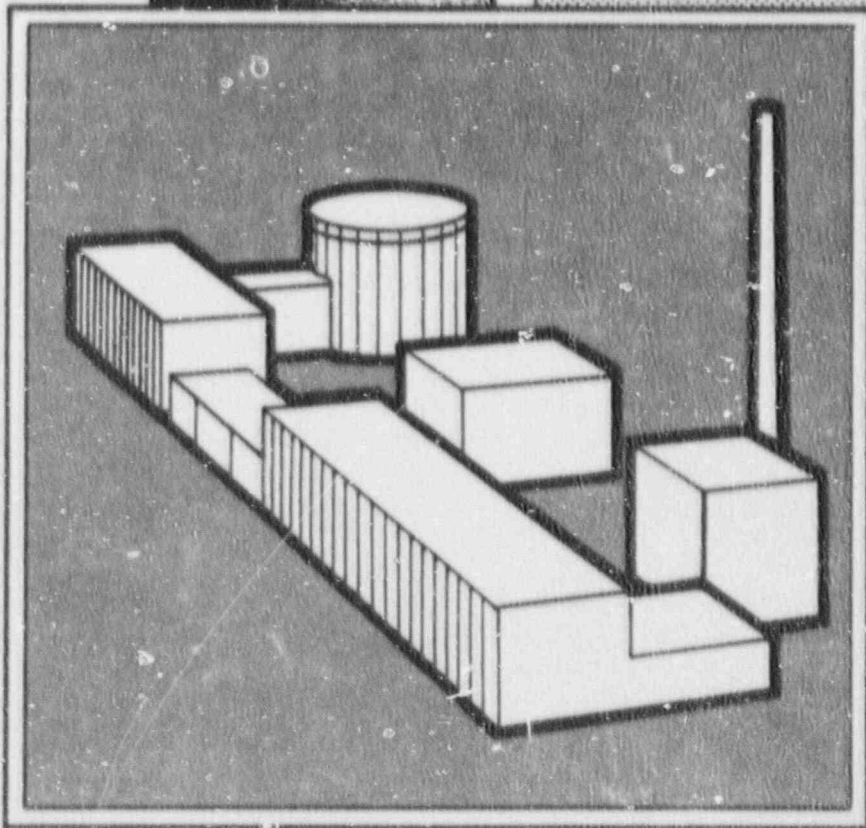
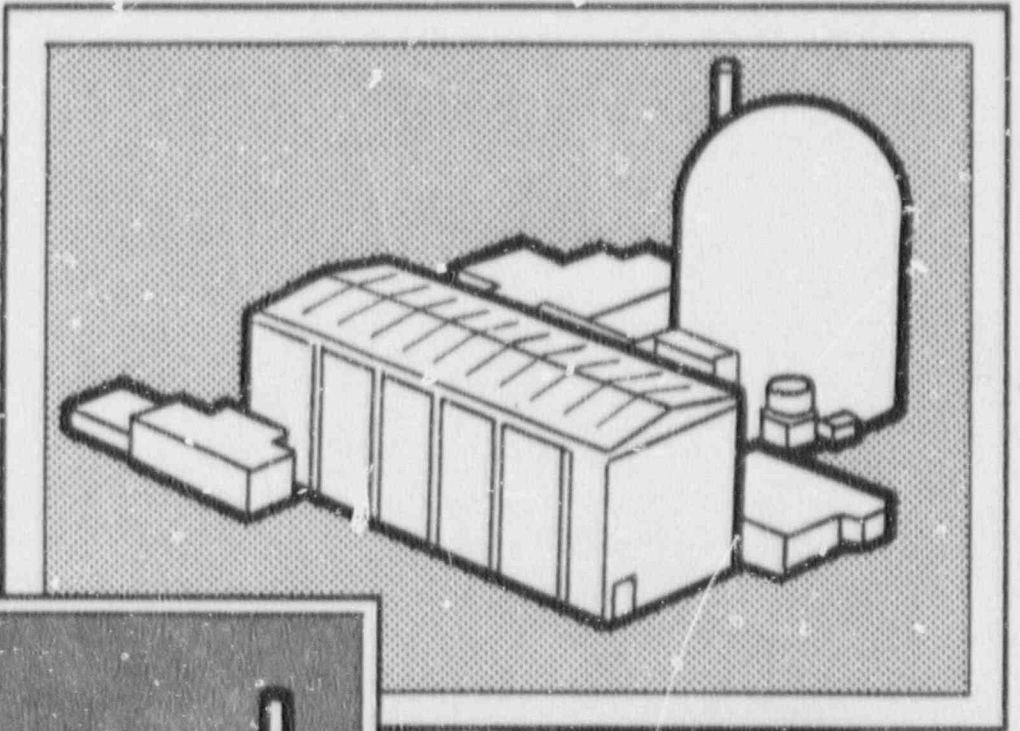
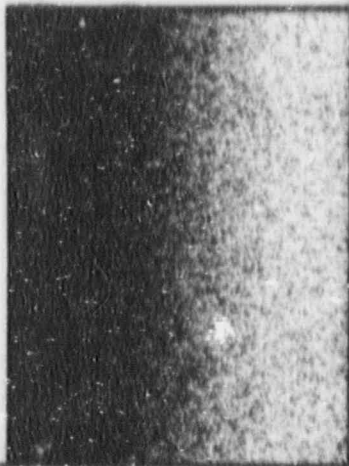


# NUSCO

## Probabilistic Safety Studies: Key Assumptions Document



UNCONTROLLED  
COPY

Controlled Copy # \_\_\_\_\_

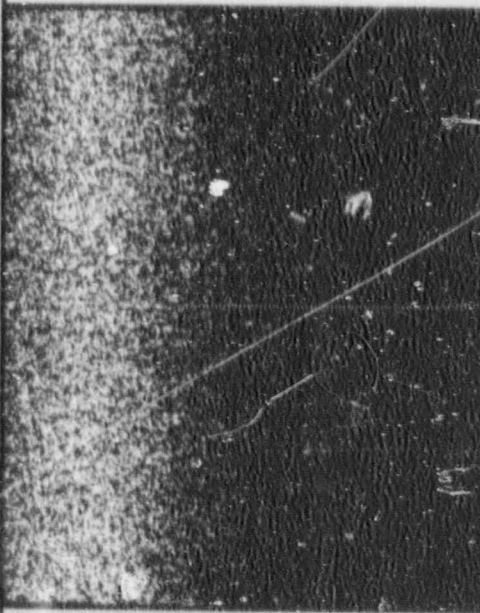
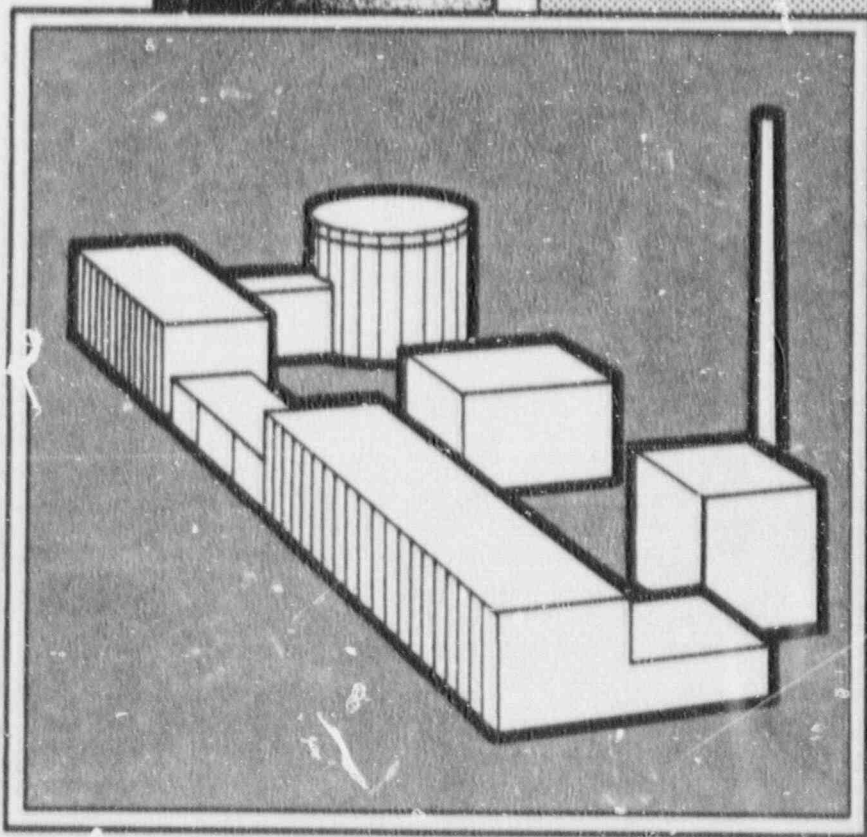
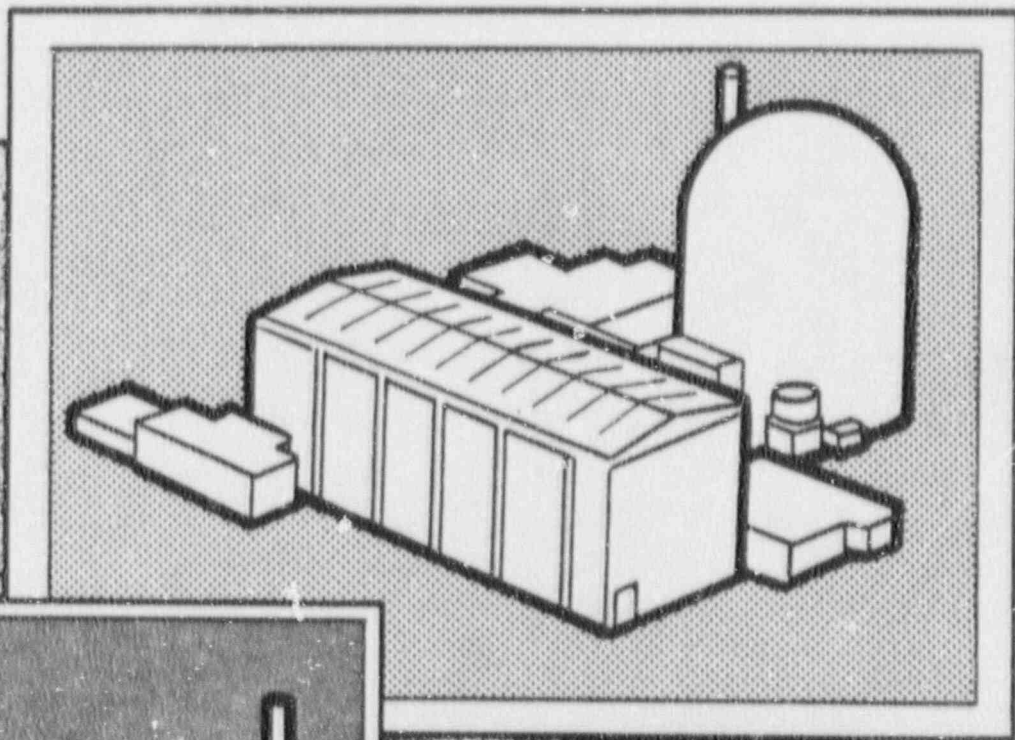
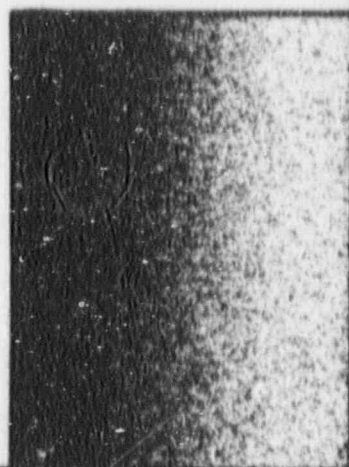
NUSCO Probabilistic Safety Studies:  
Key Assumptions Document  
Revision 0

UNCONTROLLED  
COPY

CONTROLLED  
COPY

# NUSCO

## Probabilistic Safety Studies: Key Assumptions Document



CONTROLLED  
COPY

Controlled Copy # \_\_\_\_\_

TABLE OF CONTENTS

	PAGE
1.0 Introduction.....	1.1
2.0 General Guidelines.....	2.1
Appendix A - Millstone Unit 1 Systems and Assumptions	
Appendix B - Millstone Unit 2 Systems and Assumptions (To be incorporated September 1990 after completion of PSS)	
Appendix C - Millstone Unit 3 Systems and Assumptions	
Appendix D - Connecticut Yankee Systems and Assumptions	
Appendix E - List of PRA Contacts	

## 1.0 INTRODUCTION

A Probabilistic Risk Assessment (PRA) is an analytical technique for integrating diverse aspects of design and operation in order to assess the risk of operating a nuclear power plant, and to develop an information base for analyzing plant-specific and generic issues. At Northeast Utilities, the results of a PRA are documented in a plant-specific Probabilistic Safety Study (PSS) for each plant. This assessment of plant-specific risk provides both a quantitative measure of potential accident risks to the public and qualitative insights into the adequacy of plant design and operation.

The assessment of the adequacy of plant design and operation is achieved by identifying sequences of potential events that dominate risk and establishing which plant features contribute most to the frequency of such sequences. These features may be potential hardware failures, common-mode failures, human errors during testing and maintenance, or procedural inadequacies leading to human error. As such, the PRA takes credit for both "safety related" and "nonsafety related" equipment and systems, includes the probability of multiple failures, and analyzes accidents beyond the design basis for a plant.

The general process used in developing a PRA is as follows:

- Step 1: Determination of core-damage frequencies based on system and human factors evaluation.

- 1a) Determine possible initiating events which could lead to a transient/trip and calculate their frequency of occurrence. (Examples of initiating events include loss of main feedwater, loss of normal power, and large break loss of coolant accident.)
  
- 1b) For each initiating event, an event tree is developed. The outcome of an event tree is determined by evaluating the possible permutations involved in the successful operation or failure of systems (including important operator actions) that can mitigate the consequences of the initiating event. (For example, for a small LOCA, high pressure injection fails, but reactor coolant system depressurization and low pressure injection succeed.)
  
- 1c) For each system used in an event tree, a fault tree or similar analysis is performed which logically models the various failure modes of the system. Included in this analysis are any "support systems" (such as service water and DC power) which may be required by the system being modeled. Using plant specific equipment failure rates where data are available, a failure

probability is determined for each system used in the event tree.

1d) Using the frequencies from Step 1a and the probabilities from Step 1c, the event trees from Step 1b are solved to determine the frequencies of the various core damage states (for example, early core melt with containment intact; core damage with releases via a failed steam generator tube; and so on).

Step 2: Determination of the physical and chemical phenomena that affect the performance of the containment during a core melt accident and other mitigating features, and the behavior and release of fission products to the environment.

Step 3: Determination of the off-site transport, deposition, and health effects of fission product releases.

Thus far, Steps 1, 2, and 3 have all been performed only for MP3. Step 1 has been completed for CY and MP1, and is approximately two-thirds completed for MP2. Only events at power operation have been evaluated as of this date. Fire, floods, earthquakes, tornadoes, and other "external events" have been considered to varying degrees for each plant.

In the development of a PRA, numerous procedures and practices are reviewed and assumptions made about the operability, maintenance, surveillance, and testing of the various systems which are modelled. Therefore, changes to procedures, equipment, or practices (see Section 2 for examples) could have a potential impact (either negative or positive) on the safe operation of the plant and hence, on the PRA itself.

This document was prepared to make corporate engineering and plant personnel better informed of the general assumptions made within the Northeast Utilities PSSs, and to ensure that subtle plant changes (not normally communicated to the PRA section via the Integrated Safety Evaluation or Project Description review process) get reflected in the PSS models.

## 2.0 GENERAL GUIDELINES

There are several hundred major assumptions in each plant PSS, and literally thousands of minor assumptions that are implicitly made but nowhere stated. A major assumption is made, for example, that the operators would not purposely defeat both trains of emergency core cooling equipment which actuate automatically during a loss of coolant accident with unambiguous indications. More subtle assumptions are also made that train A of the ECCS is no more likely to fail than train B simply because the power cables to the A pumps are 20 feet longer than to the B pumps.

Rather than list all key assumptions in the PSS, the approach taken in this document is to identify the systems modeled in the PSS, identify major assumptions and operator actions for each system (see Appendices A through D) and list in a general way the types of plant changes which could impact the PSS assumptions and results. It should be noted that the information contained in these Appendices is based on "best estimate" analysis and should not be assumed to be equivalent to the design basis of the plants. Most design and procedural changes that impact the PSS will be identified through NEO 3.12 Integrated Safety Evaluations and/or Plant Design Change Requests (PDCRs) which make their way to Reactor Engineering/RNA Section. However, many apparently minor changes in procedures, practices, and design could impact the PSS yet never receive an ISE.

With this in mind, corporate engineering and plant staffs should be sensitized to changes which potentially affect the PSS results. When in doubt, the PRA Section staff should be contacted directly (see Appendix A).

## 2.1 Changes Which Could Increase Core Melt Frequency

The following types of changes could increase the Core Melt Frequency for a given plant:

- o Change in valve operator type; i.e., motor-operated valve to air-operated valve, MOV to check valve, etc.
- o Change of normal/accident valve line up or locked valve checklist.
- o Change of power supplies.
- o Change of cooling water systems.
- o Reduction in time available for operator diagnosis and actions during accidents (e.g., increase in number of actions required).

- o Placing a system out of service (unless covered by Technical Specifications).
- o Changes to actuation logic.
- o Wiring changes; i.e., Appendix R.
- o MOVs de-energized.
- o Relocation of equipment.
- o Increases in surveillance intervals, a change of type of surveillance performed, or a change to sequential tests of redundant components.
- o Decrease in the scope of test requirements.
- o Substantive changes to operating procedures.
- o Substantive changes to Control Room Design.
- o Installation of additional valves in a system (except small vent and drain valves).

- o Decrease in pump flow rates.
- o Increase in pump flow rates if it adversely affects NPSH or time for manual switchover to sump recirculation.
- o Removing part or all of a fire detection/suppression system from service.
- o Any change which could impact an assumption or success criteria listed in Appendices A through D.

## 2.2 Changes Which Could Lower the CMF

The following types of changes could lower the CMF for a given plant:

- o Changes to operating procedures which clarify existing practices or provide additional checks for adequate performance.

- o Decreases in surveillance test intervals. (A reduced benefit is accrued by testing more frequently than once per month or bi-weekly. In the extreme, too frequent testing could increase component unavailability due to wear-out.)
- o Increases in the scope of test requirements.
- o Addition of redundant/diverse equipment.
- o Changes which have received a conceptual design review by the PRA Section or an Integrated Safety Evaluation for NEO 3.12.
- o Changes to equipment which will replace operator actions with automatic actions.

2.3 Changes Which Have Little or No Impact on the CMF

- o Minor setpoint changes.
- o Temporary changes of short duration (less than one day).

- o Change of generic type of valve; i.e., gate valve to globe valve.
- o One-to-one replacement of equipment.
- o Minor procedural changes.
- o Changes to systems not listed in Appendices A through D.

The above lists are not intended to be all inclusive and are provided to give general guidance on how changes to a plant can affect the Core Melt Frequency.

If a determination cannot be made on how a change affects the CMF, it is preferable to call the PRA Section than to assume that the CMF is not impacted.

Any questions regarding the accuracy of the information or the validity of the assumptions provided in Appendices A through D should be referred to the appropriate contact listed in Appendix E.

