

EMERGENCY CORE COOLING SYSTEMS

ECCS SUBSYSTEMS - T<sub>avg</sub> ≥ 350°F

LIMITING CONDITION FOR OPERATION

3.5.2 Two independent ECCS subsystems shall be OPERABLE with each subsystem comprised of the following injection systems:

- a. One OPERABLE centrifugal charging pump and associated flow path capable of taking suction from the refueling water storage tank and transferring suction to the residual heat removal pump discharge piping and;
  1. Discharging into each Reactor Coolant System (RCS) cold leg.
- b. One OPERABLE safety injection pump and associated flow path capable of taking suction from the refueling water storage tank and transferring suction to the residual heat removal pump discharge piping and;
  1. Discharging into each RCS cold leg, and; upon manual initiation,
  2. Discharging into its two associated RCS hot legs.
- c. One OPERABLE residual heat removal pump and associated residual heat removal heat exchanger and flow path capable of taking suction from the refueling water storage tank on a safety injection signal and transferring suction to the containment sump during the recirculation phase of operation and;
  1. Discharging into each RCS cold leg, and; upon manual initiation,
  2. Discharging into two RCS hot legs.

APPLICABILITY: MODES 1, 2 and 3.

ACTION:

- a. With one ECCS subsystem inoperable, restore the inoperable subsystem to OPERABLE status within 72 hours or be in HOT SHUTDOWN within the next 12 hours.
- b. In the event the ECCS is actuated and injects water into the Reactor Coolant System, a Special Report shall be prepared and submitted to the Commission pursuant to Specification 6.9.2 within 90 days describing the circumstances of the actuation and the total accumulated actuation cycles to date.
- c. With both ECCS subsystems inoperable for surveillance testing, restore at least one subsystem to OPERABLE status within 1 hour or be in at least HOT STANDBY within the next 6 hours and in at least HOT SHUTDOWN within the following 6 hours and at least COLD SHUTDOWN within the subsequent 24 hours.

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EMERGENCY CORE COOLING SYSTEMS

SURVEILLANCE REQUIREMENTS

4.5.2 Each ECCS subsystem shall be demonstrated OPERABLE:

a. At least once per 12 hours by:

1. Verifying that the following valves are in the indicated positions with power to the valve operators removed:

<u>Valve Number</u>	<u>Valve Function</u>	<u>Valve Position</u>
a. 1 SJ 69	a. RHR pump suction	a. open
b. 1 SJ 30	b. SI pump suction	b. open
c. 11 SJ 40	c. SI discharge to hot legs	c. closed
d. 12 SJ 40	d. SI discharge to hot legs	d. closed
e. 1 RH 26	e. RHR discharge to hot legs	e. closed
f. 11 SJ 49	f. RHR discharge to cold legs	f. open
g. 12 SJ 49	g. RHR discharge to cold legs	g. open
h. 1 CS 14#	h. Spray additive tank discharge	h. open
i. 1 SJ 135	i. SI discharge to cold legs	i. open
j. 1 SJ 67	j. SI recirc. line isolation	j. open
k. 1 SJ 68	k. SI recirc. line isolation	k. open
l. 11 SJ 44	l. Containment sump isolation valve	l. closed
m. 12 SJ 44	m. Containment sump isolation valve	m. closed

2. Verifying that the following valves are in the indicated positions:

<u>Valve Number</u>	<u>Valve Function</u>	<u>Valve Position</u>
a. 11 RH 19	a. RHR crosstie valve	a. open
b. 12 RH 19	b. RHR crosstie valve	b. open

b. At least once per 31 days by:

1. Verifying that each valve (manual, power operated or automatic) in the flow path that is not locked, sealed, or otherwise secured in position, is in its correct position.

2. Verifying that the ECCS piping is full of water by venting the ECCS pump casings and accessible discharge piping high points.

