UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA ST., N.W.
ATLANTA, GEORGIA 30323

Report No.: 50-302/88-20

Licensee: Florida Power Corporation
3201 34th Street, South
St. Petersburg, FL 33733

Docket No.: 50-302 License No.: DPR-72

Facility Name: Crystal River 3

Inspection Conducted: June 20-24, 1988

Inspector: _____ 9/7/88
S. Lingen Date Signed

Approved by: _____ 9/7/88
F. Jape, Section Chief Date Signed
Test Program Section
Engineering Branch
Division of Reactor Safety

SUMMARY

Scope: This routine, announced inspection was conducted in the areas of Complex Surveillance Testing and IE Bulletin followup.

Results: In Paragraph 2, a weakness was identified in the Main Steam Safety Valve setpoint test program involving failure to identify and record the as-found setpoint when performing the periodic testing. In Paragraph 3, weaknesses were identified in the licensee's IE Bulletin 85-03 program that involved a deficient procedure resulting in valve discrepancies and failure to implement the Bulletin 85-03 program for other safety-related motor operated valves. Strengths were identified in the licensee's Bulletin 85-03 program that involved diagnostic testing on Bulletin valves subsequent to specific maintenance actions and the plans to perform diagnostic testing during the next three refueling outages on all Bulletin valves regardless of whether or not maintenance was performed to trend and verify valve operability.

REPORT DETAILS

1. Persons Contacted

Licensee Employees

*S. Balliet, Site Nuclear Engineering Services, Electrical/Instrumentation and Control
*D. Beach, Acting Supervisor, Site Nuclear Engineering Services
*G. Becker, Manager, Site Nuclear Engineering Services
*M. Collins, Superintendent, Safety and Reliability
*J. Cooper, Superintendent, Technical Support
*L. Floyd, Supervisor, Nuclear Document Control
*E. Good, Nuclear Operations Licensing
*J. Holton, Senior Nuclear Results Engineer
*J. Maseda, Supervisor, Nuclear Engineer
*P. McKee, Director Nuclear Plant Operations
*T. Metcalf, Operations Technical Advisor
*J. Miele, Site Nuclear Engineering Services Electrical/Instrumentation and Control
*R. Murgatroyd, Superintendent, Nuclear Maintenance
*V. Roppel, Manager, Nuclear Maintenance and Outage
*W. Rossfeld, Manager, Nuclear Compliance
*R. Shires, Nuclear Project Engineer, Corporate
*S. Sullens, Senior Supervisor, Electrical
*R. Thompson, Supervisor, Site Nuclear Engineering Services
*E. Welch, Manager, Nuclear Electrical/Instrumentation and Control Engineering Services
*R. Widwell, Director Nuclear Operations Site Support

Other licensee employees contacted during this inspection included craftsmen, engineers, operators, mechanics, technicians, and administrative personnel.

NRC Resident Inspectors

*J. Tedrow

*Attended exit interview

2. Complex Surveillance (61701): Main Steam Safety Valve and Pressurizer Safety Valve Setpoint Surveillance

The inspector reviewed the results of Refueling Outage Six (RFO 6) Main Steam Safety Valve (MSSV) and Pressurizer Safety Valve (PSV) setpoint testing. Surveillance Procedure SP-650, ASME Code Safety Valve Test, and the PSVs RFO 6 WYLE Laboratories Certification Reports were used as the basis for this review. The acceptance criteria for MSSV and PSV setpoint testing are contained in Crystal River Unit 3 (CR3) Technical Specifications (TSs). Setpressures and tolerances are specified in the TSs and

Section XI of the 1974 ASME Boiler and Pressure Vessel Code. The licensee is committed to ANSI/ASME PTC 25.3-1966, Safety and Relief Valve Performance Test Code, for testing techniques.

