# U. S. NUCLEAR REGULATORY COMMISSION

### **REGION III**

Report No. 50-331/92011(DRS)

Docket No. 50-331

License No. DPR-49

Licensee: Iowa Electric Light and Power Company IE Towers P.O. Box 351 Cedar Rapids, IA 52406

Facility Name: Duane Arnold Energy Center

Inspection At: Palo, Iowa

Inspection Conducted: June 16-26, 1992

Inspectors: Śmith Approved By J. M. Jacobson, Chief Materials & Processes Section

7-9-92\_ Date

7-9-92 Date

<u>7-9-92</u> Date

<u>7-9-9</u> Date

Inspection Summary

Inspection conducted June 16 through 26, 1992 (Report No. 50-331/92011(DRS))

<u>Areas Inspected:</u> 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 action on previous inspection findings (92702). <u>Results:</u> No violations were identified; however, the inspection disclosed one deviation (Paragraph 3.a.(2).(b)) and one unresolved item (Paragraph 3.b.(2)).

The licensee demonstrated strengths in the following areas:

 Use of operating and industry experience to assure proper condition of MOVs.

# Inspection Summary

- Use of a post maintenance testing matrix for uniform application of testing.
- Licensee self assessment.
- A Thermal Overload (TOL) Trip modification was installed to identify and show the position of tripped MOVs in the control room.

The licensee demonstrated weaknesses in the following areas:

- No review of calculations for establishing a priority schedule for testing those valves that appear most marginal.
- Degraded voltage analysis assumed an 80% value per the UFSAR without analysis of worst case examples for verification.
- Use of some non-conservative assumptions such as stem friction coefficient, valve factor, and 36 month maintenance interval without objective evidence to support their validity.

Past control of torque switch settings.

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### DETAILS

# 1. <u>Persons Contacted</u>

# Iowa Electric Light and Power Company (IELP)

#G. Van Middlesworth, Assistant Plant Superintendent, Operations and Maintenance

#R. Baldyga, Maintenance Engineering Supervisor

#M. Fairchild, Electrical Engineering Group Leader

#M. Flasch, Manager, Engineering

#L. Heckert, Licensing Specialist

#M. McDermott, Maintenance Superintendent

#K. Putnam, Technical Support Supervisor

- #K. Steimer, MOV Coordinator
- #J. Thorsteinsen, Assistant Plant Superintendent, Operations Support
  - P. Rustebakke, Training

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

M. Parker, Senior Resident Inspector

# Denotes those attending the exit meeting on June 26, 1992.

Licensee Action on Previous Inspection Findings (92702)

(Closed) Open Item (50-331/90003-13): NRR review of Relief Request PR-13 (Deletion of high side of Required Action Range for pump flow). The licensee resubmitted Relief Request PR-13 with the second 10-year Inservice Testing Program. In the SER attached to NRC Letter dated March 11, 1992, NRC indicated that relief was not required for the pumps identified. This item is closed.

(Closed) Unresolved Item (50-331/91002-08): Anomalies were identified in calculation No. CAL-IELP-E-88-05. "Limiting Power Current for DC MOVs", Revision 0. The licensee's response to each of the five observations involved was reviewed and found to adequately resolve each concern. This item is closed.

- 3. Inspection of the Program Developed in Response to Generic Letter 89-10
  - a. <u>Generic Letter (GL) 89-10 Program Review</u>

The NRC inspectors reviewed the commitments contained in the licensee's responses submitted to the NRC by letters dated December 28, 1989, and December 21, 1990. The licensee indicated that the established program did

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not consider mispositioning, which was the only exception taken to the recommendations outlined in the GL. In Supplement 4 to the GL, dated February 12, 1992, the NRC staff indicated that BWR licensees are no longer required to address inadvertent MOV operation (mispositioning) in their GL 89-10 programs.

The program document, "Iowa Electric Light and Power Generic Letter 89-10 Motor Operated Valve Program Plan," Revision 1, dated June 4, 1992, was reviewed and found to be adequate. The program document clearly defined the responsibilities of each department with respect to each aspect of the program and was current with respect to the actual implementation of the program. The document also provided a preliminary test schedule in order to meet the requirements of the GL.

# (1) <u>Scope of the Generic Letter Program</u>

The Duane Arnold plant had a total of 250 MOVs, of which 133 were in safety-related piping systems. The GL 89-10 program included 107 valves with written justification, consistent with GL 89-10 guidance, for the exclusion of 26 MOVs from the program. The inspectors reviewed system drawings for the high pressure core injection, core spray, reactor recirculation, residual heat removal, reactor core isolation cooling, and reactor water clean-up systems to check the completeness of the scope of the program.