# If inoperable, the applicable Technical Specification is 3.6.2.2.

EMERGENCY CORE COOLING SYSTEMS

ECCS SUBSYSTEMS - T<sub>avg</sub> <350°F

LIMITING CONDITION FOR OPERATION

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3.5.3 As a minimum, one ECCS subsystem# comprised of the following shall be OPERABLE:

- a. One OPERABLE centrifugal charging pump and associated flow path capable of taking suction from the refueling water storage tank and transferring suction to the residual heat removal pump discharge piping and;
  1. Discharging into each Reactor Coolant System (RCS) cold leg.
- b. One OPERABLE residual heat removal pump and associated residual heat removal heat exchanger and flow path capable of taking suction from the refueling water storage tank on a safety injection signal and transferring suction to the containment sump during the recirculation phase of operation and;
  1. Discharging into each RCS cold leg, and; upon manual initiation,
  2. Discharging into two RCS hot legs.

APPLICABILITY: MODE 4.

ACTION:

- a. With no ECCS subsystem OPERABLE because of the inoperability of either the centrifugal charging pump or the flow path from the refueling water storage tank, restore at least one ECCS subsystem to OPERABLE status within 1 hour or be in COLD SHUTDOWN within the next 20 hours.
- b. Within no ECCS subsystem OPERABLE because of the inoperability of either the residual heat removal heat exchanger or residual heat removal pump, restore at least one ECCS subsystem to OPERABLE status or maintain the Reactor Coolant System T<sub>avg</sub> less than 350°F by use of alternate heat removal methods.
- c. In the event the ECCS is actuated and injects water into the Reactor Coolant System, a Special Report shall be prepared and submitted to the Commission pursuant to Specification 6.9.2 within 90 days describing the circumstances of the actuation and the total accumulated actuation cycles to date.

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#A maximum of one safety injection pump or one centrifugal charging pump shall be OPERABLE whenever the temperature of one or more of the RCS cold legs is less than or equal to 312°F. NOTE: This particular restriction also applies in MODE 5 and 6.

### 3/4.5 EMERGENCY CORE COOLING SYSTEMS

#### BASES

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#### 3/4.5.1 ACCUMULATORS

The OPERABILITY of each RCS accumulator ensures that a sufficient volume of borated water will be immediately forced into the reactor core through each of the cold legs in the event the RCS pressure falls below the pressure of the accumulators. This initial surge of water into the core provides the initial cooling mechanism during large RCS pipe ruptures.

The limits on accumulator volume, boron concentration and pressure ensure that the assumptions used for accumulator injection in the safety analysis are met.

The accumulator power operated isolation valves are considered to be "operating bypasses" in the context of IEEE Std. 279-1971, which requires that bypasses of a protective function be removed automatically whenever permissive conditions are not met. In addition, as these accumulator isolation valves fail to meet single failure criteria, removal of power to the valves is required.

The limits for operation with an accumulator inoperable for any reason except in isolation valve closed minimizes the time exposure of the plant to a LOCA event occurring concurrent with failure of an additional accumulator which may result in unacceptable peak cladding temperatures. If a closed isolation valve cannot be immediately opened, the full capability of one accumulator is not available and prompt action is required to place the reactor in a mode where this capability is not required.

#### 3/4.5.2 and 3/4.5.3 ECCS SUBSYSTEMS

The OPERABILITY of two independent ECCS subsystems ensures that sufficient emergency core cooling capability will be available in the event of a LOCA assuming the loss of one subsystem through any single failure consideration. Either subsystem operating in conjunction with the accumulators is capable of supplying sufficient core cooling to limit the peak cladding temperatures within acceptable limits for all postulated break sizes ranging from the double ended break of the largest RCS cold leg pipe downward. In addition, each ECCS subsystem provides long term core cooling capability in the recirculation mode during the accident recovery period.

The limitation for a maximum of one safety injection pump to be OPERABLE and the Surveillance Requirement to verify all safety injection pumps except the allowed OPERABLE pump to be inoperable below 312°F provides assurance that a mass addition pressure transient can be relieved by the operation of a single POPs relief valve.

