

APPENDIX

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

Inspection Report: 50-382/94-23

License: NPF-38

Licensee: Entergy Operations, Inc.
P.O. Box B
Killona, Louisiana

Facility Name: Waterford Steam Electric Station, Unit 3

Inspection At: Taft, Louisiana

Inspection Conducted: August 22-26, 1994

Inspectors: M. Runyan, Reactor Inspector, Engineering Branch
Division of Reactor Safety

C. Myers, Reactor Inspector, Engineering Branch
Division of Reactor Safety

Approved:


for T. F. Westerman, Chief, Engineering Branch
Division of Reactor Safety

9-13-94
Date

Inspection Summary

Areas Inspected: Routine, announced inspection of safety-related motor-operated valve testing and surveillance, and followup of engineering issues.

Results:

- The inspection verified completion of the licensee's commitments to Generic Letter 89-10, contingent on submittal within 60 days of the date of this report a letter documenting additional commitments related to periodic verification and post-maintenance testing of motor-operated valves, and subsequent NRC approval of this submittal (Section 1).
- Overall, the licensee's motor-operated valve program was strong, both administratively and technically. The program was supported by management, as evidenced by corrective actions taken on a motor-operated valve with abnormal test results (Sections 1 and 1.7).
- The inspectors concluded that the licensee had satisfactorily demonstrated the design basis capability of each motor-operated valve in the Generic Letter 89-10 program (Section 1.1).

- The licensee's Generic Letter 89-10 program included consideration of mispositioning of motor-operated valves (Section 1.2).
- The licensee had incorporated all appropriate vendor information regarding measurement accuracy using the VOTES® (registered trademark of Liberty Technology) diagnostic system (Section 1.4).
- All motor-operated valves were tested at maximum achievable conditions. Therefore, the provisions of Generic Letter 89-10, Supplement 6, related to grouping, were not applicable (Section 1.5).
- The scope of the licensee's periodic verification and post-maintenance testing was narrow. The licensee agreed to redefine commitments in this area (Section 1.6).
- The licensee had not documented corrective actions taken to address the fact that two motor-operated valves were inexplicably in manual at the time they failed to stroke (Section 1.7.1.1).
- The management support exhibited by investigating a motor-operated valve with anomalous test results was considered a strength, indicating a confidence and maturity in the capability of the diagnostic testing system (Section 1.7.1.2).
- The motor-operated valve trending program, though marginal, was adequate to support closure of the licensee's commitment to Generic Letter 89-10 (Section 1.7.2).
- All previous inspection items related to motor-operated valves were closed, with the exception of pressure locking. The efforts undertaken to date by the licensee to address pressure locking were considered sufficient to support closure of Generic Letter 89-10 (Section 1.8).
- Quality assurance utilization was sufficient for motor-operated valve program closure. However, the lack of a programmatic self-assessment and rigorous technical reviews indicated that quality assurance resources were under-utilized in the motor-operated valve area (Section 1.9).

Summary of Inspection Findings:

- Inspection Followup Item 382/9306-01 was closed (Section 2.1).
- Inspection Followup Item 382/9306-02 was closed (Section 2.2).
- Inspection Followup Item 382/9306-03 was closed (Section 2.3).
- Inspection Followup Item 382/9306-04 was closed (Section 2.4).
- Inspection Followup Item 382/9306-05 was closed (Section 2.5).

- Inspection Followup Item 382/9306-06 was closed (Section 2.6).
- Inspection Followup Item 382/9306-07 was closed (Section 2.7).
- Inspection Followup Item 382/9306-08 was closed (Section 2.8).
- Inspection Followup Item 382/9306-09 was closed (Section 2.9).
- Inspection Followup Item 382/9306-10 was reviewed but not closed (Section 2.10).

