UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555

March 16, 1994

NRC INFORMATION NOTICE 94-18: ACCURACY OF MOTOR-OPERATED VALVE DIAGNOSTIC EQUIPMENT (RESPONSES TO SUPPLEMENT 5 TO GENERIC LETTER 89-10)

Addressees

All holders of operating licenses or construction permits for nuclear power reactors.

Purpose

This information notice is intended to alert addressees to information submitted by various nuclear power plant licensees related to the accuracy of motor-operated valve (MOV) diagnostic equipment. The information was submitted in response to Supplement 5, "Inaccuracy of Motor-Operated Valve Diagnostic Equipment," to Generic Letter (GL) 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance." It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, related to operability of MOVs. However, suggestions contained in this information notice do not constitute NRC requirements; therefore, no specific action or written response is required.

Background

In GL 89-10 (June 28, 1989), the NRC staff asked holders of operating licenses and construction permits for nuclear power plants to provide additional assurance of the capability of safety-related MOVs and certain other MOVs in safety-related systems to perform their intended functions by reviewing MOV design bases, verifying MOV switch settings initially and periodically, testing MOVs under design-basis conditions where practicable, improving evaluations of MOV failures and necessary corrective action and trending MOV problems. The NRC staff issued several supplements to GL 89-10 to clarify or modify its recommendations.

As an integral part of most GL 89-10 programs, licensees are relying on MOV diagnostic equipment to provide information on the thrust required to open or close the valve, as well as the thrust delivered by the motor actuator. The various types of MOV diagnostic equipment estimate stem thrust using different methods, such as spring pack displacement or strain in the stem, the mounting bolts, or the yoke. Because some licensees make decisions regarding the operability of safety-related MOVs on the bases of diagnostic equipment

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thrust readings, the accuracy of MOV diagnostic equipment can have a significant effect on the safe operation of a nuclear power plant.

During the implementation of GL 89-10, the NRC staff became aware of new information on the accuracy of MOV diagnostic equipment. This new information raised a generic concern regarding the reliability of the data produced by MOV diagnostic equipment. For example, on February 3, 1992, the MOV Users Group (MUG) of nuclear power plant licensees released "Final Report - MUG Validation Testing as Performed at Idaho National Engineering Laboratories" (Volume 1). The report stated that the MOV diagnostic equipment that relied on spring pack displacement to estimate stem thrust was not as accurate as its vendors claimed. In addition, the NRC staff learned that specific MOV diagnostic equipment that relies on valve yoke strain to estimate stem thrust was less accurate than had been previously reported.

On March 2, 1992, the NRC staff held a public meeting with representatives of ITI-MOVATS to discuss the accuracy of the ITI-MOVATS thrust measuring device (TMD) to estimate stem thrust on the basis of spring pack displacement. At this meeting, the representatives of ITI-MOVATS described the results of their field validation program which showed that, in some instances, the TMD may be less accurate than licensees had assumed. The ITI-MOVATS representatives also discussed the results of their activities to resolve concerns about the fact that the TMD is calibrated in the valve opening direction, although it also is used to predict the thrust delivered by the actuator in the valve closing direction. ITI-MOVATS prepared Engineering Report 5.2 (March 13, 1992) to provide guidance to its licensee customers for evaluating the capability of an MOV to perform its safety function under design-basis conditions in light of the decreased accuracy of the TMD. The Nuclear Management and Resources Council (NUMARC) developed guidelines for licensees to use in evaluating MOVs that had been set up using the TMD.

ASEA-Brown Boveri (ABB) Impell manufactures MOV diagnostic equipment (known as OATIS) that relies on spring pack displacement to estimate stem thrust. Following the release of the MUG report, Impell representatives stated that they would be working with their licensee customers to develop new accuracy values.

Liberty Technologies has manufactured MOV diagnostic equipment, referred to as valve operation test and evaluation system (VOTES), that estimates the thrust required to open or close a valve based on the strain of the valve yoke. The VOTES system does this by measuring the diametral strain (the change in diameter) of the valve stem for a given yoke strain. The stem thrust is then calculated using the diametral strain and the nominal engineering properties of the stem. This stem thrust is compared to the yoke strain to provide a correlation between the yoke strain and the stem thrust. Once this correlation has been established, the stem thrust can be more easily determined by measuring the yoke strain. On October 2, 1992, Liberty Technologies notified the NRC, in accordance with 10 CFR Part 21, that it had found two new factors that can affect the thrust values obtained with its VOTES equipment. Those factors are (1) the possible use of improper stem

material constants and (2) the failure to account for a torque effect when the equipment is calibrated by measuring the strain of the threaded portion of a valve stem.