Based on preliminary assessment, the licensee planned to test 71 of the 107 valves in the program at full dp conditions, and 24 valves at near full dp utilizing extrapolation. For the remaining 12 valves, the licensee will provide a written justification as to why full dp testing is not practicable.

The scope of the program was consistent with the guidance of GL 89-10.

- (2) <u>Design Basis Reviews</u>
  - (a) <u>Differential Pressure Requirements</u>

The NRC inspectors reviewed design guide DGC-M112, "Design Basis Review and Calculation of Maximum Expected Differential Pressure for GL 89-10 MOVs," Revision 0. The design guide was found to meet the guidance of the GL and require the use of conservative assumptions. However, at the time of the inspection, no calculations had been actually performed in accordance with the design guide. The licensee indicated that dp calculations would be completed as required to support the testing schedule and this was determined to be reasonable.

#### (b) <u>Reduced Voltage Capability</u>

Preliminary calculations indicated that the 80% minimum MOV terminal voltage required by Section 8.2.2.2.5 of the UFSAR could not be met by four safety related MOVs. This is considered to be a Deviation of commitments in the UFSAR (50-331/92011-01(DRS)).

The licensee evaluated the effect of lessthan-80% voltage on MOV operability and preliminary calculations confirmed that the torque generated by the valves at the degraded voltage was still adequate to assure MOV operability.

The licensee agreed to expedite the final calculation of torque switch settings and full-dp testing of these MOVs, but noted that there were restraints which influenced the time when the work could be done. To some extent, the ability to perform calculations and testing would depend on the response of equipment manufacturers to requests for information and on the point in reactor operation when testing is possible. Within these limitations, the intent was to complete the testing of these MOVs as soon as practical.

### (3) <u>MOV Switch Settings</u>

The GL 89-10 program document provided the MOV switch setting and sizing methodology in Design Guide DGC-E108, "Design Guide for Limitorque Motor Operators," Revision 4, dated June 15, 1992. The general approach was conservative and consistent with the industry approach with the exception of several assumptions which required further justification. These assumptions included coefficient of friction, valve factor, and margins to account for degradation, torque switch repeatability, and rate-of-loading, as discussed below.

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Limitorque recommends the use of a coefficient of friction  $(\mu_s)$  for the stem/stem nut interface of 0.2 unless otherwise specified by the valve manufacturer. For most applications a  $\mu_s$  of 0.15 was used without adequate justification. The licensee is expected to justify the use of a  $\mu_s$ less than 0.2, when applicable. Justification that includes only static diagnostic testing may not be acceptable because of uncertainties in the relationship between the performance of MOVs under static and design basis conditions. Also, without a means to measure torque directly, the calculation for friction coefficient is only an approximation. The licensee indicated intent to obtain a torgue measuring device, which would enable much more accurate friction coefficient analysis. Diagnostic testing under design basis conditions at the end of the maintenance period would provide the greatest level of confidence that the assumed  $\mu_s$  is conservative.

Valve vendors were not contacted to identify the appropriate valve factors to use, but valve factors were assumed to be either 0.3 or 0.4 for gate valves. Industry test data has shown that the use of these valve factors may be inadequate. Furthermore, some valve manufacturers have recommended higher valve factors. The licensee planned to obtain the manufacturers' recommended maximum thrust values and should obtain valve factor information from the manufacturer to support the testing schedule.

Margin to account for the degradation of the MOVs was not included in the thrust calculations; instead a 10% margin was added to the minimum thrust value to account for diagnostic equipment accuracy and torque switch repeatability. Since torque switches were normally set immediately after maintenance, additional margin should be added to account for the degradation in performance that will occur over the specified maintenance period. Typically, the stem friction factor will increase over the time interval and will, in effect, decrease the thrust available to close a valve.

After discussions on the above issues, the licensee committed to: 1) analyze test data that becomes available in order to feedback actual values and determine MOV acceptability, 2) justify assumptions based on the actual values obtained, and 3) modify the switch setting methodology as needed to be bounding, especially for those values that will not be tested.

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# ) <u>Design Basis Differential Pressure and Flow</u> <u>Testing</u>

The licensee had not performed any design basis testing for the GL 89-10 program at the time of the inspection. Also, some calculations were completed without a review of results to identify and expedite testing of valves with low safety margin. However, efforts had been made to establish which valves would be testable and a schedule was prepared.

