UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

CHARGING PUMP VIBRATIONS

SAN ONOFRE, UNIT NO. 1

DOCKET NO. 50-206

INTRODUCTION

Our letter dated May 26, 1978, informed Southern California Edison Company (the licensee) of our concern that vibratory loads associated with the operation of positive displacement charging pumps in Pressurized Water Reactors (PWR) could contribute to high cycle fatigue pipe failure. Concurrently, we requested information for our evaluation of the performance of the Chemical Volume and Control System (CVCS) test pump which is the only positive displacement charging pump in use at San Onofre, Unit 1. By letters dated June 8, 1978 and April 26, 1979, the licensee provided the requested information.

DISCUSSION AND EVALUATION

San Onofre Unit 1 has two centrifugal charging pumps supplying coolant during normal operation and postulated accidents. Net positive suction head for these two pumps is more than 100 feet. The operation of these pumps will not induce substantial amount of vibrations in the piping system. However, the CVCS test pump is a positive displacement 1-1/8 inch by 3 inch triplex plunger, single acting reciprocating pump. It delivers 19 gpm at 520 rpm with a calculated peak-to-peak variation in pressure of 161 psi at 52 Hertz. The pump is used only about 5 hours per year. Normal system operating pressure is approximately 2,300 psi. The discharge piping system of this pump consists of two parallel 3/4-inch schedule 80S stainless steel pipe runs leading to the discharge piping of the centrifugal charging pumps by connecting to either a 2-inch or a 4-inch header. Each pipe run starts with a vertical riser of 5.6 feet in length followed by a horizontal run of approximately 8 feet in length. Near the top of the riser the piping runs are supported by U-bolt hangers. The natural frequency of this piping system is calculated to be 38 Hertz. The stainless steel used is A312 type 316 which has an allowable stress intensity of 18,800 psi at 200°F according to the Section III of the ASME Boiler and Pressure Vessel Code.

Working stress in the discharge piping system has been calculated to be 12,650 psi at 2,300 psi pressure. The 161 psi pressure fluctuation is only 7% of the 2,300 psi normal working pressure. Since the pressure fluctuation frequency of 52 Hertz is substantially greater than the system natural frequency of 38 Hertz, stress fluctuation will not be amplified. The total pressure fluctuation over the 30-year plant life is estimated at 28 million cycles. The corresponding Stress Amplitude (S_A) value of 26,000 psi for fatigue failure is much greater than the stress fluctuation value.

CONCLUSION

Since the calculated available net positive suction head (NPSH) for this positive displacement pump is 113 feet, more than 7 times the required 16 feet, we have concluded that fatigue failures due to operation of this positive displacement pump are not anticipated in either the discharge side or the suction side piping systems.

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