# MP1 SYSTEMS AND ASSUMPTIONS

## TABLE OF CONTENTS

	PAGE
DC Power.....	1
AC Power.....	2
120V Vital AC Power.....	3
Service Water.....	4
T.B.S.C.C.W.....	5
R.B.C.C.W.....	6
Reactor Protection System.....	7
Drywell Coolers.....	8
Safety/Relief Valves.....	9
Vapor Suppression.....	10
Feedwater/FWCI.....	11
Main Condenser.....	12
Isolation Condenser.....	13
Isolation Condenser Makeup.....	14
Fire Protection.....	15
Emergency Core Cooling Actuation.....	16
Low Pressure Permissive Logic.....	17
Automatic Depressurization System.....	18
Low Pressure Core Spray.....	19

Low Pressure Coolant Injection.....	20
Recirculation Pump Trip System.....	21
Standby Liquid Control.....	22
Shutdown Cooling.....	23
Alternate Shutdown Cooling/Containment Cooling.....	24
Emergency Service Water.....	25
MP1-MP2 AC Cross-Tie.....	26
Reactor Water Clean Up System.....	27
Fire Detection/Suppression.....	28

Appendix A  
Millstone Unit 1:  
Systems And Assumptions

UNCONTROLLED  
COPY

<b>PLANT: MP-1</b> <b>SYSTEM:DC POWER</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
<b>KEY COMPONENTS:</b> DC Bus 101A DC Bus 101B Battery 101A Battery 101B Battery Charger 101A Battery Charger 101B Battery Charger 101C	All transients/trips/LOCAs	125V DC Power to Bus 101A or 101B (Both buses preferred)	Manually align spare charger or cross-tie buses
	Station Blackout	125V DC Power on Bus 101A or 101B for duration of blackout	Loadshed DC Buses to conserve Power
<b>SYSTEM BOUNDARIES:</b> Battery Chargers to DC Buses 101A & 101B (Switchboards 101AB-1, 101AB-2, and 101AB-3 are modeled separately as support for various systems except for unisolated faults which are included here)			
<b>ADDITIONAL ASSUMPTIONS:</b> Battery Chargers are not capable of maintaining voltage without the Batteries			

<b>PLANT: MP-1</b> <b>SYSTEM:AC POWER</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
<b>KEY COMPONENTS:</b> Gas Turbine Generator Diesel Generator 4160V AC Bus 14E 4160V AC Bus 14C 4160V AC Bus 14G 4160V AC Bus 14F LNP Logic NSST RSST	All transients/trips/LOCAs except LNP & Station Blackout	4160V AC Power supplied to Bus 14E or 14F (Both preferred)	Manually backup fast transfer scheme or cross-tie AC Buses if required
	Loss of Normal Power	4160V AC Power supplied to Bus 14E or 14F (Both preferred)	Backup LNP logic with manual start of the G/T & D/G or cross-tie AC Buses if Required
	Station Blackout	4160V AC Power restored to Bus 14E or 14F	Restore D/G or G/T or cross-tie to MP2 AC Power
	<p><b>SYSTEM BOUNDARIES:</b></p> <p>Power Supplies (NSST, RSST, G/T, and D/G) to 4160V AC Buses 14E and 14F including the LNP logic, breaker logic, DC control power (up to but not including Buses 101A and 101B), service water cooling supply to the D/G, and D/G &amp; G/T auxiliaries.</p>		
<p><b>ADDITIONAL ASSUMPTIONS:</b></p> <p>The MP2 AC cross-tie will only be used if all MP1 AC sources are unavailable and both MP2 D/Gs are available.</p> <p>Failure of SW-9 to close following an LNP results in insufficient cooling to the D/G causing it to fail.</p> <p>MP1 will proceed to cold shutdown if a hurricane is expected to reach the site</p> <p>The turbine rollback feature was not credited.</p> <p>The test of the LNP logic every refueling outage does not fully test both redundant signal trains</p>			

<b>PLANT: MP-1</b> <b>SYSTEM:</b> <b>120V VITAL AC</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
<b>KEY COMPONENTS:</b> 120V Vital AC MG Set 120V Vital AC Bus AC - DC ABT	All transients/trips/LOCAs except Loss of Vital AC	120V Vital AC Supplied by either normal or Alternate Supplies	None
	Loss of 120V Vital AC	N/A - Assumed to be Failed	Recognize loss prior to manually tripping plant
<b>SYSTEM BOUNDARIES:</b> Power supplies (125V DC MCC 101 AB3, 480V AC MCC E5, and 480V AC MCC F5) to 120V Vital AC Bus			
<b>ADDITIONAL ASSUMPTIONS:</b> ABTs tested every refueling outage. Loss of all power to 120V Vital AC bus gives an erroneous "Vital AC on Alternate Supply" alarm.			

<b>PLANT: MP-1</b> <b>SYSTEM:</b> <b>SERVICE WATER</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
<b>KEY COMPONENTS:</b> Pump SW-1A Pump SW-1B Pump SW-1C Pump SW-1D Strainer SW-448 MOV SW-9 Manual Valve SW-19	All Transients, Trips, LOCAs except LNP and Loss of Service Water	2 SW Pumps providing cooling to RBCCW and TBSCCW heat exchangers	If required, start 2 stby pumps w/in 1/2 hr if 2 pumps fail or 1 pump w/in 2 hrs if 1 pump fails; Open SW-19 if Strainers plug
	Loss of Normal Power	1 SW Pump and flow to TBSCCW isolated (SW-9) or 2 SW Pumps	Open SW-19 if Strainers plug
	Loss of Service Water	None, SW assumed failed and non-recoverable	Attempt pump restart to prevent total loss of SW
<b>SYSTEM BOUNDARIES:</b>			
Service Water Pumps to RBCCW, D/G, and TBSCCW Heat Exchangers. Heat exchangers and Valve SW-99 are modeled as part of the systems they support. Also included are DC control power (up to but not including Buses 101A & 101B) and AC power (up to but not including Buses 14E & 14F)			
<b>ADDITIONAL ASSUMPTIONS:</b>			
3 Service Water Pumps are normally running in the summer months(4 months), otherwise there are 2 pumps running. The breaker between bus 12E and the ABT for SW-9 is racked open. Leakage around the travelling screens is sufficient to provide adequate suction flow for the SW Pumps should the screens fail. Should the strainer fail and begin to plug, sufficient time and indications are provided to allow the operator to bypass the strainer by opening SW-19.			

<b>PLANT: MP-1</b> <b>SYSTEM: TBSCCW</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
	All transients/trips/LOCAs	One pump and both heat exchangers supplying cooling to vital loads	Start standby pump if required
<b>KEY COMPONENTS:</b> Pump M4-15A Pump M4-15B H/X M4-14A H/X M4-14B			
	<b>SYSTEM BOUNDARIES:</b> TBSCCW Pumps and Heat exchangers including AC Power (up to but not including Buses 14E & F), DC Control Power (up to but not including buses 101A & 101B), and Service Water Cooling (only those portions which are dedicated solely to providing cooling to the TBSCCW H/X). Component Coolers are modeled separately within the system which they support.		
	<b>ADDITIONAL ASSUMPTIONS:</b> The two pumps are rotated on a regular basis such that each pump has an equal chance of being on line at a given time.		

PLANT: MP-1 SYSTEM:RBCCW	SUCCESS CRITERIA		
	INITIATOR	FUNCTIONAL REQUIREMENTS	OPERATOR ACTION
<b>KEY COMPONENTS:</b> Pump M4-10A Pump M4-10B H/X M4-9A H/X M4-9B H/X M4-9C Valve RC-39	All transients/trips/LOCAs except LNP, Station Blackout, or Loss of RBCCW	1 of 2 Pumps running with 2 of 3 Heat Exchangers in Service cooling 1 of 2 SDC Heat Exchangers	Open Valve RC-39 to provide cooling to SDC Heat Exchangers
	Loss of Normal Power or Station Blackout	1 of 2 Pumps running with 2 of 3 Heat Exchangers in Service cooling 1 of 2 SDC Heat Exchangers	Open Valve RC-39 and start 1 RBCCW pump
	Loss of RBCCW	Assumed Failed	None
<b>SYSTEM BOUNDARIES:</b> RBCCW Pumps (including AC and DC Power up to but not including Buses 14E & F and 101A & B), Heat Exchangers (including portion of Service Water System used solely for RBCCW), and Valve RC-39.			
<b>ADDITIONAL ASSUMPTIONS:</b> Both RBCCW pumps receive a trip signal on an LNP without autostart. The RBCCW System is normally operating with either pump A or B running and 2 of 3 Heat Exchangers on-line. The only system cooled by RBCCW which is important for mitigating accidents is the Shutdown Cooling System. There are no regularly scheduled tests or maintenance activities for the RBCCW System but the pumps are rotated at least monthly.			

<b>PLANT: MP-1</b> <b>SYSTEM: RPS</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
<b>KEY COMPONENTS:</b> Control Rods Scram Pilot Valves Scram Dump Valves Backup Scram Valves ATWS Valves Scram Accumulators Scram Outlet Valves Scram Inlet Valves Scram Discharge Volume CRD Pumps RPS Logic and Sensors RPS MG Sets	All transients/LOCAs except Reactor Trip	Failure of 5 adjacent control rods to insert causes failure to scram	Backup with manual scram
	Reactor Trip	Assumed to be successful	Not applicable
<b>SYSTEM BOUNDARIES:</b> RPS Panels including sensors for: APRM Flow Biased High Flux; IRM High Flux; Scram discharge Volume High Level; Reactor Low Water Level; Reactor High Pressure; Drywell High Pressure; Main Steam Line High Radiation; MSIV Closure; Turbine Condenser Low Vacuum; Turbine Stop Valve Closure; Turbine Control Valve Fast Closure. Also included is the control rod drive system including AC & DC Power (up to but not including Buses 14E & F and 101A & B).			
<b>ADDITIONAL ASSUMPTIONS:</b> The MP1 RPS is a Typical BWR RPS.			

<b>PLANT: MP-1</b> <b>SYSTEM:</b> <b>DRYWELL</b> <b>COOLERS</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
	All transients/trips/LOCAs	1 Cooler Functional	None Credited
<b>KEY COMPONENTS:</b> Cooler HVH-18 Cooler HVH-19 Cooler HVH-20 Cooler HVH-21 Cooler HVH-22 Cooler HVH-26 Cooler HVH-27 Cooler HVH-28			
<b>SYSTEM BOUNDARIES:</b>			
Coolers including RBCCW Cooling (that portion dedicated solely to drywell coolers) and trip and lockout logic including sensors (up to but not including 120V Semi-Vital AC)			
<b>ADDITIONAL ASSUMPTIONS:</b>			
Drywell Coolers not used directly in mitigating an accident. The Coolers Trip on High Drywell Pressure or Low Reactor Water Level.			

PLANT: MP-1 SYSTEM: S/RVs	SUCCESS CRITERIA		
	INITIATOR	FUNCTIONAL REQUIREMENTS	OPERATOR ACTION
KEY COMPONENTS: 6 S/RVs	All transients/trips/LOCAs except Inadvertent Opening of a S/RV	All 6 S/RVs successfully reclose after opening	None Required
	Inadvertent Opening of a S/RV	Not Applicable - 1 S/RV assumed to fail open	None Required
<b>SYSTEM BOUNDARIES:</b> S/RVs (Safety Function)			
<b>ADDITIONAL ASSUMPTIONS:</b> All 6 S/RVs open initially following an isolation event due to high decay heat levels. Subsequent cycling of S/RVs involve only the two S/RVs with the lowest pressure setpoints. In the long term the time between challenges will start to increase as the core decay heat decreases.			

<b>PLANT: MP-1</b> <b>SYSTEM:</b> Vapor Suppression System	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
<b>KEY COMPONENTS:</b> 8 Vent Pipes 96 Downcomer Pipes 10 Vacuum Breaker Check Valves	All transients/trips except LOCAs	Not Applicable	Not Applicable
	All LOCAs	All Vacuum Breakers closed: 1 Vacuum Breaker re-opens to relieve excessive drywell vacuum	Not Applicable
<b>SYSTEM BOUNDARIES:</b> Vacuum Breakers, Vent Pipes, and Downcomers including Vacuum Breaker seat alarms.			
<b>ADDITIONAL ASSUMPTIONS:</b> All Vacuum Breakers must close following a LOCA even though 1 may be open for a large break without failing containment. A 1 psig differential pressure is maintained between the Drywell and the Torus during normal operations.			

PLANT: MP-1 SYSTEM: Feedwater/FWCI	SUCCESS CRITERIA		
	INITIATOR	FUNCTIONAL REQUIREMENTS	OPERATOR ACTION
<b>KEY COMPONENTS:</b> Rx Feed Pump 10A Rx Feed Pump 10B Rx Feed Pump 10C Cond Booster Pump 7A Cond Booster Pump 7B Cond Booster Pump 7C Cond Pump 6A Cond Pump 6B Cond Pump 6C Feed Reg Valve 5A Feed Reg Valve 5B Feed Reg Valve 5C Cond Hot Well Emergency Cond Transfer Pump 96A MOV MW-96A Cond Storage Tank	Reactor Transients, Loss of RBCCW, LNP	1 Feedwater Train (1 Feed Reg Valve, 1 Rx Feed Pump, 1 Cond Booster Pump, and 1 Cond Pump)	If necessary restore FW within 20 minutes
	Loss of Feedwater	1 Feedwater Train (See above) Restored	Restore one FW train within 20 minutes
	Inadvertent Opening of a S/RV	1 Feedwater Train (1 Feed Reg Valve, 1 Rx Feed Pump, 1 Cond Booster Pump, and 1 Cond Pump)	If necessary restore FW within 20 minutes
	Small Break LOCA	1 Feedwater Train (1 Feed Reg Valve, 1 Rx Feed Pump, 1 Cond Booster Pump, and 1 Cond Pump)	None for FW
	ATWS	1 Feedwater Train (1 Feed Reg Valve, 1 Rx Feed Pump, 1 Cond Booster Pump, and 1 Cond Pump)	None for FW
	Small Small LOCA	1 Feedwater Train (1 Feed Reg Valve, 1 Rx Feed Pump, 1 Cond Booster Pump, and 1 Cond Pump)	If necessary restore FW within 20 minutes and start ECT Pump
	<b>SYSTEM BOUNDARIES:</b> Feedwater Reg Valves, FW Pumps, Cond Booster Pumps, Cond Pumps, Condenser Hotwells, ECT Pump, and Cond Transfer Pump including AC & DC Power (up to but not including Buses 14E, 14F, & 14G and 101A & 101B) and FWCI start and select logic.		
<b>ADDITIONAL ASSUMPTIONS:</b> Except for an LNP, Feedwater continues to operate post trip. Normal Feedwater is only available when normal AC Power is available from the NSST or the RSST. FWCI operates when normal AC Power is unavailable and emergency power is being supplied from the gas turbine. FWCI initiation logic provides restart of 1 train of FWCI. The non-selected FW train provides manual backup for FWCI Only the high drywell pressure signal to the FWCI logic is tested during refueling.			

<b>PLANT: MP-1</b> <b>SYSTEM:</b> <b>Main Condenser</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
<b>KEY COMPONENTS:</b> Main Condenser Turbine Bypass Valves MSIVs MSIV Bypass Valves Circulating Water Pumps Mechanical Vacuum Pump	Reactor Trips, Loss of RBCCW, Small Small LOCA, LNP, IOSRV Small & Large Loss of Feedwater	1 Circulating Pump, 1 set of Turbine Bypass Valves open, and 1 set of MSIVs or MSIV Bypass Valves Open  Not applicable - main condenser assumed failed	If necessary, restore main condenser within 4 hours  Not applicable
<b>SYSTEM BOUNDARIES:</b> Circulating Pumps, Condenser, Turbine Bypass Valves, MSIVs and MSIV Bypass Valves including AC and DC Power (up to but not including Buses 14E, 14F, & 14C and 101A & 101B).			
<b>ADDITIONAL ASSUMPTIONS:</b> The main condenser is the preferred decay heat removal system following a scram. Only 1 Circulating pump is required to provide cooling following a reactor scram. When all normal electric power is unavailable, the main condenser is considered available only if Feedwater is running (implies power to bus 14C).			

<b>PLANT: MP-1</b> <b>SYSTEM:</b> <b>ISOLATION</b> <b>CONDENSER</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
<b>KEY COMPONENTS:</b>  MOV 1-IC-1 MOV 1-IC-2 MOV 1-IC-3 Isolation Condenser	All transients/trips except LOCAs and Loss of 120V Vital AC	IC initiated within 20 minutes of trip and 1 S/RV opened periodically	Manually initiate the IC either from the control room or locally: Open 1 S/RV to vent non-condensable gases
	LOCAs and Loss of 120V Vital AC	IC not credited	Not Applicable
<b>SYSTEM BOUNDARIES:</b>			
Isolation Condenser including the steam inlet line and return line from 1-IC-1 to 1-IC-4 and the IC initiation logic (includes DC Power up to but not including buses 101A & 101B).			
<b>ADDITIONAL ASSUMPTIONS:</b>			
1 S/RV must be opened several hours after IC initiation to vent non-condensable gases.			

<b>PLANT: MP-1</b> <b>SYSTEM:</b> <b>IC MAKEUP</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
	All transients/trips except LOCAs and Loss of 120V Vital AC	Open MOV 1-IC-10 and FIRE-48 to allow flow to IC	Manually open 1-IC-10 if required
<b>KEY COMPONENTS:</b> MOV 1-IC-10 MOV 1-FIRE-48	LOCAs and Loss of 120V Vital AC	Not Applicable	Not Applicable
<b>SYSTEM BOUNDARIES:</b> Valves FIRE-47 and MW-59 to the IC including DC Power (up to but not including bus 101A).			
<b>ADDITIONAL ASSUMPTIONS:</b> The Fire Water System is the normal source of makeup to the IC as the condensate water is slightly radioactive and would result in a mild release to the environment if used.			

<b>PLANT: MP-1</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
<b>SYSTEM: FIRE PROTECTION SYSTEM</b>	All transients/trips except LOCAs and Loss of 120V Vital AC	1 of 3 Pumps providing IC makeup water	Manually start 1 pump if required
<b>KEY COMPONENTS:</b>	LOCAs and Loss of 120V Vital AC	Not Applicable	Not Applicable
Fire Water Storage Tank M7-6A			
Fire Water Storage Tank M7-6B			
Fire Pump M7-8			
Fire Pump M7-7			
Fire Pump P-82			
<b>SYSTEM BOUNDARIES:</b> Fire Water Storage Tanks to Valve 1-FIRE-47 including AC and DC Power (up to but not including Buses 14E and 101B).			
<b>ADDITIONAL ASSUMPTIONS:</b> The following valves are assumed to be normally closed: 1-FIRE-18B, 1-FIRE-18A, 2-FIRE-66, and 2-FIRE-64. Normal Power to the Unit 2 motor-driven pump is assumed to be available following any MP1 transient/trip.			

<b>PLANT: MP-1</b> <b>SYSTEM:</b> <b>ECCS</b> <b>ACTUATION</b> <b>LOGIC</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
<b>KEY COMPONENTS:</b> High Drywell Pressure Sensors Low-Low Reactor Water Level Sensors Control Relays	Large and Small LOCAs	Actuation signal to Core Spray, IC, LPCI, and FWCI Systems	None
	All other transients/trips and small small LOCAs	Not Credited	None
<b>SYSTEM BOUNDARIES:</b> Sensors to Actuation Relay Contact Pairs including control power (up to but not including buses 101A & 101B)			
<b>ADDITIONAL ASSUMPTIONS:</b> It was assumed that 3 sensors must function to generate a signal. This is somewhat conservative but it greatly simplifies the analysis without sacrificing system availability			

**PLANT: MP-1**  
**SYSTEM:**  
**LOW PRESSURE PERMISSIVE LOGIC**

**KEY COMPONENTS:**  
 Pressure Switches  
 2205/263-52A,  
 2206/263-52B,  
 2251/263-52C,  
 2252/263-52D  
 LPP Control  
 Relays

<b>SUCCESS CRITERIA</b>		
<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
All transients/trips/LOCAs	Closure of switches 52A or 52B AND 52C or 52D with associated control relays energized	None
<p><b>SYSTEM BOUNDARIES:</b>            Pressure switches to relay contacts for the LPCI and LPCS admission valves.</p>		
<p><b>ADDITIONAL ASSUMPTIONS:</b>            DC control power for logic is modelled as part of the LPCI and LPCS Systems.</p>		

<b>PLANT: MP-1</b> <b>SYSTEM:</b> <b>AUTOMATIC</b> <b>DEPRESSURIZATION</b> <b>SYSTEM</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
<b>KEY COMPONENTS:</b> 6 S/RVS Actuation Logic	All transients/LOCAs except inadvertent opening of a S/RV	Opening of 2 S/RVs	Manually Open 2 of 6 S/RVs if required
	Inadvertent Opening of a S/RV	Opening of 1 additional S/RV	Manually Open 2 of 6 S/RVs if required
<b>SYSTEM BOUNDARIES:</b> 6 S/Rvs including air lines and actuation logic (DC Power up to but not including Buses 101A & B)			
<b>ADDITIONAL ASSUMPTIONS:</b> Sufficient nitrogen is stored in the redundant emergency accumulators for several valve cycling operations. Therefore, the ADS is considered independent of AC Power.			

<b>PLANT: MP-1</b> <b>SYSTEM:</b> <b>LOW PRESSURE</b> <b>CORE SPRAY</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
<b>KEY COMPONENTS:</b> Pump CS-A Pump CS-B MOV 1-CS-5A MOV 1-CS-5B	All transients/trips and Small Small LOCAs	1 of 2 LPCS pumps running and associated injection valve open within 20 minutes	Manually start 1 pump within 20 minutes if required
	Large Break LOCAs	Autostart of 1 of 2 LPCS pumps and associated injection valve open	None
	Small Break LOCAs	1 of 2 LPCS pumps running and associated injection valve open within 2 minutes after FW is terminated	Manually start 1 pump within 2 minutes of FW termination if required
<b>SYSTEM BOUNDARIES:</b> LPCS Pumps and injection valves including AC and DC Power (up to but not including buses 14E & 14F and 101A & 101B). Low Pressure permissive Logic is modeled separately.			
<b>ADDITIONAL ASSUMPTIONS:</b> LPCS pumps tested on a staggered test interval. 1 LPCS Pump is sufficient for Reactor Vessel Makeup to mitigate the consequences of all transients/LOCAs.			

