Consumers Power
POWERING MICHIGAN'S PROGRESS

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DOCKET 50-255 - LICENSE DPR-20 - PALISADES PLANT -
COMPLETION OF IE BULLETIN 85-03 PROGRAM

Enclosed is the final Palisades response concerning IE Bulletin 85-03, "Motor Operated Valve Common Mode Failures During Plant Transients Due to Improper Switch Settings." Consumers Power Company has also submitted correspondence in a letter dated September 17, 1987 which provided an updated response to the IE Bulletin and superseded our May 15, 1986 submittal. Additional information was also submitted in letters on July 31, 1987 and September 4, 1986.

The NRC special safety inspection conducted during October 26-30, 1987 identified four open items that are discussed in Report No 50-255/87-028(DRS). We have addressed these open items within this letter as follows: Item 255/87028-01 is discussed below under the response to Item c; Item 255/87028-02 is covered in Item c response with data given in tables 5 and 6 (attached); Item 255/87028-03 is also covered in Item c below and data in tables 5 and 6; and open Item 255/87028-04 is discussed in Item d below and in Attachment E. The NRC inspection conducted during the 1987 maintenance outage entailed reviewing Consumers Power Company's bulletin response update, reviewing drawings, procedures, and engineering records; discussion of the valve test program being implemented and review of test data.

Below are our complete responses to Items a thru d from IE Bulletin 85-03.

ITEM a

Review and document the design basis for the operation of each valve. This documentation should include the maximum differential pressure expected during both opening and closing the valve for both normal and abnormal events to the extent that these valve operations and events are included in the existing, approved design basis, (ie, the design basis documented in pertinent licensee submittals such as FSAR analyses and fully approved operating and emergency procedures, etc.). When determining the maximum differential pressure, those single equipment failures and inadvertent equipment operations (such as inadvertent valve closures or openings) that are within the Plant design basis should be assumed.

IE11

RESPONSE

System evaluations and modes of valve operation are included as Attachment A to this submittal which updates with test data the information submitted on September 17, 1987. An error on page 2 of Attachment A in the September submittal has been corrected. The previous submittal indicated the HPSI isolation valves were normally open. They are normally closed. Also, included as Attachment B is the differential pressure test basis which justifies pressures used during testing.

Combustion Engineering (CE) as part of an owners group effort provided maximum differential pressures for the valves listed in Attachment A, with the exception of the Safety Injection Bottle Isolation Valves (MO-3041, 3045, 3049 and 3052). An evaluation of the affected systems (ie, high pressure injection and auxiliary feedwater), which postulated various system operating modes and design basis events both upstream and downstream of the valves, resulted in the determination of maximum differential pressures. These maximum differential pressures, associated with the affected valves, are representative of the maximum pressure producing capabilities of system equipment, when subjected to the postulated events. Consumers Power Company (CP) determined the maximum differential pressures for the SI Bottle Isolation Valves, and reviewed the maximum differential pressures provided by CE.

Attachment A identifies:

- each valve by Palisades tag number
- valve function
- postulated upstream and downstream conditions
- valve to system orientation by schematic
- valve/operator descriptions
- and the maximum differential pressure each valve will experience during valve opening or closure

This review resulted in some changes to the values provided by CE. The changes are discussed in Attachment B "Differential Pressure Test Basis".

ITEM b

Using the results from Item a above, establish the correct switch settings. This shall include a program to review and revise, as necessary, the methods for selecting and setting all switches (ie, torque bypass, position limit, over load) for each valve operation (opening and closing).

RESPONSE

Provided below is the basis used in determining correct torque switch settings (via target thrust windows) based on the maximum differential pressures described in response to Item a, and torque switch and limit switch setting procedures.

Establishment of Torque Switch Settings

Thrust calculations were performed using maximum differential pressure, valve and operator data from field walkdowns and valve and operator data supplied by the vendor, as described in the Palisades Methodology Document (Attachment D). A comparison of these values was made in order to establish conservative values from which target thrust windows could be derived. Parallel to this effort, field walkdowns and vendor information was obtained for each Limitorque operator. An engineering evaluation, using conservative values was performed in order to ensure that the operators were capable of producing enough thrust to open or close the valve, when subjected to the differential pressures, without exceeding the capability of either the valve or the operator.

