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

Report Nos.: 50-390/93-13 and 50-391/93-13

Licensee: Tennessee Valley Authority
3B Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

Docket Nos.: 50-390 and 50-391 License Nos.: CPPR-91 and CPPR-92

Facility Name: Watts Bar 1 and 2

Inspection Conducted: March 8-12, 1993

Lead Inspector: Edward H. Girard 3/31/93
E. Girard, Team Leader Date Signed

Other Inspectors: M. Hunt, Reactor Inspector
P. Taylor, Reactor Inspector
M. Thomas, Reactor Inspector

Others contributing to this inspection:
A. Trusty, Idaho National Engineering Laboratory

Approved by: Caudle A. Julian 4/6/93
Caudle A. Julian, Chief Date Signed
Engineering Branch
Division of Reactor Safety

SUMMARY

Scope:

This special, announced inspection examined the program developed in response to NRC Generic Letter (GL) 89-10, "Safety-Related Motor-Operated Valve Testing And Surveillance." In considering the population of valves included in the program and design calculations for the valves, the examination addressed only those valves considered necessary to Unit 1 operation. The inspection was the first of two or more that will be conducted for each nuclear plant in accordance with NRC Temporary Instruction 2515/109, issued January 14, 1991.

Results:

The inspectors found that the GL 89-10 Motor-Operated Valve (MOV) program for Watts Bar Unit 1 was generally satisfactory at the current stage of implementation, though several concerns were identified. These concerns involve technological unknowns and issues that are under evaluation by the industry, practices that remain to be fully defined, and program areas which may be

subject to significant change as operational lineups are further defined. Foremost among the concerns was the absence of acceptable approved procedures for performance of differential pressure testing. The concerns will be evaluated further in subsequent NRC inspections of the licensee's response to GL 89-10.

In addition to concerns, the inspectors identified several strengths in the licensee's GL 89-10 program. The concerns and strengths are listed below:

Concerns Identified

(1) Emergency and abnormal operating procedures had not been finalized and were not utilized in determining the scope of valves in the program. Because of potential changes that may occur in system operation plans prior to licensing, further NRC review of valves included in the scope of the program is considered necessary. [Section 3.a]

(2) The effects of high ambient accident temperatures on motor torque had not been accounted for in the licensee's calculations. [Section 3.b]

(3) The licensee needs to evaluate recent industry events involving steam line valve pressure locking (LaSalle event) and consider any changes needed to ensure valve operability. [Section 3.b]

(4) The MOV motor power factors used in degraded voltage calculations need to be reverified based on recent information provided by Limitorque following its Update Letter 92-02. [Section 3.b]

(5) The stem friction coefficient and valve factors used in thrust calculations need to be validated based on test results. [Section 3.c]

(6) No GL 89-10 testing had been performed on any of the valves in the program and no acceptable procedures for differential pressure testing of the valves had been issued. [Section 3.d]

(7) The procedures in development for differential pressure testing did not provide for assuring satisfactory pressure was achieved before performing the test. [Section 3.d]

(8) Procedures for periodic verification of MOV capabilities had not been developed. [Section 3.e]

(9) GL 89-10 recommendations had not been incorporated into post maintenance testing procedures. [Section 3.e]

(10) Programmatic requirements stated in licensee procedure PAI-8.03 indicated the intention to rely on static diagnostic testing for periodic verification of MOV capabilities. A basis for the acceptability of this method must be established before it is applied. [Section 3.e]

(11) No provisions had been established for refresher training on actuator maintenance or diagnostics. [Section 3.j]

Strengths Identified

(1) All MOVs had been refurbished in the 1989-92 time frame. [Section 3.e]

(2) All design-basis reviews and initial calculations for valves considered necessary for Unit 1 operation had been completed. [Section 3.g]

(3) The licensee was well-staffed for the GL 89-10 program. [Section 3.h]

(4) The licensee had a designated group assigned to MOV maintenance. [Section 3.j]

(5) The licensee had good corporate involvement in the GL 89-10 program. [Section 3.h]

No violations or deviations were identified.

TABLE OF CONTENTS

REPORT DETAILS

1. Persons Contacted

Licensee Employees

*T. Arney, Senior Quality Project Manager
*M. Bartor, Project Management
*J. Chardos, Manager of Projects
*J. Christensen, Site Quality Manager
*G. Cooper, MOV Project Engineer
*W. Elliott, Engineering Manager, Nuclear Engineering
*D. Herrin, Licensing Engineer
*N. Kazanas, Vice President, Completion Assurance
*R. Lewis, Project Manager, QA Records
*L. Maillet, Site Support Manager
*D. Moody, Plant Manager
*W. Museler, Site Vice President
*P. Pace, Compliance Licensing Supervisor
*G. Pannell, Site Licensing Manager
M. Purcell, Engineering Support Supervisor
*R. Simmons, Corporate Program Manager, Valves
T. Slaton, MOV Coordinator
*R. Taylor, MOV Project Manager
*S. Tanner, Special Projects Manager, Modifications
J. Tyrell, MOV Engineer