In its October 2 submittal, Liberty Technologies provided guidance to licensees for correcting the thrust data by performing hand calculations, and stated that the new Version 2.3 of its VOTES software would be of help in performing the corrections.

On June 28, 1993, the NRC staff issued Supplement 5 to GL 89-10 requesting licensees and construction permit holders (1) to re-examine their MOV programs and to identify measures taken to account for uncertainties in properly setting valve operating thrust to ensure operability and (2) to evaluate the schedule necessary to first consider the new information on MOV diagnostic equipment inaccuracy and then to take appropriate action in response to that information. Within 90 days of receipt of Supplement 5 to GL 89-10, licensees were required (1) to notify the NRC staff of the diagnostic equipment used to confirm the proper size, or to establish settings, for safety-related MOVs, and (2) to report whether they had taken actions or planned to take actions (including schedule) to address the new information on the accuracy of MOV diagnostic equipment.

Description of Circumstances

The NRC staff has reviewed the responses to Supplement 5 to GL 89-10 submitted by licensees and construction permit holders. The staff has found that, for the most part, licensees and permit holders have been actively addressing the uncertainties regarding the accuracy of MOV diagnostic equipment. The newly recognized reduced accuracy of MOV diagnostic equipment can raise questions regarding (1) the adequacy of torque switch settings to provide sufficient thrust while not exceeding thrust or torque structural limits and (2) the capability of actuator motors with the present settings. In their responses, licensees and permit holders indicated that many MOVs had the potential for underthrusting or overthrusting as a result of the less-than-expected accuracy of MOV diagnostic equipment. Consequently, some licensees reported that MOVs have been retested, adjusted, or modified to resolve the concerns regarding the accuracy of MOV diagnostic equipment. The staff will discuss specific aspects of the response to Supplement 5 to GL 89-10 with individual licensees during future inspections.

The following is a summary of the issues relating to the accuracy of MOV diagnostic equipment as reported by licensees in their responses to Supplement 5 to GL 89-10.

1. ITI-MOVATS Engineering Report 5.2 discussed the calibration of the ITI-MOVATS TMD in the open direction with reliance on the calibration to measure thrust in the close direction. This ITI-MOVATS report focuses on accuracy corrections for the TMD under static test conditions. The NRC staff knows of no ITI-MOVATS guidance related to accuracy corrections for the use of the TMD under dynamic test conditions.

2. The temporary installation of the ITI-MOVATS torque thrust cell (TTC) for diagnostic testing can affect the actuator output thrust. ITI-MOVATS Special Test Report 6.0 addresses the actuator repositioning effect. The licensee of the Oyster Creek Nuclear Power Plant stated in its response to Supplement 5 to GL 89-10 that this special test report indicates that ITI-MOVATS recommends that actuator repeatability values and thrust/torque measurement error values be revised when using a temporarily installed TTC.

3. The torque effects and the material characteristics that are relevant to the use of the Liberty Technologies' VOTES diagnostic equipment is discussed in this company's Part 21 notification of October 2, 1992.

4. In addition to the issues involving torque effects and material characteristics, Liberty stated in its Part 21 notification of October 2, 1992, that (a) incorrect thrust readings can arise with the use of long cable lengths between the signal conditioning box and the breakout box when calibrating a VOTES sensor with a U-clamp or D-clamp; (b) under certain conditions, one or more of the four operational amplifiers in the breakout box oscillates and causes a thrust indication which can be lower or higher than actual by a factor of about two or four; and (c) CB 23-100 cables were mistakenly shipped without the offset resistor (which results in a lower-than-actual torque indication from the VTC load cell).

5. The licensee of the Cooper Nuclear Power Plant reported in its response to Supplement 5 to GL 89-10 that Liberty Technologies is evaluating the issue of calibration of its equipment in one direction and reliance on thrust measurements in the other direction.

6. The Cooper licensee reported that Liberty Customer Service Bulletin CSB-030 (May 6, 1993), "Proximity Probe Type Calibrators With a Possible 3% Shift in Sensitivity," alerts VOTES users to possible changes in the sensitivity of the proximity probe-type calibrator that can overpredict thrust readings.

