

Report No. 02-0160-1102
Revision 0

APPENDIX F

MALFUNCTION ANALYSIS TABLES

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Plant Conditions - Power Supply
or Sensor Failure/Malfunction

Plant Response - Chapter 15 Analysis

Reactor Feedwater Control

- . No affect on plant conditions, auto trip of reactor feed pump turbine A is disabled.

- . Plant conditions not affected, no Chapter 15 analysis required.

Pressure Regulator - T/G Control

- . No affect on plant conditions, A and D T/G system alarm and trip disabled.

- . Plant conditions not affected, no Chapter 15 analysis required.

Recirculation Flow Control

- . Loss of flow in loop A due to recirculation MG trip.
- . Runback in loop B due to recirculation runback circuit activation.

- . Diffuser flow in loop A decreases sharply.
- . Flow through loop B will be reduced due to the runback signal.
- . Flow through the core will stabilize at new equilibrium condition.
- . Reactor power level stabilizes at new equilibrium conditions.
- . Reactor level increase is not sufficient to initiate a turbine trip and scram.
- . System pressures reduced from conditions existing prior to the recirculation pump trip.

1D615 125 VDCPlant Conditions - Power Supply
or Sensor Failure/MalfunctionOperator ResponseSafety System Response Per FSARReactor Feedwater Control

- . No affect on plant conditions, auto trip of reactor feed pump turbine A is disabled.

- . Operator response not required, no affect on plant conditions.

- . Safety system response not required, no affect on plant conditions.

Pressure Regulator - T/G Control

- . No affect on plant conditions, A and D T/G system alarm and trip disabled.

- . Operator response not required, no affect on plant conditions.

- . Safety system response not required, no affect on plant conditions.

Recirculation Flow Control

- . Loss of flow in loop A due to recirculation MG trip.
- . Runback in loop B due to recirculation runback circuit activation.

- . The conditions generated are within operator capabilities.
- . No scram will occur for trip of one recirculation pump.
- . Immediate operation action is not required.
- . Operator must verify that no operating limits are exceeded.
- . Operator must ensure that flow must conform to criteria for single pump flow.

- . No safety system operation is involved.

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1D615 125 VDC

Plant Condition Not Covered by Chapter 15 Analysis

- . Loss of 1D615 does not generate plant conditions not already covered by Chapter 15.

Recommendation

- . None required.

Plant Conditions - Power Supply
or Sensor Failure/Malfunction

Reactor Feedwater Control

- . No affect on plant conditions, auto trip of reactor feed pump turbine A is disabled.

Pressure Regulator - T/G Control

- . No affect on plant conditions, B and E T/G system alarm and trip disabled.

Recirculation Flow Control

- . Loss of loop B flow due to trip of recirculation MG.
- . Loop A flow remains the same.

Traversing In-Core Probe (TIP)

- . No affect on plant conditions, ability to operate TIP is lost; but automatic withdrawal of TIP is initiated upon loss of this power supply.

Plant Response - Chapter 15 Analysis

- . Plant conditions not affected, no Chapter 15 analysis required.
- . Plant conditions not affected, no Chapter 15 analysis required.
- . Diffuser flow in loop B decreases sharply.
- . Flow through the core will stabilize at new equilibrium conditions.
- . Reactor power level stabilizes at new equilibrium conditions.
- . Reactor level increase is not sufficient to initiate a turbine trip and scram.
- . System pressures reduced from conditions existing prior to the recirculation pump trip.
- . Plant conditions not affected, no Chapter 15 analysis required.

1D625 125 VDC

Plant Conditions - Power Supply
or Sensor Failure/Malfunction

Operator Response

Safety System Response Per FSAR

Reactor Feedwater Control

- No affect on plant conditions, auto trip of reactor feed pump turbine A is disabled.

- Operator response not required, no affect on plant conditions.

- Safety system response not required, no affect on plant conditions.

Pressure Regulator - T/G Control

- No affect on plant conditions B and E T/G system alarm and trip disabled.

- Operator response not required, no affect on plant conditions.

- Safety system response not required, no affect on plant conditions.

Recirculation Flow Control

- Loss of loop B flow due to trip of recirculation MG.
- Loop A flow remains the same.

- The conditions generated are within operator capabilities.
- No scram will occur for trip of one recirculation pump.
- Immediate operator action is not required.
- Operator must verify that no operating limits are exceeded.
- Operator must ensure that flow must conform to criteria for single pump flow.
- The cause of the failure must be determined before the system is returned to normal operation.
- The restart procedure for the pump must be followed.

- No safety system operation is involved for this plant condition.

1D625 125 VDC

Plant Conditions - Power Supply
or Sensor Failure/Malfunction

Operator Response

Safety System Response Per FSAR

Traversing In-Core Probe (TIP)

- No affect on plant conditions, ability to operate TIP is lost; but automatic withdrawal of TIP is initiated upon loss of this power supply.

