



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

DEC 17 1992

Report No.: 50-348/92-30 and 50-364/92-30

Licensee: Southern Nuclear Operating Company, Inc.  
 600 North 18th Street  
 Birmingham, AL 35291-0400

Docket No.: 50-348 and 50-364

License No.: NPF-2 and NPF-8

Facility Name: Farley 1 and 2

Inspection Conducted: November 16-20, 1992

Inspector: H. L. Whitener 12-10-92  
 for M. D. Hunt Date Signed

Accompanying Inspectors: P. A. Taylor  
 H. L. Whitener

Approved by: M. W. Branch 12/10/92  
 M. W. Branch, Chief Date Signed  
 Test Programs Section  
 Engineering Branch  
 Division of Reactor Safety

SUMMARY

Scope:

This announced inspection was conducted in the areas of Phase I of the licensee's Generic Letter 89-10, Safety-Related Motor Operated Valve Testing and Surveillance program and a review of licensee corrective actions associated with previous inspection findings.

Results:

The motor operated valve (MOV) inspection revealed that while the licensee had resolved several of the program weakness identified in inspection report 50-348,364/91-201, two significant weaknesses have not been resolved. These are:

Justify the applicability of Farley Nuclear Plant differential pressure test data to non-tested valves.

Justify the acceptability for the use of the MOVATS Data Base and the vendor calculations in estimating the required minimum thrust values. The d/p testing performed on 16 valves in the 1992 tests did not support the data used for the valve calculations.

In the areas inspected, violations or deviations were not identified.

## REPORT DETAILS

### 1. Persons Contacted

#### Licensee Employees

- B. Badham, Engineer, Inservice Inspection
- M. Coleman, Manager, Plant Modifications and Maintenance Support
- \*R. Hill, General Manager
- \*R. Marlow, Technical Supervisor
- \*M. Pilcher, Valve Engineer
- \*L. Stenson, Acting General Manager, Operations

#### Other Organizations

- \*S. Gates, Senior Specialist, Southern Nuclear Operating Company

#### NRC Resident Inspectors

- \*G. Maxwell, Senior Resident Inspector
- \*M. Morgan, Resident Inspector

- \*Attended exit interview

### 2. GENERIC LETTER (GL) 89-10 "SAFETY-RELATED MOTOR-OPERATED VALVE (MOV) TESTING AND SURVEILLANCE" (2515/109)

The Nuclear Regulatory Commission (NRC) conducted a team inspection of the Farley Nuclear Plant's response to Generic Letter 89-10, Safety-Related Motor-Operated Valve Testing and Surveillance, Inspection Report No. 50-348,364/91-201, dated March 28, 1991. That inspection identified seven weaknesses and required the submittal of additional information. The licensee responded to the items in a letter dated May 25, 1991. The purpose of this inspection was to review the licensee's actions taken for each of the items identified in the report in accordance with the responses submitted in their letter. Each item is discussed below.

- a. (CLOSED) Item NO. 50-348,364/91-201-01 Effects of High Temperatures on Motor-Torque and Actuator-Thrust Capabilities

The licensee had identified a few MOVs that would be required to operate in sustained elevated temperatures after an accident. No analysis or testing had been performed to establish the effects of the postulated high temperatures on the performance motor-torque and actuator-thrust capabilities. The licensee's response stated that both Limitorque and Bechtel Power Corporation evaluated the effects of high ambient temperatures on AC motor performance and concluded that the motor torque decrease should not have a significant effect on actuator thrust output.

The licensee has identified six MOVs that have a long term operation requirement following an accident. The inspector

reviewed the setpoint data for these valves. Listed below are the valve ID numbers, required motor torque, reduced voltage motor-torque, and rated motor-torque.

