

Enclosure

DONALD C. COOK NUCLEAR PLANT UNIT NOS. 1 AND 2

CVCS PUMP VIBRATIONS

SAFETY EVALUATION REPORT

Introduction

Vibrations induced by the operation of positive displacement pumps have been identified as one source that will cause fatigue failure in system piping. On May 18, 1978, NRC requested information on "pipe cracks in chemical volume control system (CVCS) due to excessive charging pump vibrations" from Indiana and Michigan Power Company with respect to Donald C. Cook Units 1 and 2. The requested information was provided in letters dated August 8, 1979, October 29, 1979, and May 22, 1980.

Description

Donald C. Cook Nuclear Plant Units 1 and 2 have similar CVCS arrangements. They each employed two centrifugal charging pumps and one reciprocating (positive displacement) charging pump. A General Atomic Company PDSN 3-200 model dampener was installed on the discharge flange of the Unit 2 reciprocating charging pump during the fall of 1979 refueling outage. Another dampener of the same model will be installed in Unit 1 during the upcoming refueling outage. The performance of these positive displacement metering pumps was calibrated by several tests.

Evaluation and Conclusion

The reciprocating charging pumps preoperational test showed that their usage did not induce excessive vibrations in the CVCS of either unit, however, operating experience indicated that control system responses were affected by the discharge pressure fluctuations. Therefore, the licensee decided to install a dampener on the pump discharge flange to smooth out the pressure pulsations. The Unit 2 dampener was installed during the fall of 1979 refueling outage.

Tests were conducted by an independent consultant before and after the dampener was installed in Unit 2. Pressure transducers were attached at the pump suction, the pump cylinder head, between the pump discharge and the dampener, and downstream of the dampener. Data were taken at various pump speeds. The results showed that the maximum pressure pulsation downstream of the dampener was 3.4% of the normal operating pressure at the maximum pump speed.

The operation of the reciprocating charging pumps with dampeners on the pumps discharge did not induce excessive vibrations. A fluctuation of 3.4% stress in the system will yield an alternate stress corresponding to negligible usage factor. We therefore do not expect that pipe cracks will develop in the CVCS system of Unit 2 due to reciprocating charging pump operation. Similarly, because the same type and model of dampener will also be installed on the discharge flange of the reciprocating charging pump in Unit 1 during the current refueling outage, we do not expect that cracks will develop in the CVCS system of Unit 1 due to reciprocating charging pump operation.