NRC Employees

*G. Walton, Senior Resident Inspector

*Attended exit meeting

2. Background

On June 28, 1989, the NRC issued Generic Letter (GL) 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance." This GL requested licensees and construction permit holders to establish a program to ensure that switch settings for safety-related motor-operated valves (MOVs) and certain other MOVs in safety-related systems are selected, set and maintained properly. The NRC subsequently held public workshops to discuss the generic letter and to answer questions regarding its implementation. On June 13, 1990, the NRC issued Supplement 1 to GL 89-10 to provide the results of those public workshops. Supplement 2 to GL 89-10 was issued August 3, 1990, stating that inspections of programs developed in response to GL 89-10 would not begin until January 1, 1991. Supplement 3 to GL 89-10 was issued on October 25, 1990, reporting concerns raised by the results of NRC-sponsored MOV tests and requesting that BWR licensees evaluate the capability of MOVs used for containment isolation in several systems. In Supplement 3, the NRC indicated that all licensees and construction permit holders should consider the applicability of the information obtained from the NRC-sponsored tests to other MOVs within the scope of

GL 89-10 and should consider this information in the development of priorities for implementing the generic letter program. On February 12, 1992, Supplement 4 was issued. It indicated it would be acceptable to omit MOVs with no active safety function from BWR programs. As Watts Bar is a PWR facility, Supplement 4 does not apply.

In GL 89-10, the NRC requested licensees to submit a response to the generic letter by December 28, 1989. TVA submitted a response for its Sequoyah, Browns Ferry, and Watts Bar Nuclear Plants on December 21, 1989. In that response, TVA stated that it planned to meet the recommendations of the generic letter and would comply with the 5-year schedule (completion by June 28, 1994) for the three plants. TVA also stated that if this commitment was altered the NRC would be notified and justification provided. In an enclosure to the letter TVA restated the commitment as being that the "intent" of the generic letter would be satisfied. The NRC provided a reply to that submittal on September 14, 1990. In this reply, TVA was informed that the NRC interpreted the TVA response to be a commitment to meet the schedule and recommendations provided in the generic letter and its Supplement 1.

3. Program Areas Inspected and Findings

Each of the section subheadings below represents a program area inspected. The findings which require followup in subsequent GL 89-10 inspections are termed concerns.

3.a Scope of the Generic Letter Program

The NRC position stated in the generic letter is that the scope of GL 89-10 includes all safety-related MOVs and other MOVs that are position-changeable in safety-related piping systems. Through Supplement 1 to the generic letter, the NRC defined "position-changeable" as any MOV in a safety-related piping system that is not blocked from inadvertent operation from the control room.

The scope of valves included in the licensee's GL 89-10 program was found described in Calculation EPM-TSS-110791, Rev. 3, Generic Letter 89-10 MOV Population at Watts Bar. The inspectors reviewed flow diagrams for a sample consisting of following five systems: Residual Heat Removal, Auxiliary Heat Removal, Reactor Coolant, Safety Injection, and Component Cooling. They found that the safety related MOVs had either been included in the program (Attachment 4 to the calculation); or they were excluded (Attachment 3 to the calculation) on the basis of being disabled from being mispositioned from the control room when the system would be required to perform a safety function.

In reviewing the calculation assumptions, the inspectors noted that the calculation did not consider Emergency Instructions or Abnormal Operating Instructions in determining the scope of valves in the program. The basis given was that these instructions had not been finalized and that design documents that provided the criteria for the procedures had been considered. Discussions with the licensee's System

Engineer for the Component Cooling System indicated potential changes in the system operating boundary where Unit 1 interfaced with Unit 2. Because of the potential for such changes and the finding that Emergency and Abnormal Operating Instructions were not considered in determining the valves in the program, the inspectors identified a concern that the scope of valves included in the program be reexamined when system boundaries and operating procedures are finalized. [Concern (1)]

The inspectors concluded that, based on the sample of systems examined, the scope of valves included in the Watts Bar Unit 1 program appeared consistent with the recommendations of GL 89-10, including guidance for exclusion of MOVs given in Supplement 1 of the generic letter. However, because of the lack of direct consideration of Emergency and Abnormal Operating Instructions in determining scope, and because of the potential for changes in system boundaries prior to plant licensing, the inspectors identified concern that the scope be reexamined when boundaries and operating procedures are finalized.

3.b Design-Basis Reviews

Recommended action a. of GL 89-10 requests the review and documentation of the design-basis for the operation of each MOV within the generic letter program to determine the maximum differential pressure and flow (and other factors) expected for both normal operations and abnormal conditions.