- Loss of TIP control is not beyond operator capability. TIP probes are designed to be automatically withdrawn and the system returned to normal upon loss of this power supply.

- Safety system response not required since there is no affect on plant conditions.

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1D625 125 VDC

Plant Condition Not Covered by Chapter 15 Analysis

Recommendation

- . Loss of 1D625 does not generate plant conditions not already covered by Chapter 15.

- . None required.

1D635 125 VDCPlant Conditions - Power Supply
or Sensor Failure/MalfunctionReactor Feedwater Control

- Feed flow increases to a rate greater than required due to erroneous zero flow input from B train flow instrumentation on loss of power.
- Reactor feed pump turbine (RFPT) C trip circuit is disabled, preventing trip if Level 8 trip occurs.
- If the Level 8 trip set point is reached due to increased RFPT flow, RFPT A and B will trip; but RFPT C will remain in operation.

Plant Response - Chapter 15 Analysis

- Chapter 15 response for a maximum flow demand assumes all three RFPTs trip upon reaching Level 8. In this case, one RFPT will continue to operate beyond the Level 8 trip position. This is not explicitly addressed by Chapter 15.
- The following actions will occur in accordance with Chapter 15 as follows:
 - Level 8 trips RFPTs A and B, and the T/G.
 - Reactor scram is activated upon closure of T/G stop valves.
 - Recirculation pumps are tripped on closure of T/G stop valves. Recirculation pump trip causes decrease in core flow to natural circulation.
 - Pressure relief is activated due to high pressure.
 - Turbine bypass valve closes causing vessel pressure to recover.
- At this point, further plant response is not explicitly documented in Chapter 15 due to the continued operation of RFPT C. See "Recommendations" sheet 3.

1D635 125 VDC

Plant Conditions - Power Supply
or Sensor Failure/Malfunction

Plant Response - Chapter 15 Analysis

Pressure Regulator and T/G Control

- . No affect on plant conditions due to loss of power supply to system. C system alarm and trip is disabled.
- . T/G will trip due to a Level 8 trip initiated from feedwater system.

- . The plant response with regard to the T/G for the Level 8 trip is covered in the reactor feedwater flow control analysis.

Plant Conditions - Power Supply
or Sensor Failure/Malfunction

Operator Response

Safety System Response Per FSAR

Reactor Feedwater Control

- Feed flow increases to a rate greater than required due to erroneous zero flow input from B flow sensor on loss of power.
- Reactor feed pump turbine (RFPT) C trip circuit is disabled, preventing trip if Level 8 trip occurs.
- If the Level 8 trip set-point is reached due to increased RFPT flow, RFPT A and B will trip; but RFPT C will remain in operation.

- The conditions generated by this power supply failure are not beyond the capabilities of the operator. The operator retains the ability to runback RFPT C through manual control of the feedwater flow control system. The RFPT can be tripped by closing its steam admission valve.

- The operation of the Level 8 trip feature for the RFPTs does not adequately cover the conditions resulting from the loss of this power supply. See "Recommendations" sheet 3.

Pressure Regulator and T/G Control

- No affect on plant conditions due to loss of power supply to system. C system alarm and trip is disabled.
- T/G will trip due to a Level 8 trip initiated from feedwater system.

- The T/G trip resulting from the Level 8 trip is not beyond operator capability. T/G trip is a normal response to the conditions generated.

- The conditions generated by the loss of the power supply are adequately covered for the T/G as per Chapter 15. The T/G is tripped when Level 8 logic is actuated by Reactor Feedwater Control System.

Plant Condition Not Covered by Chapter 15 Analysis

Reactor Feedwater Control

- The continued operation of RFPT C beyond the Level 8 trip set point is not covered by Chapter 15 analysis.

Recommendation

- Verify through thermal hydraulic and instrument analysis that the Level 8 set point will not be reached. If the set point is not reached, the conditions are explicitly addressed by Chapter 15.
- If the Level 8 set point is reached, there are two options available:
 1. Modification - feedwater flow train B instrumentation, currently powered by 1D635 125 VDC, should be changed to an alternate power supply, preferably 1Y218 120 VAC, the loss of 1D635 would not generate the transient since the feedwater flow signal from the B sensor would continue to operate normally. The Level 8 condition would not occur.
 2. Reanalysis - an alternative to design change would be to analyze this new transient to determine the net affect of continued operation of RFPT C beyond the Level 8 trip.

1D645 125 VDCPlant Conditions - Power Supply
or Sensor Failure/MalfunctionReactor Feedwater Control

- . If reactor vessel level train A is selected as input to the feedwater flow control, there will be no affect on plant conditions. The Level 8 trip circuit logic will however, be reduced from 2 of 3 to 1 of 2.
- . If reactor vessel level train B is selected, an increase in feed flow will occur due to the low level signal being processed. The Level 8 trip circuit will also be reduced from 2 of 3 to 1 of 2; however when Level 8 is reached the RFPTs and T/G will trip.

