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

ENCLOSURE

SAFETY EVALUATION BY THE
OFFICE OF NUCLEAR REACTOR REGULATION RELATED TO
THE INSERVICE TESTING PROGRAM
FLORIDA POWER CORPORATION
CRYSTAL RIVER 3
DOCKET NO.: 50-302

INTRODUCTION

The Code of Federal Regulations, 10 CFR 50.55a(g), requires that inservice testing (IST) of ASME Code Class 1, 2, and 3 pumps and valves be performed in accordance with Section XI of the ASME Boiler and Pressure Vessel Code and applicable addenda, except where specific written relief has been requested by the licensee and granted by the Commission. The regulations, 10 CFR 50.55a(a)(3)(i), (a)(3)(ii), and (g)(6)(i), authorize the Commission to grant relief from these requirements. In requesting relief, the licensee must demonstrate that (1) the proposed alternatives provide an acceptable level of quality and safety, (2) compliance would result in hardship or unusual difficulties without a compensating increase in the level of quality and safety, or (3) conformance with certain requirements of the applicable Code edition and addenda is impractical for its facility.

In a letter to the staff dated July 13, 1988, Florida Power Corporation (the licensee) submitted three relief requests which proposed alternatives to certain pump and valve IST requirements of the ASME Boiler and Pressure Vessel Code, Section XI, 1983 Edition through Summer 1983 Addenda. The relief requests addressed in this report are applicable to the second ten year inspection interval from March 13, 1987 to March 13, 1997.

EVALUATION

The staff, with assistance from its contractor EG&G, Idaho, evaluated the licensee's July 13, 1988 submittal. This review was performed using the acceptance criteria of the Standard Review Plan, NUREG-0800, Section 3.9.6, and the Draft Regulatory Guide and Value/Impact Statement titled "Identification of Valves for Inclusion in Inservice Testing Program."

1. Relief Request V-113:

   The licensee requested relief from the IWP-3100 requirements of Section XI for measurement of bearing temperature and vibration amplitude for all pumps.

1.1 Licensee's Basis for Requesting Relief:

The licensee stated: "Pumps vibration and bearing temperature measurements are used to detect changes in the mechanical characteristics of a pump. Regular testing should detect developing problems, thus repairs can be initiated prior to a pump becoming inoperable. The ASME Section XI minimum standards require measurements of the vibration amplitude in displacement (mils, peak to peak, composite) every three months and bearing temperatures once per year."

"Our proposed program is based on vibration readings in velocity (in/sec, peak, unfiltered) units rather than the mils displacement. This technique is an industry accepted method which is more sensitive to small changes at high frequencies which are indicative of developing mechanical problems and hence more meaningful. Velocity measurements detect not only high amplitude low frequency vibrations that indicate a major mechanical problem, but also the equally harmful lower amplitude high frequency vibrations due bearing wear and pump operational problems that usually go undetected by a simple displacement measurements."

"In addition, these readings go far beyond the capabilities of a bearing temperature monitoring program. A bearing will be seriously degraded prior to the detection of increased heat at the bearing housing. Quarterly vibration velocity readings should achieve a much higher probability of detecting developing problems than the once per year reading of bearing temperatures."

"Bearing temperature tests present problems which include the following:

1. Certain systems have no recirculation test loops and a limited source of water. An enforced thirty minute run time would deplete the source.

2. The lubrication fluid for some pumps is taken from the process water, which can change temperature depending on ambient conditions. Data trending for these cases is not meaningful."

"Therefore, the detection of possible bearing failure by a yearly temperature measurement is extremely unlikely. The small probability of detection of a bearing failure by temperature measurement does not justify the additional pump operating time required to obtain the measurements. In addition, it is impractical to measure bearing temperatures on many pumps."

"Alternate Examination: Pump vibration measurements will be taken in vibration velocity (in/sec, peak, unfiltered). The evaluation of the readings will be per table 6100-1. For more information, see An American National Standard, Inservice Testing of Pumps, ANSI/ASME OM-6-July 1987, draft II."

Table 6100-1
Ranges of Test Parameters

PUMP TYPE	PUMP SPEED	TEST PARAMETER	ACCEPTANCE RANGE	ALERT RANGE	ACTION RANGE
Centrifugal and Vertical Line Shaft (2)	<600 RPM	V(d)	≤2.5V(r)	>2.5V(r) to 6V(r) But Not >10.5mils	>6V(r) But not >22mils
	>600 RPM	V(v)	≤2.5V(r)	>2.5V(r) to 6V(r) But Not >.325 in/sec	>6V(r) But not >.70 in/sec
Reciprocating		V(d) OR V(v)	≤2.5V(r)	>2.5V(r) to 6V(r)	>6V(r)

NOTE: (1) Vibration parameter per Table 5200-1 (ANSI/ASME OM-6-July 1987, draft 11).

(2) Vibration displacement [V(d)] measurements shall be peak-to-peak. Vibration velocity [V(v)] measurements shall be peak. All vibration measurements are to be broadband (unfiltered). V(r) is vibration reference value in selected units."

