

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

May 24, 1990

**NRC INFORMATION NOTICE NO. 90-37: SHEARED PINION GEAR-TO-SHAFT KEYS IN
LIMITORQUE MOTOR ACTUATORS**

Addressees:

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

Purpose:

This information notice alerts addressees to potential problems related to sheared pinion gear-to-shaft keys in Limitorque motor actuators. 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 do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

On April 27, 1990, the Public Service Electric & Gas Company (PSE&G) submitted a 10 CFR Part 21 report to the NRC regarding a materials misapplication in valve motor actuators supplied by the Limitorque Corporation at its Salem Nuclear Power Generating Station, Units 1 and 2. PSE&G reported that it had discovered that the pinion gear-to-shaft keys in the motor actuators of six service water valves (three per unit) were sheared or severely deformed. These keys had failed under conditions of normal operation, and one of them showed significant deformation after only 15 valve cycles. The valve units use high-speed (3600 rpm) Limitorque SMB-0 actuators with 25 ft-lb of torque that operate 30-inch Jamesbury butterfly valves. At Salem, this type of valve is only used for the fast isolation (closing within 10 seconds) of non-safety thermal loads in the turbine building from the safety-related service water system load during accident conditions. These keys failed after the licensee had replaced the original valves with the subject Jamesbury valves in a recent upgrade program during the last fuel cycle. The original valves manufactured by the Henry Pratt Company had Limitorque SMB-1 actuators.

The failure identified by PSE&G indicated that the failed keys had wedged between the motor shafts and the pinion gears at the key-slots. These wedged keys had allowed the valves to operate under low-flow conditions. However, during normal flow conditions, the failure of these keys could prevent the valve units from operating reliably. PSE&G realized the magnitude of the

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problem after performing a thorough inspection following a second valve failure during service water valve testing. The licensee did not initially realize the magnitude of the problem because even during normal flow conditions, the valve appeared to operate adequately, masking the potential for valve failure.

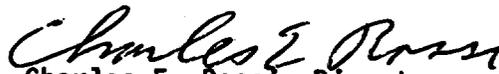
Discussion:

In the past, the NRC issued Information Notices 88-84, "Defective Motor Shaft Keys in Limitorque Motor Actuators;" 85-67, "Valve-Shaft-to-Actuator Key May Fall Out of Place When Mounted Below Horizontal Axis;" and 81-08, "Repetitive Failures of Limitorque Operator SMB-4 Motor-to-Shaft Key," regarding the failure of keys in the actuators of motor-operated valves. These earlier failures resulted either from use of improper materials or incorrect installations, whereas, the failure reported by PSE&G resulted from an apparent misapplication of material.

Although the licensee is continuing its investigation, the preliminary results indicate that the failures resulted from the impact loading on the soft keyway assemblies during fast valve closures. The licensee performed a hardness check of a failed key and of 38 other keys in stock supplied by Limitorque. The inspection confirmed that the material was within the ASTM-1018 range for material hardness that was specified by Limitorque. The licensee also inspected all 14 actuators supplied by Limitorque under the same purchase order and found the remaining 8 actuators had no similar problems. These 8 actuators are used for valves that are not required to close within 10 seconds and are not subject to the same impact loading experienced in the failed service water system valves.

PSE&G decided to replace the failed keys in the 6 valve actuators with keys made from a harder material, such as ASTM-4140 stainless steel. The licensee tested one valve with a key made from this new material with a hardness of 290 (Brinell) and found no apparent wear after it was operated for 60 valve cycles.

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 or the appropriate NRR project manager.


Charles E. Rossi, Director
Division of Operational Events Assessment
Office of Nuclear Reactor Regulation

Technical Contacts: Peter C. Wen, NRR
(301) 492-1172

Paul D. Swetland, RI
(215) 337-5114

Attachment: List of Recently Issued NRC Information Notices

LIST OF RECENTLY ISSUED
 NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
90-36	Apparent Falsification of State of Connecticut Weight Certificates	5/24/90	All holders of OLs or CPs for nuclear power reactors, and 10 CFR 70 licensees.
90-35	Transportation of Type A Quantities of Non-Fissile Radioactive Materials	5/24/90	All U.S. NRC licensees.
90-34	Response to False Siren Activations	5/10/90	All holders of OLs or CPs for nuclear power reactors.
90-33	Sources of Unexpected Occupational Radiation Exposures at Spent Fuel Pools	5/9/90	All holders of OLs or CPs for nuclear power reactors.
90-32	Surface Crack and Subsurface Indications in the Weld of A Reactor Vessel Head	5/3/90	All holders of OLs or CPs for nuclear power reactors.
90-31	Update on Waste Form and High Integrity Container Topical Report Review Status, Identification of Problems with Cement Solidification, and Reporting of Waste Mishaps	5/4/90	All holders of OLs or CPs for nuclear power reactors, fuel cycle licenses, and certain by-product materials licenses.
90-30	Ultrasonic Inspection Techniques for Dissimilar Metal Welds	5/1/90	All holders of OLs or CPs for nuclear power reactors.
90-29	Cracking of Cladding and Its Heat-Affected Zone in the Base Metal of a Reactor Vessel Head	4/30/90	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License
 CP = Construction Permit

problem after performing a thorough inspection following a second valve failure during service water valve testing. The licensee did not initially realize the magnitude of the problem because even during normal flow conditions, the valve appeared to operate adequately, masking the potential for valve failure.

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Although the licensee is continuing its investigation, the preliminary results indicate that the failures resulted from the impact loading on the soft keyway assemblies during fast valve closures. The licensee performed a hardness check of a failed key and of 38 other keys in stock supplied by Limitorque. The inspection confirmed that the material was within the ASTM-1018 range for material hardness that was specified by Limitorque. The licensee also inspected all 14 actuators supplied by Limitorque under the same purchase order and found the remaining 8 actuators had no similar problems. These 8 actuators are used for valves that are not required to close within 10 seconds and are not subject to the same impact loading experienced in the failed service water system valves.

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*SEE PREVIOUS PAGE FOR CONCURRENCE

Document Name: IN LIMITORQUE KEY FAILURE

*OGCB:DOEA:NRR	*RI	*RPB:ADM	*C/OGCB:DOEA:NRR
PCWen	PSwetland	TechEd	CHBerlinger
05/15/90	05/15/90	05/16/90	05/17/90

D/DOEA:NRR
CERossi
05/18/90

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Document Name: IN LIMITORQUE KEY FAILURE *CHB*
OGCB:DOEA:NRR, RI *PCW* RPB:ADM C/OGCB:DOEA:NRR D/DOEA:NRR
PCWen *for* PSwetland TechEd *JMahn 97m* CHBerlinger CERossi
05/15/90 05/15/90 05/16/90 05/17/90 05/ /90
PER TEL. CONV.