While the overall program plan assigned the responsibility for evaluation of test results in paragraph 3.4.2.7, there was no procedure in place to provide details at the time of the inspection. A program with definitive acceptance criteria should be developed to evaluate valve and stem factors experienced during design basis and static testing. The licensee committed to develop dp testing acceptance criteria, especially where extrapolation of results to full flow and dp conditions will be necessary. The NRC inspectors considered the slow start for dp testing to be a weakness; however, the licensee has established an aggressive testing schedule to meet the completion date prescribed in the GL.

# (5) <u>Periodic Verification of MOV Capability</u>

The plan for periodic verification of MOV capability included static diagnostic testing of MOVs every five years. The test results were to be compared with static test results performed at the same time as original full dp testing. The inspectors informed the licensee that static testing was not currently considered to be an acceptable method of periodic verification because of uncertainties in the performance of MOVs under static and design basis conditions. Justification for this approach will be required.

# (6) MOV Failures, Corrective Actions and Trending

MOV failures were reviewed by the inspectors and found to be properly documented on the corrective maintenance action requests (CMAR) forms. Also, the electrical engineering department planned a periodic review of failures for inclusion into the NPRDS program.

The licensee had developed a trending program to monitor MOV degradation, torque switch settings and current readings over time. The program indicated that data would be evaluated for trends, but did not contain specific acceptance criteria. The NRC inspectors determined that the trending program met the guidance of the GL, but could be more effective if acceptance criteria was established.

## (7) <u>Schedule</u>

The licensee was slow in beginning the scheduling of MOV testing and had not completed any full flow dp testing as part of the GL 89-10 program at the time of this inspection. The licensee was currently committed to an aggressive schedule to complete the testing within a time frame consistent with the GL. A schedule was established for testing over 40% of the MOVs during plant operation prior to the 1993 refueling outage. The schedule also included testing of MOVs during plant operation prior to the June 28, 1994 deadline.

#### b. <u>Associated Programmatic Reviews</u>

## (1) Design Control for Thermal Overload Protection

At the time of the inspection, thermal overloads were in the circuits and were sized in accordance with the original design documents. The licensee had an action item to develop new sizing criteria as part of the GL program by December 1992. This practice was within the guidance given by Position 3, Regulatory Guide 1.106, "Thermal Overload Protection for Electric Motors on MOVs," Revision 1, USNRC, March 1977 and was considered to be acceptable.

### (2) MOV Setpoint Control

The inspectors found that the licensee has had problems with control of torque switch settings in the past. The major problem was four MOVs (MO2003, MO2009, MO2132, and MO2147) that were found by the licensee to have switch settings that didn't match the design drawing, BECH E-200,

Revision 4. The drawing specified an acceptable range for the setting rather than a specific value. These particular valves were found set below the minimum value recorded on the drawing, and the corrective actions taken were to adjust all four switches to the minimum setting. In each case, a revision had been made to the drawing, altering the acceptable range without a Maintenance Action Request being initiated to adjust the actual settings in the plant.

The inspectors noted that actions have been taken to improve control of the settings. The primary mechanism for ensuring proper settings is the use of the Post Maintenance Testing matrix, which requires VOTES testing when switch settings are changed. This matrix is considered an effective tool; however, it is not a fool-proof method as was evidenced by two recent examples where the matrix was not properly followed. The matrix was later formalized as part of Maintenance Directive MD-024 to ensure its use in the future.

In the root cause analysis report, the licensee has indicated that detailed design basis calculations will be prepared by September 1, 1992 to establish critical torque switch settings, and in-plant settings will be verified. This is considered to be an unresolved item pending review of licensee actions (50-331/92011-02(DRS)).

# (3) <u>Maintenance</u>

Preventive maintenance for MOVs was accomplished by procedure VALVOP-L200-0008, "Limitorque Valve Operator Inspection and Lubrication," Revision 0. The tasks were determined to be appropriate; however, the frequency of lubrication was not in accordance with the manufacturer's recommendations. For MOVs within the GL 89-10 program, the stem lubrication frequency was 36 months, except for 8 valves located in extreme environments. The licensee will be expected to justify the lubrication frequency with test results, such as as-found testing.

Periodic refurbishment of actuators was performed every ten years as part of the PM program. The licensee also indicated that refurbishment requirements would be evaluated and modified where necessary based on the trending results from diagnostic test data and other inspections. The NRC inspectors considered the refurbishment program to be acceptable.

Maintenance Directive MD-024, "Post Maintenance Testing Program," Revision 8, specified the use of a post maintenance testing (PMT) matrix, which was determined to be an excellent tool for assuring that the proper PMT was performed for different types of maintenance. However, two weaknesses were identified with respect to the content of the PMT matrix:

- Limit switch seated valves did not require VOTES testing following torque switch adjustments. The valves must be tested carefully to ensure that the proper leak rate criteria is met and that torque switches are set high enough during static testing to allow full closure of the valve under dp and flow conditions.
- Modifications or major maintenance to the MOV after full flow, full dp testing do not currently require another full flow and full dp test, even though these operations could invalidate the previous test results.

