UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555-0001

August 1, 2001

NRC REGULATORY ISSUE SUMMARY 2001-15
PERFORMANCE OF DC-POWERED MOTOR-OPERATED VALVE ACTUATORS

ADDRESSEES

All holders of operating licenses for nuclear power reactors, except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel.

INTENT

The U.S. Nuclear Regulatory Commission (NRC) is issuing this regulatory issue summary (RIS) to inform addressees of the availability of improved industry guidance for predicting the performance of dc-powered motor-operated valve (MOV) actuators. No action or written response is requested.

BACKGROUND INFORMATION

In Generic Letter (GL) 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance," the NRC staff requested nuclear power plant licensees to ensure the capability of MOVs in safety-related systems to perform their intended functions by reviewing MOV design bases, verifying MOV switch settings, testing MOVs under design basis conditions where practicable, improving evaluations of MOV failures and corrective actions, and trending MOV problems. Subsequently, in GL 96-05, "Periodic Verification of Design-Basis Capability of Safety-Related Motor-Operated Valves," the staff requested licensees to establish a program, or ensure the effectiveness of their current program, to periodically verify that safety-related MOVs continue to be capable of performing their safety functions within the current licensing basis of the facilities. In NRC Information Notice (IN) 96-48, "Motor-Operated Valve Performance Issues," (August 21, 1996) the staff alerted licensees to lessons learned from industry activities to improve MOV performance. All licensees have reported completion of their GL 89-10 programs and are currently implementing their long-term GL 96-05 programs.

As part of their MOV programs, nuclear power plant licensees evaluated the capability of motor actuators to operate their safety-related valves under design basis conditions. In Technical Update 98-01 (May 15, 1998) and Supplement 1 (July 17, 1998), Limitorque Corporation (an actuator manufacturer) provided improved guidance for the prediction of the output capability of its ac-powered MOV motor actuators. On July 24, 1998, the NRC staff issued

Supplement 1 to IN 96-48 to alert licensees to the updated guidance for predicting ac-powered MOV motor actuator output. In the IN supplement, the staff also stated that the NRC Office of Nuclear Regulatory Research was sponsoring a study of the performance of dc-powered MOV actuators at Idaho National Engineering and Environmental Laboratory (INEEL). The results of the study are provided in NUREG/CR-6620, "Testing of dc-Powered Actuators for Motor-Operated Valves" (May 1999). In the tests documented in that study, the performance of certain Limitorque dc-powered motor actuators raised concerns about industry guidance for predicting the performance of dc-powered MOV actuators. For example, the effects of high ambient temperature in reducing the output torque of the motor were more significant than predicted. The adequacy of a linear relationship in evaluating the effects of reduced voltage supplied to the motor depended on considering reduced speed, increased temperature, and reduced output torque. The stroke time of some dc-powered MOVs increased significantly under loaded conditions. For some tested motor actuators, the efficiency of the actuator gearbox in converting input motor torque to output torque at the valve stem fell below the published "pullout" efficiency at low operating speeds and high loads.

SAFETY SIGNIFICANCE OF ISSUE

Many fluid systems at nuclear power plants depend on the successful operation of MOVs in performing their system safety functions. Safety-related MOVs must be capable of operating under design basis conditions, which may include significant differential pressure across the valves and high fluid flow, high ambient temperature, and degraded motor voltage. Operating experience at nuclear power plants in the 1980s and 1990s revealed weaknesses in many activities associated with MOV performance. These weaknesses reflected potential common-cause failure mechanisms as a result of which multiple safety-related MOVs could become incapable of performing their safety functions under design basis conditions. In light of the weaknesses, the NRC staff issued GL 89-10 and subsequently GL 96-05 to request that licensees verify initially and periodically the design basis capability of safety-related MOVs. Since then, the industry has expended significant resources to resolve deficiencies in MOV performance identified during implementation of the GL 89-10 and GL 96-05 programs. Adequate MOV actuator output capability is one issue that the industry is addressing as part of its response to GL 89-10 and GL 96-05. In this effort, the industry has implemented improvements in its methods of predicting the performance of ac-powered MOVs. The industry is now improving the guidance for predicting the performance of the less common dc-powered MOVs. As a result of weaknesses identified in the prediction of motor-actuator performance, dc-powered MOVs could become incapable of performing their safety functions under design basis conditions.

INDUSTRY RESPONSE

In response to the concerns raised in NUREG/CR-6620, the Boiling Water Reactor Owners' Group (BWROG) prepared Topical Report NEDC-32958, Revision 0, "BWR Owners' Group DC Motor Performance Methodology - Predicting Capability and Stroke Time in DC Motor-Operated Valves" (March 2000). BWROG assumed the lead among the nuclear plant owners groups in addressing this issue because dc-powered MOVs are applied more often in boiling water

reactors (BWRs) than in pressurized water reactors (PWRs). On August 30, 2000, the NRC staff held a public meeting to discuss the BWROG methodology for predicting dc-powered MOV performance. The BWROG methodology calculates (1) the required thrust to operate the valve (2) motor torque, current, voltage, speed, and heatup and (3) gearbox efficiency, at each position of the valve stroke. With this information, the BWROG methodology determines (1) the capability margin of the MOV actuator (2) the maximum allowable thrust setting at the torque switch trip position and under unwedging conditions and (3) the stroke time of the valve. BWROG used vendor motor performance curves and test data from the INEEL study and industry sources in developing the methodology. BWROG compared its methodology predictions to test data from in-plant flow tests for seven MOVs under various conditions, and found the results to be acceptable. BWROG is cooperating with the other owners groups regarding the availability of the methodology. In a letter dated October 2, 2000, BWROG recommended an implementation schedule of 12 months or the first refueling outage (whichever is later) for first-priority MOVs and two refueling outages for second-priority MOVs. As defined by BWROG, first-priority MOVs are dc-powered MOVs that have a static test frequency of two cycles or less in the industry-wide Joint Owners Group Program on MOV Periodic Verification in response to GL 96-05. Second-priority MOVs are the remaining dc-powered MOVs in the GL 96-05 program. In its letter, BWROG noted that the start date for the implementation schedule is defined as the date on which the NRC acknowledges that the BWROG methodology is acceptable through a RIS or another regulatory document.

