

3/4.4 REACTOR COOLANT SYSTEM

3/4.4.1 COOLANT LOOPS AND COOLANT CIRCULATION

STARTUP AND POWER OPERATION

LIMITING CONDITION FOR OPERATION

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3.4.1.1 Both reactor coolant loops and both reactor coolant pumps in each loop shall be in operation.

APPLICABILITY: 1 and 2.\*

ACTION:

With less than the above required reactor coolant pumps in operation, be in at least HOT STANDBY within 1 hour.

SURVEILLANCE REQUIREMENTS

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4.4.1.1 The above required reactor coolant loops shall be verified to be in operation and circulating reactor coolant at least once per 12 hours.

\*See Special Test Exception 3.10.3.

## REACTOR COOLANT SYSTEM

### HOT STANDBY

#### LIMITING CONDITION FOR OPERATION

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- 3.4.1.2 a. The reactor coolant loops listed below shall be OPERABLE:
1. Reactor Coolant Loop (A) and at least one associated reactor coolant pump.
  2. Reactor Coolant Loop (B) and at least one associated reactor coolant pump.
- b. At least one of the above Reactor Coolant Loops shall be in operation\*.

APPLICABILITY: MODE 3

#### ACTION:

- a. With less than the above required reactor coolant loops operable, restore the required loops to OPERABLE status within 72 hours or be in HOT SHUTDOWN within the next 12 hours.
- b. With no reactor coolant loop in operation, suspend all operations involving a reduction in boron concentration of the Reactor Coolant System and immediately initiate corrective action to return the required loop to operation.

#### SURVEILLANCE REQUIREMENTS

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- 4.4.1.2.1 At least the above required reactor coolant pumps, if not in operation, shall be determined to be OPERABLE once per 7 days by verifying correct breaker alignments and indicated power availability.
- 4.4.1.2.2 At least one cooling loop shall be verified to be in operation and circulating reactor coolant at least once per 12 hours.

\*All reactor coolant pumps may be de-energized for up to 1 hour provided (1) no operations are permitted that would cause dilution of the reactor coolant system boron concentration, and (2) core outlet temperature is maintained at least 10°F below saturation temperature.

## REACTOR COOLANT SYSTEM

### SHUTDOWN

#### LIMITING CONDITION FOR OPERATION

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- 3.4.1.3 a. At least two of the coolant loops listed below shall be OPERABLE:
1. Reactor Coolant Loop (A) and its associated steam generator and at least one associated reactor coolant pump.
  2. Reactor Coolant Loop (B) and its associated steam generator and at least one associated reactor coolant pump.
  3. Shutdown Cooling Loop (A) #
  4. Shutdown Cooling Loop (B) #
- b. At least one of the above coolant loops shall be in operation\*.

APPLICABILITY: MODES 4\*\* and 5\*\*

#### ACTION:

- a. With less than the above required coolant loops OPERABLE, immediately initiate corrective action to return the required coolant loops to OPERABLE status as soon as possible; be in COLD SHUTDOWN within 20 hours.
- b. With no coolant loop in operation, suspend all operations involving a reduction in boron concentration of the Reactor Coolant System and immediately initiate corrective action to return the required coolant loop to operation.

#### SURVEILLANCE REQUIREMENTS

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4.4.1.3.1 The required shutdown cooling loop(s) shall be determined OPERABLE per Specification 4.0.5.

4.4.1.3.2 The required reactor coolant pump(s), if not in operation, shall be determined to be OPERABLE once per 7 days by verifying correct breaker alignments and indicated power availability.

\*All reactor coolant pumps and decay heat removal pumps may be de-energized for up to 1 hour provided (1) no operations are permitted that would causedilution of the reactor coolant system boron concentration, and (2) core outlet temperature is maintained at least 10°C below saturation temperature.

\*\*A reactor coolant pump shall not be started with one or more of the RCS cold leg temperatures less than or equal to (275)°F unless 1) the pressurizer water volume is less than (900) cubic feet or 2) the secondary water temperature of each steam generator is less than (46)°F above each of the RCS cold leg temperatures.

#The normal or emergency power source may be inoperable in MODE 5.

REACTOR COOLANT SYSTEM

REACTOR COOLANT LOOPS AND COOLANT CIRCULATION

SURVEILLANCE REQUIREMENTS (Continued)

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4.4.1.3.2 The required steam generator(s) shall be determined OPERABLE by verifying the secondary side water level to be  $\geq$  \_\_\_\_\_ at least once per 12 hours.

4.4.1.3.4 At least one coolant loop shall be verified to be in operation and circulating reactor coolant at least once per 12 hours.

REFUELING OPERATIONS

3/4.9.8 SHUTDOWN COOLING AND COOLANT CIRCULATION

ALL WATER LEVELS

LIMITING CONDITION FOR OPERATION

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3.9.8.1 At least one shutdown cooling loop shall be in operation.