Plant Response - Chapter 15 Analysis

- . For utilization of level train A, plant conditions are not affected. Chapter 15 analysis is not required.
- . For the loss of level train B, Chapter 15 addresses the failure of the Feedwater Flow Control System in the maximum flow condition. The plant response as per Chapter 15 is as follows:
 - Level 8 vessel level set point trips main turbine and feedwater pumps. Turbine bypass operation initiated.
 - Reactor scram trip actuated from main turbine stop valve position switches.
 - Recirculation pump trip (RPT) actuated by stop valve position switches.
 - Recirculation pump motor circuit breakers open causing decrease in core flow to natural circulation.
 - Relief Group 1 actuated due to high pressure.
 - Relief Group 1 closed.
 - Turbine bypass valves close (not simulated) causing vessel pressure to recover and depress water level.
 - Trip attained causing Level 2 isolation with closure of the MSIVs and initiation of HPCI and RCIC systems.

1D645 125 VDC

Plant Conditions - Power Supply
or Sensor Failure/Malfunction

Pressure Regulator - T/G Control

- . For the case when there is no affect on the feedwater system:
 - When T/G is operating at a speed greater than 1300 rpm, there will be no affect on plant performance. The T/G EHC system will not generate a trip due to the field installed jumpers.
 - When T/G is operating at speeds lower than 1300 rpm during startup, the T/G EHC system will trip the T/G upon loss of this power supply. The subsequent closure of the T/G stop and control valves will not cause a scram due to scram inhibit logic at reactor power less than 30% NB. The T/G will have to go through restart.
- . For the case when there is a Level 8 trip due to the feedwater system, there will be an associated T/G trip.

Plant Response - Chapter 15 Analysis

- . Plant conditions are not affected since the T/G trip is not generated. Chapter 15 analysis is not required.
- . Plant condition resulting from this loss of power supply will be a T/G trip as per Chapter 15.
- . The Level 8 trip will result in a T/G trip as per Chapter 15. The plant response is as noted in the feedwater analysis.

1D645 125 VDC

Plant Conditions - Power Supply
or Sensor Failure/Malfunction

Operator Response

Safety System Response Per FSAR

Reactor Feedwater Control

- If reactor vessel level train A is selected as input to the Feedwater Flow Control, there will be no affect on plant conditions. The Level 8 trip circuit logic will however be reduced from 2 of 3 to 1 of 2.
- If reactor vessel level train B is selected; an increase in feed flow will occur due to the low level signal being processed. The Level 8 trip circuit logic will also be reduced from 2 of 3 to 1 of 2; however, when Level 8 is reached the RFPTs and T/G will trip.

- There will be no change in plant conditions. The power supply failure does not generate conditions beyond the operator capability.
- Operator retains manual control of the Feedwater Flow Control System. The RFPTs can be run back using manual control. The RFPTs can also be tripped if necessary using the RFPT trip system. The conditions are therefore within the capabilities of the operator.

- Plant conditions are not affected. The power supply failure does not require safety system response.
- The Level 8 trip for the RFPTs and the T/G will be invoked as per Chapter 15. In addition, reactor scram and recirculation pumps trip will occur in loss of the T/G. If the Level 2 set-point is reached, MSIV closure will occur; HPCI and RCIC will be initiated. The conditions are therefore within the capabilities of the safety system.

1D645 125 VDC

Plant Conditions - Power Supply
or Sensor Failure/Malfunction

Operator Response

Safety System Response Per FSAR

Pressure Regulator - T/G Control

- | | | |
|---|---|---|
| <ul style="list-style-type: none">• For the case when there is no affect on the feedwater system:<ul style="list-style-type: none">- When T/G is operating at a speed greater than 1300 rpm, there will be no affect on plant performance. The T/G EHC system will not generate a trip due to the field installed jumpers.- When T/G is operating at speeds lower than 1300 rpm during startup, the T/G EHC system will trip the T/G upon loss of this power supply. The subsequent closure of the T/G stop and control valve will not cause a scram due to scram inhibit logic at power less than 30% NB. The T/G will have to go through restart.• For the case when there is a Level 8 trip due to the feedwater system, there will be an associated T/G trip. | <ul style="list-style-type: none">• Since no T/G trip is incurred, there will be no change in plant conditions. The power supply failure does not generate conditions beyond the operator capabilities.• The conditions generated by the loss of this power supply is a T/G trip. The T/G trip is not beyond operator capabilities.• The condition generated by the feedwater system failure results in a T/G trip. The T/G trip is not beyond operator capabilities. | <ul style="list-style-type: none">• This plant condition does not require safety system response.• This plant condition does not require safety system response.• The safety system response is as noted in the feedwater analysis. The conditions generated are within safety system capabilities. |
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Plant Condition Not Covered by Chapter 15 Analysis

- . Loss of 1D645 does not generate plant conditions not already covered by Chapter 15.

