3)

One RCP in each loop may be restarted if all of the following criteria are satisfied:

Justification of Differences:

The EPG step was divided into two EOP steps. One deals with the restart criteria. The other deals with the restart of one reactor coolant pump in each loop.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-1, Level and Table 5-2, Subcooling.

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**

Success Path V-2

EOP Step Content:

Step 24. 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 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:

NA

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**
Success Path V-2

EOP Step Content:

Step 25. Evaluate Condensate inventory. Refer to Attachment 11: Feedwater Required for Heat Removal to Tc (Final) versus Tc (Initial), AND Attachment 12: Feedwater Capacity versus Time Remaining to Initiate Shutdown Cooling.

Objective:

This step evaluates the available condensate inventory and determines the amount of time the operator may remain at present conditions before needing to commence a plant cooldown.

Basis: (CEN-152, page 10-76, step 7)

The available condensate inventory should be monitored and replenished from available sources as necessary to continually provide a source for a secondary heat sink. Example of alternate sources of condensate are nonseismic tanks, fire mains, lake water supplies, potable tanks, etc. Plant specific alternate sources of feedwater should be identified and cited in the plant specific procedure.

Operational Considerations:

NA

EPG Step Content: (CEN-152, page 10-160, step 7)

If the auxiliary feedwater system is being used, ensure an adequate supply of condensate.

Justification of Differences:

The EPG step was divided into two EOP steps. One evaluates the present available condensate inventory. The other deals with condensate makeup and alternate sources.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal

Success Path V-2

EOP Step Content:

Step 26. 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 at the steam generators.

Basis:

If cold leg temperature is ≤450°F then the condensate pumps can adequately supply water to the steam generators. This action feeds the steam generators through normal system lineup at these conditions.

Operational Considerations:

Main feedwater pumps need not be operable. 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:

NA

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal
Success Path V-2

EOP Step Content:

Step 27. IF BOTH Main Feedwater AND Emergency Feedwater are lost, THEN perform the following:

Objective:

This step provides guidance for a total loss of feedwater.

Basis: (CEN-152, page 10-75, step 6)

If all feedwater is lost (both main and emergency) certain activities should be performed to keep the plant in a stable condition. These activities are listed below.

a) Stop all RCPs
b) Any cooldown is stopped to minimize steam discharge and conserve S/G inventories.
c) If in operation, the steam generator blowdown system, secondary sampling system or any other nonvital secondary discharge must be secured. Until feedwater is reestablished, the steam generator water inventories must be conserved.
d) The operator should attempt to restore the operation of the main or auxiliary feedwater system to provide a primary decay heat sink for a controlled depressurization to meet the success criteria of this recovery action guideline.

A moderate rate of increase in steam generator water level is sufficient to restore S/G level. If the refill rate is too fast, excessive cooldown of the RCS and shrinkage of RCS inventory may result. Consequently, pressurizer level may fall below that required to maintain a bubble for pressure control. An adequate feed rate for restoring steam generator level is determined by operating experience.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal

Success Path V-2

EOP Step 27 (Continued).

Basis: (Continued)

e) If both main and auxiliary feedwater cannot be restored, all plant specific sources of feedwater which could be made available to replace steam generator boil-off should be implemented. Examples of alternate sources of feedwater are fire pumps, condensate pumps, portable pumps, etc. When developing plant specific procedures, alternate sources of feeedwater should be identified and their use should be indicated in the procedures. Guidelines on steam generator depressurization should be developed for those cases when the operator is relying on low pressure sources of feedwater as a backup feedwater supply.

Operational Considerations:

Feedwater should not be restored to an empty steam generator. If both steam generators are empty, then feedwater should be restored to one steam generator only.

EPG Step Content: (CEN-152, page 10-160, step 6)

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

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**
Success Path V-2

EOP Step Content:

Step 28. IF using Emergency Feedwater to feed Steam Generators, THEN perform the following:

Objective:

This step ensures continuous suction supply to emergency feed pumps.

Basis: (CEN-152, page 10-76, step 7)

The available condensate inventory should be monitored and replenished from available sources as necessary to continually provide a source for a secondary heat sink. Example of alternate sources of condensate are nonseismic tanks, fire mains, lake water supplies, potable tanks, etc. Plant specific alternate sources of feedwater should be identified and cited in the plant specific procedure.

Operational Considerations:

Permission shall be obtained from control room supervisor prior to aligning auxiliary component cooling system to the emergency feedwater system. Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading. 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 10-160, step 7)

If the auxiliary feedwater system is being used, ensure an adequate supply of condensate.

Justification of Differences:

The EOP step was expanded to include setpoints and plant specific information. The EPG step was divided into two EOP steps. One evaluates the present available condensate inventory. The other deals with condensate makeup and alternate sources.

E_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>

Success Path V-2

EOP Step 28 (Continued).

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-1, Level.

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**
Success Path V-2

EOP Step Content:

Step 29. Check the following success path criteria:

Objective:

The objective of this step is to check the criteria associated with satisfactorily completing this success path.

Basis: (CEN-152, page 10-4, step 3)

The basis for each individual criterion is given in Section 2.0 of the technical guide. The criteria are used to judge the status of each safety function. Since each safety function has multiple success paths which can be used to control that safety function, the criteria which are used to judge the status of each safety function are organized around the success paths for each safety function. Since each success path uses or may use different technical means of achieving a function, the criteria for judging the success of that path are specific to the technical means. Also, in order to facilitate operator use, the criteria chosen are parameters which can be read directly from the control board.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>
Success Path V-2

EOP Step Content:

Step 30. <u>IF</u> the success path criteria (step 29) are met, <u>THEN</u> go to the next safety function in jeopardy.

Objective:

The objective of this step is to instruct the operator what to do if this success path is satisfactorily completed.

Basis: (CEN-152, page 10-12, step 7)

After checking the success path criteria, additional guidance is provided which aids the operator in determining the next course of action. In this step, if control of the safety function is achieved, the operator is instructed to go to the next safety function in jeopardy.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal
Success Path V-2

EOP Step Content:

Step 31. If the success path criteria (step 29) are NOT met, THEN go to Success Path V-3.

Objective:

The objective of this step is to instruct the operator what to do if this success path is not satisfactorily completed.

Basis: (CEN-152, page 10-12, step 7)

After checking the success path criteria, additional guidance is provided which aids the operator in determining the next course of action. In this step, if control of the safety function is not achieved, the operator is instructed to implement another success path for this safety function.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>
Success Path V-3

EOP Step Content:

Step 1. <u>IF</u> Pressurizer pressure drops to ≤1684 psia <u>OR</u> Containment pressure rises to ≥17.4 psia, <u>THEN</u> verify SIAS occurs as follows:

Objective:

The objective of this step is to verify SIAS occurs when required.

Basis: (CEN-152, page 10-79, step 2)

ECCS operation must be verified if pressurizer pressure decreases to 1684 psia or if containment pressure increased to 17.4 psia. If safety injection system operation has not commenced automatically when RCS pressure is below 1684 psia, it must be manually actuated. This action allows the RWT inventory to discharge into the RCS. An insufficient RCS inventory may be associated with a loss of coolant accident, a steam generator tube rupture, a control system malfunction or an excessive heat removal event. Safety injection system flow rate will follow the RCS pressure according to the ECCS delivery curves. The SIS and charging flowrate should be check and maximized relative to RCS pressure to enhance RCS inventory replenishment and/or core heat removal.

Operational Considerations:

Hot leg temperatures and cold leg temperatures may be influenced by safety injection flow. Multiple indications and core temperatures should be used to determine the reactor coolant system temperature. Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading.

EPG Step Content: (CEN-152, page 10-163, step 2)

If pressurizer pressure decreases to [1600] psia [or if containment pressure increases to 4 psig], verify initiation of an SIAS. ECCS should be delivering flow which is consistent with Figure 10-11.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal

Success Path V-3

EOP Step 1 (Continued).

Justification of Differences:

The EPG step was placed before stopping all reactor coolant pumps to place steps in the order they would occur.

The EPG step was divided into two EOP steps. One step verifies SIAS actuation. The other step verifies proper HPSI flow.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-4, Pressure.

E_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>
Success Path V-3

EOP Step Content:

Step 2. <u>IF</u> either of the following conditions occurs, <u>THEN</u> stop <u>ALL</u> Reactor Coolant Pumps:

Objective:

The objective of this step is to stop reactor coolant pump operation when pressurizer pressure $\leq$1621 psia following an SIAS or when component cooling water is lost.

Basis: (CEN-152, page 10-79, step 1)

This step serves to prevent continued RCP operation when RCS pressure is $\leq$1621 psia during a Loss of Coolant Accident. Continued RCP operation at RCS pressures below 1621 psia during a Loss of Coolant Accident may result in more severe RCS conditions. When component cooling water is lost to the reactor coolant pumps, damage to pump components could occur if the RCPs are not secured.

Operational Considerations:

Since other events could cause rapid depressurization, anytime pressurizer pressure drops below 1621 psia following a SIAS, all reactor coolant pump operation is terminated. Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading.

EPG Step Content: (CEN-152, page 10-163, step 1)

If pressurizer pressure decreases to (1300 psia) following an SIAS, stop all reactor coolant pumps.

Justification of Differences:

Loss of component cooling water to reactor coolant pumps is added to this step because component cooling system is isolated to the reactor coolant pumps when an SIAS actuation occurs.

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**

Success Path V-3

EOP Step 2 (Continued).

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-4, Pressure.

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**
Success Path V-3

EOP Step Content:

Step 3. IF Pressurizer pressure drops to ≤1385 psia, THEN verify proper HPSI Header flow exists. Refer to Attachment 2: HPSI and LPSI Flow versus Pressurizer Pressure.

Objective:

The objective of this step is to verify that inventory is provided to the reactor coolant system during a loss of coolant accident.

Basis: (CEN-152, page 10-79, step 2)

ECCS operation must be verified if pressurizer pressure decreased to 1684 psia or if containment pressure increased to 17.4 psia. If safety injection system operation has not commenced automatically when RCS pressure is below 1684 psia, it must be manually actuated. This action allows the RTW inventory to discharge into the RCS. An insufficient RCS inventory may be associated with a loss of coolant accident, a steam generator tube rupture, a control system malfunction or an excessive heat removal event. Safety injection system flow rate will follow the RCS pressure according to the ECCS delivery curves. The SIS and charging flowrate should be checked and maximized relative to RCS pressure to enhance RCS inventory replenishment and/or core heat removal.

Operational Considerations:

Hot leg temperatures and cold leg temperatures may be influenced by safety injection flow. Multiple indications and core temperatures should be used to determine the reactor coolant system temperature. Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading.

EPG Step Content: (CEN-152, page 10-163, step 2)

If pressurizer pressure decreases to [1600] psia [or if containment pressure increases to 4 psig], verify initiation of an SIAS. ECCS should be delivering flow which is consistent with Figure 10-11.

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**

Success Path V-3

EOP Step 3 (Continued).

Justification of Differences:

The EPG step was divided into two EOP steps. One step verifies SIAS actuation. The other step verifies proper HPSI flow.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-4, Pressure.

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**

Success Path V-3

EOP Step Content:

Step 4. Maintain level in at least one Steam Generator as follows:

Objective:

The objective of this step is to ensure that the steam generator level is maintained in at least one steam generator.

Basis:

When the steam generators are being used for heat removal from the reactor coolant system, main or emergency feedwater has to be supplied to the steam generator to ensure a heat sink.

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.

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal
Success Path V-3

EOP Step Content:

Step 5. Maintain Reactor Coolant System temperature AND pressure within the limits of Attachment 5: Post-Accident Pressure and Temperature Limits Graph by either of the following:

Objective:

This step maintains temperature and pressure within the limits of Attachment 5: Post-Accident Pressure and Temperature Limits Graph.

Basis: (CEN-152, page 10-79, step 3)

Steam generator heat removal should be performed by feeding the steam generators with main or auxiliary feedwater and dumping steam to the condenser via the turbine bypass system. If the condenser or turbine bypass system is not available, the next order of priority for discharging steam would be to use the atmospheric dump valves.

The use of atmospheric dump valves may have the potential release of activity to the environment. If it is suspected that a steam generator(s) may be affected by a tube rupture, S/G cooling should be performed using the unaffected or least affected generator.

Operational Considerations:

If a steam generator is isolated due to activity in the steam plant, then the use of the atmospheric dump valve on the isolated steam generator should be minimized. Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading.

EPG Step Content: (CEN-152, page 10-163, step 3)

Steam the steam generators to remove RCS heat using one of the following methods (listed in order of preference):

Justification of Differences:

NA

E_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>

Success Path V-3

EOP Step 5 (Continued).

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal
Success Path V-3

EOP Step Content:

Step 6. IF Pressurizer level >28%, THEN verify Pressurizer pressure is being restored by Pressurizer heaters.

Objective:

The objective of this step is to verify pressurizer heaters restored when inventory is restored.

Basis:

The preferred method of pressure control is using pressurizer heaters. Pressurizer heaters are deenergized when pressurizer level is low to prevent damage to the heaters. When inventory is restored pressurizer heaters should be reenergized for pressure control.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**

Success Path V-3

EOP Step Content:

Step 7. IF NO Reactor Coolant Pumps are operating AND Reactor Coolant System Subcooling Margin $\geq$28°F, THEN check Single Phase Natural Circulation by ALL the following:

Objective:

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

Basis: (CEN-152, page 10-82, step 6)

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

a) Loop ΔT (T_H - T_C) less than normal full power ΔT;
b) Cold leg temperatures constant or decreasing;
c) Hot leg temperatures stable (i.e. not steadily increasing) or slowly decreasing;
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:

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

E_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>

Success Path V-3

EOP Step 7 (Continued).

