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UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS
WASHINGTON, D.C. 20555

May 8, 1997

NRC INFORMATION NOTICE NO. 97-24: FAILURE OF PACKING NUTS ON ONE-INCH URANIUM HEXAFLUORIDE CYLINDER VALVES

Addressees

All U.S. Nuclear Regulatory Commission (NRC) licensees and certificatees authorized to handle uranium hexafluoride in 30- and 48-inch diameter cylinders.

Purpose

The U.S. Nuclear Regulatory Commission is issuing this information notice to alert addressees to incidents in which packing nuts on one-inch uranium hexafluoride cylinder valves were found to be cracked. 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.

Description of Circumstances

On March 14, 1997, the United States Enrichment Corporation (USEC) reported that cracks were observed in packing nuts on one-inch valves designed for use in 30- and 48-inch diameter uranium hexafluoride (UF_6) cylinders. The cracks have been observed in the Copper Development Association (CDA) 636 alloy nuts on valves supplied by Hunt Valve Co., Inc.

In two instances, a UF_6 release was observed during pigtail operations on a full cylinder. The release was visible as a small wisp of smoke after the pigtail was pressurized above atmospheric pressure. In both instances, a visible crack in the valve packing nut was observed. The two failed nuts were examined metallurgically and were found to exhibit intergrannular cracking. As part of the investigation, USEC conducted valve packing nut inspections. In addition to visual inspections, eddy current inspection techniques were used to help identify potentially degraded valve packing nuts. Of the 136 Hunt CDA 636 packing nuts, owned by USEC, that were inspected, 13 exhibited cracks. At least one of the valves with a cracked nut was a valve that was in storage and had not been exposed to plant process chemicals. Metallurgical analysis was performed on this nut and confirmed the presence of intergrannular cracks. This indicates that the concern is a material or manufacturing problem with the nuts. In addition, 20 Hunt CDA 636 nuts from customer cylinders were examined. Three nuts showed indications of cracking; one had visible indications. Three nuts that showed no indications of cracking were chosen for

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metallurgical examination; one showed slight indications of cracking that had not been picked up by the eddy current testing. Hunt B150 613 nuts and Superior valve nuts of CDA 636 were also eddy-current-tested; no problems with cracking were identified.

Discussion

Packing nuts with intergrannular cracks were found in valves that were in storage and had not been exposed to the plant process chemicals or handling practices that affect the packing nuts. This indicates that the problem is likely a material or manufacturing problem with the nuts. Three valve packing nut materials are currently used: monel, ASTM B150 613 alloy, and CDA 636 alloy. The cracking problem has been observed only in the CDA 636 alloy nuts on valves supplied by Hunt Valve Co., Inc.

Failure of the packing nut during plant operations to fill or empty a UF_6 cylinder could allow the packing rings to be forcefully ejected from the valve, resulting in a UF_6 release, which is a hazard to plant personnel and a challenge to plant safety systems. Failure of a cylinder valve packing nut and ejection of the valve packing with an open valve on a full cylinder would constitute a failure of a UF_6 confinement system and, therefore, could create a substantial safety hazard. Cracking of the packing nut on closed cylinder valves does not pose a hazard.

Previous problems with packing nuts have resulted from heat-treating problems that resulted in soft nuts that did not meet the required hardness requirements. One previous investigation of cracking problems concluded that the cracking is the combined result of the following:

1. Excessive stresses placed on the nut by cold flow and thermal expansion of the teflon packing rings, resulting from retightening of the nut and repeated heating of the valves;

2. Mechanical and structural characteristics of the packing nut material are incompatible with these stresses; and

3. The presence of uranium hexafluoride, hydrofluoric acid, and nascent hydrogen facilitates cracking.

The American National Standards Institute (ANSI) provides criteria for packaging of uranium hexafluoride for transport. The criteria are found in ANSI N14.1-1995, "Uranium Hexafluoride-Packaging for Transport."[1] This standard provides, in part, specific information on design, fabrication, and assembly requirements for the one-inch valve installed in uranium hexafluoride cylinders.

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[1]Copies of industry codes and standards used in a substantive manner in the NRC regulatory process are maintained at the NRC Library and are available there for reference by the public. Codes and standards are usually copyrighted and may be purchased from the originating organization or, if they are American National Standards, from the American National Standards Institute, 11 West 42nd Street, 13th floor, New York, NY 10036.

The standard states that the valve packing nut is initially to be torqued in the range of 120 to 150 foot-pounds, to compact the teflon packing rings. If leakage at the valve stem occurs, the packing nut may be retightened. However, excessive force is not to be used in an attempt to eliminate the leak. The maximum torque permitted by the standard for retightening the packing nut is 150 foot-pounds.

Related Generic Communications

NRC Information Notice 89-78, dated November 22, 1989, "Failure of Packing Nuts on One-Inch Uranium Hexafluoride Cylinder Valves," concerned cracking of packing nuts from Descote and Superior Valve Company.

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 NRC regional office.

Original Signed By

Elizabeth Ten Eyck, Director
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Attachments:
1. List of Recently Issued NMSS Information Notices
2. List of Recently Issued NRC Information Notices

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Sincerely,

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Office of Nuclear Material Safety
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Licensees and certificatees should review their retightening procedures to ensure that operators are not misapplying the ANSI torquing requirement by retightening packing nuts to the maximum torque with each valve use. Furthermore, since packing nuts are more likely to crack while in service, regulatees should have operators check for cracked packing nuts before and after each valve use.

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