

U. S. NUCLEAR REGULATORY COMMISSION

REGION III

Reports No.: 50-456/92005(DRS); 50-457/92005(DRS)

Dockets No.: 50-456; 50-457 Licenses No.: NPF-72; NPF-77

Licensee: Commonwealth Edison Company
Opus West III
1400 Opus Place
Downers Grove, IL 60515

Facility Name: Braidwood Nuclear Power Station
Units 1 and 2

Inspection At: Braidwood Site, Braceville, Illinois

Inspectors:

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3-19-92
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3-19-92
Date

Inspection Summary

Inspection conducted February 18 through March 6, 1992 (Reports No. 50-456/92005(DRS); 50-457/92005(DRS))

Areas Inspected: Announced safety inspection of the licensee's response to Generic Letter (GL) 89-10, "Safety-Related Motor-Operated Valve (MOV) Testing and Surveillance" (2515/109) and licensee actions on previously identified open and unresolved items (92701).

Results: The licensee has developed a program which is generally consistent with the guidance of GL 89-10. The inspection disclosed one violation, with two examples, (Paragraphs 3.a.(3) and 3.b.(3)) and two unresolved items (Paragraphs 3.a.(2)(b) and 3.a.(4)).

The licensee demonstrated weaknesses in the following areas:

- o Communication between corporate and station personnel was inadequate in some areas and resulted in inconsistent use of corporate guidance for frequency of stem lubrication.

- Licensee self-assessment of the GL 89-10 program addressed only conformance to Nuclear Operations Directive NOD-MA.1, "Guidelines for Motor Operated Valve (MOV) Testing, Maintenance and Evaluation," Revision 2, leaving open several areas in which errors and improper assumptions are possible.
- Lower-than-normal stem factors, which were used in torque switch setting calculations, were not adequately justified.
- A 36 month stem lubrication frequency, which was sometimes used in lieu of the 18 month manufacturer recommended frequency, was not adequately justified.

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DETAILS

1. Persons Contacted

Commonwealth Edison Company (CECo)

- # K. Kofron, Station Manager
- # C. Bedford, MOV Engineer
- # R. Branson, Nuclear Engineering Department
- # J. Cantlin, NQP Engineer
- # W. Cote, MOV Coordinator
- D. Flynn, Maintenance Training Instructor
- # J. Groth, Production Superintendent
- # L. Guthrie, Assistant Superintendent, Maintenance
- # S. Hedden, Maintenance Staff Supervisor
- # J. Lewand, Regulatory Assurance, NRC Coordinator
- B. Rjbak, Mechanical and Structural Design Superintendent
- R. Sagmoe, IST Coordinator
- # P. Ungeran, MOV Program Administrator

U. S. Nuclear Regulatory Commission (NRC)

- # S. DuPont, Senior Resident Inspector
- # D. Hartland, Reactor Engineer

Denotes those attending the exit meeting on March 6, 1992.

2. Licensee Action on Previous Inspection Findings (92701)

(Closed) Unresolved Item 50-456/37045-03(DRS); 457/87046-03(DRS): Station Oil Sampling Program procedure was not followed and attachments were difficult to use. Procedure BWAP 370-2, "Station Sampling Procedure," was revised to clarify log sheets and to require that the log sheets be properly maintained and stored in the fuel handling office. The inspectors reviewed the entries in the File Sampling Log and Oil Sample Program Log as well as sample results for several safety related pumps and determined that the documentation was acceptable, the attachments were easy to use and the procedure was being followed. This item is closed.

(Closed) Open Item 50-456/89018-02(DRS); 50-457/89018-02(DRS): Failure to include Limitorque actuator types SB and SBD in the evaluation regarding torque switches made of melamine material as described in a 10 CFR Part 21 report dated November 23, 1988. The inspectors reviewed licensee actions taken to correct the problem. The licensee had written nuclear work requests to inspect torque switches for all affected actuators and the torque switches were changed as necessary. The MOV coordinator maintained a data base that contained torque switch material and color information for all MOVs in the plant. The inspectors reviewed the documentation for a sample of MOVs to ensure that corrective actions were complete. This item is considered closed.