EPG Step Content: (CEN-152, page 10-164, step 6)

If all RCPs have tripped, inventory and pressure are being controlled and S/Gs are being used for heat removal, verify that natural circulation flow has been established in at least one loop by all the following indications:

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**
Success Path V-3

EOP Step Content:

Step 8. IF NO Reactor Coolant Pumps are operating AND Reactor Coolant System Subcooling Margin <28°F, THEN check Two Phase Natural Circulation AND Break Heat Removal by the following:

Objective:

The objective of this step is to check the conditions that indicate two phase natural circulation flow and break heat removal exist.

Basis:

For two phase natural circulation and break heat removal, the operator relies upon maintaining the steam generator heat removal process and the strict rules that require the emergency core cooling system to be kept operating to restore inventory control. The CET temperature is important in monitoring heat removal during two phase natural circulation cooling.

Operational Considerations:

This step need be performed only if all reactor coolant pumps have been stopped. 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:

PV-OP-902, Parameter Values Document. Table 5-1, Level and Table 5-3, Temperature.

E_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>
Success Path V-3

EOP Step Content:

Step 9. Check the following Safety Injection termination criteria:

Objective:

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

Basis: (CEN-152, page 10-82, step 7)

If an SIAS has been initiated and the SIS is operating, it must continue to operate at full capacity until SIS termination criteria are met. Early termination may be desirable when the criteria are met to preclude PTS situations or HPSI pump damage (e.g., shaft seals).

Operational Considerations:

Below 1000 psia, subcooling margin shall be determined by subtracting hot leg temperature from Pressurizer Temperature Water (TI 101). Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading.

EPG Step Content: (CEN-164, page 10-136, step 7)

If the ECCS is operating, it may be throttle stopped one train at a time if 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 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-1, Level and Table 5-2, Subcooling.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal

Success Path V-3

EOP Step Content:

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

Objective:

The step maintains pressurizer level and prevents solid water operation unless 28°F subcooling margin cannot be maintained. If 28°F subcooling margin cannot be maintained, then the pressurizer is taken solid with high pressure safety injection pumps.

Basis: (CEN-152, page 10-82, step 7)

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 10-164, step 7)

If the ECCS is operating, it may be throttle stopped one train at a time if 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.

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**

Success Path V-3

EOP Step 10 (Continued).

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-1, Level.

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**
Success Path V-3

EOP Step Content:

Step 11. IF ALL Safety Injection termination criteria (step 9) can NOT be maintained after throttling OR stopping Safety Injection flow, THEN reinitiate Safety Injection flow.

Objective:

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

Basis: (CEN-152, page 10-83, step 8)

If all of the criteria of step 7 cannot be maintained, the safety injection pumps must be restarted whenever necessary to satisfy all the criteria.

Operational Considerations:

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

EPG Step Content: (CEN-152, page 10-164, step 8)

If all the criteria of step 7 cannot be maintained after the ECCS has been stopped, the ECCS must be restarted.

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal
Success Path V-3

EOP Step Content:

Step 12. Evaluate Condensate inventory. Refer to Attachment 11: Feedwater Required for Heat Removal to Tc (Final) versus Tc (Initial), AND Attachment 12: Feedwater Capacity versus Time Remaining to Initiate Shutdown Cooling.

Objective:

This step evaluates the available condensate inventory and determines the amount of time the operator may remain at present conditions before needing to commence a plant cooldown.

Basis: (CEN-152, page 10-81, step 5)

The available condensate inventory should be monitored and replenished from available sources as necessary to continually provide a source for a secondary heat sink. Example of alternate sources of condensate are nonseismic tanks, fire mains, lake water supplies, potable tanks, etc. Plant specific alternate sources of feedwater should be identified and cited in the plant specific procedure.

Operational Considerations:

NA

EPG Step Content: (CEN-152, page 10-163, step 5)

If the auxiliary feedwater system is being used, ensure an adequate supply of condensate.

Justification of Differences:

The EPG step was divided into two EOP steps. One evaluates the present available condensate inventory. The other deals with condensate makeup and alternate sources.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal
Success Path V-3

EOP Step Content:

Step 13. 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:

If cold leg temperature is ≤450°F then the condensate pumps can adequately supply water to the steam generators. This action feeds the steam generators through normal system lineup at these conditions.

Operational Considerations:

Main feedwater pumps need not be operable. 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:

NA

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**

Success Path V-3

EOP Step Content:

Step 14. IF BOTH Main Feedwater AND Emergency Feedwater are lost, THEN perform the following:

Objective:

This step provides guidance for a total loss of feedwater.

Basis: (CEN-152, page 10-80, step 4)

If all feedwater is lost (both main and emergency) certain activities should be performed to keep the plant in a stable condition. These activities are listed below.

a) Stop all RCPs
b) Any cooldown is stopped to minimize steam discharge and conserve S/G inventories.
c) If in operation, the steam generator blowdown system, secondary sampling system or any other nonvital secondary discharge must be secured. Until feedwater is reestablished, the steam generator water inventories must be conserved.
d) The operator should attempt to restore the operation of the main or auxiliary feedwater system to provide a primary decay heat sink for a controlled depressurization to meet the success criteria of this recovery action guideline.

A moderate rate of increase in steam generator water level is sufficient to restore S/G level. If the refill rate is too fast, excessive cooldown of the RCS and shrinkage of RCS inventory may result. Consequently, pressurizer level may fall below that required to maintain a bubble for pressure control. An adequate feed rate for restoring steam generator level is determined by operating experience.

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**

Success Path V-3

EOP Step 14 (Continued).

Basis: (Continued)

e) If both main and auxiliary feedwater cannot be restored, all plant specific sources of feedwater which could be made available to replace steam generator boil-off should be implemented. Examples of alternate sources of feedwater are fire pumps, condensate pumps, portable pumps, etc. When developing plant specific procedures, alternate sources of feedwater should be identified and their use should be indicated in the procedures. Guidelines on steam generator depressurization should be developed for those cases when the operator is relying on low pressure sources of feedwater as a backup feedwater supply.

Operational Considerations:

Feedwater should not be restored to an empty steam generator. If both steam generators are empty, then feedwater should be restored to one steam generator only.

EPG Step Content: (CEN-152, page 10-163, step 4)

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

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal

Success Path V-3

EOP Step Content:

Step 15. IF using Emergency Feedwater to feed Steam Generators, THEN perform the following:

Objective:

This step ensures continuous suction supply to emergency feed pumps.

Basis: (CEN-152, page 10-81, step 5)

The available condensate inventory should be monitored and replenished from available sources as necessary to continually provide a source for a secondary heat sink. Example of alternate sources of condensate are nonseismic tanks, fire mains, lake water supplies, potable tanks, etc. Plant specific alternate sources of feedwater should be identified and cited in the plant specific procedure.

Operational Considerations:

Permission shall be obtained from control room supervisor prior to aligning auxiliary component cooling system to the emergency feedwater system. Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading. 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 10-163, step 5)

If the auxiliary feedwater system is being used, ensure an adequate supply of condensate.

Justification of Differences:

The EOP step was expanded to include setpoints and plant specific information. The EPG step was divided into two EOP steps. One evaluates the present available condensate inventory. The other deals with condensate makeup and alternate sources.

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**

Success Path V-3

EOP Step 15 (Continued).

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-1, Level.

E_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>
Success Path V-3

EOP Step Content:

Step 16. <u>IF</u> Refueling Water Storage Pool level drops to 10%, <u>THEN</u> verify that Recirculation Actuation Signal occurs <u>AND</u> check <u>ALL</u> the following:

Objective:

This step ensures that an RAS occurs to provide a suction source to the safety injection pumps.

Basis: (CEN-152, page 10-83, step 9)

If the Refueling Water Storage Pool level falls to 10%, initiation of recirculation should be verified. Recirculation is actuated in order to maintain a continuous flow of safety injection fluid to the RCS and a continuous flow of containment spray water. The operator should be cautioned against prematurely initiating an RAS. An inadequate amount of level in the safety injection sump may cause air binding of safety injection pumps and loosing both heat removal loops.

Operational Considerations:

When RAS occurs and safety injection sump level is <10 feet, safety injection pumps should be monitored for potential air binding. Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading.

EPG Step Content: (CEN-152, page 10-164, step 9)

If the refueling water tank level falls to [10%], verify initiation of recirculation. If necessary, manually initiate recirculation one SIS train at time [and close RWT outlet valves to the safety injection system].

Justification of Differences:

This EPG step was divided into several steps to include plant specific information.

E_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>

Success Path V-3

EOP Step 16 (Continued).

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-1, Level.

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**
Success Path V-3

EOP Step Content:

Step 17. When the RAS actions (step 16) have been verified, close the following valves:

Objective:

This step directs the operators action after an RAS.

Basis: (CEN-152, page 10-83, step 9)

Manually closing the outlet valves from the Refueling Water Storage Pool will isolate the RWSP from the safety injection pumps. The pumps recirculation valves are closed to prevent inventory loss from the safety injection sump to the RWSP.

Operational Considerations:

NA

EPG Step Content: (CEN-152, page 10-164, step 9)

If the refueling water tank level falls to [10%], verify initiation of recirculation. If necessary, manually initiate recirculation one SIS train at time [and close RWT outlet valves to the safety injection system].

Justification of Differences:

This EPG step was divided into several steps to include plant specific information.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal
Success Path V-3

EOP Step Content:

Step 18. IF RAS occurs, THEN on Attachment 4: HPSI and CS Pump Flow, record the HPSI AND Containment Spray pumps flow at the following time intervals:

Objective:

This step monitors the HPSI and CS Pumps for performance requirements.

Basis: (CEN-152, page 10-84, step 10)

After the switch to recirculation, the HPSI and CS Pumps are monitored in order to ensure that the Emergency Core Coolant System performance requirements are maintained. This action helps to avert any possible permanent pump damage.

Operational Considerations:

NA

EPG Step Content: (CEN-152, page 10-164, step 10)

If the HPSI pumps are delivering less than [30 gpm] per pump during recirculation, turn off one charging pump and/or one HPSI pump (turn off the HPSI pump with the lower indicated flow) at a time until the HPSI pumps are delivering more than [30 gpm] per pump.

Justification of Differences:

The EPG step was divided into several steps to include plant specific information.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal

Success Path V-3

EOP Step Content:

Step 19. IF HPSI flow is NOT >25 gpm per operating HPSI pump, THEN sequentially perform the following until operating HPSI pump flow ≥25 gpm:

Objective:

This step ensures that each operating high pressure safety injection pump has a minimum flow ≥25 gpm.

Basis: (CEN-152, page 10-84, step 10)

After the switch to recirculation, the HPSI flows are monitored in order to ensure that the HPSI miniflow requirement for pump protection are met to avert any possible permanent HPSI pump damage. If they are not met, the operator should turn off the charging pumps one at a time until the miniflow requirements are met. If they are still not met with all the charging pumps off and two HPSI pumps are operating, the operator turns off the HPSI pump with the lower flow. One HPSI pump should be left operating at all times, unless the criteria of step 81 are met.

Operational Considerations:

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

EPG Step Content: (CEN-152, page 10-164, step 10)

If the HPSI pumps are delivering less than [30 gpm] per pump during recirculation, turn off one charging pump and/or one HPSI pump (turn off the HPSI pump with the lower indicated flow) at a time until the HPSI pumps are delivering more than [30 gpm] per pump.

Justification of Differences:

The EPG step was divided into several steps to include plant specific information.

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**

Success Path V-3

EOP Step 19 (Continued).

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal
Success Path V-3

EOP Step Content:

Step 20. Between two hours AND four hours post-LOCA, realign Safety Injection pumps discharge for equal flow to the Hot Legs AND Cold Legs as follows:

Objective:

This step aligns safety injection pump discharge to both hot and cold leg injection.

Basis:

Simultaneous hot and cold leg injection is used for both small break and large break Loss of Coolant Accidents at [2-4 hours] after the start of the Loss of Coolant Accident. In this mode, the high pressure safety injection pumps discharge lines are realigned so that the total injection flow is divided equally between the hot and cold legs. Simultaneous injection into the hot and cold legs is used as the mechanism to prevent the precipitation of boric acid in the reactor vessel following a break that is too large to allow the reactor coolant system to refill. Injecting to both sides of the reactor vessel ensures that fluid from the reactor vessel (when the boric acid is being concentrated) flows out the break regardless of the break location and is replenished with a dilute solution of borated water from the other side of the reactor vessel. The action is taken no sooner than 2 hours after the Loss of Coolant Accident since the fluid injected to the hot leg may be entrained in the steam being released from the core and hence possibly diverted from reaching the reactor vessel. After 2 hours, the core decay heat has dropped sufficiently so that there is insufficient steam velocity to entrain the fluid being injected to the hot leg. The action is taken no later than 4 hours after the Loss of Coolant Accident in order to ensure that the buildup of boric acid is terminated well before the potential for boric acid precipitation occurs.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal

Success Path V-3

EOP Step 20 (Continued).

Basis: (Continued)

Even though the action is required only for large breaks, it is taken for any Loss of Coolant Accident so that the operator need not be required to distinguish between large and small breaks so early in the transient. Simultaneous hot and cold leg injection is not required for small breaks, because for them the buildup of boric acid is terminated when the reactor coolant system is refilled. Once the reactor coolant system is refilled, the boric acid is dispersed throughout the reactor coolant system via natural circulation.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

PV-OP-902, Parameter Values Document. Table 5-5, Time.

E_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>
Success Path V-3

EOP Step Content:

Step 21. Check the following success path criteria:

Objective:

The objective of this step is to check the criteria associated with satisfactorily completing this success path.

Basis: (CEN-152, page 10-4, step 3)

The basis for each individual criterion is given in Section 2.0 of the technical guide. The criteria are used to judge the status of each safety function. Since each safety function has multiple success paths which can be used to control that safety function, the criteria which are used to judge the status of each safety function are organized around the success paths for each safety function. Since each success path uses or may use different technical means of achieving a function, the criteria for judging the success of that path are specific to the technical means. Also, in order to facilitate operator use, the criteria chosen are parameters which can be read directly from the control board.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal
Success Path V-3

EOP Step Content:

Step 22. IF the success path criteria (step 21) are met, THEN go to the next safety function in jeopardy.