Attachment:

- Persons Contacted and Exit Meeting

DETAILS

1 GENERIC LETTER 89-10, "SAFETY-RELATED MOTOR-OPERATED VALVE TESTING AND SURVEILLANCE" (2515/109)

On June 28, 1989, the NRC issued Generic Letter 89-10, which requested licensees and construction permit holders to establish a program to ensure that switch settings for safety-related motor-operated valves were selected, set, and maintained properly. Subsequently, six supplements to the generic letter have been issued. NRC inspections of licensee actions implementing commitments to Generic Letter 89-10 and its supplements have been conducted based on guidance provided in Temporary Instruction 2515/109, "Inspection Requirements for Generic Letter 89-10, Safety-Related Motor-Operated Valve Testing and Surveillance," Revision 1. Temporary Instruction 2515/109 was divided into two parts: Part 1, "Program Review;" and, Part 2, "Verification of Program Implementation." Temporary Instruction 2515/109, Part 1, "Program Review," was conducted at Waterford 3 on January 27-31, 1992, and was documented in NRC Inspection Report 50-382/92-02. Temporary Instruction 2515/109, Part 2, "Implementation Review," was conducted at Waterford 3 on April 12-16, 1993, and was documented in NRC Inspection Report 50-382/93-06. The licensee notified the NRC in a letter dated July 28, 1994, that Waterford's commitments to Generic Letter 89-10 had been completed.

This inspection verified completion of the licensee's commitments to Generic Letter 89-10, contingent on the licensee submitting, within 60 days of the date of this report, a letter documenting additional commitments related to periodic verification and post-maintenance testing of motor-operated valves, and subsequent NRC approval of this submittal. This matter is discussed in more detail in Section 1.6 of this report.

Overall, the licensee's motor-operated valve program was strong, both administratively and technically. The program was well supported by management, as evidenced by corrective action taken on a motor-operated valve with abnormal test results (see Section 1.7.1.2).

1.1 Summary Status of Generic Letter 89-10 Motor-Operated Valves

One of the chief objectives of the inspection was to evaluate the licensee's design capability assessment of each of the 56 motor-operated valves in the motor-operated valve program developed in response to Generic Letter 89-10. In this effort, the inspectors concentrated on the methodology used to verify design assumptions and on the margins used to account for measurement uncertainties, statistical deviations in performance, and expected degradations of performance over time.

The inspectors reviewed a document entitled "Waterford 3 Steam Electric Station Generic Letter 89-10 Motor-Operated Valve Closeout Report." This document included a description of the process by which the licensee accomplished each of the objectives recommended in Generic Letter 89-10.

Appendix A to this document presented a qualification basis for two-stage approach motor-operated valves, a classification described in Generic Letter 89-10 as applying to motor-operated valves that could not be tested at, or near, design-basis differential pressure and flow. Attachment B provided a justification for removing emergency feedpump turbine trip and throttle valve, Valve MS-416, from the scope of the motor-operated valve program. Appendix C provided a detailed summary of the test results, assumptions, and margins for each motor-operated valve in the program. Appendix C was in a draft status at the time of the inspection. The licensee stated that no substantive changes were anticipated during the final review of this document.

The inspectors determined that the licensee had adequately demonstrated the capability of each Generic Letter 89-10 motor-operated valve to perform its safety function under design basis conditions. The inspectors' review focused on the test results and engineering judgement that was used to determine the valve factor, stem friction coefficient, and rate of loading values for use in the design capability calculation for each motor-operated valve. Of particular interest was whether or not the onsite test results validated the assumed constants used in the calculations.

Valve factors (based on orifice area) for the 29 gate valves in the program varied from 0.35 to 1.0, but mostly fell in a range from 0.5 to 0.7. Valve-specific differential pressure test results were available to validate the valve factor for 25 gate valves. The remaining 4 gate valves, which were impracticable to test dynamically, were assigned a valve factor of 0.7, based on test results of a similar valve. Globe valves were assigned valve factors ranging from 1.0 to 1.1. There were no cases where differential pressure tests of globe valves indicated valve factors higher than the assumed values. The inspectors determined that the licensee had satisfactorily justified the valve factors that were used in the motor-operated valve calculations.

Stem friction coefficients varied from 0.2 to 0.3 and were validated by analyses of dynamic test results at the point of torque switch trip. Calculating stem friction at the point of torque switch trip (point C14 in the VOTES® system) was potentially nonconservative, based on test results recently published by the Idaho National Engineering Laboratory. The Idaho National Engineering Laboratory testing showed that the apparent stem friction coefficient decreased after flow was cut off and while the valve was wedging into the closed seat. This information was considered preliminary with respect to this review of the licensee's motor-operated valve program. The inspectors' concern with the stem friction analysis point, however, was mitigated by the fact that the licensee was using dynamic test data to calculate stem friction, in addition to an assumption for load sensitive behavior (also known as rate of loading). Thus, in effect, the licensee was accounting twice for the degradation of stem friction under dynamic conditions. Load sensitive behavior assumptions ranged from 10 to 35 percent and were generally consistent with the test results. While some test data exceeded assumptions for stem friction coefficient and load sensitive behavior, the inspectors determined that none of these cases resulted in an immediate operability concern. However, future modifications or switch

setting changes could potentially result in operability problems if the nonconservative assumptions were left in the calculations. The licensee stated that the affected calculations would be revised to ensure that test results were fully incorporated for each motor-operated valve.