CR3 has two PSVs installed on the top of the pressurizer. There is no loop seal between the pressurizer and PSV; therefore, during normal plant operation the PSV seats are exposed to steam. CR3 has experienced seat leakage problems with the PSVs and as a result, every refueling outage both valves are removed and replaced with refurbished, setpoint tested spare valves. During RFO 6 the PSVs were removed, two previously tested valves installed, and the removed valves sent to WYLE laboratories to be leak tested, disassembled, inspected, repaired, setpoint tested, and seat leak checked. The as-found setpoint pressure was not tested for at WYLE laboratories and is therefore unknown.

CR3 has 16 MSSVs. During RFO 6 all 16 MSSVs were refurbished and subsequently setpoint tested. The valves were refurbished to correct seat leakage. The as-found setpoint pressures were not tested for and therefore unknown. Subsequent to refurbishment MSSVs were tested in place with the steam generators at approximately normal operating pressure utilizing a Dresser 1566-2 Hydroset Unit pressure assist device. In order to pass the acceptance criteria, two consecutive lifts must occur within the specified tolerance.

The inspector considers that the PSV and MSSV setpoint testing meets the requirements of Section XI; however, the following findings were noted:

a. Following a reactor trip in July 1987, six MSSVs began to leak by the seat. It was suspected that the valves were leaking by the seat because they did not properly reseat after lifting in response to the reactor trip. In order to correct the seat leakage the MSSVs were manually lifted three to four times in an attempt to reseat the valves. Manual lifting of the valves did not correct the seat leakage problem. The next action performed to stop the seat leakage was to lift and reseat the MSSVs utilizing the hydroset device. This technique had worked in the past because the hydroset lift device aligns the valve disk and seat when reseating and results in seat tightness. The hydroset lift method stopped the seat leakage, but five of the six valves that were leaking were found to have setpoints that exceeded the ±1% TS tolerance range. The setpoint results of the six valves lifted utilizing the hydroset unit to stop seat leakage were as follows:

No.	TS Set-Point (psi) and Tolerance	As-Found SetPoint (psi)	As-Left SetPoint (psi)	Percent As Found Exceeded TS Setpoint
MSV-34	1050 ± 1%	1060	1060	+1%
		1060	1060	+1%
MSV-35	1050 ± 1%	1077	10[illegible]	+2.6%
		1067	1052	+1.6%
MSV-36	1050 ± 1%	1040	1055	-1.0%
		1025	105[illegible]	-2.4%
MSV-38	1070 ± 1%	1035	1075	-3.3%
		1035	1070	-3.3%
MSV-41	1070 ± 1%	1030	1072	-3.7%
		1010	1072	-5.6%
MSV-47	1100 ± 1%	1050	1090	-4.5%
		1055	1090	-4.1%

These valves were setpoint checked while attempting to stop seat leakage, not to satisfy Section XI test frequency requirements. The inspector questioned the licensee why the setpoints were out of TS tolerance and if the setpoints of the remaining 11 MSSVs were considered to be suspect. One possible explanation offered by the licensee was that the valves tested were leaking by the seat and this has some effect on the setpoint. The inspector agreed that leakage of steam by the seat would cause the valve to heatup. The inspector questioned the licensee if the setpoints on the five MSSVs that were adjusted would change after the leakage past the seats had stopped and the valves cooled down. The licensee was not immediately able to answer the inspector questions concerning the status of the MSSVs. This is identified as Inspector Follow up Item 88-20-01, Effect on setpoint when adjustments are performed on leaking MSSVs.

b. Commencing with RFO 7, scheduled for September 1989, MSSVs and PSVs will be tested in accordance with ANSI/ASME OM-1-1981, Requirement for Inservice Testing of Nuclear Power Plant Pressure Relief Devices. The procedure for testing safety valves per ANSI/ASME OM-1-1981 is very specific where past code requirements have been very general in nature. The inspector discussed some of the changes concerning safety valve testing that ANSI/ASME OM-1-1981 will require:

(1) ANSI/ASME OM-1-1981 requires that no maintenance, adjustments, disassembly or other activity which could effect as-found set-pressure or seat tightness data be permitted prior to testing. CR3 Surveillance Procedure SP-650 is used to setpoint test MSSVs. This procedure performs a preliminary valve lift without recording lift setpressure. The procedure states that the first lift of the safety valve is not considered a factual response and is only intended to clear the seat and correct any vertical misalignment inside the valve. This information was obtained from Dresser training information. The inspector considers that this practice could effect the as-found setpressure and will not be allowed per ANSI/ASME OM-1-1981.

