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 MARTIN, J.B. Region 5, Ofc of the Director

86-12

SUBJECT: Forwards executive summary of impaired function testing of
 Limitorque gearbox relief valves, KEPNER Model 104C-18

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WASHINGTON PUBLIC POWER SUPPLY SYSTEM

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November 16, 1988
G02-88-239

Docket No. 50-397

Mr. J. B. Martin
Regional Administrator
U.S. Nuclear Regulatory Commission
Region V
1450 Maria lane, Suite 210
Walnut Creek, CA 94596

Dear Mr. Martin:

Subject: NUCLEAR PLANT NO. 2
OPERATING LICENSE NPF-21
IMPAIRED FUNCTION TESTING OF LIMITORQUE
GEARBOX RELIEF VALVES (TEST REPORT EQR 88-43)

Reference: NRC Inspection Report No. 50-297/86-12,
dated July 30, 1986

During the period October 6 & 7, 1988, Messers Bob Pate and Al Johnson of NRC Region V were at the WNP-2 plant to follow up on deficiencies initially identified in the reference NRC inspection report. The deficiencies had to do with Limitorque Motor Operators. During their exit meeting, the Supply System agreed to provide the NRC with further information on a test program we had proposed that would establish gearbox operability for those Limitorque Motor Operators that had been identified as having had a protective dust cap inadvertently left intact.

The purpose of this letter is to submit the Executive Summary for Impaired Function Testing of Limitorque Gearbox Relief Valves (Test Report EQR 88-43).

Very truly yours,

G. C. Sorensen
G. C. Sorensen, Manager
Regulatory Programs

HLA/bk
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EXECUTIVE SUMMARY

IMPAIRED FUNCTION TESTING

OF

LIMITORQUE GEARBOX RELIEF VALVES

KEPNER MODEL 104C-18

TEST REPORT EQR 88-43

Limiterque motor operators (MO) intended for containment service are equipped with Kepner relief valves (RV) on the MO gearbox to provide a venting capability when the MO is exposed to elevated temperatures. These relief valves were outfitted with a protective dust cap during the manufacturing process. During the 1986 WNP-2 Limitorque qualification walkdown campaign, a number of intact dust caps were found which had been in place since plant startup. Test program EQT 88-43 was initiated to establish gearbox operability for these cases. Results from the test program have demonstrated that existence of a protective cap will not impair the relief valve venting capability.

Two types of dust caps were found at WNP-2. One is a cylindrical red plastic plug which is inserted into threads on the discharge end of the valve. The other style is a clear vinyl cover which fits over the body of the relief valve. In discussions with Limitorque, they advise that the protective device shipped on the relief valve is left in place during their manufacturing process, and that the clear vinyl cover is the style used by the relief valve supplier. They also state that all relief valves are supplied by Kepner. While the actual source of the red plugs is unknown, both styles were included in the test program.

The failure mode postulated was failure of the RV to vent during a LOCA resulting in pressure buildup in the gearbox. This could potentially force grease through the limit switch or torque switch mechanisms, fouling these electrical devices and rendering the Limitorque operator inoperable.

Kepner valves are designed to pass grease and to function at between 1 to 2 psi. Limitorque has tested a MO gearbox without a RV and based upon this test, a known "safe" pressure of 5 psi can be tolerated by the MO. Plant specific LOCA accident parameters at WNP-2 would expose the MO to 340°F for several hours followed by 250°F. Grease and air in the MO would experience a thermal lag with accompanying pressure increase developing slower than the initial LOCA transient. Relief valves were examined for the ability to pass air or grease with the protective device in place. Tests were conducted at both room temperature and at the LOCA accident conditions. Baseline tests were also conducted with no protective device in place. The test program is summarized in the following table.

FUNCTIONAL TESTING OF LIMITORQUE MO RELIEF VALVES

KEPNER MODEL 1042-18

RV Configuration	RV test parameters			
	With Air/Room Temp	Grease/Room Temp	Air/250°F	Grease/250°F
No cap	Vented between 1.1 to 2 psi per specs (3RV)	Adequate grease flow started at about 2.2 psi	OK per Limitorque tests to 340°F, thus not tested here	Vented at 1.9 psi
Red cap	Vented at 1.4 psi (2 tests)	No grease flow, cap blocked it completely (test end at 5 psi)	See Note 1 - Adequate air flow after cap melted	See Note 1 - Adequate grease flow after cap melted.
Vinyl cap	Vented at 1.1 psi (5 tests)	Very slow flow, 2 gm/hr beginning at approximately 5 psi	Vented at 1.4 psi (Note 2) vented at 1.1 psi	Cap "slid" off by grease flow (2.2 psi) at 250°F (Note 2) start 2 psi. Very good grease flow at 2.6 psi.

Note 1: Red cap melted at approximately 200°F.

Note 2: Vinyl cap pre-aged for two hours at 340°F before test.



Without a dust cap, the Kepner RV vented air at room temperatures between 1.1 to 2 psi. This agrees with the Kepner specifications. The RV vented grease at 2.2 psi at room temperature and 1.9 psi at 250°F. This is consistent with the lowered viscosity of the grease at elevated temperature.

The red insert cap permitted the RV to vent air at room temperature at 1.4 psi, implying that the cap had no discernible affect on the RV function in this test mode. However, this cap completely blocked grease flow from the RV at room temperature. This did not affect the safety functioning of the RV though as this red insert cap also melted and fell out of place at about 200°F.

The vinyl cap readily allows the RV to vent air at room temperature (1.1 psi) and at elevated temperature (1.4 psi). Grease flow at room temperature, though present, is very slow. However, at elevated temperature the vinyl cap interposes only a slight barrier to grease flow. The cap slid off completely in one case (at approximately 2.2 psi and 250°F) or permitted grease flow around/under the cap (when cap preaged for two hours at 340°F). This grease flow was rapid enough to entirely vent the test system pressure in a couple of minutes. At elevated temperatures, the clear vinyl cover changed color becoming reddish at around 300°F and turning black at 340°F with slight signs of softening and sagging. The vinyl material did exhibit permanent degradation with a bubbling of the material where traces of grease were present. This degradation was also evident upon cooling to room temperature when a reduced pliability was noted. However, the cover remained pliable and fully capable of relieving pressure at all test temperatures.

For higher test temperatures (340°F), grease (after a two hour soak) would not pass through the vinyl covered relief valve, so the cover was removed and the RV retested. However, the valve still would not pass grease. The exact mechanism for blockage was not determined, however, separation of oils from the grease base may have left a waxy base residue which fouled the valve function. Change of grease consistency is not a potential qualification problem as the operator has been tested to full LOCA conditions and any grease changes would have also occurred during the qualification tests. Note that preaging the vinyl cap and RV at 340°F for two hours did not cause it to impede grease flow from the valve when tested at 250°F. This is representative of accident conditions since a thermal lag will be present within the Limitorque gearbox and cooler unmodified grease would be vented as the MO was heated slowly toward the current LOCA temperature which the RV cap would have maintained (i.e., to 340°F, then back down to 250°F).