The inspectors reviewed the margins provided in the motor-operated valve calculations to account for measurement uncertainties and expected degradations of performance over time. The licensee was using the standard VOTES® methodology to estimate thrust measurement uncertainties including consideration of the torque correction factor. Margins for torque switch repeatability incorporated the standard 5/10/20 percent published by Limitorque® (redistered trademark of Limitorque Corporation). Stem lubrication degradation and springpack relaxation were collectively assigned a 9 percent margin. For calculations of motor capability, the licensee used an application factor of 1.0, nominal starting torque, pullout efficiency for direct current motor-operated valves and for alternating current motor-operated valves stroking in the opening direction, and run efficiency for alternating current motor-operated valves stroking in the closing direction. In total, the margins assumed by the licensee were consistent with current industry information.

The inspectors concluded that the licensee had satisfactorily demonstrated the design basis capability of each motor-operated valve in the motor-operated valve program.

1.2 Mispositioning

The inspectors held discussions and reviewed program documents to determine the licensee's treatment of inadvertent mispositioning of motor-operated valves. As recommended in Generic Letter 89-10, the scope of licensee motor-operated valve programs was to include motor-operated valves which were not prevented from inadvertent mispositioning from the control room.

The inspectors found that the licensee's program included consideration of the mispositioning of motor-operated valves, except for those motor-operated valves that were prevented by positive means from being mispositioned. However, the licensee identified that some motor-operated valves might be removed from the program in the future if Generic Letter 89-10 recommendations regarding mispositioning were relaxed.

The inspectors found the licensee's position regarding mispositioning to be adequate.

1.3 Pressure Locking and Thermal Binding

The licensee provided, for review, a document entitled "Gate Valve Thermal Binding and Bonnet Over Pressurization Evaluation." Revision 1, dated December 29, 1993. The licensee had completed a functional review of all Generic Letter 89-10 motor-operated valves and had determined that eight gate valves were potentially susceptible to pressure locking. The calculated

thrust required to stroke the motor-operated valve, when in a pressure locked condition, was less than the available thrust for each of the eight motor-operated valves. On this basis, the licensee concluded that Generic Letter 89-10 motor-operated valves would not be functionally compromised by any foreseen pressure locking events.

The licensee also determined that the Generic Letter 89-10 motor-operated valves were capable of overcoming the effects of thermal binding. This assessment was qualitative since analytical methods were not available. Much of the qualitative assessment was based on the fact that no thermal binding incidents had occurred at Waterford 3.

The inspectors did not review the calculation for technical merit. The NRC will issue a generic letter addressing pressure locking and thermal binding, after which additional inspection will be conducted to evaluate the licensee's response.

1.4 Actions in Response to Generic Letter 89-10, Supplement 5

The inspectors reviewed the licensee's actions in response to Supplement 5 of Generic Letter 89-10. In Supplement 5, the licensee was requested to provide information regarding the diagnostic systems being used to measure thrust and torque levels during Generic Letter 89-10 testing.

In response to Supplement 5, the licensee identified that the VOTES® system was used for diagnostic testing during their Generic Letter 89-10 program. The inspectors found that the licensee had incorporated all appropriate vendor information regarding measurement accuracy using the VOTES® system.

The inspectors found the licensee's actions in this area to be satisfactory.

1.5 Grouping

The licensee did not group motor-operated valves for the purpose of reducing the motor-operated valve differential pressure test scope. All motor-operated valves were tested at maximum achievable conditions. Therefore, the provisions of Generic Letter 89-10, Supplement 6, related to grouping, were not applicable. The licensee did group certain motor-operated valves for the purpose of analysis, particularly to determine the best available information for valve factors. This effort was inspected within the motor-operated valve summary status review described in Section 1.1 of this report.