VALVE NO.	REQUIRED MOTOR-TORQUE	REDUCED VOLTAGE MOTOR-TORQUE	RATED MOTOR-TORQUE
(Unit 1&2)			
MOV 3660	1.17 ft-lbf	3.2 ft-lbf	5 ft-lbf
(Unit 1)			
MOV 3872A	1.87 ft-lbf	3.2 ft-lbf	5 ft-lbf
MOV 3872B	same	same	same
(Unit 2)			
MOV 3872A	same	same	same
MOV 3872B	same	same	same

MOVs 3660 for Units 1 and 2 are sampling line valves for containment air which is required to be sampled one hour into the LOCA. The other valves are operated within 6-10 minutes after the accident.

The calculated required motor-torque requirement is much less than the motor-torque required at the reduced voltage value and the rated motor-torque. Based on these conservative values and the fact that the licensee has a Vendor Contact Program at the corporate level that will process any revised vendor motor data when it is available, this item is closed.

- b. (Open) Item No. 50-348, 364/91-201-02, Demonstrate the Applicability of Test Data From FNP Design Basis Differential Pressure (d/p) Tests to Other Non-Tested MOVs.

The licensee tested approximately 55 MOVs at or near design d/p for the IEB 85-03 program. From a least-squares fit of these data, a 90% confidence band curve was established statistically for use in estimating the required minimum d/p thrust for non-tested MOVs considered to be identical. All similar valves were identified for grouping on the basis of physical parameters such as manufacturer, size, type, model, service application, and design d/p.

GL 89-10 recommended action f, as further explained in Question 26 of Supplement 1 to GL 89-10, specifies that alternatives to design basis pressure or flow testing an MOV, where it is not practicable to test in situ, could include the use of appropriate design basis test results from other MOVs either in situ or prototype. The licensee has not justified the applicability of the FNP test data. Research results and operating experience have shown that there can be wide variations

in operating characteristics for identical or similar valves. As identified in the licensee's response to item 91-201-03 in the May 25, 1991 letter, this inconsistency of valve performance was evident in the test results of the IEB 85-03 tested MOVs and resulted in the development of the 90% confidence band approach.

In the audit of the licensee's GL 89-10 program in February 1991 (Inspection Report No. 50-348, 364/91-201), the NRC identified the failure to verify the applicability of valve thrust data from Farley design basis pressure testing to non-tested valves as a significant weakness. In their response of May 25, 1991, for near term action, the licensee committed to performing a comparison review of the static data for the design basis tested valves and the non-tested valves to which the thrust data was applied. The purpose of this review was to identify any abnormalities or anomalous behavior. For long term action, the licensee committed to continue to participate in and monitor the results of the Electric Power Research Institute (EPRI) MOV Performance Prediction Program.

The inspectors reviewed the licensee's documentation (File A4.19) on the review of the static data and concluded that a thorough review had been performed. Additionally, discussion with licensee personnel showed that the licensee is active in industry and EPRI initiatives on MOVs. The inspectors concluded that the commitments in the May 25th letter relative to the application of the FNP design basis test data to non-tested valves using the 90% confidence band on FNP test data were met. The licensee also performed an evaluation of the set up of the MOVs to the 90% confidence band and worst case data taken in the design basis testing. In all but two instances, the worst case measurements for opening or closing any valve in a group was bounded by MOV as left set up.

The steps taken by the licensee provide some additional confidence in the reliability of the MOVs to function and are acceptable as a short term resolution. However, because an accepted relationship between performance of MOVs at static conditions and at high differential pressure conditions has not been established, the NRC staff cannot accept the licensee's use of general physical parameters and static test characteristics to justify, over the long term, the capability of the MOVs not tested under design basis differential pressure conditions. The industry in general is waiting for information from the EPRI program (or other sources) to determine whether MOVs have similar performance characteristics that allow application of test data between them. For the long term, the licensee has not verified that the performance of these MOVs (i.e. valves accepted by grouping) is understood to the extent that data from valves tested at design basis conditions can be applied to non-tested valves. If unable to justify the applicability of the test data, some other means that the MOVs are capable of operating under design basis

conditions is required. Testing at full design basis conditions where practicable or partial design basis conditions with justifications for extrapolation are among the accepted alternatives presented in GL 89-10 to demonstrate that the non-tested MOVs will function under design basis conditions.