# EMERGENCY CORE COOLING SYSTEMS

## BASES

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### ECCS SUBSYSTEMS (Continued)

With the RCS temperature below 350°F, one OPERABLE ECCS subsystem is acceptable without single failure consideration on the basis of the stable reactivity condition of the reactor and the limited core cooling requirements.

The Surveillance Requirements provided to ensure OPERABILITY of each component ensures that at a minimum, the assumptions used in the safety analyses are met and that subsystem OPERABILITY is maintained. Surveillance requirements for throttle valve position stops and flow balance testing provide assurance that proper ECCS flows will be maintained in the event of a LOCA. Maintenance of proper flow resistance and pressure drop in the piping system to each injection point is necessary to: (1) prevent total pump flow from exceeding runout conditions when the system is in its minimum resistance configuration, (2) provide the proper flow split between injection points in accordance with the assumptions used in the ECCS-LOCA analyses, and (3) provide an acceptable level of total ECCS flow to all injection points equal to or above that assumed in the ECCS-LOCA analyses. Each ECCS subsystem supplies all four cold legs to satisfy minimum flow requirements.

EMERGENCY CORE COOLING SYSTEMS

ECCS SUBSYSTEMS - T<sub>avg</sub> ≥ 350°F

LIMITING CONDITION FOR OPERATION

3.5.2 Two independent ECCS subsystems shall be OPERABLE with each subsystem comprised of the following injection systems:

- a. One OPERABLE centrifugal charging pump and associated flow path capable of taking suction from the refueling water storage tank and transferring suction to the residual heat removal pump discharge piping and;
  1. Discharging into each Reactor Coolant System (RCS) cold leg.
- b. One OPERABLE safety injection pump and associated flow path capable of taking suction from the refueling water storage tank and transferring suction to the residual heat removal pump discharge piping and;
  1. Discharging into each RCS cold leg, and; upon manual initiation,
  2. Discharging into its two associated RCS hot legs.
- c. One OPERABLE residual heat removal pump and associated residual heat removal heat exchanger and flow path capable of taking suction from the refueling water storage tank on a safety injection signal and transferring suction to the containment sump during the recirculation phase of operation and;
  1. Discharging into each RCS cold leg, and; upon manual initiation,
  2. Discharging into two RCS hot legs.

APPLICABILITY: MODES 1, 2 and 3.

ACTION:

- a. With one ECCS subsystem inoperable, restore the inoperable subsystem to OPERABLE status within 72 hours or be in HOT SHUTDOWN within the next 12 hours.
- b. In the event the ECCS is actuated and injects water into the Reactor Coolant System, a Special Report shall be prepared and submitted to the Commission pursuant to Specification 6.9.2 within 90 days describing the circumstances of the actuation and the total accumulated actuation cycles to date. The current value of the usage factor for each affected safety injection nozzle shall be provided in this Special Report whenever its value exceeds 0.70.

EMERGENCY CORE COOLING SYSTEMS

ECCS SUBSYSTEMS - T<sub>avg</sub> ≥ 350°F

ACTION (Continued):

- c. With both ECCS subsystems inoperable for surveillance testing, restore at least one subsystem to OPERABLE status within 1 hour or be in at least HOT STANDBY within the next 6 hours and in at least HOT SHUTDOWN within the following 6 hours and at least COLD SHUTDOWN within the subsequent 24 hours.