PLANT: MP-1 SYSTEM: LOW PRESSURE COOLANT INJECTION	SUCCESS CRITERIA		
	INITIATOR	FUNCTIONAL REQUIREMENTS	OPERATOR ACTION
KEY COMPONENTS: Pump 1502A Pump 1502B Pump 1502C Pump 1502D MOV 1-LP-10A MOV 1-LP-10B MOV 1-LP-9A MOV 1-LP-9B MOV 1-LP-8A Loop Selection Logic	All transients/trips and Small Small LOCAs	1 of 4 LPCI pumps running and associated injection valve open within 20 minutes	Manually start 1 pump within 20 minutes if required
	Large Break LOCAs	Autostart of 1 of 4 LPCI pumps and associated injection valve open	None
	Small Break LOCAs	1 of 4 LPCI pumps running and associated injection valve open within 2 minutes after FW is terminated	Manually start 1 pump within 2 minutes of FW termination if required
<b>SYSTEM BOUNDARIES:</b> LPCI Pumps and injection valves including AC and DC Power (up to but not including buses 14E & 14F and 101A & 101B) and Loop Selection Logic. Low Pressure permissive Logic is modeled separately.			
<b>ADDITIONAL ASSUMPTIONS:</b> LPCI pumps tested on a staggered test interval. 1 LPCI Pump is sufficient for Reactor Vessel Makeup to mitigate the consequences of all transients/LOCAs.			

<b>PLANT: MP-1</b> <b>SYSTEM:</b> <b>RECIRCULATION PUMP TRIP</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
	All ATWS events	Trip of both Recirculation Pumps	Manual trip of both Recirculation Pump Motor Generator Output Breakers
<b>KEY COMPONENTS:</b> Recirc Pump Circuit Breakers ATWS Panel Auto Recirc Pump Trip Signal			
	<b>SYSTEM BOUNDARIES:</b> Recirculation Pump Motor-Generator Output Breakers and ATWS panel automatic trip on low-low reactor water level and/or high reactor pressure including DC Power (up to but not including Buses 101A & 101B).		
	<b>ADDITIONAL ASSUMPTIONS:</b> Recirculation Pump Trip is only required for transients/LOCAs with failure to Scram.		

**PLANT: MP-1**  
**SYSTEM:**  
**STANDBY LIQUID**  
**CONTROL SYSTEM**

**KEY COMPONENTS:**  
 Standby Liquid  
 Control Tank  
 Standby Liquid  
 Control Pumps  
 Explosive Valves  
 5A & 5B  
 MOV 1-CU-2  
 MOV 1-CU-3

<b>SUCCESS CRITERIA</b>		
<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
All ATWS events	1 SLCS Pump with 1 open injection valve and the RWCU System Isolated	Manually start pumps, open injection valves, and isolate RWCU System
<p><b>SYSTEM BOUNDARIES:</b>            SLCS Tank thru injection valves and RWCU Isolation Valves including AC and DC Power (up to but not including Buses 14E &amp; 14F and 101A &amp; 101B).</p>		
<p><b>ADDITIONAL ASSUMPTIONS:</b>            SLCS is only successful if the Recirculation Pumps have been Tripped.</p>		

<b>PLANT: MP-1</b> <b>SYSTEM:</b> <b>SHUTDOWN COOLING SYSTEM</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
<b>KEY COMPONENTS:</b> SDC PUMP A SDC PUMP B SDC H/X A SDC H/X B RBCCW SYSTEM MOV 1-SD-1 MOV 1-SD-2A MOV 1-SD-2B MOV 1-SD-4A MOV 1-SD-4B MOV 1-SD-5	All Transients/trips except small and large break LOCA	1 SDC Pump, 1 SDC H/X, 1 RBCCW Pump and 2 RBCCW H/Xs	Manually star SDC System within 4 hours of event
	Small and Large Break LOCA	Not Credited	Not Applicable
<b>SYSTEM BOUNDARIES:</b>			
SDC Pumps, Heat Exchangers, and admission valves and RBCCW Cooling to the SDC Heat Exchangers including AC and DC Power (up to but not including Buses 14E & 14F and 101A & 101B).			
<b>ADDITIONAL ASSUMPTIONS:</b>			
The SDC System is designed for 1250 psig to guard against system rupture in the event that reactor coolant enters the system while the reactor is at power. If fuel damage has occurred, the SDC System is considered inoperable due to high radiation levels in the Reactor Building which prevents local operations to initiate the System. One SDC loop is sufficient to cool the reactor although it will not be cooled to 125 F within 24 hours. Although not a "Safety Grade" System, the SDCS is important for long term core cooling.			

PLANT: MP-1 SYSTEM: ALTERNATE SHUTDOWN COOLING /CONTAINMENT COOLING SYSTEM	SUCCESS CRITERIA		
	INITIATOR	FUNCTIONAL REQUIREMENTS	OPERATOR ACTION
KEY COMPONENTS: A LPCI Pump B LPCI Pump C LPCI Pump D LPCI Pump LPCI H/X A LPCI H/X B MOV 1-LP-7A MOV 1-LP-7B ESW System	All transients/trips/LOCAs except LNP and Inadvertent Opening of a S/RV	1 LPCI H/X with ESW flow, 1 LPCI Pump per H/X, 1 open S/R	Manually initiate system within 4 hours and throttle flow from LPCI pumps as require to maintain NPSH
	LNP	1 LPCI H/X with ESW flow, 1 LPCI Pump per H/X, 1 open S/R	If IC available, throttle LPCI flow. If IC unavailable, add water to torus to maintain NPSH
	Inadvertent Opening of a S/RV	1 LPCI H/X with ESW flow, 1 LPCI Pump per H/X, 1 open S/R	If IC available, throttle LPCI flow. If IC unavailable, add water to torus to maintain NPSH
<b>SYSTEM BOUNDARIES:</b>			
LPCI Pumps, LPCI Heat Exchangers, and ESW System including AC and DC Power (up to but not including Buses 14E & 14F and 101A & 101B).			
<b>ADDITIONAL ASSUMPTIONS:</b>			
As no procedure exists explicitly instructing the operator to add water to the torus, it was assumed that for LNP and IOSRV events that if the IC was unavailable, ASDC was unavailable. Since issuance of Rev 2 of the MP1 PSS, additional analysis has shown that 1 LPCI pump is sufficient for the LNP case and that 2 LPCI pumps per heat exchanger are sufficient for the IOSRV case without adding water to the torus. This is based on information from GE that the LPCI pumps are expected to be able to operate with only 80% of NPSH Required for several hours.			

<b>PLANT: MP-1</b> <b>SYSTEM:</b> <b>EMERGENCY SERVICE WATER SYSTEM</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
<b>KEY COMPONENTS:</b> ESW Pump A ESW Pump B ESW Pump C ESW Pump D ESW Strainer A ESW Strainer B 120V Instrument AC MOV 1-ES-4A MOV 1-ES-4B	All transients/trip/LOCAs	2 ESW Pumps providing flow to 1 LPCI Heat Exchanger	Manually start pumps
<b>SYSTEM BOUNDARIES:</b> ESW Pumps and Strainers including AC and DC Power (up to but not including Buses 14E & 14F and 101A & 101B). Also includes the 120V Instrument AC System.			
<b>ADDITIONAL ASSUMPTIONS:</b> Failure to maintain a differential pressure between the ESW and LPCI Systems results in failure of the ESW System.			

<b>PLANT: MP-1</b> <b>SYSTEM:</b> <b>MP1 - MP2 AC</b> <b>POWER</b> <b>CROSS-TIE</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
<b>KEY COMPONENTS:</b> D/G 15G-12U D/G 15G-13U MP2 SW Pump P-5C MP2 SW Pump P-5A 4.16KV Bus 24C 4.16KV Bus 24D 4.16KV Bus 24E 4.16KV Bus 24F 4.16KV Bus 14C 4.16KV Bus 14D 4.16KV Bus 14E 4.16KV Bus 14F	LNP, Station Blackout, and Inadvertent Opening of a S/RV	2 of 2 MP2 D/Gs running with 1 X-tied to 1 MP1 Emergency Bus	Manually X-tie AC Buses
	All other transients/trips/LOCAs	Not Applicable	Not Applicable
<b>SYSTEM BOUNDARIES:</b> MP2 Emergency AC Power including D/Gs, DC Power, Service Water Cooling, and LNP Logic. MP1 - MP2 X-Tie Buses and Circuit Breakers (up to but not including Buses 101A & 101B and including Buses 201A & 201B).			
<b>ADDITIONAL ASSUMPTIONS:</b> It was assumed that the X-Tie would only be used if both of the MP2 D/Gs were available. It was assumed that all LNPs at MP1 resulted in an LNP at MP2			

<b>PLANT: MP-1</b> <b>SYSTEM:</b> <b>REACTOR WATER</b> <b>CLEANUP</b> <b>SYSTEM</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
<b>KEY COMPONENTS:</b> AOV 1-CU-10 RELIEF VALVE 1-CU-68 MOV 1-CU-2 MOV 1-CU-3 CHECK VALVE 1-CU-27 MOV 1-CU-28	Spurious opening or failure of 1-CU-10	Relief Valve 1-CU-68 opens or MOV 1-CU-2 or 1-CU-3 Close	Manually close Valves 1-CU-2, 1-CU-3 and 1-CU-28 if required
	Break in RWCU Piping in Reactor Building	MOVs 1-CU-2 (or 3) and Valves 1-CU-27 (or 28) close	Manually close Valves 1-CU-2, 1-CU-3 and 1-CU-28 if required
	All other transients/LOCAs/Trips	MOVs 1-CU-2 (or 3) and Valves 1-CU-27 (or 28) close on low-low Reactor Vessel Level	Manually close Valves 1-CU-2, 1-CU-3 and 1-CU-28 if required
<b>SYSTEM BOUNDARIES:</b>			
Valves 1-CU-2 and 1-CU-27 to Relief Valve 1-CU-68 including AC and DC Power (up to but not including buses 14E & 14F and 101A & 101B).			
<b>ADDITIONAL ASSUMPTIONS:</b>			
MOVs 1-CU-2, 1-CU-3 and 1-CU-28 are not qualified for an adverse environment and are thus assumed to have a large probability of failure if exposed to a steam environment following a LOCA. Check Valve 1-CU-27 is assumed to be never tested.			

<b>PLANT: MP-1</b> <b>SYSTEM:</b> <b>FIRE DETECTION AND SUPPRESSION SYSTEM</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
	All Fires	Detection/Suppression System suppresses fire before extensive equipment damage occurs	Detect and suppress fire as required
<b>KEY COMPONENTS:</b> Fire Detection/Suppression Systems for the Following Areas: Control Room Cable Vault Mezzanine Feedwater Area Switchgear Area Reactor Building Diesel Generator Room Gas Turbine Generator Building			
	<b>SYSTEM BOUNDARIES:</b> All Fire Detection and Suppression Systems, including automatically initiated, manually initiated, and portable fire extinguishers in the areas listed.		
	<b>ADDITIONAL ASSUMPTIONS:</b> <b>GENERAL</b> Damage caused by fires to MOV control circuits causes a spurious operation of the Valve which defeats the intended system function. Fires which cause a failure of the RPS result in a Reactor Trip. Early warning of a fire can only be accomplished within 5 minutes by area smoke detectors.		

## ADDITIONAL FIRE ASSUMPTIONS

### GENERAL (Continued)

Fires without early suppression are assumed to grow for 15 minutes until eutectic heat sensing wires or control room alarms from an induced transient event alert the operator.

Suppression with manual hose stations or automatic sprinkler systems implies that the affected equipment is irretrievably lost and multiple power/control cables damaged.

For fires that are not successfully extinguished, propagation to all unprotected cables within the area is assumed.

All fire detection/suppression systems are assumed to be available 100% of the time.

### DIESEL GENERATOR ROOM (Zone T-7)

No fires will propagate to adjacent areas.

Any fire in the D/G Room results in the loss of the D/G although a transient is not induced.

### GAS TURBINE GENERATOR BUILDING

No fires will propagate to adjacent areas.

Any fire in the GTG Room results in the loss of the GTG although a transient is not induced.

### CONTROL ROOM (Zone T-21)

Early discovery of a fire within 3 minutes is credited as this area is continuously occupied by trained operators.

If a fire in a panel is suppressed within 3 minutes, only minimal damage is assumed.

Fire spreading between panel rows is only possible as the result of gross human error.

Credited detection/suppression systems include: early warning smoke detectors, automatic Halon system, one 20 lb. and two 10 lb. CO2 portable extinguishers, and two 17 lb. Halon portable extinguishers.

No credit is given for the hose station since water would probably cause as much damage as the fire.

### CABLE VAULT (Zone T-16)

Fires detected early and suppressed by portable extinguishers cause only minimal damage.

If smoke detectors or portable extinguishers fail, the fire is assumed to burn long enough to damage cables in one tray prior to detection by eutectic heat sensing wires or operators.

## ADDITIONAL FIRE ASSUMPTIONS (Continued)

### CABLE VAULT (Continued)

If the fire is suppressed in one hour, damage would be confined to one tray.

Beyond this time, cables in other vertical trays could be damaged.

An unextinguished fire could propagate and eventually damage all cables in the room, including those in conduits.

Credited detection/suppression systems include: ionization detectors, heat sensing wire in cable trays, Halon suppression System, portable extinguishers, and hose stations.

### MEZZANINE (Zone T-17)

Credited detection/suppression systems include: ionization detectors, portable extinguishers, hose station, and automatic sprinklers.

If a fire is detected early, only minimal damage is incurred.

If fire is suppressed by use of the hose station or automatic sprinklers, damage would consist of a loss of feedwater control or reactor trip with a possible loss of either the S1 or S2 power trains.

If smoke detectors fail only the automatic sprinkler is credited for early suppression.

Failure to extinguish the fire results in a loss of both S1 and S2 control power in the Control Room.

### FEEDWATER AREA

Credited detection/suppression systems include: ionization detectors, eutectic heat sensing wires in cable trays, portable extinguishers, automatic sprinkle/deluge systems, and hose stations throughout the area.

#### Zone T-5A

Given a fire in any single condensate or condensate booster pump, it is assumed that a reactor trip would occur on low vessel level with subsequent MSIV closure.

#### Zone T-5B

If a fire causes a loss of a single feedwater pump a reactor trip with MSIV closure is postulated.

More severe fires which cause the loss of 2 or more pumps also result in a total loss of feedwater with the possible loss of S1 power.

An unmitigated fire causes all of the above plus a total loss of service water and emergency service water.

## ADDITIONAL FIRE ASSUMPTIONS (Continued)

### FEEDWATER AREA (Continued)

#### Zone T-5C

For fires in cables or components which are suppressed early, a reactor trip is assumed with minimal equipment damage.

Fires which are not suppressed early cause a total loss of feedwater with possible loss of the S1 power train.

Unmitigated fires are assumed to cause the equivalent of a station blackout because of damage to vital equipment.

### SWITCHGEAR AREA

Credited detection/suppression systems include: ionization detectors, eutectic heat sensing wires located adjacent to cable trays and near vents of each major switchgear cabinet, both CO<sub>2</sub> and dry chemical portable extinguishers, and hose stations.

If a fire propagates between two adjacent zones, all safety related functions are lost.

#### Zone T-19A

Cable fires could cause a reactor trip or loss of feedwater with a loss of emergency power.

#### Zone T-19B

A loss of either bus 14F or 12F would cause loss of most of the normal drywell cooling and hence a reactor trip.

Cable fires could result in a reactor trip and loss of S1 control power.

#### Zone T-19C

A fire in bus 14A or 14C causes a loss of feedwater.

A fire in bus 14C causes a loss of S2 control power.

#### Zone T-19D

A fire in bus 14B or 14D causes a reactor trip.

A fire in bus 14D causes a loss of bus 14F.

Cable fires in S2 control power circuits cause a reactor trip with loss of S2 control power.

## ADDITIONAL FIRE ASSUMPTIONS (Continued)

### SWITCHGEAR AREA (Continued)

#### Zone T-19E

A fire in one bus or charger would not induce a transient.

A fire in the S2 control cables would cause a reactor trip with loss of S2 control power.

### REACTOR BUILDING

#### Zones R-2A, R-2B, and R-2C

A non-propagating fire would not cause a transient if it were detected early and suppressed.

A fire in Zone R-2A would cause a reactor trip following suppression by hose stations as the CRD hydraulic control units are located in this area. If a fire in a cable tray is not immediately suppressed, any of the following could occur: reactor trip, MSIV closure, or a stuck open relief valve.

Unsuppressed fires are assumed to propagate throughout all Zones resulting in a core melt.

Credited detection/suppression systems include: ionization detectors, heat detectors in all MCCs, portable extinguishers, hose stations, and individual sprinkler systems over all of the cable trays.

#### Zone R-2D

A component fire that is successfully extinguished always results in a reactor trip.

A fire in MCC F-3 causes a loss of the S2 train ECCS function.

Credited detection/suppression systems include the same as for Zones R-2A thru R-2C with the exception of not having installed sprinkler systems over the cable trays.

#### Zone R-19

A fire in the running RBCCW pump is assumed to fail both pumps causing a reactor trip.

A fire in MCC DC 101AB-2 causes the loss of remote opening capability of IC-3 but no transient is induced.

Credited detection/suppression systems include: ionization detectors, heat rate-of-rise detectors at each MG lube oil location providing automatic initiation of the deluge system, portable fire extinguishers, and a sprinkler system that is independent of the deluge system installed over the MG sets.

Appendix B  
Millstone Unit 2:  
Systems And Assumptions

(To be Completed)

Appendix C  
Millstone Unit 3:  
Systems And Assumptions

UNCONTROLLED  
COPY  
COPY

## MP3 Systems and Assumptions Table of Contents

AC Power.....	1
DC Power.....	2
120V Vital AC Power .....	3
Reactor Protection.....	4
Engineered Safety Features Actuation.....	5
Emergency Generator Load Sequencer.....	6
Auxiliary Feedwater.....	7
Main Feedwater.....	8
Main Steam Isolation.....	9
High Pressure Safety Injection.....	10
Low Pressure Safety Injection.....	11
Accumulators.....	12
High/Low Pressure Recirculation.....	13
Charging Pump Cooling.....	14
Safety Injection Pump Cooling.....	15
Containment Recirculation Spray.....	16
Quench Spray.....	17
Service Water.....	18
Turbine Trip.....	19
Primary Pressure Relief.....	20

# MP3 Systems and Assumptions Table of Contents

RPCCW.....	21
TPCCW.....	21
Instrument Air.....	22
Containment Isolation.....	22
Fire Protection.....	23
Seismic.....	29
Interfacing Systems LOCA Valving.....	31

<b>PLANT: MP-3</b> <b>SYSTEM:</b> <b>AC POWER</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
	All Transients/Trips/LOCAs except LOSP and Station Blackout	4160V AC Power Supplied to Bus 34C or 34D (Both preferred)	Recovery of Offsite Power within 30 minutes
<b>KEY COMPONENTS:</b>  Emergency Diesel Generators  4160V AC Bus 34C 4160V AC Bus 34D  NSST  RSST	Loss of Offsite Power	4160V AC Power Supplied to Bus 34C or 34D (Both preferred)	Recovery of Offsite Power within 30 minutes
	Station Blackout	4160V AC Power restored Bus 34C or 34D	Recovery of Offsite Power within 60 mins., 120 mins., or 6 hours
	<b>SYSTEM BOUNDARIES:</b> Power Supplies (NSST, RSST, DGs) to 4160V AC Buses 34C and 34D including the load sequencer logic, DC control power, service water cooling to DGs and DG auxiliaries.		
	<b>ADDITIONAL ASSUMPTIONS:</b> Each of the Diesel Generators and its associated circuitry is tested monthly on a staggered basis.  Common cause plugging failure of the Diesel Generator heat exchangers due to mussel fouling is assumed to be negligible due to plant specific design features and procedures.  When Offsite Power is available, the probability of random equipment failures in electrical equipment is negligible compared to losing offsite power over the same interval. Therefore, electric power states with offsite power available but only Bus 34C or 34D or neither available were not considered further in PSS.  Service Water Cooling supply to Diesel Generators is assumed available if supply to service water header is available.		

<b>PLANT: MP-3</b> <b>SYSTEM:</b> <b>VITAL DC POWER</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
	All Transients/Trips LOCAs except Loss of a Single DC Bus or Total Loss of DC	125V DC power to Bus 125-VDC-1 or 2 (both buses preferred)	
<b>KEY COMPONENTS:</b>  DC Buses 125-VDC-1 to 4  4 Safety Related Batteries and Battery Chargers	Loss of Single Vital DC Bus (125-VDC-1 or -2)	1 DC Bus assumed unavailable, DC Power supplied to other buses	
	Total Loss of Vital DC Power	NA - Assumed to be Failed	
	Station Blackout	125V DC Power on Bus 125-VDC-1 or 2 for the duration of the Blackout	
	<b>SYSTEM BOUNDARIES:</b>  Battery, Battery Charger, DC Bus		
	<b>ADDITIONAL ASSUMPTIONS:</b>  The design of Vital DC Buses 125-VDC-1 and 125-VDC-2 are symmetric and that the mechanically interlocked swing (or standby charger) has not been credited as it is disconnected the majority of the time.  Failures of DC Buses 125-VDC-3 or 4 were found to result in minimal disruption to plant operation provided that AC power is available.  The Station Batteries are depleted in 6 hours.		