1.6 Periodic Verification

The inspectors reviewed the licensee's plans to periodically verify the design basis capability of Generic Letter 89-10 motor-operated valves. The licensee had established periodic static testing for all motor-operated valves within the recommended frequency of Generic Letter 89-10 as the fundamental method of periodic verification. Additionally, the licensee had established periodic differential pressure testing for low margin gate valves. The licensee

defined low margin as less than 25 percent margin in excess of the minimum required thrust to overcome worst case design basis differential pressure conditions. The inspectors found that no motor-operated valves in the licensee's program were considered to be low margin motor-operated valves requiring periodic differential pressure testing.

According to the licensee, one gate valve in steam service and one gate valve in liquid service will be periodically tested under differential pressure conditions to validate the licensee's method of periodic verification of gate valves.

The inspectors found that the licensee's method for gate valves appeared to focus solely on a type of valve factor degradation reported by the Electric Power Research Institute as being dependent on the number of valve strokes following valve rework. Valve factor is a measure of the condition of the valve internals affecting valve operation. Valve factor was defined (at Waterford 3) as the ratio of the actuator thrust to the differential pressure acting over the area of the valve orifice. An increasing valve factor indicated a change in the valve internal sliding surfaces.

The inspectors noted that the licensee did not consider globe or butterfly valve periodic differential pressure testing to be necessary because the Electric Power Research Institute had not reported similar degradation affecting these types of valves. The inspectors considered the scope of the licensee's periodic verification to be narrow.

The inspectors reviewed the licensee's post-maintenance test matrix. This matrix identified maintenance activities requiring subsequent diagnostic testing to assure that design basis capability was maintained. The inspectors found that the matrix addressed only static testing following actuator maintenance. The inspectors considered the lack of prescribed differential pressure testing following valve maintenance (e.g. reassembly of valve internals, visual inspection, relapping valve seats and disc replacement) to be a program weakness, in light of the limited differential pressure testing planned during periodic verification. Specifically, some of these maintenance activities could affect a motor-operated valve's valve factor. Static testing alone cannot detect valve factor changes.

In response to the inspectors' concern, the licensee committed to submit additional information within 60 days of the date of this report delineating specific requirements for post-maintenance differential pressure testing and also presenting additional commitments regarding periodic differential pressure testing of globe and butterfly valves.

The closure of the licensee's motor-operated valve program is contingent on receipt and subsequent NRC approval of the licensee's submittal.

1.7 Failure Analysis and Trending

1.7.1 Failure Analysis

The inspectors reviewed the licensee's actions in response to operational failures of motor-operated valves. According to the licensee, there have been no operational failures of Generic Letter 89-10 motor-operated valves at Waterford 3 subsequent to Generic Letter 89-10 testing. The inspectors reviewed all condition reports regarding motor-operated valve problems during 1993-94.

1.7.1.1 Operational Status of Declutched motor-operated valves

Manual operation of certain model Limitorque® actuators involved uncoupling the motor from the actuator gear drive and coupling a handwheel. The manufacturer referred to this design feature of the actuator as declutching. Declutching was accomplished by depressing the declutch lever of the actuator. After declutching, the motor cannot be manually recoupled to the actuator. Provisions for automatically recoupling the motor were incorporated within the actuator by design during electrical operation.

The inspectors found that the licensee had established procedural requirements to electrically operate motor-operated valves subsequent to manual operation. The inspectors noted, however, several instances in which motor-operated valves failed to operate because they would not re clutch after being in the manual operating mode. The inspectors noted that the failures had occurred prior to Generic Letter 89-10 differential pressure testing of the motor-operated valves.

Condition Report CR-94-082 identified a failure of Valve MS-120B to close during quarterly containment isolation actuation signal surveillance testing in October 1993. The licensee had determined that the re clutching mechanism in the actuator had failed to automatically recouple the motor in the actuator. It was uncertain whether the motor-operated valve had not been properly restored to remote service following a previous manual operation or had been inadvertently declutched during unrelated maintenance in the general area. Additionally, the inspectors found that in January 1994, the same problem had occurred on the identical opposite train valve (MS-120A) which was located in the same general area in the plant. This was documented in Condition Report CR-94-026. Since neither condition report addressed corrective actions related to the manual configuration of the motor-operated valves, the inspectors were concerned that the licensee had not emphasized the fact that the motor-operated valves were inexplicably in manual at the time of the surveillance test.