EMERGENCY CORE COOLING SYSTEMS

SURVEILLANCE REQUIREMENTS

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4.5.2 Each ECCS subsystem shall be demonstrated OPERABLE:

a. At least once per 12 hours by:

1. Verifying that the following valves are in the indicated positions with power to the valve operators removed:

<u>Valve Number</u>	<u>Valve Function</u>	<u>Valve Position</u>
a. 2 SJ 69	a. RHR pump suction	a. open
b. 2 SJ 30	b. SI pump suction	b. open
c. 21 SJ 40	c. SI discharge to hot legs	c. closed
d. 22 SJ 40	d. SI discharge to hot legs	d. closed
e. 2 RH 26	e. RHR discharge to hot legs	e. closed
f. 21 SJ 49	f. RHR discharge to cold legs	f. open
g. 22 SJ 49	g. RHR discharge to cold legs	g. open
h. 2 CS 14#	h. Spray additive tank discharge	h. open
i. 2 SJ 135	i. SI discharge to cold legs	i. open
j. 2 SJ 67	j. SI recirc. line isolation	j. open
k. 2 SJ 68	k. SI recirc. line isolation	k. open
l. 21 SJ 44	l. Containment sump isolation valve	l. closed
m. 22 SJ 44	m. Containment sump isolation valve	m. closed

2. Verifying that the following valves are in the indicated positions:

<u>Valve Number</u>	<u>Valve Function</u>	<u>Valve Position</u>
a. 21 RH 19	a. RHR crosstie valve	a. Open
b. 22 RH 19	b. RHR crosstie valve	b. Open

b. At least once per 31 days by:

1. Verifying that each valve (manual, power operated or automatic) in the flow path that is not locked, sealed, or otherwise secured in position, is in its correct position.

2. Verifying that the ECCS piping is full of water by venting the ECCS pump casings and accessible discharge piping high points.

#If inoperable, the applicable Technical Specification is 3.6.2.2.

EMERGENCY CORE COOLING SYSTEMS

ECCS SUBSYSTEMS - T<sub>avg</sub> < 350°F

LIMITING CONDITION FOR OPERATION

3.5.3 As a minimum, one ECCS subsystem# comprised of the following shall be OPERABLE:

- a. One OPERABLE centrifugal charging pump and associated flow path capable of taking suction from the refueling water storage tank and transferring suction to the residual heat removal pump discharge piping and;
  1. Discharging into each Reactor Coolant System (RCS) cold leg.
- b. One OPERABLE residual heat removal pump and associated residual heat removal heat exchanger and flow path capable of taking suction from the refueling water storage tank on a safety injection signal and transferring suction to the containment sump during the recirculation phase of operation and;
  1. Discharging into each RCS cold leg, and; upon manual initiation,
  2. Discharging into two RCS hot legs.

APPLICABILITY: MODE 4.

ACTION:

- a. With no ECCS subsystem OPERABLE because of the inoperability of either the centrifugal charging pump or the flow path from the refueling water storage tank, restore at least one ECCS subsystem to OPERABLE status within 1 hour or be in COLD SHUTDOWN within the next 20 hours.
- b. With no ECCS subsystem OPERABLE because of the inoperability of either the residual heat removal heat exchanger or residual heat removal pump, restore at least one ECCS subsystem to OPERABLE status or maintain the Reactor Coolant System T<sub>avg</sub> less than 350°F by use of alternate heat removal methods.
- c. In the event the ECCS is actuated and injects water into the Reactor Coolant System, a Special Report shall be prepared and submitted to the Commission pursuant to Specification 6.9.2 within 90 days describing the circumstances of the actuation and the total accumulated actuation cycles to date. The current value of the usage factor for each affected safety-injection nozzle shall be provided in this Special Report whenever its value exceeds 0.70.

#A maximum of one safety injection pump or one centrifugal charging pump shall be OPERABLE whenever the temperature of one or more of the RCS cold legs is less than or equal to 312°F. NOTE: This particular restriction also applies in MODES 5 and 6.

## 3/4.5 EMERGENCY CORE COOLING SYSTEMS

### BASES

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#### 3/4.5.1 ACCUMULATORS

The OPERABILITY of each RCS accumulator ensures that a sufficient volume of borated water will be immediately forced into the reactor core through each of the cold legs in the event the RCS pressure falls below the pressure of the accumulators. This initial surge of water into the core provides the initial cooling mechanism during large RCS pipe ruptures.