<b>PLANT: MP-3</b> <b>SYSTEM:</b> <b>120 VITAL AC</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
	All Transients/Trips/LOCAs except Loss of a Single Vital AC Bus	120V AC supplied by either normal or alternate supplies	None
<b>KEY COMPONENTS:</b>  Vital AC Buses VIAC-1 VIAC-2 VIAC-3 VIAC-4  Inverters INV-1 INV-2 INV-3 INV-4	Loss of a Single Vital AC Bus	1 Vital AC Bus assumed unavailable, 120V AC supplied to other buses by either normal or alternate supplies	None
	<b>SYSTEM BOUNDARIES:</b> AC and DC Power Supplies (up to but not including Buses 34C and 34D) to 120V Vital AC Buses		
	<b>ADDITIONAL ASSUMPTIONS:</b> Loss of any single Vital AC Bus will result in a Loss of Feedwater Transient and a resultant reactor trip.  Each 120V AC vital bus can receive power from any one of three separate and diverse sources.  The 120V AC Vital Power System has no tests requiring components to be out of service during normal power operation.  No scheduled maintenance on the Vital AC System during normal plant operation. All maintenance is performed during the refueling outage.		

PLANT: MP-3 SYSTEM: REACTOR PROTECTION	SUCCESS CRITERIA		
	INITIATOR	FUNCTIONAL REQUIREMENTS	OPERATOR ACTION
	All Transients, Small LOCA except Reactor Trip	Generation of reactor trip signal and insertion of reactor control rods.	None
KEY COMPONENTS:	Reactor Trip	insertion of reactor control rods.	None
Control Rods and Drives	Anticipated Transients Without Scram	Operator initiated reactor trip with insertion of reactor control rods within one minute upon failure of automatic trip signal.	Manually initiate a reactor trip.
RPS Logic and Sensors			
MG Sets			
<b>SYSTEM BOUNDARIES:</b>  Electrical and mechanical portions of RPS including RPS logic and sensors, control rods and drives and MG sets.			
<b>ADDITIONAL ASSUMPTIONS:</b>  Generic data used to evaluate MP3's RPS.			

PLANT: MP-3

SYSTEM:

**ENGINEERED  
SAFETY  
FEATURES  
ACTUATION**

**KEY COMPONENTS:**

Analog and Digital  
Circuitry

**SUCCESS CRITERIA**

**INITIATOR**

**FUNCTIONAL REQUIREMENTS**

**OPERATOR ACTION**

All Transients/Trips/  
LOCAs

ESF Actuation System transmits signals to  
the ESF components required for the accident

Manual Start of ESF systems by the  
Operator given failure of ESFAS

**SYSTEM BOUNDARIES:**

Analog portion of ESFAS circuitry consisting of 3 or 4 redundant channels per system parameter and a digital portion consisting of two redundant logic transmitters which process analog inputs (up to but not including logic related to an individual system). 120V Vital AC power supplies also included.

**ADDITIONAL ASSUMPTIONS:**

Since the ESF Actuation System has many outputs, it was determined that a model for the Safety Injection. Signal would adequately represent all of the other signals.

The ESF common sensor faults are modeled separately in each ESF system.

By design and administrative procedure, it is impossible to have both ESF trains simultaneously unavailable due to test.

During the bi-monthly test of each ESF actuation train, the digital portion is isolated in order to perform the test. The ESF actuation train being tested and all of its associated equipment are thus unavailable for test duration ~ 1/2 hour.

<b>PLANT: MP-3</b> <b>SYSTEM:</b> <b>EMERGENCY GENERATOR LOADING SEQUENCER</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
	All Transients/Trips/LOCAs	Provides actuation signals to shed loads, temporarily block manual equip. starts and eventually load ESF equip. on Buses 34C and D during emergency conditions.	Manual start, or loading of ESF systems by Operator given failure of EGLS.
<b>KEY COMPONENTS:</b>  2 EGLS Cabinets Solid State Logic Gates			
	<b>SYSTEM BOUNDARIES:</b>  Overall sequencing system comprising two EGLS cabinets (up to but not including the output relays). Each output relay and logic is modeled as part of the individual ESF systems they support. Power supply from 120V AC Vital Buses VIAC-3 and 4.		
	<b>ADDITIONAL ASSUMPTIONS:</b>  The sequencing system generates an identical signal for each of the redundant ESF equipment trains. Therefore, sequencing system failure is defined as loss of actuation signals from both EGLS cabinets.  Testing of the sequencer does not inhibit the accident signal.  Only two modes of sequencer operation were modeled - SIS only and SIS with LOP. These modes adequately represent all seven operating modes of the sequencer.		

PLANT: MP-3 SYSTEM: AUXILIARY FEEDWATER	SUCCESS CRITERIA		
	INITIATOR	FUNCTIONAL REQUIREMENTS	OPERATOR ACTION
	All Transients/Trips Small LOCA except SGTR, Steamline Breaks	1 of 3 AFW pumps providing flow to at least 2 of 4 steam generators	None Credited
KEY COMPONENTS:	SGTR, Steamline Breaks	Same as above except 2 of 3 unfaulted steam generators	None Credited
DWST	Station Blackout following Recovery of AC	1 of 2 motor driven AFW pumps providing flow to 2 of 4 steam generators	None Credited
AFW Pumps: 3FWA*P1A 3FWA*P1B 3FWA*P2			
Terry Turbine Steam Admission Valves 3MSS*AOV31A <i>ABO</i>			
<b>SYSTEM BOUNDARIES:</b> DWST to Auxiliary Feedwater Pumps to Steam Generators. Also including AC Power (up to but not including Buses 34C and D), DC Power (up to but not including Buses 125-VDC-1 and 2) and ESF/EGLS logic related only to AFW system.			
<b>ADDITIONAL ASSUMPTIONS:</b> All AFW pumps are tested on a monthly staggered basis.  Failure of steam supply to the turbine-driven pump was deemed not to be a credible failure event because both check valves in the steam supply line would have to fail and the operator would have to fail to isolate steam supply from the faulted SG.  Secondary cooling is required for success but failure is assumed to be negligible given the alternate methods - dumping steam to Main Condenser, if available or dumping steam through the steam generator PORVs or safety valves to the atmosphere.			

PLANT: MP-3 SYSTEM: MAIN FEEDWATER	SUCCESS CRITERIA		
	INITIATOR	FUNCTIONAL REQUIREMENTS	OPERATOR ACTION
KEY COMPONENTS:  Motor Driven Main Feedwater Pumps  Condensate Pumps  TBCCW Pumps  FW Flow Regulating Valves 3FWS*FCV510-540  FW Isolation Valves 3FWS*CTV41A-D  FW Flow Control Bypass Valves 3FWS*LV550-580  Condenser	Small LOCA, General Plant Transients/Trips, SGTR, Loss of 1 Vital AC Bus	1 Condensate Pump, Motor Driven MFW Pump, 1 TBCCW Pump, opening of FW isolation valves and either FW flow control bypass valves or regulating valves to 2 steam generators	Reset FWI signal (and SI if actuated) start motor driven MFW pump and open FW valves
<b>SYSTEM BOUNDARIES:</b> Condenser, Condensate Pumps, TBCCW Pumps, Motor Driven MFW Pumps to the steam generators. Also includes AC power (up to but not including Buses 35A-D) and DC power (up to but not including Buses 125-VDC-1, 2, and 6) and ESF logic related to the Main Feedwater System.			
<b>ADDITIONAL ASSUMPTIONS:</b>  Due to the relatively low T-AVG setpoint, the MFW system isolates each time the reactor trips. Operator will take actions to recover main feedwater if auxiliary feedwater system fails following the transient.  Although the turbine driven MFW pumps continue running following a FWI signal it was assumed that the operator would have to start the motor driven FW pump. The mission time is 24 hours and the steam generated via decay heat removal may not be sufficient to run one turbine driven pump for the entire interval.  One TBCCW pump and heat exchanger provide sufficient heat removal capability for the motor driven FW pump and the instrument air compressors following a reactor trip.  Failure of the steam relief capability is assumed to be negligible. Nine turbine bypass valves are potentially available to dump steam to condenser. If condenser is not available, there are 4 main steam pressure relief valves, four pressure relief bypass valves and 16 (4 per line) main steam safety relief valves which can vent the steam.  The Instrument Air System is required because the isolation valves, regulating valves and the bypass valves fail closed on a loss of air. The system is normally operating and is backed up by the Service Air System. Failure of both systems is assumed to be negligible when recovering MFW.  No regular surveillance test of the motor driven main feedwater pump is performed. However, the pump can be used when a turbine driven pump fails which is assumed to be once every 3 months.			

PLANT: MP-3

SYSTEM:

MAIN STEAM  
ISOLATION

KEY COMPONENTS:

MSIVs

3MSS\*CTV27A

3MSS\*CTV27B

3MSS\*CTV27C

3MSS\*CTV27D

SUCCESS CRITERIA

INITIATOR

FUNCTIONAL REQUIREMENTS

OPERATOR ACTION

Steamline Break  
Inside Containment

Closure of the MSIV on the faulted steam  
generator/steamline  
or  
Closure of 3 of 3 MSIVs on the unfaulted  
steam generators/steamlines

None

Steamline Break  
Onside Containment

Closure of any 3 of 4 MSIVs

None

SYSTEM BOUNDARIES:

4 MSIVs and associated solenoid valves, ESFAS logic related to MSIVs, and  
CC Control power (up to but not including DC buses).

ADDITIONAL ASSUMPTIONS:

Unavailability due to testing was not considered to be a factor because of the  
following:

the short time involved for testing

the valve moves in the closed direction (which is the  
desired direction in the event of a postulated accident)

the testing would be overridden in the event of a  
postulated accident.

The MSIVs are not maintainable during reactor power operation.

PLANT: MP-3 SYSTEM: HIGH PRESSURE SAFETY INJECTION	SUCCESS CRITERIA		
	INITIATOR	FUNCTIONAL REQUIREMENTS	OPERATOR ACTION
	Large LOCA	2 out of 4 High Pressure Safety Injection pumps delivering flow to 3 of 3 unfaulted RCS cold legs	None Credited
KEY COMPONENTS:  RWST  Safety Injection Pumps 3SIH*P1A 3SIH*P1B	Medium/Small LOCA SGTR, Steamline Breaks	1 out of 4 HPSI pumps delivering flow to 3 of 3 unfaulted RCS cold legs	None Credited
	All Transients/Trips except those above	1 out of 4 HPSI pumps delivering flow to 3 unfaulted RCS cold legs	Manually align HPSI pumps to take suction from RWST and start pumps to initiate feed portion of feed and bleed
Charging Pumps 3CHS*P3A 3CHS*P3B	<b>SYSTEM BOUNDARIES:</b> RWST to HPSI pumps to RCS cold legs. Also included are AC and DC Power (up to but not including Buses 34C and 34D, and Buses 125-VDC-1 and -2) and ESF/EGLS logic related to the HPSI system.		
Valves 3CHS*LCV112D 3CHS*LCV112E 3SIH*MOV8801A 3SIH*MOV8801B	<b>ADDITIONAL ASSUMPTIONS:</b> <p>The third Charging Pump is not credited since it must be manually aligned.</p> <p>Failure to isolate the charging pumps from the VCT following a SI signal is assumed to fail both charging pumps.</p> <p>Following a LOSP, the circuit breaker on the running charging pump does not open. However, the charging pump will stop and will not restart until power is restored to the bus.</p> <p>Failure to isolate the letdown lines is assumed not to fail high pressure injection due to flow diversion.</p>		

<b>PLANT: MF-3</b> <b>SYSTEM:</b> <b>LOW PRESSURE</b> <b>SAFETY</b> <b>INJECTION</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
<b>KEY COMPONENTS:</b>  RHR Pumps: 3SIL*P1A 3SIL*P1B  RWST	Large LOCA	1 of 2 RHR pumps supplying flow to 3 of 3 intact RCS loops	None
	Medium/Small LOCA Incore Instrument Tube Rupture	1 of 2 RHR pumps supplying flow to 2 of 3 intact RCS loops	HPSI has failed and operator must first depressurize the secondary side before LPSI can be initiated.
<b>SYSTEM BOUNDARIES:</b>			
RWST through the RHR pumps, to the RCS cold legs. Also included are AC and DC Power (up to but not including Buses 34C and 34D, and Buses 125-VDC-1 and -2) and ESF/EGLS logic related to LPSI System only.			
<b>ADDITIONAL ASSUMPTIONS:</b>			
Failure of RHR due to inadequate cooling is not treated as a credible event due to the short mission time (3 hours) required of the LPSI system.			

<b>PLANT: MP-3</b> <b>SYSTEM:</b> <b>ACCUMULATORS</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
	Medium/Large LOCA	3 accumulators discharging into 3 of 3 intact RCS loops	None
<b>KEY COMPONENTS:</b>  Tanks 3SIL*TK1A 3SIL*TK1B 3SIL*TK1C 3SIL*TK1D  Accumulator Discharge Check Valves 3SIL*CV8956A-D 3SIL*CV8948A-D			
	<b>SYSTEM BOUNDARIES:</b>  Accumulators to RCS cold leg injection nozzles.		
	<b>ADDITIONAL ASSUMPTIONS:</b>  The accumulator discharge check valves are flow tested at each refuel outage. Physical limitations prevent full flow resulting in a part stroke test of the check valves which is not recognized by ASME codes.		

<b>PLANT: MP-3</b> <b>SYSTEM:</b> <b>HIGH/LOW PRESSURE RECIRCULATION</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
	All LOCAs (LPR)	1 of 2 Containment Recirculation Pumps delivering flow to 2 of 4 Safety Injection Pumps into 1 of 3 intact RCS cold legs	Manually align system for recirculation via EOP35ES1.3
<b>KEY COMPONENTS:</b> Containment Recirculation Pumps 3RSS*P1A 3RSS*P1B  Safety Injection Pumps 3SIH*P1A 3SIH*P1B  Charging Pumps 3CHS*P3A 3CHS*P3B  Service Water Valves 3SWP*MOV54A,B 3SWP*MOV50A,B 3SWP*MOV71A,B  Sump	All Transients/Trips and LOCAs except Large LOCA (HPR)	1 of 2 Containment Recirculation Pumps delivering flow to 1 of 4 Safety Injection Pumps into 3 intact RCS cold legs	Manually align system for recirculation via EOP35ES1.3
	<b>SYSTEM BOUNDARIES:</b> Sump to Containment Recirculation Pumps to Safety Injection Pumps to RCS cold legs. Also included are AC and DC power (up to but not including Buses 34C and D, and Buses 125-VDC-1 and -2), ESF/EGLS logic specific to High/Low Pressure Recirculation and service water flow to TPCCW and RPCCW Heat Exchangers and Containment Recirculation Coolers.		
<b>ADDITIONAL ASSUMPTIONS:</b> Assume Containment Recirculation pump trains A and B are available for recirculation only and trains C and D are available only for sprays.  Two diversion paths must be isolated to prevent insufficient service water cooling to the containment recirculation coolers - diversion of water to TPCCW heat exchangers and to RPCCW heat exchangers.  Sufficient time is available, between the onset of an accident and when the system is actually needed, for an operator to recover a component from test and place it in the required operating mode.  Common cause failure due to plugging of the sump screens is assumed to be negligible based on procedural limits on the nature and quantity of materials brought into containment during outages and walkdown inspections.			

<b>PLANT: MP-3</b> <b>SYSTEM:</b> <b>CHARGING PUMP</b> <b>COOLING</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
	All Transients, Trips and LOCAs	1 Charging Pump Cooling Pump providing cooling for each Charging Pump in operation	None
<b>KEY COMPONENTS:</b>  Pumps 3CCE*P1A 3CCE*P1B			
<b>SYSTEM BOUNDARIES:</b>  Closed loop which contains the charging pump cooling pumps, pump coolers and a divided charging pump cooling surge tank. AC power (up to but not including Buses 34C and 34D) and ESF/EGLS logic related to Charging Pump Cooling System.			
<b>ADDITIONAL ASSUMPTIONS:</b>  Pressure switches (3CCE*PS34A and B) are assumed to be tested during refuel outage.  Due to the closed nature of the system, testing the pumps also tests all other components in the system.  Service Water is assumed to be available for charging pumps cooling if service water flow to service water is proven successful (See Service Water Section) and the heat exchangers have not been plugged.			

<b>PLANT: MP-3</b> <b>SYSTEM:</b> <b>SAFETY INJECTION PUMP COOLING</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
	All Transients, Trips and LOCAs	1 Safety Injection Pump Cooling Pump supplying cooling for each Safety Injection Pump in operation	None
<b>KEY COMPONENTS:</b>  Pumps 3CCI*P1A 3CCI*P1B			
	<b>SYSTEM BOUNDARIES:</b> A closed loop system comprised of two safety injection pump cooling pumps, two safety injection pump oil coolers and a divided safety injection pump surge cooling tank. Also included is AC power (up to but not including Buses 34C and 34E).		
	<b>ADDITIONAL ASSUMPTIONS:</b> Due to the closed nature of the system, testing the pumps also tests all other components in the system. The system is available during test.  It is assumed that all isolable components outside containment can be maintained, as necessary on an unscheduled basis.  Service Water is assumed to be available for safety injection pump cooling if service water flow is provided to the service water headers (See Service Water Section) and no plugging of the heat exchangers has occurred.		

<b>PLANT: MP-3</b> <b>SYSTEM:</b> <b>CONTAINMENT</b> <b>RECIRCULATION</b> <b>SPRAY</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
	All Transients/Trips and LOCAs	1 of 2 Containment Recirculation Pumps delivering flow to 1 of 2 Containment Spray headers	None
<b>KEY COMPONENTS:</b>  Containment Recirculation Pumps: 3RSS*P1C 3RSS*P1D  Service Water Valves: 3SWP*MOV54C,D 3SWP*MOV50A,B 3SWP*MOV71A,B			
	<b>SYSTEM BOUNDARIES:</b> Sump to Recirculation Pumps to the spray headers. All AC power (up to but not including Buses 34C and D), all DC power (up to but not including Buses 125-VDC-1 and -2) and ESF/EGLS logic related only to Containment Recirculation Spray System. Also included is service water flow to TPCCW and RPCCW heat exchangers and containment recirculation heat exchangers.		
	<b>ADDITIONAL ASSUMPTIONS:</b>  See High/Low Pressure Recirculation Section.		

<b>PLANT: MP-3</b> <b>SYSTEM:</b> <b>QUENCH SPRAY</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
	All Transients, Trips and LOCAS	1 of 2 Quench Spray pumps delivering flow to 1 of 2 Quench Spray headers	None
<b>KEY COMPONENTS:</b>  Quench Spray Pumps 3QSS*P3A 3QSS*P3B  Valves 3QSS*MOV34A 3QSS*MOV34B  RWST			
	<b>SYSTEM BOUNDARIES:</b>  RWST to the Quench Spray headers. Also included are DC control power (up to but not including Buses 125-VDC-1 and -2), AC power (up to but not including Buses 34C and 34D) and ESF/EGLS logic solely related to the Quench Spray System.		
	<b>ADDITIONAL ASSUMPTIONS:</b>  Failures related to the addition of NaOH are not modeled. NaOH is added to prevent corrosion and is not necessary for successful Quench Spray operation during a mission time of 24 hours.  Failures of RWST water cooling via the chilled water system are not modeled due to the limited effect of cold RWST water on the overall containment failure probability.		

PLANT: MP-3 SYSTEM:  SERVICE WATER	SUCCESS CRITERIA		
	INITIATOR	FUNCTIONAL REQUIREMENTS	OPERATOR ACTION
	All Transients, Trips and LOCAs	1 or 4 Service Water pumps delivering flow to 1 of 2 Service Water headers	None
KEY COMPONENTS:  Pumps 3SWP*P1A 3SWP*P1B 3SWP*P1C 3SWP*P1D  Strainers 3SWP*STR1A 3SWP*STR1B 3SWP*STR1C 3SWP*STR1D  Valves 3SWP*MOV102A 3SWP*MOV102B 3SWP*MOV102C 3SWP*MOV102D			
	<b>SYSTEM BOUNDARIES:</b> Service Water pumps to the Service Water headers. Also included are DC control power (up to but not including Buses 125-VDC-1 and 125-VDC-2), AC power (up to but not including Buses 34C and 34D), ESF/EGLS logic related to the Service Water System only. Service water flow to individual heat exchangers/coolers (i.e., RPCCW, TPCCW, CRS) is modeled as part of the Containment Recirculation Spray System and High/Low Pressure Recirculation System.		
	<b>ADDITIONAL ASSUMPTIONS:</b> The Service Water System consists of two trains, each of which contains an in-service pump and a standby pump.  For equal wear, each pump is used in service mode 50 percent of the time and in standby mode the remainder of the time.  Leakage around the traveling screens is sufficient to provide adequate suction flow for the SW pumps should the screens totally plug.		