Although the licensee has met their commitments for item 91-201-02 stipulated in the May 25, 1991, response to NRC Inspection Report 50-348,364/91-201, the item remains open until programmatic issues are resolved. Additionally, item 91-201-03 below describes NRC concerns associated with validation of the MOVATS data base. Since d/p testing has indicated that required thrust is greater than that predicted by the MOVATS data base any additional d/p testing required should include testing of different valve types and sizes in establishing a data base that may be applied to similar valves.

Additional information was requested from FNP to enable the NRC to complete its review of this item.

- c. (Open) Item No. 50-348, 364/91-201-03, Demonstrate the Applicability of Required Thrust Estimates From the MOVATS Data Base and Vendor Calculations.

On June 28, 1983, the NRC issued Generic Letter 89-10, which extended the scope of I.E. Bulletin 85-03 to include all safety-related and position-changeable motor-operated valves (MOVs). Item 1 of the Generic Letter (GL) requested that each licensee advise the NRC whether the recommendations and schedule contained in the GL would be met. The letter further requested that for any recommendations or schedule elements which would not be met, the licensee should present technical justification along with alternative actions and schedules. In a letter dated December 28, 1989, Alabama Power Company (APCo) responded to the NRC request concerning GL 89-10. In this letter APCo indicated that further design basis differential pressure testing of motor operated valves will be deferred and a methodology which involves the use of vendor calculations, MOVATS differential pressure test data base and/or Farley Nuclear Plant (FNP) design basis differential pressure test data will be used to establish the minimum required thrust for valve operation at design basis conditions.

The NRC responded to the licensee's GL 89-10 program submittal in a letter dated June 25, 1990. In this letter the NRC stressed that the accuracy and applicability of data obtained from differential pressure testing (such as MOVATS or FNP data) to non-tested MOVs is the licensee's responsibility. In regard to deferment of in-situ design basis testing, the NRC staff pointed out an acceptable method to justify MOV operability at design basis conditions based on static tests or data obtained at less

than design basis conditions has not been determined due to problems observed at both test facilities and operating plants. It is these inconsistencies and uncertainties in MOV performance which form the basis of the staff's recommendation to test MOVs at design basis conditions of pressure and flow.

Subsequent to the above correspondence, an inspection of the FNP MOV program was performed by the NRC in February 1991. A number of program concerns were identified in inspection report 50-348, 364/91-201 and the licensee was asked to respond in writing. In view of the inspector's concerns relative to using the MOVATS data base and vendor calculations to determine minimum required thrust, the licensee, in response to item 91-201-03 dated May 25, 1991, committed to evaluate and to test selected motor operated gate valves to demonstrate the adequacy of the MOVATS data base and vendor calculations for prediction of the minimum required thrust.

During this inspection the inspectors determined that the licensee had performed differential pressure in-situ tests in January and October 1992. Nine MOVs were differential pressure tested in January and seven were d/p tested in October (Unit 1 refueling outage). These tests included MOVs in the Service Water System associated with the containment Fan Coolers and discharge side of the RHR pumps. Of the 16 MOVs d/p tested in 1992, 11 were first time tests on Service Water System valves set up using the MOVATS data base and 3 were retested after valve maintenance. Two of the tests were on RHR system valves set up using vendor calculations.

