UNITED STATES
NUCLEAR REGULATORY COMMISSION
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

LICENSEE RESPONSE TO GENERIC LETTER 96-05, "PERIODIC VERIFICATION OF DESIGN-BASIS CAPABILITY OF SAFETY-RELATED MOTOR-OPERATED VALVES"

COMANCHE PEAK STEAM ELECTRIC STATION, UNITS 1 AND 2

DOCKET NOS. 50-445 AND 446

1.0 INTRODUCTION

Many fluid systems at nuclear power plants depend on the successful operation of motor-operated valves (MOVs) in performing their safety functions. Several years ago, MOV operating experience and testing, and research programs sponsored by the nuclear industry and the U. S. Nuclear Regulatory Commission (NRC), revealed weaknesses in a wide range of activities (including design, qualification, testing, and maintenance) associated with the performance of MOVs in nuclear power plants. For example, some engineering analyses used in sizing and setting MOVs did not adequately predict the thrust and torque required to operate valves under their design-basis conditions. In addition, inservice tests of valve stroke time under zero differential-pressure and flow conditions did not ensure that MOVs could perform their safety functions under design-basis conditions.

Upon identification of the weaknesses in MOV performance, significant industry and regulatory activities were initiated to verify the design-basis capability of safety-related MOVs in nuclear power plants. After completion of these activities, nuclear power plant licensees began establishing long-term programs to maintain the design-basis capability of their safety-related MOVs. This safety evaluation addresses the program developed by Texas Utilities Electric (TU Electric/licensee) to verify periodically the design-basis capability of safety-related MOVs at the Comanche Peak Steam Electric Station (CPSES), Units 1 and 2.

2.0 REGULATORY REQUIREMENTS

The NRC regulations require that MOVs important to safety be treated in a manner that provides assurance of their intended performance. Criterion 1 to Appendix A, "General Design Criteria for Nuclear Power Plants," to Part 50 of Title 10 of the *Code of Federal Regulations* (10 CFR Part 50) states, in part, that structures, systems, and components important to safety shall be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed. The quality assurance program to be applied to safety-related components is described in Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR

Part 50. In Section 50.55a of 10 CFR Part 50, the NRC requires licensees to establish inservice testing (IST) programs in accordance with Section XI of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code.

In response to concerns regarding MOV performance, the NRC staff issued Generic Letter (GL) 89-10 (June 28, 1989), "Safety-Related Motor-Operated Valve Testing and Surveillance," which requested that nuclear power plant licensees and construction permit holders ensure the capability of MOVs in safety-related systems to perform their intended functions by reviewing MOV design bases, verifying MOV switch settings initially and periodically, testing MOVs under design-basis conditions where practicable, improving evaluations of MOV failures and necessary corrective action, and trending MOV problems. The staff requested that licensees complete the GL 89-10 program within approximately three refueling outages or 5 years from the issuance of the GL. Permit holders were requested to complete the GL 89-10 program before plant startup or in accordance with the above schedule, whichever was later.

The NRC staff issued seven supplements to GL 89-10 that provided additional guidance and information on MOV program scope, design-basis reviews, switch settings, testing, periodic verification, trending, and schedule extensions. GL 89-10 and its supplements provided only limited guidance regarding MOV periodic verification and the measures appropriate to assure preservation of design-basis capability. Consequently, the staff determined that additional guidance on the periodic verification of MOV design-basis capability should be prepared.

On September 18, 1996, the NRC staff issued GL 96-05, "Periodic Verification of Design-Basis Capability of Safety-Related Motor-Operated Valves," requesting each licensee establish a program, or ensure the effectiveness of its current program, to verify on a periodic basis that safety-related MOVs continue to be capable of performing their safety functions within the current licensing bases of the facility. In GL 96-05, the NRC staff summarized several industry and regulatory activities and programs related to maintaining long-term capability of safety-related MOVs. For example, GL 96-05 discussed non-mandatory ASME Code Case OMN-1, "Alternative Rules for Preservice and Inservice Testing of Certain Electric Motor Operated Valve Assemblies in LWR Power Plants, OM Code 1995 Edition; Subsection ISTC," which allows the replacement of ASME Code requirements for MOV quarterly stroke-time testing with exercising of safety-related MOVs at least once per operating cycle and periodic MOV diagnostic testing on a frequency to be determined on the basis of margin and degradation rate. In GL 96-05, the NRC staff stated that the method in OMN-1 meets the intent of the GL with certain limitations. The NRC staff also noted in GL 96-05 that licensees remain bound by the requirements in their code of record regarding MOV stroke-time testing, as supplemented by relief requests approved by the NRC staff.

