ENGINEERING BRANCH PWR-A

EVALUATION OF MAIN STEAM LINE CHECK VALVE OPERABILITY
DIABLO CANYON UNITS 1 AND 2

Background:

In a letter dated November 7, 1986, (DCL-86-333), the licensee, Pacific Gas and Electric Company (PG&E), discussed a problem with the Unit 1 main steam line check valves. During performance of the Unit 1 refueling outage surveillance testing, the licensee discovered a problem with the retainer nuts associated with the discs in the four main steam line check valves. The nut that retains the valve disc on one main steam line check valve was missing from its stud; the retainer nut was backed-off halfway on a second valve; the retainer nut was tight but the locking pin was loose on a third valve; and the retainer nut was loose with the locking pin in place on the remaining check valve. This problem and four corrective actions for Unit 2 were described in the PG&E letter dated November 7, 1986. The results of the four action items were addressed in a second letter by PG&E dated December 1, 1986 (DCL-86-333).

The investigations performed under the action items outlined in the November letter, were undertaken by the licensee to determine whether or not Diablo Canyon Unit 2 which was operating at the time, may have the same problem with its main steam line isolation valves. Information presented in the letter dated December 1, 1986 provides the licensee's basis for continued operation of Unit 2 until the next refueling outage.

Evaluation:

The staff reviewed the information provided by the licensee in the two letters and the staff assessment is as discussed below:

1. The licensee had performed a cobalt source radiograph for the Unit 2 valves, but this study was not successful in determining whether the retainer nuts for the check valve discs are in position. Then the licensee used a portable linear accelerator to examine all four Unit 2 valves. It was verified that the retaining nuts were in place for all four valves. The locking pins for three valves were verified to be bent as they should be; for the remaining valve, the locking pin could not be verified to be bent due to the configuration of the imaging.

The imaging with the linear accelerator of the retaining units and of the locking pins has provided the most important verification that the valve discs are properly attached to the swing arms. This is satisfactory.

2. The licensee had committed to perform an analysis of the forces on the check valve disc to determine whether or not the disc would close one time under reverse flow condition even if the retaining nut were missing. Based on the results of the calculations, the licensee concluded that for one time closure, the dynamic torque to move the disc from the fully open position to the fully closed position does not produce sufficient loading to overcome the forces associated with friction and momentum. The staff did not review or audit these calculations. The staff judgment about the operability of these valves is based upon the linear accelerator image discussed in item 1 above. The calculations performed by the licensee are supplementary. If the disc is hanging on the swing arm without the retaining nut, these calculations show that even in this condition the valve should close one more time against a reverse flow. The staff finds that the licensee met its commitment and this is acceptable.

3. The licensee had committed to perform a probabilistic analysis of concurrent main steam line break inside containment with failure of a main steam isolation valve in one of the unbroken main steam lines. The licensee's calculations show the probability for this postulated event to be less than 6×10^{-7}. Although staff judgment on the operability of these check valves is not based on the probabilistic argument, nevertheless the licensee's results provide a helpful perspective.

4. The licensee had committed to perform a mass and energy release calculation with an evaluation of the containment pressure response based on a postulated failure of all four main steam line check valves

coincident with a high energy line break in one of the main steam lines inside the containment. The calculated peak containment pressure is 65 psig which is well within the 1.5 times the design pressure of 70.5 psig, a pressure that the containment is designed to withstand.

The licensee has determined that the root cause is an inadequate design of the disc retainer nut and its locking pin. The licensee has also developed a corrective action through extensive discussion with Anchor/Darling Valve Company, the service representative of Shaffe and Koerting, the valve manufacturer. The licensee is currently required to perform inservice testing on these valves in accordance with its pump and valve testing program. According to this program, the licensee will perform a Fibroscope examination to inspect the internal condition and verify that the valve disc is in closed position for each valve for both Units 1 and 2 during every refueling outage. This testing program should verify the effectiveness of the modifications made by the licensee, and it provides the staff with a firm basis to accept the licensee's resolution to this issue.

This result described above provide assurance that the Unit 2 check valves are operable and provide an additional measure of confidence that, should the postulated accident occur, the protection provided by the containment would be equivalent to that provided under the design basis accident. This is acceptable.

Conclusion:

Based on the above evaluation, the staff concludes that the continued operation of the Unit 2 reactor until the next refueling outage is acceptable. In addition, the licensee will periodically monitor the condition of the Unit 2 main steam line isolation check valves by monitoring the steam generator flow and pressure.