Florida
Power
CORPORATION
Crystal River Unit 3
Docket No. 50-302

March 13, 1995

3F0395-01

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Subject: NRC to FPC letter, 3N0195-06, dated January 6, 1995
NRC Inspection Report 50-302/94-18

Dear Sir:

Florida Power Corporation (FPC) received NRC Inspection Report 94-18 on January 13, 1995. The NRC inspection team concluded that FPC implemented a satisfactory GL89-10 program. However, the referenced inspection report identified several follow-up items (IFIs) for which FPC response is requested to achieve closure. The attachment to this letter documents FPC's response. If, after your review of our response there are no additional follow-up items, FPC requests GL89-10 be considered closed for CR-3.

Sincerely,

P. M. Beard, Jr.
Senior Vice President
Nuclear Operations

PMB/PVF/RLM:ff

Attachments

cc: Regional Administrator, Region II
NRR Project Manager
Senior Resident Inspector

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IE01

FLORIDA POWER CORPORATION

ATTACHMENT TO FPC LETTER 3F0395-01

RESPONSE TO INSPECTION REPORT 50-302/94-18

GENERIC LETTER 89-10 FOLLOW-UP ITEMS

IFI 50-302/94-18-01, Torque Switch Repeatability Errors.

The error resulting from the inaccuracy in torque switch repeatability had not been included in the maximum thrust limits specified by the licensee. Also, the licensee had not accounted for the increased torque switch repeatability error that occurs at a switch setting of 1. This issue was licensee identified. (See Section 2.2)

FPC Response

Calibration data sheets will be modified to include consideration of torque switch repeatability in the maximum total thrust allowed. Expected completion date is October 1, 1995.

Maintenance procedures have been revised stating a torque switch setting of one should not be used. Where a setting of one is required to ensure maximum thrust limits are not exceeded due to inertia, the procedure will direct maintenance personnel to notify engineering. Switch settings will be adjusted for differences in torque switch repeatability accuracy. Evaluation of the current torque switch settings is expected to be completed by May 1, 1995.

IFI 50-302/94-18-02, Rate of Loading.

The licensee had used a 15% value to correct calculated settings for rate of loading uncertainty. This was not fully justified by the licensee test results. Additional data should become available from industry testing or the licensee's program to support the value used. (See Section 2.2)

FPC Response

Information provided in Enclosure 1 (Rate of Loading) is considered the most applicable to the CR-3 Motor Operated Valve (MOV) Program. FPC continues to monitor industry activity with respect to this subject. New developments are evaluated against assumptions used in the MOV Thrust Calculation and if appropriate, changes made. Plant procedures for evaluating industry information will be used to control this activity.

In addition to the above, data from the seven valves to be dynamically tested over the next three refuel outages (see IFI 94-18-09) will be evaluated to assure the results noted in Enclosure 1 remain valid.

IFI 50-302/94-18-03, Stem Friction Factor.

The licensee had not developed dynamic test data to support the stem friction factor assumed. Additionally, the licensee was changing lubricants and had not evaluated the affect on stem friction factor. (See Section 2.2)

FPC Response

The change in dynamic stem friction factor as used in the CR-3 MOV program is addressed under the term load sensitive behavior. Load sensitive behavior was addressed in DP test reports by either direct measurement or overall inclusion in the calculated valve factor.

In cases where direct stem thrust could not be measured, delivered thrust for a given torque output was assumed to remain constant between the static and dynamic test.

Changes in delivered thrust associated with load sensitive behavior could not be directly quantified, however the calculated valve factor would be higher since no change in the torque to thrust conversion was assumed. This assumption results in higher closing thrust requirements. The higher valve factors were incorporated into the thrust calculations, resulting in greater minimum thrust requirements. The net affect is the same as increasing values used for rate of loading. Degraded voltage capability is based on a .15 stem coefficient of friction. This value has been validated for use in static tests. Since the torque output at switch trip does not change between the static and dynamic test, the reduced voltage capability of the motor will not be challenged. Increased values for valve factor or load sensitive behavior raise the minimum required thrust, in a sense standardizing static test set-up to dynamic test requirements. The adjusted minimum required thrust must be below the calculated reduced voltage capability to be considered acceptable. This evaluation was included in the thrust calculation validation process.