(Closed) Unresolved Item 456/90014-01(DRS); 50-457/90017-01(DRS): Failure to perform a 10 CFR 50.59 evaluation for the ATWS mitigation system actuation circuitry (AMSAC). The licensee had not originally prepared a safety evaluation on the basis that the modification had been approved by the NRC in an SCR. Further evaluation of this issue by the licensee resulted in the preparation of a 50.59 evaluation and issuance of a memo to the engineering staff directing the preparation of safety evaluations for all modifications regardless of the status of NRC approval. Based on the above actions, this item is considered closed.

3. Inspection of the Program Developed in Response to Generic Letter 89-10

a. Generic Letter 89-10 Program Review

The NRC inspectors reviewed "CECo response to Generic Letter 89-10," submitted to the NRC by letter dated September 28, 1990. Braidwood implemented the CECo corporate level GL 89-10 program in accordance with Nuclear Operations Directive NOD-MA.1, "Guidelines for Motor Operated Valve (MOV) Testing, Maintenance and Evaluation," Revision 2. This document was being revised during the inspection, so any changes resulting from the inspection may be readily incorporated into Revision 3 for implementation at Braidwood. Items noted during this inspection are detailed below.

(1) Scope of the Generic Letter Program

The inspectors reviewed system drawings for service water, charging, and safety injection as a sample check for the completeness of the scope of the GL 89-10 program. There were 237 MOVs included in the program at Braidwood Station.

The licensee provided written justification for the exclusion of 34 MOVs from the program. The justification appeared to be acceptable with one exception. The licensee indicated that MOVs 1CV8109 and 2CV8109 were removed from the program because they had no passive or active safety function. However, if the MOVs were mispositioned open, a failure of check valve 1CV8497 or 2CV8497 to close would allow flow to be inadvertently diverted from the charging system to other plant systems. Based on the consequences of mispositioning these valves, the licensee may need to reevaluate their exclusion from the program. However, an appeal of this issue was under review by the NRC staff at the time of the inspection. The inspectors informed the licensee that it would be expected to comply with the results of the appeal.

The inspectors 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 inspectors discussed design basis reviews with licensee personnel and reviewed procedures controlling the performance of design basis reviews for the MOVs in the GL 89-10 program. The results are discussed below.

(a) Differential Pressure Requirements

Documents used to determine the maximum expected dp and flow conditions for MOVs in the program included the UFSAR, Technical Specifications, normal and abnormal operating procedures, and system descriptions. The licensee did not review the Emergency Operating Procedures (EOPs) as part of the design basis review. However, as a result of findings from an NRC inspection at the Dresden Station, the licensee performed a review to determine if the MOV design basis documents generated as part of the GL 89-10 program envelop the EOP scenarios. The review confirmed that the EOP scenarios were enveloped by the MOV design basis documents.

The licensee evaluated valve mispositioning events in its design basis reviews. However, if an MOV would not be able to accommodate the dp and flow resulting from a valve mispositioning event, the licensee's program would allow the mispositioning scenario to be discarded for less demanding scenarios. The NRC inspectors discussed this issue with the licensee and it was noted that mispositioning was not considered for 22 MOVs that were included in the program. An appeal of the mispositioning issue was under review by the NRC staff at the time of the inspection. The licensee was informed that it would be expected to comply with the results of the appeal.

(b) Reduced Voltage Capability

The NRC inspectors evaluated the licensee's methods for determining the capability of MOVs to achieve the required thrust under degraded voltage conditions.

The licensee's procedure for establishing degraded voltage conditions was "Procedure for Performance of Project Task 4, MOV Terminal Voltage Calculations," Rev 2, dated March 18, 1991. While the procedure permitted the use of stall torque current in lieu of the GL recommended locked rotor current, the licensee indicated that Braidwood utilized only the locked rotor current for degraded voltage calculations.