(2) Per ANSI/ASME OM-1-1981, valves that are removed and replaced with spare valves have to be tested within a specified time period following removal of the valve. The time period is dependent on whether a partial or full valve replacement was performed.

(3) Review of the WYLE Laboratory PSVs test results indicate that bonnet temperature was approximately 178°F when setpoint testing the valves. Per the licensee, PSV ambient temperature while the unit is in normal operation is approximately 210°F. ANSI/ASME OM-1-1981 requires that the ambient temperature of the operating environment shall be simulated during the setpressure test unless a correlation between the test temperature and ambient temperature on the safety valves can be established.

This is not a full list of ANSI/ASME OM-1-1981 requirements, only some of the major differences the licensee will encounter during RFO 7 MSSVs and PSVs Testing.

No violations or deviations were identified.

3. IE Bulletin 85-03 Followup (25573)

(Open) 50-302/85-BU-03, T2515/73, "Motor Operated Valve Common Mode Failures During Plant Transients due to Improper Switch Settings." The purpose of this bulletin is to require licensees to develop and implement a program to ensure that switch settings for High Pressure Coolant Injection and Emergency Feedwater System Motor Operated Valves (MOVs) subject to testing for operational readiness in accordance with 10 CFR 50.55a(g) are properly set, selected and maintained. Action Item a required a review of the design basis for the operation of each valve. Action Item b requires that correct switch settings be established, Item c requires differential pressure testing or alternate methods to demonstrate operability with the settings from Item b; Item d requires plant procedures to be provided to assure the maintenance of correct switch settings throughout plant life. Florida Power Corporation, letter dated February 17, 1988, provided the CR3 final response to Bulletin 85-03.

In order to evaluate the CR3 Bulletin 85-03 program the inspector held discussions with the appropriate licensee personnel and reviewed the following:

a. Procedure TP-15, MOVATS "As-Left" Data Acquisition MOV-27

b. Procedure SP-370, Quarterly Cycling of Valves

c. Maintenance Histories for Valves EFV-0014, ASV-005, ASV-2024, and EFV-0211

d. Florida Power Corporation Final Bulletin 85-03 Response for CR3 contained in letter dated February 17, 1988

e. Procedure MP-402, Maintenance of "Limitorque" Valve Controls and As-found and As-Left Torque Switch Settings and Corresponding Thrust Valves

f. Operation of Valves at Degraded Voltages

The CR3 Bulletin 85-03 program identified 17 valves, eight of which are DC motor driven and the remaining seven are AC motor driven. All valve operators are Limitorque SMB models that operate gate, globe and stop check valves ranging in sizes from 2½" to 6". In order to accomplish bulletin valve diagnostic testing, Florida Power Corporation contracted MOVATS Incorporated. For future diagnostic testing the licensee is developing a program to qualify its own personnel to perform diagnostic testing utilizing MOVATS test equipment.

The 17 bulletin valves are divided into eight separate groups. All valves in each group are the same size, manufacturer, type, and operate in identical pressure ranges forefilling identical functions. With the exception of one of the eight groups of valves, the licensee differential pressure tested one valve in each group prior to any repairs or switch adjustments in order to determine the as-found condition. During the differential pressure testing actual system flow was simulated, and design pressure was also simulated when possible. In the cases where design pressures could not be fully achieved thrust values were extrapolated. During the differential pressure testing MOVATS test equipment was installed to establish the as-found opening and closing thrusts, limit switch trip points, motor current and inadvertent back seating. The main objective of the differential pressure testing was to determine as-found opening and closing thrust values at the end of an operating cycle prior to performing maintenance on the valves, and to verify valve operability prior to maintenance and alteration of switch values. During differential pressure testing all valves successfully operated as required. In order to determine bulletin valve design thrust values, the licensee obtained thrust values from the valve vendor and from

the MOVATS data bank except that the MOVATS data bank did not have thrust values for valves MUV-058 and MUV-073. These thrust values were compared to the thrust values obtained during the differential pressure testing of the licensee bulletin valves. The final thrust values that would be used for CR3 bulletin valves were based on the thrust values that were obtained during differential pressure testing. In some instances the MOVATS thrust values exceeded the thrust values obtained while differential pressure testing; however, the final thrust value for the valves was based on the licensee differential pressure testing results. Comparison between MOVATS provided thrust values, differential pressure testing thrusts values, and as-left thrust values are as follows:

Valve	Minimum MOVATS Thrust (lbs)	Diff Pressure Thrust (lbs)	As Left Thrust Torque Switch Setting (lbs)
ASV-5,204*			
Opening	8501	4015	8100
Closing	6783	Not Applicable	7520/7800
EFV 11,14*			
Opening	11896	11818	17900/18880
Closing	20104	14440	17850/17560
EFV-32,33*			
Opening	10884	5923	20530/21200
Closing	19429	13216	21200/20600
MSV-55*,56			
Opening	Not Available	23363	17200/17800 (Note 1)
Closing	Not Available	Not Applicable	15400/15860
MUV-23,24,25,*26			
Opening	11282	6118	13120-14560
Closing	11186	2791	13500-13900
MUV-27*			
Opening	4609	2545	6700
Closing	3418	2695	6700
MUV-53,257*			
Opening	Not Available	7877	13600/13660
Closing	Not Available	8818	13240/13490
MUV-58,73			
Opening	463	Not Performed	7200/6800
Closing	303	Not Performed	6860/7100

*Denotes which valve in Group that was differential pressure tested
Note 1 - During DP test, valves were over thrusting into seat which resulted in excessive opening thrust.

Valves MUV-58 and MUV-73 were not in the MOVATS data base, nor were these valves differential pressure tested by the licensee. In an accident condition these valves would be required to operate under a 20 psid. Based on calculations the valves would require less than 1000 pounds of thrust to seat and unseat. The licensee considered that a differential pressure test would have been meaningless because the spring pack preload was in excess of 1000 pounds and therefore would not be visible on the MOVATS signature. The as-left torque switch settings for the valves were approximately 13,000 pounds thrust which is significantly greater than the 1000 pound calculated thrust valve.

Seven valves were differential pressure tested and ten were stroke tested utilizing MOVATS test equipment with the systems depressurized in order to determine the as-found condition. During the testing and subsequent maintenance, all valves were determined to be operable; however, the following deficiencies were found: (The percentage number following the deficiency indicates the percentage of the 17 bulletin valves where the deficiency was observed.)

Deficiency	% of Bulletin Valves Where Observed
Spring pack relaxation after closing	24%
Torque switch unbalanced	47%
Spring pack gap (greater than .020")	18%
Spring pack deformation	12%
Inadequate limit switch grease	29%
Declutch problems	24%
Faulty torque switch	6%
Hydraulic locking	35%
Actuator body grease inadequate	24%
Actuator gear problems	12%
Loose stem nut locknut	6%
Damaged motor lead wires	35%
Wire labeling incorrect	18%
Torque switch set incorrect	12%
Valve backseating	12%
Inadequate torque bypass	6%

Additional Bulletin valve deficiencies not addressed in the above list were:

(1) A failed worm gear and two internal stellite bearings were found to be absent in the actuator of MUV-53 (Valve was operational with these deficiencies).

(2) Valves MUV-55 and MUV-56 were found to be overthrusting into the seat.

Misalignment of the valve stem on MUV-53, resulting from the absence of the stellite bearings, caused abnormal high loads on the worm gear which resulted in fatigue cracks and subsequent worm failure. In the past, the licensee had performed maintenance on the MUV-53 actuator and it is suspected that the bearings were removed and not reinstalled at that time.

Following the as-found stroke testing the appropriate corrective maintenance actions were taken, torque switch trip settings adjusted to new values, torque switch bypass modifications made to place limit switches on separate rotors, torque switch bypass adjustments made, and actuator modifications to prevent actuator hydraulic lock were performed. Following these actions the Bulletin valves were stroke tested with MOVATS test equipment while the systems were depressurized to verify proper valve operation and switch settings.