PLANT: MP-3

SYSTEM:

TURBINE TRIP

SUCCESS CRITERIA

INITIATOR

FUNCTIONAL REQUIREMENTS

OPERATOR ACTION

ATWS

Closure of all Turbine Stop or Control Valves.

None

KEY COMPONENTS:

Turbine Stop Valves

Turbine Control Valves

Emergency Trip System

Electro-Hydraulic Control

SYSTEM BOUNDARIES:

Turbine Stop and Control Valves, Emergency Trip System.

ADDITIONAL ASSUMPTIONS:

Failure to trip the turbine when initial power level is greater than 25 percent is assumed to result in a severe overpressurization of RCS that leads to core damage via loss of HPSI System and primary piping or pressurizer valve failures.

<b>PLANT: MP-3</b> <b>SYSTEM:</b> <b>PRIMARY PRESSURE RELIEF</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
	Small LOCA, All Transients/Trips	1 of 2 PORVs open to provide a bleed path for the primary system	Manually open PORVs from the control room within 30 minutes from start of transient
<b>KEY COMPONENTS:</b> Pressurizer PORVs Block Valves	Consequential Small LOCA due to Stuck Open PORV	Isolate the faulted PORV by closing appropriate block valve	Operator manually closes the block valve from the control room within 10 minutes
<b>SYSTEM BOUNDARIES:</b> Pressurizer PORVs, DC power (up to but not including Buses 125-VDC-1 and -2) Block valves, AC power (up to but not including Buses 34C and D).			
<b>ADDITIONAL ASSUMPTIONS:</b> The 30 minute time frame to open PORVs corresponds to the approximate steam generator dry-out time if feedwater has failed.  HPSI flow is also required to provide a feed and bleed cooling method for removing core heat (See HPSI System).  PORV block valves are open during normal operation.  The PORV is assumed to be challenged only once per transient event. For extended transients, if PORV functions properly on the initial challenge, it is assumed to function properly during subsequent challenges.			

## REACTOR PLANT COMPONENT COOLING WATER SYSTEM

Not modeled in MP3 Probabilistic Safety Study for the following reasons:

Loss of RPCCW will have no impact on safety related mitigation systems such as ECCS or containment heat removal systems. ECCS cooling systems are directly cooled by service water.

Loss of RPCCW will lead to degradation in RCP lube oil cooling. Such a degradation is alarmed in the control room and would likely lead to a manual reactor trip and RCP trip.

In view of these considerations, full or partial loss of RPCCW is recognized as not being unique from the loss of Reactor coolant flow and the manually initiated reactor trip events already modeled in the PSS.

## TURBINE PLANT COMPONENT COOLING WATER SYSTEM

This is no dependency on TPCCW in any of the vital safety systems. A loss of TPCCW was found to lead to the following:

Loss of Instrument Air,

An eventual turbine trip due to inadequate turbine lube oil cooling,

Eventual trips of a number of condensate pumps due to inadequate cooling.

Because of these considerations, a loss of TPCCW event is recognized to be either a loss of feedwater event or a turbine trip event already modeled in the PSS. TPCCW is necessary for the recovery of main feedwater system (see MFW System Section).

## INSTRUMENT AIR SYSTEM

Not modeled in MP3 Probabilistic Safety Study for the following reasons:

MP3 ECCS is designed to be totally independent of the instrument air system and hence exhibits no intersystem common cause failure dependency.

The PORVs, which are needed to allow feed and bleed cooling, are DC powered and are also totally independent of instrument air.

The Auxilliary Feedwater system includes a steam turbine driven pumps designed with three parallel steam admission valves which will all fail open on a loss of air pressure (thus starting the pump without a direct ESF command).

A loss of air will lead to a loss of main feedwater transient or partial loss of main feedwater transient due to consequential failure of the feedwater regulating valves.

Because of these considerations, a loss of instrument air is recognized to be no different from other types of main feedwater flow disruption already modeled.

## CONTAINMENT ISOLATION

Assumption: Negative Containment Pressure results in no gross pre-existing leakage.

<b>PLANT: MP-3</b> <b>SYSTEM:</b> <b>FIRE DETECTION AND SUPPRESSION SYSTEM</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
	All Fires	Detection/Suppression System suppresses fire before extensive equipment damage occurs	Detect and Suppress fire as required
<b>KEY COMPONENTS:</b> Fire Detect./Suppress. Systems for the following Areas:  Cable Spreading Rm  Control Room  Instrum. Rack Rm  Switchgear Rooms  Electrical Tunnels  Motor Controls and Rod Control Areas  Charging Pumps and Reactor Plant Component Cooling Pumps  Diesel Generator Enclosures			
	<b>SYSTEM BOUNDARIES:</b>  All Fire Detection and Suppression Systems, including automatically initiated, manually initiated and portable extinguishers in the areas listed.		
	<b>ADDITIONAL ASSUMPTIONS:</b>  All fires are assumed to increase in size, none are assumed to self extinguish.  No credit is taken for feed and bleed in the fire analysis. The PORVs and their block valves are powered by opposite trains. This could prevent the opening of the PORVs if one train of electric power is unavailable.  An oil fire is assumed to cause loss of a pump.		

## ADDITIONAL FIRE ASSUMPTIONS

### GENERAL

#### Detection of a fire:

Unless an area, such as the control room, is occupied at all times no detection is initially credited to humans,

Smoke detectors are assumed to detect a fire before heat detectors and are credited with detecting a fire in the earliest, or discovery stage,

Human detection could occur because of a spurious signal if the smoke detectors have not responded.

#### Suppression given detection:

If the smoke detectors detect the fire and the fire is suppressed with portable extinguishers, it is assumed that this is an early stage and no safety loss has occurred.

If the portable extinguishers do not suppress the fire and the smoke detectors have not detected the fire, but either the heat detectors or humans have responded, then suppression may depend on either automatic systems or hose stations. If the fire is suppressed at this stage, it is assumed that a partial safety loss has occurred, based on the proportion of safe shutdown components in the area.

If the fire is detected, but not suppressed, a total loss of all safety functions is postulated.

Undetected fires are assumed to cause a loss and to propagate between cable trays. The probability of propagating to other components would depend on the type of equipment.

### CABLE SPREADING FIRES (CB-8)

Credited detection/suppression systems include: smoke detectors, rate of rise heat detectors, human detection, portable fire extinguishers, total flooding CO<sub>2</sub>, hose stations.

If early detection and suppression (within 3 to 8 minutes), no safety loss is assumed.

If fire is suppressed by automatic CO<sub>2</sub> or hose stations, the fire is assumed to have propagated to additional cable trays in one stack but not to adjacent stacks.

## ADDITIONAL FIRE ASSUMPTIONS (CONTINUED)

### CABLE SPREADING FIRES (CB-8) (CONTINUED)

If fire has not been detected or has been detected but unsuppressed the fire zone is assumed to be lost.

### CONTROL ROOM (CB-9)

Credited detection/suppression systems include: smoke detectors, human detection, portable fire extinguishers.

Both smoke detectors and human detection credited for early detection.

Early suppression via the portable extinguishers is credited for a time interval of 1 to 5 minutes.

No partial safety loss is considered in control room. If portable extinguishers fail, control room is lost.

Hose stations (used in the event of a large, uncontrolled fire) are not credited for prevention of a safety loss.

### INSTRUMENT RACK ROOM (CB-11A AND CB-11B)

Credited detection/suppression systems for both zones include: smoke detectors, human detection, portable extinguishers Zone 11A only; heat detectors, total flooding Halon 1301 system

Partial loss of a zone is not considered for these zones.

#### CB11A

If smoke detectors and portable extinguishers are successful in fire suppression within 1 to 5 minutes, no safety loss is assumed. If human detection and portable extinguishers are successful in suppression the fire within 5 to 10 minutes, no safety loss is also assumed.

#### CB11B

Same assumptions as made in CB11A including this:

If heat detectors and portable extinguishes or the halon system succeed, no safety loss is assumed.

## ADDITIONAL FIRE ASSUMPTIONS (CONTINUED)

### SWITCHGEAR ROOMS (CB-1 AND CB-2)

Credited detection/suppression systems include: smoke detectors, heat detectors, human detection, portable fire extinguishers, total flooding CO<sub>2</sub>

Hose stations are available but not credited in preventing a safety loss.

If early smoke detection via smoke detectors and early suppression (3 to 8 minutes) via the portable extinguishers are successful, no damage is assumed.

If heat detectors or humans detect fire and CO<sub>2</sub> system is successful in suppression, a partial safety loss is assumed.

### ELECTRICAL TUNNELS (SB-2 AND SB-3)

Credited detection/suppression systems include: smoke detectors, rate of rise heat detectors, human detection, portable fire extinguishers, total flooding CO<sub>2</sub>

No hose stations are credited because this could cause a safety loss to the cables. It would be used to prevent fire spread if the total area were destroyed.

If early detection via smoke detectors and early suppression (3 to 8 minutes) are successful, no equipment loss is assumed.

A partial safety loss occurs if the fire is detected and extinguished by CO<sub>2</sub> system.

Approximately 1/3 of the cable trays are related and 1/3 of these are necessary for safe shutdown or 1/9 of all cable fires could cause a safety loss.

## ADDITIONAL FIRE ASSUMPTIONS (CONTINUED)

### MOTOR CONTROL AND ROD CONTROL AREAS (AB-5 AND AB-6)

Credited detection/suppression systems include: smoke detectors, heat detectors, human detection, portable extinguishers and total CO<sub>2</sub> system.

Same assumptions as made for electrical tunnels.

### CHARGING PUMPS AND REACTOR PLANT COOLING (AB-1)

Credited detection/suppression systems include: smoke detectors, human detection, portable fire extinguishers, hose stations, water curtain over cable trays and charging pumps.

If both charging pumps and reactor plant component cooling pumps are lost, a reactor coolant pump seal LOCA would be initiated.

For modeling this area, fires were broken up into three types:

#### Electrical Fires

If smoke detectors or human detection and portable extinguishers or hose stations are successful in suppressing the fire, components could be lost but fire would be prevented from spreading to both trains.

#### Charging Pump Cubicle Fire

For a fire starting in a charging pump cubicle, either the hose status or water curtain is used to suppress the fire.

For an oil fire, the portable extinguishers are not credited, as any fire in the cubicle is considered to cause the loss of the charging pump.

#### Cable Fires

Suppression would be portable extinguishers, hose stations or the water curtain. All detected and unsuppressed fires and all undetected fires in cable trays are assumed to be a total loss of safety equipment.

### CIRCULATING AND SERVICE WATER BUILDING (CSW-3 AND CSW-4)

Credited Detection/Suppression Systems include: smoke detectors, human detection, portable fire extinguishers.

Success of smoke detectors or human detection and portable extinguishers results in no safety loss.

All undetected or unsuppressed fires result in a loss of one service water train.

## ADDITIONAL FIRE ASSUMPTIONS (CONTINUED)

### DIESEL GENERATOR ENCLOSURES (EG-3 and EG-4)

The diesel generators are in separate fire areas. A fire in one of these areas is assumed to result in a loss of the associated diesel generator.

## SEISMIC RISK ANALYSIS

### LIST OF KEY STRUCTURES AND EQUIPMENT MODELED

Loss of Offsite Power (ceramic insulator failure)  
Containment Recirculation Heat Exchangers  
Emergency Generator Enclosure Building (collapse)  
Refueling Water Storage Tank (wall footing failure)  
Emergency Diesel Generator (oil cooler anchor bolt failure)  
Reactor Vessel Core Geometry Distortion  
Control Building Collapse (diaphragm)  
Control Building Failure (sliding)  
Control Rod Drive System (failure to SCRAM)  
Component Cooling Water System Pumps  
Service Water System Piping (due to pumphouse sliding)  
Service Water Pumphouse Failure (sliding)  
Emergency Generator Enclosure Building (sliding)  
Auxiliary Building Collapse (shear wall failure)  
Reactor Coolant System Piping  
Demineralized Water Storage Tank  
Turbine Driven Aux. FW Pump  
Service Water Pumphouse (shear wall failure)

SEISMIC RISK ANALYSIS (Cont.)

LIST OF KEY STRUCTURES AND EQUIPMENT MODELED (Cont.)

Engineered Safeguard Features Building (base mat shear wall failure)

Containment Recirculation System Pumps

Power Operated Relief Valves (loss of operability)

Chemical Volume Control System Piping

Containment Recirculation System Piping

RCP Component Cooling Water System Piping

Quench Spray System Piping

Containment Crane Wall (collapse)

480V Motor Control Centers (trip)

Reactor Vessel (support pads fail)

Service Water System Pumps

Reactor Coolant Pumps

RCP Seal Water Heat Exchangers

RCP Component Cooling Water Heat Exchangers

Cable Trays

Quench Spray System Pumps

Quench Spray System Header Piping

Steam Generator Tubes Rupture

## IMPORTANT VALVING IN PREVENTING AN INTERFACING SYSTEMS LOCA

- 3 Possible Interfacing Systems LOCA scenarios have been identified for detailed analysis in th PSS.

### V SEQUENCE - COLD LEG INJECTION LINES

#### DESCRIPTION

There are four cold leg injection lines, each of which contains three series check valves. An interfacing systems LOCA via this path would involve disc rupture of three valves in one of the four lines and subsequent failure to close the appropriate motor operated valve (MOV 8809A or B) upstream of the check valves.

#### ASSUMPTIONS

Present analysis takes no credit for the possibility of manually closing MOVs 8809A and B.

It has been determined, based on consideration of possible check valve failure modes, that disc failing to open of these valves is not a credible failure mode. These check valves are tested for leakage to ensure proper disc seating.

#### KEY EQUIPMENT

3SIL\*CV8818A-D

3SIL\*CV8948A-D

3SIL\*CV8847A-D

### V SEQUENCE - HOT LEG INJECTION LINES

#### DESCRIPTION

In order to have a V-sequence scenario through this path, sequential disc rupture must occur in two series check valves in one of two paths and disc rupture or transfer open through a normally closed containment isolation MOV 8840.

## V SEQUENCE - HOT LEG INJECTION LINES (Cont.)

### ASSUMPTIONS

Given failure of two series check valves, failure of MOV 8840 can be due to internal rupture, spurious opening or inadvertently being left open.

### KEY EQUIPMENT

3SIL\*MOV8840  
3SIL\*CV8841A&B  
3RCS\*CV8949B&D

## V SEQUENCE - RHR SUCTION LINES

### DESCRIPTION

An interfacing systems LOCA would be caused by the sequential failure of three series motor operated valves in either of two RHR suction lines.

### ASSUMPTIONS

Disc rupture of the MOVs is the failure mode modeled. Other valve failure modes are judged inapplicable based on system characteristics. Disc failing open which is defined as failure of a valve disc to return to closed position after use, is not modeled since indication is located in the Control Room. The RHR lines are also used during plant shutdown conditions. If all three of these valves in either line had discs which failed open, this condition would become apparent during subsequent startup and corrective action would be taken.

The breakers for MOVs 8701C and 8702C are racked out to prevent spurious operation.

### KEY EQUIPMENT

3RHS\*M.OV8701A-C  
3RHS\*M.OV8702A-C

## CY Systems and Assumptions Table of Contents

DC Power.....	1
AC Power.....	2
Motor Control Center 5 (MCC-5).....	3
Semi-Vital AC Power.....	4
120V Vital AC Power.....	5
Reactor Protection.....	6
Service Water.....	7
Component Cooling Water.....	9
RCP Seal Cooling.....	10
Instrument Air (Control Air/Service Air).....	11
Closed Cooling Water.....	12
Well Water.....	13
Feedline and Steamline Isolation.....	14
Main Feedwater.....	16
Auxiliary Feedwater.....	17
Steam Generator Cooling.....	19
Safety Injection Actuation Signal.....	20
Charging (CVCS).....	21
Low Pressure Safety Injection.....	23
High Pressure Safety Injection.....	24

## CY Systems and Assumptions Table of Contents

Primary Pressure Relief.....	25
Bleed and Feed.....	26
High/Low Pressure Recirculation .....	27
Two Path Recirculation.....	29
Long Term Cooling.....	30
Containment Spray.....	31
CAR Fans.....	32
Containment Heat Removal.....	33
Primary Depressurization.....	34
Emergency Boration.....	35
Turbine Trip.....	36
Loop Isolation Valves.....	37
Interfacing Systems LOCA Valving.....	38
Fire Detection and Suppression.....	39

Appendix D  
Connecticut Yankee:  
Systems And Assumptions

UNCONTROLLED  
COPY

PLANT: CY

SYSTEM:

DC POWER

SUCCESS CRITERIA

INITIATOR

FUNCTIONAL REQUIREMENTS

OPERATOR ACTION

All Transients/Trips,  
and LOCAS except  
Total loss of DC, loss of  
DC Bus 1 and loss of DC  
Bus 2

DC Bus 1 or 2 energized  
(both preferred)

KEY COMPONENTS:

DC BUS 1

Loss of DC Bus 1 or  
Bus 2

One DC Bus failed, other DC bus must be  
energized

DC BUS 2

Total Loss of DC Power

NA- Assumed to be failed

Dominant failure modes are  
non-restorable.

BATTERY CHARGERS

BC-1A

BC-1B

Station Blackout

Sufficient amp-hours available to operate  
breakers to recover offsite power.

Non-essential loads are removed  
in 1 hour.

BATTERIES A AND B

SYSTEM BOUNDARIES:

DC buses, static battery chargers, 60-cell batteries and AC power (up to  
but not including MCC-5 and EAC Buses 8 and 9).  
Modeling of DC control power from buses to individual loads is  
incorporated into the individual system models.

ADDITIONAL ASSUMPTIONS:

The battery charger is not capable of supplying the loads without the battery.  
Following a station blackout, each battery is assumed to have a 9 hour lifetime.  
Given an actual battery failure, an average detection interval of 1 week is assumed.

CHANGES NOT UPDATED IN PSS:

Addition of another DC Bus, Battery Charger and Battery as a result of the new switchgear room.  
Loads on DC Buses are modified and some transferred to new DC Bus.

New battery chargers for B and C batteries will be battery eliminating battery chargers. The A battery  
charger will still not be capable of supplying loads without the battery.

<b>PLANT: CY</b> <b>SYSTEM:</b> <b>AC</b> <b>POWER</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
	All Trips/Transients, and LOCAS except LOSP	4160V AC supplied to Bus 8 or 9 (Both preferred).	
<b>KEY COMPONENTS:</b> DIESEL GENERATORS  4160V AC BUS 8  4160V AC BUS 9  480V AC BUSES 4, 5, 6, AND 7  SERVICE WATER VALVES  SW-FCV-129 SW-FCV-130  4160V/480V TRANSFORMERS  RELATED CIRCUIT BREAKERS	LOSP	4160V AC supplied to Bus 8 or 9 (Both preferred).	Restoration of AC power from an offsite source within 30 minutes.
	Station Blackout	4160V AC supplied to Bus 8 or 9 (Both preferred).	Electrical Power Recovery within 15 minutes, 30 minutes or 8 hours from an offsite source.
<b>SYSTEM BOUNDARIES:</b> Diesel Generators, 4160V AC Buses 8 and 9, DC control power (up to but not including DC Buses 1 and 2) and Service Water cooling via SW-FCV-129 and 130. Modeling of 480V Buses, MCC's (except MCC-5) and undervoltage trip and lockout relaying scheme have been directly included in the individual system models.			
<b>ADDITIONAL ASSUMPTIONS:</b>  The part of the diesel loading circuitry used only for manually loading the diesel onto a dead bus following a LOSP and failure of the diesel to auto load is assumed to never be tested.  If the only test on redundant trains of logic is to input a signal to both trains and only observe the end result, then it is assumed that one train is never tested.  Service water cooling of the Diesel Generators is successful if service water is supplied to the SW header (see SW section) and FCV's 129 and 130 open successfully (these valves are de-energized to open).			
<b>CHANGES NOT UPDATED IN PSS:</b>  The most significant change has to do with the addition of the new switchgear room. 480V Bus 11 and MCC-12 have not been modeled.			

<b>PLANT: CY</b> <b>SYSTEM:</b> <b>MCC-5</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
<b>KEY COMPONENTS:</b>  MCC-5  ABT  FEEDER BREAKERS 9C AND 11C	All Trips, Transients and LOCAs	MCC-5 energized by either 480V AC Bus 5 or 6	
	Loss of MCC-5, LOSP and Loss of MCC-5	Restore power to MCC-5 via Bus 5 or Bus 6.	Actions dependent on cause of MCC-5 loss but include manually reclosing breakers associated with MCC-5 or Manually re-aligning the selector switch to a different power source.
	<b>SYSTEM BOUNDARIES:</b>  Consists of MCC-5, ABT, Feeder Breakers 9C and 11C, DC power (up to but not including Buses 1 and 2), and AC power (up to but not including 4160V AC Buses)		
<b>ADDITIONAL ASSUMPTIONS:</b>  Both DC Buses 1 and 2 are required for an automatic bus transfer.  480V Bus 5 is assumed to be the preferred source of power.  It was assumed that spurious trip of breaker 9C leads to loss of power from both supplies to MCC-5, since undervoltage detection is on Bus 5 itself and the ABT will not function.  Following a LOSP, the time available to restore MCC-5 is approximately 15 minutes.  Charging pumps trip on loss of MCC-5 (i.e., semi-vital power) and CVCS valves are manually re-aligned.			

