QUESTION 10.3

Describe and provide a summary of the results of tests that have been performed to demonstrate that the main steam line isolation valves and the non-return valves will function in accordance with design.

ANSWER

The purchase specification for the main steam isolation valves and non-return valves required a hydrostatic test and hydrostatic seat test. The seat leakage was not to exceed 10 cc/hr/in. of nominal valve size diameter, stem leakage was not to exceed 1 cc/hr/in. of stem diameter. All valves were to be given an air seat test with actual leakage measured and recorded. The operation of each valve was to be checked and timed with the valve to close within 4 seconds. An air loss test was to be conducted on the air cylinder and accumulator to show that the accumulator would maintain the valve in an open position for a period of not less than 6 hours without air supply.

During acceptance testing at the manufacturer's facility these tests were performed with acceptable results as shown in Table Q10.3-1. 2

TABLE Q10.3-1 | 2

MAIN STEAM ISOLATION AND CHECK VALVES MANUFACTURER'S TEST

RESULTS

Tests		ISOLATION VALVES		CHECK VALVES	
	Casting #	RT-F6281	RT-F6494	RT-F6484	RT-F6442
	Serial #	N-690515	N-690516	N-690571	N-690570
Hydrostatic		No Leakage		No Leakage	
Hydrostatic Seat Leakage cc/hr (240 cc/hr acceptable)		15	12.5	60	3
Air Leakage, cfh		1.86	3.17	2.33	2.33
Stuffing Box Leakage @ 1100 psig (2 cc/hr acceptable)		No Leakage		No Leakage	
By-Pass Valve Stuffing Box Leakage @ 1100 psig (2 cc/hr acceptable)		No Leakage		--	--
Valve Closing, sec. (4 sec. acceptable)		2 to 4	2 to 2-1/2	--	--
Valve Open Holding Time, hr (6 hours acceptable)		7-1/2 (No Drop)	10 (No Drop)	--	--

QUESTION 10.4

Provide a discussion of the possible dynamic loads on the system caused by rapid steam line isolation valve action. What design provisions have been incorporated to accommodate these dyanmic loads?

ANSWER

The most severe dynamic loads on the system due to rapid steam line isolation valve action would occur as a result of a cleavage separation between the isolation valve and check valve. This condition would provide the minimum mass and restraint for absorption of the momentum changes.

There is no indication that this valve action represents a hazard to safe shut down. There have been no special design provisions for it.

The following consideration has been given to the occurrence:

1. It is assumed that a steady state flow condition is established prior to trip of the isolation valve.

2. After the valve is tripped the disc is assumed to accelerate under the influence of a pressure differential. This pressure differential, which is a function of disc position and flow rate, has been established by tests on similar valves.

3. The disc is assumed to impact with the valve seat. By equating the entire kinetic energy of the disc to strain energy in the disc, a maximum stress in the disc is computed. This is conservative because the valve seat is considered immovable.

4. To evaluate the effect of disc impact on pipe and restraints, it is assumed that the entire momentum of the disc is transmitted to a representative mass at the valve. By assuming the energy of the resultant momentum goes to strain energy in the piping, stresses and forces are calculated.

5. To evaluate the effect of change of momentum of the steam, it is assumed that an average steady state condition exists along the length of the pipe. Using these conditions, it is assumed that valve closure creates a shock wave wherein the absolute velocity ahead of the shock is the steady state velocity and the absolute velocity behind the shock wave is zero. The characteristics of this shock condition can be readily evaluated.

6. The resultant force on the system in the direction of flow due to change in steam momentum has been found to be about 125 kips. This force is not large enough to cause stress problems in the main steam pipe or its restraints.

QUESTION

10.6 The plant is equipped with multiple safety valves, power-operated relief valves and atmospheric dump valves in the steam lines as described in Section 10.2.2 of the FSAR. These valves provide a path for the release of potentially contaminated secondary coolant direct to the atmosphere. Provide a discussion of the possible radiation hazard from these sources including consideration of the following:

10.6.1 What is the maximum potential radioactivity that could be released through this path assuming that the plant is operated with the secondary system radioactivity concentration at the maximum level permitted by the Technical Specifications?

10.6.2 What provisions have been made to monitor the radioactivity that could be discharged via this path?

ANSWER

10.6.1 The maximum steam release to atmosphere based on a 100% electrical load rejection would be 110,000 lbs. This conservatively assumes end-of-life core operation with subsequent minimum control rod worths and no reactor trip. It is additionally assumed that the secondary system radioactivity level is at 1.3 uCi/cc (Technical Specification limit) and a DF of 10 is applicable to the halogen release. Any plate-out or condensation effects on the plume are ignored.

The calculated release to atmosphere is 8.5 Ci of I-131 equivalent. Using the yearly averaged χ/Q, the resultant thyroid dose would be 1.5 mrem at the site boundary.

ANSWER 10.6.2

Continuous monitoring of the secondary loops of the steam generators is provided by the Steam Generator Liquid Sample Monitor and the Condenser Air Ejector Gas Monitor. The Steam Generator Liquid Sample Monitor provides the sensitivity required to detect any incipient leakage paths in the steam generators. Assuming plant operation with 1% defective fuel clad and equilibrium leakage activity levels in a steam generator, long term leak rates as low as 0.1 gallons per day may be detected. The lower limit for instantaneous leak detection would be about 0.15 gallons per minute (this assumes homogeneous mixing of the leakage and detection during the first minute).

Once there is an indication of tube leakage in a steam generator, steam samples are taken from the main steam line and a laboratory analysis is made of the condensate and non-condensible fractions. The analysis will differentiate at least 90% of the activity on an isotopic basis as well as a discrete analysis for iodine isotopes. Concurrent sampling of the steam generator liquid will be used to establish a decontamination factor for all significant nuclides contained in the steam sample. Based on this information, dose models will allow calculation of the off-site dose commitment associated with a postulated steam release. The actual release documentation will be based on the known isotopic inventory in the steam generator, measured decontamination factors, steam generator pressure and temperature history, and the existing meteorology. Since a fraction of the rejected steam will normally go to the condenser, the Condenser Air Ejector Gas Monitor will provide confirmation that no change in system activity has taken place during the steam release.