3.4 STEAM AND POWER CONVERSION SYSTEM

Applicability

Applies to the turbine cycle components for removal of reactor decay heat.

Objective

To specify minimum conditions of the turbine cycle equipment necessary to assure the capability to remove decay heat from the reactor core.

Specifications

3.4.1 The reactor shall not be heated, above 280F unless the following conditions are met:

1. Capability to remove a decay load of 5% full reactor power by at least one of the following means:

   a. A condensate pump and a main feedwater (MFW) pump, using turbine by-pass valve.

   b. A condensate pump and the auxiliary feedwater (AFW) pump using turbine by-pass valve.

2. Fourteen of the steam system safety valves are operable.

3. A minimum of 16.3 ft. (107,000 gallons) of water is available in the condensate storage tank.

4. Both emergency feedwater (EFW) pumps and both EFW block valves are capable of automatic actuation, or a dedicated operator is available for their operation.* 4

5. Both main steam block valves and both main feedwater isolation valves are operable.

6. The emergency feedwater valves associated with Specification 3.4.4 shall be operable.

3.4.2 The Steam Line Break Instrumentation and Control System (SLBIC) shall be operable when main steam pressure exceeds 700 psig and shall be set to actuate at 600 $\pm$ 25 psig.

* One train of EFW may be removed from the control-grade automatic actuation mode for purposes of surveillance testing of the automatic actuation circuitry for a period not to exceed one (1) hour per test without invoking the reporting requirements of Specification 6.12.3.

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3.4.3 Components required by Specification 3.4.1 and 3.4.2 to be operable 4
shall not be removed from service for more than 24 consecutive hours.
If the system is not restored to meet the requirements of Specifi-
cation 3.4.1 and 3.4.2 within 24 hours, the reactor shall be placed 4
in the hot shutdown condition within 12 hours. If the requirements
of Specification 3.4.1 and 3.4.2 are not met within an additional
48 hours, the reactor shall be placed in the cold shutdown condition 4
within 24 hours.

3.4.4 The reactor shall not be heated above 280F unless both EFW pumps are operable. 4

3.4.5 If the condition specified in 3.4.4 cannot be met:

1. With one EFW flow path inoperable, the unit shall be brought to hot shutdown within 36 hours, and if not restored to an operable status within the next 36 hours, the unit shall be brought to cold shutdown within the next 12 hours or at the maximum safe rate.

2. If both EFW trains are inoperable, the AFW pump shall be demonstrated operable immediately, and the unit shall be brought to hot shutdown within one hour. The unit shall be placed in cold shutdown within the next 12 hours or at the maximum safe rate.

3. If both EFW trains and the AFW pump are inoperable, the unit shall be immediately run back to $\leq 5\%$ full power with feedwater supplied from the MFW pumps. As soon as an EFW train or the AFW train is operable, the unit shall be placed in cold shutdown within the next 12 hours or at the maximum safe rate.

Bases

The feedwater flow required to remove decay heat corresponding to 5% full power with saturated steam at 1065 psia (lowest setting of steam safety valve) as a function of feedwater temperature is:

Feedwater Temperature	Flow
60	758
90	777
120	799
140	814

The feedwater system and the turbine bypass system are normally used for decay heat removal and cooldown above 280F. Feedwater makeup is supplied by operation of a condensate pump and either a main or the auxiliary feedwater pump.

In the incredible event of loss of all AC power, feedwater is supplied by the turbine driven emergency feedwater pump which takes suction from the condensate storage tank. Decay heat is removed from a steam generator by steam relief through the atmospheric dump valves or safety valves. Fourteen of the steam system safety valves will relieve the necessary amount of steam for rated reactor power.

The minimum amount of water in the condensate storage tank would be adequate for about 4.5 hours of operation. This is based on the estimate of the average emergency flow to a steam generator being 390 gpm. This operation time with the volume of water specified would not be reached, since the decay heat removal system would be brought into operation within 4 hours or less.

If the turbine driven emergency feedwater pump has not been verified to be operable within 3 months prior to heatup its operability will be verified upon reaching hot shutdown conditions.