These issues were discussed with the licensee and were to be considered for inclusion into the PMT matrix as applicable.

A "Technical Position for Adjusting Packing on MOVs" was developed, which affected post maintenance testing. The paper was based on work performed by EPRI, various valve and packing manufacturers, and DAEC. The position was further reinforced by ASME Code Committee replies to DAEC inquiries.

The observations on which the position is based were as follows:

- The friction load on the stem is directly proportional to the applied packing gland torque, even when torque is reduced from a higher value.
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- The friction load on the stem is reduced with valve operation and packing consolidation for a given packing gland torque.

The inspectors indicated that the original EPRI information may not be directly applicable to the MOVs in the DAEC plant because of a difference of valve sizes, applications, and maintenance practices. The basis for deletion of testing after packing adjustment should be justified by sampling stem friction load values from DAEC plant valves in regular use.

The inspectors concluded that, with the exception of the stem lubrication frequency, maintenance was appropriate to ensure ability of the MOVs to perform the safety functions.

### (4) <u>Training</u>

The NRC inspectors reviewed course outlines, technical texts, training facilities, examinations, training records and qualification documentation for personnel performing work on MOVs. Laboratory facilities were limited and no motor-operated globe valves or butterfly valves were available to trainees. The licensee was encouraged to consider supplementing the existing training program with training on a wider variety of MOVs.

The extent and depth of the courses presented appeared to be adequate. The time allocated to presentation of the training information was considered to be appropriate for assimilation of the quantity and complexity of the course material.

Electrical maintenance personnel were not provided with extensive training in the mechanical construction and operation of valves. Such training is usually considered essential in order to provide a technical basis for carrying out the switch setting adjustments normally performed by these personnel.

There was no formal qualification of operators for the VOTES diagnostic system. Failure to properly control the qualifications for personnel permitted to operate this technically complex equipment could produce improper test results which could, in turn, influence MOV operability. The development of a formal program for ensuring the

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use of qualified personnel to operate MOV diagnostic equipment is considered particularly important to allow for transfer of personnel within and outside the DAEC organization.

Although technical updates are provided to technical staff engineers and management, there was no training routinely provided in the basic area of MOVs. Some familiarization with this subject is considered beneficial, particularly for new personnel.

# (5) Operating Experience and Vendor Notification

The NRC inspectors reviewed applicable procedures and discussed the process for handling various information notices from different sources. Steps had been taken to ensure that information received was screened, evaluated and maintained by appropriate organizations and that appropriate actions were planned. The inspectors noted that the licensee obtained accurate bill-of-sale documentation in response to a concern that Limitorque nameplate data may be incorrect. The inspectors considered this effort to be a strength. The program for the processing and control of operating experience and vendor notifications was good.

(6) <u>Diagnostics</u>

The program included the use of VOTES diagnostic equipment during static and dp testing. The planned use of the diagnostic equipment appeared to be acceptable. However, as noted in 3.b.(4), above, training and qualification of diagnostic equipment operators was not formally implemented. Future training, which was to be provided through the manufacturer's normal channels, will offer an opportunity to readily provide formal qualification of personnel.

# (7) <u>Walkdown</u>

The inspectors performed a general inspection of the plant as well as a detailed inspection of a large number of MOVs. In general, housekeeping appeared to be reasonable in most areas. The valve stems that were accessible appeared to be well lubricated and most valves appeared to be in very good condition.

### <u>Licensee Self-Assessment</u>

Licensee self-assessment in the area of MOVs was evaluated by reviewing a consultant's independent assessment of the DAEC GL 89-10 Program and an internal QA review of the program. These documents were dated May 27, 1992 and June 16, 1992, respectively. Both reviews provided objective analyses of the program and sound bases for program improvements. Essentially all of the major findings in the NRC inspection were predicted in the self-assessment documents. The thoroughness of the assessments is considered a strength. Earlier initiation of these reviews would have materially assisted the licensee in avoiding most of the findings made in this report. Timely use of such assessments could prove valuable to the licensee in the future.

### 5. <u>Unresolved Items</u>

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

# 6. Exit Meeting

The inspectors met with licensee representatives (denoted in Paragraph 1) at the conclusion of the inspection on June 26, 1992, at the Duane Arnold Energy Center. The inspectors summarized the purpose and scope of the inspection and the findings. 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. The licensee did not identify any such documents or processes as proprietary.

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