The inspectors reviewed documents which prescribed guidance and requirements for the design-basis reviews, reviewed examples of the calculations used to document the reviews, and discussed the performance of the design-basis reviews with Watts Bar Nuclear (WBN) personnel. The documents reviewed were as follows:

- TVA Program Plan, Implementation of NRC Generic Letter 89-10, Safety Related Motor-Operated Valve Testing and Surveillance, Rev. 3

- Plant Administrative Instruction PAI-8.03, Generic Letter 89-10 Motor-Operated Valve Testing and Surveillance Program, Rev. 2

- Mechanical Design Standard DS-M18-2.2.22, MOV Design-Basis Review Methodology, Rev. 1

- EEB-TI-6, AC Voltage Analysis, Rev. 0

- Calculation for MOV 1-FCV-70-133A

- Calculation for MOV 1-FCV-63-93

- EPM-MA-0301954, Evaluation of Gate Valves Subject to Thermal Binding and Bonnet Pressurization per SOER 84-7, Rev. 0

- EEB-MS-TI06-0010, Auxiliary Power System Analysis on 1E Buses Via CSST C and CSST D with Auto Load Tap Changers, Rev. 5

The purpose of the review and discussions conducted by the inspectors was to determine if the methodology and criteria were consistent with the recommendations of GL 89-10 and Supplement 1.

The inspectors verified that DS-M18-2.2.22 provided satisfactory guidelines for determining the maximum expected differential pressure for each MOV during opening and closing for normal and abnormal events, including valve mispositioning. Other design-basis factors, such as flow, temperature, and seismic conditions, as discussed in the NRC response to Question 16 of Supplement 1 to GL 89-10 were also satisfactorily addressed. The licensee's schedule indicated all of the design-basis reviews had been completed.

The inspectors found that the method used for calculating the capability of the MOV actuator under degraded voltage conditions, was provided by EEB-TI-6. Results of the degraded voltage calculations were documented in the Attachments of EEB-MS-TI06-0010. Thermal overload heater resistances were included in the degraded voltage calculations. In addition, the motor power factor (PF) and the voltage drop across the cables at locked rotor conditions were also included. WBN used Limitorque Update 92-02, which provided a power factor range between 0.6 to 0.9. The PFs used for the MOVs were in the low part of the range. The inspectors questioned whether the PF values used in the degraded voltage calculations were appropriate. Licensee personnel were unaware of additional information recently provided by Limitorque, which indicates that the PF depends on the frame size and the number of motors at locked rotor conditions. A higher PF could result in a lower minimum voltage at the motor. The inspectors were informed that WBN was in the process of reviewing the PF values recommended by Limitorque for all of their MOVs and would make any changes necessary. The inspectors identified the application of appropriate power factors as a concern which will be reexamined in a subsequent NRC inspection of GL 89-10 implementation at WBN.
[Concern (4)]

In reviewing calculations the inspectors found that WBN assumed an ambient temperature of 90 degrees C for most cable runs. However, WBN performed an evaluation for cable and motor resistance for those motors identified in an environment where the ambient temperatures were above 90 degrees C. For example, such an evaluation was performed for MOV 1-FCV-63-93 which was identified to be in an environment where the ambient temperature was above 90 degrees C. The cable and the corrected motor resistance was determined and used as input to determine the minimum voltage at this MOV. However, margin was not included in its sizing calculation to account for high ambient accident temperature effects on AC motor performance. WBN needs to consider the results of Limitorque testing for AC motors at high ambient temperature, when these results become available. WBN personnel stated that the results would be

evaluated and incorporated into their calculations. The inspectors identified this as a concern to be verified in a subsequent NRC inspection of GL 89-10 implementation at WBN. [Concern (2)]

The inspectors verified the WBN evaluation for pressure locking and thermal binding of MOVs, which was documented in EPM-MA-0301954. Nine MOVs were identified to be modified. Two additional MOVs were determined to be subject to pressure locking but could overcome this condition and did not require modification. Because of a recent event that occurred at the LaSalle nuclear facility, the inspectors asked licensee personnel whether pressure locking for MOVs in the steam line had been reconsidered. WBN personnel were not aware of the event but indicated that they would determine whether the event is applicable to the MOVs in the steam lines and if it would effect MOV operability. The licensee response to the potential for pressure locking was identified as a concern to be reexamined in a subsequent NRC inspection of GL 89-10 implementation at WBN. [Concern (3)]

The inspectors concluded that the licensee was properly addressing the most important aspects of the GL 89-10 design-basis review recommendations. The inspectors identified three concerns, stemming from information which the licensee has not had the opportunity to evaluate. These concerns are described in greater detail above and involve: verification that correct motor power factors have been used in calculations, accounting for AC motor torque reduction for motors that experience elevated ambient accident conditions, and further consideration of the potential for pressure locking in steam line MOVs.

3.c MOV Switch Settings

In recommended action b. of Generic Letter 89-10, the NRC requested licensees to review, and to revise as necessary, the methods for selecting and setting all MOV switches.

