U. S. NUCLEAR REGULATORY COMMISSION

REGION III

Report No. 50-483/91020(DRS)

Docket No. 50-483 License No. NPF-30

Licensee: Union Electric Company
Post Office Box 149 - Mail Code 400
St. Louis, MO 63166

Facility Name: Callaway Nuclear Plant

Inspection At: Steedman, MO 65077

Inspectors: for J. F. Smith 2/7/92
J. F. Smith Date

for G. D. Replogle 2/7/92
G. D. Replogle Date

for M. N. Leach 2/7/92
M. N. Leach Date

William D. Pegg Feb 7, 1991
W. D. Pegg Date

Approved By: for J. M. Jacobson, Chief 2/7/92
J. M. Jacobson, Chief Date
Materials and Processes Section

Inspection Summary
Inspection conducted during January 6-17, 1992 (Report No. 50-483/91020(DRS)
Areas Inspected: Announced special team inspection to assess the licensee's response to Generic Letter (GL) 89-10, "Safety-Related Motor-Operated Valve (MOV) Testing and Surveillance", (2515/109).
Results: No violations of NRC requirements were identified during the course of this inspection. There was one open item (Paragraph 2.b.(2)(b)) concerning the need to confirm the use of the proper MOV motor power factor in the calculation of degraded voltage performance.

The licensee demonstrated strengths in the following areas:

- The licensee performed partial diagnostic testing on MOVs every 18 months for the purpose of trending.

- The licensee performed full-flow differential pressure testing on MOVs in both the opening and closing directions.

The licensee demonstrated a weakness in the following area:

- The licensee used a questionable 0.2 power factor for MOV motors in their degraded voltage analysis. If actual power factors are higher, calculated motor voltages will be nonconservative.

TABLE OF CONTENTS

DETAILS

1. Persons Contacted

Union Electric Company (UE)

*#D. F. Schnell, Senior Vice President, Nuclear Engineering
*G. Randolph, Vice President, Nuclear Operations
*#R. D. Affolter, Superintendent, Systems Engineering
*#R. H. Batey, General Supervisor
*#M. Evans, Superintendent, Training
*#J. C. Gearhart, Superintendent, Quality Assurance
*#M. D. Haag, Senior Engineer, Design
*#R. A. Hamblen, Supervisor, Engineering, Electrical
*#D. E. Heinlein, Supervisor, Engineering, Mechanical
*#J. F. Hogg, Superintendent, Maintenance
#L. H. Kanuckel, Supervisor, Engineering
*J. V. Laux, Manager
*U. A. Lees, Jr., Design Engineer
#R. L. Luechtefeld, Engineer
*D. J. Maxwell, Supervising Engineer
#E. Mayhorn, Engineer
*#J. A. McGraw, Superintendent, Design Control
*C. Naslund, Manager, Nuclear Engineering
*W. A. Norton, Maintenance MOV Engineer
*A. C. Passwater, Manager, Licensing and Fuels
*#S. Petzel, Engineer
#J. R. Peavey, Manager, Operations Support
*#S. H. Reed, MOV Engineer
*#J. D. Schnack, Quality Assurance Engineer
*#M. E. Taylor, Assistant Manager, Work Control
*R. C. Wink, MOV Engineer
*W. A. Witt, Operating Supervisor

U. S. Nuclear Regulatory Commission (NRC)

*#E. Bartlett, Senior Resident Inspector
*K. Marcus, Reactor Inspector (Intern)
#D. R. Calhoun, Resident Inspector

*Denotes those attending the entrance meeting on January 6, 1992.

#Denotes those attending the exit meeting on January 17, 1992.

2. Inspection of the Program Developed in Response to Generic Letter 89-10 (2515/109)

a. Background

On June 28, 1989, the NRC issued Generic Letter (GL) 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance", which requested addressees 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 team followed Temporary Instruction (TI) 2515/109 (January 14, 1991), "Inspection Requirements for Generic Letter 89-10, Safety-Related Motor-Operated Valve Testing and Surveillance," in performing this inspection. The inspection focused on Part 1 of the TI which involves a review of the program being established by the licensee in response to GL 89-10. The licensee had not progressed sufficiently to perform Part 2 of the TI which involves a review of program implementation.

b. Generic Letter 89-10 Program Review

The licensee submitted their response to the GL to the NRC by letter dated December 28, 1989, and committed to meet the intent of GL 89-10.