SUMMARY OF THE ISSUE

The weaknesses identified in NUREG/CR-6620 regarding the prediction of dc-powered MOV actuator performance could prevent dc-powered MOVs from performing their safety functions under design basis conditions. In support of its evaluation of the industry response to this issue, the NRC staff has reviewed the new BWROG methodology for predicting the performance of dc-powered MOVs. As part of ongoing NRC-sponsored research, INEEL predicted the performance of a sample of dc-powered MOV actuators included in the development of the BWROG methodology, using an independent model developed at INEEL. The staff notes that the BWROG methodology used best available information for some aspects of dc-powered MOV performance that could be refined in the future. Based on its sample review, the staff considers the BWROG methodology to represent a reasonable approach in the improvement of past industry guidance for predicting the stroke time and output of dc-powered MOV actuators. The staff considers the BWROG methodology to be applicable to BWRs and PWRs because of the similarity in the design and application of dc-powered MOVs used in nuclear plants. In reviewing MOV programs established in response to GL 96-05, the staff has discussed with licensees the prediction of the performance of dc-powered MOVs, and verified that licensees are aware of the BWROG initiative. The staff also discussed the ongoing efforts regarding dc-powered MOV output performance in safety evaluations prepared to close the reviews of GL 96-05 programs at individual nuclear plants. Now that the new BWROG methodology is available to licensees, the NRC staff considers the regulatory issue of the adequate prediction of the performance of safety-related dc-powered

MOV actuators can be effectively resolved through implementation of improved industry guidance.

The staff will continue to monitor long-term periodic verification programs for MOVs (including dc-powered MOV actuators) being implemented by licensees in response to GL 96-05 at nuclear power plants.

BACKFIT DISCUSSION

This RIS requires no action or written response and is, therefore, not a backfit under 10 CFR 50.109. Consequently, the NRC staff did not perform a backfit analysis.

FEDERAL REGISTER NOTIFICATION

A notice of opportunity for public comment was not published in the *Federal Register* because this RIS is informational.

PAPERWORK REDUCTION ACT STATEMENT

This RIS does not request any information collection.

Please refer questions about this RIS to the technical contact identified below.

/RA Frank P. Gillespie Acting for/
David B. Matthews, Director
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Technical Contact: Thomas G. Scarbrough
301-415-2794
E-mail: tgs@nrc.gov

Attachment:
List of Recently Issued NRC Regulatory Issue Summaries

MOV actuators can be effectively resolved through implementation of improved industry guidance.

The staff will continue to monitor long-term periodic verification programs for MOVs (including dc-powered MOV actuators) being implemented by licensees in response to GL 96-05 at nuclear power plants.

BACKFIT DISCUSSION

This RIS requires no action or written response and is, therefore, not a backfit under 10 CFR 50.109. Consequently, the NRC staff did not perform a backfit analysis.

FEDERAL REGISTER NOTIFICATION

A notice of opportunity for public comment was not published in the *Federal Register* because this RIS is informational.

PAPERWORK REDUCTION ACT STATEMENT

This RIS does not request any information collection.

Please refer questions about this RIS to the technical contact identified below.

/RA Frank P. Gillespie Acting for/
David B. Matthews, Director
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Technical Contact: Thomas G. Scarbrough
301-415-2794
E-mail: tgs@nrc.gov

Attachment:
List of Recently Issued NRC Regulatory Issue Summaries

Distribution:
RIS File PUBLIC

ADAMS ACCESSION NUMBER: ML011920054 Template: #NRR=052

OFFICE	DE:EMEB	TECH ED	REXB/6/25	DE:EMEB	D:DE	OGC
NAME	TScarbrough*	PKleene*	CPetrone*	EImbro/DTero	JStrosnider	MYoung*
DATE	06/14/2001w/comments	04/09/2001	04/24/2001	06/25/2001	06/25/2001	07/03/2001

REXB	C:REXB	D:DRIP
JTappert*	LMarsh	Dmatthews/fpg for
07/18/2001	07/27/2001	08/01/2001

OFFICIAL RECORD COPY

CITF

LIST OF RECENTLY ISSUED
NRC REGULATORY ISSUE SUMMARIES

Regulatory Issue Summary No.	Subject	Date of Issuance	Issued to
2001-14	Position on Reportability Requirements for Reactor Core Isolation Cooling System Failure	07/19/2001	All holders of boiling-water (BWR) operating licenses
2001-13	10 CFR Part Exemptions for Uranium Contained in Aircraft Counterweights	07/20/2001	All holders of licenses authorized to manufacture aircraft counterweights containing uranium, and organizations and end users who may possess such counterweights
2001-12	Nonconservatism in Pressurized Water Reactor Spent Fuel Storage Pool Reactivity Equivalencing Calculations	05/11/2001	All holders of operating licenses for pressurized water reactors
2001-11	Voluntary Submission of Performance Indicator Data	05/18/2001	All holders of operating licenses for nuclear power reactors, except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel
2001-10	Revisions to Staff Guidance on Notices of Enforcement Discretion	04/02/2001	All holders of operating licenses for nuclear power reactors, except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel
2001-09	Control of Hazard Barriers	04/02/2001	All holders of operating licenses for nuclear power reactors, except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel

OL = Operating License
CP = Construction Permit