

U. S. NUCLEAR REGULATORY COMMISSION

REGION III

Report No. 50-346/92010(DRS)

Docket No. 50 346

License No. NPF-3

Licensee: Toledo Edison Company
Edison Plaza
300 Madison Avenue
Toledo, OH 43652

Facility Name: Davis-Besse Nuclear Power Station

Inspection At: Oak Harbor, Ohio

Inspection Conducted: July 13 through July 29, 1992

Inspectors: *G. D. Replogle* 8-20-92
G. D. Replogle Date

C. A. Gainty 8-20-92
C. A. Gainty Date

D. M. Liao 8-20-92
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Approved By: *J. M. Jacobson* 8-20-92
J. M. Jacobson, Chief Date
Materials & Processes Section

Inspection Summary

Inspection conducted July 13 through July 29, 1992
(Report No. 50-346/92010(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 action on previous inspection findings (92701).

Results: The inspection disclosed one deviation (Paragraph 3.a.(4)), one unresolved item (Paragraph 3.b.(3)), and two open items, (Paragraphs 3.a and 3.a.(2)(b)).

The licensee demonstrated strengths in the following areas:

- ° The Potential Condition Adverse to Quality Report (PCAQR) review process ensured thorough root cause evaluations and corrective actions.

- The licensee assumed the lead in the Electrical Power Research Institute (EPRI) Lubrication Testing Program.

The licensee demonstrated weaknesses in the following areas:

- Thrust and dp calculations to support the program were not complete.
- Guidance was not given for determining new open torque switch settings.
- The licensee had not completed a significant amount of differential pressure (dp) testing.
- Valves that were dp tested greater than five years ago had not been retested in accordance with the recommendations for periodic verification contained in the GL.
- Comprehensive programs to trend and evaluate data from MOV testing did not exist.
- Post maintenance testing requirements were not formalized into procedures.

DETAILS

1. Persons Contacted

Toledo Edison Company (TE)

L. Storz, Plant Manager
J. Barron, Supervisor, Test Engineering
J. Hayes, Senior Nuclear Technologist
P. Jacobsen, Supervisor, Design Engineering Electrical
S. Jain, Engineering Director
G. Laird, Electrical Maintenance
M. Parker, Supervisor, Station Performance
N. Peterson, Licensing Engineer
D. Schreiner, Supervisor, Operations Assessment
F. Szanyi, Performance Engineer

U. S. Nuclear Regulatory Commission (NRC)

J. Hopkins, Licensing Project Manager
J. Jacobson, Chief, Materials and Processes Section
K. Walton, Resident Inspector
J. Zwelinski, Assistant Director for Region III Reactors

The persons listed above attended the exit meeting on July 29, 1992.

2. Licensee Action on Previous Inspection Findings (92701)

(Closed) Open Item 50-346/89201-01: The licensee did not consider the high pressure injection pump discharge check valves, HP 22 and 23, as pressure isolation valves (PIVs). In a note at the end of Table II in the licensee's response to the GL 87-06, HP 22 and 23 were included as two valves that provided the second boundary between the high and low pressure piping. Since the testing and Technical Specification requirements for these valves are the same as for PIVs, this item is closed.

(Closed) Open Item 50-346/89201-03: The plant startup procedures did not specify removal of control power from the decay heat removal (DHR) suction valves to prevent inadvertent operation. In addition, the high pressure injection (HPI) system was not properly vented after the performance of surveillance tests such that the HPI discharge high pressure alarm could be in the alarming condition for a prolonged period resulting in reduced operator sensitivity to an actual inter-system loss of coolant accident event. These two issues were revisited by NRC inspectors and additional details were contained in inspection report 50-346/91018(DRP). However, during that

inspection, concerns were raised regarding procedure revision and erroneous HPI discharge high pressure alarms. During this inspection, the corrective actions were reviewed by the NRC inspectors and appeared to be adequate. This item is closed.

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

a. Generic Letter (GL) 89-10 Program Review

The NRC inspectors reviewed the commitments contained in the licensee's responses submitted to the NRC by letters dated January 5, 1990, and November 6, 1990. Exceptions taken to the recommendations outlined in the GL included completion of the program by the Fall, 1994 outage (as compared to June 28, 1994, as specified in the GL) and the grouping of MOV's for differential pressure (dp)/flow testing purposes.