The program appeared to have all the essential elements of a successful GL 89-10 program and was consistent with the recommendations outlined in the GL. The testing program is on schedule and should be completed by December 1993.

(1) Program Scope

The NRC staff position 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 GL, the staff defined "position-changeable" as any MOV in a safety-related piping system that is not blocked from inadvertent operation from the control room.

There were 153 MOVs in the GL 89-10 program at Callaway Station at the time of the inspection. The NRC team reviewed system drawings of the Auxiliary Feedwater, Component Cooling Water, Essential Service Water, and the Residual Heat

Removal systems as a sample check for the completeness of the scope of the program. The licensee indicated that they were considering some non-safety related valves for inclusion into their program.

The NRC team discussed mispositioning of MOVs with licensee personnel. The licensee indicated that mispositioning was encompassed in its GL 89-10 program. However, valve mispositioning was counted as the "single-failure" in some scenarios. The team cautioned the licensee that consideration of valve mispositioning as the single-failure was currently unacceptable. However, an appeal of this issue by the BWR Owners' Group is currently under review by the NRC staff. The team advised the licensee that they would be expected to comply with the results of the appeal when the results are released.

Based on the review and the discussions, the NRC team determined that the scope of the licensee's program was consistent with the guidance of GL 89-10, with the exception of valve mispositioning.

(2) Design Basis Reviews

The NRC team discussed design basis reviews with licensee personnel and reviewed applicable documentation. The results of the different areas reviewed by the NRC team are discussed below.

(a) Differential Pressure Requirements

The NRC team reviewed differential pressure (dp) calculations and guidance documents for MOVs in the Callaway GL 89-10 program. The team noted that program document EDP-ZZ-01114, "Motor Operated Valve Predictive Performance Manual," allowed the licensee to use standard component and piping pressure drops, if necessary, to reduce calculated dps. The team cautioned the licensee that standard pressure drops published in various vendor documents are normally based on the maximum flow expected through the components and would need to be reduced to reflect the actual pressure drops at reduced flow. The team also cautioned the licensee that under most instances flow would not exist in piping and components upstream of closed MOVs. In

such cases, losses due to flow would not exist.

The Callaway program document stated "Where operator action is identified for sequencing of equipment, i.e., opening and closing valves prior to starting pumps, conservative margin in the DP determination may be removed." The NRC team cautioned the licensee that removal of margin in such instances may not be acceptable if the effects of valve mispositioning are neglected.

Design basis dp values at Callaway were based on emergency operating procedures (EOPs), design basis accidents, normal operating procedures and abnormal operating procedures The licensee indicated that it may be acceptable to base design basis dps only on EOPs and design basis accidents if an MOV can not perform its function under other conditions (e.g., commercial considerations). The NRC team advised the licensee that it would be expected to ensure that MOVs are capable of performing all of their safety-related functions, but would not be required to exceed the conditions on which the original design basis for the MOVs were based.

The licensee indicated that all pump discharge pressures are based on ASME Section XI testing values. The team noted that these values may not always be the most conservative. The licensee agreed to review all pump discharge values used to ensure that they are the most conservative experienced during analyzed conditions.

The NRC team noted that the licensee planned to exclude 27 MOVs from dp testing but had not provided formal justification for their exclusion. An additional 24 MOVs were under evaluation to determine whether or not testing was practicable. The licensee indicated that removal of any MOV from the testing program would be in accordance with the guidelines established in GL 89-10 and that justification for such action would be formally documented.

(b) Reduced Voltage Capability

The team reviewed the effect of degraded voltage on the performance of MOVs. The licensee indicated that the lowest voltage which could be observed at the Motor Control Center (MCC) before the emergency diesel generators started would be 92% of the rated voltage. The motors were stated to be capable of producing their rated torque at a minimum of 90% of their rated voltage, leaving 2% for voltage drop in cabling from the MCC to the MOVs. The team noted that a 0.2 motor power factor was used in the calculations. The power factors expected by the team would normally be between 0.6 and 0.85 depending on the motor. If actual power factors at Callaway are higher than 0.2, calculated motor voltages will be higher than the actual voltage.