Based upon this engineering evaluation, a target thrust window was established for each operator. The torque switches for the valves were adjusted, as necessary, allowing the operator to produce a stem thrust that corresponds to the target thrust window established above. Target thrust windows are provided in Table 1.

Torque Switch, Limit Switch and Position Indication Switch Setting Methodology

Torque and limit switch setpoints of the valve operators were set and confirmed using MOVATS diagnostic equipment. All plant Limitorque motor operators switch setpoints are controlled via the modification process. All torque switch settings are also on controlled drawings. The technical basis and policies pertaining to these setpoints, provided by MOVATS, are contained in Attachment C, Switch Adjustment Policies and Justifications.

Listed below are the switches for which setpoint policies were required. Also listed are the policies which were not included in Attachment C.

A. Open Torque Switch - see Attachment C

As shown in Table 4, only four operators (MO-3080, 3081, 3082 and 3083) have torque switches which are active during valve opening. The torque switch for these valves acts as a backup to the limit switch, since all of the valves have been set using the open limit switch.

Thrust values shown in the Control Switch Trip (CST) column, reflect the thrust required to trip the torque switch in the open direction. However, these values can only be achieved if limit switch failure occurs, which is very unlikely. The torque switch will also trip on high opening torque past the torque switch bypass, see C below for switch setting policy.

B. Open Limit Switch - see Attachment C

C. Close-to-Open Torque Bypass Limit Switch - see Attachment C

D Open Indication Limit Switch

The policy to be utilized at Palisades for the open indication limit switch will have the open indication limit switch set at the same point as the open limit switch. Each of the valves has an open limit switch and will be set per B. above.

E. Close Torque Switch - see Attachment C

F. Close Limit Switch - see Attachment C

G. Open-to-Close Torque Bypass Limit Switch - see Attachment C

H. Close Indication Limit Switch

The policy to be utilized at Palisades will be to have the close indication limit switch set at the same point as the close limit switch, if a close limit switch exists for the valve. If the valve is designed to close on torque, ie, no close limit switch, the close indication limit switch will be set within 3% of valve travel from the fully closed position.

In no case will the closed indication limit switch be set at the same position as the close-to-open torque bypass limit switch (see Attachment C, Item II-C3). This is prevented by using four limit switch rotors instead of two.

ITEM c

Individual valve settings shall be changed, as appropriate, to those established in Item b above. Whether the valve setting is changed or not, the valve will be demonstrated to be operable by testing the valve at the maximum differential pressure determined in Item a above with the exception that testing motor operated valves under conditions simulating a break in the line containing the valve is not required. Otherwise, justification should be provided for any cases where testing with the maximum differential pressure cannot practicably be performed. This justification should include the alternative to maximum differential pressure testing which will be used to verify the correct settings.

NOTE: This bulletin is not intended to establish a requirement for valve testing for the condition simulating a break in the line containing the valve. However, to the extent that such valve operation is relied upon in the design basis, a break in the line containing the valve should be considered in the analyses prescribed in items A and B above. The resulting switch settings for pipe break conditions should be verified, to the extent practical, by the same methods that would be used to verify other settings (if any) that are not tested at the maximum differential pressure.

RESPONSE

Addressed below are the as-found condition of the valves, the as-left torque switch setting corresponding to the thrust window determined in response to Item b and justification of valve operability by testing or alternate methods.

As-Found Conditions

Consumers Power Company selected MOVATS, Inc., to perform diagnostic testing of the valve operators, at the Palisades Plant. Prior to operator refurbishment, as-found diagnostic testing was performed on each of the valves and valve operators. Results of the opening and closing diagnostic testing are contained in Table 2. Even though three valves (MO-3062, 3066 and 3068) were identified as exceeding both the valve and operator thrust ratings during closing, neither equipment inspection nor diagnostic testing results revealed valve or operator damage. Therefore, all plant valves were considered operable during past operation.