The inspectors verified that the licensee's program had provided a review and revision, as necessary, of the methods of selecting and setting MOV switches. The inspectors accomplished this by reviewing the design standard developed for determining the torque switch settings, a tabulation of the minimum and maximum thrust requirements, two examples of the thrust calculations, and the specification requirements for setting torque and limit switches. These documents are identified as follows:

- Mechanical Design Standard DS-M18.2.21, Motor-Operated Valve Thrust and Torque Calculations, Rev. 1

- Mechanical Table of Motor-Operated Valve Requirements, 1-47W576-8

- Thrust Calculations EPM-DTN101792 and EPM-DTN101092 for the Charging Header Isolation Valves 1-FCV-62-90 and 1-FCV-62-91

- General Engineering Specification G-50, Torque and Limit Switch Settings for Motor-Operated Valves, Rev. 4

The inspectors found that Mechanical Design Standard DS-M18.2.21 used a modified version of the thrust equation taken from EPRI Guide NP-6660-D. The equation used a valve friction factor of 0.40. Additionally, it employed a multiplier of 1.2 to provide a 20 percent safety factor to account for uncertainties regarding seat friction, degraded seat conditions, MOV load sensitive behavior known as rate of loading, and other effects which have not been quantified. No testing had been conducted at WBN which could be used to demonstrate the friction and safety factors were valid for its valves.

A standard industry equation was specified for determining required actuator torque. The required torque is determined as the product of the required thrust and a stem factor. The stem factor was selected based on an assumed stem friction coefficient. For the stem friction coefficient, the inspectors found that DS-M1S.2.21 used 0.15. As for the valve friction and safety factors referred to in the previous paragraph, the licensee had no test data to verify the validity of this stem friction coefficient for WBN MOVs. Accurate stem friction coefficients and valve factors are needed for calculations and extrapolations of thrust determinations for MOVs that cannot be tested at full design-basis differential pressure (DP). The inspectors identified the validity of the assumed valve friction and safety factors and of the assumed stem friction coefficient as concerns to be reexamined in Region II inspection of GL 89-10 program implementation at WBN. [Concern (5)]

The inspectors reviewed and assessed the licensee's calculations of minimum and maximum thrust requirements for Charging Header Isolation Valves 1-FCV-62-90 and 1-FCV-62-91. They observed that the margins between the minimum and maximum thrust bands were small (less than two thousand pounds). The actuators were identified to be the limiting component in setting both the maximum and minimum. The inspectors noted that when instrument accuracy was included, margins would be even smaller and setting the torque switch to achieve the required thrust would be difficult. Licensee personnel indicated this potential problem had been recognized and provided the inspectors a copy of Design Change Notice F-220008-A, which had been initiated to replace the current actuator spring pack with a lighter spring pack. This would permit the actuator to be set to achieve a lower minimum thrust. The upper thrust margins are to be raised on the basis of increased SMB-00 actuator allowable thrust limits stated by the actuator manufacturer, Limitorque, in its Technical Update 92-01.

The inspectors found that the setting of torque and limit switches was prescribed in Specification G-50. In accordance with this specification, MOV operation for rising stem valves in the open direction is controlled by the open limit switch. The open limit switch is set to change position for its contacts at 80 to 90 percent for high

speed valves and 95 to 98 percent for non-high speed valves. The torque switches are bypassed as a minimum for the first 20 percent of the open stroke. The closing limit switch is set to change position for its contacts at 85 to 90 percent for high speed valves and 95 to 99 percent for non-high speed valves. For the closing direction, the torque switch is bypassed 95 percent to 98 percent of the closing stroke and then put back into the control circuit for completion of the stroke to ensure adequate seating of the valve.

Based on the calculation examples and other documents examined, the inspectors concluded that the WBN program provided adequate determination and control of settings for the current stage of program implementation. However, the inspectors identified concerns that future test results be analyzed to validate the assumed valve friction and safety factors and the assumed stem friction coefficient used in the licensee's calculations.

3.d Design-Basis Differential Pressure and Flow Testing

Recommended action c. of the generic letter requests licensees to test MOVs within the generic letter program in situ under their design-basis DP and flow conditions. If testing under these conditions is not practicable, it permits alternate methods to be used to demonstrate the capability of the MOV. A two-stage approach is suggested for situations where design-basis testing in situ is not practicable and, at the time, an alternate method of demonstrating MOV capability cannot be justified. With the two-stage approach, a licensee would evaluate the capability of the MOV using the best data available and then would work to obtain applicable test data within the schedule of the generic letter.

Plant Administrative Instruction (PAI) 8.03, Generic Letter 89-10 Valve Testing and Surveillance Program, assigns responsibilities for the establishment of the program for testing, surveillance, and maintenance of MOVs to assure that operability can be maintained and validated. Section H of this instruction assigns the development of the MOV population within the GL 89-10 program and the quantity of MOVs to be tested to the Nuclear Engineering Section. Calculation EMP-TSS-110971, Rev. 2, identified 151 MOVs for inclusion in the GL 89-10 program scope for Unit 1.

