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IE Supplement 4 to Bulletin No. 80-17: FAILURE OF CONTROL RODS TO INSERT DURING A SCRAM AT A BWR

NRC staff evaluation of failures of the continuous monitoring system (CMS) for the scram discharge volume (SDV) at an operating BWR has identified the need for licensee actions in addition to those requested by IEB 80-17 and Supplements 1-3. The purpose of these actions is to provide assurance that the CMS has been tested to demonstrate operability as installed, remains operable during plant operation, and is periodically surveillance tested to demonstrate continued operability.

The occurrence of CMS failures at Dresden Nuclear Power Station was discussed in IE Information Notice 80-43, which was issued on December 5, 1980 to those operating BWR's with CMS recently installed. Subsequently, investigation into the cause of the failure to receive the alarm with the SDV essentially full revealed several items which required correction, including:

1. Excess portions of transducer cable were placed in physical positions which would increase external noise sensitivity.

2. The UT transducers were not placed in a physical position to optimize system sensitivity.

3. A certain amount of "cross-talk" was occuring between redundant transducers located a few feet apart on the same run of 4" pipe.

Station and vendor personnel shortened and rerouted transducer cables to improve noise rejection. Vendor specialists optimized transducer placement and synchronized both transducers to the same ultrasonic instrument internal clock to minimize cross-talk and improve signal to noise characteristics. Following these actions the CMS appeared to function properly.

Further difficulties were encountered when apparently minor quantities of water leaked into the SDV as a result of control rod drive scram valve maintenance activities and minor scram outlet valve leakage. It appears that the transducers are located on a section of SDV piping which forms a local low point. Accordingly, small amounts of water can accumulate to a depth which triggers the high level alarm (at 1-1/4") before the water drains to the instrument volume. The licensee in conjunction with the NSSS vendor, performed a unit specific analysis for a conservative high alarm setpoint and reset the alarm point to 2-1/2". The system now appears to function properly. A five second alarm time delay was also installed to aid in rejecting spurious alarms.

Potential malfunction modes which are still of concern are:

1. The capability of the CMS to adequately determine level of water for the entire range of depths which may occur during slow and rapid fill conditions, that is, beam penetration capability.

2. The potential for loss of transducer sensitivity during periods of rapid flow, or when the water being detected is turbulent or mixed with entrained air or steam bubbles.

The ability of the CMS installed in your facility to operate in respect to these concerns should be considered in the preparation of your response to this bulletin. The following actions are requested in addition to those specified in IE Bulletin 80-17 and Supplements 1 through 3.

Actions to be Taken by Licensees of Operating BWR's Using CMS

1. Bench Test of CMS

Make available the following information which describes the CMS design and the bench tests which have been performed to demonstrate system operability and sensitivity:

(a) System description including a schematic of the apparatus and associated electronics.

(b) Type of sensing device and characteristics (include response characteristics versus temperature).

(c) Calibration criteria, including transmission losses.

(d) Training and testing of personnel performing the calibration test.

Items a through c above may be referenced by the licensee if the information has been submitted to the NRC by the equipment manufacturer.

2. Operability Test of CMS

Prior to conducting the operability test, verify that the CMS on the SDV is installed and calibrated in accordance with the vendor recommendations.

In order to provide assurance of operability of the CMS, if not already performed conduct an operability test within 14 days of the date of this bulletin. In this test, inject a sufficient amount of water into each SDV header to determine that the ultrasonic transducers are adequately coupled to the SDV piping and that the trip alarm function of the CMS will perform satisfactorily. The test may be performed by single (multiple) rod scram tests while operating. No water may be introduced into the SDV header while the reactor is operating except using the scram function. Independent level measurement must be used to verify CMS operation and proper calibration.