As-Left Switch Settings

Following the as-found diagnostic test, operator and valve maintenance was performed by Babcock & Wilcox Field Services Division, using Consumers Power approved procedures. Upon maintenance completion, the torque switch and limit switch setpoints on each operator were set using the guidelines described in response to Item b and verified by MOVATS Signature Analysis. As mentioned previously, the target thrust windows were used to establish the as-left torque switch settings. Both the as-left torque switch settings and associated thrusts are provided in Table 3 "As-Left Closing Thrust Results" and Table 4 "As-Left Opening Thrust Results".

Demonstration or Justification of Valve Operability

Differential pressure testing was accomplished on fourteen (14) of the twenty-four (24) valves, in order to demonstrate operability. Due to plant conditions, differential pressure testing was not achievable on the untested valves. However, conclusions can be reached on six (6) of the remaining ten (10) untested valves, since they are similar (redundant valves) to some of the tested valves. Consumers Power has concluded that the remaining four (4) untested valves do not require a demonstration of operability. These four safety injection bottle isolation valves (MO-3041, 3045, 3049 and 3051) are electrically locked open prior to plant startup.

Testing was achieved by pressurizing the affected system under full flow (not hydrostatically) and verifying valve opening and closure, via light indication in the control room. This method was used in lieu of using MOVATS data base, since the valves did not fall onto their design curves.

In addition to justifying operability by differential pressure testing, ten (10) of the tested valves were monitored with MOVATS diagnostic equipment during differential pressure testing. The data obtained on the ten valves was analyzed to establish thrust margin. In the event that pressurization equal

to the maximum differential pressure was not achievable (see Attachment B "Differential Pressure Test Basis"), extrapolation was used to determine the dP thrust at the maximum differential pressure. The actual margin available was determined by subtracting the maximum differential pressure thrust from the thrust measured at control switch trip. (This margin will be used to determine valve operability following future valve repairs or adjustments with the use of a motor load test from the motor control center, see Attachment E for the long term operability program.) If the margin is greater than the running load, operability is confirmed. However, in many cases, the magnitude of the running load thrust cannot be quantified, if it is less than the spring pack preload. In such cases, the running load is assumed to be less than the margin. Preload is the amount of precompression applied to the belleville spring during assembly. Running load is the amount of thrust required to actuate the valuve (without dP, unseating on seating thrust).

During the next refueling outage the remaining four HPSI valves (MO-3007, 3009, 3011 and 3013), three of the four HPSI hot leg injection valves (MO-3081, 3082 and 3083) and one Auxiliary Feedwater Valve (MO-0753), after valve repairs will be tested, as close as possible, against the maximum differential pressures (see Attachment B) with the MOVATS diagnostic testing equipment attached during testing to gather more data.

A summary of the testing performed is provided below and specifics are shown in Tables 5 and 6.

* Auxiliary Feedwater valves (MO-0743, 0748, 0753, 0754, 0755, 0759, 0760 and 0798).

All of the Auxiliary Feedwater valves were demonstrated to be operable (opened and closed) during the differential pressure test. However, MO-0753 exibited a test discrepancy which is discussed below. Positive indication and diagnostic equipment was used to monitor the performance of each of these valves.

During the dP test, MO-0753 failed to fully seat against a differential pressure of 1524 psid. Control room indication did not display fully closed even though line flow was stopped. The valve was determined to be approximately 0.2 inches from fully closed torqued shut position by comparison with static conditions. The close torque switch tripped at a thrust of 10,700 lbs. The valve successfully opened on demand under dP conditions and stroked closed sufficiently to stop flow and therefore is considered operable. Valve guides are suspected to be the cause of MO-0753 to "torque out" prior to the full close position. The severity of the condition, determined by Consumers Power Company, is negligible to the auxiliary feedwater system, at this time, since MO-0798 is the in series redundant isolation to MO-7053 and it tested successfully against the differential pressure. Valve inspection is planned for the next refueling outage to determine the root cause of the problem.

* Redundant HPSI Valves (MO-3062, 3064, 3066 and 3068)

Operability on these four valves was demonstrated by successful opening and closing against a differential pressure which was within 5 psi of the maximum

differential pressure. This difference is deemed to be negligible when compared to the capability of the operator, therefore operability is demonstrated.