Recommendation

- . None required.

1Y218 120 VACPlant Conditions - Power Supply
or Sensor Failure/MalfunctionPlant Response - Chapter 15 AnalysisReactor Feedwater Control

- . For Complete loss of feedwater flow control (auto and manual); a speed freeze is invoked on Reactor Feed Pump Turbines (RFPTs), upon loss of control signal to the Electric Automatic Positioner for RFPTs A, B and C. Feedwater flow rate is locked in at the flow rate in effect prior to loss of power. There are three categories of conditions that can occur subsequent to the speed freeze.
 - a. Maximum feed demand at time of speed freeze will result in a Level 8 trip of the RFPTs and the T/G.
 - b. Minimum feed demand at the time of speed freeze will result in Level 3 and 2 trips.
 - c. If the speed freeze occurs between maximum and minimum demand conditions, the feedwater system will be locked in at the flow rate prior to the loss of power.

- . For maximum feed demand, the Chapter 15 response is as follows:
 - Level 8 vessel level set point trips main turbine and feedwater pumps. Turbine bypass operation initiated.
 - Reactor scram trip actuated from main turbine stop valve position switches.
 - Recirculation pump trip (RPT) actuated by stop valve position switches.
 - Recirculation pump motor circuit breakers open causing decrease in core flow to natural circulation.
 - Relief Group 1 actuated due to high pressure.
 - Relief Group 1 closed.
 - Turbine bypass valves close (not simulated) causing vessel pressure to recover and depress water level.
 - Low water level trip attained causing isolation with closure of the MSIVs and initiation of HPCI and RCIC systems.
- . For minimum feed demand, the Chapter 15 response is as follows:
 - Reactor vessel water Level 3 initiates Scram.
 - Reactor vessel water Level 2 initiates recirculation pump trip and HPCI and RCIC actuation.
 - MSIVs close.
 - Group 1 pressure relief valves open to relieve pressure, then close.

1Y218 120 VACPlant Conditions - Power Supply
or Sensor Failure/MalfunctionReactor Feedwater Control (cont'd)Reactor Manual Control System (RMCS)

- Ability to move control rod(s) is lost for any plant operating mode upon loss of power supply. The Scram safety function is still fully available since it is completely independent from control rod operation.
- If either the Level 8 or Level 3 trip is reached due to feedwater flow transient (maximum or minimum demand), a scram will be initiated.

Recirculation Flow Control

- Flow control for recirculation pumps A and B is disabled. Upon the loss of control signal, flow rates at the instant of bus failure will be maintained via locking of the MG set scoop tubes.

Plant Response - Chapter 15 Analysis

- For the category between maximum and minimum demand, no Chapter 15 analysis is required. No transient is generated by the conditions of "speed freeze" in the feedwater system.
- The loss of the ability to move control rods does not generate a plant transient; and therefore does not required Chapter 15 analysis. This system condition has no safety implications.
- The Level 8 or Level 3 conditions resulting from the feedwater flow transient directly lead to a Scram. The Scram is adequately covered in Chapter 15. It overrides the effect of loss of power on the RMCS system.
- Since the scoop tube locking mechanisms (recirculation Loops A and B) react to maintain the flow at the instant of the failure, no transient is introduced into bus the system. Chapter 15 states that the loss of the master controllers cannot be more severe than the trip of both recirculation pumps.

1Y218 120 VAC

Plant Conditions - Power Supply
or Sensor Failure/Malfunction

Plant Response - Chapter 15 Analysis

Recirculation Flow Control (cont'd)

- . If the Level 2 set-point is reached as a result of the feedwater flow problem, the recirculation pumps will trip.

- . The Level 2 conditions resulting from the feedwater flow transient directly lead to a trip of the recirculation pumps. This response is adequately covered in Chapter 15. It overrides the effect of loss of power to Recirculation Flow Control System.

Pressure Regulation - T/G Control

- . The loss of this power supply will not affect plant conditions for this system; however, the conditions generated by the feedwater system on Level 8 or Level 3 and 2 trips will cause the T/G to trip.

- . Trip of the T/G under these conditions is covered by Chapter 15 analysis. See Feedwater System (page 1) for further explanation.

Reactor Water Cleanup System

- . No affect on plant conditions, RWCS pump high differential shut-off lost.

- . Plant conditions are not affected, no Chapter 15 analysis is required.

Nuclear Pressure Relief

- . No affect on plant conditions, loss of Nuclear Pressure Relief Valve temperature monitoring capability.

- . Loss of Nuclear Pressure Relief Valve temperature indication does not require Chapter 15 analysis.

Traversing In-Core Probe (TIP)

- . No affect on plant conditions, loss of ability to operate TIP.

- . Loss of ability to operate TIP does not require Chapter 15 analysis.

