

U. S. NUCLEAR REGULATORY COMMISSION

REGION III

Reports No. 50-295/90034(DRS); No. 50-304/90034(DRS)

Docket Nos. 50-295; 50-304

Licenses No. DPR-39; No. DPR-48

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

Facility Name: Zion Nuclear Power Station - Units 1 and 2

Inspection At: Zion Site, Zion, IL 60099

Inspection Conducted: December 17-21, 1990

Inspector: *D. F. Smith*  
D. F. Smith

1/10/91  
Date

Approved By: *D. H. Danielson*  
D. H. Danielson, Chief  
Materials and Processes Section

1/10/91  
Date

Inspection Summary

Inspection on December 17-21, 1990 (Reports No. 50-295/90034(DRS);  
No. 50-304/90034(DRS))

Areas Inspected: Routine, announced safety inspection of inservice testing (73756) with emphasis on resolution of motor operated valve (MOV) issues disclosed by the Diagnostic Evaluation Team (DET) inspection conducted at the Zion Station June 4 through June 29, 1990 (92701).

Results: Within the areas inspected, one violation was identified and closed as a result of corrective action already taken. Three open items were closed. The MOVs in the IE Bulletin 85-03 program were found to be tested in accordance with the Bulletin, and correct torque switch setpoints (or thrusts) were established, recorded, and controlled. The licensee has demonstrated significant improvement in implementation of the program for motor operated valves.

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## DETAILS

### 1. Persons Contacted

#### Commonwealth Edison Company (CECo)

- \*T. Joyce, Station Manager
- \*P. F. Cantwell, Assistant Technical Staff Supervisor
- \*L. B. Cerda, MOV Coordinator
  - R. Branson, Nuclear Engineering Department
  - K. Brennan, ENC Regulatory Assurance
  - R. Rybak, Nuclear Engineering Department
- \*T. Saksefьki, Regulatory Assurance
- \*C. Schulz, Quality Control Supervisor
  - B. Shelton, Nuclear Engineering Department
- \*W. Stone, Assistant to the Technical Superintendent
- \*W. D. T'Niemi, Technical Staff Supervisor

#### U. S. Nuclear Regulatory Commission (NRC)

J. D. Smith, Senior Resident Inspector

\*Denotes those participating in the exit interview conducted on December 21, 1990.

### 2. Licensee Action on Previous Inspection Findings (92701)

#### a. (Closed) Unresolved Item (295/90014-01(DRS); 304/90016-01(DRS)):

Torque switch settings did not reflect settings of licensee records for MOVs. Additional review of this item resulted in its reclassification as a violation. Further discussion of this subject is included in Paragraph 3 of this report. This unresolved item is closed.

#### b. (Closed) Unresolved Item (295/90014-02(DRS); 304/90016-02(DRS)):

Torque switch bypass for MOVs did not conform to corporate guidelines. The torque switch bypass settings which were in question were observed on either two rotor operators or on four rotor operators which were wired the same as two rotor operators. CECo corporate guidance indicated that torque switch bypass of 25% to 35% was appropriate for MOVs used in nuclear power plants. The nuclear power industry approach is generally similar to this. However, that philosophy is only valid for operators with four rotors because this permits functional separation of the torque switch bypass rotor from the position indicating rotors (which also control the stroke timing).

The licensee recognized the problem inherent in the use of operators with only two rotors and acted accordingly. The interim

compromise was to use the minimum required torque switch bypass and thereby minimize the error in position indication. This was reported by Zion in their response to the corporate guidance. The purpose of the torque switch bypass is to prevent torque switch trip while the obturator is being disengaged from the seat on the opening stroke. Previous testing in the industry had indicated that a bypass of at least 25% would encompass the high-load portion of the opening stroke of all valves tested at that time. However, this was extremely conservative. Some valves needed no more than a 5% bypass to provide protection from spurious torque switch tripping. Instead of following the all-encompassing "generic" bypass setting, the licensee elected to base the individual MOV setting on the loads actually observed on each MOV. The NRC inspector reviewed the data from which the torque bypass was established. In every instance, the torque switch setting conformed with the licensee's procedures approved for use at that time. Had the licensee immediately complied with the corporate guidance, the position indicating limit switches (and the measured stroke time) would have displayed materially greater error as a result. The licensee's actions appear to have been appropriate for the conditions observed and the knowledge available at the time.