TVA personnel indicated that they would differential pressure test 148 of the 151 MOVs identified in the calculation. No testing had been performed on any of 151 valves at the time of the inspection. Only one differential pressure testing procedure had been issued and discussions with licensee engineers revealed that this test procedure would require revision. The inspectors identified as a concern the fact that no testing of the program valves had been accomplished and that no acceptable testing procedures for differential pressure testing had been issued. [Concern (6)]

The inspectors observed that the DP test procedures currently in draft did not identify a DP value that the testers should expect at the time the dynamic test was being performed. Since the principal intent of the testing is to demonstrate MOV operability at design-basis DPs, it is important to verify that acceptable pressures are achieved prior to testing. The failure to include test pressure required values in the procedures was identified by the inspectors as a concern that will be reexamined in subsequent inspection of GL 89-10 implementation. [Concern (7)]

TVA Nuclear Engineering has issued a 47W576 series of drawings which the inspectors verified to contain all the actuator, motor, and valve information required to establish thrust/torque setting values for the GL 89-10 MOVs. The drawings also specify the minimum and maximum required thrust/torque settings. PAI-8.03 establishes these drawings as the setpoint control documents. The DP testing setup requirements will be controlled by the applicable Technical Instruction (TI) in the 85 Series of procedures, which are then performed in conjunction with

Maintenance Instruction (MI) 0.6, which is the instruction for diagnostic testing of the valve identified in the TI 85 series procedure.

TVA presented a guidance document, MOV Differential Pressure Test Evaluation Reconciliation with Design-Basis Methodology, which is to be issued to provide criteria for reconciliation of DP test results with calculated thrust/torque requirements. At the present time the draft document covers only gate valves.

The inspectors concluded that the licensee's program for design-basis testing would require further assessment when procedures, completed testing and data analysis, and application of test results, had progressed further. While most basic program elements were in place, the lack of issued procedures and performed tests hindered evaluation.

3.e Periodic Verification of MOV Capability

Recommended action d. of the generic letter requests the preparation or revision of procedures to ensure that adequate MOV switch settings are determined and maintained throughout the life of the plant. Section j of the generic letter recommends surveillance to confirm the adequacy of the settings. The interval of the surveillance is to be based on the safety importance of the MOV as well as its maintenance and performance history but is not to exceed 5 years or 3 refueling outages unless a longer interval is justified. Further, the capability of the MOV is to be verified if the MOV is replaced, modified, or overhauled to an extent that the existing test results are not representative of the MOV.

The inspectors found that the principal licensee MOV program documents (TVA Program Plan and PAI-8.03) contain information on periodic verification of MOV capability including preventive maintenance.

Preventive Maintenance Instruction 1380V provides for lubricating the gear casing, upper thrust bearing and valve stem every 18 months. Completed maintenance schedules reviewed by the inspectors showed that the GL 89-10 MOVs had been refurbished during 1989-1992. The inspectors consider the refurbishment of the MOVs prior to baseline and DP testing to be a strength in the MOV program. [Strength (1)] Site procedure PAI-8.03 requires MOV periodic tests to be preformed at "as found " conditions in order to properly evaluate the valve condition and determine if degradation is occurring in stem/stem nut lubrication or if there are other MOV problems.

According to PAI-8.03, periodic testing of MOVs will consist of a static test using diagnostic equipment. The inspectors noted that static tests of MOVs have not been proven to demonstrate design-basis DP capability. The licensee will need to justify that the static periodic test methodology will demonstrate MOV capability at design-basis conditions. [Concern (10)]

The inspectors found that MI-0.3, 0.15, and 0.6, and General Engineering Specification G-50, provide the guidelines for setting limit, torque, and torque bypass switches for Westinghouse MOVs and for Limitorque actuators on MOVs from other suppliers. Thermal overload devices (TOLs) are required to be inspected annually for degradation and correct size in accordance with MI-57.20, Periodic Inspection of 480V and 6900V Switchgear Bus and 480V Motor Control Center Bus. The operabilities of the TOL relay bypass devices is demonstrated in accordance with Surveillance Instruction 8.28, MOV TOL Relay Bypass Functional Test, on a 92 day frequency and following maintenance.