In GL 96-05, licensees were requested to submit the following information to the NRC:

a. within 60 days from the date of GL 96-05, a written response indicating whether or not the licensee would implement the requested actions; and

b. within 180 days from the date of GL 96-05, or upon notification to the NRC of completion of GL 89-10 (whichever is later), a written summary description of the licensee's MOV periodic verification program.

The NRC staff is preparing safety evaluations on the response of each licensee to GL 96-05. The NRC staff intends to rely to a significant extent on an industry initiative to identify valve age-related degradation which could adversely affect the design-basis capability of safety-related MOVs (described in Section 3.0) where a licensee commits to implement that industry program. The NRC staff will conduct inspections to verify the implementation of GL 96-05 programs at nuclear power plants as necessary.

3.0 JOINT OWNERS GROUP PROGRAM ON MOV PERIODIC VERIFICATION

In response to GL 96-05, the Boiling Water Reactor Owners Group (BWROG), Westinghouse Owners Group (WOG), and Combustion Engineering Owners Group (CEOG) jointly developed an MOV periodic verification program to obtain benefits from the sharing of information between licensees. The Joint Owners Group (JOG) Program on MOV Periodic Verification is described by the BWROG in its Licensing Topical Report NEDC-32719, "BWR Owners' Group Program on Motor-Operated Valve (MOV) Periodic Verification," and described by the WOG and the CEOG in their separately submitted Topical Report MPR-1807, "Joint BWR, Westinghouse and Combustion Engineering Owners' Group Program on Motor-Operated Valve (MOV) Periodic Verification." The stated objectives of the JOG Program on MOV Periodic Verification are (1) to provide an approach for licensees to use immediately in their GL 96-05 programs, (2) to develop a basis for addressing the potential age-related increase in required thrust or torque under dynamic conditions, and (3) to use the developed basis to confirm, or if necessary to modify, the applied approach. The specific elements of the JOG program are (1) providing an "interim" MOV periodic verification program for applicable licensees to use in response to GL 96-05, (2) conducting a dynamic testing program over the next 5 years to identify potential age-related increases in required thrust or torque to operate gate, globe, and butterfly valves under dynamic conditions, and (3) evaluating the information from the dynamic testing program to confirm or modify the interim program assumptions.

The JOG interim MOV periodic verification program includes (1) continuation of MOV stroke-time testing required by the ASME Code IST program, and (2) performance of MOV static diagnostic testing on a frequency based on functional capability (age-related degradation margin over and above margin for GL 89-10 evaluated parameters) and safety significance. In implementing the interim MOV static diagnostic test program, licensees will rank MOVs within the scope of the JOG program according to their safety significance. The JOG program specifies that licensees need to justify their approach for risk ranking MOVs. In Topical Report NEDC 32264, "Application of Probabilistic Safety Assessment to Generic Letter 89-10 Implementation," the BWROG described a methodology to rank MOVs in GL 89-10 programs with respect to their relative importance to core-damage frequency and other considerations to be added by an expert panel. In a safety evaluation dated February 27, 1996, the NRC staff accepted the BWROG methodology for risk ranking MOVs in boiling water reactor nuclear plants with certain conditions and limitations. In the NRC safety evaluation (dated October 30, 1997) on the JOG Program on MOV Periodic Verification, the NRC staff indicated its view that the BWROG methodology for MOV risk ranking is appropriate for use in response to GL 96-05. With respect to Westinghouse-designed pressurized water reactor nuclear plants, the WOG prepared Engineering Report V-EC-1658, "Risk Ranking Approach for Motor-Operated Valves in Response to Generic Letter 96-05." On April 14, 1998, the NRC staff issued a safety evaluation accepting with certain conditions and limitations the WOG approach for ranking

MOVs based on their risk significance. Licensees not applicable to the BWROG or WOG methodologies need to justify their MOV risk-ranking approach individually.

