

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

September 5, 2003

NRC INFORMATION NOTICE 2003-15: IMPORTANCE OF FOLLOWUP ACTIVITIES IN  
RESOLVING MAINTENANCE ISSUES

Addressees

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

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert addressees to recent experience that emphasizes the importance of followup activities in resolving maintenance issues in nuclear power plants. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this information notice are not NRC requirements; therefore, no specific action or written response is required.

Background

Nuclear power plant licensees establish and implement programs to maintain the capability of a wide range of components to perform their safety functions and provide assurance of safe plant operation. In addition to prescribing planned work activities based on industry standards or vendor recommendations, these maintenance programs address component performance issues that are identified through plant-specific and industry-wide operating experience, and through NRC and industry research activities. As illustrated by the example described herein regarding motor-operated valves (MOVs), followup activities to verify implementation of corrective actions are an important part of a successful plan to resolve maintenance issues for safety-related components at nuclear power plants.

For the purposes of the example in this information notice, an MOV can be described as a valve operated by an actuator gear train driven by an electric motor. In an MOV, motor torque is transmitted through a motor pinion gear on the motor shaft to the worm shaft clutch gear in the actuator, which uses additional gearing to open or close the valve. The motor pinion gear and the motor shaft are connected through a key placed in a recessed keyway in the pinion gear and motor shaft. The key is staked to prevent it slipping from the keyway. A set screw in the motor pinion gear is located at a recess mark on the motor shaft to prevent axial movement of the gear. A lockwire is wrapped around the motor shaft to help the set screw remain in place.

For many years, MOVs used in nuclear power plants experienced deficiencies in the connection of the motor pinion gear to the motor shaft. In some instances, failure to secure the motor pinion gear to the motor shaft in an adequate manner has prevented MOVs from opening or

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closing. In response to this operating experience, the NRC issued several information notices. In addition, the nuclear industry has updated MOV maintenance guidance for securing the motor pinion gear to the motor shaft. For example, in 1989 Limitorque Corporation issued Maintenance Update 89-1 to provide improved guidance for the installation of the motor pinion gear in its MOV actuators.

#### Description of Circumstances

On January 25, 2003, at South Texas Unit 2, an MOV in the residual heat removal (RHR) system failed to open upon demand. The licensee determined that the MOV failed because the motor pinion gear had moved along the motor shaft until it contacted the MOV declutch mechanism. The resulting increased friction loading on the motor shaft caused the motor to stall and its electric circuit breaker to trip. The licensee found that the motor pinion set screw was not properly installed in the drilled recess on the motor shaft. Although not the cause of this MOV failure, the licensee also found that the motor pinion key for the RHR MOV had not been adequately staked so that the key had become partially disengaged from its keyway (Licensee Event Report [LER] 50-499/2003-01, dated April 18, 2003, ADAMS Accession No. ML031150024).

In determining the cause of the MOV failure, the licensee discovered that the most recent work activity on the failed RHR MOV that involved the motor pinion gear was in 1993. The licensee corrected an identical deficiency but did not enter it into the corrective action program. The licensee stated that the previous work activity involving the motor pinion gear for this MOV occurred in 1987 during the Unit 2 construction phase. The 1987 work activity did not ensure that maintenance instructions for spot-drilling the motor shaft and properly installing the set screw were accomplished.

The licensee inspected 327 other MOVs installed in South Texas Units 1 and 2 and identified deficiencies in the connection of the motor pinion gear to the motor shaft in many of them. Deficiencies in 24 of the MOVs required operability evaluations. The licensee determined that these deficiencies had not progressed to an extent that rendered the MOVs inoperable. However, these deficiencies might have eventually caused some MOVs to be incapable of performing their intended functions. For example, one of those MOVs, a flow control valve in the auxiliary feedwater (AFW) system, had lost its motor pinion key and was depending solely on the set screw to secure the motor pinion gear to the motor shaft. Because the set screw is not designed to transfer torque from the motor shaft to the motor pinion gear, the AFW MOV might have failed to operate under its design-basis hydrodynamic loading conditions.

#### Discussion

Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to Part 50 in Title 10 of the *Code of Federal Regulations* (10 CFR Part 50) specifies requirements applicable to the assessment of operating experience that can reflect the inability of safety-related MOVs to perform their design-basis functions. For example, Criterion V, "Instructions, Procedures, and Drawings," in 10 CFR Part 50, Appendix B, states, in part, that activities affecting quality shall be prescribed by documented procedures of a type appropriate to the circumstances and shall be accomplished with these procedures. Criterion XVI, "Corrective Action," states, in part, that measures shall be established to assure that conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, defective material and equipment, and nonconformances, are promptly identified and corrected.