PAI-8.03 required development of periodic testing and trending instructions to ensure continued operability of MOVs on a schedule consistent with that recommended by GL 89-10. It also specified the establishment of alert and action levels of parameters measured to assess MOV capabilities. Action levels would be values above which operability could not be assured without corrective action or verification through design-basis testing. Alert levels would be indicators of degraded MOV capabilities, to be addressed by increasing the test frequency or correcting the condition that caused the alert level to be exceeded. The inspectors found that the periodic test procedures had not been prepared and that the methodology and acceptance criteria for the periodic testing was not documented. This was identified as a concern to be re-examined during inspection of GL 89-10 program implementation. [Concern (8)]

The inspectors found that the post maintenance test (PMT) program was described in PAI-10.05, Post Maintenance Test Program, Rev. 2, and in PAI-8.03. Both refer to TVA Maintenance Good Practice (MGP) M-150, as the source to be used for PMT requirements. MGP-M-150 provides suggested guidelines for developing and maintaining a motor-operated valve program, and includes guidelines for PMT. Various testing stated in the guidelines remains to be fully defined and the inspectors could not determine if the licensee's program adequately incorporated GL 89-10

recommendations. For example, re-verification of running load is the test indicated following packing adjustment and it is not clear what will actually be measured or how. The licensee had not issued implementing procedures which would provide details of the post maintenance testing requirements that could be more readily assessed by the inspectors. This was identified as a concern for further examination during inspection of GL 89-10 implementation. [Concern (9)]

The licensee's program documents and procedures generally provided for the periodic verification of MOV capabilities recommended by the GL. However, many details remain to be better defined and justified. Concerns were identified by the inspectors regarding justification for use of static diagnostic tests for periodic reverification and the lack of issued details on test methodology for periodic and post maintenance testing.

3.f MOV Failures, Corrective Actions, and Trending

Recommended action h. of the generic letter requests that licensees analyze and justify each MOV failure and corrective action. The documentation should include the results and history of each as-found deteriorated condition, malfunction, test, inspection, analysis, repair, or alteration. All documentation should be retained and reported in accordance with plant requirements. It also suggested that the material be periodically examined (every 2 years or after each refueling outage after program implementation) as part of the monitoring and feedback effort to establish trends of MOV operability. These trends could provide the basis for a licensee revision of the testing frequency established to verify periodically adequate MOV capability. The generic letter indicates that a well-structured and component-oriented system is necessary to track, capture, and share equipment history data.

The inspectors reviewed the licensee's activities related to MOV failures, corrective actions, and trending. MOV failures are processed through the licensee's normal corrective action program which is comprised of a number of elements that identify and correct adverse conditions. These elements include significant corrective action reports in accordance with Site Standard Practice (SSP)-3.04, Rev. 7, Corrective Action Program; and the Administrative Control Programs (ACPs) which include a number of procedures that address the other elements of the corrective action program. These procedures include the following:

- SSP-3.06, Rev. 9, Problem Evaluation Reports, is the process for documenting and evaluating identified problems that are not known to meet the criteria of other ACPs.

- SSP-6.02, Rev. 9, Maintenance Management System, is the work request/work order (WR/WO) system and is the method used to identify and correct routine hardware deficiencies on equipment, structures, or spare components.

- SSP-12.09, Rev. 7, Incident Investigation and Root Cause Analysis, documents reports of incidents to determine cause and to effect corrective action.

All WOs initiated to correct MOV problems which involve using one of the maintenance instructions written to perform work on MOVs are reviewed by the MOV Coordinator to verify that the cause of the failure has been determined in the WO.

The inspectors review found that PAI-8.03, describes the process for reviewing GL 89-10 MOV corrective maintenance history and periodic test performance to identify and evaluate potential failure trends and to track the disposition of potential trends until evaluations are complete. A biannual GL 89-10 MOV failure trend report that includes all the MOVs in the program is to be provided for evaluation. The inspectors discussed MOV trending with licensee personnel who stated that procedures for trending and tracking GL 89-10 MOV failures are being developed to incorporate the requirements of PAI-8.03, and will not be completed until January 1994. Trending and tracking of GL 89-10 MOV failures will not be established until the plant is licensed. The inspectors noted that GL 89-10 MOV DP testing is scheduled to begin prior to implementation of the trending program. Licensee personnel were questioned as to how MOV failures (if any occurred) would be tracked and trended during DP testing. Licensee personnel indicated that MOV failures will be evaluated in accordance with the ACPs and trended in accordance with SSP-6.04, Equipment History and Failure Trending, until the GL 89-10 MOV trending program is established. The inspectors considered that the licensee procedure PAI-8.03 described the basis for an adequate MOV trending program.

3.g Schedule

GL 89-10 requested that nuclear power plant construction permit holders complete all design reviews, analyses, verifications, tests and inspections that were initiated to satisfy its recommendations by June 28, 1994 or before the operating license is issued, whichever is later.

The inspectors held discussions with licensee personnel and reviewed scheduled GL 89-10 MOV Program activities to assess the progress of the program. The schedule showed that the design-basis reviews and the torque/thrust calculations for the 151 MOVs currently identified in the GL 89-10 MOV program were complete. This was considered a strength. [Strength (2)]

The inspectors found that baseline tests and subsequent DP tests to establish the adequacy of the initial MOV torque/thrust switch settings had not started, but the Watts Bar Unit 1 Integrated Level 1 schedule has these activities scheduled to start in June 1993. All MOV testing in the program is scheduled to be completed by December 1993, prior to planned request for an operating licensee for Unit 1 in January 1994. The inspectors concluded that current scheduled commitments are acceptable.