Differential pressure for these systems is 150 psid and 700 psid respectively. Results from the January 1992 testing had been analyzed by the licensee. Design differential pressure for these tests (Service Water System) was 150 psid. The test differential pressure was a nominal 50 psid (ranging from 40 to 65 psid). The test results were linearly extrapolated to 150 psid to evaluate the adequacy of the MOVATS data base to predict the minimum required thrust at design basis conditions. The results show that in approximately 25% of the tests the MOVATS data base under predicted the minimum required thrust to the extent that torque switch trip would have occurred at less than the 150 psid design basis differential pressure. The licensee reevaluated the design basis differential pressure for these cases and determined that a realistic design basis differential pressure for these MOVs was 82 psid. At a design basis condition of 82 psid the MOVs were functional. However, operability of the MOVs was due to the conservatism built into design basis differential pressure calculated in the initial design basis review. The MOVATS data base did not adequately predict the required minimum thrust for these low differential pressure MOVs. In the October Unit 1 refueling outage 7 additional MOVs were differential pressure tested. Evaluation of this data is still in process. However, from a preliminary review of this data, the licensee indicated

that these tests support the results of the January tests. Two MOVs (8887 A and B) on the discharge of the RHR pump were included in these tests. These MOVs were set up based on vendor calculations. The d/p tests were performed at a nominal 200 psid. The test data extrapolated to the design basis differential pressure of 700 psid showed that the thrust required for valve operation was greater than the minimum available thrust obtained from vendor calculations. This means that minimum required thrust based on vendor calculations is non-conservative. The licensee concluded that the MOVs were functional based on a Westinghouse Owners Group determination that the maximum expected differential pressure for the safety function of these valves is 202 psid.

In the May 25, 1991, response the licensee also committed to review, document and substantiate adequate margin for the instances in which vendor calculations were utilized to establish torque switch settings. The inspectors reviewed a Southern Company Services (SCS) letter to J. D. Woodard (APCo) dated November 14, 1991 (File ENG 15-90-1653) which documents the margin available for MOVs setup using vendor calculations. SCS calculated the thrust by the standard industry equation using a valve factor of 0.5 and a differential pressure obtained from the Westinghouse generic design basis review for a Farley type Westinghouse plant (WCAP 13097). Thrust obtained from this calculation was then compared to the vendor calculations which used a valve factor of 0.3 and a conservative differential pressure obtained from the FNP design basis review. The vendor also uses an adjustment to the cross sectional area of the valve which adds some slight conservatism. The vendor and SCS calculated thrust values were then compared to the as left open/close available thrust for the MOVs. Westinghouse and/or licensee analysis indicate, that for the safety function, the as left MOV setup bounds the required thrust.

The inspectors concluded that the licensee has met the commitments in the May 25, 1991, response to NRC report item 50-348,364/91-201-03. Specifically, the licensee performed additional differential pressure tests to evaluate the adequacy of the MOVATS data base and reviewed and documented that margin was available for those MOVs set up using vendor calculations. The licensee's actions show that in some cases the MOVATS data base and vendor calculations are not adequate for determining the minimum required thrust without consideration of the built-in margin based on conservative estimates of the design basis differential pressure in the initial design basis review. MOV operability is based on this margin in a number of cases. To complete the review of these issues the NRC requests additional information as to the extent of conservatism available for an MOV and how this conservatism will be incorporated into the MOV program to assure that adequate conservatism is established and maintained.

The inspectors assessed the licensee's current program status with regard to programmatic issues identified in the February 1991, inspection (NRC Report 50-348, 364/91-201). The licensee's position is that the current program of utilizing MOVATS data base and vendor calculations with conservative differential pressure assumptions in conjunction with the practice of setting torque switches as close to maximum thrust as achievable provide a reasonable reliability that MOVs will function as required. The outstanding program issues relative to conformance with the recommendations of GL 89-10 include:

1. Failure to test each MOV at design basis conditions where practicable.
2. Use of a restrictive criteria to determine which MOVs are practicable to test. Specifically, exclusion of MOVs with a design basis differential pressure 300 psid or less and exclusion of MOVs for which a test pressure of 50% of the conservative design basis differential pressure cannot be achieved.
3. Use of static characteristics and general physical parameters to justify capability of MOVs not tested under design basis conditions.
4. Applications of FNP differential pressure test data to non-tested MOVs that the licensee considered identical on the basis of physical parameters.
5. Lack of formal controls to establish and maintain quantified margins, where conservative design basis differential pressure is used to justify estimates of required thrust from MOVATS data base and vendor calculations.

