TABLE 5.5-1

RESIDUAL HEAT REMOVAL SYSTEM DESIGN PARAMETERS

Code Requirements	
Residual Heat Exchangers (Tube Side)	ASME III, Class C
(Shell Side)	ASME VIII
Residual Heat Removal Piping and Valves	ANSI B31.1.0(1)
	ANSI B31.7(2)
General	
Plant design life, years	40
Component cooling water supply temperature design, °F	95
Reactor coolant temperature at startup of decay heat removal °F	350
Time to cool Reactor Coolant System from 350°F to 140°F, starting at 4 hours after shutdown, hr	16(3)

(1) Used for design.

(2) For piping not supplied by the NSSS supplier, material inspection fabrication and quality control conform to ANSI B31.7. Where not possible to comply with ANSI B31.7, the requirements of ASME III-1971, which incorporated ANSI B31.7, were adhered to.

(3) 16 hours was the original design value. With the 1.4% power uprate, reduction in temperature can be accomplished in 18 hours. To cool down in 16 hours is not a design requirement. The design requirement is to cool down in 72 hours with a single train.

TABLE 5.5-1 (Cont.)

Refueling water storage temperature, °F	Ambient
Decay heat generation at 20 hours after shutdown, Btu/hr	72.1×10^6 *
H_3BO_3 concentration in refueling water storage tank, ppm boron	~2000

COMPONENTS

Residual Heat Exchangers

Number		2 (per unit)
Design heat transfer, Btu/hr		34.15×10^6
	Shell	Tube
Design pressure, psig	150	600
Design temperature, °F	200	400
Design flow rate, lb/hr	2.475×10^6	1.48×10^6
Design outlet temperature, °F	108.8	114
Design inlet temperature, °F	95	137
Fluid	Component cooling water	Reactor coolant (borated demineralized water)

* Original decay heat value used in the initial design

Material of construction	Carbon steel	Austenitic stainless steel
Residual Heat Removal Pumps		
Number		2 (per unit)
Type		Vertical centrifugal
Design pressure, psig		600
Design temperature, °F		400
Shutoff head, psi		170
Design flow rate, gpm		3,000
Design head, ft		350
Available NPSH at design flow rate, ft		25
Temperature of pump fluid, °F		40 - 350
Normal fluid		Reactor coolant
Fluid during LOCA recirculation phase		Radioactive borated water with H_2 and NaOH in solution
Material of construction		Austenitic stainless steel

TABLE 5.5-1 (Cont.)

Piping and Valves

	Pump Suction	Pump Discharge
Residual heat removal loop (piping and valves in isolated loop):		
Design pressure, psig	450*	600
Design temperature, °F	400	400
Residual loop isolation valves and piping:		
Design pressure, psig		2,485
Design temperature, °F		650

* Unit 2 piping downstream of 2RH75 & 76 are designed to 600 psig.

TABLE 5.5-2

RESIDUAL HEAT REMOVAL SYSTEM FAILURE ANALYSIS

Component	Malfunction	Comments and Consequences
1. Residual heat removal pumps	Rupture of a pump casing	The casing and shell are designed for 600 psi and 400°F. The pump is protected from overpressurization by two normally closed valves in the pump suction line and by an open relief line, containing a relief valve, back to the containment sump. 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 half of the flow required to meet design cooldown rate. This increases the time necessary for plant cooldown.
3. Residual heat removal pump	Motor operated valve on pump suction is closed	This is prevented by prestartup and startup and operational checks.
4. Residual heat removal pump	Stop valve on discharge line closed or check valve sticks closed	Stop valves are locked 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 steam generators, while additional recovery actions could be implemented based on plant's abnormal and emergency operating procedures, equipment availability and resources.

TABLE 5.5-2 (Cont.)

Component	Malfunction	Comments and Consequences
6. Remote operated valves inside containment on pump discharge line	Valve fails to open	Pump discharge pressure gauge shows pump shut-off head indicating no flow. The low head safety injection lines may be opened and utilized to direct flow to the RCS hot legs. A reactor coolant pump must be operated.
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.

TABLE 5.5-3

SALEM NUCLEAR GENERATING STATIONS
UNIT NOS. 1 AND 2

STEAM GENERATOR AND REACTOR COOLANT PUMP SUPPORTS
LOADING COMBINATION AND ALLOWABLE STRESS LIMITS

LOADING COMBINATIONS		SUPPORTS - ALLOWABLE STRESS LIMIT
1.	Normal loads	Working stresses per AISC code
2.	Normal loads + operating base earthquake (upset condition)	1-1/3 working stresses AISC code
3.	Normal loads + design base earthquake + pipe rupture loads (faulted condition)	Yield stress of material, or AISC Code * or ASME III, Subsection NF and Appendix F

* with increase factors consistent with the guidance of R. G. 1.124