3.h Overall Administration of MOV Activities

The inspectors found that the corporate TVA Program Plan, Implementation of NRC GL 89-10, Rev. 3, provided a plan for implementing the recommendations of GL 89-10 for all of TVAs nuclear plants. Plant Administrative Instruction 8.03, was found to implement the TVA Program Plan and establish the onsite administrative controls for developing and implementing GL 89-10 recommendations.

The inspectors reviewed the licensee Corporate Charter, GL 89-10 Steering Committee meeting minutes, Task Force meeting minutes and reports on resolving industry MOV issues and concluded that significant management oversight and communications between corporate and plant personnel is in effect. This was considered a strength. [Strength (5)] The inspectors found that engineers and project personnel assigned to the MOV program were knowledgeable regarding the current MOV issues and the diagnostic system used to determine torque and thrust capabilities of MOVs under static and dynamic conditions.

PAI-8.03 described the duties and responsibilities for Watts Bar plant personnel and the overall MOV Project Organization. The inspectors noted that the allocation of resources to support the MOV program was established on a continuing basis. The MOV coordinator is assigned to the Technical Support Group where two engineers and an engineering aide provide full time support. The MOV engineer is located on site within the Nuclear Engineering organization and provides day to day support for the MOV program. [Strength (3)]

The inspectors concluded that the licensee's program provided for satisfactory administration of the MOV activities to respond to GL 89-10.

3.i MOV Setpoint Control

Watts Bar has a dedicated MOV maintenance group which consists of mechanics and electricians. This group performs the testing, preventive maintenance, and adjustment of the limit and torque switches for the plant MOVs. The group occupies a separate work location. Any work request submitted for a MOV is processed through the work planning group which routes the work order to the dedicated group. The members of this group have been trained to perform the testing and maintenance of MOVs and the foreman is responsible for insuring that only qualified personnel work on the MOVs.

The inspector reviewed the series of Maintenance Instructions MI-0.16.01, .02, .03, .04, and .09, which cover the disassembly and repair of the various valve actuators that are installed at this site. These MIs were found to direct the setting of the limit switches for each type of actuator when installed on a specified type of valve. Maintenance Instructions MI-0.6 and MI-03 define the diagnostic switch settings for the torque switch and settings of the limit switches, respectively.

3.j Training

The inspectors reviewed the licensee's MOV training program, courses, facilities, and held discussions with training and maintenance personnel. The training requirements for craft personnel involved with MOV activities are described in the Maintenance Training Specialized Program (MTS), MTS316. In addition to receiving the MTS316 Program training, the craft receive on-the-job-training in accordance with the Electrical Maintenance Qualification Standards, and the Mechanical Maintenance Qualification Standards, as applicable. The craft also received MOV diagnostic training provided by MOVATS, the diagnostic equipment supplier. The licensee's organization chart indicated that a designated group of craft personnel had been assigned to work on GL 89-10 MOVs. This was considered a strength. [Strength (4)] The inspectors reviewed training records and verified that the craft personnel assigned to work on MOVs had received the required training.

The MOV Engineer and MOV Coordinator are assigned to the Technical Support Department. Qualification and training requirements for Technical Support personnel are described in SSP-12.52, Technical Support Program. Additional training requirements for the MOV Engineer are described in PAI-8.03, which includes satisfactorily completing a diagnostic test equipment signature analysis course. The inspectors verified that the MOV Engineer and MOV Coordinator received MOV diagnostic training for the equipment currently being used by the licensee. The inspectors also verified through licensee records that the MOVATS personnel who taught the MOV diagnostics courses to licensee craft and engineers were qualified.

During further review of the licensee's MOV training, the inspectors noted that no provisions had been established for refresher training on actuator maintenance or MOV diagnostics. During discussions with licensee personnel the inspectors noted that once the units are operating, craft personnel and engineers will have longer periods of time between actuator maintenance and MOV diagnostics. The licensee's failure to establish provisions for refresher training on actuator maintenance or diagnostics was identified as a concern to be further evaluated during inspection of GL 89-10 implementation. [Concern (11)]

The inspectors considered the licensee's program to provide satisfactory initial training, but found it was deficient in not providing for refresher training to ensure skills will be maintained at a satisfactory level.

3.k Industry Experience and Vendor Information

The inspectors reviewed the licensee's program for evaluating and applying industry experience and vendor information, which is controlled by procedure SSP-4.04, Managing the Nuclear Experience Review Program. This procedure requires that in-house and industry experience reports be screened for applicability and significance and distributed to the identified TVA organizations for information or evaluation. The Nuclear

Experience Review (NER) Program evaluates experience reports generated within TVA and received from nuclear industry groups which include the NRC; INPO; nuclear vendors and equipment suppliers; and architect engineers and constructors.