Objective:

The objective of this step is to instruct the operator what to do if this success path is satisfactorily completed.

Basis: (CEN-152, page 10-12, step 7)

After checking the success path criteria, additional guidance is provided which aids the operator in determining the next course of action. In this step, if control of the safety function is achieved, the operator is instructed to go to the next safety function in jeopardy.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>
Success Path V-3

EOP Step Content:

Step 23. <u>IF</u> the success path criteria (step 21) are <u>NOT</u> met, <u>THEN</u> go to Success Path V-4.

Objective:

The objective of this step is to instruct the operator what to do if this success path is not satisfactorily completed.

Basis: (CEN-152, page 10-12, step 7)

After checking the success path criteria, additional guidance is provided which aids the operator in determining the next course of action. In this step, if control of the safety function is not achieved, the operator is instructed to implement another success path for this safety function.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal
Success Path V-4

EOP Step Content:

Step 1. IF Pressurizer pressure drops to ≤1684 psia OR Containment pressure rises to ≥17.4 psia, THEN verify SIAS occurs as follows:

Objective:

The objective of this step is to verify SIAS occurs when required.

Basis: (CEN-152, page 10-86, step 2)

Once through cooling through an RCS pressure boundary opening is established in the following manner. All operating RCPs are stopped since a LOCA or sustained opening the [PORVs] will probably result in saturation conditions in the RCS which is not a desirable fluid condition for RCP operation. The SIS and charging pumps are started and the [PORV's] are opened (unless there is already an adequate opening in the RCS for once through cooling as there would be if a large break had occurred). This provides the path and motive force for core flushing and will reduce RCS temperature, since cooler safety injection fluid is replacing the hot RCS fluid leaving through the opening. This cooling could also take place through a break in the RCS boundary. An adequate size break for adequate core cooling usually results in an initial RCS depressurization to below 300 psia.

Operational Considerations:

Hot leg temperatures and cold leg temperatures may be influenced by safety injection flow. Multiple indications and core temperatures should be used to determine the reactor coolant system temperature. Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading.

EPG Step Content: (CEN-152, page 10-167, step 2)

Establish once through cooling (either through the [PORVs] or, if present, through the break in the RCS boundary) by performing all of the following:

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**

Success Path V-4

EOP Step 1 (Continued).

Justification of Differences:

The EPG step was placed before stopping all reactor coolant pumps to place steps more in the order they would occur. Since Waterford-3 does not have PORVs, this success path was written for a large break Loss of Coolant Accident.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-4, Pressure.

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**
Success Path V-4

EOP Step Content:

Step 2. IF either of the following conditions occurs, THEN stop ALL Reactor Coolant Pumps:

Objective:

The objective of this step is to stop reactor coolant pump operation when pressurizer pressure ≤1621 psia following a SIAS or when component cooling water is lost.

Basis: (CEN-152, page 10-86, step 1)

This step serves to prevent continued RCP operation when RCS pressure is ≤1621 psia during a Loss of Coolant Accident. Continued RCP operation at RCS pressures below 1621 psia during a Loss of Coolant Accident may result in more severe RCS conditions. When component cooling water is lost to the reactor coolant pumps, damage to pump components could occur if the RCPs are not secured.

Operational Considerations:

Since other events could cause rapid depressurization, anytime pressurizer pressure drops below 1621 psia following an SIAS, all reactor coolant pump operation is terminated. Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading.

EPG Step Content: (CEN-152, page 10-167, step 1)

If pressurizer pressure decreases to (1300 psia) following an SIAS, stop all reactor coolant pumps.

Justification of Differences:

Loss of component cooling water to reactor coolant pumps is added to this step because component cooling water is isolated to the reactor coolant pumps when an SIAS actuation occurs.

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**

Success Path V-4

EOP Step 2 (Continued).

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-4, Pressure.

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**
Success Path V-4

EOP Step Content:

Step 3. IF Pressurizer pressure drops to ≤1385 psia, THEN verify proper HPSI Header flow exists. Refer to Attachment 2: HPSI and LPSI Flow versus Pressurizer Pressure.

Objective:

The objective of this step is to verify that inventory is provided to the reactor coolant system during a Loss of Coolant Accident.

Basis:

Emergency core cooling system operation must be verified if pressurizer pressure decreases to 1684 psia or if containment pressure increases to 17.4 psia. If safety injection system operation has not commenced automatically when reactor coolant system pressure is below 1684 psia, it must be manually actuated. This action allows the refueling water storage pool inventory to discharge into the reactor coolant system. An insufficient reactor coolant system inventory may be associated with a loss of coolant accident, a steam generator tube rupture, a control system malfunction or an excessive heat removal event. Safety injection system flow rate will follow the reactor coolant system pressure according to the emergency core cooling system delivery curves. The safety injection system and charging flowrate should be checked and maximized relative to reactor coolant system pressure to enhance reactor coolant system inventory replenishment and/or core heat removal.

Operational Considerations:

Hot leg temperatures and cold leg temperatures may be influenced by safety injection flow. Multiple indications and core temperatures should be used to determine the reactor coolant system temperature. Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal

Success Path V-4

EOP Step 3 (Continued).

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

PV-OP-902, Parameter Values Document. Table 5-4, Pressure.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal

Success Path V-4

EOP Step Content:

Step 4. IF Pressurizer pressure drops to ≤183 psia, THEN verify proper LPSI Header flow exists. Refer to Attachment 2: HPSI and LPSI Flow versus Pressurizer Pressure.

Objective:

The objective of this step is to verify that inventory is provided to the reactor coolant system during a Loss of Coolant Accident.

Basis:

Emergency core cooling system operation must be verified if pressurizer pressure decreases to 1684 psia or if containment pressure increases to 17.4 psia. If safety injection system operation has not commenced automatically when reactor coolant system pressure is below 1684 psia, it must be manually actuated. This action allows the refueling water storage pool inventory to discharge into the reactor coolant system. An insufficient reactor coolant system inventory may be associated with a loss of coolant accident, a steam generator tube rupture, a control system malfunction or an excessive heat removal event. Safety injection system flow rate will follow the reactor coolant system pressure according to the emergency core cooling system delivery curves. The safety injection system and charging flowrate should be checked and maximized relative to reactor coolant system pressure to enhance reactor coolant system inventory replenishment and/or core heat removal.

Operational Considerations:

Hot leg temperatures and cold leg temperatures may be influenced by safety injection flow. Multiple indications and core temperatures should be used to determine the reactor coolant system temperature. Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading.

EPG Step Content:

NA

E_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>

Success Path V-4

EOP Step 4 (Continued).

Justification of Differences:

NA

Source Document:

PV-OP-902, Parameter Values Document. Table 5-4, Pressure.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal

Success Path V-4

EOP Step Content:

Step 5. Check the following Safety Injection termination criteria:

Objective:

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

Basis: (CEN-152, page 10-87, step 3)

If once through cooling has been established, it must be continued unless RCS conditions can be brought within the limits of Attachment 5: Post Accident Pressure and Temperature Limits Graph and as follows:

a) RCS is at least [20°F] subcooled (Figure 10-10). Establishing [20°F] subcooling prevents void formation in the core when SIS flow is terminated, and provides sufficient margin for establishing flow should the [20°F] subcooling deteriorate when SIS flow is secured. The [200°] subcooled limit minimizes the effects of PTS.

b) Pressurizer level is greater than [100]" and is constant or increasing. A pressurizer level greater than [100]" and responding normally ensure the RCS inventory control has been established.

c) At least one steam generator is available for removing heat from the RCS. A steam generator available for removing heat from the RCS ensures that primary to secondary heat removal is being maintained. A steam generator available includes feedwater available for removing heat from the generator and a method for removing steam (e.g. atmospheric dump valves, etc).

Operational Considerations:

Below 1000 psia, subcooling margin shall be determined by subtracting hot leg temperature from Pressurizer Temperature Water (TI 101). Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal

Success Path V-4

EOP Step 5 (Continued).

EPG Step Content: (CEN-152, page 10-167, step 3)

Once through cooling may be stopped if core exit thermocouples < [800°F] and all 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. Since Waterford-3 does not have PORVs, this success path was written for a large break Loss of Coolant Accident.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-1, Level and Table 5-2, Subcooling.

E_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>
Success Path V-4

EOP Step Content:

Step 6. <u>IF</u> <u>ALL</u> Safety Injection termination criteria (step 5) are satisfied, <u>THEN</u> throttle <u>OR</u> stop Safety Injection <u>FLOW</u> one train at a time <u>AND</u> stop Charging pumps as necessary to control Pressurizer level 33% to 60%.

Objective:

The step maintains pressurizer level and prevents solid water operation unless 28°F subcooling margin cannot be maintained. If 28°F subcooling margin cannot be maintained, then the pressurizer is taken solid with high pressure safety injection pumps.

Basis: (CEN-152, page 10-87, step 3)

If once through cooling has been established, it must be continued unless RCS conditions can be brought within the limits of Attachment 5: Post-Accident Pressure and Temperature Limits Graph and as follows:

a) RCS is at least [20°F] subcooled (Figure 10-10). Establishing [20°F] subcooling prevents void formation in the core when SIS flow is terminated, and provides sufficient margin for establishing flow should the [20°F] subcooling deteriorate when SIS flow is secured. The [200°] subcooled limit minimizes the effects of PTS.
b) Pressurizer level is greater than [100]" and is constant or increasing. A pressurizer level greater than [100]" and responding normally ensure the RCS inventory control has been established.
c) At least one steam generator is available for removing heat from the RCS. A steam generator available for removing heat from the RCS ensures that primary to secondary heat removal is being maintained. A steam generator available includes feedwater available for removing heat from the generator and a method for removing steam (e.g. atmospheric dump valves, etc).

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal

Success Path V-4

EOP Step 6 (Continued).

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 10-167, step 3)

Once through cooling may be stopped if core exit thermocouples < [800°F] and all 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. Since Waterford-3 does not have PORVs, this success path was written for a large break Loss of Coolant Accident.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-1, Level and Table 5-2, Subcooling.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal
Success Path V-4

EOP Step Content:

Step 7. IF ALL Safety Injection termination criteria (step 5) can NOT be maintained after throttling OR stopping safety injection flow, THEN reinitiate Safety Injection flow.

Objective:

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

Basis: (CEN-152, page 10-87, step 4)

Once through cooling must be restarted if all the criteria in step 3 cannot be maintained. This provides a sufficient margin for restarting once through cooling and minimizes the chances of void formation in the core.

Operational Considerations:

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

EPG Step Content: (CEN-152, page 10-167, step 4)

If all the criteria of step 3 cannot be maintained after the ECCS has been stopped, the ECCS must be restarted.

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal

Success Path V-4

EOP Step Content:

Step 8. IF Refueling Water Storage Pool level drops to 10%, THEN verify that Recirculation Actuation Signal occurs AND check ALL the following:

Objective:

This step ensures that an RAS occurs to provide a suction source to the safety injection pumps.

Basis: (CEN-152, page 10-87, step 5)

If the Refueling Water Storage Pool level falls to 10%, initiation of recirculation should be verified. Recirculation is actuated in order to maintain a continuous flow of safety injection fluid to the RCS and a continuous flow of containment spray water. The operator should be cautioned against prematurely initiating an RAS. An inadequate amount of level in the safety injection sump may cause air binding of safety injection pumps and loosing both heat removal loops.

Operational Considerations:

When an RAS occurs and safety injection sump level is <10 feet, monitor safety injection pumps should be monitored for potential air binding. Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading.

EPG Step Content: (CEN-152, page 10-167, step 5)

Monitor refueling water tank level. If the refueling water tank level falls to [10%], verify initiation of recirculation. If necessary, manually initiate recirculation one train at a time [and close RWT outlet valves to the safety injection system].

Justification of Differences:

This EPG step was divided into several steps to include plant specific information.

E_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>

Success Path V-4

EOP Step 8 (Continued).

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-1, Level.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal

Success Path V-4

EOP Step Content:

Step 9. When the RAS actions (step 8) have been verified, close the following valves:

Objective:

This step directs the operators action after an RAS.

Basis: (CEN-152, page 10-87, step 5)

Manually closing the outlet valves from the Refueling Water Storage Pool will isolate the RWSP from the safety injection pumps. The pumps recirculation valves are closed to prevent inventory loss from the safety injection sump to the RWSP.

Operational Considerations:

NA

EPG Step Content: (CEN-152, page 10-127, step 5)

Monitor refueling water tank level. If the refueling water tank level falls to [10%], verify initiation of recirculation. If necessary, manually initiate recirculation one train at a time [and close RWT outlet valves to the safety injection system].

Justification of Differences:

This EPG step was divided into several steps to include plant specific information.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal

Success Path V-4

EOP Step Content:

Step 10. IF RAS occurs, THEN on Attachment 4: HPSI and CS Pump Flow, record the HPSI AND Containment Spray pumps flow at the following time intervals:

Objective:

This step monitors the high pressure safety injection and containment spray pumps for performance requirements.

Basis: (CEN-152, page 10-88, step 6)

After the switch to recirculation, the HPSI and CS Pumps are monitored in order to ensure that the Emergency Core Coolant System performance requirements are maintained. This action helps to avert any possible permanent pump damage.

Operational Considerations:

NA

EPG Step Content: (CEN-152, page 10-168, step 6)

If the HPSI pumps are delivering less than [30 gpm] per pump during recirculation, turn off one charging pump and/or one HPSI pump (turn off the HPSI pump with the lower indicated flow) at a time until the HPSI pumps are delivering more than [30 gpm] per pump.