The objectives of the JOG dynamic test program are to determine degradation trends in dynamic thrust and torque, and to use dynamic test results to adjust the test frequency and method specified in the interim program if warranted. The JOG dynamic testing program includes (1) identification of conditions and features which could potentially lead to MOV degradation, (2) definition and assignment of valves for dynamic testing, (3) testing valves three times over a 5-year interval with at least a 1-year interval between valve-specific tests according to a standard test specification, (4) evaluation of results of each test, and (5) evaluation of collective test results.

In the last phase of its program, the JOG will evaluate the test results to validate the assumptions in the interim program to establish a long-term MOV periodic verification program to be implemented by licensees. A feedback mechanism will be established to ensure timely sharing of MOV test results among licensees and to prompt individual licensees to adjust their own MOV periodic verification program, as appropriate.

Following consideration of NRC staff comments, the BWROG submitted Licensing Topical Report NEDC-32719 (Revision 2) describing the JOG program on July 30, 1997. Similarly, the CEOG and the WOG submitted Topical Report MPR-1807 (Revision 2) describing the JOG program on August 6 and 12, 1997, respectively. On October 30, 1997, the NRC staff issued a safety evaluation to the BWROG, CEOG and WOG accepting the JOG program with certain conditions and limitations as an acceptable industry-wide response to GL 96-05 for valve age-related degradation.

4.0 CPSES GL 96-05 PROGRAM

On November 15, 1996, TU Electric submitted a 60-day response (TXX-96503) to GL 96-05 indicating its intent to implement the actions requested in GL 96-05 at CPSES Units 1 and 2. On March 14, 1997, the licensee submitted a 180-day response (TXX-97055) to GL 96-05 providing a summary description of the MOV periodic verification program planned at that time to be implemented at CPSES Units 1 and 2. In a submittal (TXX-98136) dated May 21, 1998, and a follow-up submittal (TXX-98154) dated June 24, 1998, the licensee revised its response to GL 96-05 and updated its plans for establishing an MOV periodic verification program.

In its letter dated June 24, 1998, in response to GL 96-05, the licensee stated that implementation of the GL 96-05 recommendations will be completed at CPSES by the eighth refueling outage for Unit 1 (scheduled for early 2001) and by the fifth refueling outage for Unit 2 (scheduled for late 2000). The licensee's basis for this schedule for full implementation of the GL 96-05 recommendations was to allow coordination of the GL 96-05 program with the CPSES risk-informed IST program. The licensee is currently implementing its MOV periodic verification program at CPSES with the initiation of MOV static and dynamic diagnostic testing.

As described in the June 24, 1998, letter in response to GL 96-05, the licensee's program at CPSES Units 1 and 2 to verify periodically the design-basis capability of safety-related MOVs

will implement the provisions of ASME Code Case OMN-1. With respect to the limitations specified in GL 96-05 for the use of OMN-1, the licensee indicates that:

a. the potential benefits and adverse effects will be considered when determining the appropriate testing for each MOV;

b. where the selected MOV diagnostic test frequency extends beyond 6 years or four refueling cycles (whichever is longer), performance and test experience obtained from MOV testing conducted during the first 6 years or four refueling outage time period shall be evaluated to justify the longer periodic verification interval; and

c. the risk insights determined during its participation in the Electric Power Research Institute (EPRI) Risk-Informed IST Pilot Project and on-going development of an updated risk-informed categorization process based upon ASME Research guidance and Codes as applicable will be used in accordance with the provisions of OMN-1.

