

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

July 21, 2003

NRC INFORMATION NOTICE 2002-26, Supplement 1:    ADDITIONAL FAILURE OF STEAM  
   DRYER AFTER A RECENT  
   POWER UPRATE

Addressees

All holders of operating license or construction permits for nuclear power reactors, except those that have permanently ceased operations and have certified that fuel has been permanently removed from the reactor.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice (IN) to alert addressees to another failure of the steam dryer at Quad Cities Nuclear Power Station, Unit 2 (QC-2), a boiling water reactor (BWR), during operations following a power uprate. It is expected that the 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

The failure of a steam dryer cover plate in June 2002 at QC-2 was discussed in IN 2002-26, "Failure of Steam Dryer Cover Plate After a Recent Power Uprate" (ML022530291). The failure followed completion of a refueling outage in March 2002 and subsequent implementation of an extended power uprate (EPU) from 2511 MWt to 2957 MWt (17.8% increase). Before the unit was shut down in 2002, steam dryer degradation was indicated by an increase in moisture carryover and minor perturbations in reactor pressure, water level, and steam flow. The licensee determined that the failure of the plate was due to high-cycle fatigue. This fatigue was attributed to excessive vibration caused by the synchronization of the cover plate resonance frequency, the nozzle chamber standing acoustic wave frequency, and the vortex shedding frequency. The licensee concluded that the three frequencies synchronized in a very narrow band of steam flow at or near the steam flow required to reach full power under the power uprate. Prior to returning the unit to service, the dryer cover plates were replaced with thicker plates with a higher fundamental frequency to eliminate the resonance of induced pressure oscillations with the natural frequency of the plate.

In late May 2003, the licensee again noted increasing moisture carryover; however, there were no discernible changes in other reactor parameters that indicated dryer degradation. On May 28, 2003, the licensee reduced power on QC-2 to the pre-EPU 100% power level.

**ML031980434**

Moisture carryover levels remained above normal, and on June 11, 2003, the licensee shut down QC-2 to inspect the dryer. Inspection of the dryer revealed (1) through-wall cracks (about 90 inches long) in the vertical and horizontal portions of the outer bank hood, 90-degree side, (2) one vertical and two diagonal internal braces detached on the outer bank hood, 90-degree side, (3) one severed vertical internal brace on the outer bank hood, 270-degree side, and (4) three cracked tie bars on top of the dryer. A root cause analysis by the licensee is in progress. The licensee believes the most probable cause of the failure is low-frequency, high-cycle fatigue driven by flow-induced vibrations associated with the higher steam flows present during EPU operating conditions.

#### Discussion

GE Nuclear Energy and the licensee did not foresee this phenomenon. GE Nuclear Energy, the licensee, and the NRC are evaluating this event with regard to its generic implications for plants that are operating with or planning to apply for an extended power uprate. Licensees should be alert to the possibility of similar unanticipated effects from increasing flow, power, or differential pressure associated with a major modification such as an extended power uprate.

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 Office of Nuclear Reactor Regulation (NRR) project manager.

**/RA/**

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2003-07	Water in the Vent Header/vent Line Spherical Junctions	06/24/2003	All holders of operating licenses for boiling water reactors (BWRs) with a Mark I containment.
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2003-05	Failure to Detect Freespan Cracks in PWR Steam Generator Tubes	06/05/2003	All holders of operating licenses or construction permits for pressurized-water reactors (PWRs).
2002-15, Sup 1	Potential Hydrogen Combustion Events in BWR Piping	05/06/2003	All holders of operating licenses for light water reactors, except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor.

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