Justification of Differences:

The EPG step was divided into several steps to include plant specific information.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal

Success Path V-4

EOP Step Content:

Step 11. IF HPSI flow is NOT ≥25 gpm per operating HPSI pump AND RAS has occurred, THEN sequentially perform the following until operating HPSI pump flow ≥25 gpm:

Objective:

This step ensures that each operating high pressure safety injection pump has a minimum flow ≥25 gpm.

Basis: (CEN-152, page 10-88, step 6)

After the switch to recirculation, the HPSI flows are monitored in order to ensure that the HPSI miniflow requirements for pump protection are met to avert any possible permanent HPSI pump damage. If they are not met, the operator should turn off the charging pumps one at a time until the miniflow requirements are met. If they are still not met with all the charging pump off and two HPSI pumps are operating, the operator turns off the HPSI pumps with the lower flow. One HPSI pump should be left operating at all times, unless once through cooling termination criteria are met (step 3).

Operational Considerations:

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

EPG Step Content: (CEN-152, page 10-168, step 6)

If the HPSI pumps are delivering less than [30 gpm] per pump during recirculation, turn off one charging pump and/or HPSI pump (turn off the HPSI pump with the lower indicated flow) at a time until the HPSI pumps are delivering more than [30 gpm] per pump.

Justification of Differences:

The EPG step was divided into several steps to include plant specific information.

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**

Success Path V-4

EOP Step 18 (Continued).

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal

Success Path V-4

EOP Step Content:

Step 12. Between two hours AND four hours post-LOCA, realign Safety Injection pumps discharge for equal flow to the Hot Legs AND Cold Legs as follows:

Objective:

This step aligns safety injection pump discharge to both hot and cold leg injection.

Basis:

Simultaneous hot and cold leg injection is used for both small break and large break Loss of Coolant Accidents at 2-4 hours after the start of the Loss of Coolant Accident. In this mode, the high pressure safety injection pumps discharge lines are realigned so that the total injection flow is divided equally between the hot and cold legs. Simultaneous injection into the hot and cold legs is used as the mechanism to prevent the precipitation of boric acid in the reactor vessel following a break that is too large to allow the reactor coolant system to refill. Injecting to both sides of the reactor vessel ensures that fluid from the reactor vessel (when the boric acid is being concentrated) flows out the break regardless of the break location and is replenished with a dilute solution of borated water from the other side of the reactor vessel. The action is taken no sooner than 2 hours after the Loss of Coolant Accident since the fluid injected to the hot leg may be entrained in the steam being released from the core and hence possibly diverted from reaching the reactor vessel. After 2 hours, the core decay heat has dropped sufficiently so that there is insufficient steam velocity to entrain the fluid being injected to the hot leg. The action is taken no later than 4 hours after the Loss of Coolant Accident in order to ensure that the buildup of boric acid is terminated well before the potential for boric acid precipitation occurs.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal

Success Path V-4

EOP Step 12 (Continued).

Basis: (Continued)

Even though the action is required only for large breaks, it is taken for any Loss of Coolant Accident so that the operator need not be required to distinguish between large and small breaks so early in the transient. Simultaneous hot and cold leg injection is not required for small breaks, because for them the buildup of boric acid is terminated when the reactor coolant system is refilled. Once the reactor coolant system is refilled, the boric acid is dispersed throughout the reactor coolant system via natural circulation.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

PV-OP-902, Parameter Values Document. Table 5-5, Time.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal
Success Path V-4

EOP Step Content:

Step 13. Check the following success path criteria:

Objective:

The objective of this step is to check the criteria associated with satisfactorily completing this success path.

Basis: (CEN-152, page 10-4, step 3)

The basis for each individual criterion is given in Section 2.0 of the technical guide. The criteria are used to judge the status of each safety function. Since each safety function has multiple success paths which can be used to control that safety function, the criteria which are used to judge the status of each safety function are organized around the success paths for each safety function. Since each success path uses or may use different technical means of achieving a function, the criteria for judging the success of that path are specific to the technical means. Also, in order to facilitate operator use, the criteria chosen are parameters which can be read directly from the control board.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal
Success Path V-4

EOP Step Content:

Step 14. IF the success path criteria (step 13) are met, THEN go to the next safety function in jeopardy.

Objective:

The objective of this step is to instruct the operator what to do if this success path is satisfactorily completed.

Basis: (CEN-152, page 10-12, step 7)

After checking the success path criteria, additional guidance is provided which aids the operator in determining the next course of action. In this step, if control of the safety function is achieved, the operator is instructed to go to the next safety function in jeopardy.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal

Success Path V-4

EOP Step Content:

Step 15. IF the success path criteria (step 13) are NOT met, THEN continue with Subprocedure V. RCS And Core Heat Removal until a success path criterion is satisfactorily being maintained.

Objective:

The objective of this step is to instruct the operator what to do if this success path is not satisfactorily completed.

Basis: (CEN-152, page 10-92)

If the criteria are not met, then RCS And Core Heat Removal is still in joepardy. The operator should not leave RCS And Core Heat Removal until this function is fulfilled.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**

Success Path V-4

EOP Step Content:

Step 16. IF the Control Room Supervisor determines it is necessary to pursue other safety functions in jeopardy, THEN go to the next safety function in jeopardy AND implement its subprocedure concurrently with this subprocedure.

Objective:

The objective of this step is to allow the control room supervisor to pursue other safety functions in jeopardy while efforts are continued on RCS And Core Heat Removal.

Basis: (CEN-152, page 10-92)

The operator may, if necessary, pursue other urgent safety functions but must continue to attempt to establish RCS And Core Heat Removal.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**
Success Path V-5

EOP Step Content:

Step 1. IF necessary, when Pressurizer pressure is lowered to 650 psia, THEN lower Safety Injection Tank pressure to between 300 psig AND 235 psig by operating the following SAFETY INJECTION TANKS vent valves:

Objective:

This step lowers safety injection tank pressure to prevent dumping tanks into reactor coolant system if they have not already done so as a result of inventory control being in jeopardy.

Basis: (CEN-152, page 10-91, step 2)

[The safety injection tanks should be isolated, vented, or drained at a RCS pressure of 250 psig to avoid introducing their nitrogen cover gas into the RCS and increasing the severity of the event.]

Operational Considerations:

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

EPG Step Content: (CEN-152, page 10-170, step 2)

[Isolate, vent, or drain the safety injection tanks (SIT) at 250 psia RCS pressure.]

Justification of Differences:

This step was divided into two steps to include plant specific information.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal

Success Path V-5

EOP Step Content:

Step 2. IF SIAS has been reset, THEN 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:

During cooldown and depressurization, the automatic operation of certain safeguard systems is undesirable.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal
Success Path V-5

EOP Step Content:

Step 3. When Pressurizer pressure is between 392 psia AND 350 psia, perform the following:

Objective:

This step isolates the safety injection tanks.

Basis: (CEN-152, page 10-91, step 2)

[The safety injection tanks should be isolated, vented, or drained at a RCS pressure of 250 psig to avoid introducing their nitrogen cover gas into the RCS and increasing the severity of the event.]

Operational Considerations:

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

EPG Step Content: (CEN-152, page 10-170, step 2)

[Isolate, vent, or drain the safety injection tanks (SIT) at 250 psia RCS pressure.]

Justification of Differences:

This step was divided into two steps to include plant specific information.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**
Success Path V-5

EOP Step Content:

Step 4. IF Pressurizer pressure is between 392 psia AND 205 psia, THEN check the following Shutdown Cooling criteria:

Objective:

This step checks the criteria which are required for entry into shutdown cooling.

Basis: (CEN-152, page 10-90, step 1)

The operator should determine if SCS operation criteria are met. If pressurizer level is stable, the pressurizer and/or HPSI pumps are maintaining system pressure such that RCS hot and cold leg temperatures are at least [20°F] below saturation temperature for pressurizer pressure, and the steam generators are available (steam flow and feed flow) to reduce the RCS temperature to the shutdown cooling entry value, SCS operation may be appropriate if the SCS is available. Before the SCS is operated, RCS activity levels must be determined since the RCS fluid will now be circulated outside of the containment building. The operator must decide whether to circulate high activity RCS coolant outside containment if high activity is present and such circulation has the potential for release to the environment. If the potential for significant releases exists, it may be more desirable to continue cooling with the steam generator. The condensate inventory must be checked to ensure that the supply is sufficient to cool down the plant to SCS entry conditions or continue cooling the RCS. Other plant specific prerequisites for SCS operation must be considered (e.g. component cooling water, instrument air and valve control power).

Operational Considerations:

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

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**

Success Path V-5

EOP Step 4 (Continued).

EPG Step Content: (CEN-152, page 10-170, step 1)

If the RCS T_H is cooled to [300°F] and depressurized to [300 psia] and the following criteria are met, initiate shutdown cooling per the SCS operating instructions.

Justification of Differences:

This step was divided up into several steps to provide plant specific information.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-1, Level and Table 5-2, Subcooling.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal
Success Path V-5

EOP Step Content:

Step 5. IF Shutdown Cooling criteria (step 4) are NOT met, THEN go to step 10.

Objective:

This step directs the operator to the proper step if shutdown cooling criteria are not met.

Basis:

If the shutdown cooling entry conditions cannot be met the operator is directed to a step which will assure that shutdown cooling criteria are met before shutdown cooling is entered. This step also provides further guidance to the operator to ensure the RCS And Core Heat Removal safety function is being satisfactorily maintained.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal
Success Path V-5

EOP Step Content:

Step 6. Verify Safety Injection flow aligned to Cold Legs as follows:

Objective:

This step ensures safety injection system is lined up properly for shutdown cooling.

Basis: (CEN-152, page 10-90, step 1)

If SCS operation is determined to be appropriate the ECCS (if operating) is aligned for cold leg injection.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**

Success Path V-5

EOP Step Content:

Step 7. IF Containment Spray pumps are operating, THEN stop either Containment Spray pump A OR Containment Spray pump B.

Objective:

This step secures one containment spray pump if both pumps are operating.

Basis:

For one train of shutdown cooling to be placed in service a shutdown cooling heat exchanger must be available. Since containment spray flow is through the shutdown cooling heat exchangers, one containment spray pump is removed from service so that the shutdown cooling heat exchanger may be used for shutdown cooling.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>
Success Path V-5

EOP Step Content:

Step 8. Verify ALL the following:

Objective:

This step verifies the low pressure safety injection system is aligned for shutdown cooling.

Basis:

The low pressure safety injection pumps are used for shutdown cooling. The low pressure safety injection pumps should be stopped prior to aligning shutdown cooling.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal
Success Path V-5

EOP Step Content:

Step 9. Place one train of Shutdown Cooling in service. Refer to OP-9-005, SHUTDOWN COOLING SYSTEM, Sections 3.0, 4.0, 5.0, AND 6.0.

Objective:

This step places one train of shutdown cooling in service.

Basis: (CEN-152, page 10-90, step 1)

If SCS operation is determined to be appropriate the ECCS (if operating) is aligned for cold leg injection and the RCS is cooled down and depressurized as follows. If necessary, RCS hot leg temperature should be cooled to less than [300°F] and depressurized to [300 psia]. The RCS is depressurized to [300 psia] or less by using auxiliary spray. Depressurization may also be accomplished by stopping charging pumps, or stopping or throttling HPSI pumps. If auxiliary spray is used, the difference between the pressurizer temperature and the auxiliary spray water temperature should be maintained below [200°F] if possible. If RCS inventory control is satisfactory, auxiliary spray water temperature may be increased by increasing letdown flow or reducing charging flow which will increase the regenerative heat exchanger outlet temperature. Other plant specific methods to increase auxiliary spray water temperature may be used. If auxiliary spray is used when a [200°F] or more difference exists, then such a cycle must be recorded as per Technical Specifications. The number of such cycles should be minimized. [Another operational alternative for the RCS pressure reduction is to throttle the HPSI pumps and adjust charging pump flow (if the pressurized is solid) to maintain level and control pressure.]

Operational Considerations:

If containment spray is in service, then the opposite train of shutdown cooling should be placed in service. If a steam generator is isolated due to activity in the steam plant, then shutdown cooling should be lined up to the loop with the steam generator which is not isolated.

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**

Success Path V-5

EOP Step 9 (Continued).

EPG Step Content: (CEN-152, page 10-170, step 1)

If the RCS T_H is cooled to [300°F] and depressurized to [300 psia] and the following criteria are met, initiate shutdown cooling per the SCS operating instructions.

Justification of Differences:

This step was divided up into several steps to provide plant specific information.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal
Success Path V-5

EOP Step Content:

Step 10. Check the following success path criteria:

Objective:

The objective of this step is to check the criteria associated with satisfactorily completing this success path.

Basis: (CEN-152, page 10-4, step 3)

The basis for each individual criterion is given in Section 2.0 of the technical guide. The criteria are used to judge the status of each safety function. Since each safety function has multiple success paths which can be used to control that safety function, the criteria which are used to judge the status of each safety function are organized around the success paths for each safety function. Since each success path uses or may use different technical means of achieving a function, the criteria for judging the success of that path are specific to the technical means. Also, in order to facilitate operator use, the criteria chosen are parameters which can be read directly from the control board.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal
Success Path V-5

EOP Step Content:

Step 11. IF the success path criteria (step 10) are met, THEN go to the next safety function in jeopardy.

Objective:

The objective of this step is to instruct the operator what to do if this success path is satisfactorily completed.

Basis: (CEN-152, page 10-12, step 7)

After checking the success path criteria, additional guidance is provided which aids the operator in determining the next course of action. In this step, if control of the safety function is achieved, the operator is instructed to go to the next safety function in jeopardy.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. **Recovery Actions: Subprocedure V. RCS And Core Heat Removal**
Success Path V-5

EOP Step Content:

Step 12. IF the success path criteria (step 10) are NOT met, THEN continue with Subprocedure V. RCS And Core Heat Removal until a success path criterion is satisfactorily being maintained.

Objective:

The objective of this step is to instruct the operator what to do if this success path is not satisfactorily completed.