APPLICABILITY: MODE 6

ACTION:

- a. With less than one shutdown cooling loop in operation, except as provided in b. below, suspend all operations involving an increase in the reactor decay heat load or a reduction in boron concentration of the Reactor Coolant System. Close all containment penetrations providing direct access from the containment atmosphere to the outside atmosphere within 4 hours.
- b. The shutdown cooling loop may be removed from operation for up to 1 hour per 8 hour period during the performance of CORE ALTERATIONS in the vicinity of the reactor pressure vessel hot legs.
- c. The provisions of Specification 3.0.3 are not applicable.

SURVEILLANCE REQUIREMENTS

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4.9.8.1 At least one shutdown cooling loop shall be verified to be in operation and circulating reactor coolant at a flow rate of greater than or equal to (3000) gpm at least once per 4 hours.

## REFUELING OPERATIONS

### LOW WATER LEVEL

#### LIMITING CONDITION FOR OPERATION

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3.9.8.2 Two independent shutdown cooling loops shall be OPERABLE.\*

APPLICABILITY: MODE 6 when the water level above the top of the irradiated fuel assemblies seated within the reactor pressure vessel is less than 23 feet.

#### ACTION:

- a. With less than the required shutdown cooling loops OPERABLE, immediately initiate corrective action to return loops to OPERABLE status as soon as possible.
- b. The provisions of Specification 3.0.3 are not applicable.

#### SURVEILLANCE REQUIREMENTS

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4.9.8.2 The required shutdown cooling loops shall be determined OPERABLE per Specification 4.0.5.

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\*The normal or emergency power source may be inoperable for each shutdown cooling loop.

## 3/4.4 REACTOR COOLANT SYSTEM

### BASES

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#### 3/4.4.1 REACTOR COOLANT LOOPS AND COOLANT CIRCULATION

The plant is designed to operate with both reactor coolant loops and associated reactor coolant pumps in operation, and maintain DNBR above 1.30 during all normal operations and anticipated transients.

In MODE 3, a single reactor coolant loop provides sufficient heat removal capability for removing decay heat; however, single failure considerations require that two loops be OPERABLE.

In MODES 4 and 5, a single reactor coolant loop or shutdown cooling loop provides sufficient heat removal capability for removing decay heat; but single failure considerations require that at least two loops be OPERABLE. Thus, if the reactor coolant loops are not OPERABLE, this specification requires two shutdown cooling loops to be OPERABLE.

The operation of one Reactor Coolant Pump or one shutdown cooling pump provides adequate flow to ensure mixing, prevent stratification and produce gradual reactivity changes during boron concentration reductions in the Reactor Coolant System. The reactivity change rate associated with boron reductions will, therefore, be within the capability of operator recognition and control.

The restrictions on starting a Reactor Coolant Pump during MODES 4 and 5 with one or more RCS cold legs less than or equal to  $(275)^{\circ}\text{F}$  are provided to prevent RCS pressure transients, caused by energy additions from the secondary system, which could exceed the limits of Appendix G to 10 CFR Part 50. The RCS will be protected against overpressure transients and will not exceed the limits of Appendix G by either (1) restricting the water volume in the pressurizer and thereby providing a volume for the primary coolant to expand into or (2) by restricting starting of the RCPs to when the secondary water temperature of each steam generator is less than  $(46)^{\circ}\text{F}$  above each of the RCS cold leg temperatures.



## REFUELING OPERATIONS

### BASES

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#### 3/4.9.8 COOLANT CIRCULATION

The requirement that at least one shutdown cooling loop be in operation ensures that (1) sufficient cooling capacity is available to remove decay heat and maintain the water in the reactor pressure vessel below 140°F as required during the REFUELING MODE, and (2) sufficient coolant circulation is maintained through the reactor core to minimize the effects of a boron dilution incident and prevent boron stratification.

The requirement to have two shutdown cooling loops OPERABLE when there is less than 23 feet of water above the core, ensures that a single failure of the operating shutdown cooling loop will not result in a complete loss of decay heat removal capability. With the reactor vessel head removed and 23 feet of water above the core, a large heat sink is available for core cooling, thus in the event of a failure of the operating shutdown cooling loop, adequate time is provided to initiate emergency procedures to cool the core.



DEFINITION OF COMBUSTION ENGINEERING PWR

OPERATIONAL MODES

<u>OPERATIONAL MODE</u>	<u>REACTIVITY CONDITION, <math>K_{eff}</math></u>	<u>% OF RATED THERMAL POWER*</u>	<u>AVERAGE COOLANT TEMPERATURE</u>
1. POWER OPERATION	$\geq 0.99$	$> 5\%$	$\geq 300^{\circ}\text{F}$
2. STARTUP	$\geq 0.99$	$\leq 5\%$	$\geq 300^{\circ}\text{F}$
3. HOT STANDBY	$< 0.99$	0	$\geq 300^{\circ}\text{F}$
4. HOT SHUTDOWN	$< 0.99$	0	$300^{\circ}\text{F} > T_{avg} > 200^{\circ}\text{F}$
5. COLD SHUTDOWN	$< 0.99$	0	$\leq 200^{\circ}\text{F}$
6. REFUELING**	$\leq 0.95$	0	$\leq 140^{\circ}\text{F}$

\* Excluding decay heat.

\*\*Reactor vessel head unbolted or removed and fuel in the vessel.