<b>PLANT: CY</b> <b>SYSTEM:</b> <b>SEMI-VITAL</b> <b>AC POWER</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
	All Trips, Transients and LOCAs except Loss of MCC-5	Both Semi-Vital AC distribution panels are energized, 1 of 2 stepdown transformers operating and proper circuit breaker operation.	None Credited.
	Loss of MCC-5	NA - Assumed to be failed.	
<b>KEY COMPONENTS:</b>  <b>SEMI-VITAL</b> <b>DISTRIBUTION</b> <b>PANELS 1 AND 2</b>  <b>ABT</b>  <b>TWO REGULATING</b> <b>TRANSFORMERS</b>	Loss of Semi-Vital AC	Recovery of power to Semi-Vital AC.	Manual closure of breaker to the alternate power supply.
	<b>SYSTEM BOUNDARIES:</b>  Semi-Vital Distribution Panels, Automatic Bus Transfer (ABT), AC power (up to but not including MCC-5).		
<b>ADDITIONAL ASSUMPTIONS:</b>  The Semi-Vital AC System ABT is tested every refueling outage.  The two Distribution Panels are not redundant.			
<b>CHANGES NOT UPDATED IN PSS:</b>  The addition of the new switchgear room will make it possible for Semi-Vital AC to obtain its supply power via MCC-5 or via MCC-12.			

PLANT: CY

SYSTEM:

120V VITAL  
AC POWER

**SUCCESS CRITERIA**

**INITIATOR**

**FUNCTIONAL REQUIREMENTS**

**OPERATOR ACTION**

All Transients/Trips,  
except Loss of 1 DC Bus,  
Total Loss of DC Power

Vital AC Power supplied by four Vital  
AC Buses

None

Total Loss of DC Power

NA-Assumed to be failed

Loss of 1 DC Bus

Vital AC Power supplied by two Vital  
AC Buses

None

**KEY COMPONENTS:**

VITAL AC  
INVERTERS A-D

VITAL AC  
PANELS A-D

**SYSTEM BOUNDARIES:**

Consists of Vital AC Panels and Inverters, and DC Power (up to but not including DC Buses 1 and 2).

**ADDITIONAL ASSUMPTIONS:**

Vital AC Inverters are dependent on switchgear ventilation fans, F-6-1A and F-44-1A for long term cooling.

Alternate feed for each vital bus from opposite power division is not credited.

Most components "fail safe" on loss of 120V vital AC. Only auto auxiliary feedwater initiation is critically dependent on 120V vital AC and modelled in the PSS.

**CHANGES NOT UPDATED IN PSS:**

Vital AC Panels C and D will receive supply power from either DC Bus 2A or MCC-12 following the addition of the new switchgear room.

Pressure interlocks, charging flow control and additional instrumentation (AFW flow, etc.) are now or will be powered by 120V Vital AC.

PLANT: CY SYSTEM: REACTOR PROTECTION	SUCCESS CRITERIA		
	INITIATOR	FUNCTIONAL REQUIREMENTS	OPERATOR ACTION
	All Transients/Trips, Small LOCA except LOSP and SBO	Generation of reactor trip signal and insertion of control rods.	None
<b>KEY COMPONENTS:</b>	LOSP, Station Blackout	Insertion of reactor control rods.	None
CONTROL RODS AND DRIVES	ATWS	Operator initiated reactor trip with insertion of control rods upon failure of automatic trip signal.	Manually initiate a Reactor Trip [-] energize buses 4 and 7.
RPS LOGIC AND SENSORS			
MG SETS			
REACTOR SCRAM BREAKERS	<b>SYSTEM BOUNDARIES:</b> Electrical and mechanical portions of RPS including logic and sensors, control rods and drives, reactor scram breakers, and MG sets, as well as AC power up to but not including buses 4 and 7, and DC power up to but not including buses 1 and 2.		
	<b>ADDITIONAL ASSUMPTIONS:</b> Generic data used to evaluate CY's RPS. LOSP results in interruption of power to MG sets.		
	<b>CHANGES NOT UPDATED IN PSS:</b> RPS modernization (PDCR 861) and RPS Phase II.		

<b>PLANT: CY</b> <b>SYSTEM:</b> <b>SERVICE WATER</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
	All Trips/Transients, and LOCAS except Loss of Service Water	1 of 4 service water pumps if secondary side loads isolated or 2 of 4 service water pumps if secondary side loads not isolated	Manually close valves to isolate secondary side loads; manually start additional pumps as required
<b>KEY COMPONENTS:</b>  SERVICE WATER PUMPS P-37-1A P-37-1B P-37-1C P-37-1D  SERVICE WATER VALVES SW-MOV-1 SW-MOV-2	Loss of Service Water	NA - Assumed to be failed	Open cross-tie between service water and fire protection system headers (SW-V-281)
	<b>SYSTEM BOUNDARIES:</b> Service Water pumps to the service water headers. Also included are AC and DC power (up to but not including MCC-5, EAC Buses 8 and 9, and DC Buses 1 and 2) and the pumps' start circuitry. Service water flow to individual heat exchangers (i.e., RHR, CCW, Diesel Generators) is modeled in the individual systems.		
<b>ADDITIONAL ASSUMPTIONS:</b>  Use of the fire pumps as a backup to service water was not considered except for loss of service water as an initiating event.  No credit for manual actions (pump start or valve closure) is taken, except for when offsite power and EAC bus 8 (or 9) and DC Bus 1 (or 2) are unavailable.  Passive failures such as pipe rupture are not major contributors.  Only one service water pump can be unavailable due to maintenance at a given time.  The pre-trip full load configuration is assumed to be with three service water running pumps.			

PLANT: CY

SYSTEM:

SERVICE  
WATER  
(CONT.)

KEY COMPONENTS:

**ADDITIONAL ASSUMPTIONS:**

It is assumed that if either MOV 1 or 2 do not close, full service water flow will continue to the secondary side. An equivalent faulted condition on SW-MOVs 3 and 4 or SW-AOVs 8 and 9 requires at least a double failure and is discounted on the grounds that the failure probabilities are sufficiently smaller compared to a single failure of MOV 1 or 2 to close. (This assumption is affected by recent Westinghouse analysis).

Screen plugging is not modeled explicitly, but the common cause failure rate data is assumed to implicitly account for plugging.

**CHANGES NOT UPDATED IN PSS:**

With the addition of the new switchgear room, SW pump D will be repowered from AC Bus 11 and DC Bus 2A.

Service Water System flow analysis is being performed now to determine actual flows required for different modes of operation. The number of SW pumps required has been increased by one with or without isolation.

Modifications to SW MOVs 1 and 2 result in the valves closing automatically on a SIAS.

<b>PLANT: CY</b> <b>SYSTEM:</b> <b>COMPONENT</b> <b>COOLING</b> <b>WATER</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
<b>KEY COMPONENTS:</b>  CCW PUMPS P-13-1A P-13-1B P-13-1C	All Transients/Trips, LOCAs except LOSP	1 of 3 CCW pumps and 1 of 2 heat exchangers supplying cooling to the RHR and the charging pump lube oil coolers.	Possible manual alignment of heat exchanger if other is unavailable and isolation of non-essential loads if necessary.
	LOSP	Same as above and successful reopening of SW-MOVs 3 and 4.	Manually reopen SW-MOVs 3 and 4 and restart CCW pumps.
SERVICE WATER VALVES SW-MOV-3 SW-MOV-4	<b>SYSTEM BOUNDARIES:</b> CCW Pumps and heat exchangers, piping and valves. Also includes AC Power (up to but not including 4160V AC Buses and MCC-5), DC Power (up to but not including Buses 1 and 2), and Service Water MOVs 3 and 4.		
	CCW HEAT EXCHANGERS	<b>ADDITIONAL ASSUMPTIONS:</b> <p>Thermal barrier cooling via CCW success criteria is found in RCP Seal Cooling Section.</p> <p>CCW pumps P-13-1A and 1B are assumed to be the operating pumps while CCW pump P-13-1C is on standby. (More pumps/heat exchangers are required during the hottest summer months and are desirable for plant shutdown).</p> <p>After LOSP, service water MOVs 3 and 4 have to be reopened by the operator in order to reestablish service water cooling to the CCW heat exchangers. The CCW pumps have to be restarted manually within 2 minutes to reestablish CCW flow.</p> <p>Per AOP 3.2-10, service water can be used to cool CCW components for loss of all CCW.</p>	
<b>CHANGES NOT UPDATED IN PSS:</b> <p>With the addition of the new switchgear room, CCW pump C will be repowered from 480V Bus 11 and DC Bus 2A.</p> <p>SW-MOVs 3 and 4 can now be closed from the control room for isolation during LOCA.</p>			

**PLANT: CY**  
**SYSTEM:**  
**RCP SEAL**  
**COOLING**

---

**KEY COMPONENTS:**

METERING PUMP  
 P-11-A

THERMAL BARRIER  
 RETURN VALVE  
 CC-FCV-608

METERING PUMP  
 SUCTION VALVE  
 CH-AOV-278

SEE CHARGING  
 AND CCW SECTIONS.

**SUCCESS CRITERIA**

INITIATOR	FUNCTIONAL REQUIREMENTS	OPERATOR ACTION
All Transients/Trips	Seal injection (1 of 2 charging pumps or metering pump) to all 4 RCP seals or RCP Thermal Barrier cooling via CCW (1 of 3 CCW pumps and 1 of 2 heat exchangers) through CC-FCV-608	Start metering pump and/or align charging system to RWST, if necessary or manual alignment of heat exchanger if other is unavailable, manually reopen SW-MOVs 3 and 4 following LOSP
<p><b>SYSTEM BOUNDARIES:</b></p> <p>See Charging System and Component Cooling Water System Sections.</p> <p>Also includes metering pump, thermal barrier return valve, VCT, Control Air and Semi-Vital AC.</p>		
<p><b>ADDITIONAL ASSUMPTIONS:</b></p> <p>It is assumed that if RCP seal integrity is lost, it is lost to all loops. Credit has been given for isolating 1 failed RCP seal, but for extended loss of seal cooling assume all fail.</p> <p>No credit is taken for using service air as a back-up to Control Air to keep FCV-608 open.</p> <p>The RCP thermal barrier return control valve will not close on high containment pressure.</p> <p><b>CHANGES NOT UPDATED IN PSS:</b></p> <p>Two thermal barrier inlet valves have been added in series. These valves, CC-FCV-912 and 913 which are powered by DC Buses 1 and 2 respectively, fail closed on a loss of air or loss of DC power. A nitrogen supply bottle has been added to reopen these valves and CC-FCV-608 on a loss of air.</p> <p>A dedicated air bottle will be added to CH-AOV-278 to keep it open on a loss of control air. Also the power source for this AOV will be a 120V distribution panel from MCC12 following 1989 outage.</p> <p>With the addition of the new switchgear room, the metering pump's power source will be changed to DC Bus 2A and AC Bus 11. Speed control during normal operation will be via Semi-Vital AC power, and 120V vital AC power during Appendix R control from the remote indication panel.</p>		

<b>PLANT: CY</b> <b>SYSTEM:</b> <b>INSTRUMENT</b> <b>AIR</b> <b>(CONTROL/SERVICE</b> <b>AIR)</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
	Loss of Service Water flow	Control air or service air supplies air needed for plant operation; compressor cooling using well water.	Manually cross tie service air to control air if needed and operate manual valves to align well water to closed cooling water system if necessary.
	Loss of MCC-5	Service Air supplies air needed for plant operation; compressor cooling using well water.	Manually cross tie service air to control air and align well water to air compressors directly.
<b>KEY COMPONENTS:</b>  CONTROL AIR COMPRESSORS C-3-1A C-3-1B C-3-1C  SERVICE AIR COMPRESSORS C-2-1A C-2-1B  REFER TO WELL WATER SECTION AND CLOSED COOLING WATER SECTION	Loss of Offsite Power	Control Air supplies air for plant operations; closed cooling water system cools compressors.	Re-establish service water cooling to CC heat exchangers.
<b>SYSTEM BOUNDARIES:</b>  Consists of the Control Air Compressors and the Service Air Compressors. AC and DC Power are also included (up to but not including MCC-5, 4160V AC Buses and DC Buses 1 and 2).  For compressor cooling, refer to Well Water section and Closed Cooling Water Section.			
<b>ADDITIONAL ASSUMPTIONS:</b>  The availability of Instrument Air is only considered in those initiators where a direct challenge or failure of the system exists (e.g., loss of MCC-5, loss of service water). The frequency of other initiating events with control air failures and service air failures is negligible.			

<b>PLANT: CY</b> <b>SYSTEM:</b> <b>CLOSED COOLING WATER</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
	Loss of Service Water	1 of 2 closed cooling water pumps providing cooling to the instrument air compressors.	Manual alignment of well water system.
<b>KEY COMPONENTS:</b> CLOSED COOLING WATER PUMPS P-79-1A P-79-1B  CLOSED COOLING HEAT EXCHANGERS	Loss of MCC-5	NA - Assumed to be unavailable.	Manual alignment of well water directly to air compressors credited (See Well Water Section).
	Loss of Offsite Power	1 of 2 closed cooling pumps.	Re-establish service water cooling to CC heat exchangers.
	<b>SYSTEM BOUNDARIES:</b>  Closed Cooling Water Pumps and Heat Exchangers, AC power (up to but not including MCC-5).		
	<b>ADDITIONAL ASSUMPTIONS:</b>  Service Water Cooling is assumed available if service water flow to the service water headers is proven successful (See Service Water System Section) and the heat exchangers are not plugged. If Service Water is unavailable, well water can be aligned for cooling (See Well Water Section).		
	<b>CHANGES NOT UPDATED IN PSS:</b>  The proposed use of fire hoses which connect to the SW system upstream of SW-MOV-1 and 2 and directly cool the closed cooling heat exchangers is not modeled.		

<b>PLANT: CY</b> <b>SYSTEM:</b> <b>WELL</b> <b>WATER</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
	Loss of MCC-5	1 of 2 well water pumps supplying cooling to the service air compressors.	Manual alignment of several valves and start of well water pumps.
	Loss of Service Water	1 of 2 well water pumps supplying cooling to the closed cooling water heat exchangers.	Manual alignment of several valves and start of well water pumps.
<b>KEY COMPONENTS:</b> <b>WELL WATER</b> <b>PUMPS</b> P-3-1A P-3-1B  <b>WELL WATER AIR</b> <b>COMPRESSOR</b> C-5-1A  <b>WELL WATER VALVE</b> WW-FCV-1870	LOSP	NA - Assumed to be failed.	
	<b>SYSTEM BOUNDARIES:</b> Well Water Pumps, Air Compressor, and Valving. AC and DC Power are also included (up to but not including 4160V AC Buses 2 and 3, and DC Buses 1 and 2).		
	<b>ADDITIONAL ASSUMPTIONS:</b> During a LOSP, the well water pumps and the well water air compressor are assumed failed since it requires the manual action of resetting the associated lock-out relays.  The test interval for the well water pumps is assumed to be every 10 months. This is based on the summer time interval when the well water pumps are used to cool the closed cooling water heat exchangers (service water becomes too warm to sufficiently cool the exchangers).  <b>CHANGES NOT UPDATED IN PSS:</b>  Recent modifications to well water system.		

**PLANT: CY**  
**SYSTEM:**  
**FEEDLINE AND STEAMLINE ISOLATION**

**KEY COMPONENTS:**  
**MAIN STEAM TRIP VALVES**  
 MS-TV-1211-1  
 MS-TV-1211-2  
 MS-TV-1211-3  
 MS-TV-1211-4

**FEEDWATER ISOLATION VALVES**  
 FW-MOV-11  
 FW-MOV-12  
 FW-MOV-13  
 FW-MOV-14

**FEEDWATER BYPASS VALVES**  
 FW-HICV-1301-1  
 FW-HICV-1301-2  
 FW-HICV-1301-3  
 FW-HICV-1301-4

**NRVS**

**SUCCESS CRITERIA**

INITIATOR	FUNCTIONAL REQUIREMENTS	OPERATOR ACTION
MFW Line Break between the Feedstation and Containment	Successful closure of MFW isolation MOV and the feedwater bypass valve to the steam generator that is affected by the break.	Identify break location and close the necessary valves remotely via the control room within 40 min. after break.
MFW Line Break between the Feedstation and the MFW Pumps	4 of 4 MFW isolation MOVs must close.	Identify break location and close the pertinent valves remotely via the control room within 40 min. after break.
SGTR	Closure of the MSTV, MFW isolation valve and feed bypass valve on the faulted steam generator.	Identify and isolate faulted steam generator by closing necessary valves either from control room or locally.
Steamline Break Upstream of NRVs	Closure of NRV on the faulted SG - OR - Closure of 3 MSTVs on the 3 unfaulted SGs and Closure of feedwater isolation valve and bypass valve on the faulted loop.	Identify and isolate faulted steam generator by closing necessary valves either from control room or locally.
Steamline Break Downstream of NRVs	Closure of 4 of 4 MSTVs - OR - Closure of 3 of 4 MSTVs and Closure of feedwater isolation valve and bypass valve on the loop with the failed MSTV.	Identify and isolate feedwater to SG with the failed MSTV.
<p><b>SYSTEM BOUNDARIES:</b></p> <p>Consists of MSTVs and associated solenoid valves, NRVs, Feedwater Isolation MOVs, and Feedwater Bypass Valves. AC and DC power (up to but not including MCC-5 and DC Buses 1 and 2), control air supply to valves, automatic AFW initiation logic, 120 Vital AC, MSTV auto actuation logic, and SIAS actuation logic are also included.</p>		
<p><b>ADDITIONAL ASSUMPTIONS:</b></p> <p>Isolation of both types of feedline breaks are totally manually operations which must be taken in the Control Room. It is assumed no local operation of valves will be possible because the breaks will flood area around valves and create a harsh environment.</p> <p>Breaks between the NRV and MSTV are treated as breaks downstream of the MSTV because of more stringent success criteria.</p> <p>For a steamline break upstream of NRV, the faulted steamline must be isolated to prevent more than one SG from blowing down (unanalyzed event)</p>		

**PLANT: CY  
SYSTEM:  
FEEDLINE AND  
STEAMLINE  
ISOLATION  
(CONTINUED)**

**KEY COMPONENTS:**

**ADDITIONAL ASSUMPTIONS:**

For a steamline break downstream of NRV, no local recovery actions are possible after this type of break because of the possibility of flooding and high temperatures in the area surrounding the break and valves.

Following a MFW line break between the feedstation and the feedpumps, all 4 MFW isolation MOVs must close and all 4 check valves between each feedwater bypass valve and the feedwater must close. However, only failures of the isolation MOVs are modeled because it is assumed that the unavailabilities of the check valves would be small in comparison to the MOVs.

The feedwater regulating valves are not credited with isolating the main feedwater lines because of their leakage.

MSTVs fail closed on a loss of control air. However, without auto-actuation the valves will require several minutes to close. Since fast closure of valves is necessary for steamline breaks, auto actuation is still required when control air fails.

PLANT: CY SYSTEM: MAIN FEEDWATER/ POWER CONVERSION	SUCCESS CRITERIA		
	INITIATOR	FUNCTIONAL REQUIREMENTS	OPERATOR ACTION
KEY COMPONENTS:			
CONDENSATE PUMPS P-35-1A P-35-1B	Unisolated RCP Seal Leak, General Plant Transient, Loss of DC Bus 2, ATWS and Loss of Semi-Vital AC	1 of 2 trains of main feedwater (one MFW pump, one condensate pump) delivering flow to 1 of 4 steam generators.	None explicitly modeled, although control of SG levels is implied.
MAIN FEEDWATER PUMPS P-31-1A P-31-1B	Steamline Breaks, Main Feedline Break	1 of 2 trains of main feedwater to 1 of 3 unfaulted steam generators and steamline or feedline break is not in a location that disables MFW.	
MAIN CONDENSER STEAM RELIEF PATHS: ATMOSPHERIC STEAM DUMP VALVE	Total Loss of MFW, LO SP, Loss of MCC-5, Loss of Control Air, Loss of Semi-Vital AC	Recovery of 1 of 2 MFW trains to 1 of 4 steam generators.	Actions necessary to recover MFW within about 40 minutes.
SG VENT VALVES	<b>SYSTEM BOUNDARIES:</b> Condenser, Condensate Pumps, Main Feedwater pumps to the Steam Generators. Also includes Semi-Vital AC (up to but not including panels), AC Power (up to but not including 4160 V Buses and MCC-5), DC power (up to but not including Buses 1 and 2) and MFW pump lube oil cooling via closed cooling water system (availability dependent on success of system modeled in closed cooling water system section).		
TURBINE BYPASS VALVES	<b>ADDITIONAL ASSUMPTIONS:</b> Steam relief is not considered because of the multiple paths including: steam dump to the condenser, atmospheric steam dump, steam generator vent valves and steam generator safety relief valves.		
MAIN STEAM SAFETY VALVES	Steamline breaks downstream of the NRVs or feedline breaks which occur inside the Turbine Building are assumed to disable the MFW system due to the adverse environment created by the break.		