In response to the inspectors' concern, the licensee provided documentation confirming that the two motor-operated valves had been restored to electric service following the previous manual operation. Additional corrective actions had also been implemented to prevent inadvertent declutching of motor-operated valves. Control of painting contractors had been enhanced, and

additional operations procedural requirements had been added to control restoration from manual operation. The inspectors considered the lack of documentation of corrective actions in the condition reports to be a weakness.

The inspectors found the licensee's corrective actions to be sufficient. The inspectors found a weakness in that the design basis capability of motor-operated valves initially in manual had not been demonstrated during the licensee's Generic Letter 89-10 program. As such, the inspectors noted that declutched motor-operated valves could be in a degraded condition, and potentially inoperable, until the motor-operated valves were electrically operated to reconnect the motor. In this light, any Generic Letter 89-10 motor-operated valve found unexpectedly in the manual mode of operation would be considered a nonconforming condition until independent confirmation of the operability of the automatic re clutching mechanism or re clutching of the valve operator.

1.7.1.2 Discovery of Improperly Installed Valve Disc

The inspectors reviewed Work Authorization 01119260, dated April 10, 1993, in which repairs performed on motor-operated Valve SI-407B following diagnostic testing were documented. Although successfully tested under differential pressure, the licensee had identified that Valve SI-407B exhibited significantly higher unseating thrust compared to Valve SI-407A, the sister valve. The licensee had concluded that a concern existed for the disc/seat area in the valve and had initiated the work authorization to inspect the valve internals.

The licensee found that the disc had been originally installed upside down and did not mate properly with the seat. After rotating the disc 180 degrees, the valve was reassembled and exhibited a significant reduction in unseating thrust during post-maintenance diagnostic testing.

The inspectors found that the licensee had taken aggressive corrective action in response to the anomalous test results. The management support exhibited by this event was considered a strength, indicating a confidence and maturity in the capability of the diagnostic testing system.

1.7.2 Trending

The inspectors reviewed the licensee's motor-operated valve trending program, described in Procedure UNT-005-0024, Revision 1. The licensee had developed, and was implementing, a computer-based program for trending motor-operated valve data. The inspectors observed a demonstration of the licensee's trending software. The inspectors found that the trending program was being controlled by the motor-operated valve coordinator.

The inspectors found that the licensee's trending program had not matured to the point of providing meaningful information for detecting trends related to motor-operated valve design basis capability. For example, the inspectors found that the licensee trended motor-operated valve stroke time, but no

the licensee's trending applied Technical Specification limits as an upper limit. In this example, the trending provided no meaningful indication of degradation in design basis capability.

The inspectors found that the licensee did not periodically review the trended information on a formal basis. The motor-operated valve coordinator informally reviewed the information in connection with planned maintenance or modification activities.

The inspectors considered the rudimentary state of trending activity to be a weakness in the licensee's Generic Letter 89-10 program. The licensee identified that additional enhancement of their trending activity would be made as additional guidance developed in the industry and additional data was obtained during periodic testing.

The inspectors determined that the current trending program, though marginal, was sufficient to support program closure. Future inspections of the program will monitor the licensee's intended progress.

1.8 Open Items

The inspectors closed all previous inspection items related to motor-operated valves with the exception of pressure locking. The efforts undertaken to date by the licensee to address pressure locking were considered sufficient to support closure of Generic Letter 89-10. Details of these items are presented in Section 2 of this report.

1.9 Quality Assurance

The inspectors reviewed efforts undertaken by quality assurance groups to monitor the status of the motor-operated valve program during the time period following the most recent NRC motor-operated valve inspection. Motor-operated valve activities were surveilled as part of audits conducted in the areas of maintenance and test control. Additionally, six quality assurance "process surveys" were conducted in the areas of VOTES® testing, response to NRC Information Notices, and pressure locking. No significant findings associated with the motor-operated valve program were identified by quality assurance during this time period.

The inspectors determined that quality assurance reviews were sufficient for motor-operated valve program closure. However, the lack of a programmatic self-assessment and rigorous technical reviews indicated that the scope of quality assurance involvement was not broad in the motor-operated valve area.

