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

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NRC INFORMATION NOTICE 2007-18: OPERATING EXPERIENCE REGARDING ENTRAINMENT OF GAS OR DEBRIS INTO AUXILIARY FEEDWATER SYSTEMS

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.

PURPOSE

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice (IN) to inform addressees of operating experience regarding possible entrainment of air or debris into auxiliary feedwater (AFW) systems, potentially affecting the operability of these systems. The NRC expects that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. Suggestions contained in this IN are not NRC requirements; therefore, no specific action or written response is required.

DESCRIPTION OF CIRCUMSTANCES

Several events have occurred at nuclear power facilities involving possible entrainment of gas or debris into AFW systems. Air or debris entrained in AFW systems can impact the capability of the AFW pumps to perform their specified safety functions. Several recent events are discussed below:

McGuire Nuclear Station

A design deficiency resulted in gas coming out of solution and collecting in the nuclear service water system where the Train A AFW assured suction was located. When this was recognized, the licensee decided to use operator manual alignments to preclude gas entrainment into the AFW pumps when alignment was to the standby nuclear service water pond. NRC inspectors identified that the licensee was crediting non-seismic pipe for no less than 30 minutes after a seismic event to allow time to perform the AFW valve lineup. Consequently, there was not reasonable assurance that the non-seismic pipe would be available to support supplying water to the AFW pumps. (NRC Integrated Inspection Report 05000369/2004005 and 05000370/2004005, October 8, 2004, Agencywide Documents Access and Management System (ADAMS) Accession No. ML042860339)

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The licensee subsequently initiated a piping modification and test program to address the issue. (Duke Energy letters to NRC dated April 25, 2006, and September 7, 2006, ADAMS Accession Nos. ML061230672 and ML062640070, respectively)

Davis-Besse Nuclear Power Station

NRC inspectors identified an inadequate procedure that could have resulted in sufficient air in an AFW pump suction to make it inoperable. The procedure addressed the realignment of the AFW pumps' suction from the condensate storage tank to the service water system using a pipe that was normally voided to preclude potential leakage through a closed valve that could adversely affect steam generator chemistry. The voided 6-inch diameter pipe section was 11-feet long. The licensee responded with a procedure change to adequately fill the affected piping prior to transferring the suction supply. (NRC Inspection Report 05000346/2005004, June 14, 2005, ADAMS Accession No. ML051660047)

Watts Bar Nuclear Plant

The Watts Bar backup safety-related water supply to the AFW system is provided by the essential raw cooling water (ERCW) system. On January 13, 2006, the licensee discovered air in a 12-inch ERCW pipe that supplies water to a motor-driven AFW pump and a turbine-driven AFW pump and in an attached 30-inch pipe. The licensee determined that the air in the 12-inch pipe was, in part, caused by inadequate filling and venting during work performed in the Cycle 6 refueling outage. The air in the 30-inch discharge pipe and a portion of the 12-inch pipe was due to gas coming out of solution. Corrective actions included the establishment of continuous vent paths for the 30-inch ERCW Train A and B discharge headers and the addition of ultrasonic equipment for verification of the water level in the 30-inch headers and the 12-inch header. (Licensee Event Report 2006-001-00, March 14, 2006, ADAMS Accession No. ML060760381)

Virgil C. Summer Nuclear Station

The backup source of water to the emergency feedwater pumps (the licensee's designation for the AFW pumps) is the service water system. In its inspection report, the NRC reported that the safety-related water supply could become unavailable due to the accumulation of tubercles or other debris and that the flow control valves were not designed to handle relatively unclean service water. (NRC Inspection Report 05000395/2005007, March 10, 2005, ADAMS Accession No. ML050700044)

San Onofre Nuclear Generating Station

The seismically qualified Enclosure Building surrounding the non-seismically qualified condensate storage tank is designed to ensure sufficient condensate remains available if this tank should fail during a design basis earthquake. An NRC inspection team found that the licensee failed to follow procedural requirements and establish the necessary foreign material exclusion areas. As a result, foreign materials could cause AFW operational problems following a seismic event. Further, the licensee failed to properly address industry operating experience related to foreign materials in AFW water sources. (NRC Inspection Report 05000361;362/2006009, December 8, 2006, ADAMS Accession No. ML063420342)

Kewaunee Nuclear Power Plant

The AFW pump shaft seals require a small amount of leakage to maintain adequate cooling and sealing. Leakage reduction or loss can cause loss of seal cooling and lubrication with subsequent seal degradation that may allow air flow into the pump inlet if the inlet pressure is sub-atmospheric, a condition that may occur following a steam line break. This may cause pump damage due to air entrainment. (Licensee Event Report 2005-006-00, May 25, 2005, ADAMS Accession No. ML051530312 and NRC Inspection Report 05000305/2005010, October 16, 2005, ADAMS Accession No. ML052290348)

BACKGROUND

Some of the issues of gas entrainment on AFW systems are similar to the concerns discussed in NRC IN 2006-21, "Operating Experience Regarding Entrainment of Air into Emergency Core Cooling and Containment Spray Systems," dated September 21, 2006, ADAMS Accession No. ML062570468.

DISCUSSION

Licensees rely on backup water supplies to AFW systems in response to low probability events, such as seismic and station blackout events, that render normal and preferred water sources unavailable. The above events indicate that use of backup water sources or other unique and potentially overlooked conditions may introduce air or debris that could render AFW inoperable and illustrate the importance of having developed a complete understanding of the implications of gas or debris in AFW systems. This is particularly important for operational aspects that are not tested, as illustrated by the above events where the likelihood of being in the condition was small, but the condition impacted defense-in-depth and resulted in a failure to comply with the plant design basis.

CONTACT

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

/RA/

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