The source of the 0.2 power factor was the "IEEE Recommended Practice for Power Systems Analysis", ANSI/IEEE Std 399-1980. The 0.2 power factor stated in the standard was for motors under 1000 hp at locked rotor conditions. The team felt that this was not necessarily applicable to MOV motors.

The licensee immediately initiated an investigation of the situation. The MOVs previously demonstrated to have the greatest cable voltage drops were reanalyzed. The informal analysis included the more generally accepted range of power factors, but conservatisms in areas such as cable length and ambient temperature were reduced. Based on the results of these analyses and on previous full flow, full dp tests, the licensee demonstrated the continued operability of the MOVs. However, if the licensee's investigation shows the power factor of existing MOVs to be other than the assumed 0.2 power factor, all calculations involving this power factor will have to be revised and the true conditions at the MOVs established. Pending completion of these activities, this is considered an open item (483/91020-01).

The team noted that the licensee did not evaluate the effects of high ambient

temperatures on the performance of MOV motors. The licensee indicated that Limitorque is currently performing testing and analysis to address this issue and agreed to incorporate the effects of high ambient temperatures on MOV motors when testing data is made available.

(c) Completed Design Basis Review

The NRC team reviewed "Request for Resolution" (RFR) 05353, Rev. X, "Reconcile Westinghouse Report MUHP-1200", which contains the licensee's basis for design basis dps, and discussed its contents with licensee personnel. The team found the final analysis, for the sample of MOVs examined, to be conservative.

(3) MOV Switch Settings

In recommended action b. of GL 89-10, the staff requested licensees to review and to revise as necessary, the methods for selection and setting of all MOV switches.

To determine the upper thrust limit of the actuator, the licensee performed a weak-link analysis. The team reviewed the methodology for the analysis and found it to be acceptable.

The licensee determined the minimum thrust to reposition a MOV by measuring spring pack displacement during dp testing. The licensee then added additional margin to this value to account for inaccuracies such as torque switch repeatability and diagnostic equipment inaccuracy. This new compound value was the minimum allowable thrust value. The torque switches were then set between the minimum and maximum allowable values after baseline testing and spring pack calibration. The team considered this approach to be conservative.

When dp testing was not practicable, the Henze-MOVATS DP data base and data from similar and/or identical valves at Callaway were used as part of the two stage approach (outlined in GL 89-10) to determine switch settings. The NRC team reviewed the licensee's justification for using the Henze-MOVATS data base for this application and found it to be acceptable. The licensee plans to

incorporate additional industry testing data into its program as it becomes available.

(4) Design Basis Differential Pressure and Flow Testing

The licensee performed dp testing on MOVs in its GL 89-10 program where practicable. This testing was performed in both the opening and closing directions, which was considered a strength by the team.

The licensee indicated that partial dp testing was performed on some MOVs when it was not possible to perform full flow dp testing. The full design basis dp was obtained using linear extrapolation from zero through one data point. The NRC team noted that this type of extrapolation alone may not be acceptable due to the non-linear behavior previously seen in some MOVs. The licensee agreed to incorporate data from the Electrical Power Research Institute (EPRI), when it becomes available, to ensure that factors such as rate-of-loading are accounted for in the final analysis.

The licensee indicated that an extensive dp testing program was completed for MOVs at Callaway during the construction phase of the plant. The testing was performed to demonstrate that the MOVs were operable prior to initial startup. The NRC team advised the licensee that it would be expected to attempt to identify degradation mechanisms at work on any MOVs that fail GL 89-10 dp testing since the valves were previously shown to be operable under similar testing conditions.

