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

September 25, 1989

NRC INFORMATION NOTICE NO. 89-68: EVALUATION OF INSTRUMENT SETPOINTS DURING MODIFICATIONS

Addressees:

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

Purpose:

This information notice is being issued to alert addressees to a potential safety problem resulting from inadequate evaluation of operating and design characteristics when modifying instrumentation and control (I&C) systems. It is expected that recipients will review the information for applicability to their facilities and consider actions, if applicable, to avoid similar problems. Suggestions contained in this information notice do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

Several design inspections of plant modifications in the I&C area by the Nuclear Regulatory Commission have revealed that calculations relating to the setpoints of the modified instrument loops were not performed properly to verify that the original design objectives of the safety systems were still satisfied. Modifications to the instrument system(s) may introduce undesirable operating characteristics because of a change in the margin between the nominal setpoint and the technical specification (TS) limit or a change in the system's response time. The changed attributes of the I&C components may degrade the safety system's ability to meet its design requirements. Summarized below are inspection findings from three recent and two earlier inspections that illustrate these concerns.

Oyster Creek Nuclear Power Plant (November - December 1988):

The reactor instrumentation system at the Oyster Creek station was modified to convert certain reactor protection system pressure switches to an analog trip system. In determining the setpoint values for the modified I&C loops, the licensee arbitrarily established margin values and was not thorough in accounting for all potential error contributors to the total uncertainty for I&C measurement loops. Because of this, I&C technicians could leave calibrated instrument channels at the upper limits of their calibration bands and create conditions that permit setpoints of plant process parameters to deviate beyond their TS limits without the condition being detected. In this regard, the licensee identified several instrument loops with a history of exceeding TS limits.

IA 88-11-C

Zion Nuclear Power Station (March - April 1988):

For modification packages in the I&C area at the Zion station, setpoint calculations for modified instrument loops did not consider head correction changes caused by changes in instrument tap location. Also, calculations did not address compensations for temperature and/or density changes where applicable. The value of allowance for instrument drift was not related to the interval between surveillances. The inspection team found that some calculations used a value equivalent to 12 months drift for instrument loops that had a surveillance interval of 18 months. In addition, calculations used assumed values for uncertainty in measuring and test equipment (M&TE), assumed values of calibration tolerances, and assumed values of instrument dead bands. All these errors resulted in a nonconservative value of setpoint margin. The failure to account correctly for drift, head correction, temperature and density correction, accuracies of M&TE, and values of calibration tolerances could create an unanalyzed situation in which the instrument may not be able to initiate the required safety function even if the process variable is in the non-conservative direction with respect to the allowable value.

Indian Point, Unit 2 (January - February 1988):

An inspection of the preventive maintenance program at Indian Point Unit 2 revealed that the licensee was not trending for directional changes (positive or negative) in instrument accuracy occurring between successive calibrations. The inspection team found that in several loops, accuracy and drift values of the instruments were changing only in one direction between successive surveillance intervals. Uncertainty calculations for setpoint margins of these loops were performed by combining uncertainty attributes using the square root of the sum of the squares (SRSS) method. This method is acceptable provided uncertainty attributes of loop components have random directions. In a situation in which uncertainty attributes are known to be changing only in one direction, use of the SRSS method for computing the setpoint margin will result in a nonconservative value. This value, when applied to the setpoint, may compromise the ability of an instrument to initiate a safety function before the process variable exceeds its process safety limit. Furthermore, instrument drift values occurring in only one direction over several surveillance tests warrant review by the licensee to determine their cause.

Dresden Nuclear Power Station, Unit 3 (November - December 1985):

The reactor instrumentation system at Dresden Unit 3 was modified by replacing the old mechanical instruments with new solid-state instruments. The new instrument loop had increased response time and drift. Also, the accuracy values of the new instruments were different. The inspection team found that an engineering evaluation of the impact of characteristics of new instrument(s) on the system operation was not performed. Also, an analysis of the impact of the increased drift on the existing surveillance frequency was not performed. After installation, the new instruments were adjusted to the setpoints established for the original instruments. In this situation, the effectiveness of the modified system to meet the original design objectives could not be ascertained, creating a potentially unanalyzed situation.

Edwin I. Hatch Nuclear Plant, Units 1 and 2; Joseph M. Farley Nuclear Plant, Units 1 and 2 (May 1986):

Design changes at the Hatch and Farley units included replacement of the existing mechanical-type instruments with either a single instrument or a string of instruments consisting of a primary sensor, a signal conditioner, and bistables. An analysis of the setpoint margin using characteristics of the new instruments was not performed, and the new instruments were set to either a setpoint established for the original instruments or to a new setpoint chosen by the instrument vendor. In the absence of any engineering analysis, the ability of the modified system to meet the original design objectives could not be ascertained, thus creating a potentially unanalyzed situation.

Discussion:

It is important that an engineering analysis be performed to verify that the static and dynamic characteristics of a system, when modified by the installation of new instrumentation, continue to meet the design objectives. In modifying I&C systems, it is important that careful consideration be given to the necessity of recalculating setpoints, setpoint margins, and values of the TS limits to ensure that improper operating characteristics have not been introduced by the modification. Useful guidance is provided in ISA 67.04-1982, "Setpoints for Nuclear Safety-Related Instrumentation used in Nuclear Power Plants" which has been endorsed by Regulatory Guide 1.105 Revision 2-1986,"Instrument Setpoints for Safety-Related Systems".

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 NRR project manager.

Charles E. Rossi

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

Technical Contacts: S. V. Athavale, NRR
(301)492-0974

J. Mauck, NRR
(301)492-3264

S. C. Guthrie, NRR
(301)492-0991

Attachment: List of Recently Issued NRC Information Notices

LIST OF RECENTLY ISSUED
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
89-67	Loss of Residual Heat Removal Caused by Accumulator Nitrogen Injection	9/13/89	All holders of OLs or CPs for PWRs.
89-66	Qualification Life of Solenoid Valves	9/11/89	All holders of OLs or CPs for nuclear power reactors.
88-46, Supp. 4	Licensee Report of Defective Refurbished Circuit Breakers	9/11/89	All holders of OLs or CPs for nuclear power reactors.
89-65	Potential for Stress Corrosion Cracking in Steam Generator Tube Plugs Supplied by Babcock and Wilcox	9/8/89	All holders of OLs or CPs for PWRs.
89-64	Electrical Bus Bar Failures	9/7/89	All holders of OLs or CPs for nuclear power reactors.
89-63	Possible Submergence of Electrical Circuits Located Above the Flood Level Because of Water Intrusion and Lack of Drainage	9/5/89	All holders of OLs or CPs for nuclear power reactors.
89-62	Malfunction of Borg-Warner Pressure Seal Bonnet Check Valves Caused By Vertical Misalignment of Disk	8/31/89	All holders of OLs or CPs for nuclear power reactors.
89-61	Failure of Borg-Warner Gate Valves to Close Against Differential Pressure	8/30/89	All holders of OLs or CPs for nuclear power reactors.
88-48, Supp. 2	Licensee Report of Defective Refurbished Valves	8/22/89	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License
CP = Construction Permit

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The instruments of a safety-related system must provide the proper control and monitoring to ensure that the system will perform its intended design functions without letting the process limits of the controlled variable exceed the applicable TS limit. An engineering analysis may be required to verify that the static and dynamic characteristics of the system, as modified by the addition of the new instrumentation, continue to meet their design objectives. In modifying I&C systems, careful consideration should be given to the necessity of recalculating setpoints, setpoint margins, and values of the TS limits to ensure that improper operating characteristics have not been introduced by the modification.

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