

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

May 9, 1997

**NRC INFORMATION NOTICE 97-25: DYNAMIC RANGE UNCERTAINTIES IN THE
REACTOR VESSEL LEVEL INSTRUMENTATION**

Addressees

All holders of operating licenses or construction permits for Westinghouse pressurized-water reactors.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert addressees to a recent incident in which a licensee failed to provide adequate periodic corrections for analytical uncertainties in the reactor vessel level indicating system (RVLIS). This failure could lead plant operators to take nonconservative actions during an emergency. It is expected that recipients will review this information for applicability to their facilities and consider actions, as appropriate. However, suggestions contained in this information notice are not NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances

On March 3, 1997, the licensee for Diablo Canyon Units 1 and 2 discovered that since initial installation of the RVLIS, dynamic range indications had not been renormalized as described in the Westinghouse operations manuals. Because dynamic range uncertainties caused by changes in the reactor coolant system (RCS) hydraulics were not verified, normalized, or changed periodically per vendor recommendations, it was initially believed that the RVLIS dynamic flow range indication readings were 6-8 percent higher than actual values. Later, an engineering evaluation performed by the licensee showed that RVLIS readings were about 10 percent higher than actual values. These higher-than-actual readings could have caused plant operators to take non-conservative actions during a loss of RCS inventory event.

Discussion

The Westinghouse RVLIS is a differential pressure (d/p) measuring system for determining the water level in the reactor vessel or the relative void content of the RCS, or both. In addition to directly indicating of vessel water level, it provides useful information relating to leaks and small breaks in the RCS. This system employs separate sets of three d/p cells, and the display consists of level indications in three ranges. The narrow range (also called full range), displays collapsed water levels from 0 to 100 percent between the empty and the full vessel with none of the reactor coolant pumps (RCPs) running. The upper range displays vessel levels above hot-leg connections, again with none of the RCPs running. During

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normal at-power plant operation with the RCPs running, the displays for these two ranges are off scale. The wide range or dynamic range is scaled from 0 percent with the vessel empty and with no RCPs running, to 100 percent with the vessel full and all RCPs running.

After initial installation, instruments for the dynamic range are calibrated using analytical uncertainties associated with the calculated values of the flow differential pressure head loss. This calculation is based on head characteristics of the RCPs and various flow resistances of the RCS. The vendor recommended that all calculated values be verified, confirmed, and adjusted during subsequent plant startups to correct uncertainties involving system hydraulic changes for each fuel cycle, such as steam generator tube plugging and change in fuel assembly flow resistance. This process, known as "normalizing," returns the outputs to an indication of 100 percent at zero power with all RCPs running. In the event of an accident during the cycle leading to loss of coolant with continued RCPs operation, the coolant would be circulated as a void mixture, and the RVLIS dynamic range would indicate the increase in voids as a decrease in dynamic range output. By renormalizing the dynamic range to 100 percent at the beginning of each cycle, the dynamic range output indicates the approximate void content relative to a zero void condition.

During an internal review, the Diablo Canyon licensee discovered that, since initial startup, the calculated uncertainty values associated with the RCS flow characteristics for the RVLIS dynamic head transmitter had never been periodically verified as recommended in the Westinghouse (vendor) manual. The licensee contacted Westinghouse to discuss the problem, and implemented corrections for RVLIS indications by recalibrating the instruments through an online dynamic range normalization. During this process, the licensee discovered that the RVLIS readings erred by about 10 percent in the nonconservative direction.

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Suzanne H. Weiss for

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Information Notice No.	Subject	Date of Issuance	Issued to
97-24	Failure of Packing Nuts on One-Inch Uranium Hexafluoride Cylinder Valves	05/08/97	All U.S. Nuclear Regulatory Commission licensees and certificatees authorized to handle uranium hexafluoride in 30- and 48-inch diameter cylinders
97-23	Evaluation and Reporting of Fires and Unplanned Chemical Reactor Events at Fuel Cycle Facilities	05/07/97	All fuel cycle conversion, enrichment, and fabrication facilities
97-22	Failure of Welded-Steel Moment-Resisting Frames During the Northridge Earthquake	04/25/97	All holders of OLs or CPs for nuclear power reactors
97-21	Availability of Alternate AC Power Source Designed for Station Blackout Event	04/18/97	All holders of OLs for nuclear power reactors
97-20	Identification of Certain Uranium Hexafluoride Cylinders that do not comply with ANSI N14.1 Fabrication Standards	04/17/97	All holders of OLs for nuclear power
97-19	Safety Injection System Weld Flaw at Sequoyah Nuclear Power Plant, Unit 2	04/18/97	All holders of OLs or CPs for nuclear power reactors

OL = Operating License
CP = Construction Permit

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After initial installation, instruments for the dynamic range are calibrated using analytical uncertainties associated with the calculated values of the flow differential pressure head loss. This calculation is based on head characteristics of the RCPs and various flow resistances of the RCS. As recommended by the vendor, all such calculated values are required to be verified, confirmed, and adjusted to their actual values during subsequent plant startups to correct analytical uncertainties addressing system hydraulic changes during each fuel cycle, such as steam generator tube plugging and change in fuel assembly flow resistance. This process, known as "normalizing," returns the outputs to an indication of 100 percent at zero power with all RCPs running. In the event of an accident during the cycle leading to loss of coolant with continued RCPs operation, the coolant would be circulated as a void mixture, and the RVLIS dynamic range would indicate the increase in voids as a decrease in dynamic range output. By renormalizing the dynamic range to 100 percent at the beginning of each cycle, the dynamic range output indicates the approximate void content relative to a zero void condition.

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