The licensee used the "expected" low grid voltages, based on operational history, instead of the degraded voltage relay setpoint to determine worse case bus voltages. The inspectors informed the licensee that this method was not acceptable because it allowed a range of voltages for which some MOVs may be operable. This finding is consistent with the findings of a NRC Electrical Distribution System Functional Inspection (EDSFI) which found this problem to be generic to all six CECo nuclear facilities.

This degraded voltage issue was identified for MOVs during the Quad Cities GL 89-10 inspection in December of 1991. At that time, CECo personnel were advised that potential MOV operability issues should be addressed for other CECo nuclear facilities and that a final resolution of this issue could be addressed in response to the EDSFI. CECo had not addressed potential operability issues for Braidwood at the time of this inspection. This is considered an unresolved item pending review of the licensee's evaluation by NRC (456/92005-01 (DRS); 457/92005-01 (DRS)).

The inspectors performed a preliminary review of all MOVs in the Braidwood GL 89-10 testing program and found no immediate operability concerns due to the use of the expected low grid voltage in the degraded voltage calculations. However, the licensee will be expected to perform a more extensive review of this issue in response to the EDSFI.

The licensee did not evaluate the effects of high ambient temperatures on the performance of MOV motors. However, CECo staff was aware that Limitorque was performing testing and analysis to address this issue and planned to incorporate the information resulting from the testing into its GL 89-10 program when it was made available.

(c) Completed Design Basis Review

The inspectors reviewed a sample of completed design basis review packages and noted the following non-conservative assumptions.

- 1) Valves 1/2AF013A-H. The maximum steam generator (SG) pressure was used in the calculation when the minimum anticipated SG pressure should have been used.
- 2) Valves 1/2SI8801A-B. A maximum containment pressure of 45 psi was assumed in the

calculation. Containment pressure was not expected to reach 45 psi during the design basis accident.

The effect of these assumptions was to minimize the dp across the valves in the calculations, which is non-conservative. Although no operability concerns resulted from the NRC review, the licensee should take steps to correct the noted design basis documents and to ensure that other non-conservative assumptions were not made in other design basis documents.

(3) MOV Switch Settings

The licensee's process for sizing MOVs and setting of MOV switches was discussed with licensee personnel.

Close torque switches were set to values consistent with design basis thrust requirements for closing. Open torque switches were set to match the close torque switch settings although, in some instances the required opening thrust was much greater than the required closing thrust. As a result of this practice, the open torque switch setting may be inadequate. The licensee was informed that this method for setting open torque switches was unacceptable because of the potential to set the switches too low. The licensee should review the open torque switch settings to ensure that MOVs are operable in the open direction.

Limitorque recommends that MOV users use a coefficient of friction (μ_s) for the stem/stem nut interface of 0.2 unless otherwise specified by the valve manufacturer. While Westinghouse has specified a μ_s of 0.15 for MOVs purchased from Westinghouse as a unit, the licensee has applied the 0.15 factor to valves purchased from other vendors. Furthermore, values of μ_s as low as 0.1 were used to calculate thrust windows for Westinghouse MOVs. The inspectors informed the licensee that the values used for μ_s may not be conservative and should be justified. The licensee used CECO White Paper MOV-WP101, "Justification of Using Coefficient of Friction of $\mu=0.15$ for the Torque to Thrust Conversion of Motor Operated Valves (MOV) with Rising Stems," to support its position. The White Paper issued by corporate engineering consisted of seven recommendations to ensure a μ_s of 0.15 or better. The paper also specified the need to clean and lubricate the stems every 18 months. The inspectors determined that the document was not adequate justification because it was not supported by applicable test data. Furthermore, the White Paper did not address values of μ_s less than 0.15, which were used for some Westinghouse MOVs.

The licensee did not implement the seven recommendations noted in White Paper MOV-WP101 to support the use of a low μ_s , nor did the licensee consistently implement the requirement to lubricate stems on an 18 month interval when μ_s less than that recommended by Limitorque and Westinghouse was used. Apparently, the recommendations and lubrication frequency specification had not been adequately communicated to station personnel. As a result, they were not incorporated into Braidwood or CECO corporate procedures. Failure to incorporate engineering specifications forming the basis of MOV performance determinations is an example of a violation of NRC requirement 10 CFR 50, Appendix B, Criterion V, which requires, in part, that activities affecting quality shall be prescribed by documented instructions, procedures, or drawings, of a type appropriate to the circumstances. (456/92005-02A(DRS); 457/92005-02A(DRS)).