Although the licensee only committed to group MOVs for the purpose of dp testing, industry test data has shown that apparently identical MOVs may behave differently under design basis conditions. Furthermore, MOVs at Davis-Besse have also demonstrated inconsistent behavior during testing. For example, in October, 1986, auxiliary feedwater valves AF-599 and AF-608 (auxiliary feed to steam generator stop valves, apparently identical valves) required 25,200 and 16,500 pounds of thrust, respectively, to close under similar dp test conditions (approximately 1400 psid). Similar testing on MOVs AF-3869 and AF-3870 also revealed that those valves behaved differently. As such, grouping of MOVs for the purpose of dp testing may not provide an acceptable level of confidence that untested MOVs could perform their safety functions under worst case conditions. The licensee agreed to provide technical justification for the grouping of some MOVs. This will be considered an open item pending NRC review of the technical justifications for grouping. (Open Item 50-346/92010-01(DRS))

Several tasks, such as differential pressure and thrust calculations, were not complete at the time of the inspection. These calculations would normally be expected to be complete at an early stage in the program because other tasks, such as torque switch setting adjustments and design basis testing, are

dependent on the results from the calculations. The failure to complete differential pressure and thrust calculations in a timely manner may have a negative impact on the schedule and was considered to be a weakness.

(1) Scope of the Generic Letter Program

The NRC inspectors reviewed system drawings for auxiliary feedwater, component cooling, and makeup and purification systems, as a sample check for the completeness of the scope of the GL 89-10 program. There were 154 MOVs included in the program at Davis-Besse Station. The scope of the program appeared to be consistent with the guidance contained in the GL.

(2) Design Basis Reviews

(a) Differential Pressure Requirements

The NRC inspectors reviewed a sample of dp calculations and discussed the methods for performing the calculations with licensee personnel. The information reviewed and discussed appeared to be acceptable.

(b) Reduced Voltage Capability

Degraded voltage calculations to determine the worst case AC motor terminal voltages were complete, but several weaknesses were identified. For example, cable resistances were based on an anticipated cable temperature of 90 degrees Celsius. The NRC inspectors determined that this assumption may be non-conservative because cable temperatures inside containment may be as high as 128 degrees Celsius during a design basis accident (LOCA). Furthermore, cables in other parts of the plant may be exposed to temperatures as high as 223 degrees Celsius during some high energy line breaks.

Additionally, degraded voltage calculations did not assume the worst case grid voltage as a starting point (as specified in the GL) but used a minimum expected voltage based on previous grid history. The NRC inspectors did not consider this approach to be conservative because a grid voltage could exist that would be less than that used in

the calculations. As such, the operability of some MOVs under those conditions would be questionable.

As a result of the concerns raised by the NRC inspectors, the licensee re-performed the degraded voltage calculations and assumed worst case bus voltage and cable temperatures. The revised calculations appeared to be acceptable.

Since the program had not progressed sufficiently to incorporate the results from the degraded voltage calculations into the MOV capability assessments, the NRC inspectors performed capability assessments on a sample of MOVs using data provided by the licensee. Some MOVs appeared to be marginal at worst case degraded voltage conditions. For example, AF-599 appeared to require 22,000 pounds of thrust under worst case conditions, but the actuator appeared to be capable of providing only 21,000 pounds of thrust to close the valve. The licensee did not consider the MOV to be inoperable because the dp used in the calculation was overly conservative. Additionally, a 0.5 valve factor was assumed and may also be overly conservative. The licensee agreed to provide technical justification to show that AF-599 is capable of performing its safety function. This is considered an open item pending further NRC review of the technical justification. (Open Item 50-346/92010-02)

The program did not consider the effects of high ambient temperatures on the performance of MOV motors. However, Limitorque was performing testing and analysis to address this issue. The licensee planned to incorporate the information from the testing into the program when it becomes available.

(3) MOV Switch Settings

The NRC inspectors reviewed procedure EN-DP-01082, "Limitorque Motor Operated Valve Thrust Calculation," Revision 00, dated April 10, 1992, and discussed the contents with licensee personnel. The document established the method for completing MOV sizing and setting calculations and assumed valve and stem friction factors to be

0.5 and 0.15, respectively. The valve factor appeared to be conservative. However, a review of old thrust calculation worksheets (based on a 0.3 valve factor) revealed that many of the valves could not support a 0.5 valve factor. As such, some valve factors may need to be reduced. The inspectors considered this approach to be acceptable provided valve factors are verified to be conservative with data from design basis testing.

Limitorque recommends that MOV users use a coefficient of friction (μ_s) for the stem/stem nut of 0.2 unless otherwise specified by the valve manufacturer. For most applications a μ_s of 0.15 was used without adequate justification. The licensee agreed to perform as-found design basis testing at the end of the specified maintenance period (and to evaluate the test data) to ensure that the actual μ_s values do not exceed 0.15. This approach appeared to be acceptable.

Guidance for determining open torque switch settings was not included in the program. Since the current program included an increased valve factor (0.5 versus 0.3) and dp calculations are being performed, adjustments to open torque switches would be expected. The licensee agreed to develop the necessary guidance to correct the deficiency. The failure to provide the appropriate guidance was considered to be a weakness.

