

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555-0001

January 18, 2002

NRC INFORMATION NOTICE 2002-06: DESIGN VULNERABILITY IN BWR REACTOR
VESSEL LEVEL INSTRUMENTATION BACKFILL
MODIFICATION

Addressees

All holders of operating licenses or construction permits for boiling water reactors (BWRs).

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert addressees to a potential design vulnerability in a hardware modification to the reactor vessel water level instrumentation system. 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.

Background

NRC Bulletin (NRCB) 93-03, "Resolution of Issues Related to Reactor Vessel Water Level Instrumentation in BWRs," issued on May 28, 1993, requested that licensees implement hardware modifications necessary to ensure the level instrumentation system design is of high functional reliability for long-term operation. In response to this bulletin, all BWR licensees with the exception of Big Rock Point, which does not use cold-reference-leg instrumentation, have either implemented or committed to implement modifications. The majority of these licensees have decided to install a reference leg backfill system to supply a continuous flow of water from the control rod drive (CRD) hydraulic system through the reference legs. The back-fill system precludes migration of dissolved noncondensable gases down the legs. In August 2001, a design vulnerability in this backfill modification was found at the Pilgrim Nuclear Power Station.

Description of Circumstances

It was discovered that, under certain conditions, the safety-related reactor vessel water level indicators that provide certain safety-related initiation signals could give nonconservative water level readings. During a reactor trip at Pilgrim, both trains of the emergency core cooling system (ECCS) reactor water level instruments indicated higher than actual levels. These instrument inaccuracies were noted after operator actions were taken to isolate the CRD system charging water header supply valve, CRD 301-25, to insert a control rod that had not settled at position 00. Closure of the charging water header isolates the ECCS level indicator reference-leg backfill system (see Attachment 1). The erroneous readings were attributed to

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the reference legs draining back through the reference-leg keepfill system to the CRD hydraulic control units (HCUs). With the CRD charging header valve shut, the reactor scram reset, and reactor pressure rising, the reference legs drained back to the HCUs. This occurs when the CRD system pump is secured or the charging header isolation valve is closed, the source of the reference-leg keepfill system, is at a slightly lower pressure than the reactor so that the differential pressure across the keepfill system check valve is not sufficient to fully seat the check valves. The draining of the reference legs results in a transient false reference-leg indication until the check valves seat and the reference legs refill via the condensate pots or flow is reestablished through the CRD reference leg backfill system. Pilgrim concluded that this phenomenon can occur with either the isolation of the reference leg backfill system or possibly with the loss of the running CRD pump.

During the reactor scram at Pilgrim, this event resulted in both the wide-range vessel level instruments indicating higher than actual water level with the A train reaching a maximum deviation of 26 inches and the B train reaching a maximum of 11 inches. These erroneous high readings occurred for approximately 30 minutes. During this time, the automatic emergency core cooling system initiation function would not have occurred on low-low water level as designed. This false reading is due to the relative locations of the reactor vessel instrument nozzles and the differential pressure corresponding to the ECCS initiation setpoint.

Related Generic Communications:

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|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| NRC Information Notice 93-89 | “Potential Problems With BWR Level Instrumentation Backfill Modifications,” November 26, 1993 |
| NRC Information Notice 92-54 | “Level Instrumentation Inaccuracies Caused by Rapid Depressurization,” July 24, 1992 |
| Generic Letter 92-04 | “Resolution of the Issues Related to Reactor Vessel Water Level Instrumentation in BWRs Pursuant to 10 CFR 50.54(f),” August 19, 1992 |
| NRC Information Notice 93-27 | “Level Instrumentation Inaccuracies Observed During Normal Plant Depressurization,” April 8, 1993 |
| NRC Bulletin 93-03 | “Resolution of Issues Related to Reactor Vessel Water Level Instrumentation in BWRs,” May 28, 1993 |

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.

/RA/

William D. Beckner, Program Director
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Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

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Attachments:

1. Sketch of Backfill Modification
2. List of Recently Issued NRC Information Notices

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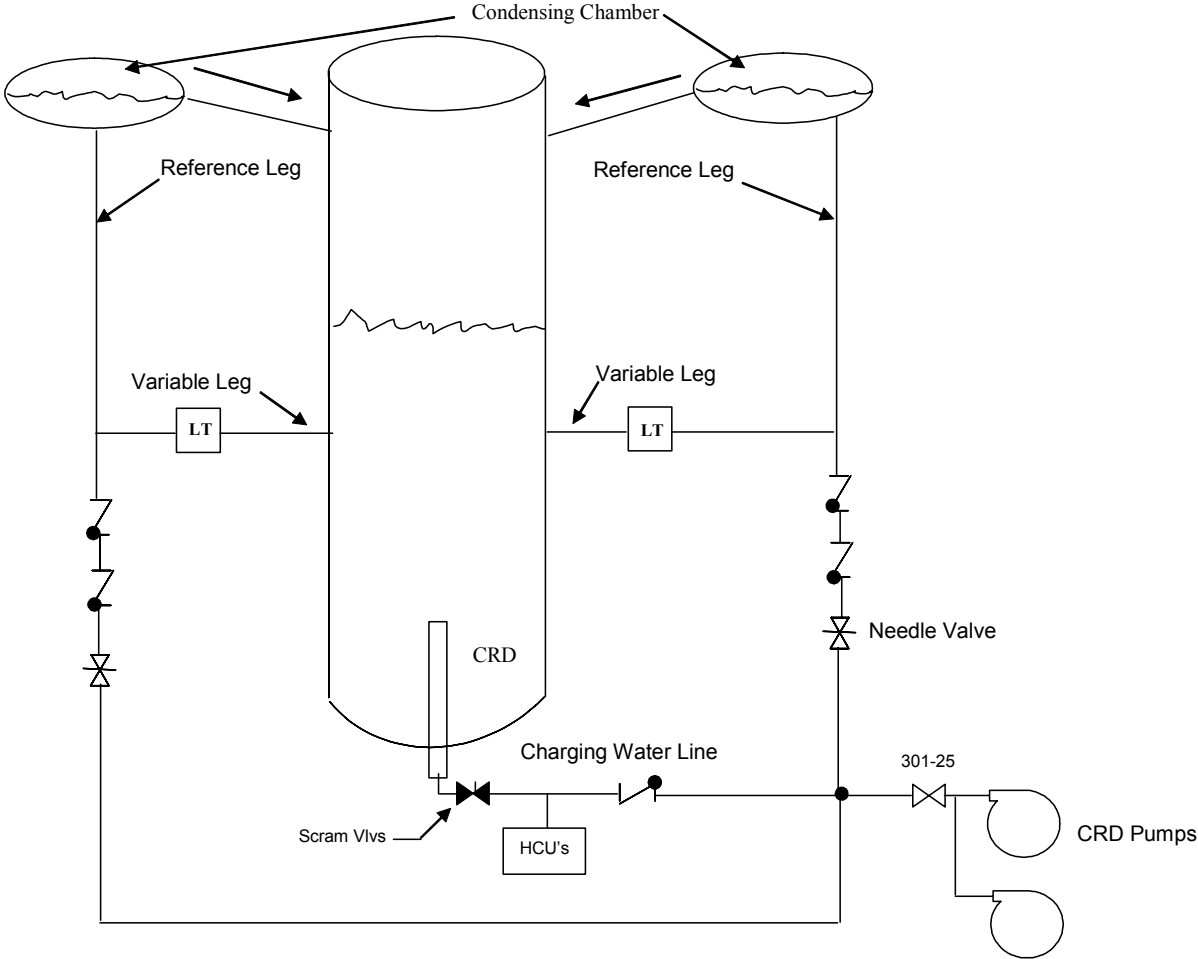
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*See previous concurrence

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| DATE | 01/ /2002 | 12/04/2001 | 12/17/2001 | 01/17/2002 | 01/17/2002 | 01/18/2002 |

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RWL Reference Leg Backfill



LIST OF RECENTLY ISSUED
 NRC INFORMATION NOTICES

| Information Notice No. | Subject | Date of Issuance | Issued to |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2002-05 | Foreign Material in Standby Liquid Control Storage Tanks | 01/17/02 | All holders of licenses for nuclear power reactors. |
| 2002-04 | Wire Degradation at Breaker Cubicle Door Hinges | 01/10/02 | All holders of operating licenses for nuclear power reactors. |
| 2002-03 | Highly Radioactive Particle Control Problems During Spent Fuel Pool Cleanout | 01/10/2002 | All holders of operating licenses for nuclear power reactors, holders of licenses for permanently shutdown facilities with fuel onsite, and holders of licenses for non-power reactors. |
| 2002-02 | Recent Experience with Plugged Steam Generator Tubes | 01/08/2002 | All holders of operating licenses for pressurized-water reactors (PWRs), except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor. |
| 2002-01 | Metalclad Switchgear Failures and Consequent Losses of Offsite Power | 01/08/2002 | All holders of licenses for nuclear power reactors. |
| 2001-19 | Improper Maintenance and Reassembly of Automatic Oil Bubblers | 12/17/2001 | 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. |
| 2001-18 | Degraded or Failed Automated Electronic Monitoring, Control, Alarming, Response, and Communications Needed for Safety and/or Safeguards | 12/14/2001 | All uranium fuel conversion, enrichment, and fabrication licensees and certificate holders authorized to receive safeguards information. Information notice is not available to the public because it contains safeguards information. |