HPSI Valves (MO-3007, 3009, 3011, and 3013)

Differential pressure testing was not performed on these valves due to plant condition. Therefore, operability is justified by establishing similarity with the redundant HPSI valves (MO-3062, 3064, 3066 and 3068). The capability of the HPSI valves are identical to the redundant HPSI valves since they are the same size, were purchased from the same manufacturer, have the same operator order numbers, are required to open or close against the same differential pressure, and since they generate approximately the same as-left thrust as shown in Tables 3 and 4. Operability is justified for these valves.

* HPSI Hot Leg Injection Valves (MO-3080, 3081, 3082, and 3083)

MO-3080 was demonstrated to be operable even though it was differential pressure tested at a pressure lower than the maximum dP established in Attachment A. MOVATS test results were extrapolated, providing the required thrust to overcome the maximum differential pressure. Table 5 identifies that the margin for this valve (10,169 psid) is much larger than the running load, thus demonstrating operability.

MO-3081 is the identical valve to MO-3080, therefore, operability is justified by similarity.

MO-3082 was differential pressure tested, with diagnostic equipment attached, at a pressure lower than the maximum dP. A negative margin resulted in the dP testing, indicating that an insufficient amount of thrust was generated to close the valve against the maximum differential pressure. During the test, the valve successfully opened against a differential pressure of 1050 psid. However, when attempting to close the valve, the valve failed to fully close against a differential pressure of 1050 psid. The close torque switch tripped at a thrust of 10,395 lbs. Closing thrust against system dP was directly measured by the use of a torque wrench to quantify the necessary thrust. The pump was turned off and the valve closed against no differential pressure. An engineering evaluation was performed, resulting in operator modifications, ie, heavier spring pack and larger motor, to provide the necessary thrust. Since MO-3083 was its redundant valve, it received the same modifications. Following modifications, as-left testing was performed but differential pressure testing was not repeated. Based upon the data obtained from testing and the modification performed these valves are operable. Differential pressure testing on these two valves will be performed at the next refueling outage.

ITEM d

Prepare or revise procedures to ensure that correct switch settings are determined and maintained throughout the life of the plant. Ensure that applicable industry recommendations are considered in the preparation of these procedures.

RESPONSE

Procedures

Babcock & Wilcox has reviewed, revised and rewritten all of Palisades Plant's Limitorque maintenance procedures to ensure that switch settings are properly set and maintained. Babcock & Wilcox was chosen to review and revise our Limitorque procedures because they are an authorized Limitorque repair facility and are adequately prepared to address all applicable industry recommendations concerning Limitorque operators. These maintenance procedures have been reviewed and approved by Palisades Plant personnel and will be used to perform all future Limitorque motor operator maintenance.

Industry information from equipment vendors, INPO (SOERs and SERs), NSSS vendors (CE ADP Infobulletins), and the NRC is reviewed and evaluated through the Palisades operating experience review program. The program is administered by the Plant Safety Engineering (PSE) group with recommendations resulting from the review of applicable items forwarded to the appropriate plant department(s) for action as necessary. Additionally, Palisades participates in the NPRDS program in which equipment failures can be tracked. Maintenance procedures will be revised as necessary to incorporate the PSE recommendations resulting from industry information. Periodic reviews (a minimum of every two years) by knowledgeable personnel also ensure the maintenance procedures contain up-to-date information.

Precautions

* Although unlubricated stem conditions and margins were included in the establishment of the target thrust windows, it is acknowledged that valve adjustments (ie, packing) or operator degradations may occur between scheduled maintenance intervals which may necessitate torque switch adjustments. In this event, an engineering evaluation would have to be made to allow torque switch adjustment.

* Since September 12, 1985, all torque switch settings have been documented on a controlled drawing. All changes to switch settings (ie, torque switch, position limit, torque bypass, etc) are evaluated and controlled via our modification process.

* Torque switch limiter plates have been ordered for each affected operator. Each limiter plate was sized to prohibit the torque switch from being adjusted to a value that would exceed the rating of either the valve or the operator.

* Also, each operator which has been tested with diagnostic equipment has been labeled, identifying that modifications or maintenance to either valve or operator must be approved by engineering.

* Preventative maintenance program and its associated periodic activities will monitor the operators to insure that they are kept in good working order. Periodic testing will also be conducted to demonstrate continued valve operability.

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Attachments