PLANT: CT SYSTEM:  AUXILIARY FEEDWATER	SUCCESS CRITERIA		
	INITIATOR	FUNCTIONAL REQUIREMENTS	OPERATOR ACTION
	Unisolated RCP Seal Leak, General Plant Transient, Total Loss of MFW, LOFP, Loss of DC Bus 2, ATWS, Loss of Service Water	1 of 2 AFW pump trains delivering flow to 1 of 4 unfaulted steam generators.	Manually open MOV 35 or local manual control of bypass valves, if necessary.
KEY COMPONENTS:  AFW PUMPS P-32-1A P-32-1B  STEAM ADMISSION VALVES MS-PICV-1206A MS-PICV-1206B  FEEDWATER BYPASS FLOW CONTROL VALVES FW-HICV-1301-1 FW-HICV-1301-2 FW-HICV-1301-3 FW-HICV-1301-4  ALTERNATE INJECTION PATH VALVE FW-MOV-35  DWST	Loss of Control Air, Station Blackout, Loss of MCC-5 and Total Loss of DC	Same as above and local manual operation of valves required.	Locally operate the steam admission valves and feedwater bypass valves to control feed flow and steam generator level.
	Steamline Breaks, Main Feedline Break	1 of 2 AFW pump trains delivering flow to 1 of 3 unfaulted steam generators and break is not in adverse location to disable AFW.	Manually open MOV 35 or local manual control of bypass valves, if necessary.
<b>SYSTEM BOUNDARIES:</b> DWST to AFW pumps to steam generators, main steamlines, AC power (up to but not including MCC-5 and 4160V Buses), Vital AC and DC power (up to but not including Buses 1 and 2), and Control Air supply to valves.			
<b>ADDITIONAL ASSUMPTIONS:</b>  Operator action to control steam generator level from the Control Room is not modeled since it is a well practiced step.  A steamline break upstream of the NRVs which occurs outside containment is assumed to result in a loss of AFW due to the adverse environment created by the break and the close approximation to the AFW equipment. This is also assumed for steamline breaks downstream of the NRVs and main feedline breaks just outside containment.  If the steamline or feedline break occurs in the Turbine Building, it is assumed control air is rendered unavailable due to adverse environment. The loss of control air requires local control of AFW flow by the AFW pumps since the bypass valves fail wide open and could overflow the steam generators.			

PLANT: CY  
SYSTEM:

AUXILIARY  
FEEDWATER  
(CONT.)

KEY COMPONENTS:

**ADDITIONAL ASSUMPTIONS:**

The motor driven AFW pump was not credited since, at the time of study, it was never tested or maintained. Also, because of the large recirculation line back to the DWST, there would be insufficient flow to the steam generators. This recirculation line is now isolated and no longer a diversion path.

The ability to transfer water from the PWST to the DWST in the long term was presumed.

Steam diversion path through MS-HICV-1201 to the atmosphere was considered insignificant because the leakage is so small compared to the main steam flow path.

If AFW flow to only one steam generator could be established and the RCP for that loop was not in operation, the remaining RCPs would be tripped and natural circulation would be established.

**CHANGES NOT UPDATED IN PSS:**

The charge of power supplies for AFW flow transmitter.

Proposed changes to CD-LCV-1371A to prevent draining of DWST on loss of air.

AFW success criteria will be changed in the next update.

<b>PLANT: CY</b> <b>SYSTEM:</b> <b>STEAM</b> <b>GENERATOR</b> <b>COOLING</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
<b>KEY COMPONENTS:</b> REFER TO MFW AND AFW SECTIONS.	Small LOCA Loss of DC Bus 1 Consequential Small LOCA	1 of 2 main feed trains or 1 of 2 auxiliary feedwater pumps delivering flow to 1 of 4 steam generators.	Manually open MOV-35 if bypass valves fail to open for AFW use.
	SGTR Consequential SGTR	Same as above except delivering flow to 1 of 3 steam generators.	Manual alignment of MOV-35 if necessary.
<b>SYSTEM BOUNDARIES:</b> <p style="text-align: center;">See MFW and AFW Sections.</p>			
<b>ADDITIONAL ASSUMPTIONS:</b> <p style="text-align: center;">The flow from MFW and AFW must pass through the common bypass line valves  because of auto closure of the feedwater isolation valves on an SI signal.</p> <p style="text-align: center;">See MFW and AFW Sections.</p>			

PLANT: CY SYSTEM: SAFETY INJECTION ACTUATION	SUCCESS CRITERIA		
	INITIATOR	FUNCTIONAL REQUIREMENTS	OPERATOR ACTION
KEY COMPONENTS:  PRESSURIZER PRESSURE TRANSMITTERS: PT-401-1 PT-401-2 PT-401-3  CONTAINMENT PRESSURE TRANSMITTERS: PS-1816-1A PS-1816-2A PS-1816-3A PS-1816-1B PS-1816-2B PS-1816-3B  RELAY COILS 4A AND 4B	All LOCAs	Actuation of the 4A or 4B relay coils which requires operation of any 2 of 3 low pressurizer pressure sensors or 2 of 3 high containment pressure sensors on either of 2 trains.	None
	SGTR	Actuation of the 4A or 4B relay coils which requires operation of any 2 of 3 low pressurizer pressure sensors.	None
<b>SYSTEM BOUNDARIES:</b> Pressurizer Pressure Sensors, High Containment Pressure Sensors, Relay Coils 4A and 4B, and DC Power (up to but not including Buses 1 and 2).			
<b>ADDITIONAL ASSUMPTIONS:</b> Manual initiation of SI was not considered.  The Vital AC System (including inverters) is not modeled because the failure of a train results in a fail-safe position.			
<b>CHANGES NOT UPDATED IN PSS:</b>  The six containment pressure transmitters are being replaced by four transmitters.			

PLANT: CY  
 SYSTEM:  
 CHARGING  
 SYSTEM  
 (CVCS)

**SUCCESS CRITERIA**

INITIATOR	FUNCTIONAL REQUIREMENTS	OPERATOR ACTION
Small Break LOCA Unisolated RCP Seal Leak Consequential Small LOCA (Injection Phase)	1 of 2 charging pumps taking suction from RWST and delivering flow to Loop 2 cold leg.	Backup valve operation, load pump on emergency bus if LOSP.
Medium/Small LOCA Consequential Small LOCA (Recirculation Phase)	Same as above for high pressure recirc. phase except charging pumps take suction from RHR system.	Same as above
SGTR (High Pressure Injection)	Same as above taking suction from RWST - OR - success of HPSI (see HPSI Section).	Same as above

**KEY COMPONENTS:**  
 CHARGING PUMPS  
 P-18-1A  
 P-18-1B

RWST  
 RWST SUCTION VALVES  
 BA-MOV-373  
 BA-MOV-32

VCT ISOLATION VALVE  
 CH-MOV-257

MAIN AND AUX. LUBE OIL PUMPS

LETDOWN ISOLATION VALVES  
 LD-MOV-200  
 LD-AOV-230

**SYSTEM BOUNDARIES:**

RWST, charging pumps to Loop 2 Cold Leg. Also includes AC Power (up to but not including 4160V AC buses and MCC-5), and DC Power (up to but not including Buses 1 and 2) and SIAS logic related to the charging system. Also includes Semi-Vital AC, Control Air, and Component Cooling Water which are developed in system specific sections.

**ADDITIONAL ASSUMPTIONS:**

- Sump recirculation using charging system (via MOV33A and B) will remain an alternative to the HPSI recirculation alignment.
- Component Cooling Water or the fan coolers are required for cooling the charging pumps.
- Isolation of the letdown line is also required for charging system success during LOCA or feed and bleed cooling.
- VCT isolation valve CH-MOV-257 must close to prevent charging pump cavitation.

PLANT: CY  
SYSTEM:

CHARGING  
SYSTEM  
(CVCS)  
CONTINUED

KEY COMPONENTS:

**ADDITIONAL ASSUMPTIONS:**

Alternate injection paths for charging were not credited. Injection via CH-MOV-290 into Loop 4 hot leg was not credited because this valve is disabled. Use of the reactor fill lines was not credited because at the time the EOPs did not address this path. Since the PSS completion, this path has been added to the EOPs.

**CHANGES NOT UPDATED IN PSS:**

VCT isolation valve CH-MOV-257B is being added in series with CH-MOV-257. It will be powered from MCC-12. Also, MOVs 32 and 373 will both open on SIAS or low-low VCT level (under PA 88-027).

RWST suction valve BA-MOV-373 will now be powered by MCC-12 and charging pump P-18-A will be powered by DC Bus 2A with the addition of the new switchgear room.

New flow controllers for FCV-110 and 110A are not currently modeled.

Charging pump trip on SIAS is not currently modeled in PSS, and as it is a temporary fix, will not be modeled.

<b>PLANT: CY</b> <b>SYSTEM:</b> <b>LOW PRESSURE</b> <b>SAFETY</b> <b>INJECTION</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
	Large LOCA	1 of 2 LPSI pumps injecting water into the RCS via 1 of 2 core deluge lines following a successful SIAS.	None
<b>KEY COMPONENTS:</b>			
RWST			
LPSI PUMPS P-92-A P-92-B	<b>SYSTEM BOUNDARIES:</b> RWST to LPSI pumps to core deluge lines. Also consists of AC and DC power (up to but not including EAC Buses 8 and 9, MCC5, and DC Buses 1 and 2) and Safety Injection actuation logic related to the LPSI system.		
CORE DELUGE VALVES SI-MOV-871A SI-MOV-871B	<b>ADDITIONAL ASSUMPTIONS:</b> <p>PAB ventilation is not required for successful operation of LPSI.</p> <p>A mission time of 24 hours is conservatively assumed even though these pumps run for only a couple of hours at most in the injection phase.</p> <p>Check valve CV-103 is assumed to be tested every third refueling based on CY in-service inspection practices.</p>		
CHECK VALVE CV-103	<b>CHANGES NOT UPDATED IN PSS:</b> <p>LPSI pump A control power will be changed to DC BUS 2A when the modifications to the new switchgear room are completed.</p>		

<b>PLANT: CY</b> <b>SYSTEM:</b> <b>HIGH PRESSURE</b> <b>SAFETY</b> <b>INJECTION</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
<b>KEY COMPONENTS:</b>  RWST  HIGH PRESSURE SAFETY INJECTION PUMPS P-15-1A P-15-1B  HPSI DISCHARGE VALVES SI-MOV-861A SI-MOV-861B SI-MOV-861C SI-MOV-861D	Medium and Small LOCAs. All Transients and Trips except loss of Both DC Buses, SGTR.	1 of 2 HPSI pumps delivering flow to 3 of 3 unfaulted injection lines or 2 of 2 HPSI pumps delivering flow to 2 of 3 unfaulted lines.	None
	Loss of Both DC Buses	NA - Assumed to be failed.	
<b>SYSTEM BOUNDARIES:</b>  RWST to HPSI pumps to cold injection lines. Also consists of AC and DC power (up to but not including EAC Buses 8 and 9, DC Buses 1 and 2 and MCC5 ). SIAS logic related to the HPSI system is also included.			
<b>ADDITIONAL ASSUMPTIONS:</b>  PAB ventilation is not required for successful operation of HPSI.  MOV-24 is locked open and (undetected) mispositioning is of negligible probability.  The success criteria is based on the assumption that a LOCA has occurred in one of the cold legs, so only three unfaulted injection paths are potentially available.  The same success criteria is used for both small and medium break LOCAs. This is conservative since flow requirements are much less stringent for smaller breaks.			
<b>CHANGES NOT UPDATED IN PSS:</b>  Control Power for HPSI pump A will be from DC Bus 2A in the new switchgear room. Manual valves 854A and B are being changed to normally open motor operated valves receiving power from MCC-12 and MCC-5 respectively.			

<b>PLANT: CY</b> <b>SYSTEM:</b> <b>PRIMARY PRESSURE RELIEF</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
	All Plant Transients and Trips	1 of 2 pressurizer PORVs (and associated block valve) open to provide bleed path for the primary system when charging is the feed source, and 2 of 2 PORVs and block valves open when HPSI is the feed source.	Manually open PORVs from the Control Room within 35 minutes from the start of transient.
	ATWS	Pressurizer Relief via 1 of 2 PORVs (and associated block valve) opening automatically on 2 of 3 high pressure signals.	None
<b>KEY COMPONENTS:</b>  PORVS PR-AOV-568 PR-AOV-570  BLOCK VALVES PR-MOV-567 PR-MOV-569	Consequential Small LOCA due to stuck open PORV	Closure of stuck open PORV or the associated block valve.	Manual operation to close PORV or block valve.
	<b>SYSTEM BOUNDARIES:</b>		
	Pressurizer PORVs and associated block valves, DC power (up to but not including Buses 1 and 2), AC power (up to but not including MCC-5) and Semi-Vital AC (up to but not including panels). Also included are Pressurizer Pressure channels and DC power (up to but not including Buses 1 and 2) and Vital AC (see Vital AC Section).		
<b>ADDITIONAL ASSUMPTIONS:</b>			
PORVs are assumed not to be dependent on the containment air system. Air is supplied by an accumulator system sized to supply enough air for at least 25 PORV open/close cycles at 85 psig air pressure and 30 psia containment pressure. Once this air is depleted, long-term cooling via the LTOPs is considered.			
The 35 minutes is a conservative value based on the assumption of reactor trip on low steam generator level.			

PLANT: CY  
SYSTEM:

**SUCCESS CRITERIA**

**INITIATOR**

**FUNCTIONAL REQUIREMENTS**

**OPERATOR ACTION**

**BLEED AND FEED**

All Transients and Trips

1 of 2 PORVs with associated block valve with feed delivered from 1 of 2 charging pumps taking suction from the RWST and injecting into Loop 2  
or  
2 of 2 PORVs with both block valves with feed delivered from 1 of 2 HPSI pumps taking suction from the RWST and injecting through 2 of 3 injection paths.

Manually open PORVs from the Control Room within 35 minutes from the start of the transients.

**KEY COMPONENTS:**

REFER TO CHARGING, HPSI AND PRIMARY PRESSURE RELIEF SECTIONS

**SYSTEM BOUNDARIES:**

Refer to Charging, HPSI and Primary Pressure Relief Sections.

**ADDITIONAL ASSUMPTIONS:**

The success criteria for bleed and feed using the HPSI system is based on the HPSI system success criteria for medium-break LOCA where one loop is assumed unavailable.

Refer to Charging, HPSI and Primary Pressure Relief Sections for other assumptions.

The 35 minutes is a conservative value based on the assumption of reactor trip on low steam generator level. With greater SG water inventory at the time of trip, this time can be extended 10 or more minutes.

Feed and bleed using HPSI could succeed with only one PORV if action is taken much earlier than 35 minutes.

PLANT: CY SYSTEM: HIGH/LOW PRESSURE RECIRCULATION	SUCCESS CRITERIA		
	INITIATOR	FUNCTIONAL REQUIREMENTS	OPERATOR ACTION
	Large LOCA (Low Pressure Recirc.)	1 of 2 RHR pumps taking suction from containment sump and operation of 1 of 2 RHR heat exchangers.	Manually align and start pumps, operate valves.
<b>KEY COMPONENTS:</b> RHR PUMPS P-14-1A P-14-1B	Medium/Small LOCA Consequential Small LOCA (High Pressure Recirc.)	1 of 2 RHR pumps taking suction from containment sump, 1 of 2 RHR heat exchangers and 1 of 2 flow paths to the charging system - and - RCS break is not of adverse size and location.	Manually realign pumps and valves.
RHR SUMP SUCTION VALVES RH-MOV-22 RH-V-808A	<b>SYSTEM BOUNDARIES:</b> Sump, RHR pumps, RHR to charging valves. Also includes AC Power (up to but not including MCC5 and EAC Buses 8 and 9), DC Power (up to but not including Buses 1 and 2), Service water valving and PAB ventilation.		
SERVICE WATER VALVES SW-MOV-5 SW-MOV-6	<b>ADDITIONAL ASSUMPTIONS:</b>  During low pressure recirculation, given success of LPSI, the core deluge valves are assumed to be available (open).  For high pressure recirculation, successful charging operation is also required (see charging section).  If a medium or small LOCA occurs in the loop 2 cold leg or connecting piping or in the charging line downstream of the isolation check valve and be of sufficient size to degrade charging flow but not depressurize the system, high pressure recirculation would fail.  Normally for modes 5 and 6 RHR heat exchanger cooling is by CCW, but during a LOCA, service water is supplied directly to the exchangers.  Following a small/medium LOCA, valve BA-MOV-373 (BA-MOV-32) which was opened for the injection phase must be closed during the recirculation phase to prevent system failure.  Due to lack of analysis supporting that the RHR pumps can operate successfully without ventilation cooling, it was assumed that the RHR pumps are dependent on PAB ventilation. Current analysis is being performed which might change this assumption.		
RHR TO CHARGING VALVES CH-MOV-33A CH-MOV-33B			
RHR HEAT EXCHANGERS			
RHR TO HPSI VALVES SI-MOV-24 RH-MOV-874			

**PLANT: CY  
SYSTEM:  
HIGH/LOW  
PRESSURE  
RECIRCULATION  
(CONT.)**

**KEY COMPONENTS:**

**ADDITIONAL ASSUMPTIONS:**

**CHANGES PARTIALLY UPDATED IN PSS:**

The PSS report has not been updated and therefore still distinguishes between "low" and "high" pressure recirculation. Since the publication of the report in 1986, significant changes have been made to ES-1.3 Transfer to RHR Recirculation and ES-1.4 Transfer to Two Path Recirculation in the EOPs. Containment sump recirculation via the HPSI system (closing SI-MOV-24 and opening RH-MOV-874)) has been credited and reflected in the core melt frequency calculation. After the 1989 refueling outage, this path will no longer be used.

**CHANGES NOT UPDATED IN PSS:**

As a result of the new switchgear room, RHR pump P-14-1B will be repowered from 480V Bus 11 and DC Bus 2A. BA-MOV-373 will be repowered from MCC-12.

As part of the long term ECCS modifications, a crosstie was installed between RHR and the HPSI system. Thus during sump recirculation, the RHR pump can take suction from the sump and feed the suction of the HPSI pump for high pressure recirculation. Manual valves SI-V-854 A and B were replaced with MOVs. SI-MOVs 901, 902, 903, and 904 were installed. One train of new valves will be powered from MCC-5, the other from MCC-12.

<b>PLANT: CY</b> <b>SYSTEM:</b>  <b>TWO PATH</b> <b>RECIRCULATION</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
<b>KEY COMPONENTS:</b>  RHR-TO-CHARGING PUMP SUCTION VALVES RH-MOV-33A RH-MOV-33B  RWST SUCTION VALVE BA-MOV-373  VCT ISOLATION VALVE CH-MOV-257	Large LOCA	Supply 50 gpm of net core flushing reactor vessel via a flow path from RHR pumps through the charging system and/or core deluge to prevent boron precipitation.	Operator manually realigns discharge of RHR pumps to charging between 6 to 8 hours following a large LOCA.
	<b>SYSTEM BOUNDARIES:</b>  Valving from RHR to Charging System to the Reactor Vessel. AC Power (up to but not including MCC-5).		
	<b>ADDITIONAL ASSUMPTIONS:</b>  The charging pumps are tripped during this mode of operation.  CH-MOV-257 or CH-CV-260 must be closed to prevent backflow ir.to the VCT.		
	<b>CHANGES NOT UPDATED IN PSS:</b>  As noted under HIGH/LOW PRESSURE RECIRCULATION, significant procedural changes have been made which are not currently modeled in the PSS.		