One of the major problems found during MOVATS testing of the Bulletin valves was hydraulic locking of the Belleville spring packs. This is not a new problem for CR3, previous modifications were made to solve this problem. Six of the 17 Bulletin valves tested exhibited hydraulic locking. A new modification was implemented for the Bulletin valves to prevent hydraulic locking from reoccurring. The modification machined two slots, 180 degrees apart, at each end of the spring pack thrust limiting sleeve to allow grease to flow through the spring pack assembly and relieve to the grease reliefs. Hydraulic locking was experienced in both opening and closing direction; however, it was more prevalent in the open direction. During disassembly of the spring pack on valves that hydraulic locking occurred, grease was found inside and outside the Belleville washers. If hydraulic lock is caused from restriction of grease from outside of the Belleville washers into adjacent areas, the modification made to solve the problem will work. If hydraulic lock is caused from restriction of flow of grease from inside the Belleville washers, the modification will not solve the hydraulic lock problem. For the next three refueling outages Bulletin valves will be stroke tested and monitored for hydraulic lock. If hydraulic lock occurs in the future, one of the solutions under study is to place star washers in-between the Belleville washers in order to aid the flow of grease from between the washers. During a walkdown of CR3 bulletin valves the inspector noted a previous modification made to MOVs to solve hydraulic lock problems which involved installation of tubing from the spring pack area to the actuator body. Hydraulic lock is still somewhat of a mystery to the licensee and will be monitored for in the future.

In Babcock and Wilcox Report Number 32-1102B3-01 operation of CR3 Bulletin valves at 80% degraded voltage was determined to be satisfactory. The inspector reviewed the report and verified that AC and DC motor driven actuators provided adequate thrust at degraded voltages.

Inspector Findings:

Procedure MP-402 has been the maintenance procedure utilized by CR3 over the years to perform maintenance on Limitorque operators. The licensee is in the process of rewriting this procedure and until the rewrite is complete if a Limitorque operator requires maintenance a special procedure is written to accomplish the maintenance. Many of CR3 Bulletin valve deficiencies can be attributed to deficiencies with MP-402. The following examples illustrate this finding:

(1) Forty-seven percent of the actuator torque switches were not balanced. MP-402 did not provide instructions to balance torque switches or acknowledge that balancing was required.

(2) Twelve percent of the Bulletin valves were found to be back seating and six percent of the Bulletins had torque bypass switches set incorrectly.

These problems are associated with incorrect limit switch adjustments. MP-402 provided instructions on what the limit switch setting was required to be but did not give instructions on how to set the limit switches. The procedure did not specify to count handwheel turns after removing handwheel free play or to measure stem movement as the method to set limit switches. In addition, the procedure did not require checking for valve backseating following switch adjustment.

(3) Twenty four percent of the actuators had inadequate body grease. MP-402 provided instructions to disassemble and clean actuators but did not mention lubrication requirements during the reassembly of the actuator.

(4) During review of MP-402, the inspector noted that IE Information Notices associated with MOVs were not addressed. For Example IE Information Notice 86-34 discusses the need to place the valve in the mid position when installing valve to actuator fasteners. If the valve is shut when torquing those fasteners the torque is transferred to the valve seat via the valve disk and stem, resulting in loose fasteners when the valve is opened. In addition to not specifying valve position, MP-402 did not specify torque values for valve to actuator fasteners. The Bulletin valves are seismic qualified and a torque value should be specified. Another example of an Information Notice not incorporated into MP-402 is IE Information Notice 86-22. This Information Notice discusses the need to ensure that the motor pinion gear is not installed in the reverse direction, and states that installation of the pinion gear in the reverse direction is an easy mistake to make and results in actuator failure.

The inspector discussed the need to incorporate into the revised edition of MP-402 the discrepancies discovered during performance of the Bulletin 85-03 program and the need to incorporate problems identified by IE Information Notices.

