

AUG 12 1985

Mr. L. Del Butterfield, Chairman
Westinghouse Owners Group
Commonwealth Edison Company
Post Office Box 767
Chicago, Illinois 60609

Dear Mr. Butterfield:

SUBJECT: IE DRAFT BULLETIN: MOTOR-OPERATED VALVE FAILURES DURING PLANT
TRANSIENTS DUE TO IMPROPER SWITCH SETTINGS

The enclosed draft bulletin is being considered for issuance to all nuclear power reactor facilities holding an operating license or construction permit.

We would appreciate your comments on the draft bulletin and any input on the anticipated burden the bulletin may impose on nuclear utilities. Any comments received prior to August 23, 1985 will be considered in the preparation of the final draft to be presented to the Committee to Review Generic Requirements.

If you have any questions regarding this matter, please feel free to contact me or Mr. Henry Bailey of my staff. I can be reached at (301) 492-4193 and Henry at (301) 492-9006.

Sincerely,

Original signed by

G.L. for

Charles E. Rossi, Chief
Events Analysis Branch
Division of Emergency Preparedness
and Engineering Response
Office of Inspection and Enforcement

Enclosure: IE draft bulletin

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, DC 20555

, 1985

IE BULLETIN NO. 85- : MOTOR-OPERATED VALVE FAILURES DURING PLANT
TRANSIENTS DUE TO IMPROPER SWITCH SETTINGS

Addressees:

All holders of nuclear power reactor operating licenses (OLs) or construction permits (CPs) for action.

Purpose:

The purpose of this bulletin is to request licensees to develop and implement a program to ensure that switch settings on all safety-related motor operated valves are set and maintained to accomodate the most severe loading expected on these valves during design basis events.

Description of Circumstances:

On June 9, 1985, the Davis-Besse Plant experienced a complete loss of main and auxiliary feedwater. This event was described previously in IE Information Notice No. 85-50, "Complete Loss of Main and Auxiliary Feedwater at a PWR Designed by Babcock & Wilcox," dated July 8, 1985. Normally open, Limitorque motor-operated auxiliary feedwater (AFW) gate valves failed to reopen on a signal from the main control room after they were inadvertently closed during the event. While other failures also occurred in the AFW system, the failure of these two valves was itself enough to prevent AFW from reaching either steam generator. On manually attempting to open the valves, limited exercising of the valve handwheels appears to have caused relaxation of the motor-operator torque switch spring pack. This action reset the torque switch allowing existing control signals to operate, permitting the valves to fully open utilizing their motor-operators.

The results of licensee troubleshooting activities, combined with indications of valve operations during the event, led to the conclusion that the torque switch bypass limit switch in each valve's control circuit was not set to remain closed long enough to provide the necessary bypass function on valve opening with differential pressure conditions across the valve. During the event, the valves experienced a high differential pressure after closing. This caused the torque switch to open immediately upon the valve receiving an opening signal. Since the bypass switch was improperly set, this stopped valve motion. The bypass limit switch setting error revealed itself only when a

high differential pressure condition across the valve caused higher loading. The valve failures were reproduced during tests performed by the licensee with differential pressure applied across the valve. During the tests, the valves operated properly when low differential pressures were applied across them but failed to open when high differential pressures (loadings) were applied.

The valves were identified as passive in the licensee's program for inservice testing of pumps and valves under Section XI of the American Society of Mechanical Engineer's Boiler and Pressure Vessel Code. The licensee has been testing these valves during refueling outages, however, with no indication of a problem because the test was done without a differential pressure across the valve. Testing quarterly, per Code requirements for active valves, would not necessarily have revealed the valve deficiencies.

An event also occurred on May 2, 1985 at Sequoyah Nuclear Plant Unit 2 while returning to power after a reactor trip. Feedwater was being supplied through the main feedwater (MFW) system isolation valve bypass line. Actions were initiated to commence the supply of water to the steam generators through the MFW system isolation valves; however, two of the MFW isolation valves would not open. The startup was discontinued and the unit was returned to hot shutdown.

During examination to determine the reason for the valve failures, the licensee discovered that the valve stem had sheared from its disc. The disc was found in the closed position within the valve seat. The stem had suffered a fracture failure through approximately three-quarters of the diameter of the shaft, in addition to stress failure of the remaining quarter. One of the remaining valves that had not failed was examined employing the use of Motor-Operated Valve Analysis and Test Services (MOVATS) equipment. The Limitorque motor-operator on the valve uses a limit switch to control valve motion in the open direction. These MFW system isolation valves are large (18 inch diameter), fast acting (154 inch per minute travel speed) valves. Due to the high speed of these valves and the large mass of the disc, the limit switch setpoint needs to account for the large momentum of the disc and its continued motion after the limit switch deenergizes the valve motor operator. The set point was not correctly established and the disc impacted the backseat during opening. The failure mechanism of these valves was identified by the licensee to be impact loading of the stem on the opening stroke as a result of the disc impacting the backseat, combined with a stress failure of the remaining portion of the stem on the opening stroke.