Basis: (CEN-152, page 10-92)

If the criteria are not met, then RCS And Core Heat Removal is still in jeopardy. The operator should not leave RCS And Core Heat Removal until this function is fulfilled.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>
Success Path V-5

EOP Step Content:

Step 13. IF the Control Room Supervisor determines it is necessary to pursue other safety functions in jeopardy, THEN go to the next safety function in jeopardy AND implement its subprocedure concurrently with this subprocedure.

Objective:

The objective of this step is to allow the control room supervisor to pursue other safety functions in jeopardy while efforts are continued on RCS And Core Heat Removal.

Basis: (CEN-152, page 10-92)

The operator may, if necessary, pursue other urgent safety functions but must continue to attempt to establish RCS And Core Heat Removal.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_6. Recovery Actions: Subprocedure VI. Containment Isolation

Success Path VI-1

EOP Step Content:

Step 1. IF Pressurizer pressure drops to ≤1684 psia OR Containment pressure rises to ≥17.4 psia, THEN verify CIAS occurs.

Objective:

This step verifies that a CIAS occurs when required by plant conditions.

Basis: (CEN-152, page 10-94)

If containment pressure rises to 17.4 psia or pressurizer pressure drops to 1684 psia, the automatic initiation of containment isolation is verified. If it is necessary to close the containment isolation valves by manually initiating a containment isolation actuation signal, this action is taken.

Operational Considerations:

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

EPG Step Content: (CEN-152, page 10-173, step 1)

If containment pressure increases to [4 psig], [or if pressurizer pressure decreases to 1600 psig], or if containment radiation levels exceed plant specific limits, verify initiation of containment isolation. If necessary, manually initiate containment isolation.

Justification of Differences:

This EPG step was divided into two different EOP steps so that the plant specific instructions could be given.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-4, Pressure.

E_6. **Recovery Actions: Subprocedure VI. Containment Isolation**

Success Path VI-1

EOP Step Content:

Step 2. IF the RAD MONITORING SYS ACTIVITY HI-HI (CP-36, A-9) occurs due to high Containment radiation, THEN manually initiate CIAS.

Objective:

This step checks that the radiation levels in the containment are normal.

Basis: (CEN-152, page 10-94)

If containment radiation exceeds plant specific limits, the containment should be isolated. If it is necessary to close containment isolation valves by manually initiating a containment isolation actuation signal, this action is taken.

Operational Considerations:

NA

EPG Step Content: (CEN-152, page 10-173, step 1)

If containment pressure increases to [4 psig], [or if pressurizer pressure decreases to 1600 psig], or if containment radiation levels exceed plant specific limits, verify initiation of containment isolation. If necessary, manually initiate containment isolation.

Justification of Differences:

This EPG step was divided into two different EOP steps so that the plant specific instructions could be given.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_6. **Recovery Actions: Subprocedure VI. Containment Isolation**

Success Path VI-1

EOP Step Content:

Step 3. IF CIAS has occurred, THEN complete Attachment 13: CIAS Automatic Actions.

Objective:

This step has the operator verify automatic actions when a CIAS occurs.

Basis:

This step verifies all CIAS automatic actions occur.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_6. **Recovery Actions: Subprocedure VI. Containment Isolation**

Success Path VI-1

EOP Step Content:

Step 4. IF any Containment Isolation valves on Attachment 13: CIAS Automatic Actions did NOT close, THEN perform the following:

Objective:

This step verifies that all containment penetrations are closed when not required for plant operation.

Basis: (CEN-152, page 10-94)

If the containment isolation actuation signal (either automatic or remote manual) has failed to cause a closure of the required isolation valves, they are manually closed by all means possible.

Operational Considerations:

Health Physics should be contacted before attempting any local containment isolation valve operations.

EPG Step Content: (CEN-152, page 10-173, step 2)

If containment isolation valves are not closed, attempt to close them remote manually or local manually as appropriate.

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_6. <u>Recovery Actions: Subprocedure VI. Containment Isolation</u>

Success Path VI-1

EOP Step Content:

Step 5. <u>IF</u> it is necessary to operate pneumatic valves inside Containment, <u>THEN</u> open CNTMT ISOLATION INSTRUMENT AIR (IA 908).

Objective:

The objective of this step is to verify that instrument air is available to containment.

Basis:

If instrument air is isolated from containment, then realignment is necessary for operation of pneumatically operated valves.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_6. Recovery Actions: Subprocedure VI. Containment Isolation
Success Path VI-1

EOP Step Content:

Step 6. Check for Steam Plant activity as indicated by any of the following:

Objective:

The objective of this step is to check that a steam generator with high activity is determined prior to further cooldown.

Basis: (CEN-152, page 10-94)

If activity is detected in the steam plant, this usually means that at least one steam generator has tube leaks. This step will provide information to the operator so containment integrity can be assured in the following steps of this procedure.

Operational Considerations:

Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading. The blowdown radiation monitor will indicate only on the steam generator to which it is selected. Automatic feedwater modulations may mask the expected steam generator level rise due to a steam generator tube rupture.

EPG Step Content: (CEN-152, page 10-173, step 3)

If activity is detected in the steam, the operator should identify the leaking steam generator(s) and attempt to isolate that steam generator if plant conditions permit.

Justification of Differences:

This EPG step was divided into several steps to include plant specific information.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_6. Recovery Actions: Subprocedure VI. Containment Isolation

Success Path VI-1

EOP Step Content:

Step 7. IF NO Steam Plant activity is indicated, THEN go to step 18.

Objective:

This step directs the operator to go to other steps when steam plant activity is not indicated.

Basis:

If steam plant activity is indicated, then the operator must proceed with step 8. If no steam plant activity is indicated, then the operator will go to the step for success path criteria.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_6. Recovery Actions: Subprocedure VI. Containment Isolation
Success Path VI-1

EOP Step Content:

Step 8. Verify Condenser Vacuum pump exhaust diverts to the Plant Stack filters as follows:

Objective:

The objective of this step is to stop an unfiltered radioactive release from the condenser vacuum pumps exhaust.

Basis:

This step aligns the exhaust from the vacuum pumps to the reactor auxiliary building normal exhaust filter train to minimize the radioactive release to site personnel and the general public.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

FSAR, Section 10.4.2.2.

E_6. **Recovery Actions: Subprocedure VI. Containment Isolation**
Success Path VI-1

EOP Step Content:

Step 9. 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:

Reactor coolant system temperature is controlled at $\leq$550°F so that the reactor coolant system heat inventory is not sufficient to cause steam generator safety valves to lift. The steam bypass control system is the preferred means for control of steam generator pressure because the atmospheric dump valves would allow an unmonitored radioactive release to the environment.

Operational Considerations:

This step is performed before the leaking steam generator has been identified and isolated to prevent the steam generator safety valves from lifting. If the condenser is available, then by using the steam bypass control system, a closed system is maintained. 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, more than one instrument should be used to obtain a particular reading.

EPG Step Content:

NA

Justification of Differences:

NA

E_6. Recovery Actions: Subprocedure VI. Containment Isolation

Success Path VI-1

EOP Step 9 (Continued).

Source Document:

PV-OP-902, Parameter Values Document. Table 5-3, Temperature and Table 5-4, Pressure.

E_6. Recovery Actions: Subprocedure VI. Containment Isolation

Success Path VI-1

EOP Step Content:

Step 10. Determine the Steam Generator to be isolated by one OR more of the following:

Objective:

The objective of this step is to ensure that the steam generator with the higher activity is determined prior to further cooldown and steam generator isolation.

Basis: (CEN-152, page 10-94)

This action identifies the steam generator that is in jeopardy or has to be isolated due to higher activity. This step will provide information to the operator so containment integrity can be assured in the following steps of this procedure.

Operational Considerations:

If both steam generators have a tube rupture, then the one with the higher radiation levels shall be selected for isolation. The blowdown radiation monitor will indicate only on the steam generator to which it is selected. Automatic feedwater modulations may mask the expected steam generator level rise due to a steam generator tube rupture. Where multiple indications for one parameter exist, more than one instrument should be used to obtain a particular reading.

EPG Step Content: (CEN-152, page 10-173, step 3)

If activity is detected in the steam, the operator should identify the leaking steam generator(s) and attempt to isolate that steam generator if plant conditions permit.

Justification of Differences:

This EPG step was divided into several steps to include plant specific information.

E_6. <u>Recovery Actions: Subprocedure VI. Containment Isolation</u>

Success Path VI-1

EOP Step 10 (Continued).

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_6. Recovery Actions: Subprocedure VI. Containment Isolation
Success Path VI-1

EOP Step Content:

Step 11. Isolate selected Steam Generator as follows:

Objective:

The objective of this step is to isolate the steam generator with the tube rupture.

Basis: (CEN-152, page 10-94)

The steam generator with higher activity, higher radiation levels, or rising water level should be isolated. Isolation the steam generator is an attempt to reestablish the containment integrity.

Operational Considerations:

If a tube rupture is indicated in both steam generators, then both steam supplies to the A/B emergency feedwater pump may be isolated.

EPG Step Content: (CEN-152, page 10-173, step 3)

If activity is detected in the steam, the operator should identify the leaking steam generator(s) and attempt to isolate that steam generator if plant conditions permit.

Justification of Differences:

This EPG step was divided into several steps to include plant specific information.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_6. **Recovery Actions: Subprocedure VI. Containment Isolation**

Success Path VI-1

EOP Step Content:

Step 12. Check that the correct Steam Generator is isolated by any of the following:

Objective:

The objective of this step is to verify that the correct steam generator is isolated.

Basis:

Isolation of the correct steam generator should be verified by sampling, radiation level and changes in steam generator level. This provides feedback that the proper steam generator has been isolated.

Operational Considerations:

If a tube rupture is indicated in both steam generators, then the control room supervisor should be cautious in determining the correct steam generator.

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_6. Recovery Actions: Subprocedure VI. Containment Isolation

Success Path VI-1

EOP Step Content:

Step 13. IF determined by step 12 that the incorrect Steam Generator was isolated, THEN perform the following:

Objective:

The objective of this step is to isolate the correct steam generator.

Basis:

If the wrong steam generator has been isolated or confirmed by the previous step, it should be realigned and the affected steam generator should be isolated.

Operational Considerations:

If a tube rupture is indicated in both steam generators, then the control room supervisor should be cautious when realigning the steam generator which was isolated.

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_6. **Recovery Actions: Subprocedure VI. Containment Isolation**

Success Path VI-1

EOP Step Content:

Step 14. When a Steam Generator Low Pressure Pretrip alarm occurs, reset the setpoint.

Objective:

This step prevents an MIS from occurring and inhibiting cooldown.

Basis:

During a controlled cooldown and depressurization, the automatic operation of certain safeguard systems is undesirable. Therefore, the setpoint of the MSIS must be manually reset (lowered) as the cooldown progresses to ensure that automatic engineered safeguards protection remains available until the reactor coolant system is cooled down and depressurized.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_6. Recovery Actions: Subprocedure VI. Containment Isolation
Success Path VI-1

EOP Step Content:

Step 15. Commence a Plant cooldown to obtain Hot Leg temperature of 500°F for the loop with the Steam Generator which is NOT isolated by EITHER of the following:

Objective:

This step ensures cooldown prior to depressurization so that 50°F subcooling is maintained.

Basis:

This step is done to ensure that during the plant depressurization 28°F subcooling will be maintained. The 500°F will actually provide 45°F subcooling at 1000 psia. This provides an additional margin during the transient condition. The hot leg temperature of 500°F also considers core uplift when all reactor coolant pumps are operating.

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:

PV-OP-902, Parameter Values Document. Table 5-3, Temperature.

E_6. **Recovery Actions: Subprocedure VI. Containment Isolation**

Success Path VI-1

EOP Step Content:

Step 16. When Hot Leg temperature is 500°F for the loop with the Steam Generator which is NOT isolated, depressurize the Reactor Coolant System to 1000 psia as follows:

Objective:

This step depressurizes the reactor coolant system to 1000 psia to reduce the reactor coolant leakage into the steam generator.

Basis:

The general goals associated with reactor coolant system pressure control are providing subcooling to support the core heat removal process, avoiding overpressure situations for pressurizer thermal shock and RT_{NDT} considerations, minimizing the pressure differential between the steam generator and the reactor coolant system to minimize the leakage and control reactor coolant system pressure so that it is below the steam generator safety valve setpoints.

Operational Considerations:

Controlled depressurization below 1621 psia does not require stopping reactor coolant pumps. Pressurizer level anomalies during controlled depressurization to 1000 psia may be tolerated. 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

E_6. **Recovery Actions: Subprocedure VI. Containment Isolation**

Success Path VI-1

EOP Step 16 (Continued).

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-3, Temperature.

E_6. <u>Recovery Actions: Subprocedure VI. Containment Isolation</u>
Success Path VI-1

EOP Step Content:

Step 17. Maintain Pressurizer temperature 10°F to 20°F above isolated Steam Generator temperature.

Objective:

This step ensures that pressurizer pressure is slightly above steam generator pressure to minimize leakage through the affected steam generator.

Basis:

The small differential pressure will minimize the loss of primary fluid to the secondary side which will help to minimize potential releases of radioactive effluents to the environment. Since pressurizer pressure is above steam generator pressure, this will preclude secondary fluid from diluting reactor coolant system.

Operational Considerations:

Where multiple indications for one parameter exist, use more than one instrument to obtain a particular reading. Due to the accuracy of the pressure transmitters, temperature difference is used to satisfy the objective of this step.

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-3, Temperature.

E_6. <u>Recovery Actions: Subprocedure VI. Containment Isolation</u>
Success Path VI-1

EOP Step Content:

Step 18. Check the following success path criteria:

Objective:

The objective of this step is to check the criteria associated with satisfactorily completing this success path.

