3.4 STEAM AND POWER CONVERSION SYSTEM

4-17-75

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 280°F unless the following conditions are met:

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

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

   b. A condensate pump and the auxiliary feedwater 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 pumps are operable.

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

6. The emergency feedwater valves associated with Specification 3.4.1.4 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 ±25 psig.

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

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 280 F. 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.

References

FSAR, Section 10

for protective action from a digital ESAS subsystem will not cause that subsystem to trip. The fact that a module has been removed will be continuously annunciated to the operator. The redundant digital subsystem is still sufficient to indicate complete ESAS action.

The testing schemes of both the RPS and the ESAS enable complete system testing while the reactor is operating. Each channel is capable of being tested independently so that operation of individual channels may be evaluated.

The Automatic Closure and Isolation System (ACI) is designed to close the Decay Heat Removal System (DHRS) return line isolation valves when the Reactor Coolant System (RCS) pressure exceeds a selected fraction of the DHRS design pressure or when core flooding system isolation valves are opened. The ACI is designed to permit manual operation of the DHRS return line isolation valves when permissive conditions exist. In addition, the ACI is designed to disallow manual operation of the valves when permissive conditions do not exist.

Power is normally supplied to the control rod drive mechanisms from two separate parallel 480 volt sources. Redundant trip devices are employed in each of these sources. If any one of these trip devices fails in the untripped state on-line repairs to the failed device, when practical will be made, and the remaining trip devices will be tested. Four hours is ample time to test the remaining trip devices and in many cases make on-line repairs.

The Steam Line Break Instrumentation and Control System (SLBIC) is designed to automatically close the Main Steam Block valves and the Main Feedwater Isolation valves upon loss of pressure in either of the two main steam lines.

The SLBIC is also designed to be reset from its trip position only when the system is shut down or the Main Steam line pressure is below 650 psig.

REFERENCE

FSAR, Section 7.1

Table 3.5.1-1 (Contd)

OTHER SAFETY RELATED SYSTEMS	1	2	3	4	5
Functional unit	No. of channels	No. of channels for system trip	Min. operable channels	Min. degree of redundancy	Operator action if conditions of column 3 or 4 cannot be met
2. Steam line break instrumentation control system (SLBIC)					
a. SLBIC Control & Logic channels	2	1	2	1	Notes 9, 5

Notes:

1. Initiate a shutdown using normal operating instructions and place the reactor in the hot shutdown condition if the requirements of Columns 3 and 4 are not met within 12 hours.

2. When 2 of 4 power range instrument channels are greater than 10% rated power, hot shutdown is not required.

3. When 1 of 2 intermediate range instrument channels is greater that 10^{-10} amps, hot shutdown is not required.

4. For channel testing, calibration, or maintenance, the minimum number of operable channels may be two and a degree of redundancy of one for a maximum of 4 hours, after which Note 1 applies.

5. If the requirements of Columns 3 or 4 cannot be met within an additional 48 hours, place the reactor in the cold shutdown condition within 24 hours.

6. The minimum number of operable channels may be reduced to 2, provided that the system is reduced to 1 out of 2 coincidence by tripping the remaining channel. Otherwise, Specification 3.3 shall apply.

7. These channels initiate control rod withdrawal inhibits not reactor trips at <10% rated power. Above 10% rated power these inhibits are bypassed.

8. If any one component of a digital subsystem is inoperable, the entire digital subsystem is considered inoperable. Hence, the associated safety features are inoperable and Specification 3.3 applies.

9. The minimum number of operable channels may be reduced to one and the minimum degree of redundancy to zero for a maximum of 24 hours, after which Note 1 applies.

Table 4.1-1 (Contd)

Channel Description	Check	Test	Calibrate
30. Decay Heat Removal System Isolation Valve Automatic Closure And Interlock System	S(1)(2)	M(1)(3)	R
31. Turbine Overspeed Trip Mechanism	N/A	R	N/A
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	N/A
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. Boric Acid Mix Tank			
a. Level Channel	NA	NA	R
b. Temperature Channel	M	NA	R

Remarks

(1) Includes RCS Pressure Analog Channel

(2) Includes CFT Isolation Valve Position

(3) Shall Also Be Tested During Refueling Shutdown Prior to Pressurization