1Y218 120 VAC

Plant Conditions - Power Supply
or Sensor Failure/Malfunction

Operator Response

Safety System Response Per FSAR

Reactor Feedwater Control

- For complete loss of feedwater flow control (auto and manual); a speed freeze is invoked on Reactor Feed Pump Turbines (RFPTs), upon loss of control signal to the Electric Automatic Positioner for RFPTs A, B, and C. Feedwater flow rate is locked in at that flow rate in effect prior to loss of power. There are three categories of conditions that can occur subsequent to the speed freeze.
 - a. Maximum feed demand at time of speed freeze will result in a Level 8 trip of the RFPTs and the T/G.
 - b. Minimum feed demand at the time of speed freeze will result in Level 3 and 2 trips.
 - c. If the speed freeze occurs in between maximum and minimum demand conditions, the feedwater system will be locked in at the flow rate prior to the loss of power.
- The maximum feed demand condition is not beyond operator capability. The RFPTs will be automatically tripped on reaching the Level 8 set-point. The plant response is also within operator capabilities as per Chapter 15.
- The minimum feed demand condition is within operator capabilities. The conditions generated as part of the plant response are also within operator capabilities as per Chapter 15.
- The conditions generated by an RFPT speed freeze between minimum demand are not beyond operator capability. The feedwater flow cannot be adjusted until power is restored to the feedwater system and the speed freeze circuit is reset.
- If Level 8 trip occurs due to speed freeze at maximum demand, the following safety systems as per Chapter 15 will be actuated: Scram, HPCI, RCIC and RHR. The conditions generated are not beyond the capability of these safety systems:
- If Level 3 and 2 trips occur due to speed freeze at minimum demand, the following safety systems will be actuated: Scram, HPCI, RCIC and RHR. The conditions generated are within the capabilities of these safety systems.
- If speed freeze occurs between maximum and minimum demand no safety systems are required to function. The conditions generated by the power supply failure are therefore within the capabilities of the safety systems as per Chapter 15.

1Y218 120 VACPlant Conditions - Power Supply
or Sensor Failure/MalfunctionOperator ResponseSafety System Response Per FSARReactor Manual Control System (RMCS)

- . Ability to move control rod(s) is lost for any plant generating mode upon loss of power supply. The Scram safety function is still fully available since it is completely independent from control rod operation.
- . If either the Level 8 or Level 3 trip is reached due to Feedwater flow transients (maximum or minimum demand), a Scram will be initiated.
- . For the situation when the feedwater system does not cause a Level 8 or Level 3 and 2 trip the loss of the ability to move control rods is not beyond operator capability. Even without electric power to these major components of the RMCS system, the operator still retains the capability to Scram since it is completely independent from the RMCS system. The operator would be required to regain electric power in order to be able to move rods once more.
- . In the case in which either the Level 8 or Level 3 and 2 trips are reached, a Scram will occur. The Scram does not present conditions which are beyond the operator capabilities. It should be noted that due to loss of Rod Position Indication (RPI) from the RMCS, the operator will not be able to verify all rods in using RPI. Alternate methods of Scram verification are available through monitoring nuclear instrumentation, plant pressure, temperature, etc.
- . For the situation when the feedwater system does not cause a Level 8 or Level 3 and 2 trip, the condition generated by the loss of power to the RMCS system does not require safety system response. There is no transient generated by this condition that would involve a safety function.
- . In the case in which either the Level 8 or Level 3 and 2 trips are reached, a Scram will occur in accordance with Chapter 15. Therefore, the conditions generated by each of these trips are within the capability of this safety system.

1Y218 120 VACPlant Conditions - Power Supply
or Sensor Failure/MalfunctionOperator ResponseSafety System Response Per FSARRecirculation Flow Control

- . Flow control for recirculation pumps A and B is disabled. Upon the loss of control signal, flow rates at the instant of bus failure will be maintained via locking of the MG set scoop tubes.
- . If the Level 2 set-point is reached as a result of the feedwater flow transient, the recirculation pump will trip.
- . The conditions generated by the loss of power to this system are not beyond operator capability. Recirculation flow remains as it was prior to the loss of power. Speed control of the recirculation pumps is possible by manually positioning the scoop tubes.
- . In the case of Level 2 trip, the recirculation pumps will be tripped. This does not generate conditions beyond operator capability.
- . Since no transient is introduced by these plant condition, no safety system response is required.
- . The safety system response upon Level 2 trip is covered in the feedwater system. The conditions generated are within the capabilities of these safety systems.

Pressure Regulator - T/G Control

- . The loss of this power supply will not affect plant conditions for this system; however, the conditions generated by the feedwater system for Level 8 or Level 3 and 2 trips will cause the T/G to trip.
- . Trip of the T/G under these conditions are not beyond operator capabilities.
- . The safety system response upon Level 8 or Level 3 and 2 trips is covered in the feedwater system safety system response description. The conditions generated are within the capability of these supply systems.