Basis: (CEN-152, page 10-4, step 3)

The basis for each individual criterion is given in Section 2.0 of the technical guide. The criteria are used to judge the status of each safety function. Since each safety function has multiple success paths which can be used to control that safety function, the criteria which are used to judge the status of each safety function are organized around the success paths for each safety function. Since each success path uses or may use different technical means of achieving a function, the criteria for judging the success of that path are specific to the technical means. Also, in order to facilitate operator use, the criteria chosen are parameters which can be read directly from the control board.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_6. Recovery Actions: Subprocedure VI. Containment Isolation

Success Path VI-1

EOP Step Content:

Step 19. IF the success path criteria (step 18) are met, THEN go to the next safety function in jeopardy.

Objective:

The objective of this step is to instruct the operator what to do if this success path is satisfactorily completed.

Basis: (CEN-152, page 10-12, step 7)

After checking the success path criteria, additional guidance is provided which aids the operator in determining the next course of action. In this step, if control of the safety function is achieved, the operator is instructed to go to the next safety function in jeopardy.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_6. <u>Recovery Actions: Subprocedure VI. Containment Isolation</u>
Success Path VI-1

EOP Step Content:

Step 20. <u>IF</u> the success path criteria (step 18) are <u>NOT</u> met, <u>THEN</u> continue with Subprocedure VI. Containment Isolation until the success path criteria are satisfactorily being maintained.

Objective:

The objective of this step is to instruct the operator what to do if this success path is not satisfactorily completed.

Basis:

If the criteria are not met, then Containment Isolation is still in jeopardy. The operator should not leave Containment Isolation until this function is fulfilled.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_6. Recovery Actions: Subprocedure VI. Containment Isolation

Success Path VI-1

EOP Step Content:

Step 21. IF the Control Room Supervisor determines it is necessary to pursue other safety functions in jeopardy, THEN go to the next safety function in jeopardy AND implement its subprocedure concurrently with this subprocedure.

Objective:

The objective of this step is to allow the control room supervisor to pursue other safety functions in jeopardy while efforts are continued on Containment Isolation.

Basis:

The operator may, if necessary, pursue other urgent safety functions but must continue to attempt to establish Containment Isolation.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_7. Recovery Actions: Subprocedure VII. Containment Temperature And Pressure Control

Success Path VII-1

EOP Step Content:

Step 1. IF Pressurizer pressure drops to ≤1684 psia OR Containment pressure rises to ≥17.4 psia, THEN verify the following:

Objective:

This step verifies the containment fan coolers start in slow speed when required due to containment conditions.

Basis: (CEN-152, page 10-98)

The containment fan cooling system removes heat from the containment by passing containment air through heat exchangers cooled by the component cooling water system. Four fan coolers running on slow are required to provide post-accident heat removal capability. These fans should start automatically. If not, the fans should be started manually. Component cooling water flow is verified to each fan cooler.

Operational Considerations:

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

EPG Step Content: (CEN-152, page 10-176, step 1)

[Verify automatic operation of the containment fan cooling system. If at least 2 containment fans are not running in slow they should be started manually.]

Justification of Differences:

This EOP step includes verification of component cooling water flow to each fan cooler.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-4, Pressure.

E_7. **Recovery Actions: Subprocedure VII. Containment Temperature And Pressure Control**

Success Path VII-1

EOP Step Content:

Step 2. Check the following success path criteria:

Objective:

The objective of this step is to check the criteria associated with satisfactorily completing this success path.

Basis: (CEN-152, page 10-4, step 3)

The basis for each individual criterion is given in Section 2.0 of the technical guide. The criteria are used to judge the status of each safety function. Since each safety function has multiple success paths which can be used to control that safety function, the criteria which are used to judge the status of each safety function are organized around the success paths for each safety function. Since each success path uses or may use different technical means of achieving a function, the criteria for judging the success of that path are specific to the technical means. Also, in order to facilitate operator use, the criteria chosen are parameters which can be read directly from the control board.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-3, Temperature and Table 5-4, Pressure.

E_7. Recovery Actions: Subprocedure VII. Containment Temperature And Pressure Control

Success Path VII-1

EOP Step Content:

Step 3. IF the success path criteria (step 2) are met, THEN go to the next safety function in jeopardy.

Objective:

The objective of this step is to instruct the operator what to do if this success path is satisfactorily completed.

Basis: (CEN-152, page 10-12, step 7)

After checking the success path criteria, additional guidance is provided which aids the operator in determining the next course of action. In this step, if control of the safety function is achieved, the operator is instructed to go to the next safety function in jeopardy.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_7. <u>Recovery Actions: Subprocedure VII..Containment Temperature And Pressure Control</u>

Success Path VII-1

EOP Step Content:

Step 4. IF the success path criteria (step 2) are NOT met, THEN go to Success Path VII-2.

Objective:

The objective of this step is to instruct the operator what to do if this success path is not satisfactorily completed.

Basis: (CEN-152, page 10-12, step 7)

After checking the success path criteria, additional guidance is provided which aids the operator in determining the next course of action. In this step, if control of the safety function is not achieved, the operator is instructed to implement another success path for this safety function.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_7. **Recovery Actions: Subprocedure VII. Containment Temperature And Pressure Control**

Success Path VII-2

EOP Step Content:

Step 1. IF Containment pressure ≥17.7 psia, THEN verify CSAS by the following:

Objective:

This step verifies containment spray pumps start and header isolation valves open to supply flow to spray headers if required.

Basis: (CEN-152, page 10-99)

Operation of this system is required once containment pressure increases to 17.7 psia. Operation should commence automatically upon receipt of a containment spray actuation signal; otherwise a manual CSAS should be initiated. In the event a manual CSAS does not start containment spray system operation, the system should be aligned and the pumps started manually.

Operational Considerations:

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

EPG Step Content: (CEN-152, page 10-177, step 1)

If containment pressure increases to [10 psig], verify initiation of containment spray. If it does not start automatically, manually initiate containment spray.

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

PV-OP-902, Parameter Values Document. Table 5-4, Pressure.

E_7. Recovery Actions: Subprocedure VII. Containment Temperature And Pressure Control

Success Path VII-2

EOP Step Content:

Step 2. IF CSAS has occurred, THEN verify Containment Spray flow exists.

Objective:

This step verifies that containment spray flow exists when required.

Basis:

If a CSAS occurred, then containment spray flow is verified. The containment spray system removes heat from the containment by spraying water droplets throughout the containment atmosphere. This condenses steam and cools the air, subsequently reducing containment pressure.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_7. Recovery Actions: Subprocedure VII. Containment Temperature And Pressure Control

Success Path VII-2

EOP Step Content:

Step 3. IF CSAS has occurred, THEN complete Attachment 14: CSAS Automatic Actions.

Objective:

This step has the operator verify automatic actions when a CSAS occurs.

Basis:

This step ensures all CSAS automatic actions occur.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

NA

E_7. Recovery Actions: Subprocedure VII. Containment Temperature And Pressure Control

Success Path VII-2

EOP Step Content:

Step 4. IF Containment pressure <17.7 psia AND RAS has NOT occurred, THEN stop Containment Spray pumps A AND B.

Objective:

This step secures the containment spray pumps when they are not required.

Basis: (CEN-152, page 10-99, step 2)

Before terminating containment spray, the operator must verify that containment pressure is <17.7 psia. Termination may be useful to recover from the Loss of Coolant Accident since continuous use of the containment sprays may impact the operation of equipment inside containment. Since containment spray provides the cooling for long term cooling, the containment spray pumps cannot be secured when a RAS has occurred.

Operational Considerations:

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

EPG Step Content: (CEN-152, page 10-177, step 2)

If the CSAS has been actuated and containment pressure subsequently falls below [7 psig], containment spray should be terminated. Upon termination, it must be realigned for automatic actuation. It may be desirable to operate containment spray to control containment atmospheric iodine levels.

Justification of Differences:

This EPG step was divided into three steps to include plant specific information.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_7. Recovery Actions: Subprocedure VII. Containment Temperature And Pressure Control

Success Path VII-2

EOP Step Content:

Step 5. IF Containment Spray pumps are stopped, THEN realign Containment Spray for automatic initiation as follows:

Objective:

This step ensures that the containment spray system is available for operations.

Basis: (CEN-152, page 10-99, step 2)

Since the containment pressure may rise again, the containment spray system should be relaigned for automatic operation when it is terminated.

Operational Considerations:

NA

EPG Step Content: (CEN-152, page 10-177, step 2)

If the CSAS has been actuated and containment pressure subsequently falls below [7 psig], containment spray may be terminated. Upon termination, it must be realigned for automatic actuation. It may be desirable to operate containment spray to control containment atmospheric iodine levels.

Justification of Differences:

This EPG step was divided into three steps to include plant specific information.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_7. <u>Recovery Actions: Subprocedure VII. Containment Temperature And Pressure Control</u>

Success Path VII-2

EOP Step Content:

Step 6. <u>IF</u> sample of the Containment indicates rising iodine levels, <u>THEN</u> manually initiate Containment Spray.

Objective:

This step initiates containment spray when iodine levels rise in the containment.

Basis: (CEN-152, page 10-99, step 2)

The containment spray system is used to control iodine levels in the containment when chemistry samples indicate a problem with iodine.

Operational Considerations:

NA

EPG Step Content: (CEN-152, page 10-177, step 2)

If the CSAS has been actuated and containment pressure subsequently falls below [7 psig], containment spray may be terminated. Upon termination, it must be realigned for automatic actuation. It may be desirable to operate containment spray to control containment atmospheric iodine levels.

Justification of Differences:

This EPG step was divided into three steps to include plant specific information.

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_7. Recovery Actions: Subprocedure VII. Containment Temperature And Pressure Control

Success Path VII-2

EOP Step Content:

Step 7. Check the following success path criteria:

Objective:

The objective of this step is to check the criteria associated with satisfactorily completing this success path.

Basis: (CEN-152, page 10-4, step 3)

The basis for each individual criterion is given in Section 2.0 of the technical guide. The criteria are used to judge the status of each safety function. Since each safety function has multiple success paths which can be used to control that safety function, the criteria which are used to judge the status of each safety function are organized around the success paths for each safety function. Since each success path uses or may use different technical means of achieving a function, the criteria for judging the success of that path are specific to the technical means. Also, in order to facilitate operator use, the criteria chosen are parameters which can be read directly from the control board.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_7. Recovery Actions: Subprocedure VII. Containment Temperature And Pressure Control

Success Path VII-2

EOP Step Content:

Step 8. IF the success path criteria (step 7) are met, THEN go to the next safety function in jeopardy.

Objective:

The objective of this step is to instruct the operator what to do if this success path is satisfactorily completed.

Basis: (CEN-152, page 10-12, step 7)

After checking the success path criteria, additional guidance is provided which aids the operator in determining the next course of action. In this step, if control of the safety function is achieved, the operator is instructed to go to the next safety function in jeopardy.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_7. Recovery Actions: Subprocedure VII. Containment Temperature And Pressure Control

Success Path VII-2

EOP Step Content:

Step 9. IF the success path criteria (step 7) are NOT met, THEN continue with Subprocedure VII. Containment Temperature And Pressure Control until a success path criterion is satisfactorily being maintained.

Objective:

The objective of this step is to instruct the operator what to do if this success path is not satisfactorily completed.

Basis:

If the criteria are not met, then Containment Temperature And Pressure Control is still in jeopardy. The operator should not leave Containment Temperature And Pressure Control until this function is fulfilled.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_7. **Recovery Actions: Subprocedure VII. Containment Temperature And Pressure Control**

Success Path VII-2

EOP Step Content:

Step 10. IF the Control Room Supervisor determines it is necessary to pursue other safety functions in jeopardy, THEN go to the next safety function in jeopardy AND implement its subprocedure concurrently with this subprocedure.

Objective:

The objective of this step is to allow the control room supervisor to pursue other safety functions in jeopardy while efforts are continued on Containment Temperature And Pressure Control.

Basis:

The operator may, if necessary, pursue other urgent safety functions but must continue to attempt to establish Containment Temperature And Pressure Control.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_8. <u>Recovery Actions: Subprocedure VIII. Containment Combustible Gas Control</u>
Success Path VIII-1

EOP Step Content:

Step 1. IF Containment hydrogen concentration reaches 3%, THEN perform either of the following:

Objective:

This step directs the operator actions if hydrogen concentration reaches 3%.

Basis:

If the hydrogen concentration reached 3%, then either the hydrogen recombiners or the containment atmospheric release system has to be placed in operation. This action will prevent or limit the rise of the hydrogen concentration in the containment. If the hydrogen concentration reaches 4%, then the containment atmospheric release system is placed in operation with the hydrogen recombiners.

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:

OP-8-006, Hydrogen Recombiner.

OP-8-002, Containment Atmospheric Release.

E_8. Recovery Actions: Subprocedure VIII. Containment Combustible Gas Control
Success Path VIII-1

EOP Step Content:

Step 2. Check the following success path criteria:

Objective:

The objective of this step is to check the criteria associated with satisfactorily completing this success path.

Basis: (CEN-152, page 10-4, step 3)

The basis for each individual criterion is given in Section 2.0 of the technical guide. The criteria are used to judge the status of each safety function. Since each safety function has multiple success paths which can be used to control that safety function, the criteria which are used to judge the status of each safety function are organized around the success paths for each safety function. Since each success path uses or may use different technical means of achieving a function, the criteria for judging the success of that path are specific to the technical means. Also, in order to facilitate operator use, the criteria chosen are parameters which can be read directly from the control board.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_8. <u>Recovery Actions: Subprocedure VIII. Containment Combustible Gas Control</u>
Success Path VIII-1

EOP Step Content:

Step 3. IF the success path criteria (step 2) are met, THEN go to the next safety function in jeopardy.

Objective:

The objective of this step is to instruct the operator what to do if this success path is satisfactorily completed.