The inspectors reviewed selected MOV related NRC Information Notices (INs) and vendor information received by the licensee and verified that the information was screened, distributed to appropriate organizations, evaluated, and corrective actions taken where applicable. Examples of the INs and vendor information addressed by the inspectors were: INs 92-59 and 92-83 and Limitorque Maintenance Update Letter 92-2. The inspectors concluded that the licensee's NER program had adequate controls to ensure that MOV related industry experience and vendor information was properly screened for applicability and significance.

3.l Use of Diagnostics

The licensee will use MOVATS diagnostic equipment to test and document MOV test data during both static and dynamic testing. MI-0.6, MOVATS Testing of Motor-Operated Valves, provides the procedures for the collection of MOV data using the MOVATS equipment. The licensee is installing permanently mounted "Quick Stem Sensors" stem strain gauges for use with the MOVATS.

The vendor equipment information for accuracy of test equipment and the Limitorque information on torque switch repeatability are incorporated and documented at the time the MOV is set up for testing. MI-0.6 appeared to be complete except for minor discrepancies that were being corrected during this inspection. No valves in the GL 89-10 program had been tested at the time of the inspection.

3.m Walkdown

During this inspection a walkdown was performed by the inspectors to review the condition of the following MOVs in the program:

- Feedwater Valves 1-FCV-3-116A-A, 1-FCV-3-116B-A, 1-FCV-3-126B-B, 1-FCV-3-136A-A, 1-FCV-3-136A-B, 1-FCV-3-179A-B and 1-FCV-3-179B-B

- High Pressure Fire Protection Valves 1-FCV-26-241B and 1-FCV-26-242A

- Safety Injection Valves 1-FCV-63-39A and 1-FCV-63-40B

- Essential Raw Cooling Water Valves 1-FCV-67-83B, 1-FCV-67-88B, and 1-FCV-67-107A

- Component Cooling Water Valves 1-FCV-70-153B and 1-FCV-70-156A

- Containment Spray Valve 1-FCV-72-40A

The inspectors examined the installation of the MOVs for proper orientation, valve stem lubrication, grease relief valves, and general appearance. In various areas of the plant, construction activities near the valves made them subject to possible damage. In some instances the MOV had been removed for modification such as "Smart Stem" diagnostic sensor installation or to permit removal of other equipment. It was noted that the licensee was in the process of installing stem strain gauges to provide input to the diagnostic test equipment when testing is started. Only certain valves could have these strain gauges installed due to the movement of the stem during operation of the valve.

Of the MOVs examined during the walkdown, four were found to have the actuator mounted in such a position that the motor was situated below the actuator. These are denoted above by underlining. The inspectors observed that there were industry and NRC notices issued that warned that the lubricant in the actuator could seep into the motor causing premature failure. An evaluation had been completed which identified those valves which were installed with the motors below the actuator. The evaluation was not reviewed, but those that are not rotated, are to be periodically inspected for grease intrusion in accordance with Maintenance Good Practice MGP-M-150. The inspectors found that this MGP also required inspection of MOV spring packs for grease intrusion. Additionally, there are Maintenance Instructions which require the inspection of motors and spring packs. The licensee's implementation of such inspections will be evaluated in NRC inspection of GL 89-10 implementation.

All MOVs examined were found to be in good condition and most were clean and painted. There were no construction debris found on any of the valves inspected.

4. Conclusions

The licensee's program was generally satisfactory at the current stage of implementation. The program was still developing and will require further NRC evaluation, which will be accomplished as part of the NRC inspection of GL 89-10 implementation. Concerns were identified which are to be reexamined during the planned subsequent inspection.

In addition to concerns, several strengths were noted in the program. The concerns and strengths are listed in the Summary at the beginning of the report and are discussed in the text.

5. Exit Interview

The inspection scope and findings were summarized on March 12, 1993, with those persons indicated in Appendix 1. The licensee was apprised of the concerns identified during the inspection and listed in the "SUMMARY" at the beginning of this report. No dissenting comments were received. Proprietary information is not contained in this report.

APPENDIX

ACRONYMS AND INITIALISMS

ACP	-	Administrative Control Program
BWR	-	Boiling Water Reactor
DP	-	Differential Pressure
EPRI	-	Electric Power Research Institute
GL	-	Generic Letter
INPO	-	Institute for Nuclear Power Operations
MGP	-	Maintenance Good Practice
MI	-	Maintenance Instruction
MOV	-	Motor-Operated Valve
MOVATS	-	Motor-Operated Valve Analysis and Test System
MTS	-	Maintenance Training Specialized Program
NER	-	Nuclear Experience Review
NRC	-	Nuclear Regulatory Commission
PAI	-	Plant Administrative Instruction
PF	-	Power Factor
PMT	-	Post Maintenance Test
PWR	-	Pressurized Water Reactor
SSP	-	Site Standard Practice
TI	-	Technical Instruction
TOL	-	Thermal Overload Device
TVA	-	Tennessee Valley Authority
WBN	-	Watts Bar Nuclear
WO	-	Work Order
WR	-	Work Request