As further information, the licensee referenced a separate letter (TXX-98153) dated June 24, 1998, forwarding its IST relief request for application of OMN-1 as an alternative to the ASME Code requirements for quarterly MOV stroke-time tests at CPSES. In the IST relief request, the licensee described the same limitations for the implementation of OMN-1 as listed in its June 24, 1998, response to GL 96-05. Also in its IST relief request, the licensee took exception to OMN-1 with respect to the initial MOV test frequency and the calculation of deterministic capability margin for its MOVs.

In its letter dated June 24, 1998, in response to GL 96-05, the licensee stated that it is participating in the JOG Program on MOV Periodic Verification as a member of the Westinghouse Owners Group. The licensee also states that it will incorporate the results of the JOG program into the GL 96-05 program at CPSES. The identified difference between the CPSES GL 96-05 program and the JOG program involves the interim MOV static diagnostic testing program. First, the licensee will implement OMN-1 at CPSES which allows exercising of MOVs at least once per refueling outage and periodic MOV diagnostic testing on longer intervals in lieu of the ASME Code quarterly stroke-time testing referenced by the JOG. Second, the licensee and JOG have different matrices for assigning the test frequency for interim MOV static diagnostic testing. Specifically, as described in its IST relief request dated June 24, 1998, the licensee uses a two-tier (high and low) approach for MOV risk-significance categories and three levels of capability margin with low margin less than 10%, medium margin greater than or equal to 10% but less than 15%, and high margin greater than or equal to 15%. On the other hand, the JOG uses a three-tier (high, medium and low) approach for MOV risk-significance categories and three levels of capability margin with low margin less than 5%, medium margin greater than or equal to 5% but less than 10%, and high margin greater than or equal to 10% in its MOV static diagnostic test matrix. Both the licensee and the JOG assign test frequencies ranging from one to six refueling cycles in their interim MOV static diagnostic testing matrices based on the individual risk significance category and margin level with a maximum test interval of 10 years.

5.0 NRC STAFF EVALUATION

The NRC staff has reviewed the information provided in the licensee's submittals describing the program to verify periodically the design-basis capability of safety-related MOVs at CPSES in response to GL 96-05. The staff reviewed NRC Inspection Report 50-445 and 446/95-19 which provided the results of the inspection at CPSES to close the NRC staff review of the licensee's program to verify the design-basis capability of safety-related MOVs in response to GL 89-10. The staff also reviewed NRC Inspection Report 50-445 and 446/97-12 which provided follow-up information on a specific aspect of the licensee's MOV program. The NRC staff's evaluation of the licensee's response to GL 96-05 is described below.

5.1 MOV Program Scope

In GL 96-05, the NRC staff indicated that all safety-related MOVs covered by the GL 89-10 program should be considered in the development of the MOV periodic verification program. The staff noted that the program should consider safety-related MOVs that are assumed to be capable of returning to their safety position when placed in a position that prevents their safety system (or train) from performing its safety function; and the system (or train) is not declared inoperable when the MOVs are in their nonsafety position. In NRC Inspection Report 50-445 and 446/95-19, the NRC staff did not identify any concerns regarding the scope of the licensee's GL 89-10 program at CPSES. In its letter dated November 15, 1996, the licensee indicated its plans to implement the actions requested in GL 96-05 and did not take exception to the scope of the GL. The NRC staff considers the licensee to have made adequate commitments regarding the scope of its MOV program.

5.2 MOV Assumptions and Methodologies

In NRC Inspection Report 50-445 and 446/95-19, the NRC staff stated that, following closure of its review of GL 89-10, there remains the expectation that the assumptions and methodologies used in the development of the MOV program will be maintained for the life of the plant (a concept commonly described as a "living program"). For example, the design basis of safety-related MOVs will need to be maintained up-to-date including consideration of any plant modifications or power uprate conditions. The NRC staff considers the licensee to have made adequate commitments to maintain its assumptions and methodologies used in its MOV program, including the design basis of its safety-related MOVs.