Valve factors used in the MOV thrust calculations were based on closing dynamic test results. Based on test data recorded at CR-3 this approach was considered the most appropriate. Specific opening valve factors were not calculated, however test results were evaluated to ensure the measured thrust requirements fell below calculated values. Although credit is taken for the torque switch bypass in the open direction, the thrust calculation was validated to ensure the opening thrust requirement was below the actuator reduced voltage capabilities and all structural limits.

In-plant and industry test data supports the use of a .15 coefficient of friction when using either FelPro N-1000 or Chevron EP-2. Further evaluation of the lubricants used will be part of the CR-3's tracking and trending program. In addition, results from planned dynamic testing will be evaluated to ensure assumptions used for load sensitive behavior remain valid.

IFI 50-302/94-18-04, Reliance on DMT Results.

Setup and dynamic testing of some valves had been performed using the MOVATS DMT (displacement measuring transducer) to determine torque. Industry testing has found a high degree of uncertainty in thrusts determined using the DMT. (See Section 2.3)

FPC Response

As discussed with the NRC inspectors, CR-3 is committed to improving the test methods used to establish torque switch settings. Use of ITI MOVATS open vs close test methodology is only used when alternatives are not available.

Although the open vs close test methodology, utilizing the MOVATS DMT and load cell, is not a preferred method of testing, when used in conjunction with ITI MOVATS engineering report 5.2 it is considered acceptable. CR-3 does not intend on re-performing dynamic testing solely based on the test method used. CR-3 does intend to reduce and hopefully eliminate reliance on this test methodology when re-setting valves under static test conditions. The schedule for implementation will coincide with scheduled preventative or corrective maintenance.

IFI 50-302/94-18-05, Correction of Measured Thrust for Diagnostic Uncertainties.

The licensee's evaluations of differential pressure test thrust measurements against calculated values failed to account for inaccuracies in the measured values. (See Section 2.3)

FPC Response

Although CR-3 considers the method used to evaluate test results appropriate with respect to overall conservatism in the program, an acceptable plant-specific error value will be determined. This will be applied to dynamic test results when comparing measured values to calculated values. The error value will be utilized beginning November 1, 1995.

IFI 50-302/94-18-06, Use of Calculated Thrust Limits Where Directly Measured Thrust Limits Were Appropriate.

Although the licensee had direct torque measurements for most of their dynamically tested valves, they converted actuator and valve torque limits to thrust acceptance limits for dynamic tests. A stem friction coefficient was assumed for the conversion calculation resulting in uncertainty that could have been avoided by directly comparing measured torque with the actuator and valve torque limits. (See Section 2.3)

FPC Response

Direct torque measurements were not available for most of the valves tested. Spring pack displacements were available but are not considered a direct torque measurement due to uncertainties associated with using spring pack charts. Torque limits were maintained through validation of the stem factor used during static test setup. Although delivered thrust can change under dynamic conditions (and as stated in our response to IFI 50-302/94-18-03 is accounted for in the minimum thrust requirements), actuator torque output at switch trip will not change. If the torque limits are established under static conditions, the torque at switch trip under dynamic conditions will be the same.

IFI 50-302/94-18-07, Adequacy of Extrapolations.

The licensee linearly extrapolated the thrust necessary to overcome differential pressure to design-basis conditions. In some cases, the extrapolation was approximately 50% of DP. There is uncertainty regarding the accuracy of such extrapolations. (See Section 2.3)

FPC Response

Acceptability of the extrapolation methodology currently used is based on information presented at MOV users group meetings and a review of data obtained from the EPRI Performance Prediction Program (Ref: EPRI letter dated December 14, 1993).