The limits on accumulator volume, boron concentration and pressure ensure that the assumptions used for accumulator injection in the safety analysis are met.

The accumulator power operated isolation valves are considered to be "operating bypasses" in the context of IEEE Std 279-1971, which requires that bypasses of a protective function be removed automatically whenever permissive conditions are not met. In addition, as these accumulator isolation valves fail to meet single failure criteria, removal of power to the valves is required.

The limits for operation with an accumulator inoperable for any reason except an isolation valve closed minimizes the time exposure of the plant to a LOCA event occurring concurrent with failure of an additional accumulator which may result in unacceptable peak cladding temperatures. If a closed isolation valve cannot be immediately opened, the full capability of one accumulator is not available and prompt action is required to place the reactor in a mode where this capability is not required.

#### 3/4.5.2 and 3/4.5.3 ECCS SUBSYSTEMS

The OPERABILITY of two independent ECCS subsystems ensures that sufficient emergency core cooling capability will be available in the event of a LOCA assuming the loss of one subsystem through any single failure consideration. Either subsystem operating in conjunction with the accumulators is capable of supplying sufficient core cooling to limit the peak cladding temperatures within acceptable limits for all postulated break sizes ranging from the double ended break of the largest RCS cold leg pipe downward. In addition, each ECCS subsystem provides long term core cooling capability in the recirculation mode during the accident recovery period.

BASES

ECCS SUBSYSTEMS (Continued)

With the RCS temperature below 350°F, an OPERABLE ECCS subsystem is acceptable without single failure consideration on the basis of the stable reactivity condition of the reactor and the limited core cooling requirements.

The limitation for a maximum of one safety injection pump or one centrifugal charging pump to be OPERABLE and the Surveillance Requirement to verify all safety injection pumps except the allowed OPERABLE safety injection pump to be inoperable below 312°F provides assurance that a mass addition pressure transient can be relieved by the operation of a single POPS relief valve.

The Surveillance Requirements provided to ensure OPERABILITY of each component ensures that at a minimum, the assumptions used in the safety analyses are met and that subsystem OPERABILITY is maintained. Surveillance requirements for throttle valve position stops and flow balance testing provide assurance that proper ECCS flows will be maintained in the event of a LOCA. Maintenance of proper flow resistance and pressure drop in the piping system to each injection point is necessary to: (1) prevent total pump flow from exceeding runout conditions when the system is in its minimum resistance configuration, (2) provide the proper flow split between injection points in accordance with the assumptions used in the ECCS-LOCA analyses, and (3) provide an acceptable level of total ECCS flow to all injection points equal to or above that assumed in the ECCS-LOCA analyses. Each ECCS subsystem supplies all four cold legs to satisfy minimum flow requirements.

3/4.5.4 REFUELING WATER STORAGE TANK

The OPERABILITY of the RWST as a part of the ECCS ensures that a sufficient supply of borated water is available for injection by the ECCS in the event of a LOCA.

The limits on RWST minimum volume and boron concentrations ensure that: (1) sufficient water is available within containment to permit recirculation cooling flow to the core, (2) the reactor will remain subcritical in the cold condition following a small LOCA assuming complete mixing of the RWST, RCS, and ECCS water volumes with all control rods inserted except the most reactive control assembly (ARI-1), and (3) the reactor will remain subcritical in the cold condition following a large break LOCA (break flow area > 3.0 sq. ft.) assuming complete mixing of the RWST, RCS, and ECCS water and other sources of water that may eventually reside in the sump following a LOCA with all control rods assumed to be out (ARO). The limits on contained water volume and boron concentration also ensure a pH value of between 8.5 and 11.0 for the solution recirculated within containment after a LOCA. This pH band minimizes the evolution of iodine and minimizes the effect of chloride and caustic stress corrosion on mechanical systems and components. The contained water volume limit includes an allowance for water not usable because of tank discharge line location or other physical characteristics.