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

June 24, 2003

NRC INFORMATION NOTICE 2003-07: WATER IN THE VENT HEADER/VENT LINE SPHERICAL JUNCTIONS

Addressees

All holders of operating licenses for boiling water reactors (BWRs) with a Mark I containment.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice (IN) to inform addressees of recent issues involving the pressure suppression containment system in BWRs with a Mark I containment. During a recent refueling outage at Nine Mile Point Unit 1 (NMP1), unanticipated standing water was found inside the vent header/vent line (VH/VL) spherical junctions (vent system low point or "bowl"). The weight of this standing water inside the VH/VL spherical junctions was not included in the generic Mark I containment accident analysis because the spherical junctions are assumed to remain dry. This standing water inside the VH/VL spherical junction increases the thrust loads on the vent system. The primary concern is that this standing water will increase vent system thrust loads during reactor blowdown after a loss-of-coolant accident inside containment beyond design limits.

The licensees for other plants with Mark I containment designs have also noted standing water in the VH/VL spherical junctions (Pilgrim, Hope Creek, and Fermi). It is expected that recipients will review the information in this notice 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.

Background

The pressure suppression containment system of a Mark I BWR consists of a drywell, a torus-shaped pressure suppression chamber, which is approximately half filled with water, a connecting vent system between the drywell and the pressure suppression chamber, isolation valves, a vacuum relief system, a containment cooling system and other service equipment. An illustration of portions of this system is provided in Figure 1.

The vent pipe descending from the drywell joins the ring header at a VH/VL spherical junction. There are 8 to 10 vent pipes and spherical junctions in most Mark I containments. The ring header is arranged within the suppression chamber shell, with downcomer pipes from the header extending below the water surface in the suppression chamber. Submergence of the downcomer pipes is operationally maintained by a minimum required suppression chamber water level in Technical Specifications.

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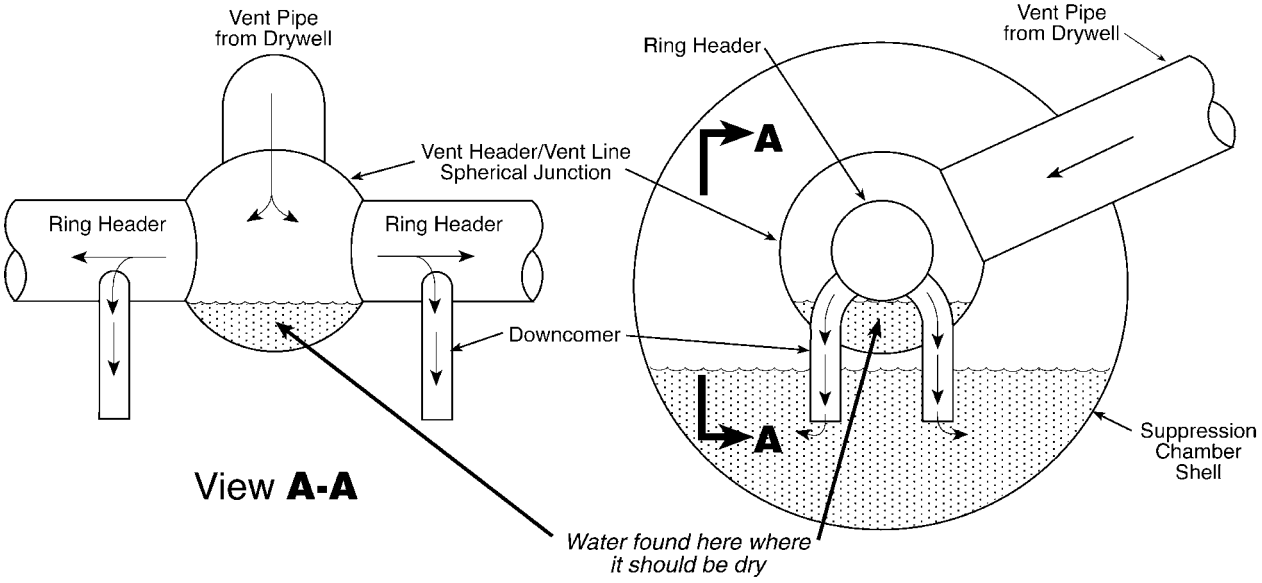

Figure 1 BWR Mark I Pressure Suppression Containment System (Partial View)

The limiting event for containment pressurization and vent system flow rates is the design basis loss-of-coolant accident (DBA-LOCA). The DBA-LOCA results in the maximum pressurization rate, maximum pressure, and highest vent system flow rates; therefore, it produces the highest vent system thrust loads. The vent system thrust load is a function of the vent system pressure relative to the suppression chamber air space and the mass flow and velocity through vent piping. The Mark I Containment Program for NMP1 has previously defined vent system thrust loads for the DBA-LOCA based on these parameters.

Description of Circumstances

During a refueling outage, NMP1 personnel discovered that the VH/VL spherical junctions contained approximately 3 feet of standing water or 1100 gallons per sphere (11,000 gallons total) where it should be dry. Because of the system geometry, the volume of water in the spherical junction was at its maximum. Addition of more water would result in spilling into the ring header and downcomers. The source of the water is believed to be condensation in the relatively cool vent header lines. The original plant design of some Mark I containments had drain lines from the spherical junctions to the torus. Some of the plants having these drain lines removed them in the early 1980s to eliminate a potential torus bypass path. These drain lines were not part of the original design at NMP1 and were not installed.

The licensee's analysis of the standing water in the spheres concluded that the mass could become entrained in the initial blowdown and would increase the thrust loads during a LOCA. A subsequent analysis demonstrated that the majority of the system components met American Society of Mechanical Engineers (ASME) Code allowable stress values with the exception of the VH/VL spherical junction at the connection to the ring header. The calculated stress level for the VH/VL junction exceeded the original design acceptance criteria (ASME Service Level A/B), but remained below ASME Service Level C and the higher acceptance stress level limits for operability (ASME Service Level D). The guidance provided in NRC Generic Letter 91-18 was used to demonstrate that the VH/VL spherical junction stress levels remained operable.

At the time of this information notice, analysis was continuing to determine if additional actions were needed to restore compliance with the original design criteria.

This information notice requires no specific action or written response. If you have any questions regarding the information notice, please contact the technical contacts listed below or the appropriate Office of Nuclear Reactor Regulation (NRR) project manager.

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