

RESIDUAL HEAT REMOVAL SYSTEM MALFUNCTION ANALYSIS

Component		Malfunction	Comments and Consequences
1.	Residual heat removal pumps	Rupture of a pump casing	The casing and shell are designed for 600 psig and 400°F. The pump is protected from overpressurization by two normally closed valves in the pump suction line and by a relief line, containing a relief valve, back to the pressurizer relief tank. The pump is inspectable and is located in the auxiliary building protected against credible missiles. Rupture is considered unlikely but in any event the pump can be isolated.
2.	Residual heat Removal pump	Pump fails to start	One operating pump furnishes removal pump half of the flow required to meet design cooldown rate. Failure of the other pump to start increases the time necessary for plant cooldown.
3.	Residual heat removal pump	Manual valve on pump suction is closed	This is prevented by pre startup and operational check. The valve is normally locked or sealed open.
4.	Residual Heat removal pump	Stop valve on discharge line closed or check valve sticks closed.	Stop valve is locked or sealed open. Prestartup and operational checks confirm position of valves.
5.	Remote operated valves inside containment in pump suction line	Valve fails to open	In the improbable event that one of the remote operated valves on the suction line to the residual heat removal pumps is inoperable, an attempt will be made to open it manually. If this is impossible, the plant will be cooled to about 280 °F with steam dump from the team generators, and kept at that temperature for several weeks until decay heat could be matched by the letdown heat exchangers and by feed and bleed. Feed and bleed through the CVCS will done intermittently to prevent heat transfer through the regenerative heat exchanger. The pressurizer level will be to minimum during the bleed operation and to maximum during the feed operation. It is estimated that plant cooldown be accomplished within a month.
6.	Remote operated valves inside containment on pump discharge line	Valve fails to open	Pump discharge pressure gage shows pump shut-off head indicating no flow. An alternate return line may be opened and utilized to direct flow to the RCS.
7.	Residual heat exchanger	Tube or shell rupture	Rupture is considered unlikely, but in any event the faulty heat exchanger may be isolated.
8.	Residual heat exchanger vent or drain valve	Left open	This is prevented by prestartup operational checks.