CR-3 has established programs for monitoring and evaluating industry information for applicability to our plant. We will continue to monitor industry developments in this area and make program adjustments, as needed.

IFI 50-302/94-18-08, As-Found Static Diagnostic Testing.

Licensee personnel stated that static diagnostic direct thrust measurements would be performed on the GL 89-10 MOVs, for as-found and as-left testing, to better establish confidence in past measurements and assure acceptable margins are maintained. The licensee's preventive maintenance program database identified a requirement for periodic static diagnostic testing but did not specify both as-found and as-left testing. (See Section 2.4.1)

FPC Response

Specific requirements for as-found and as-left test requirements are already detailed in the plants preventive maintenance (PM) control sheets. As found test requirements will also be incorporated into applicable plant procedures. Completion is expected by December 1, 1995.

IFI 50-302/94-18-09, Review of Plans for Periodic Verification.

As described in the licensee's internal correspondence NPTS94-0602, entitled Periodic DP Testing, dated December 2, 1994, the licensee plans to dynamically test several MOVs with diagnostic equipment during upcoming outages. The inspectors were not able to determine whether the licensee's planned actions are sufficient to meet the recommendations of GL 89-10 regarding periodic verification of design-basis capability. (See Section 2.4.1)

FPC Response

(1) At this time, static testing is scheduled on a six year frequency or following maintenance activities which could affect switch settings. The scope of this testing applies to all valves included within the CR-3 MOV Program.

Testing of MOVs at design basis conditions will be repeated if a valve is replaced, modified or overhauled to the extent that the existing test results are not considered representative of the MOV in its modified configuration.

(2) In most cases no valve/actuator maintenance was completed prior to the performance of in-situ dynamic tests. DP test results are considered representative of valve performance including expected degradation. Margin for degradation was ensured through the validation of MOV thrust calculations based on DP test results.

Further degradation in dynamic performance is expected to be nominal. To support this position, CR-3 plans on dynamically testing seven valves over the next three refuel outages. Test results will be evaluated to determine if a specific margin for degradation is required.

(3) Enclosure 2 (Periodic DP Testing) provides a discussion of the schedule for DP testing. The valves selected for dynamic testing are considered a representative sample for evaluating the potential for age degradation. Gate valves were the predominant selection based on a review of all DP test results. These valves are considered to be the most susceptible to age related degradation.

(4) As found periodic static testing will be evaluated to determine if the torque switch is set within the acceptance criteria established by the calibration data sheet. Measured values found outside established limits are controlled in accordance with the site problem report system. This evaluation includes: affects on operability, reportability and steps to prevent re-occurrence. This information will also be used to adjust test and maintenance frequencies.

IFI 50-302/94-18-10, Post-Maintenance Test Requirements.

The licensee's Post-Maintenance Testing Manual was unclear regarding testing requirements following packing adjustment and there were no requirements to verify acceptable thrust following valve repair/replacement or internal repairs. (See Section 2.4.2)

FPC Response

Specific requirements for Post Maintenance Testing will be clarified and incorporated into plant procedures by December 1, 1995.

IFI 50-302/94-18-11, MOV Trending Parameters.

The licensee had not established requirements for trending and periodic examination of MOV failures and degradation. (See Section 2.5.2)

FPC Response

Tracking and trending of MOV and other equipment failures is controlled by the plant problem report system. A separate program for tracking and trending MOV performance is under development and will be fully implemented by June 1996. Parameters to be monitored include; as-found/as-left torque switch settings, lubrication condition, spring pack displacement, stem factor (where available), diagnostic evaluation for anomalies and a general inspection for items similar to those identified in attachment "A" of GL89-10. Maintenance procedures will typically be used to obtain this information. A significant amount of this information has already been obtained and will be formalized when the program is fully implemented.