The licensee committed to modify all MOVs with both torque switch bypass and position indicating switch requirements to the four rotor variety. In the meantime, a new procedure was being written to require stroke timing of MOVs wired for two rotor operation from the motor control centers. This method measures the motor run time and is independent of position indicating light switches. The NRC inspector agreed that this was a practical temporary alternative. Training in the use of this procedure was also being prepared. These items were included in the Zion Performance Improvement Plan (PIP) Decision Planning Worksheet.

The principal problem involved in the use of two rotor operators outside of stroke timing is that the indication for a closed valve may appear up to 25% of the stroke prior to the time when the valve is actually closed. In most cases, this is of little consequence, because the close switch "seals-in". This means that a momentary actuation of the close switch causes the switch to hold in the close position until the valve is fully closed. As a result, the lights show the valve to be closed sooner than it really is closed, but that the motor will continue to operate until the valve is fully closed. Some valves do not have the seal-in option. These are valves which are used for throttling. These valves open and close only during the time that the operator actuates them. At Zion, these valves are identified in the control room by extra long operating handles. At remote operating positions, these MOVs are identified by tags on the panels by the switches. The NRC inspector confirmed that the licensee has completed the training of all operators to recognize the condition and to hold the handles in the close position for a time

sufficient for the MOV to fully close. The licensee has taken appropriate action to deal with this issue and corrective action is already in process. This unresolved item is closed.

c. (Closed) Unresolved Item (295/90014-03(DRS); 304/90016-03(DRS)):

MOV position indicating light switches were improperly set. Several MOVs were found to have their position indicating light switches set to show that the valve was closed when it was as much as 25% open. These operators were wired as two-rotor operators in which the functions of torque switch bypass and position indicating light switch are not separated. By setting the torque switch to give the commonly accepted 25% bypass to prevent torque switch trip during the disengagement of the obturator and the seat, the position indicating light switch was moved along with it, with the result that the error in closure indication was incurred.

As indicated in the discussion of torque switch bypass setting, the licensee was aware of this problem before it was detected by the Diagnostic Evaluation Team (DET), and was in the process of correcting it at that time. The operators were informed of the problem and the NRC inspector confirmed that the operators have received training in proper operation of the affected equipment until the two-rotor wiring has been replaced with four-rotor wiring. The licensee has addressed all the potentially detrimental aspects of this problem. This unresolved item is closed.

3. Licensee Action on IE Bulletin 85-03 (73756)

In a memorandum dated September 4, 1990, the Executive Director for Operations of the NRC described a number of findings related to the Zion Diagnostic Evaluation Team and included actions to be taken to resolve each of them. Actions required to resolve Issue #3 of that memorandum included inspection to ensure that I.E. Bulletin (IEB) 85-03 motor operated valves are tested in accordance with the bulletin and that correct switch setpoints (or thrusts) are established, recorded and controlled. The inspection was considered to be the responsibility of Region III, Division of Reactor Safety and was included as a part of a routine inspection. The results of the inspection are included in this section.

a. (Closed) Violation (295/90034-01; 304/90034-01):

Torque switch settings did not reflect settings of licensee records for MOVs (previously unresolved item 295/90014-01(DRS); 304/90016-01(DRS)). The torque switch settings of some MOVs were found to be different from the values at which they were reported to be tested in accordance with IEB 85-03 with no justification for and no record of the changes. As a result of this, the



operability tests for these MOVs could not be shown to be applicable to the MOVs in their later condition.

The licensee has taken significant actions to correct the condition and to prevent a recurrence. The operability of each MOV in Unit 2 (which was in an outage at the time of the DET) was established by inspection and corrections were made as required. The operability of IEB 85-03 MOVs in Unit 1 (which was operating at the time) was established as a condition for closing a Confirmatory Action Letter, as discussed in Paragraph 3.c., "Testing of IEB 85-03 MOVs". The licensee is committed to visually confirming the adequacy of Unit 1 torque switch settings by the end of outage 12 (approximately November 1991). The occurrence of an unplanned outage provided an earlier date for performing this work, so the licensee wrote work requests to complete the inspection of Unit 1 valves during this outage. This may permit completion of this task by the end of February 1991, which is a full nine months ahead of their original commitment. A dedicated full time MOV coordinator has been appointed to oversee MOV activities and several procedures for assuring the maintenance and control of torque switch settings have been generated. These procedures are discussed subsequently in this report in Paragraph 4, "Recording and Control of IEB 85-03 MOV Switch Setpoints".

