

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, DC 20555-0001

June 11, 2007

NRC INFORMATION NOTICE 2007-21: PIPE WEAR DUE TO INTERACTION OF
FLOW-INDUCED VIBRATION AND REFLECTIVE
METAL INSULATION

ADDRESSEES

All holders of operating licenses or construction permits for nuclear power reactors, except those who have permanently ceased operations 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 (IN) to alert addressees that a licensee identified significant wear marks on the outside wall of chemical volume control system (CVCS) stainless steel piping, which was subject to flow-induced vibration conditions. The licensee determined that the wear marks were caused by the interaction between the piping base metal and the properly installed reflective metal insulation (RMI). The NRC expects that addressees will review the information for applicability to their facilities and consider actions, as appropriate, to identify and address similar problems. However, suggestions contained in this IN are not NRC requirements; therefore, no specific action or written response is required.

DESCRIPTION OF CIRCUMSTANCES

During a Catawba Unit 1 refueling outage conducted in the fall of 2006, the licensee identified multiple wear marks on CVCS field-run stainless steel piping (see Enclosure, Figure 1) that was downstream of the CVCS letdown orifices. The licensee determined that these marks were a result of abrasive wear between the stainless steel RMI end caps and the stainless steel piping. This abrasive wear was most probably caused by the known flow-induced vibration downstream of the letdown orifices combined with end cap to piping interaction. RMI is assembled by clipping short segments of insulation together. End caps are found at the intersection of each insulation segment, and these end caps are perpendicular to the pipe wall (see Enclosure, Figure 2). The licensee confirmed that the RMI end caps had been installed properly in accordance with plant procedures and vendor instructions. None of the wear marks around the piping were continuous for 360 degrees and most extended less than 180 degrees of the circumference. The deepest wear mark was one thirty-seconds of an inch. All of the CVCS piping with identified wear marks was located inside containment.

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The licensee initially discovered three locations of base metal damage and completed weld repairs with subsequent radiographic testing for those locations. During the extent of condition review, the licensee identified an additional 81 discrete wear marks over a 150-foot length of pipe downstream of the letdown orifices. These additional wear marks were located at insulation end cap locations and were repaired by light grinding. The licensee performed ultrasonic testing of the repaired areas to confirm acceptable pipe thickness, and liquid penetrant testing to confirm the absence of any surface cracks. System piping stress analysis calculations were revised and evaluated with the new wall thickness measurements taken after repairs and inspections had been completed.

The licensee installed temporary stainless steel cuffs directly on the piping at the RMI end cap locations to provide a physical barrier so as to prevent piping wear during the next operating cycle. In some locations, where the cuffs could not be installed, the licensee placed fiberglass insulation pads. The placement of additional fibrous insulation inside containment was evaluated by the licensee in accordance with site-specific emergency core cooling system sump debris calculations. During the next scheduled refueling outage in 2008, the licensee plans to install modified RMI that will eliminate the sharp end cap to piping interaction. The licensee plans to inspect for similar piping wear at Catawba Unit 2 no later than the next scheduled refueling outage scheduled for the fall of 2007.

DISCUSSION

There is no regulation or industry code requirement for licensees to periodically remove insulation from the affected CVCS piping and visually inspect for piping degradation. The affected portion of piping is classified as an American Society of Mechanical Engineering (ASME) Class 2 piping segment. Section XI, Subarticle IWC-2000 of the ASME Boiler and Pressure Vessel Code, requires a system leakage test and visual examination (VT-2) once every inspection period (3 years); however, the ASME Code does not require the removal of pipe insulation when performing system leakage tests or VT-2 examinations. The licensee at Catawba Unit 1 had planned to remove only the RMI needed to accomplish a CVCS valve replacement when workers discovered the abrasive wear. Otherwise, the abrasive wear of the CVCS piping could have continued undetected and led to a more significant reduction in piping wall thickness, and potentially a through-wall leak.

CONTACTS

This information notice requires no specific action or written response. Please direct any questions about this matter to the technical contacts listed below or the appropriate Office of Nuclear Reactor Regulation (NRR) project manager.

/RA by TQuay for/

Michael J. Case, Director
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Enclosure: Catawba Unit 1, Chemical and Volume Control System Piping

Note: NRC generic communications may be found on the NRC public Web site, <http://www.nrc.gov>, under Electronic Reading Room/Document Collections.

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Catawba Unit 1, Chemical and Volume Control System Piping



Figure 1: Wear indications identified on CVCS Letdown Piping



Figure 2: Insulation End-Cap to Pipe Interaction