IFI 50-302/94-18-12, Mispositioning.

The licensee did not assure the capabilities of non-active GL 89-10 valves to be repositioned should they be mispositioned. There is a PWR owners group position against the related generic letter recommendation which continues under NRC review. Guidance given in an NRC internal memorandum from B. Sheron of July 12, 1994, indicates staff review of GL 89-10 may be closed for a site if the licensee commits to consider the findings of the NRC review of mispositioning, when completed. (See Section 2.11)

FPC Response

CR-3 commits to consider the findings of the NRC review of mispositioning, when completed.

IFI 50-302/94-18-13, Functional Testing.

Several MOVs had been functionally tested to demonstrate their capabilities without diagnostics. This was limited to MOVs that are routinely operated under conditions that meet, or exceed design-basis conditions and 1) are normally closed valves of less than 1 inch diameter, 2) are throttle valves that are not required to fully close, and 3) valves with no active safety function. The licensee stated that these tests were done at design-basis conditions. However, the differential pressure test conditions were not clearly documented in the packages reviewed. Also, it was not clear how operability under degraded voltage conditions was ensured. Further, it was not clear how the licensee intended to periodically reverify design-basis capability in the future or monitor for valve degradation. (See Section 2.3)

FPC Response

Enclosure 3 (MOV Functional Verification) documents the procedures used when functional testing was completed. These procedures were reviewed and in some cases revised to ensure testing was representative of expected design basis conditions.

All valves included within the functional test category were baseline tested and set-up using diagnostic equipment. Reduced voltage capability was established analytically and confirmed by meeting the acceptance window provided in the calibration data sheet. This method is consistent with all valves included within the CR-3 MOV Program.

Periodic verification of switch settings for these valves, using diagnostic equipment, will be completed at the same frequency as all program valves. A specific surveillance interval for testing at design basis conditions is not considered warranted since these valves are used routinely in accordance with plant procedures at pressures similar to worst case requirements. Problems associated with valve operation would be identified through normal use.

IFI 50-302/94-18-14, Verification of Setting Assumptions for Valves Not Practical to Test.

The licensee's program did not indicate any long-term plans to validate the valve factors and other assumptions that had been used in setting valves that had not been dynamically tested at design-basis conditions. Data from the licensee's future periodic testing and/or from industry testing (e.g., from the EPRI MOV test program) could be used to provide increased confidence in the capabilities of these valves. (See Section 2.3)

FPC Response

CR-3 has validated assumptions used for the 21 valves that could not be tested through the use of in plant and EPRI MOV test program data. 11 of these valves are considered to have sufficient additional margin to assure reliable operation, with no further evaluation required. 10 of the valves were identified as having minimal margin and are currently being evaluated. These evaluations are expected to be complete by December 1, 1995 and will identify modifications to improve the available margin or further validate the assumptions used.

Results of future dynamic testing will be evaluated and applied to all valves in the MOV Program.

Rate of Loading

The standard Limitorque sizing equation is based on the following relationship;

$$\text{Required Stem Thrust} = (A_m)(V_f)(\Delta P) + SBL + (\Delta P)A_s$$

Where;

- A_m = Mean seat area
- V_f = Valve Factor
- ΔP = Differential Pressure
- SBL = Stuffing box load
- A_s = Stem area

Results of this calculation represent the minimum stem thrust required to close the valve under "dynamic conditions". Valve set-up is typically accomplished by measuring and setting the delivered thrust under "static" conditions. Industry and in plant testing has shown that thrust at torque switch trip may vary between static and dynamic conditions. This phenomenon is commonly termed either "rate of loading" (ROL) or load sensitive behavior. To account for the possible affects of ROL, additional margin is added to the standard Limitorque sizing calculation.
The term ROL as used in CR-3 thrust calculations combines this margin with margin for degradation. Minimum required thrust with ROL is calculated as follows;

$$\text{Required Stem Thrust}_{w/ROL} = \text{Required Stem Thrust} + (\text{Required Stem Thrust} \times ROL)$$

ROL values used in the thrust calculation range from 15% to 30% for valves not supported by in plant testing.