The NRC inspectors performed calculations to determine the μ_s for a sample of valves using available Braidwood dp test data. Valves 2S18802A and 2AF013D had a μ_s of 0.20 and 0.22, respectively, under differential pressure conditions. Although these valves were tested after maintenance with freshly lubricated stems, both valves exhibited a μ_s in excess of the CECO claimed values of 0.10 and 0.15, respectively, for their non-degraded conditions. The inspectors informed the licensee that the use of a μ_s less than the values recommended by Limitorque and Westinghouse did not appear to be supported by the available test data.

Without test data or acceptable rationale to support their use, some stem factors used at Braidwood may not be conservative. The licensee had started collecting information from testing but had not started the evaluation phase. Evaluation of test data and feedback into thrust calculations is necessary to ensure that adequate MOV performance margins are maintained. For these evaluations, the licensee should establish acceptance criteria and consider the assumed condition of the MOVs (degraded or non-degraded) at the time of testing.

The licensee has not addressed rate-of-loading in its program. However, an effect from rate-of-loading was apparent in the test data. The NRC inspectors informed the licensee that it will be expected to add additional margin to its calculations to envelop this effect, when applicable.

The licensee has, on several occasions, operated MOVs in a manner which exceeded the manufacturer's recommended thrust rating. Limitorque (the manufacturer) has previously approved limited overthrusting of operators under certain conditions. The NRC staff is currently reviewing the acceptability of studies by Westinghouse and Kalsi

Engineering. These studies attempt to justify further increases in thrust that may be tolerated without damage to the operators. Pending completion of this review, comments on this subject were withheld. However, the inspectors noted that steps should still be taken to ensure that the manufacturer's recommended torque ratings are not exceeded, because the torque required to produce a given thrust must increase to compensate for MOV deterioration.

For globe valve thrust calculations, the licensee assumed 0 psi downstream pressure in the closing direction. This method was not consistent with Limitorque calculation methods. The downstream pressure may be assumed to be the upstream pressure minus the differential pressure across the valve, typically a value greater than 0. The 0 psi downstream pressure value caused the calculated stem rejection load to be reduced to 0, making the final calculated required thrust lower than would normally be expected. The licensee performed a review of all globe valve calculations at Braidwood Station to ensure that the assumed 0 psi downstream value did not significantly affect the calculated thrust windows. Since similar downstream pressure assumptions were made at other CECO nuclear facilities, the NRC inspectors informed CECO personnel that a similar review should be performed at other CECO sites in a timely manner.

(4) Design Basis Differential Pressure and Flow Testing

The licensee indicated that testing of MOVs would not be performed where a dp of less than 80% of the design basis dp was attainable because of the limited value of the information obtained. The NRC inspectors informed the licensee that this position was not consistent with the "two stage approach," defined in the GL. This issue was originally identified at Quad Cities and was referred to NRR for resolution. This is an unresolved item (50-456/92005-03(DRS); 50-457/92005-03(DRS)).

(5) Periodic Verification of MOV Capability

The licensee's plan for ensuring that adequate MOV switch settings were established and maintained throughout the life of the plant included static diagnostic testing of MOVs on an interval that will be determined once the initial stages of the GL 89-10 program are completed. The period recommended by GL 89-10 was every third refueling outage. The NRC inspectors informed the licensee that static testing was not currently an acceptable method of periodic verification because of uncertainties in the performance of MOVs under static and design basis conditions.