1Y218 120 VAC

Plant Conditions - Power Supply
or Sensor Failure/Malfunction

Operator Response

Safety System Response Per FSAR

Reactor Water Cleanup

- | | | |
|---|--|---|
| <ul style="list-style-type: none">. No affect on plant conditions, RWCS pump high differential shut-off lost. | <ul style="list-style-type: none">. Loss of the automatic RWCS pump high differential shut-off is not a condition beyond operator capability. The operator can manually stop the pump if the condition exists. | <ul style="list-style-type: none">. This plant condition does not require safety system response. |
|---|--|---|

Nuclear Pressure Relief

- | | | |
|---|--|--|
| <ul style="list-style-type: none">. No affect on plant conditions, loss of Nuclear Pressure Relief Valve temperature monitoring capability. | <ul style="list-style-type: none">. Loss of Nuclear Pressure Relief Valve temperature monitoring is not a condition beyond operator capabilities. Relief valve downstream conditions can be monitored by relief valve flow monitoring until power is restored. | <ul style="list-style-type: none">. The plant condition does not require safety system response. |
|---|--|--|

Traversing In-Core Probe (TIP)

- | | | |
|--|---|--|
| <ul style="list-style-type: none">. No affect on plant conditions, loss of ability to operate TIP. | <ul style="list-style-type: none">. Loss of the ability to operate TIP does not generate conditions beyond operator capability. If TIP isolation is desired it can be accomplished by operating the DC shear valve; otherwise, no operator action is required until the system power is returned. | <ul style="list-style-type: none">. The plant condition does not require safety system response. |
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1Y218 120 VAC

Plant Condition Not Covered by Chapter 15 Analysis

- Loss of 1Y218 does not generate plant conditions not already covered by Chapter 15 analysis.

Recommendation

- None required.

1Y219 120 VAC

Plant Conditions - Power Supply
or Sensor Failure/Malfunction

Reactor Manual Control System

- Control rod drive temperature monitoring is lost.

Reactor Water Cleanup System

- Loss of letdown capability to condenser or liquid radwaste system; purification is still available.
- Loss of RWCS pump cooling protection and RWCS temperature monitoring.

Plant Response - Chapter 15 Analysis

- Plant conditions are not affected, no Chapter 15 analysis is required.

- Loss of letdown capability is not a condition that impacts on safety. Chapter 15 analysis is not required.

1Y219 120 VAC

Plant Conditions - Power Supply
or Sensor Failure/Malfunction

Operator Response

Safety System Response Per FSAR

Reactor Manual Control System

- Control rod drive temperature monitoring is lost.

- Loss of control rod drive temperature monitoring capability is not a condition beyond operator capability; loss of temperature monitoring creates an alarm condition that will alert the operator that a system failure has occurred. The power must be restored to the system to return temperature monitoring capability.

- This plant condition does not require safety system response.

Reactor Water Cleanup System

- Loss of letdown capability to condenser or liquid radwaste system, purification is still available.
- Loss of RWCU pump cooling protection and RWCU temperature monitoring.

- If letdown is required for the plant operating mode, operator must regain power to operate the RWCS. Control of this failure is within the capability of the operator.

- This plant condition does not require safety system response.

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1Y219 120 VAC

Plant Condition Not Covered by Chapter 15 Analysis

Recommendation

- Loss of 1Y219 does not generate plant conditions not already covered in Chapter 15 analysis.

- None required.

1Y226 120 VAC

Plant Conditions - Power Supply
or Sensor Failure/Malfunction

Nuclear Pressure Relief

- . Loss of Division II relief valve flow monitoring capability.

Reactor Water Cleanup System

- . Loss of filter demineralization inlet temperature monitoring capability.

Plant Response - Chapter 15 Analysis

- . Plant conditions are not affected, loss of Division II relief valve flow monitoring does not require Chapter 15 analysis.
- . Plant conditions are not affected, loss of filter demineralizer inlet temperature monitoring does not require Chapter 15 analysis.

1Y226 120 VAC

Plant Conditions - Power Supply
or Sensor Failure/Malfunction

Operator Response

Safety System Response Per FSAR

Nuclear Pressure Relief

- | | | |
|--|--|---|
| <ul style="list-style-type: none">. Loss of Division II relief valve flow monitoring capability. | <ul style="list-style-type: none">. Loss of flow monitoring is not a condition beyond operator capability. Flow monitoring is still available on Division I relief valves. Temperature monitoring is also available until the power supply can be reenergized. | <ul style="list-style-type: none">. This plant condition does not require safety system response. |
|--|--|---|

Reactor Water Cleanup System

- | | | |
|---|---|---|
| <ul style="list-style-type: none">. Loss of filter demineralizer inlet temperature monitoring capability. | <ul style="list-style-type: none">. Loss of filter demineralizer inlet temperature monitoring is not a condition beyond operator capability. RWCS system temperatures can be monitored until the power supply can be reenergized. | <ul style="list-style-type: none">. This plant condition does not require safety system response. |
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1Y226 120 VAC

Plant Condition Not Covered by Chapter 15 Analysis

Recommendation

- . Loss of 1Y226 does not generate plant conditions not already covered by Chapter 15.