Forty two valves were dynamically tested using diagnostic equipment. Test data for the majority of these valves recorded spring pack displacement, without direct stem thrust measurement. Valve factors calculated from this data were combined with the affects of load sensitive behavior, since thrust requirements were based on correlation of spring pack displacement to expected thrust under static conditions. Displacement at CST varies only with torque switch repeatability. Although test results were factored into the thrust calculation, the data was not used in evaluating expected values for ROL.

Nine of the valves were tested using the ITI MOVATS Torque Thrust Cell. This arrangement provides direct measurement of both stem thrust and torque. To evaluate the affects of load sensitive behavior, test results for these valves have been tabulated based on the following relationship;

ROL = (Measured Static Thrust - Measured Dynamic Thrust)/ Measured Static Thrust

Valve #	STATIC THRUST	DYNAMIC THRUST	STATIC S.P. DISPL	DYNAMIC S.P. DISPL	ROL
ASV-204	14,257	13,756	0.0428	0.0431	4%
DHV-12	2,327	1,975	0.1109	0.1059	15%
FWV-14	41,696	41,208	0.2302	0.2327	1%
FWV-15	38,842	40,477	0.1067	0.1198	-4%
	46,396	46,614	0.1937	0.1924	0%
FWV-31	30,861	27,310	0.1753	0.175	12%
FWV-32	29,480	25,284	0.147	0.1547	14%
FWV-33	14,646	12,233	0.0916	0.0969	16%
FWV-36	17,913	14,123			21%
MUV-62	9,637	10,474	0.0615	0.0639	-9%

As seen from the above results, ROL varies from -9% to 21%, with the average falling well below 15%. Although the 15% used in the thrust calculation does not bound all in plant test data, it is considered representative of expected results, given the best available industry information at this time. It should be noted that the factors that cause the phenomenon of load sensitive behavior are still unknown and several industry sponsored activities are in progress in an attempt to quantify the affects. CR-3 will continue to monitor industry activities and will make program adjustments, if necessary as new information becomes available.

Periodic DP Testing

CR-3 has now completed all MOV in situ testing at design-basis or best achievable pressure for those valves determined to be practical to test. In most cases, no valve/actuator maintenance was completed prior to the performance of the in-situ dynamic test. DP tests results are considered representative of valve performance, including expected degradation. As stated under item "f" of GL89-10, testing of MOVs at design-basis conditions need not be repeated unless the MOV is replaced, modified, or overhauled to the extent that the licensee considers that the existing test results are not representative of the MOV in its modified configuration. Based on in plant test results and the recommendation in GL89-10, periodic testing at design-basis conditions for all valves in the MOV program is not required.

DP test re-performance will be considered if a valve is replaced/modified, system parameters change beyond acceptable extrapolation methodologies or the available margin for valve degradation is a concern. An example is the testing completed on FWV-14/15. Based on in situ test results, the MOV thrust calculation for these valves uses a valve factor of .4 and rate of loading of 10%. This data was obtained following maintenance on both the valve and actuator. To ensure the margin for degradation was sufficient, the valves were re-tested two years from the initial baseline. Results confirmed the acceptability of assumptions used in the thrust calculation. Evaluation of test requirements is controlled by; CR-3 MOV Program Manual, NEP-235 and the Post Maintenance Test Manual.

DP testing is to be scheduled for FWV-14/15, EFV-32/33, MUV-257, FWV-36 and FWV-30 over the next three refuel outages. These valves were chosen for the following reasons:

FWV-14/15 were selected due to the limited available margin used in the thrust calculation.

EFV-32/33 were included due to the horizontal gate valve arrangement and the fact that maintenance was performed prior to the initial baseline. It should be noted that these valves were the subject of SYPR-91-0025.

