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

July 24, 1992

NRC INFORMATION NOTICE NO. 92-54: LEVEL INSTRUMENTATION INACCURACIES CAUSED BY RAPID DEPRESSURIZATION

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Addressees

All holders of operating licenses or construction permits for nuclear power reactors.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert addressees to potential inaccuracies in water level indication during and after rapid depressurization events. This problem may affect the indication of pressurizer level for pressurized water reactors (PWR) and reactor vessel level for boiling water reactors (BWR). 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.

Description of Circumstances

On April 17, 1991, Northeast Utilities (NU) filed a licensee event report (LER) for Millstone Unit 3, documenting pressurizer level instrument inaccuracies. According to the LER the inaccuracies result from non-condensible gases collecting in the condensing pots of the instrument reference legs. The LER stated that pressurizer level would be used to make decisions concerning operator actions directed by the Emergency Operating Procedures (EOP).

During the previous operating cycle, NU monitored the accuracy of the pressurizer level instrumentation and observed a worst case error of 3.6% of full scale and also confirmed that non-condensible gases had accumulated inside the condensing pots. The root causes for the accumulation of non-condensible gases in the condensing pots were 1) the instrument lines sloped upward from the pressurizer to the condensing pots and, 2) a restricting orifice in each instrument line prevented the free flow of steam and non-condensible gases between the pressurizer and the condensing pots. NU corrected the problem by removing the condensing pot and changing the instrument line slope.

Westinghouse and Combustion Engineering performed further engineering evaluations and concluded that during a rapid depressurization of the Reactor

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Coolant System (RCS), during certain design basis accidents, the release of non-condensible gases could result in a level indication error of about +40 percent of full scale. The staff has evaluated the effects of this error and determined that the only unacceptable actions that could be taken by operators as a result of this error are to prematurely terminate safety injection (SI) or to fail to re-initiate SI if required. The staff further determined that the pressurizer level instrumentation is not used as the primary parameter evaluated by operators for safety injection termination and that PWR emergency operating procedures direct operators to consult other instrumentation and parameters (reactor vessel level monitoring system, RCS subcooling and a stable or increasing RCS pressure) prior to terminating SI.

For BWRs, reactor vessel level indication system (RVLIS) errors had also been identified in the past and the staff issued Generic Letter (GL) No. 84-23, "Reactor Vessel Water Level Instrumentation in BWRs" to address the concern. This GL was based on the BWR Owners Group (BWROG) report (SLI-8218 issued in November 1982), "Inadequate Core Cooling Detection in Boiling Water Reactors." However, these documents do not specifically address the non-condensible gas evolution concern associated with rapid depressurization. The staff has requested the BWROG to address this issue and GE is preparing a report on behalf of the BWROG.

On July 15, 1992, Northeast Utilities (NU) made a notification to the NRC under Section 50.72 of Title 10 of the Code of Federal Regulations (10 CFR 50.72) regarding inaccuracies in reactor vessel level indication at Millstone Unit 1. This notification indicated that the level instrumentation may not provide accurate indication following a rapid depressurization event as a consequence of the expulsion of water from the reference leg due to the release of non-condensible gases in the instrument reference leg. In a conference call with NU on July 21, 1992, the licensee stated that the Yarway level measurement instrumentation which provides the automatic actuation of safety systems at Millstone Unit 1 would not be affected by this phenomenon. However, the GE/MAC level instrumentation, which is used for indication, feedwater control, and containment spray pump interlocks, would be affected. Following a rapid depressurization event, the operator might receive inaccurate information from the GE/MAC instrumentation leading the operator to perform inappropriate manual actions. The licensee has estimated, based on a conservative analysis, that the upper bound of the error in the GE/MAC instrumentation could be as much as 15 to 20 feet. Millstone Unit 1 is currently in cold shutdown for service water repairs, and NU is reviewing the error analysis and a possible modification to the condensing pot arrangement in order to reduce inaccuracies in the level indication to an acceptable level before restart.

In a conference call on July 22, 1992, the staff informed the BWROG of the results of the Northeast Utilities' analyses and the licensee's planned actions. The BWROG indicated its position that the error would not exceed 4 inches if the reference leg configuration is installed in accordance with vendor recommendations.

The NRC has activated the BWR Regulatory Response Group and scheduled a meeting to discuss this issue at NRC headquarters in Rockville, Md., on July 29, 1992.

Discussion

Inaccuracies in level instrumentation in PWRs and BWRs could affect the performance of safety functions. GL 84-23, BWROG report SLI-8218, and vendor recommendations are intended to provide guidance to preclude the operators from taking improper actions during normal plant operation. The inaccuracies caused by rapid depressurization events in PWRs have limited safety significance because instrumentation other than that for pressurizer level is used by the operators to determine appropriate manual actions. For BWRs, however, large errors in level indication may have greater safety significance. An evaluation by the staff is continuing and when the evaluation is completed the staff will determine if additional regulatory actions will be necessary.

This information notice requires no specific action or written response. If you have any questions regarding 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.

Charles E. Rossi, Director
Division of Operational Events Assessment
Office of Nuclear Reactor Regulation

Technical contacts: Hukam C. Garg, NRR
(301) 504-2929

Tim Collins, NRR
(301) 504-2897

Attachment:
List of Recently Issued NRC Information Notices

LIST OF RECENTLY ISSUED
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
92-53	Potential Failure of Emergency Diesel Generators due to Excessive Rate of Loading	07/29/92	All holders of OLs or CPs for nuclear power reactors.
91-52, Supp. 1	Nonconservative Errors in Overtemperature Delta-Temperature (OTΔT) Setpoint Caused by Improper Gain Settings	07/16/92	All holders of OLs or CPs for Westinghouse (W)-designed nuclear power reactors.
92-52	Barriers and Seals Between Mild and Harsh Environments	07/15/92	All holders of OLs or CPs for nuclear power reactors.
92-51	Misapplication and Inadequate Testing of Molded-Case Circuit Breakers	07/09/92	All holders of OLs or CPs for nuclear power reactors.
92-50	Cracking of Valves in the Condensate Return Lines of A BWR Emergency Condenser System	07/02/92	All holders of OLs or CPs for BWRs.
92-49	Recent Loss or Severe Degradation of Service Water Systems	07/02/92	All holders of OLs or CPs for nuclear power reactors.
92-48	Failure of Exide Batteries	07/02/92	All holders of OLs or CPs for nuclear power reactors.
92-47	Intentional Bypassing of Automatic Actuation of Plant Protective Features	06/29/92	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License
CP = Construction Permit

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