The SLBIC System is designed to isolate the steam generators to assure that only one steam generator will experience uncontrolled blowdown following a steam line break. Normal steam line operating pressures are approximately 900 psig at all power levels, thus operability above 700 psig with actuation at 600 ±25 psig are appropriate. The setpoint is based on severe transients in the main steam lines resulting in rapid pressure decays. 4

The control-grade EFW automatic actuation system is required per NUREG-0578 to assure that EFW will be available when necessary. This control-grade system is fully testable, but only at the risk of cold EFW reaching a hot steam generator during operation. To reduce the risk of this, and the subsequent transient, the EFW train to be tested may be removed from the automatic actuation mode if the other train is operable by automatic action, and the train to be tested is still operable is the manual mode.

References

FSAR, Section 10

Table 4.1-1

Instrument Surveillance Requirements

	Channel Description	Check	Test	Calibrate	Remarks
1.	Protective Channel Coincidence Logic	NA	M	NA	
2.	Control Rod Drive Trip Breaker	NA	M(1)	NA	(1) To include tripping of breakers via shunt trip circuit.
3.	Power Range Amplifier	NA	NA	T/W(1)	(1) Heat balance calibration twice weekly under steady state operating conditions, daily under non-steady state operating conditions.
4.	Power Range Channel	S M(1)	M	M(1)(2)	(1) Using incore instrumentation. (2) Axial offset upper and lower chambers monthly and after each startup if not done previous week.
5.	Intermediate Range Channel	S	P/M	NA	
6.	Source Range Channel	S(1)	P	NA	(1) When in service.
7.	Reactor Coolant Temperature Channel	S	M	R	
8.	High Reactor Coolant Pressure Channel	S	M	R	
9.	Low Reactor Coolant Pressure Channel	S	M	R	
10.	Flux-Reactor Coolant Flow Comparator	S	M	R	
11.	Reactor Coolant Pressure	S	M	R	
12.	Pump Flux Comparator	S	M	R	

Table 4.1-1 (Cont'd)

	Channel Description	Check	Test	Calibrate	Remarks
30.	Decay Heat Removal System Isolation Valve Automatic Closure and Interlock System	S(1)(2)	M(1)(3)	R	(1) Includes RCS Pressure Analog Channel (2) Includes CFT Isolation Valve Position (3) Shall Also Be Tested During Refueling Shutdown Prior to Repressurization at a pressure greater than 300 but less than 420 psig.
31.	Turbine Overspeed Trip Mechanism	NA	R	NA	
32.	Steam Line Break Instrumentation and Control System Logic Test & Control Circuits	W	Q	R	
33.	Diesel Generator Protective Relaying Starting Interlocks And Circuitry	M	Q	NA	
34.	Off-site Power Undervoltage And Protective Relaying Interlocks And Circuitry	W	R	R	
35.	Borated Water Storage Tank Level Indicator	W	NA	R	
36.	Reactor Trip Upon Loss of Main Feedwater Circuitry	NA	PC	NA	

Table 4.1-1 (Cont'd)

Channel Description	Check	Test	Calibrate	Remarks
37. Boric Acid Addition Tank				
a. Level Channel	NA	NA	R	
b. Temperature Channel	M	NA	R	
38. Deleted				
39. Sodium Hydroxide Tank Level Indicator	NA	NA	R	
40. Incore Neutron Detectors	M(1)	NA	NA	(1) Check Functioning
41. Emergency Plant Radiation Instruments	M(1)	NA	R	(1) Battery Check
42. Reactor Trip Upon Turbine Trip Circuitry	NA	PC	NA	
43. Strong Motion Acceleographs	Q(1)	NA	Q	(1) Battery Check
44. ESAS Manual Trip Functions				
a. Switches & Logic	NA	P	NA	
b. Logic	NA	M	NA	
45. Reactor Manual Trip	NA	P	NA	
46. Reactor Building Sump Level	NA	NA	R	

Table 4.1-1 (Cont'd)

	Channel Description	Check	Test	Calibrate	Remarks
47.	EFW Actuation Control Logic	NA	M	R	
48.	EFW Flow Indication	R	NA	R	

Note:

S-Each Shift	T/W-Twice per Week	R-Once every 18 months
D-Daily	B/M-Every 2 Months	NA-Not applicable
W-Weekly	Q-Quarterly	PC-Prior to Going Critical if Not Done Within Previous 31 Days
M-Monthly	P-Prior to Each Startup if Not Done Previous Week	