5.3 GL 89-10 Long-Term Items

In NRC Inspection Report 50-445 and 446/95-19, the NRC staff stated that all significant issues related to the GL 89-10 program at CPSES have been resolved. In the inspection report, the staff indicated that the licensee at that time did not have an explicit margin to account for valve degradation in its MOV program. In response to GL 96-05, the licensee is establishing a program for periodic verification of MOV design-basis capability, which includes margin to account for valve degradation. In the inspection report, the staff stated that the review of the licensee's response to GL 95-07, "Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves," would be completed separately. The staff is currently reviewing the licensee's response to GL 95-07 for preparation of a safety evaluation. In the inspection

report, the staff indicated that the licensee's program to trend MOV performance was well-established. However, the staff noted uncertainties involving the prediction of MOV motor actuator output. The resolution of the concern regarding prediction of motor actuator output is discussed in a following paragraph of this safety evaluation. With the implementation of the MOV trending program and the licensee's consideration of motor actuator output, no outstanding issues regarding the licensee's GL 89-10 program remain at CPSES.

5.4 ASME Code Case OMN-1

The licensee's program at CPSES to verify periodically the design-basis capability of safety-related MOVs will implement the provisions of ASME Code Case OMN-1 with certain limitations described in the licensee's June 24, 1998, letter in response to GL 96-05. In a separate submittal dated June 24, 1998, the licensee requested relief from the ASME Code IST requirements for MOV stroke-time testing through the application of OMN-1. In that IST relief request, the licensee described the limitations for the implementation of OMN-1 such as (1) consideration of the benefits and adverse effects of MOV testing, (2) evaluation of valve test data for MOVs with test intervals beyond 6 years or four refueling outages, and (3) the application of risk insights from the EPRI risk-informed IST pilot project. In its IST relief request, the licensee also took exception to OMN-1 with respect to the initial MOV test frequency and the calculation of MOV deterministic capability margin. The NRC staff has reviewed and accepted with certain conditions the licensee's implementation of OMN-1 as an alternative to the ASME Code MOV stroke-time test requirements as described in the NRC safety evaluation dated August 14, 1998, on the licensee's risk-informed IST program at CPSES. The NRC staff's acceptance of the licensee's use of OMN-1 in its IST program is also applicable to the use of OMN-1 in response to GL 96-05 at CPSES with the same conditions specified in the NRC safety evaluation dated August 14, 1998.

5.5 JOG Program on MOV Periodic Verification

In its letter dated June 24, 1998, in response to GL 96-05, the licensee states that the results of the JOG Program on MOV Periodic Verification will be incorporated into the GL 96-05 program at CPSES. In a safety evaluation dated October 30, 1997, the NRC staff accepted the JOG program as an industry-wide response to GL 96-05 with certain conditions and limitations. The NRC staff considers the commitments by the licensee to implement the JOG program at CPSES to be an acceptable response to GL 96-05 for valve age-related degradation. The licensee is responsible for reviewing and implementing the limitations and conditions discussed in the NRC safety evaluation dated October 30, 1997, in applying the JOG program at CPSES. This includes the coordination and feedback of test information obtained from the JOG dynamic testing program.

The NRC staff has reviewed the interim MOV static diagnostic testing program at CPSES in comparison to the interim program recommended by the JOG. As noted above, the licensee will implement OMN-1 which allows exercising of MOVs at least once per refueling outage and periodic diagnostic testing on longer intervals in lieu of the ASME Code quarterly stroke-time testing requirements referenced by the JOG. In its interim MOV static diagnostic testing matrix, the licensee uses a two-tier (high and low) approach for MOV risk-significance categories and three levels of capability margin with low margin less than 10%, medium margin greater than or

equal to 10% but less than 15%, and high margin greater than or equal to 15%. The licensee's interim MOV static diagnostic testing matrix assigns test frequencies ranging from one to six refueling cycles based on the MOV risk-significance category and margin level with a maximum test interval of 10 years. In the NRC safety evaluation dated August 14, 1998, on the licensee's risk-informed IST program, the NRC staff specified that the licensee should evaluate any plans to extend the quarterly test intervals for High Safety Significant Component (HSSC) MOVs to ensure that the potential increase in core damage frequency and risk is small and consistent with the intent of the Commission's Safety Goal Policy Statement. Also in the NRC safety evaluation dated August 14, 1998, the NRC staff accepted with certain conditions the licensee's risk categorization approach for MOVs at CPSES. Further, the margin requirements in the licensee's interim MOV static diagnostic test matrix may result in more frequent diagnostic testing for some MOVs at CPSES than would be directed by the JOG interim test matrix. Finally, the licensee will evaluate test results during the JOG dynamic testing program to ensure prompt consideration of any adverse MOV performance information. On this basis, the NRC staff considers the interim MOV static diagnostic testing program at CPSES to be acceptable.