The failure to control torque switch settings is considered to be a violation of 10 CFR 50, Appendix B, Criterion III, "Design Control." The actions already taken by the licensee to correct and to prevent a recurrence of this deficiency are considered appropriate and adequate. This violation is closed.

b. Establishment of Torque Switch Settings

The establishment of torque switch settings at Zion Station is performed by the Nuclear Engineering Department (NED) at corporate headquarters. At present, the process is still split between retention of torque switch settings originally recommended by the equipment manufacturers and thrust values established by calculation of thrust required at the most severe conditions under which the MOV might be called upon to operate.

The need for two different bases for setting torque switches is the result of the fact that the licensee has not completed the initial testing of all MOVs using the Valve Operation Test and Evaluation System (VOTES). Without the VOTES equipment, the technician cannot set the MOV to a prescribed thrust value. In such cases, NED confirms the adequacy of the manufacturers recommendations by calculation and provides torque switch settings which are calculated to provide the required thrust.

When the torque switch setting requirements are transmitted to the station, they are in the form of a "window" within which the torque switch must be set. The lower value in the window is the

minimum torque switch setting which is acceptable under the most demanding circumstances. The upper limit is the maximum torque switch setting which can be applied to this MOV without jeopardizing the structural integrity of the unit. Setting changes which are made within the window are made at the prerogative of the station and need no approval from NED.

The specific setting of each MOV is controlled by the station. All changes within the window require station approval. MOVs which are controlled by torque switch settings are maintained at that value until the need for a change becomes obvious. Then a form specifically designed for the purpose is initiated to justify and document the change. Details of the control mechanisms are provided in Paragraph 4. Although both torque switch and thrust settings are provided for MOVs on which the VOTES system has been applied, the torque switch settings for these MOVs are considered primarily for information. Thrust at a given torque switch setting may vary with time, and the setting of significance is thrust. With time, the torque switch setting required to achieve a constant thrust would be expected to increase. This change in torque switch setting requires authorization and documentation. Although no such changes have been observed to date, the trending of torque switch settings will be performed to track deterioration of MOV condition.

The NRC inspector reviewed the records of the establishment of settings for a sample of MOVs for the Zion Station and found no conditions or calculations in the records to be of questionable origin or application. The licensee appears to have a sound basis for the establishment of all torque switch settings.

c. Testing of IEB 85-03 MOVs

Testing of IEB 85-03 valves was performed as prescribed in the bulletin, using full differential pressure and full flow to confirm operability. The test criteria were reviewed by NRC (as a part of the licensee's program) without comment or questions. Testing at full differential pressure and full flow represents the most conservative test available; no diagnostic test can provide equal assurance of operability. Diagnostic testing does not compensate for change in valve operating characteristics between valves operating in severe conditions and those operating at moderate temperature, pressure, and flow.

The full contingent of valves in the IEB 85-03 program was subjected to the principal test prescribed by that document. The MOVs were assumed to be operable because their torque switches were unchanged from the value at which they were tested. However, the licensee's control of the torque switch settings was questioned when a significant number of observed torque switch settings were found to differ from recorded settings. The discovery of this anomaly discredited the basic premise for

assuring valve operability and resulted in the issuance of Confirmatory Action Letter (CAL) RIII-90-011. Operability of the valves was subsequently established in a number of different ways and the CAL was closed by the NRC Regional Administrator in a letter dated October 17, 1990.

The licensee performed extensive historical analyses of all IEB 85-03 MOVs and conservatively confirmed that the present torque switch setting of most valves would produce at least as much torque as was available when the IEB 85-03 test were conducted. The exceptions to this are found in Unit 1, which was operating when the torque switch settings were being confirmed. Because these MOVs were in service at that time, they could not be inspected to confirm their torque switch settings. The continued use of Unit 1 MOVs which could not be inspected was justified based on one or more of the following bases:

- MOV was deenergized in the required position until torque switch setting can be confirmed.
- Procedure change eliminated high differential pressure on the valve.
- Valve was stroked periodically at or near accident differential pressures.
- Valves were recently retested at full accident differential pressure.
- Parallel valves periodically tested at or near accident differential pressures.

The licensee committed to completing the inspection of torque switch settings during the next outage (approximately November 1991). As noted in Paragraph 3.a., this work is expected to be completed by the end of February 1991.