Further NRC review will be required to disposition these matters. Additional information was requested from FNP to enable the NRC to complete its review of this item.

- d. (Closed) Item No. 50-348,364/91-201-04, Correction to MOV Setpoint Data Sheets

The original MOV program inspection identified three concerns with the MOV setpoint document data sheets as follows: (1) The bases for the minimum and maximum thrust limits were not clearly identified. (2) The MOV setpoint document data sheets did not include MOVATS latest estimates for the diagnostic equipment accuracy. (3) The MOV setpoint document data sheets did not specify the maximum thrust limits for certain MOVs in the program.

The above concerns were based on Supplement 1 to GL 89-10, (dated June 13, 1990) where the NRC staff responded to questions regarding the implementation of GL 89-10 recommendations.

Specifically, question 26 states that licensee's should account for MOV diagnostic equipment inaccuracies when statically or dynamically testing MOVs and also when applying test data between MOVs. Question 30 states that parameters measured by diagnostic equipment should be capable of providing information to assist in demonstrating that a MOV will operate under design basis conditions.

The inspectors reviewed Project Desk Instruction (PDI), 005.3, Revision 1, which provides the methodology used to establish the minimum and maximum thrust values. The inspector verified that the MOV setpoint document was changed to incorporate the thrust value basis for MOVs in the program. The basis for each MOV is provided as asterisk footnotes on the setpoint document data sheets. Southern Company Services performed an evaluation of Units 1 and 2 MOV setpoint documents regarding the maximum thrust limits for certain MOVs and the latest accuracies for MOVATS diagnostic equipment. The setpoint documents, B175804 (Unit 1) and B205805 (Unit 2) were revised (Revision 2 dated 12/9/91) to incorporate the maximum thrust limits and the latest MOVATS diagnostic equipment accuracies. The inspectors used the latest MOVATS Engineering Report (ER) 5.0 Revision 4, Equipment Accuracy Summary to confirm that setpoint documents were using the current equipment accuracy data.

- e. (Closed) Item No. 50-348,364/91-201-05, Review and Implementation of the Recommendation from the Annual Assessment of MOV Failures

The original MOV program inspection identified a weakness in the licensee's program for dispositioning and implementing the recommendations stemming from the annual assessment of MOV failures. No specific actions had been taken regarding the assessment recommendations.

Procedure FNP-O-EMP-1005.4, Revision 1, MOV Failure Trending/Analysis was revised (May 5, 1991) and now requires the review and approval of management for the disposition of recommended actions concerning the annual evaluation of MOV failures. The MOV engineer is assigned the task of ensuring that the recommendations are implemented. The inspectors examined the actions taken for those recommendations specified in the May 29, 1991 memorandum from the MOV engineer to the maintenance manager. The inspectors reviewed the close out records associated with each recommendation (6) and determined that disposition of the items was appropriate and timely.

- f. (Closed) Item No. 50-348,364/91-201-06, Limiting Values for MOV stroke time testing

The original MOV program inspection identified that the inservice test program (IST) was using the technical specification (TS) or FSAR full stroke time value as the limiting value even if the

normal stroke time for the MOV was a shorter time. This approach is contrary to good engineering practice because the TS or FSAR addresses the systems performance requirements rather than the component characteristics.

GL 89-04 (dated April 3, 1989) Guidance on Developing Acceptable IST Programs, recommends that the limiting value of full-stroke time should be based on the valve average stroke time. When the TS or FSAR time limit is greater than the value established during IST program then the limiting value should be based on the average stroke time instead of the TS or FSAR limit.

The inspectors reviewed the licensee IST Program plan for FNP, Units 1 and 2, M-071 and verified that in those cases where the valve average stroke time is less than the TS or FSAR then the lesser value is limiting. The new limit is then used to trend stroke time where evaluations can then be made to determine valve degradation, any necessary increase in test frequency, operability, and corrective action for the valve as required by the IST program plan.