- . None required

1Y629 120 VACPlant Conditions - Power Supply
or Sensor Failure/MalfunctionReactor Manual Control System

- Loss of rod control; rod(s) remain in same position prior to loss of power; further rod motion cannot be accomplished.

Pressure Regulator - T/G Control

- The loss of this power supply at T/G rated speed does not generate a transient due to redundant power provided by the Permanent Magnet Generator (PMG). The T/G will continue to operate normally.
- The loss of this power supply at less than rated speed, when the PMG is not providing redundant power, will result in a T/G trip. If this loss of power supply occurs at greater than 30% reactor power, a scram will occur.

Recirculation Flow Control

- Recirculation runback circuit is partially armed due to loss of power supply.
- The recirculation pumps will trip if the T/G is tripped.

Plant Response - Chapter 15 Analysis

- The loss of the ability to move control rods does not generate a plant transient and therefore does not require Chapter 15 analysis.
- Plant conditions are not affected, no Chapter 15 analysis is required.
- Both the T/G trip and scram conditions are addressed by Chapter 15 analysis.
- With no T/G trip, plant conditions remain unchanged with respect to the recirculation system. Chapter 15 analysis is not required.
- With the T/G trip, the recirculation pumps will trip.

1Y629 120 VAC

Plant Conditions - Power Supply
or Sensor Failure/Malfunction

Operator Response

Safety System Response Per FSAR

Reactor Manual Control System

- Loss of rod control; rod(s) remain in same position prior to loss of power; further rod motion cannot be accomplished.

- Loss of the ability to move control rods is not beyond operator capabilities. Even without electric power to rod drive control, the operator still retains the capability to scram since it is completely independent from the RMCS system. The operator would be required to regain power in order to be able to move rods once more.

- The conditions generated by the loss of power to the RMCS system do not require safety system response. There is no transient generated by this condition.

Pressure Regulation - T/G Control

- The loss of this power supply at T/G rated speed does not generate a transient due to redundant power provided by the Permanent Magnet Generator (PMG). The T/G will continue to operate normally.
- The loss of this power supply at less than rated speed, when the PMG is not providing redundant power, will result in a T/G trip. If this loss of power supply occurs at greater than 30% reactor power, a scram will occur.

- Operator response not required, no affect on plant conditions.
- The T/G trip and scram do not generate conditions beyond operator capabilities as per Chapter 15.

- Safety system response not required, no affect on plant conditions.
- The safety system response to the T/G trip is Scram, HPCI and RCIC as per Chapter 15. The conditions are therefore with safety system capabilities.

1Y629 120 VAC

Plant Conditions - Power Supply
or Sensor Failure/Malfunction

Operator Response

Safety System Response Per FSAR

Recirculation Flow Control

- Recirculation runback circuit is partially armed due to loss of power supply.

- Without the T/G trip, the Feedwater low flow signal only partially arms the runback logic in auxiliary circuits A and B. No special compensating operator action will be required until the bus voltage is recovered. The condition is within the capabilities of the operator.

- With a T/G trip, both Recirculation pumps will trip. This trip is a normal occurrence based on the T/G trip condition. It is within operator capabilities.

- No transient is introduced into the system. Chapter 15 indicates that the trip of one or both recirculation pumps under normal operating conditions involves no unique safety action system response.

- The safety system responses as noted in the analysis for T/G trip at greater than 30% NB power, is through Scram, HPCI and RCIC as noted in Chapter 15.

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Plant Condition Not Covered by Chapter 15 Analysis

- Loss of 1Y629 does not generate plant conditions not already covered by Chapter 15 analysis.

Recommendation

- None required.

Feedwater Flow Element - FE-1N001 A, B, CPlant Conditions - Power Supply
or Sensor Failure/MalfunctionPlant Response - Chapter 15 AnalysisReactor Feedwater Control

- . If a single feed flow element fails such that an erroneous high flow signal exists, the feedwater system will decrease feed flow. This reduction in flow may lead to Level 3 and 2 trips.

- . If a single feed flow element fails such that an erroneous low flow signal exists, the feedwater system will increase feed flow. This increase in flow may lead to a Level 8 trip.

- . For this low feed flow condition, the Chapter 15 response is as follows:
 - Reactor Vessel Water Level 3 initiates scram.
 - Reactor Vessel Water Level 2 initiates recirculation pump trip and HPCI and RCIC actuation.
 - MSIVs close.
 - Group 1 pressure relief valves open to relieve pressure, then close.