The logic by which NED demonstrated that the previously performed operating tests could be shown to apply to valves with the observed torque switch settings was shown in a flow chart. The flow chart prescribes various courses of the analysis of MOV torque switch setting acceptability, based on the various conditions pertinent to MOVs included in the IEB 85-03 program at Zion Station. MOVs may pass through up to eight decision steps before evaluation is completed. The path used for each MOV is traced on a copy of the flow chart which is included with the record of that MOV. In addition, the justification for each decision and the operability assessment is also included in the record. The NRC inspector reviewed records for the following MOVs and found no anomalous data or reasoning:

1-MOV-SI8801A	2-MOV-SI8801A
1-MOV-SW101	2-MOV-VC112B
1-MOV-VC112B	2-MOV-VC8105
1-MOV-MV8105	2-MOV-FW0050

The licensee's analysis of MOV requirement and history demonstrated that the current torque switch settings of IEB 85-03 MOVs equal or exceed those of record at the time of the IEB 85-03 tests. Based on this evidence, the testing previously performed on the IEB 85-03 valves provides satisfactory evidence of the ability of these MOVs to perform their required function under the most severe conditions under which they may be called upon to function.

4. Recording and Control of IEB 85-03 MOV Switch Setpoints (73756)

The licensee generated ZAP 3-52-8, "Motor Operated Valve (MOV) Setpoint Change," to formally prescribe changes to be made to safety-related or nonsafety-related setpoints for MOVs. The procedure is applicable to changes in MOV torque switches, torque switch bypass, thermal overload heater sizes and thermal overload settings. It prescribes the responsibilities of personnel who may be involved with the changes including the requester, the MOV coordinator, and eight others of various disciplines including the station manager. It provides three forms which are to be used to record the following data:

- old and new parameter values;
- justification of changes;
- authorization for changes;
- identification of other documents which must be changed as a result of these changes and the times when such changes are required; and
- information to facilitate tracking of those changes of procedures, design documents and vendor manuals which may be completed after declaring the affected MOV operable.

The NRC inspector reviewed the procedure and found it to provide an effective method of avoiding uncontrolled changes in MOVs. The NED provides each nuclear power plant with MOV torque switch and/or thrust setting information based on the demands of the application and information provided by the original manufacturer. Torque switch settings for MOVs with VOTES tests are provided in the form of thrust windows. Because of mechanical efficiency losses sustained in the operator and in the valve, the same torque will not always produce the same thrust. In addition, the springs in the operator sometimes relax after long periods of compression. Because the torque switch setting is a measure of the compression of this spring, the relaxation of the



spring will result in operation of the torque switch at a lower value than that at which it was originally set. Increased friction in the gears, stem/stem nut joint and stem packing areas will also reduce the thrust delivered at a given torque switch setting. As the licensee conversion to MOV diagnostic equipment progresses, more of the MOV population will have torque switch control based on thrust, rather than torque.

The licensee is aware that periodic maintenance and testing will allow MOVs to remain within their thrust window by increasing the torque switch setting. If only the thrust window is observed, a deteriorating valve condition might be overlooked. To counteract this effect, the licensee is considering the trending of torque switch settings required to stay within the thrust window.

The licensee has elected to rely on the MOV settings recorded for each individual MOV record, rather than listing all settings on a single document which must be revised when any setting of any valve on it is changed. Although the torque switch setting of any valve is readily available on a computer data base, CHAMPS, the value in that computer program is for information. The setting of record is the hard copy of the individual MOV record. This system is somewhat cumbersome when attempting to review significant numbers of MOV switch settings, but it has the advantage of avoiding the potential for conflicting data between two sets of records.

During the period when the initial VOTES testing is being extended to the MOVs, some MOVs will be controlled by thrust windows, while those not yet tested will be controlled by torque switch setting windows. The licensee is aware of the potential problems inherent in this dichotomous treatment of MOVs, but is better equipped to deal with it than most other licensees. Zion has been dealing with the modification of original equipment for some time. They procure replacement torque switch limiter plates and match them to the characteristics of spring packs for which they have tests. By dealing with the relationship between torque switch setting and thrust on a frequent basis, the licensee is less likely to be confused by the different requirements assigned to the different groups of MOVs.

5. Exit Interview

The inspector met with licensee representatives (denoted in Paragraph 1) at the conclusion of the inspection on December 21, 1990, to discuss the scope and findings of the inspection. In addition, the inspector discussed the likely informational content of the inspection report with regard to documents or processes reviewed by the inspector during the inspection. The licensee did not identify any such documents or processes as proprietary.