1.2 Evaluation

Using vibration velocity measurements rather than vibration displacement measurements has been demonstrated to provide a better indication of pump degradation. The velocity measurements are more sensitive to small changes in pump performance which can be indicative of developing mechanical problems. These measurements detect the high amplitude vibration that can indicate major mechanical problems such as imbalance or misalignment. They also detect the low amplitude, high frequency vibration caused by bearing wear that usually goes undetected by simple displacement measurements. The ANSI/ASME OM-6 draft guidelines for measuring vibration velocity and determining the allowable ranges and action levels are acceptable to the NRC as an alternative to the requirements of Section XI (for vibration measurements in units of displacement) provided that the licensee complies with all of the OM-6 vibration measurement requirements except for those for which specific relief has been requested and granted.

Since the licensee has elected to use the more predictive measurement of vibration velocity on a quarterly basis, the deletion of annual bearing temperature measurements will not adversely affect the determination of pump operational readiness and provides a reasonable alternative to the Code requirements. Annual bearing temperature measurement for some pumps would present a hardship for the licensee.

1.3 Conclusion

Based on the determination that the licensee's proposed alternative testing method is equivalent or superior to the Code requirements and therefore that it provides an acceptable level of quality and safety, the requested relief is granted pursuant to 10 CFR 50.55a(a)(3)(i) for all pumps in the IST program.

2. Relief Request V-191:

The licensee requested relief from the requirement IWV-3522 of Section XI to full stroke exercise valves MUV-1, -7 and -11 during each cold shutdown.

2.1 Licensee's Basis for Requesting Relief:

The licensee stated: "These valves are located on the discharge of the makeup pumps, and are downstream of where the pump discharge tees with the pump recirculation line back to the makeup tank (MUT-1). During normal operation one of these three lines is used to provide RCS makeup and reactor coolant pump seal injection. Flow through MUV-1, MUV-7 and MUV-11, is limited by letdown capacity and seal injection flow requirements. This flow provides a partial stroke of these valves. Any remaining makeup pump flow is through the recirculation line and does not pass through MUV-1, 7 and 11."

"These valves can not be full stroke tested during cold shutdowns because of low temperature overpressure (LTOP) concerns."

"Alternate Examination: These valves will be full stroke tested each refueling outage."

2.2 Evaluation

It is impractical to demonstrate the full-stroke capability of valves MUV-1, -7 and -11 during cold shutdowns using flow since this could pose the risk of low temperature overpressurization of the reactor coolant system. These valves receive their flow from high pressure sources and should only be full-stroke exercised using flow when a sufficient surge volume is available (i.e., when the reactor vessel head is removed). Cool-down and depressurization of the reactor coolant system and removal of the reactor vessel head solely to facilitate full-stoke exercising these valves at cold shutdown (due to low temperature overpressurization concerns) would be extremely time consuming, difficult, and burdensome to the licensee. The licensee's proposal to full-stoke exercise these valves during refueling outages with the reactor vessel head removed should provide a reasonable assurance of operational readiness. However, these valves must also be partially stroked and individually back-seat tested quarterly.

2.3 Conclusion

Based on the determination that the Code requirements are impractical and that the granting of the reliefs is authorized by law and will not endanger life or property or the common defense and security and is otherwise in the public interest, giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility, the requested relief is granted pursuant to 10 CFR 50.55a(g)(6)(i).

3. Relief Request V-192:

The licensee requested relief from the requirement IWV-3522 of Section XI to full stroke exercise valves MUV-2, MUV-6, and MUV-10.

3.1 Licensee's Basis for Requesting Relief:

The licensee stated: "These valves are located on the discharge of the makeup pumps and are downstream of where the pump discharge tees with the pump recirculation line back to the makeup tank (MUT-1). During normal operation one of these three lines is used to provide RCS makeup and reactor coolant pump seal injection. Flow through MUV-2, MUV-6 and MUV-10, is limited by letdown capacity and seal injection flow requirements. This flow provides a partial stroke of these valves. Any remaining makeup pump flow is through the recirculation line and does not pass through MUV-2, -6, and -10."

"These valves can not be full stroke tested during cold shutdowns because of low temperature overpressure (LTDP) concerns."

"Alternate Examination: These valves will be full stroke tested each refueling outage."

3.2 Evaluation

It is impractical to demonstrate the full-stroke capability of valves MUV-2, -6 and -10 during cold shutdowns using flow since this could pose the risk of low temperature overpressurization of the reactor coolant system. These valves receive their flow from high pressure sources and should only be full-stroke exercised using flow when a sufficient surge volume is available (i.e., when the reactor vessel head is removed). Cooldown and depressurization of the reactor coolant system and removal of the reactor vessel head solely to facilitate full-stroke exercising these valves at cold shutdown (due to low temperature overpressurization concerns) would be extremely time consuming, difficult, and burdensome to the licensee. The licensee's proposal to full-stroke exercise these valves during refueling outages with the reactor vessel head removed should provide a reasonable assurance of operational readiness. However, these valves must also be partially stroked and individually back-seat tested quarterly.

3.3 Conclusion

Based on the determination that the Code requirements are impractical and that the granting of the reliefs is authorized by law and will not endanger life or property or the common defense and security and is otherwise in the public interest, giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility, the requested relief is granted pursuant to 10 CFR 50.55a(g)(6)(i).

Principal Contributor:

K. Dempsey

Dated: October 6, 1988