(5) Periodic Verification of MOV Capability

(a) General

The NRC team reviewed the licensee's plan for ensuring that adequate MOV switch settings were determined and maintained throughout the life of the plant. The plan consisted of a complete static diagnostic test of MOVs every four refueling outages. The period recommended by GL 89-10 is every three refueling outages or five years unless a longer interval is justified. The licensee indicated that the extension was justified by performing partial diagnostic testing of the MOVs at every refueling outage (approximately

every 18 months). The NRC team offered two comments:

1. The licensee should identify the basis for the assumption that partial test data generated after an 18 month interval is comparable to previous test data (partial tests now include no calibration). This clarification should provide evidence to ensure that no deterioration of spring packs will occur between tests.

2. The licensee should recall that static diagnostic tests are not acceptable at this time without justification of the capability to extrapolate from static conditions to design basis conditions.

(b) Valves Tested Under IEB 85-03

The licensee indicated that credit would be taken for full flow/full dp testing of MOVs under its IEB 85-03 program. The team indicated that this would be acceptable, provided:

1. There is objective evidence that the test data can be directly related to the currently used diagnostic system; and

2. the licensee's method of periodic verification is accepted by the NRC.

c. Associated Programmatic Reviews

The NRC team reviewed other licensee programs associated with MOVs.

(1) Design Control for Thermal Overload Protection

The NRC team reviewed design control of thermal overloads with licensee personnel. Thermal overloads were normally bypassed for MOVs within the GL 89-10 program at Callaway. The primary function of thermal overloads at Callaway was to protect the motors during testing performed when the plant was not in operation and when the operation of the valves was not necessary for safety. This practice was within the guidance given by Regulatory Guide 1.106 and was considered to be acceptable. However, the team reminded the

licensee that this was not the only practice considered to be acceptable and that the philosophy followed should be reviewed periodically.

(2) MOV Setpoint Control

The NRC team reviewed licensee documents to evaluate the MOV setpoint control program. No problems were identified in this area.

(3) Maintenance

The NRC team reviewed applicable preventive maintenance documents and discussed their contents with licensee personnel.

The NRC team reviewed the licensee's position in the area of valve stem packing adjustments. The licensee's practice was to perform a partial Motor Operated Valve Analysis and Test System (MOVATS) diagnostic test after packing adjustment or packing replacement.

The team noted that 45 MOVs in the Callaway GL 89-10 program had not been MOVATS tested at the time of the inspection. Before the use of diagnostic testing at Callaway, the specified post maintenance test for a packing adjustment was valve stroke timing. Stroke time testing of MOVs with ac motors is not an effective method to detect over-tightened packing. To compensate for this shortcoming, the licensee indicated that all MOVs in its GL 89-10 program that had experienced packing adjustments or packing replacement since initial startup will have initial MOVATS baseline testing completed by the end of refueling outage number 5 (May 1992). However, the licensee did provide engineering justification for elimination of ten butterfly valves from this initial baseline testing. The valves will be replaced during future outages.

(4) Training

The NRC team reviewed the training provided to personnel performing work associated with the implementation of the Callaway MOV program. The licensee has made a significant commitment to training. The training facilities were good, the courses appeared to be thorough, and the instructors appeared to be competent. The training program for MOVs at Callaway was

considered to be acceptable.

(5) Followup and Trending of MOV Maintenance and Problems

The team reviewed the licensee's procedures for identifying MOV problems, determining root cause and implementing corrective action. The licensee updated the Predictive Performance Report on each MOV every 18 months and reviewed the history of the valve at that time. The report included all maintenance and performance problems observed on each valve in the program. The team sampled several MOVs on which work had been performed and confirmed that the root cause of the problem was properly determined and that adequate records of the work were available.

Actuator over-thrusting was a significant problem at Callaway. At least 20 MOVs had experienced over-thrusting during testing prior to this inspection. Additional MOVs may experience over-thrusting as the testing program proceeds. The licensee used Kalsi Engineering Report 1707C, Rev. 0, "Thrust Rating Increase of Limitorque Actuators", to justify continued operability and use of some over-thrusted MOVs. The licensee had not completed its internal review of this report at the time of the inspection. The team advised the licensee to complete its review of the Kalsi report expeditiously. The NRC team could not deem the Kalsi report to be acceptable at the time of the inspection due to the limited information available from the evaluations in progress. This issue will be reviewed during a future inspection.