7. The licensee of the Susquehanna Nuclear Power Station reported in its response to Supplement 5 to GL 89-10 that factors that can affect VOTES accuracy are (a) the change in stem transition areas resulting from Liberty Technologies' refinement of its finite element model, (b) changes in effective stem diameters, (c) the need to differentiate between General Purpose ACME and Stub ACME threads when determining torque correction factors and effective stem diameters, and (d) new accuracy values based on torque correction values and percent extrapolation beyond calibration ranges.

8. The licensee of the Maine Yankee Nuclear Power Plant noted in its response to Supplement 5 to GL 89-10 that it had submitted a notice in accordance with 10 CFR Part 21 on July 21, 1993, regarding its determination that the accuracy cited by Liberty Technologies for its VOTES equipment is only

appropriate for torque switch trip when the Best-Fit-Straight-Line (BFSL) calibration method is used. As a result of this question regarding the accuracy of the VOTES calibration method, the Susquehanna licensee reported that its diagnostic tests will need to be repeated using the BFSL calibration method. Liberty Technologies is in the process of issuing a customer service bulletin that will give guidance on the inaccuracies of the results obtained by using the BFSL method. The service bulletin will also include a summary of a statistical analysis that was done to verify the accuracy of the BFSL method.

Related Generic Communications

The NRC has issued other generic communications on the accuracy of MOV diagnostic equipment. For example, the NRC issued Information Notice (IN) 92-23, "Results of Validation Testing of Motor-Operated Valve Diagnostic Equipment," to alert licensees to the potential decreased accuracy of MOV diagnostic equipment manufactured by ITI-MOVATS and ABB Impell; and IN 93-01, "Accuracy of Motor-Operated Valve Diagnostic Equipment Manufactured by Liberty Technologies."

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact one of the technical contacts listed below.

Brian K. Grimes, Director
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Office of Nuclear Reactor Regulation

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(301) 504-1390

Attachment:
List of Recently Issued NRC Information Notices

LIST OF RECENTLY ISSUED NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
94-17	Strontium-90 Eye Applicators: Submission of Quality Management Plan (QMP), Calibration, and Use	03/11/94	All U.S. Nuclear Regulatory Commission Medical Use Licensees.
94-16	Recent Incidents Resulting in Offsite Contamination	03/03/94	All U.S. Nuclear Regulatory Commission material and fuel cycle licensees.
94-15	Radiation Exposures during an Event Involving a Fixed Nuclear Gauge	03/02/94	All U.S. Nuclear Regulatory Commission licensees authorized to possess, use, manufacture, or distribute industrial nuclear gauges.
94-14	Failure to Implement Requirements for Biennial Medical Examinations and Notification to the NRC of Changes in Licensed Operator Medical Conditions	02/24/94	All holders of OLs or CPs for nuclear power and non-power reactors and all licensed reactor operators and senior reactor operators.
92-36, Supp. 1	Intersystem LOCA Outside Containment	02/22/94	All holders of OLs or CPs for nuclear power reactors.
94-13	Unanticipated and Unintended Movement of Fuel Assemblies and Other Components due to Improper Operation of Refueling Equipment	02/22/94	All holders of OLs or CPs for nuclear power reactors.
94-12	Insights Gained from Resolving Generic Issue 57: Effects of Fire Protection System Actuation on Safety-Related Equipment	02/09/94	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License
CP = Construction Permit

appropriate for torque switch trip when the Best-Fit-Straight-Line (BFSL) calibration method is used. As a result of this question regarding the accuracy of the VOTES calibration method, the Susquehanna licensee reported that its diagnostic tests will need to be repeated using the BFSL calibration method. Liberty Technologies is in the process of issuing a customer service bulletin that will give guidance on the inaccuracies of the results obtained by using the BFSL method. The service bulletin will also include a summary of a statistical analysis that was done to verify the accuracy of the BFSL method.

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Original signed by
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DATE	01/31/94	01/27/94	01/14/94	01/31/94	01/31/94

D:DE/NRR*	AC:OGCB/DORS*	D:DORS/NRR
WHodges	AJKugler	BKGrimes
02/01/94	03/03/94	03/11/94

DOCUMENT NAME: 94-18.IN

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