(6) MOV Failures, Corrective Actions and Trending

The inspectors noted some weaknesses in the licensee's method for identification and correction of equipment problems. For example, several MOVs (1SI8920, 1SI8806, 1SI8814) in the plant had "laundry tags" identifying deficiencies dating back to 1988 with no associated work request (WR) on file. Obvious boric acid crystals were covering the packing and stem areas of 1SI8920 and 1SI8814. Although the licensee performed periodic walkdowns to check for boric acid leaks, the November 20, 1990 walkdown on the safety injection system did not identify a packing leak on 1SI8920 because of confusion caused by the hanging tags. Personnel thought that a WR was already written for this valve. Once the discrepancies were identified by the NRC inspectors, WRs were written to make necessary repairs. Additionally, the licensee agreed to provide training to the technical staff to ensure that laundry tags are noted during walkdowns and that WRs are written if necessary. The inspectors determined the licensee's actions taken on this issue to be acceptable.

The licensee indicated that the corporate guidance document for implementation of GL 89-10 is being revised in accordance with commitments made during the Byron MOV inspection to correct two deficiencies also noted during this inspection. These were: 1. Comparison of new test results with original reference data, rather than with previous testing results so that long term degradation can be identified, and 2. Provision of finite acceptance criteria to determine when to initiate major maintenance on MOVs.

The results of the periodic grease inspection were not provided to the MOV coordinator for trending purposes as required by NOD-MA.1, section 5.7.3.1. Trending of grease inspection information is necessary to determine when major maintenance is required on MOVs.

(7) Schedule

The licensee committed to implementation of all GL 89-10 actions by the end of the fifth refueling outages, beginning with the 1991 outages. Although the schedule was beyond the time frame recommended by the GL, it appeared to be based on an aggressive dp and flow testing program. However, as noted in paragraph 3.a.(4), dp and flow testing is not planned for MOVs where at least 80% of design basis dp and flow can not be achieved. This position and the implementation schedule for GL 89-10 will be reviewed by NRR to determine acceptability.

b. Associated Programmatic Reviews

The NRC inspectors reviewed other licensee programs associated with MOVs.

(1) Design Control for Thermal Overload Protection

The NRC inspectors reviewed the licensee's methods for the design control of thermal overloads. The licensee's methods appeared to be acceptable.

(2) MOV Setpoint Control

The NRC inspectors reviewed licensee documents and discussed MOV setpoint control with licensee personnel. The licensee's MOV setpoint control program appeared to be acceptable.

(3) Maintenance

The licensee's nominal preventive maintenance (PM) frequency was 36 months. The Limatorque recommended frequency for stem lubrication was 18 months. The exact effects of the extended maintenance frequency are not known, however, some additional degradation and increased stem factors would be expected. The NRC inspectors informed the licensee that it would be expected to justify the 36 month maintenance frequency. Such justification should be supported by MOV testing. For example, some "as-found" design basis testing may be used to support the position. Static diagnostic testing may not be acceptable because of uncertainties in the relationship between the performance of MOVs under static and design basis conditions.

The NRC inspectors reviewed the licensee's position in the area of valve stem packing adjustments. The practice was to perform a motor current signature test after packing adjustments. However, changes in power requirements associated with loading may not be accurately reflected in ac motor current analysis due to the changing power factor. Large changes in thrust requirements due to packing adjustments may result in only small changes in motor current. The licensee committed to incorporate the effects of the power factor into the analysis for MOVs after baseline testing is performed.

The licensee's lubrication program (LUBQ) specified the use of EP-1 on most valve stems, including MOVs 2SI8807A, 2SI8807B and ICC9473. However, documentation showed that these valve stems were last lubricated with Neolube. This discrepancy was caused by an inadequate procedure. In 1988,

station personnel decided to change the LUBQ to specify EP-1 as a stem lubricant (to replace Neolube) partially because Neolube had been deemed an inferior lubricant for use on valve stems based on information from the Electrical Power Research Institute. However, Procedure BwFP FS-1, "Inspection of Limitorque Gear Case Lubrication," Revision 0, was not updated and still specified the use of Neolube on all valve stems instead of referring to the LUBQ program for the appropriate lubricant. Failure to incorporate the LUBQ requirement to use EP-1 on MOV stems in Procedure BWFP-1 is an example of a violation of 10 CFR 50, Appendix B, Criterion V, which requires, in part, that activities affecting quality shall be prescribed by documented instructions, procedures, or drawings, of a type appropriate to the circumstances. (456/92005-02B(DRS); 457/92005-02B(DRS)).