2 FOLLOWUP - ENGINEERING (92903)

2.1 (Closed) Inspection Followup Item 382/9306-01: Justification of Design Assumptions

During the previous motor-operated valve inspection, the licensee had not fully justified the design assumptions used in motor-operated valve calculations. During this inspection, the inspectors verified that the licensee had satisfactorily validated these assumptions. The details of this review are presented in Section 1.1 of this report.

2.2 (Closed) Inspection Followup Item 382/9306-02: Thrust Margin for Motor-Operated Valves

This concern involved a problem in the licensee's computation of the margin of error for the minimum thrust required to stoke a motor-operated valve open or closed. The licensee had included all errors and margins within a square root sum of the squares calculation. This statistical manipulation was nonconservative because some of the margin effects, such as stem lubrication degradation and rate of loading, were biased effects that should not be applied in an square root sum of the squares computation.

During this inspection, the inspectors verified that the licensee had appropriately accounted for both biased and non-biased effects in the motor-operated valve calculations.

2.3 (Closed) Inspection Followup Item 382/9306-03: Design Engineering Review of Motor-Operated Valve Data Records

During the previous motor-operated valve inspection, the inspectors identified a situation where maintenance engineering had revised the valve factor assumption in a motor-operated valve data record without concurrence from design engineering. The valve factor had been adjusted downward to create a larger thrust margin. The inspectors were concerned that this process could circumvent the integrity of the design information contained in the motor-operated valve data records. The licensee committed to have design engineering review all future changes to motor-operated valve data records and review the existing motor-operated valve data records for any inconsistencies.

The inspectors verified that Procedure MD-001-031, "MOV Setting, Signature Analysis and Trending Evaluation," had been revised to require design engineering to act as an additional reviewer for the development of or changes to motor-operated valve data records. Additionally, the review of (then) existing motor-operated valves was adequately documented.

2.4 (Closed) Inspection Followup Item 382/9306-04: Diagnostic Equipment Inaccuracies/Torque Switch Repeatability

During the previous motor-operated valve inspection, calculations that delineated torque limits did not account for torque measurement error or torque switch repeatability, relying instead on alternate sources of margin that were not verified to adequately account for these effects.

The inspectors reviewed several randomly-selected motor-operated valve data records and verified that torque measurement error (generally, approximately 7.5 percent) and torque switch repeatability were properly incorporated in the calculations establishing torque margins.

2.5 (Closed) Inspection Followup Item 382/9306-05: Incorporation of VOTES® 2.31 Software

The inspectors verified that the licensee had fully incorporated the VOTES® 2.31 software into the motor-operated valve program.

2.6 (Closed) Inspection Followup Item 382/9306-06: Verify Method of Extrapolation

At the time of the previous motor-operated valve inspection, the licensee was using linear extrapolation to estimate thrust requirements for motor-operated valves that were tested at differential pressures less than the maximum expected differential pressure. The inspectors had informed the licensee that this extrapolation methodology would need to be justified by the schedule commitment date for Generic Letter 89-10 program closure.

The inspectors reviewed a paper entitled "Justification for Linear Extrapolation in Determining motor-operated Valve Factors," Revision 0. This document summarized test results of four motor-operated valves that were tested at various differential pressures. The valves were 4-in, 900-lb, (10.16 cm, 6.2 MPa) Anchor/Darling flexible wedge gate valves. Valve factors in both the opening and closing direction were computed for each test. The results are presented below:

VALVE	DIFFERENTIAL PRESSURE MPa/PSID	VALVE FACTOR (OPEN)	VALVE FACTOR (CLOSED)
SI-120A	5.03/730	0.304	0.394
	7.86/1140	0.214	0.303
	10.20/1480	0.160	0.269
SI-120B	7.72/1120	0.278	0.398
	8.89/1290	0.268	0.369
	9.93/1440	0.264	0.357

SI-121A	5.10/740	0.259	0.447
	7.72/1120	0.184	0.357
	10.14/1470	0.128	0.302
SI-121B	7.72/1120	0.117	0.311
	9.79/1420	0.106	0.306

The test results indicated that valve factors at maximum expected differential pressure can be conservatively bounded by using valve factors measured at differential pressures lower than the maximum expected differential pressure. This method was functionally equivalent to linear extrapolation. Although the licensee's testing was restricted to only one valve type, the inspectors considered it to be adequate to justify linear extrapolation at this site because other industry multi-point differential pressure testing has shown similar results.