For globe valve thrust calculations, the stem rejection term was assumed to be zero in the closing direction, which was not consistent with Limitorque calculation methods. The stem rejection term would normally be expected to be the downstream pressure times the cross sectional area of the stem, typically a value greater than zero. The licensee agreed to correct the deficiency.

Margin to account for the degradation of the MOVs was not included in the thrust calculations. Since some testing and initial setting of torque switches will be performed prior to the end of the specified maintenance period, additional margin should be in the thrust calculations to account for the degradation in performance that will occur over the remainder of the specified maintenance

period, when applicable. Typically, the stem friction factor will increase over the time interval and will, in effect, decrease the thrust available to close a valve at torque switch trip.

Margin to account for the rate-of-loading phenomena was not included in thrust calculations. Additional margin may need to be added to envelop this effect, when applicable.

(4) Design Basis Differential Pressure and Flow Testing

A significant amount of design basis testing had not been accomplished at the time of the inspection. Some dp/flow testing had been accomplished as part of the corrective actions taken in response to the June 9, 1985 loss of feedwater event; however, additional testing in response to the GL recommendations had not been started. In addition, only minor efforts had been made to determine which valves were testable and only a few testing procedures were written. The minimal effort in the area of dp testing was considered to be a weakness.

Plans for dp testing MOVs did not include valves where the test dp was estimated to be less than 70% of the full design basis dp. This approach was not consistent with the "two stage approach" defined in GL 89-10, Supplement 1, Question 37. This is considered to be a deviation of the licensee's commitments to GL 89-10. (50-346/92010-03(DRS))

(5) Periodic Verification of MOV Capability

The plan for periodic verification of MOV capability included static diagnostic testing of MOVs on a schedule consistent with the GL recommendations. However, static testing alone may not be an acceptable method of periodic verification because of uncertainties in the performance of MOVs under static and design basis conditions.

The licensee planned to take credit for testing MOVs that were dp tested in 1985 and 1986 as part of the corrective actions taken in response to the June 9, 1985 loss of feedwater event. However, the periodic verification time period (5 years) had expired for these MOVs. As such, steps should

be taken to complete the appropriate testing in a timely manner. The failure to complete the required periodic verification testing within a time frame consistent with the GL was considered to be a weakness.

(6) MOV Failures, Corrective Actions and Trending

MOV failures were reviewed and found to be properly documented on Potential Condition Adverse to Quality Reports (PCAQR). The high level of review for PCAQRs ensured thorough root cause evaluations and corrective actions, and was considered to be a strength.

A formal trending program to monitor MOV degradation did not exist. Data from motor current testing was monitored but was not formally trended. Stroke times were trended in accordance with inservice testing (IST) requirements, but data from this testing would shed little insight to most forms of MOV degradation. The licensee indicated plans to obtain trending software to enhance the current diagnostic equipment. Trending parameters such as thrust, torque switch setting, valve factor, and stem factor, are recommended and would strengthen the program. The lack of a formal trending program was considered to be a weakness.

The licensee did not have a specified refurbishment frequency for MOVs but instead based the need to overhaul MOVs on the results from motor current tests and actuator grease evaluations. However, monitoring these parameters alone may not adequately detect MOV degradation. Basing the refurbishment requirements on additional parameters from an improved trending program may be appropriate.

A program to specifically evaluate MOV test data was not in place at the time of the inspection. A program with definitive acceptance criteria should be developed to evaluate valve and stem factors, and other test data obtained during design basis and static testing. The NRC inspectors considered the lack of an evaluation program to be a weakness.

(7) Schedule

A schedule that specified the testing of MOVs was not complete at the time of the inspection, only extending to November, 1992. The licensee planned to complete all design basis testing by the fall of 1994. However, most of the testing would have to be performed in two refueling outages. Considering the large number of MOVs to be tested (both statically and at design basis conditions), the lack of completed dp and thrust calculations, and several other weaknesses in the program, completion of the program within the specified time frame would be unlikely.

b. Associated Programmatic Reviews

(1) Design Control for Thermal Overload (TOL) Protection

At the time of the inspection, TOLs were bypassed. This practice was within the guidance given by Regulatory Guide 1.106 and was considered to be acceptable.

(2) MOV Setpoint Control

The NRC inspectors reviewed applicable documentation and discussed the control of MOV switch settings with licensee personnel. The MOV setpoint control program appeared to be acceptable.

(3) Maintenance

The PM and lubrication frequency for approximately 70 MOVs was 36 months, which exceeded the manufacturer's recommended 18 month frequency. The licensee did not have adequate justification for using the extended frequency at the time of the inspection but agreed to justify the position with data from as-found design basis testing which would take place at the end of the specified maintenance period. This approach appeared to be acceptable.