<b>SUCCESS CRITERIA</b>			
<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>	
SGTR	1 of 2 RHR pumps taking suction from loop 1 hot leg and delivering flow to loop 2 cold leg and 1 of 2 RHR heat exchangers.	Locally open MOVs inside containment if motor operator fails, align valves and start pumps, override pressure interlocks.	
All Transients/Trips where feed and bleed is necessary	1 or 2 RHR pumps, 1 of 2 RHR heat exchangers and Suction from loop 1 hot leg or the containment sump with 1 of 2 LTOP trains open Injection into loop 2 hot leg or through 1 of 2 core deluge valves.	Manually open valves and start pumps; override electrical interlocks.	
<b>SYSTEM BOUNDARIES:</b>			
LTOPs, Sump, Loop 1 hot leg valving, RHR pumps, Loop 2 cold leg valving, and core deluge valving. Also included AC Power (up to but not including EAC buses 8 and 9 and MCC-5), DC power (up to but not including Buses 1 and 2), Semi-Vital AC power, component cooling water and service water valving related to RHR heat exchangers and PAB ventilation.			
<b>ADDITIONAL ASSUMPTIONS:</b>			
It is assumed that by opening the pressurizer low temperature over-pressure safety relief valves enough water will be in the sump for long term cooling.			
The rupture disc in the pressurizer relief tank is assumed to have opened following feed and bleed.			
PAB ventilation is necessary for successful RHR operation. This assumption is under analysis now and might result in no dependency on ventilation cooling for RHR.			
<b>CHANGES NOT UPDATED IN PSS:</b>			
The pressure interlocks for the LTOPs, loop 1 hot leg valves and the loop 2 cold leg valves power dependency has been changed from Semi Vital AC to Vital AC panels A and D. A loss of vital panels A and D will result in having to jumper bypass to open the RHR valves but the LTOPs still can be opened manually in the control room.			
As a result of analysis and procedural changes, the success criteria for long term cooling will be redefined. Sump recirculation is required following feed and bleed cooling. LTOPs can only be used when charging is used.			
<b>KEY COMPONENTS:</b>			
RHR PUMPS P-14-1A P-14-1B			
LOOP 1 HOT LEG SUCTION VALVES RH-MOV-780 RH-MOV-781			
LOOP 2 COLD LEG DISCHARGE VALVES RH-MOV-803 RH-MOV-804			
LTOP VALVES PR-MOV-596 PR-MOV-597 PR-MOV-598 PR-MOV-599			
CORE DELUGE VALVES SI-MOV-871A SI-MOV-871B			

PLANT: CY  
SYSTEM:  
LONG TERM  
COOLING  
(RHR)

<b>PLANT: CY</b> <b>SYSTEM:</b>  <b>CONTAINMENT</b> <b>SPRAY</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
	Large/Medium LOCA	2 of 2 LPSI pump trains or 1 of 2 fire pump trains - and - 2 of 2 RHR pump trains.	See individual system sections.
<b>KEY COMPONENTS:</b>  REFER TO LPSI AND LPR (RHR) SYSTEM SECTIONS.  CONTAINMENT SPRAY INJECTION VALVES RH-MOV-34 RH-MOV-23  DIESEL DRIVEN FIRE PUMP P-5-1A MOTOR DRIVEN FIRE PUMP P-4-1A FIRE PUMP TO CONTAINMENT SPRAY HEADER VALVE RH-MOV-31	Small LOCA, all Transients and Trips (pre-core melt)	1 of 2 LPSI pump trains or 1 of 2 fire pump trains - and - 1 of 2 RHR pump trains.	See Above
	Small LOCA, all other Transients (post core melt)	1 of 2 fire pumps discharging flow through RH -MOV-31 to the containment spray header.	Manually start pumps and open valve.
	Station Blackout	Successful operation of the diesel driven fire pump and opening of RH-MOV-31.	Start fire pump and open RH-MOV-31.
	<b>SYSTEM BOUNDARIES:</b> See Low Pressure Safety Injection System and Low Pressure Recirculation (RHR) Systems Sections.  Also includes Fire pumps and valving to containment spray header and valving from RHR and LPSI to Containment spray header.		
	<b>ADDITIONAL ASSUMPTIONS:</b>  If the core deluge valves are open creating a diversion path to the spray, both LPSI pumps and both RHR pumps are required.  During transients, LPSI is assumed to be needed for containment spray in the initial phase to provide water for the containment sump. Although, there are some transients where the accident scenario provides water itself.  Short-term use of fire protection system for containment spray will not cause a significant boron dilution concern (pre-core melt). For post core melt/post reactor vessel failure, a re-criticality condition is not possible, hence there are no constraints on using river water for spray as a last resort.  In case of LOSP, the electric driven fire pump is assumed to be failed since the pump start is blocked by lockout relays.		
	<b>CHANGES NOT UPDATED IN PSS:</b>  As a result of the Long Term ECCS Modifications which allow using HPSI for recirculation, and single failure concerns, containment spray via LPSI/RHR may no longer be used concurrently. Also, recent procedural changes allow use of containment spray for only beyond design basis events.		

<b>PLANT: CY</b> <b>SYSTEM:</b>  <b>CAR FANS</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
	All Transients/Trips and LOCAs except Loss of Service Water	2 out of 4 CAR Fans operating.	Remote manual starts from Control Room.
<b>KEY COMPONENTS:</b>  CAR FANS F-17-1 F-17-2 F-17-3 F-17-4	Total Loss of Service Water	NA - Assumed to be Failed.	
	<b>SYSTEM BOUNDARIES:</b> Fans, Fan cooler coil units, a system of distribution duct work and service water cooling. Also including AC power (up to but not including Buses 8 and 9), DC power (up to but not including Buses 1 and 2) and SIAS logic related to the CAR fans.		
	<b>ADDITIONAL ASSUMPTIONS:</b> <p>Operation of the dampers is not necessary for the CAR fans to perform their heat removal function, although the fission product removal function will not be performed.</p> <p>Since no significant single failure (other than a support system failure) will fail the CAR system, system unavailability is dominant by common cause failures.</p> <p>There is substantial margin between containment design pressure and ultimate capacity. Based on best estimate containment analyses, two CAR fans have been shown to be adequate.</p> <p>Normally, 3 or 4 CAR fans are operating. For this analysis, 3 CAR fans are assumed to be adequate.</p>		
	<b>CHANGES NOT UPDATED IN PSS:</b> <p>The addition of the new switchgear room will make it possible to align CAR fans F-17-3 and F-17-4 power supply to 480V Bus 11 and DC Bus 2A if necessary.</p>		

PLANT: CY  
SYSTEM:

**SUCCESS CRITERIA**

**CONTAINMENT  
HEAT REMOVAL**

**INITIATOR**

**FUNCTIONAL REQUIREMENTS**

**OPERATOR ACTION**

All Transients/Trips  
and LOCAs

CAR Fans or Containment Spray

See individual system sections.

**KEY COMPONENTS:**

REFER TO  
CAR FANS  
AND  
CONTAINMENT  
SPRAY  
SYSTEM  
SECTIONS

**SYSTEM BOUNDARIES:**

See CAR Fans and Containment Spray Sections.

**ADDITIONAL ASSUMPTIONS:**

<b>PLANT: CY</b> <b>SYSTEM:</b> <b>RCS</b> <b>DEPRESSURIZATION</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
<b>KEY COMPONENTS:</b>  PORVS PR-AOV-568 PR-AOV-570  BLOCK VALVES PR-MOV-567 PR-MOV-569  PRESSURIZER SPRAY VALVES PR-AOV-573 PR-AOV-574  AUXILIARY SPRAY VALVE CH-MOV-298	SGTR	RCS depressurization via normal pressurizer spray which requires operation of #3 or #4 RCP and associated valves or Via auxiliary pressurizer spray which requires 1 of 2 charging pumps and associated valves or Via opening of 1 of 2 PORVS and associated block valve.	Manually initiate and control cooldown and depressurization.
	Consequential Small LOCA due to RCP seal failure	Opening of 1 of 2 PORVS and associated block valve.	Manually initiate and control cooldown and depressurization.
<b>SYSTEM BOUNDARIES:</b>  PORVs, Block Valves, Pressurizer Spray Valves, Auxiliary Spray Valves, AC power (up to but not including MCC-5 and 4160V Buses), DC power (up to but not including DC Bus 1 and 2), Semi-Vital AC (up to but not including the panels), Charging System (if available for high pressure injection, assume successful for depressurization.)			
<b>ADDITIONAL ASSUMPTIONS:</b>  See Pressurizer Relief Section  <b>CHANGES NOT UPDATED IN PSS:</b>  Because of Appendix R concerns, power has been removed from CH-MOV-298.			

PLANT: CY

SYSTEM:

EMERGENCY  
BORATION

SUCCESS CRITERIA

INITIATOR

FUNCTIONAL REQUIREMENTS

OPERATOR ACTION

ATWS

Flow from 1 of 2 boric acid pumps delivered to the charging system with 1 of 2 charging pumps injecting into Loop 2.

Manually operate valves and start boric acid pumps; isolate VCT.  
Align RWST to charging suction.

KEY COMPONENTS:

BORIC ACID PUMPS  
P-9-1A  
P-9-1B

BORIC ACID MIX  
TANK VALVES:  
BA-MOV-366  
BA-V-369

SYSTEM BOUNDARIES:

Consists of Boric Acid Pumps, the Boric Acid Mix Tank and associated valving. AC power is also included (up to but not including MCC-5 and 4160V AC Buses). The Charging System portion of Emergency Boration is addressed in the Charging Section.

ADDITIONAL ASSUMPTIONS:

No credit is taken for the gravity fill line.

Failure of the boric acid mix tank was assumed to be negligible. Alarms signal the operator that the solution level of the tank is low or that the temperature is too high or too low. The temperature of the solution prevents boron precipitation. The boric acid mix tank is also involved in a weekly test. If the mixer was to fail, this failure would be discovered during the test.

PLANT: CY SYSTEM: TURBINE TRIP	SUCCESS CRITERIA		
	INITIATOR	FUNCTIONAL REQUIREMENTS	OPERATOR ACTION
	ATWS	Closure of all turbine stop valves or closure of 4 of 4 MSTVs.	Manually trip the turbine following reactor trip signal indicator.
KEY COMPONENTS:  TURBINE STOP VALVES  MSTVS			
<p><b>SYSTEM BOUNDARIES:</b></p> <p>Turbine Stop Valves, MSTVs, DC power (up to but not including Buses 1 and 2).</p>			
<p><b>ADDITIONAL ASSUMPTIONS:</b></p> <p>A loss of DC Bus 1 makes it impossible to trip turbine automatically or manually from the Control Room, because the tripping circuit is fed from Battery "A"</p> <p>A loss of DC Bus 1 does trip the MSIVs closed, stopping the steam supply to the turbine.</p>			

PLANT: CY

SYSTEM:

PRIMARY LOOP  
ISOLATION  
VALVES

SUCCESS CRITERIA

INITIATOR

FUNCTIONAL REQUIREMENTS

OPERATOR ACTION

SGTR  
Consequential SGTR

Hot leg and cold leg loop isolation valves  
on affected loop both close.

Manually trip RCP on affected loop and  
close valves.

KEY COMPONENTS:

LOOP ISOLATION  
VALVES

RC-MOV-526  
RC-MOV-537  
RC-MOV-538  
RC-MOV-546  
RC-MOV-501  
RC-MOV-512  
RC-MOV-524  
RC-MOV-513

SYSTEM BOUNDARIES:

Loop Isolation Valves and AC Power (up to but not including MCC-5).

ADDITIONAL ASSUMPTIONS:

Loop Isolation valves are used following a SGTR for the following conditions:

A SRV stuck open in the faulted SG

RCS depressurization capability is lost

Core Melt has occurred.

CHANGES NOT UPDATED IN PSS:

Primary to secondary pressure difference must be less than 400 psig.

<b>PLANT: CY</b> <b>SYSTEM:</b> <b>INTERFACING SYSTEMS LOCA EQUIPMENT</b>	<b>SYSTEM</b>	<b>OPERATOR RECOVERY ACTION</b>
<b>KEY COMPONENTS:</b>  SI-MOV-871A SI-MOV-871B SI-CV-872A SI-CV-872B  SI-MOV-861A SI-MOV-861B SI-MOV-861C SI-MOV-861D  SI-CV-862A SI-CV-862B SI-CV-862C SI-CV-862D SI-CV-856A SI-CV-856B  RH-MOV-803 RH-MOV-804 RH-MOV-780 RH-MOV-781  LD-MOV-200 LD-TV-230	LPSI/Core Deluge	Following a SIS at high RCS pressure (opening both CD MOVs) operators attempt to remotely reclose the MOVs if LOCA outside containment occurs (within approximately 15 minutes).
	HPSI	Following a SIS at high RCS pressure (opening all four SI MOVs) operators attempt to remotely reclose the MOVs if a LOCA outside containment occurs (within approximately 30 minutes). Note that this is credited even though responses to a LOCA Outside Containment (ECA-1.2) do not specifically include action to verify HPSI valve alignment.
	Letdown	Given a piping failure or orifice rupture outside containment and auto logic fails to close MOV-200 and/or AOV-230, operators are credited with attempting to remotely reclose these valves (within approximately 30 minutes). Given that remote operation fails, credit is given for attempting to manually close valves (within approximately one hour).
	RHR	In the unlikely event that MOVs 803 and 781 were to fail open catastrophically with MOVs 804 and 780 in an open position, operators are credited with attempting to remotely reclose the latter.
	<b>ADDITIONAL ASSUMPTIONS:</b>  The potential frequency of an Interfacing Systems LOCA in the charging system is negligible.  HPSI, LPSI/CD, RHR and letdown MOVs can close substantially if not completely against different pressure.  LPSI piping cannot withstand the thermal or pressure stresses induced by RCS flow upstream of the outboard check valves.  LPSI/CD and HPSI MOVs are inaccessible for local manual operation.  Local manual operation of valve V-221 will not be possible given a pipe rupture outside containment.  If all three flow control valves in the letdown line were opened, overpressurization will be prevented by relief valves RV-205 and RV-252.  <b>CHANGES NOT UPDATED IN PSS:</b>  Credit for closure of SI-MOV-873 not taken.	

<b>PLANT: CY</b> <b>SYSTEM:</b> <b>FIRE DETECTION</b> <b>AND SUPPRESSION</b> <b>SYSTEM</b>	<b>SUCCESS CRITERIA</b>		
	<b>INITIATOR</b>	<b>FUNCTIONAL REQUIREMENTS</b>	<b>OPERATOR ACTION</b>
	All Fires	Detection/Suppression: System suppresses fire before extensive equipment damage occurs.	Detect and suppress fire as required.
<b>KEY COMPONENTS:</b> FIRE DETECTION/SUPPRESSION SYSTEMS FOR THE FOLLOWING AREAS:  CONTROL ROOM  CABLE SPREADING AREA  SWITCHGEAR ROOM  CABLE VAULT  PRIMARY AUXILIARY BUILDING  TURBINE BUILDING  SCREENWELL PUMPHOUSE  DIESEL GENERATOR BUILDING  CONTAINMENT BUILDING			
	<b>SYSTEM BOUNDARIES:</b>  All Fire Detection and Suppression Systems, including automatically initiated, manually initiated and portable fire extinguishers in the areas listed.		
	<b>ADDITIONAL ASSUMPTIONS:</b>  Damage caused by fires to control circuits causing spurious equipment operation defeats the intended system function.  Fires which cause a failure of the RPS result in a reactor trip.  The roving fire patrol which inspects each assigned area once every 20 minutes is credited with detection but not suppression of a fire.  Fire detection considers plant personnel who occupy an area, roving fire patrol, early warning area smoke detectors and rate of rise heat detectors. In event early heat detection fails, the fire is generally assumed to grow in size.		

## ADDITIONAL FIRE ASSUMPTIONS

If a fire is discovered early by personnel or area smoke detectors, then portable extinguishers are credited for early suppression. Sprinklers are also credited for early suppression if they are located close to equipment.

If the fire is not detected or suppressed early, then manual hose stations are credited as being used for late suppression.

Vertical propagation to cable trays is assumed unless detection and suppression are early.

An unsuppressed equipment fire would cause a loss of all unprotected or adjacent components within an area.

### CONTROL ROOM

Credited detection/suppression systems include: smoke detectors, operators, portable extinguishers and Halon system.

If a fire in any one of the zones or sections is detected early and suppressed within 3 minutes, only minimum damage and a reactor trip is assumed.

In the event that the fire is not rapidly extinguished the entire zone and its contents are considered lost.

Propagation to adjacent zones is not expected to take place until approximately 15 minutes after the fire starts.

Late detection and suppression are credited because of time involved for spread and the availability of additional extinguishers in Service Building.

### CABLE SPREADING AREA

Credited detection/suppression systems include: smoke detectors, operators and fire patrol detection, sprinklers, portable extinguishers, and hose station.

Fire is assumed to start in any one of the cable trays.

If the fire is suppressed early by the automatic sprinkler system or portable extinguishers then minimal damage to the affected cable tray and a reactor trip are assumed.

## ADDITIONAL FIRE ASSUMPTIONS (CONTINUED)

### CABLE SPREADING AREA (CONTINUED)

Smoke detectors are credited for early detection.

Fires not detected/suppressed early are assumed to result in loss of entire affected zone.

Credit is given for late detection by control room operators and the fire patrol.

Late suppression via the hose station is credited.

A failure of late detection or suppression equates to a total room loss and damage to all cables within.

### SWITCHGEAR ROOM

Credited detection/suppression systems include: smoke detectors, fire watch, Halon system, and hose station.

Fire is assumed to start in the following equipment groupings: 4160V and 480V buses, MCC-5, MCC-6, transformers, DC batteries, battery chargers, Vital AC inverters or RPS MG sets.

If fire is detected by smoke detectors or humans and suppressed early by portable extinguishers or automatic halon system, then only the affected component within the equipment grouping is damaged.

No credit is given for human detection or suppression via portable extinguishers in case of transformer oil fires. Since this analysis, the oil filled transformers have been replaced by dry ones. This change has not been updated.

If early detection/suppression fail, fire is assumed to spread to adjacent components within the same equipment groupings.

If late detection by the operators and late suppression via the hose station fail, fire is assumed to spread to overhead cables resulting in loss of the total room.

## ADDITIONAL FIRE ASSUMPTIONS (CONTINUED)

### CONTAINMENT CABLE VAULT

Credited detection/suppression systems include: smoke detectors, portable extinguishers, automatic CO<sub>2</sub> system, fire patrol, and hose station.

Fire zones are defined as cable trays which run from the duct bank side to containment side of the vault.

If the fire is detected early by smoke detectors and suppressed early by portable extinguishers or automatic CO<sub>2</sub> system, damage to just one side of the zone is expected.

Fires that are not suppressed early are assumed to damage the entire affected zone.

Credit is given for late detection by the fire patrol and late suppression by using the hose stations.

A failure of late detection or suppression implies total loss of all cables in the vault.

### PRIMARY AUXILIARY BUILDING

Credited detection/suppression systems include: smoke detectors, test or maintenance personnel, fire patrol, portable extinguishers, hose stations, and sprinklers.

Fire is assumed to start in one of the following equipment groupings: electric motor driven pumps, MCC-8, waste control panel or area where flammable liquids are stored.

If fire is detected early by smoke detectors, fire patrol, or maintenance personnel and suppressed early by portable extinguishers or auto sprinkler system, then minimum PAB damage and loss of affected component is expected.

No credit is given to human detection of fires involving large quantities of flammable liquid.

## ADDITIONAL FIRE ASSUMPTIONS (CONTINUED)

### PRIMARY AUXILIARY BUILDING (CONTINUED)

Late suppression by hose stations is credited only if the fire is not expected to propagate to overhead cables.

Failure of late suppression results in total loss of the room.

No fires are assumed for RHR pumps since they are not usually running when the plant is at power.

### TURBINE BUILDING

Credited fire detection/suppression systems include: heat detection, plant personnel detection, portable extinguishers, sprinklers, and hose stations.

A Turbine Building fire is assumed to start in either the SG feedwater pumps, turbine oil reservoir or closed cooling water pumps.

#### Feedwater Pumps

If detected by plant personnel and suppressed by portable extinguishers or automatic sprinkler system early, a reactor trip with a partial loss of feedwater is expected.

If late detection by Control Room operators and late suppression by using hose stations fails, a non-recoverable loss of instrument air and a total loss of main feedwater is assumed.

#### Turbine Oil Reservoir

Early detection is credited to both area heat detectors and personnel who are present when the fire starts.

If early detection or early operation of sprinkler system fails, hose stations are credited with late suppression before the fire has a chance to spread.

## ADDITIONAL FIRE ASSUMPTIONS (CONTINUED)

### TURBINE BUILDING (CONTINUED)

#### Closed Cooling Water Pumps

Closed cooling water pump fires are considered to be negligible.

The frequency of losing instrument air due to other causes are larger contributors than the frequency due to fires.

### SCREENWELL PUMPHOUSE

Due to the early fire warning capability, the low combustible fire loading and the available fire protection features, the contribution of a pumphouse fire to the total core melt frequency is negligible.

### DIESEL GENERATOR BUILDING

The diesel generators are not operating during normal plant operation and fire is assumed to start during periodic testing of the units.

If the fire is detected early by smoke detectors or humans in the area and suppressed early by the auto sprinkler system or hose station, it is assumed that the diesel generator is lost but will not affect plant operation.

### CHANGES NOT UPDATED IN PSS:

Removal of the PCB oil-filled transformers from the old switchgear room.

Modifications to the halon suppression system in the old switchgear room.

New switchgear building.

Other Appendix R mods since September 1986.

# Appendix E

## List of PRA Contacts