The licensee performed partial MOVATS testing every 18 months on MOVs for the purpose of trending. This approach was considered to be a strength.

(6) Operating Experience and Vendor Notification

The NRC team reviewed applicable procedures and discussed the process for handling various information notices from different sources. Callaway procedure EDP-ZZ-060000, "Vendor Equipment Technical Information Review Program," controlled the evaluation of industry information and experience from sources such as the Nuclear Regulatory Commission, Institute of Nuclear Power Operations, Westinghouse, Limitorque and other

vendors. The licensee took steps to ensure that information received was screened and evaluated by appropriate licensee organizations and that appropriate actions were planned. The team confirmed the effectiveness of the existing system by searching for eight known vendor information releases distributed to industry. The licensee recovered all the identified documents. The team found the licensee's program for the processing and control of operating experience and vendor notifications to be acceptable.

(7) MOV Modifications and Design Changes

The NRC team briefly reviewed licensee procedures and methodology for performing design modifications. No problems were noted in this area.

(8) Diagnostics

MOVATS diagnostic equipment was used on MOVs during dp testing and static testing. Procedures were developed to guide the use of MOVATS equipment in the field and in the analysis of the results. The licensee was using recently published inaccuracies for its equipment and planned to incorporate additional inaccuracy information as it becomes available.

The MOVATS methodology calibrates the torque switch in the open direction by comparing spring pack displacement to the measured stem thrust. This calibration is then used to set the torque switch in the closed direction. The valve stem directional effect is the change in the relationship between the output thrust and the displacement of the spring pack that would be caused by differences in valve stem travel direction. The licensee did not include valve stem directional effect but was investigating the issue and agreed to evaluate new information as it becomes available.

The licensee was considering the purchase of a new diagnostic system that could measure stem thrust directly. The advantages of such a system would include an improvement in the accuracy of the diagnostics program and the ability to determine actual valve and stem factors for MOVs.

(9) Control of Open Maintenance Items

The NRC team reviewed the licensee's methods for controlling open maintenance items. The principal tool for recording and disseminating data concerning the work in progress was a computer program identified as "Work Request Phase II". The data in this program was accessible to all licensee personnel for review, but could be modified only by the Planning Group. The program appeared to offer adequate identification and control of open maintenance items.

(10) Walkdown

The NRC team performed a walkdown to observe the condition of MOVs at Callaway. No problems were noted in this area.

3. Licensee Self Assessment

The NRC team reviewed Quality Assurance (QA) department involvement in the MOV program. This included two surveillances of the MOV program and three audits of activities which included MOV testing. The surveillances provided an initial program assessment relative to the requirements of GL 89-10, and a reassessment following the results of the NRC inspection of the Wolf Creek facility. These surveillances were performed using preestablished critical attributes and were comprehensive. The audits evaluated the performance of MOV testing activities in the field against procedural requirements. In addition, the team reviewed part of the Safety System Functional Assessment performed on the RHR system. This assessment evaluated the adequacy of MOV testing within the RHR system. The QA engineer involved is trained in both Limitorque operators and MOVATS testing. The licensee's resolution of the surveillance and audit findings was considered to be adequate.

4. Conclusions

The licensee is actively pursuing the development of its program in response to GL 89-10. The licensee's program was on schedule and may be completed significantly before the June 1994, commitment date. The licensee should take action to resolve several issues identified in this report. The results of the inspection were discussed with cognizant NRC Headquarters personnel. Future inspections will be performed to determine the acceptability of the licensee's program and to evaluate the implementation of the GL 89-10 program.

5. Open Items

An open item is a matter that requires further review and evaluation by the inspector, including an item pending specific action by the licensee. An open item disclosed during this inspection is discussed in Paragraph 2.b.(2)(b).

6. Exit Meeting

The team met with licensee representatives (denoted in Paragraph 1) at the conclusion of the inspection on January 17, 1992. The team summarized the purpose and scope of the inspection and the findings. The team also discussed the likely informational content of the inspection report with regard to documents or processes reviewed by the team during the inspection. The licensee identified Kalsi Engineering Report 1707C, Revision 0 as proprietary. No other documents were identified as proprietary.

W