The JOG program is intended to address most gate, globe and butterfly valves used in safety-related applications in the nuclear power plants of participating licensees. The JOG indicates that each licensee is responsible for addressing any MOVs outside the scope of applicability of the JOG program. In the NRC safety evaluation dated October 30, 1997, the NRC staff specifies that licensees implementing the JOG program must determine any MOVs outside the scope of the JOG program (including service conditions) and justify a separate program for periodic verification of the design-basis capability of those MOVs. The NRC staff recognizes that the JOG has selected a broad range of MOVs and conditions for the dynamic testing program. Consequently, the NRC staff expects significant information to be obtained on the performance and potential degradation of safety-related MOVs during the interim static diagnostic testing program and the JOG dynamic testing program. As the test results are evaluated, the JOG might include or exclude additional MOVs with respect to the scope of its program. Although the test information from the MOVs in the JOG dynamic testing program might not be adequate to establish a long-term periodic verification program for each MOV outside the scope of the JOG program, sufficient information should be obtained from the JOG dynamic test program to identify any immediate safety concern for potential valve age-related degradation during the interim period of the JOG program. Therefore, the NRC staff considers it acceptable for the licensee to apply its interim static diagnostic testing program to GL 96-05 MOVs at CPSES that currently might be outside the scope of the JOG program with the feedback of information from the JOG dynamic testing program to those MOVs. Upon completion of the JOG dynamic testing program and development of the JOG long-term MOV periodic verification criteria, the licensee will be expected to establish a long-term MOV periodic verification program for those MOVs at CPSES outside the scope of the JOG program by applying information from the JOG program or additional dynamic tests, as necessary.

5.6 Motor Actuator Output

The JOG program focuses on the potential age-related increase in the thrust or torque required to operate valves under their design-basis conditions. In the NRC safety evaluation dated October 30, 1997, on the JOG program, the NRC staff specified that licensees are responsible for addressing the thrust or torque delivered by the MOV motor actuator and its potential

degradation. Although the JOG does not plan to evaluate degradation of motor actuator output, significant information on the output of motor actuators will be obtained through the interim MOV static diagnostic testing program and the JOG dynamic testing program. The NRC staff stated in Inspection Report 50-445 and 446/97-12 that the licensee's methodology for predicting MOV motor actuator output was acceptable based on additional conservative assumptions in its calculations and the extensive motor actuator testing program at CPSES. Also, the licensee will be implementing ASME Code Case OMN-1 which includes provisions for evaluating motor actuator output and its potential degradation with time. Further, the licensee stated in its letter dated June 24, 1998, in response to GL 96-05 that it had reviewed Limitorque Technical Update 98-01 which provides updated guidance from the actuator manufacturer for predicting the torque output of Limitorque motor actuators. Based on its specific motor actuator output testing, the licensee determined that the guidance in Limitorque Technical Update 98-01 does not affect the MOV program at CPSES. The NRC staff considers the licensee to have established sufficient means to monitor MOV motor actuator output and its potential degradation.

6.0 CONCLUSION

On the basis of this evaluation, the NRC staff finds that the licensee has established an acceptable program to verify periodically the design-basis capability of the safety-related MOVs at CPSES. Therefore, the staff concludes that the licensee has adequately addressed the actions requested in GL 96-05. The NRC staff may conduct inspections to verify the implementation of the MOV periodic verification program at CPSES is in accordance with the licensee's commitments; this NRC safety evaluation; the NRC safety evaluation dated October 30, 1997, on the JOG Program on MOV Periodic Verification; and the NRC safety evaluation dated August 14, 1998, on the CPSES risk-informed IST program.

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