During inspections at nuclear power plants, the NRC identified instances where licensees failed to satisfy the criteria in Appendix B to 10 CFR Part 50 with respect to their responses to MOV operating experience and other performance information. For example, in reviewing the recent RHR MOV failure at South Texas Unit 2, the NRC identified a 10 CFR Part 50, Appendix B, Criterion V, issue in that the licensee failed to track implementation of corrective actions recommended in Limitorque Maintenance Update 89-1 on applicable MOV actuators (NRC Inspection Report 05000498/2003002 and 05000499/2003002, dated August 5, 2003, ADAMS Accession No. ML032170569). Similarly, the NRC found that the Comanche Peak licensee had not satisfied Criterion V of 10 CFR Part 50, Appendix B, by failing to properly identify the applicability of Limitorque Maintenance Update 92-02 and, as a result, failing to evaluate the applicability of a change to the criterion for determining the acceptable tolerance for actuator torque switch repeatability (NRC Inspection Report 05000445/9310 and 05000446/9310, dated May 3, 1993, NUDOCs Accession No. 9305070163).

When responding to operating experience and other component performance information, it is important for licensees to have a clear plan of action to identify specific potentially affected components and to address and track to completion those components in a reasonable amount of time based on their safety significance. For example, the identification of deficiencies associated with the connection of the motor pinion gear to the motor shaft in safety-related MOVs at South Texas after the issuance of NRC information notices and vendor guidance over a long time period emphasizes the importance of followup activities to verify the implementation of revised maintenance procedures. The revision of maintenance procedures will only resolve a generic issue if the revised procedures are implemented during work activities associated with the applicable components. In particular, if MOV maintenance procedures are revised to improve the connection of the motor pinion gear to the motor shaft, the procedures need to ensure the removal of the motor from the MOV during the maintenance activity so the motor pinion gear connection can be inspected and appropriate corrective action taken. Where revised procedures are not implemented in a manner that fully resolves a maintenance issue, the potential for common cause failure can continue to exist for affected components in multiple plant systems. The importance of a plan when responding to operating experience issues and other component performance information is applicable to all components that perform a safety function at a nuclear power plant, not just MOVs.

Addressees are reminded of the quality assurance requirements in 10 CFR Part 50, Appendix B, to address operating experience issues and component performance information and the maintenance requirements in 10 CFR 50.65 to consider industry-wide operating experience and component performance information (including issues described in NRC information notices), where practical, when setting goals and performing periodic evaluations.

#### Related Generic Communications

NRC Information Notice 85-67, "Valve-Shaft-to-Actuator Key May Fall Out of Place When Mounted Below Horizontal Axis."

NRC Information Notice 88-84, "Defective Motor Shaft Keys in Limitorque Motor Actuators."

NRC Information Notice 90-37, "Sheared Pinion Gear-to-Shaft Keys in Limitorque Motor Actuators."

NRC Information Notice 94-10, "Failure of Electric Power Train Due to Sheared or Dislodged Motor Pinion Gear Key."

NRC Information Notice 96-48, "Motor-Operated Valve Performance Issues."

This information notice requires no specific action or written response. If you have any questions about this notice, contact one of the persons listed below or the appropriate Office of Nuclear Reactor Regulation (NRR) project manager.

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NRC Information Notice 94-10, "Failure of Electric Power Train Due to Sheared or Dislodged Motor Pinion Gear Key."

NRC Information Notice 96-48, "Motor-Operated Valve Performance Issues."

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LIST OF RECENTLY ISSUED  
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| Information Notice No. | Subject   | Date of Issuance | Issued to   |
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| 2003-14                | Potential Vulnerability of Plant Computer Network to Worm Infection                                   | 08/29/2003       | 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.        |
| 2003-13                | Steam Generator Tube Degradation at Diablo Canyon   | 08/28/2003       | All holders of operating licenses for pressurized-water reactors (PWRs), except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor.    |
| 89-69, Sup 1           | Shadow Corrosion Resulting in Fuel Channel Bowing   | 08/25/2003       | All holders of operating licenses for boiling water reactors (BWRs), except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel. |
| 2003-12                | Problems Involved in Monitoring Dose to the Hands Resulting from the Handling of Radiopharmaceuticals | 08/22/2003       | All holders of 10 CFR Parts 32, 33, and 35 licenses.  |

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