TP-15 performed differential pressure MOVATS testing on MUV-27. In this procedure MUV-27 stroke time was measured using local position indicating lights. The stroke time was not being performed to satisfy Inservice Test requirements, but was being performed to provide general data. In some instances measuring a valves' stroke time using local indication, light to light, does not comply with Section XI. The Code requires the time interval from initiation of the actuating signal to the end of the actuating cycle be timed. In order to determine if stroke timing of valves was done by measuring local indication lights, the inspector reviewed Surveillance Procedure SP-370, Quarterly Cycling of Valves. The purpose of this procedure is to measure power operated valves stroke time per Section XI of the ASME Boiler and Pressure Vessel Code. Step 7.3 of SP-370 states, "Valve stroke time should be recorded from a remote operating station using indicator lights." The inspector questioned control room operators who perform stroke time testing and observed actual performance of stroke time testing for five valves. Despite the instruction in SP-370 to time light to light, the practice at CR3 is to time actuation of control switch to closed light indication with a calibrated stopwatch. While observing stroke time testing for five valves, the inspector noted that simultaneously with placing the valve control switch in the closed position the valve position indication lights indicated the intermediate position. For the five valves tested there was no significant difference between stroke timing using light to light and switch actuation to light. The inspector discussed with the licensee the need to change SP-370 to reflect CR3 practice for stroke timing valves and that stroke timing utilizing light to light indication is acceptable only when switch actuation is instantaneous with obtaining valve intermediate indication, and the closed indication light is instantaneous with end of valve stroke. The inspector also noted that SP-370 was not the only procedure that covered stroke timing of valves.

CR3 has identified 17 Bulletin 85-03 valves. As discussed in this report while performing bulletin action items for these valves, numerous deficiencies were found. The valves were determined to be operable at the time, but without the corrective maintenance performed subsequent to this special testing future operability of the valves would have been questionable. CR3 has 63 other safety-related MOVs. The inspector questioned

the licensee if the deficiencies discovered in the 17 bulletin valves could exist in the other 63 safety-related valves. The licensee has recognized this situation and is developing a program to take the appropriate corrective action, however no formal program has been developed or implemented.

The licensee has issued Inter Office Correspondence dated February 22, 1988 and June 13, 1988, to provide guidelines for MOVATS testing of bulletin valves subsequent to maintenance. The inspector reviewed these guidelines and considers them acceptable. These guidelines also recognize that MP 402 is lacking in technical adequacy for performing work on MOVs and is not to be used until revised.

IEB 85-03, Action Item e.

As requested by Action Item e. of Bulletin 85-03, "Motor-Operated Valve Common Mode Failures During Plant Transients Due to Improper Switch Settings," the licensee identified the selected safety-related valves, the valves' maximum differential pressures and the licensee's program to assure valve operability in their letter dated May 13, 1986. Review of this response indicated the need for additional information which was requested in a Region II letter dated August 18, 1987, to FPC.

Review of the licensee's September 17 and 25, 1987, responses to the request for additional information, indicates that the licensee's selection of the applicable safety-related valves to be addressed and the valves' maximum differential pressures meets the requirements of the bulletin and that the program to assure valve operability requested by Action Item e. of the bulletin is now acceptable.

With the exception of MP-402 the inspector considers that the licensee program to implement Bulletin 85-03 to be acceptable. Prior to final acceptance of Bulletin 85-03 the following must be completed:

a. Revision of MP-402 and subsequent Region II review of the revision,

b. NRR review of the final response required by Action Item f. of the Bulletin. On February 17, 1988, the licensee provided this final response and this response is presently undergoing review by NRR.

c. Eight of the 17 Bulletin valve actuators are DC motor driven. DC motor failure in Limitorque MOV actuators with continuously energized shunt fields may be susceptible to surge voltages induced in the short field winding when energized has been identified as a occurrence at other utilities. The licensee has been notified of this problem and is determining if this is applicable to CR3.

No violations or deviations were identified.

4. Exit Interview

The inspection scope and results were summarized on June 24, 1988, with those persons indicated in Paragraph 1. The inspector described the areas inspected and discussed in detail the inspection results.