Basis: (CEN-152, page 10-12, step 7)

After checking the success path criteria, additional guidance is provided which aids the operator in determining the next course of action. In this step, if control of the safety function is achieved, the operator is instructed to go to the next safety function in jeopardy.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_8. Recovery Actions: Subprocedure VIII. Containment Combustible Gas Control
Success Path VIII-1

EOP Step Content:

Step 4. IF the success path criteria (step 2) are NOT met, THEN continue with Subprocedure VIII. Containment Combustible Gas Control until the success path criteria are satisfactorily being maintained.

Objective:

The objective of this step is to instruct the operator what to do if this success path is not satisfactorily completed.

Basis:

If the criteria are not met, then Containment Combustible Gas Control is still in jeopardy. The operator should not leave Containment Combustible Gas Control until this function is fulfilled.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

E_8. Recovery Actions: Subprocedure VIII. Containment Combustible Gas Control
Success Path VIII-1

EOP Step Content:

Step 5. IF the Control Room Supervisor determines it is necessary to pursue other safety functions in jeopardy, THEN go to the next safety function in jeopardy AND implement its subprocedure concurrently with this subprocedure.

Objective:

The objective of this step is to allow the control room supervisor to pursue other safety functions in jeopardy while efforts are continued on Containment Combustible Gas Control.

Basis:

The operator may, if necessary, pursue other urgent safety functions but must continue to attempt to establish Containment Combustible Gas Control.

Operational Considerations:

NA

EPG Step Content:

NA

Justification of Differences:

NA

Source Document:

CEN-152, Section 10.0, Functional Recovery Guideline.

2.0 Guidelines for Safety Function Status Checklist

Safety Function	Criteria	Bases
Vital Auxiliaries		
Success Path I-1	a. BOTH A AND B Train 6.9KV AND 4.16KV busses energized from the Startup Transformer b. BOTH A AND B Train 4.16KV safety busses energized from the 4.16KV nonsafety busses.	Having both A and B nonsafety and safety busses ensures that all required auxiliaries are available. If A and B train nonsafety busses are not available, then one emergency diesel generator supplying a safety bus can supply enough loads to safely shutdown and cooldown the plant. (LW3-1666-83) If no AC power is available then maintaining all three battery busses with the required reduced loading will allow the operator to safely control the plant for an expected battery duty cycle in excess of 2 hours.
Success Path I-2	a. At least one Emergency Diesel Generator supplying a 4.16KV safety bus with proper voltage AND frequency.	
Success Path I-3	a. ALL 125-volt DC busses energized: 1) 3A-DC-S 2) 3B-DC-S 3) 3AB-DC-S.	

Safety Function	Criteria	Bases
Reactivity Control		
Success Path II-1	a. Either of the following exists: 1) ≤ 2 CEAs NOT fully inserted AND Reactor power dropping OR 2) Reactor power is BOTH: a) $<10^{-4}$% b) Constant OR dropping.	(CEN-152, page 10-5) For all emergency events, the reactor must be shutdown. The minimum number of CEAs which could remain withdrawn and keep the reactor critical is approximately 2 CEAs. This criterion, occurring with decreasing reactor power ensures that reactivity is under control.
Success Path II-2	a. Emergency Boration flow >40 gpm AND Reactor power dropping OR b. One of the following Emergency Boration termination criteria is met: 1) ALL of the following are satisfied: a) ≤ 2 CEAs NOT fully inserted b) Emergency borated 165 ppm c) Reactor power dropping OR 2) Reactor power is BOTH: a) $<10^{-4}$% b) Constant OR dropping OR 3) RCS borated to 1300 ppm.	Reactor shutdown may also be assured by the minimum boration rate accompanied by decreasing core power or a constant reactor power less than that at the maximum expected subcritical multiplication level. Since procedures require boration prior to cooldown, these criteria are adequate to ensure shutdown.
Success Path II-3	a. Boron addition rate to the RCS ≥ 40 gpm AND Reactor power dropping OR b. Reactor power is BOTH: 1) $<10^{-4}$% 2) Constant OR dropping OR c. RCS borated to 1300 ppm.	(W3Y84-0550) If two rods are stuck out, then shutdown margin requirements can be met by 165 ppm above reactor coolant system boron concentration. If all rods were stuck out a boron concentration of 1300 ppm would satisfy out shutdown margin requirements.

Safety Function	Criteria	Bases
RCS Inventory Control		
Success Path III-1	a. Pressurizer level between 7% AND 60% b. RCS $\geq$28°F subcooled.	(CEN-152, page 10-5 and Technical Guideline, Section 5.10, Parameter Values Document. Table 5-1, Level.) A value of 60% was chosen as an upper limit for pressurizer level to account for instrument accuracies and other uncertainties. A value of 7% was chosed as the minimum dependable pressurizer level. These values bound the limits of best estimate analysis. The value of 28°F subcooling is based on keeping the core covered and thus ensuring adequate core cooling. If the core is covered with fluid, the RCS will not indicate superheated conditions. When the ECCS is operating, its performance adequacy is judged by observing its delivery flow versus RCS pressure.
Success Path III-2	a. Safety Injection flow has been throttled OR terminated to maintain inventory OR b. IF Pressurizer pressure <1385 psia, THEN proper HPSI flow exists. Refer to Attachment 2: HPSI and LPSI Flow versus Pressurizer Pressure OR c. IF Pressurizer pressure <183 psia AND RAS has NOT occurred, THEN proper LPSI flow exists. Refer to Attachment 2: HPSI and LPSI Flow versus Pressurizer Pressure.	

Safety Function	Criteria	Bases
RCS Pressure Control		
Success Paty IV-1 Low/High Pressure	a. Pressurizer pressure <2300 psia b. Pressurizer Pressure Control System maintaining OR restoring pressure within limits of Attachment 5: Post-Accident Pressure and Temperature Limits Graph c. RCS Subcooling Margin between 28°F AND 200°F.	(CEN-152, page 10-6) RCS subcooling greater than 28°F ensure a liquid state of the coolant for effective heat removal properties. Subcooling less than 200°F is based on PTS criteria.
Success Path IV-2 Low Pressure	a. Pressurizer pressure <2300 psia b. Pressurizer pressure within limits of Attachment 5: Post-Accident Pressure and Temperature Limits Graph c. RCS Subcooling Margin between 28°F AND 200°F.	When the ECCS is operating, its performance adequacy is judged by observing its delivery flow versus RCS pressure. 2300 psia pressurizer pressure is the maximum expected pressure following a reactor trip.
Success Path IV-3 Low Pressure	a. Safety Injection flow has been throttled OR terminated to maintain inventory OR b. IF Pressurizer pressure <1385 psia, THEN proper HPSI flow exists. Refer to Attachment 2: HPSI and LPSI Flow versus Pressurizer Pressure OR c. IF Pressurizer pressure <183 psia AND RAS has NOT occurred, THEN proper LPSI flow exists. Refer to Attachment 2: HPSI and LPSI Flow versus Pressurizer Pressure.	Maintaining the RCS within the PT curves ensures adequate core cooling and minimizes the chance of PTS.
Success Path IV-4 High Pressure	a. Pressurizer pressure <2300 psia b. Pressurizer pressure within limits of Attachment 5: Post-Accident Pressure and Temperature Limits Graph c. RCS Subcooling Margin between 28°F AND 200°F.	
Success Path IV-5 High Pressure	a. Pressurizer pressure <2300 psia b. Pressurizer pressure within limits of Attachment 5: Post- Accident Pressure and Temperature Limits Graph c. RCS Subcooling Margin between 28°F AND 200°F.	

Safety Function	Criteria	Bases
RCS And Core Heat Removal		
Success Path V-1	a. At least one Steam Generator is satisfying either: 1) Steam Generator level Wide Range is <u>BOTH</u>: a) ≥50% b) Constant <u>OR</u> rising <u>OR</u> 2) Level is being restored by either MFW <u>OR</u> EFW flow b. Loop ΔT <13°F c. Tc is <u>BOTH</u>: 1) ≤550°F 2) Constant or dropping d. RCS Subcooling Margin between 28°F <u>AND</u> 200°F.	(CEN-152, pages 10-6 through 10-8) Decay heat levels may not be high enough to require feedwater flow. If this is the case, once steam generator level is returned to zero power level band and feedwater remains available to maintain that level, then the S/G contribution to RCS heat removal is being satisfied. Feed flow is used instead of a minimum level since even on an uncomplicated reactor trip level may go below the instrument ranges. Operators use flow, S/G pressure and RCS temperatures to verify the S/G is intact and that level will recover. ΔT <13°F is verified by best estimate analysis to be the maximum ΔT expected for minimum forced circulation with maximum decay heat. RCS subcooling greater than 28°F ensures a liquid state of the coolant for effective heat removal properties. Subcooling less than 200°F is based on PTS criteria.

Safety Function	Criteria	Basis
RCS And Core Heat Removal (Continued)		
Success Path V-2	a. At least one Steam Generator is satisfying either: 1) Steam Generator level Wide Range is BOTH: a) >50% b) Constant OR rising OR 2) Level is being restored by either MFW OR EFW flow b. Loop T <64°F c. Tc is BOTH: 1) <550°F 2) Constant OR dropping d. RCS Subcooling Margin between 28°F AND 200°F.	550°F is based on control program for ADVs and steam generator dump bypass valves and best estimate analysis. 64°F is based on best estimate analysis which reveals that 64°F T will not be exceeded for cooldown with maximum decay heat and one steam generator isolated with cooldown rate <75°F/hr. 550°F is based on control program for ADVs and steam generator dump bypass valves and best estimate analysis. Decay heat levels may not be high enough to require feedwater flow. If this is the case, once steam generator level is returned to the zero power level band and feedwater remains available to maintain that level then RCS heat removal is possible. Subcooling >28°F is necessary to assure an adequate medium for core heat transfer. 200°F is a limit based on PTS considerations.

Safety Function	Criteria	Bases
RCS And Core Heat Removal (Continued)		
Success Path V-3	a. Either of the following is satisfied: 1) Safety Injection flow has been throttled OR terminated to maintain inventory OR 2) IF Pressurizer pressure <1385 psia, THEN proper HPSI flow exists. Refer to Attachment 2: HPSI and LPSI Flow versus Pressurizer Pressure b. Core temperature <700°F OR dropping c. At least one Steam Generator is satisfying either: 1) Steam Generator level Wide Range is BOTH: a) >50% b) Constant OR rising OR 2) Level is being restored by either MFW OR EFW flow.	(CEN-152 pages 10-6 through 10-8) Adequate S/G performance is indicated by level in the hot zero power band or being restored with feedwater available. When ECCS is operating, its performance adequacy is judged by comparing expected to observed delivery flow versus RCS pressure.
Success Path V-4	a. Any of the following are satisfied: 1) Safety Injection flow has been throttled OR terminated to maintain inventory OR 2) IF Pressurizer pressure <1385 psia, THEN proper HPSI flow exists. Refer to Attachment 2: HPSI and LPSI Flow versus Pressurizer Pressure OR 3) IF Pressurizer pressure <183 psia, AND RAS has NOT occurred, THEN proper LPSI flow exists. Refer to Attachment 2: HPSI and LPSI Flow versus Pressurizer Pressure b. Pressurizer pressure <1385 psia OR dropping c. Core temperature <700°F OR dropping	Core exit thermocouples less than 700°F or decreasing is a limit which recognizes that RCS temperature may be superheated for short periods during recovery. If temperatures are in excess of 700°F, the trend must be decreasing to indicate satisfactory performance. 700°F is the plant specific core exit termocouple temperature which will not be exceeded during events which are not complicated by significant, multiple failures. When cooling by once through cooling, RCS pressure should be less than shutoff head of the HPSI pumps (1385 psia.) If greater than 1385 psia, then a decreasing trend indicated that pressure will be below 1385 PSIA soon.

Safety Function	Criteria	Basis
RCS And Core Heat Removal (Continued)		
Success Path V-5	a. One train of Shutdown Cooling in service b. Pressurizer pressure ≤392 psia c. Tc ≤350°F.	

Safety Function	Criteria	Bases
Containment Isolation		
Success Path VI-1	a. Either of the following is satisfied: 1) ALL of the following exist: a) Pressurizer pressure >1684 psia b) Containment pressure <17.4 psia c) NO Containment Radiation alarms OR 2) At least one Containment Isolation valve closed for each Containment penetration NOT in use	(CEN-152, page 10-8) 17.4 psia is the CIAS setpoint. If pressure goes above 17.4 psia containment isolation valves should shut. (i.e. CIAS should be present). Radiation alarms may also indicate the need for containment isolation.
	b. Either of the following is satisfied: 1) NO Steam Plant activity OR 2) The faulted Steam Generator has been isolated.	Steam plant activity alarm may indicate a steam generator tube rupture and require isolating a S/G.

Safety Function	Criteria	Bases
Containment Temperature and Pressure Control		
Success Path VII-1	a. Containment pressure is BOTH: 1) <17.4 psia 2) Constant OR dropping b. Containment temperature is BOTH: 1) <120°F 2) Constant OR dropping.	(CEN-152, page 10-9) 17.4 psia is based on containment pressure alarm. It is not expected for the selected events that containment pressure will increase to the alarm setpoint unless there is an energy release into containment.
Success Path VII-2	a. Containment pressure is BOTH: 1) <17.7 psia 2) Constant OR dropping OR b. ALL of the following are satisfied: 1) Containment Spray flow exists 2) Containment temperature constant OR dropping 3) Containment pressure constant OR dropping.	120°F is the maximum expected containment temperature for the selected events. It is not expected that containment temperature will increase to 120°F unless there is an energy release. During the selected event, containment temperature and pressure may exceed these limits if the break is inside containment. If this happens, a CSAS should be present and the CSPs should be pumping spray solution at [1500] gpm.