As a part of the resolution of Generic Issue II.E.6, "In-Situ Testing of Valves," the NRC contracted with the Oak Ridge National Laboratory in 1984 to perform a limited study to determine the effectiveness of signature tracing techniques in determining the operational readiness of safety-related motor-operated valves. It was also hoped that this study could provide some insight as to current conditions of valve switch settings at nuclear power plants. Using MOVATS equipment, signature traces were obtained from 36 motor-operated valves at four nuclear plant sites. Although the formal technical letter report (ORNL/NRC/LTR-85-13, "Evaluation of the Motor-Operated Valve Analysis and Test System (MOVATS) to Detect Degradation, Incorrect Adjustments, and

Other Abnormalities in Motor-Operated Valves") has yet to be formally issued, the current draft of the letter report indicates that there were problems with nearly every valve tested.

Table 1 contains a summary of the study's findings with respect to switch setting abnormalities. Of particular interest with respect to the events described above is the finding that 75% of the valves had improperly set bypass switches (50% of the valves had the close-to-open bypass switch set so that it was opening before the valve unseated) and 8% of the valves were backseating.

Background:

The NRC has previously identified problems with motor operated valve switch setpoints in Bulletin No. 72-3, "Limitorque Valve Operator Failures"; Circular No. 77-01, "Malfunctions of Limitorque Valve Operators"; Circular No. 81-13, "Torque Switch Electrical Bypass Circuit for Safeguard Service Valve Motors"; Information Notice No. 82-10, "Following Up Symptomatic Repairs To Assure Resolution of the Problem"; and Information Notice No. 84-10, "Motor-operated Valve Torque Switches Set Below The Manufacturer's Recommended Value."

The relationship between backseating loads and stem failures has been previously identified in IE Information Notice 84-48, Supplement 1, "Failure of Rockwell International Globe Valves."

Copies of the above referenced NRC Bulletin, Circulars and Information Notices can be obtained from your local public document room.

Actions for All Holders of Operating Licenses or Construction Permits

For all motor-operated valves that are required to be operability tested in accordance with 10 CFR 50.55a(g), develop and implement a program to ensure that valve and operator switches are set and maintained properly. This should include the following components:

- a. Review and revise as necessary the design basis for the operation of each valve. Unless otherwise justified, the design basis shall include both opening and closing the valve with the most severe loading expected during design basis events.
- b. Using the results from a above, review and revise as necessary the proper settings for all switches (e.g., torque, torque bypass, position limit, overload) for each valve operation (opening and closing).
- c. The settings determined in item b above shall be demonstrated to be correct by testing the valves at the most severe loadings determined in item a above. Justification should be provided for any cases where testing with the most severe loadings expected during design basis events can not be performed to demonstrate correct switch settings. This justification should include the alternative to testing which will be used to ensure

correct settings. Prototypical testing may be substituted for individual valve tests where justified. However, each valve shall be stroke tested to the extent practical to verify that the settings defined in item b above have been properly implemented.

- d. Prepare or revise procedures to ensure that correct switch settings are utilized throughout the life of the plant.*
- e. Within 120 days of the date of this bulletin, submit a written report to the NRC which describes the program to accomplish items a through d, above, and which contains a schedule for completion of the items.
 - 1. For plants with an OL, the schedule shall ensure that these items are completed within two years from the date of this bulletin.
 - 2. For plants with a CP, this schedule shall ensure that these items are completed before the scheduled date for OL issuance or within two years from the date of this bulletin, whichever is later.
- f. Provide a written report upon completion of the above program. This report should provide (1) a verification of completion of the requested program and (2) a summary of the findings as to the valve operability and setting of the valve switches in the pre-test condition. The NRC staff intends to use this data in the resolution of Generic Issue II.E.6. This report shall be submitted to the NRC within 60 days of completion of the program.

The written reports required shall be submitted to the appropriate Regional Administrator under oath or affirmation under provisions of Section 182a, Atomic Energy Act of 1954, as amended. Also, the original copy of the cover letters and a copy of the reports shall be transmitted to the U.S. Nuclear Regulatory Commission, Document Control Desk, Washington, DC 20555 for reproduction and distribution.

This request for information was approved by the Office of Management and Budget under a blanket clearance number 3150-0011. Comments on burden and duplication may be directed to the Office of Management and Budget, Reports Management, Room 3208, New Executive Office Building, Washington, DC 20503.

Although no specific request or requirement is intended, the time required to complete each action item above would be helpful to the NRC in evaluating the cost of this bulletin:

*This item is intended to be completely consistent with action item 3.2, "Post-Maintenance Testing (All Other Safety-Related Components)," of Generic Letter 83-28, "Required Actions Based on Generic Implications of Salem ATWS Events."

If you have any questions regarding this matter, please contact the Regional Administrator of the appropriate NRC Regional Office or the technical contact listed below.

James M. Taylor, Director
Office of Inspection and Enforcement

Technical Contact: H. A. Bailey, IE
(301) 49-29006

R. J. Kiessel, IE
(301) 492-8119

Attachments:

1. Table 1
2. List of Recently Issued IE Bulletins

TABLE 1

Summary of Significant MOV Abnormalities
Identified by MOVATS

Bypass switch improperly set	75*
Incorrect thrust	50
Unbalanced torque switch	33
Valve backseating	0
High motor current	3
Torque switch abnormalities	2
Miscellaneous abnormalities	33

* Percent of valves experiencing abnormality. The total does not equal 100 percent as most valves had more than one abnormality.