2.7 (Closed) Inspection Followup Item 382/9306-07: Advanced VOTES® Signature Analysis Course

During the previous motor-operated valve inspection, the inspectors had identified an improper marking of the flow cutoff point (C10) on a VOTES® diagnostic trace. The licensee agreed to review other traces for similar problems and to conduct training in advanced signature analysis.

Two licensee employees completed a VOTES® advanced training class. These same employees reviewed all of the differential pressure traces from Refueling Outage 5. In the interim, the licensee changed its point of valve factor analysis from flow cutoff to the maximum thrust between flow cutoff and seat contact (C11). As a result of this review, other questionable markings were identified and 12 motor-operated valves were selected to be retested during Refueling Outage 6. These tests were completed as scheduled. The inspectors determined that the licensee had satisfactorily addressed the identified concern.

2.8 (Closed) Inspection Followup Item 382/9306-08: Validity of VOTES® Force Sensor Calibration for Tests

The inspectors had questioned the calibration of the VOTES® force sensor for tests conducted on Valves SI-135B and SI-401A. The VOTES® force sensor trace did not match the calibrator trace for a portion of the calibrator stroke.

The licensee installed new sensors and repeated VOTES® tests on the two valves. The inspectors reviewed the new traces and verified that the VOTES® force sensor and calibrator traces were consistent in shape.

2.9 (Closed) Inspection Followup Item 382/9306-09: Corrective Actions for Valve MS-401B

Motor-operated Valve MS-401B was set up such that, with uncertainty margins applied, the total torque in the closing direction was 1.91 MPa (277 ft-lb) and torque at torque switch trip was 1.75 MPa (254 ft-lb). The nominal torque rating of the SMB-00 actuator was 1.72 MPa (250 ft-lb). The overtorque situation was within guidelines published by Limitorque®, but required that no more than 100 cycles take place under these conditions.

The licensee retested MS-401B during Refueling Outage 6. The torque switch setting was lowered such that total torque and torque switch trip torque were both less than the nominal actuator torque rating. The inspectors reviewed the test data package and concluded that the licensee had adequately addressed this issue.

2.10 (Open) Inspection Followup Item 382/93-06-10: Evaluation of Licensee's Computational Methodology

This item involved the licensee's calculational method to determine the capability of motor-operated valves to overcome the thrust requirements imposed by pressure locking and thermal binding. The NRC has not approved analyses of pressure locking and thermal binding that rely solely on analytical methods. This item, which was discussed in greater detail in Section 1.3 of this report, will remain open pending additional review pursuant to a generic letter expected later this year.

ATTACHMENT

1 PERSONS CONTACTED

1.1 Licensee Personnel

- R. Allen, Manager, S&GS
- R. Burski, Director, Nuclear Safety
- A. Cilluffa, Maintenance Engineering Supervisor
- E. Fields, Lead Senior Engineer, Design Engineering-Electrical
- K. Fitzsimmons, Engineer III
- T. Gaudet, Licensing Supervisor
- P. Gropp, Supervisor, Design Engineering Mechanical Specialties
- J. Hoffpauir, Maintenance
- J. Hologa, Manager, Mechanical and Civil Design Engineering
- J. Houghtaling, Manager, Technical Services
- R. LeBlanc, Licensing Supervisor
- A. Lockhart, Quality Assurance Manager
- J. Meibaum, System Engineer
- R. Murillo, Senior Staff Engineer, Licensing
- J. Poff, Electrical Supervisor
- P. Prasankumar, Manager, Electrical and Instrumentation and Control Engineering
- J. Seeber, Craft Supervisor
- P. Stanton, Engineer III, Design Engineering Motor-Operated Valve Program Engineer
- K. Van Le, Maintenance Engineer/Motor-Operated Valve Coordinator

1.2 Other Organizations

- E. Simbles, ERIN Engineering
- W. White, Senior Engineer, Design Engineering (Grand Gulf)

1.2 NRC Personnel

- E. Ford, Senior Resident Inspector
- K. Weaver, Resident Inspector

The personnel listed above attended the exit meeting. In addition to the personnel listed above, the inspectors contacted other personnel during this inspection period.

2 EXIT MEETING

An exit meeting was conducted on August 26, 1994. During this meeting, the inspectors reviewed the scope and findings of the report. The licensee acknowledged the inspection findings documented in this report. The licensee did not identify as proprietary any information provided to, or reviewed by, the inspectors.