Safety Function	Criteria	Bases
Containment Combustible Gas Control		
Success Path VIII-1	a. Containment hydrogen concentration <3% OR b. Either of the following is satisfied: 1) BOTH Hydrogen Recombiners in operation OR 2) Containment Atmospheric Release System in operation.	(CEN-122, page 10-9) H_2 in the containment is indicative of a primary system leak to containment and may be indicative of core damage. The explosive hazarad which may exist in the containment may present a threat to containment integrity.

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_0. Recovery Actions: General Instructions

Step 6 (page 10-103):

If the first (on the left of each tree) success path is being used for all the safety functions on Figure 10-3 and the criteria for that path are satisfied, implement the Reactor Trip Recovery guideline.

Justification:

OP-902-000, Emergency Entry Procedure, Section D. Diagnostics provides diagnosis and kickouts to each optimal recovery procedure. Therefore, it was decided to use only one kickout step in this procedure. The kickout step directs the operator to go to the entry procedure when all safety functions are being controlled. No matter what success path is in use the diagnostics will determine the correct optimal recovery procedure to go to, if any, or return the operator to the safety function recovery procedure.

E_2. Recovery Actions: Subprocedure II. Reactivity Control
Success Path RC-1

Precaution 5 (page 10-112):

Main or auxiliary pressurizer spray should be used as necessary to equalize the pressurizer and RCS loop water boron concentration as a change is made to the RCS boron concentration. If pressurizer spray is not available, RCS boron concentration should be increased. This avoids an RCS dilution below minimum shutdown requirements by a possible pressurizer outsurge.

Justification:

Since the RCS Pressure Control safety function is a lower priority safety function, the availability of pressurizer spray may not have been determined at this time. Using pressurizer spray during the Reactivity Control safety function deviates from the philosophy of this procedure and thereby can jeopardize other safety functions. Emergency boration is terminated when specific criteria are satisfied. If the criteria are satisfied, then the Reactivity Control safety function is no longer in jeopardy. If later, the criteria are not being satisfied thereby placing the Reactivity Control safety function in jeopardy, then the operator is required to return to the Reactivity Control safety function due to its higher priority.

E_2. <u>Recovery Actions: Subprocedure II. Reactivity Control</u>
Success Path RC-2

Precaution 3 (page 10-115):

Main or auxiliary pressurizer spray should be used as necessary to equalize the pressurizer and RCS loop water boron concentration as a change is made to the RCS boron concentration. If pressurizer spray is not available, RCS boron concentration should be increased. This avoids an RCS dilution below minimum shutdown requirements by a possible pressurizer outsurge.

Justification:

Since the RCS Pressure Control safety function is a lower priority safety function, the availability of pressurizer spray may not have been determined at this time. Using pressurizer spray during the Reactivity Control safety function deviates from the philosophy of this procedure and thereby can jeopardize other safety functions. Emergency boration is terminated when specific criteria are satisfied. If the criteria are satisfied, then the Reactivity Control safety function is no longer in jeopardy. If later, the criteria are not being satisfied thereby placing the Reactivity Control safety function in jeopardy, then the operator is required to return to the Reactivity Control safety function due to its higher priority.

E_2. Recovery Actions: Subprocedure II. Reactivity Control
Success Path RC-3

Precaution 7 (page 10-120):

Main or auxiliary pressurizer spray should be used as necessary to equalize the pressurizer and RCS loop water boron concentration as a change is made to the RCS boron concentration. If pressurizer spray is not available, RCS boron concentration should be increased. This avoids an RCS dilution below minimum shutdown requirements by a possible pressurizer outsurge.

Justification:

Since the RCS Pressure Control safety function is a lower priority safety function, the availability of pressurizer spray may not have been determined at this time. Using pressurizer spray during the Reactivity Control safety function deviates from the philosophy of this procedure and thereby can jeopardize other safety functions. Emergency boration is terminated when specific criteria are satisfied. If the criteria are satisfied, then the Reactivity Control safety function is no longer in jeopardy. If later, the criteria are not being satisfied thereby placing the Reactivity Control safety function in jeopardy, then the operator is required to return to the Reactivity Control safety function due to its higher priority.

E_3. Recovery Actions: Subprocedure III. RCS Inventory Control
Success Path IC-1

Precaution 4 (page 10-126):

Steam plant radiation alarms usually indicate a steam generator tube leak which may result in a loss of RCS inventory.

Justification:

This precaution is an information only precaution. There are no instructions given here for what to do with a steam generator tube leak (i.e., isolate the affected steam generator). Steam plant activity is part of the Containment Isolation safety function. The safety function status checklist will alert the operator if the Containment Isolation safety function is in jeopardy due to steam plant activity.

E_3. Recovery Actions: Subprocedure III. RCS Inventory Control
Success Path IC-2

Precaution 5 (page 10-130):

Steam plant radiation alarms usually indicate a steam generator tube leak which may result in a loss of RCS inventory.

Justification:

This precaution is an information only precaution. There are no instructions given here for what to do with a steam generator tube leak (i.e., isolate the affected steam generator). Steam plant activity is part of the Containment Isolation safety function. The safety function status checklist will alert the operator if the Containment Isolation safety function is in jeopardy due to steam plant activity.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control
Success Path PC-5

Step 5 (page 10-143):

[If the auxiliary feedwater system (AFW) is started, perform the following to prevent steam generator feedring damage:

Justification:

Per Combustion Engineering letter (C-CE-8998), the Waterford-3 design for automatic initiation of 200 gpm is acceptable. The design of the Waterford-3 feedring minimizes drainage of the feedring, thus the conditions for waterhammer are minimized.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control
Success Path PC-5

Step 7 (page 10-144):

If all feedwater is lost and pressurizer sprays (main and auxiliary) are not available, go to PC-7, RCS Pressure Control using [PORVs].

Justification:

PC-7, RCS Pressure Control using PORVs, was not used since Waterford-3 does not have PORVs.

E_4 Recovery Actions: Subprocedure IV. RCS Pressure Control
Success Path PC-6

Step 6 (page 10-147):

[If the auxiliary feedwater system (AFW) is started, perform the following to prevent steam generator feedring damage:

Justification:

Per Combustion Engineering letter (C-CE-8998), the Waterford-3 design for automatic initiation of 200 gpm is acceptable. The design of the Waterford-3 feedring minimizes drainage of the feedring, thus the conditions for waterhammer are minimized.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path PC-6

Step 7.c (**page 10-147**):

If feedwater cannot be regained in at least one operable steam generator, go to PC-7, [RCS pressure control using PORVs].

Justification:

PC-7, RCS Pressure Control using PORVs, was not used since Waterford-3 does not have PORVs.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control
Success Path PC-6

Precaution 5 (page 10-149):

Natural circulation flow should not be verified until the RCPs have stopped coasting down after being tripped.

Justification:

This precaution was not used because it was decided that operators would be trained to know when to monitor natural circulation. Also, by the way the procedures are structured, the steps for monitoring natural circulation are located at a point when reactor coolant pumps should have stopped coasting down.

E_4. <u>Recovery Actions: Subprocedure IV. RCS Pressure Control</u>
Success Path PC-6

Precaution 6 (page 10-149):

Verification of temperature responses to a plant change cannot be accomplished until approximately 5 to 15 minutes following the action due to increased loop cycle times during natural circulation.

Justification:

This precaution was not used because it was decided that the operators would be trained to know that natural circulation had longer loop transient times which causes plant responses to be slower.

E_4. Recovery Actions: Subprocedure IV. RCS Pressure Control

Success Path PC-6

Precaution 7 (page 10-150):

When RCS heat removal is conducted by natural circulation with an isolated steam generator, an inverted ΔT (i.e. T_c higher than T_h) may be observed in the idle loop. This is due to a small amount of reverse heat transfer in the isolated steam generator and will have no affect on natural circulation flow in the operating steam generator loop.

Justification:

This precaution was not used because it was decided that operators would be trained to recognize this inverted ΔT and its effect on cooldown.

E_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>
Success Path HR-1

Step 4 (page 10-154):

[If the auxiliary feedwater system (AFW) is started, perform the following to prevent steam generator feedring damage:

Justification:

Per Combustion Engineering letter (C-CE-8998), the Waterford-3 design for automatic initiation of 200 gpm is acceptable. The design of the Waterford-3 feedring minimizes drainage of the feedring, thus the conditions for waterhammer are minimized.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal

Success Path HR-1

Step 5.f (page 10-155):

If feedwater cannot be regained, go to [HR-4, RCS and Core Heat Removal using ECCS and PORVs].

Justification:

HR-4, RCS And Core Heat Removal using PORVs, was not used since Waterford-3 does not have PORVs.

E_5. Recovery Actions: Subprocedure V. RCS And Core Heat Removal
Success Path HR-1

Precaution 6 (page 10-157):

If voids are present (see voiding guidance in IC-1 and IC-2), they may have to be eliminated to depressurize.

Justification:

By the philosophy of this procedure, anytime a higher priority safety function becomes in jeopardy the operator is required to go to that subprocedure. The operator will be trained to know and understand this philosophy.

E_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>
Success Path HR-2

Step 5 (page 10-159):

[If the auxiliary feedwater system (AFW) is started, perform the following to prevent steam generator feedring damage:

Justification:

Per Combustion Engineering letter (C-CE-8998), the Waterford-3 design for automatic initiation of 200 gpm is acceptable. The design of the Waterford-3 feedring minimizes drainage of the feedring, thus the conditions for waterhammer are minimized.

E_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>
Success Path HR-2

Step 6.e (page 10-160):

If feedwater cannot be regained, go to [HR-4, RCS and Core Heat Removal using ECCS and PORVs].

Justification:

HR-4, RCS And Core Heat Removal using PORVs, was not used since Waterford-3 does not have PORVs.

E_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>
Success Path HR-2

Precaution 1 (page 10-162):

Natural circulation flow should not be verified until the RCPs have stopped coasting down after being tripped.

Justification:

This precaution was not used because it was decided that operators would be trained to know when to monitor natural circulation. Also, by the way the procedures are structured, the steps for monitoring natural circulation are located at a point when reactor coolant pumps should have stopped coasting down.

E_5. <u>Recovery Actions: Subprocedure V. RCS And Core Heat Removal</u>
Success Path HR-2

Precaution 2 (page 10-162):

Verification of temperature responses to a plant change cannot be accomplished until approximately 5 to 15 minutes following the action due to increased loop cycle times during natural circulation.

Justification:

This precaution was not used because it was decided that the operators would be trained to know that natural circulation had longer loop transient times which causes plant responses to be slower.

E_5 Recovery Actions: Subprocedure V. RCS And Core Heat Removal
Success Path HR-2

Precaution 4 (page 10-162):

If cooling down by natural circulation with an isolated steam generator, an inverted ΔT (i.e. T_c higher than T_h) may be observed in the idle loop. This is due to a small amount of reverse heat transfer in the isolated steam generator and will have no affect on natural circulation flow in the operating steam generator loop.

Justification:

This precaution was not used because it was decided that operators would be trained to recognize this inverted ΔT and its effect on cooldown.

4.0 List of Instruments and Ranges

Parameter and Ranges
for Safety Function Recovery Procedure

Parameters	Required Range	Available Range
1. Pressurizer pressure	350 to 2250 psia	0 to 3000 psia
2. Pressurizer level	28 to 60%	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. Core temperature	350 to 800°F	200 to 2300°F
8. Subcooling margin	20 to 200°F	-200 to 200°F
9. Volume control tank level	10 to 68%	0 to 100%
10. Charging header flow	40 to 132 gpm	0 to 150 gpm
11. Steam generator pressure	67 to 1050 psia	0 to 1200 psia
12. Steam generator level		
a. Wide range	52 to 85%	0 to 100%
b. Narrow range	60 to 70%	0 to 100%
13. Steam generator outlet temperature	300 to 572°F	0 to 600°F
14. Steam flow	0 to 7.5 x 10^6 lbm/hr	0 to 8.0 x 10^6 lbm/hr
15. Feed flow	0 to 7.5 x 10^6 lbm/hr	0 to 8.0 x 10^6 lbm/hr
16. Emergency feedwater flow	0 to 400 gpm	0 to 800 gpm
17. Condensate storage pool level	27.7 to 97.7%	0 to 100%
18. High pressure turbine gland sealing steam (local)	1.5 to 3 psig	0 to 15 psia
19. Low pressure turbine gland sealing steam (local)	1.5 to 3 psig	-30 in Hg Vac to 15 psig
20. Main feed pump gland sealing steam (local)	4 psig	-30 in Hg Vac to 60 psig
21. Gland steam pressure	140 psig	0 to 150 psig
22. Containment pressure	0 to 17.4 psia	0 to 30 psia
23. Safety injection tank pressure	235 to 625 psig	0 to 700 psig

Parameters	Required Range	Available Range
24. High pressure safety injection		
a. Flow	0 to 500 gpm	0 to 500 gpm
b. Pressure	0 to 2500 psig	0 to 2500 psig
25. Low pressure safety injection		
a. Flow	0 to 5500 gpm	0 to 5500 gpm
b. Pressure	0 to 650 psig	0 to 650 psig
26. Steam generator blowdown activity monitor	10 to 10^6 cpm	10 to 10^6 cpm
27. Main steam line activity monitor	10^0 to 10^5mr/hr	10^0 to 10^5mr/hr
28. Condenser vacuum pump exhaust activity monitor	10 to 10^7 cpm	10 to 10^7 cpm
29. Containment radiation monitor	10^1 to 10^5 mr/hr	10^1 to 10^5 mr/hr
30. Main condenser vacuum	0 to 30" Hg	0 to 30" Hg
31. Emergency diesel generator megawatts	0 to 7 MW	0 to 7 MW
32. Emergency diesel generator voltage	0 to 5250 volts	0 to 5250 volts
33. 4.16KV safety bus voltage	0 to 5250 volts	0 to 5250 volts
34. 4.16KV nonsafety bus voltage	0 to 5250 volts	0 to 5250 volts
35. Battery bus voltage	0 to 150 volts	0 to 150 volts