The licensee does not perform periodic refurbishment of actuators. Instead, refurbishment is based solely on the results of trending operator performance. This is in accordance with the manufacturer's recommendations. No effective acceptance criteria were available, but corporate CECO indicated a prior commitment to provide finite acceptance criteria to correct this deficiency. The inspectors suggested that the licensee also consider the possibility that trending alone may be insufficient to detect actuator degradation and wear. Some forms of wear may not be detectable until the actuators are virtually inoperable. In such a case, periodic visual inspections may provide a measure of added assurance.

(4) Training

The NRC inspectors reviewed the training provided to personnel performing work associated with the implementation of the Braidwood MOV program. The MOV training program at Braidwood was considered acceptable.

(5) Operating Experience and Vendor Notification

The NRC inspectors reviewed applicable procedures and discussed the process for handling various information notices from different sources. The licensee has taken steps to ensure that information received was screened, evaluated and maintained by appropriate organizations and that appropriate actions were planned. The Braidwood program for the processing and control of operating experience and vendor notifications was found to be acceptable.

The inspectors informed the licensee that the Limitorque nameplate, and other information documents issued by

Limitorque may have inaccurate information. For example, Limitorque is known to have installed some 10 ft-lb motors in place of 7.5 ft-lb motors without changing the information on the nameplate. Such a change could have an impact on thermal overload sizing calculations, degraded voltage calculations, and the weak link analysis. Some MOV users have indicated that other nameplate information such as the "over-all-ratio" may be inaccurate. Limitorque recently stated publicly (at the MOV Users Group meeting in February 1992) that nameplate information may not be correct. The licensee should take steps to ensure that information used is accurate.

(6) Diagnostics

The licensee uses the Valve Operational Test Equipment System (VOTES) to test MOVs under both static and dynamic conditions. The licensee plans to incorporate the use of a "torque measuring device" with existing equipment to allow the measurement of spring pack displacement as well as thrust delivered to the valve. This will allow the quantification of actual stem factors experienced during valve operation, which is essential in order to justify stem factors used in calculations. Currently, the licensee can only quantify the stem factor at torque switch trip.

(7) Walkdown

The inspectors performed a general inspection of the plant as well as a detailed inspection of MOVs. In general, housekeeping appeared to be good, except for the 1B SI pump room and the service water pump room, where some improvements were needed. There was inconsistent lubrication on some valve stems. This was attributed to weaknesses in the lubrication program. Several valves had obvious packing leaks and had been previously identified as being in need of maintenance, however, no WRs were written. These issues are discussed in greater detail in paragraphs 3.a.(6) and 3.b.(3) of this report.

4. Licensee Self Assessment

The licensee had no plans to perform a self-assessment of the conformance of the MOV program to the commitments of the "CECo Response to Generic letter 89-10" attached to CECo letter dated September 28, 1990. A quality assurance audit of corporate engineering's conformance to NOD-MA.1 was completed, but assumed the corporate document complied with the commitments. A corporate inspection of Braidwood's implementation of NOD-MA.1 is planned but will not address conformance to the NRC commitments directly. Self-assessment in the MOV area at Braidwood Station was considered to be a weakness.

5. Unresolved Items

Unresolved items are matters about which more information is required in order to ascertain whether they are acceptable items, items of noncompliance, or deviations. Unresolved items disclosed during this inspection are discussed in paragraphs 3.a.(2)(b) and 3.a.(4) of this report.

6. Exit Meeting

The inspectors met with licensee representatives (denoted in Paragraph 1) at the conclusion of the inspection on March 6, 1992. The inspectors summarized the purpose and scope of the inspection and the findings. The inspectors informed the licensee of the violation and two unresolved items identified during this inspection. The inspectors also discussed the likely informational content of the inspection report with regard to documents or processes reviewed by the inspectors during the inspection. Several documents were identified as proprietary but were not noted in this report.