The GL 89-10 program document specifications for post maintenance testing (PMT) were not consistent with the PMT Manual, Revision 02, dated July 10, 1992, which was the document used by maintenance planners in the field. In response to the concerns, the licensee agreed to update the PMT

manual to incorporate the PMT requirements specified in the program document. The failure to translate the PMT requirements into applicable procedures was considered to be a weakness.

The PMT following packing adjustments did not appear to be adequate to detect a significant increase in packing load. The testing consisted of Valve Operation Test Equipment System (VOTES) motor current and power measurements, before and after packing adjustments, with an allowable increase of 40% (which may be excessive when compared to the 10% value used at other utilities). Furthermore, due to the lack of baseline VOTES testing for most MOVs, the current and power measurements could not be compared to baseline data, a point of known packing load. In response to the concerns, the licensee agreed to revise the PMT requirements to include a VOTES thrust trace and to specify appropriate acceptance criteria following packing adjustments. The licensee also agreed to evaluate the current packing loads for safety-related MOVs in a timely manner. Pending further NRC review of this issue, this is considered an unresolved item.
(Unresolved Item 346/92010-04(DRS))

The program did not require retesting at design basis conditions for MOVs that were replaced, modified, or overhauled to an extent that the existing test results may be invalidated, although retesting under these circumstances was recommended in the GL. This issue will be revisited during a future inspection.

The licensee assumed the lead in the Electrical Power Research Institute (EPRI) Lubrication Testing Program. Participation in the EPRI program, as lead, should provide technical insight not available to most utilities. Information from the program has already been used to validate the attributes of the lubricants used at Davis Besse. The licensee's active participation in the EPRI program was considered to be a strength.

(4) Training

The inspectors reviewed course outlines, training facilities, examinations, and descriptions of on-the-job training provided to personnel performing

maintenance and testing of MOVs. The training of personnel working in the area of MOVs appeared to be 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 with licensee personnel. The program for the processing and control of operating experience and vendor information appeared to be acceptable.

(6) Diagnostics

Most torque switches were adjusted with the aid of the MOV Analysis and Test System (MOVATS). Industry testing has shown that the inaccuracies associated with MOVATS equipment may be substantially greater than originally claimed by the manufacturer. The licensee planned to respond to an upcoming supplement to GL 89-10 which addresses this issue. Since no torque switch settings were reduced as a result of using the MOVATS equipment, immediate operability concerns were not apparent. The NRC inspectors considered the approach to be acceptable.

The licensee planned to re-perform all static baseline testing with VOTES diagnostic equipment within a schedule consistent with the completion of the program in 1994. The planned use of diagnostic equipment appeared to be acceptable.

(7) Walkdowns

The inspectors performed a general inspection of the plant as well as a detailed inspection of approximately 30 MOVs. In general, housekeeping appeared to be reasonable in most areas. The valve stems that were accessible were well lubricated and most valves appeared to be in good condition. However, valves MU-6422 and DH-63 were oriented such that the motor was below the rest of the actuator, which could allow grease to enter the motor more easily. Steps should be taken to ensure that the potential for damage to the motors is minimized. Also, MOVs DH-1518 and MS-603 were oriented such that the spring-packs were at a low point on the actuators, which could increase the potential for spring-pack hydraulic lock. The licensee planned to follow up on this issue with

PCAQR 90-0423. Corrective steps will be reviewed during a future NRC inspection.

4. Licensee Self-Assessment

The self-assessment performed to evaluate the GL 89-10 program appeared to be comprehensive. Although most of the issues raised during the NRC inspection did not appear to be adequately addressed and resolved in the self-assessment (such as degraded voltage concerns, PMT requirements, and requirements for design basis testing), many of the issues were complex. As such, a self-assessment team, not normally working with MOV issues on a daily basis, would not be expected to make these findings. The self-assessment did, however, focus additional management attention on the MOV program. The NRC inspectors considered the effort in the area of self-assessment to be acceptable.

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. An unresolved item disclosed during this inspection was discussed in Paragraph 3.b.(3) of this report.

6. Open Items

Open items are matters which have been discussed with the licensee, which will be reviewed further by the inspectors, and which involve some action on the part of the NRC or licensee or both. Open items disclosed during this inspection are discussed in Paragraphs 3.a and 3.a.(2)(b).

7. Exit Meeting

The inspectors met with licensee representatives (denoted in Paragraph 1) at the conclusion of the inspection on July 29, 1992 at the Davis-Besse Nuclear Power Station. 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 during the inspection. The licensee did not identify any such documents or processes as proprietary.