MUV-257 is a Rockwell Edwards rising rotating stem globe valve. Initial set-up under static conditions found the actual thrust capability less than the calculated value. Testing at design-basis conditions confirmed the ability of the valve to perform as required, however corrective maintenance was identified and will be scheduled for 10R. Dynamic testing will be included as part of the post maintenance test requirements.

FWV-36 is a horizontally mounted gate valve. As determined from dynamic testing, the valve factor and rate of loading were approximately .78 (mean seat diameter) and 21%. Maintenance was completed in 9R.
FWV-30 is a vertically mounted gate valve. Measured valve factor was approximately .84 (mean seat diameter), including rate of loading. A value of 10% was used for rate of loading in the thrust calculation.

The above valves were chosen based on past test results, in some cases the limited available margin and to be representative of expected degradation typical for valves. The results of this testing combined with industry information will be used to evaluate the need for any further DP testing.

MOV Functional Verification

The following information is provided to document the Functional Testing completed in accordance with the requirements of the CR-3 MOV Program;

CFV-11/12: These valves are used to bubble nitrogen for sampling and reduce CFT pressure when required. OP-401 has been revised such that CFV-11/12 will be subjected to the maximum expected differential pressure of 625 psid during normal operation. Functional testing of the valves was completed during start-up from Refuel 9 and documented per section 4.3 of OP-401.

CFV-15/16: These MOV's are isolations to the Waste Gas Header. OP-401 has been revised such that CFV-15/16 will be subjected to the maximum expected differential pressure of 625 psid during normal operation. Functional testing of the valves was completed during start-up from Refuel 9 and documented per section 4.5 of OP-401.

CAV-126: This valve is used to sample the RCS letdown. It's safety function is to close for containment isolation. Under normal operations, this valve is stroked after the downstream isolation valve is closed. Therefore, it is not normally stroked against a differential pressure. Functional verification of CAV-126 against maximum expected differential pressure conditions was completed in accordance with PT-448. As-found static testing completed during Refuel 9 found the torque switch set below the minimum required per the calibration data sheet. This ensure the torque switch will always be set higher then the conditions present during the functional test.

CAV-1: This valve is used to sample the pressurizer steam space. It's safety function is to close for containment isolation. Under normal operations, this valve is stroked after the downstream isolation valve is closed. Therefore, it is not normally stroked against a differential pressure. CAV-1 was functionally stroked satisfactory in the closed direction under dp conditions in accordance with PT-448. As-found static testing completed during Refuel 9 found the torque switch set below the minimum required per the calibration data sheet. This ensures the torque switch will always be set higher then the conditions present during the functional test.

CAV-3: This valve is used to sample the pressurizer water space. It's safety function is to close for containment isolation. Under normal operations, this valve is stroked after the downstream isolation valve is closed. Therefore, it is not normally stroked against a differential pressure. CAV-3 was functionally stroked satisfactory in the closed direction under dp conditions in accordance with PT-448. As-found static testing completed during Refuel 9 found the torque switch set below the minimum required per the calibration data sheet. This ensures the torque switch will always be set higher then the conditions present during the functional test.

CAV-4/5: These MOV's are used for sampling the OTSG's at <15% power. OP-203 (Plant Startup) closes these valves before going above 15% power, if they were used for blowdown. OP-202 (Plant Shutdown) uses these MOV's to start blowdown at <15% power. The Operating Procedures that stroke these MOV's have no articular order in which these valves are stroked. These MOV's were functionally stroke tested in the closed direction during plant shutdown satisfactorily. This stroke test was performed by operations personnel and documented in the Control Center Logbook.

DHV-110/111 These MOV's are not stroked full open or full closed when their respective DH pump is running. Their normal position is open. They are used as throttle valves for normal flow control. Proper operation is verified in SP-340B and SP-340E.