3. Interim Manual Surveillance

In the interim 14-day period before the operability test is completed, perform a manual surveillance for the presence of water in the SDV at least once per shift and after each reactor scram. In order to provide assurance that manual surveillance can detect water accumulation in the SDV, verify that the method and the operator have been qualified by testing which uses or simulates the SDV piping and has the ability to detect different levels of water in the SDV.

Surveillance of SDV manual measurement techniques should be done before completion of the operability test described in Item 2 above.

4. Full Test of CMS to be Conducted During a Planned Outage

During a planned outage within six months, perform a full CMS test using the SDV headers:

(a) Admit water into the SDV to establish fill rates for several (not less than three) in-leakage flow rates. The in-leakage rates should range from approximately the minimum which results in water accumulation in the SDV to a full scram.

(b) Establish and record the response of the CMS indication and alarm functions from the trip level to a full SDV. Provide criteria for replacement or adjustment when exceeding design specifications of the system.

(c) Verify by independent measurement that the alarm initiates at the proper level setpoint.

5. Operability of CMS During Reactor Operation

The CMS shall be operable prior to reactor startup and during reactor operation. If the CMS becomes less than fully operable, within 8 hours perform a manual check for water in the SDV and institute procedures for a manual check of the SDV each shift and following scram until the CMS is fully operable. When not fully operable, the CMS should be used to the extent practical in addition to the manual checks.

If the CMS is not operable within 7 days, the frequency of the manual check should be increased to once every 4 hours. If the CMS is not operable within 30 days the plant shall be shutdown.

To demonstrate continued operability of the CMS during reactor operation, perform periodic surveillance tests for operability of the CMS. For these periodic surveillance tests, test as much of the CMS as practical during reactor operation without injecting water in the SDV. Establish criteria for repair or replacement when the system design criteria or estimated service life limitations are exceeded. The frequency of these periodic surveillance checks should be determined by the licensee.

These periodic surveillance tests should include the following:

(a) determination that the response and power output of the transducer has not degraded;

(b) visual inspection for adequate condition of the transducer to SDV coupling material; and

(c) a calibration check of the electronics to assure alarm initiation in the control room.

Water should be periodically injected into the SDV to perform a CMS operability and calibration check similar to that specified in Item 2 above. This check should be performed semiannually and during startup after plant outages where maintenance operations may have taken place near to CMS equipment.

6. Operating Procedures

Develop procedures for operation, periodic testing and calibration of the CMS and for repair or replacement when system design specifications are exceeded. Develop procedures for the calibration and use of the hand held UT device in the event of a malfunctioning CMS. Notify the NRC before changing the established CMS alarm level setpoints.

Licensees of all operating BWRs with a CMS shall provide the information requested in Item 1 and shall submit a report summarizing action taken in response to each of the above items within 45 days of the date of this Bulletin Supplement. Accordingly, you are requested to provide within 45 days as specified above, written statements of the above information signed under oath or affirmation under provisions of Section 182a of the Atomic Energy Act of 1954. Reports shall be submitted to the Director of the appropriate NRC Regional Office and a copy forwarded to the Director, NRC, Office of Inspection and Enforcement, Washington, D.C. 20555.

This request for information was approved by GAO under a blanket clearance number R0072 which expires November 30, 1983. Comments on burden and duplication should be directed to the U.S. General Accounting Office, Regulatory Reports Review, Room 5106, 441 Eighth Street, N.W., Washington, D.C. 20548

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| 80-22 | Automation Industries, Model 200-520-008 Sealed-Source Connectors | 9/11/80 | All radiography licensees |
| 80-21 | Valve yokes supplied by Malcolm Foundry Company, Inc. | 11/6/80 | All light water reactor facilities with OLs or CPs |
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| Supplement 2 to 79-01B | Environmental Qualification of Class 1E Equipment | 9/30/80 | All power reactor facilities with an OL |
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| 79-26 Revision 1 | Boron Loss from BWR Control Blades | 8/29/80 | All BWR power facilities with an OL |
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OL = Operating License
CP = Construction Permit