- g. (CLOSED) ITEM NO. 50-348,364/91-201-07, Establishment of MOVATS Accuracy

The licensee is using MOVATS diagnostic equipment to determine torque switch settings. At the time of the NRC Inspection, documented in IR 50-348,364/91-201, the overall accuracy of the system had not been established even though the Generic Letter 89-10 indicated that licensees should consider instrument inaccuracies when using diagnostic equipment.

The licensee has reviewed the FNP MOV program implementation with regard to the recent MUG/INEL validation testing and the ITI-MOVATS OPEN VERSUS CLOSE testing data. The inspectors reviewed Engineering Report 5.0, ITI MOVATS EQUIPMENT ACCURACY SUMMARY, which contains tables listing equipment application limitations, component accuracies, overall setup accuracies when utilizing the spring pack displacement methodology, overall measurement accuracies, and load rate testing summary. These tables list accuracies for various components when used in various applications. The engineering report directs the method to be used for determining the overall system accuracies. For each type of test conducted the report directs the manner in which the component accuracy is to be incorporated in the testing and acceptance of a MOV. Based on the data contained in the subject report and the licensee's Vendor Contact Program this item is closed. The Vendor Contact Program is expected to address new information such as the open-close issue on diagnostic equipment accuracy.

## 3. Action on Previous Inspection Findings (92702)

(CLOSED) Violation, 50-348/92-16-01, Failure of Design Controls to Ensure Incorporation of Setpoint Tolerances Into Plant Drawings.

The licensee's letter dated July 28, 1992, forwarded information regarding the corrective actions taken and the steps taken to avoid further violations in this area. The inspectors reviewed a representative sample of the Farley Nuclear Plant Unit 1 Setpoint Index B-175968, Revision No. 21, dated August 7, 1992, which was revised to add the setpoint tolerance data. Setpoint data for pressure relief valves is now contained in this document. This item is closed.

(CLOSED) Violation, 50-364/92-16-02, Failure to Specify and Perform Adequate Post Modification Testing.

The licensee's letter dated July 28, 1992, forwarded information regarding the corrective actions and steps taken to avoid further violations in this area. The licensee revised Farley Nuclear Plant MODIFICATIONS PROCEDURE FNP-O-PMP-100, DESIGN CHANGE ENGINEERING EVALUATION PREPARATION, Paragraph 4.12 to now require testing to "demonstrate correction of the problem or situation requiring the design change." It further requires careful considerations be taken for the need for flow testing when service water piping is replaced to insure adequate flow to the affected components. This item is closed.

## 4. Exit Interview

The inspection scope and results were summarized on November 20, 1992, with those persons indicated in paragraph 1. The inspectors described the areas inspected and discussed in detail the inspection results. The inspectors concerns, discussed in Paragraphs 2b and 2c, were described during the meeting. The licensee representatives suggested that another meeting be held to allow them to present additional information, or that the inspectors come to the corporate offices where the engineering calculations and vendor data is on file. The inspectors advised the licensee that the NRC would contact them as to what actions or information would be requested. Proprietary information is not contained in this report. Dissenting comments were not received from the licensee.

## 5. Acronyms and Initialisms

ENG	ENGINEERING
FNP	FARLEY NUCLEAR PLANT
FSAR	FINAL SAFETY ANALYSIS REPORT
GL	GENERIC LETTER
IEB	INSPECTION AND ENFORCEMENT BULLETIN
INEL	IDAHO NATIONAL ENGINEERING LABORATORY

IR	INSPECTION REPORT
LOCA	LOSS OF COOLANT ACCIDENT
MUG	MOTOR OPERATED VALVE USERS GROUP
NRC	Nuclear Regulatory Commission
psid	POUNDS PER SQUARE INCH DIFFERENTIAL
RHR	RESIDUAL HEAT REMOVAL