- . For this high flow condition, the Chapter 15 response is as follows:
 - Level 8, vessel level set-point trips main turbine and feedwater pumps. Turbine bypass operation initiated.
 - Reactor scram trip actuated from main turbine stop valve position switches.
 - Recirculation pump trip (RPT) actuated by stop valve position switches.
 - Recirculation pump motor circuit breakers open causing decrease in core flow to natural circulation.
 - Relief Group 1 actuated due to high pressure.
 - Relief Group 1 closed.
 - Turbine bypass valves close (not simulated) causing vessel pressure to recover and depress water level.
 - Level 2 trip attained causing isolation with closure of the MSIVs and initiation of HPCI and RCIC systems.

Feedwater Flow Elements - FE-1N001 A, B, C

Plant Conditions - Power Supply
or Sensor Failure/Malfunction

Plant Response - Chapter 15 Analysis

Recirculation Flow Control

- . Failure of a single flow element under an apparent high or low flow condition will not introduce a transient via the recirculation system.
- . If a Level 8 or Level 3 and 2 trip results, the recirculation pumps will trip.

- . Since no transient is introduced by this failure, plant conditions are not affected. Chapter 15 analysis is not required.
- . If Level 8 or Level 3 and 2 trip results, the plant response will be as described in the feedwater system. The recirculation pumps will trip as a result of these conditions.

Feedwater Flow Elements - FE-1N001 A, B, CPlant Conditions - Power Supply
or Sensor Failure/MalfunctionOperator ResponseSafety System Response Per FSARReactor Feedwater Control

- If a single feed flow element fails such that an erroneous high flow signal exists, the feedwater system will decrease feed flow. This reduction in flow may lead to Level 3 and 2 trips.
- If a single feed flow element fails such that an erroneous low flow signal exists, the feedwater system will increase feed flow. This increase in flow may lead to a Level 8 trip.

- The low flow condition is not beyond operator capability. The operator retains the ability to take manual control of feedwater flow prior to reaching the Level 3 and 2 trips. The conditions resulting from the Level 3 and 2 trips are also within operator capabilities as per Chapter 15.
- The high flow condition is not beyond operator capability. The RFPTs will be automatically tripped on reaching the Level 8 set-point. The operator also has the ability to take manual control of feedwater flow prior to the Level 8 trip occurring.

- If Level 3 and 2 trips occur due to the low flow condition, the following safety systems as per Chapter 15, will be actuated: Scram, HPCI, RCIC. The conditions generated are within the capabilities of these safety systems.
- If Level 8 trip occurs due to the high flow the following safety systems, as per Chapter 15, will be actuated: Scram, HPCI, RCIC. The conditions generated are within the capabilities of these safety systems.

Recirculation Flow Control

- Failure of a single flow element under an apparent high or low flow condition will not introduce a transient via the recirculation system.
- The conditions generated by the flow element failure will not require operator response.

- There is no safety system response required for this plant condition.

Feedwater Flow Elements - FE-1N001 A, B, C

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Plant Conditions - Power Supply
or Sensor Failure/Malfunction

Operator Response

Safety System Response Per FSAR

Recirculation Flow Control (cont'd)

- . If a Level 8 or Level 3 and 2 trip results, the recirculation pumps will trip.

- . The conditions generated by the Feedwater System impact on recirculation pump operation. Both recirculation pumps will trip. Loss of both recirculation pumps is within the capabilities of the operator.

- . The Level 8 or Level 3 and 2 trips require the same safety system response as noted in the feedwater system. The response to these trips is within the capabilities of these safety systems.

Feedwater Flow Element - FE-1N001 A, B, C

Plant Condition Not Covered by Chapter 15 Analysis

Recommendation

- . Failure of a single feedwater flow element does not generate plant conditions not already covered by Chapter 15 analysis.

- . None required.

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CASCADING POWER SUPPLY EFFECT
1Y218/1Y219 120 VAC

Plant Conditions - Power Supply
or Sensor Failure/Malfunction

Plant Response - Chapter 15 Analysis

The plant conditions generated by the simultaneous loss of these two power supplies are covered in the individual analysis for 1Y218 and 1Y219, respectively. The simultaneous failure of these power supplies do not result in conditions that have not already been covered in previous malfunction analyses.

CASCADING POWER SUPPLY EFFECT
1Y218/1Y219 120 VAC

Plant Conditions - Power Supply
or Sensor Failure/Malfunction

Operator Response

Safety System Response Per FSAR

The plant conditions generated by the simultaneous loss of these two power supplies are covered in the individual analysis for 1Y218 and 1Y219, respectively. The simultaneous failure of these power supplies do not result in conditions that have not already been covered in previous malfunction analyses.

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CASCADING POWER SUPPLY EFFECT

1Y218/1Y219 120 VAC

Plant Condition Not Covered by Chapter 15 Analysis

Recommendation

The plant conditions generated by the simultaneous loss of these two power supplies are covered in the individual analysis for 1Y218 and 1Y219, respectively. The simultaneous failure of these power supplies do not result in conditions that have not already been covered in previous malfunction analyses.

