Nebraska Public Power District

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To ADM/DMB:

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LPDR
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January 27, 1981

Mr. Karl V. Seyfrit, Director
U.S. Nuclear Regulatory Commission
Office of Inspection and Enforcement
Region IV
611 Ryan Plaza Drive
Suite 1000
Arlington, Texas 76011

RECEIVED
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U.S. NUCLEAR REGULATORY COMMISSION

Subject: Response to IE Bulletin 80-17, Supplement 4
Failure of Control Rods to Insert
During a Scram at a BWR

Dear Sir:

This response is being submitted in accordance with the requirements of the subject bulletin. The areas of concern with regard to system installation have not been a particular problem at Cooper Nuclear Station due to the design of this system and the operability checks performed after its installation.

Item 1 - Bench Test of CMS

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

The enclosed schematic shows the apparatus and associated electronics. As previously transmitted, the monitoring system at Cooper Nuclear Station is an adaptation of existing equipment on the market used to measure fluid depths in open channels. Four independent sensing circuits constantly monitor the header through the installed sensors. The analog output is continuously displayed by local meters. The outputs to the recorder are monitored by that apparatus and the recorder will start automatically when a signal corresponding to 1.5" water level is received. The recorder is located in the control room along with an alarm that initiates after a 10 second time delay. The digital comparator initiates a local alarm after a 16 second time delay. At this point, operating procedures dictate required operator action.

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The depth computing circuitry is all-digital logic. Each time a signal is emitted from the transducer, a digital count is begun. When the echo return is sensed, counting stops. The resulting count corresponds to the liquid depth, normalized to full scale. This measurement is updated every five seconds.

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

The sensing circuit utilizes an ultrasonic transducer that propagates a sound wave through the pipe wall into the water. When the sound wave reaches the water surface, the majority of the energy is reflected back towards the transducer. The returning pulses strike the transducer and are converted back to electrical energy.

The operating frequence is 1 MHz resulting in a relatively short wave length. The short wave length gives a good echo, even with turbulent or choppy water surfaces. Reliability is further enhanced by the short duty cycle. With the 5 microsecond transmit period every five seconds, the transducer is actually operating less than one minute per year.

The measurement is affected by changes in the speed of sound in the measured liquid, the most significant factor being temperature. The depth meter corrects for liquid temperature changes by monitoring a thermistor embedded in the sonic transducer; monitoring is done between depth measurements, using the same transducer cable.

(c) Calibration criteria, including transmission losses.

Until more operational data is obtained, an initial calibration criteria of ±½" deviation in output versus water level has been adopted. This criteria was taken into account when determining the required action steps outlined in operation procedures.

Another concern of the NRC is transmission losses. The transducer cable is impedance matched which reduces transmission losses to an insignificant level.

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

Personnel performing the calibration test and the installation were given guidance and instruction by the vendor. No specific testing of personnel is required by the vendor to be able to perform such calibration.

Extensive testing was performed prior to installation using a mock-up of the header. At that time, installation procedures and calibration procedures were verified. As a result of these tests, the acceptance criteria for installation was generated. Tests included simulating various flows, within the limitations of the mock-ups, to verify no loss of signal, determining maximum variation of transducer orientation to the pipe before signal loss would occur, and verification of a linear output by the sensing circuit.

Item 2 - Operability Test of CMS

An operability test was performed after installation of the CMS on the Scram Discharge Header during a plant outage. This test was performed after calibration of the individual sensing circuits. The vendor's recommendation did not include an independent verification measurement. The design of the system is such that as long as the signal is received, the indication will be correct. This is based on the above discussion on the design of the system.

The test consisted of filling the Scram Discharge Header and assuring a response was received from all transducers. Level indication was consistent and all alarm functions and the recorder checked out satisfactorily. Additional testing as outlined by Item 4 of the subject bulletin, will be performed during our next scheduled outage slated for late April 1981.

Item 3 - Interim Manual Surveillance

Inasmuch as the operability test, noted in Item 2, was completed to the satisfaction of the vendor, manual surveillance will not be performed.

Item 4 - Full test of CMS to be conducted during a planned outage

As noted in Item 2, a full test of the CMS will be performed during our scheduled April outage. This test will meet the requirements of Item 4.

We would like to express our concern as to whether it is realistic to expect a consistent and reliable depth indication during a full scram. The original intent of the system was to monitor header level to provide sufficient warning of loss of free volume. This loss of free volume could only be due to scram outlet valve leakage or failure, that would exceed the capacity of the header's ability to drain. Tests run at Cooper Nuclear Station as a result of IE Bulletin 80-17 indicate the maximum flow rate to be approximately 60 gpm, this was from a header with 125 psig pressure after the scram test. This would indicate that

during operation, flow in the header would be small resulting in an insignificant amount of turbulence as compared with that associated with full scram testing. Considering the above, it is realistic to expect a momentary loss of signal due to the turbulence and other phenomena of a full scram.

Items 5 and 6 - Operability of CMS during reactor operation and operating procedures

Surveillance procedures have been prepared to assure continued operability of the CMS. These procedures consist of the following:

(a) Quarterly functional check of the sensing circuit and alarm function using a calibration standard and prior to startup after a scram.

(b) Quarterly visual inspection of the transducer mountings.

(c) Annual calibration check of the sensing circuit and alarm functions using the scram discharge header as the source of the water level. Calibration will consist of an independent verification of the instrument output. This will be performed during our scheduled refueling outage. This test will not be performed semiannually as requested by Item 5 of the subject bulletin for the following reasons:

1) Testing shows scram testing of individual rods will not put sufficient amounts of water into the header to allow measurement.

2) Testing also shows the duration of time the water is in the header is very short making manual verification next to impossible.

3) Present scram testing of individual control rods is done in conjunction with rod swaps to minimize the power shocks the fuel is subjected to as a result of control rod movements. The locations of the control rods which are scrammed as part of the rod swap control rod manuevers are not necessarily the same control rod locations that would permit the injection of sufficient amounts of water to the individual headers to permit an adequate level measurement. It is possible to scram multiple rods so as to maximize the possibility of obtaining sufficient water level in the headers to permit measurements

for surveillance purposes. This, however, has some potentially severe drawbacks in regards to potential fuel damage. The control rods scrammed in as part of the rod swap are carefully selected considering potential power shocks to the fuel and to limit the control rod movements to only those control rod movements that are absolutely necessary to swap from one control rod sequence to another. Selecting control rods to be scrammed solely for the purpose of measuring water level in the headers would violate the above logical selection of control rods. Additionally, if the control rods are not scrammed in based upon the above criteria, the possibility exists that a limiting control rod pattern might be developed during the subsequent withdrawal of the scrammed control rods. For the above reasons, multiple scram testing of rods for verification of CMS operability will not be performed.

(d) A functional check will be performed prior to startup as described in (a) above when maintenance activities in the area of the CMS would have affected its operability.

The limiting conditions for operation as defined in Item 5 of the subject bulletin will be adhered to except for the use of a hand held UT device for manual checks of the SDV. In lieu of this method, an air test, previously approved for use by the NRC, will be used to verify that there isn't a significant amount of water in the SDV.

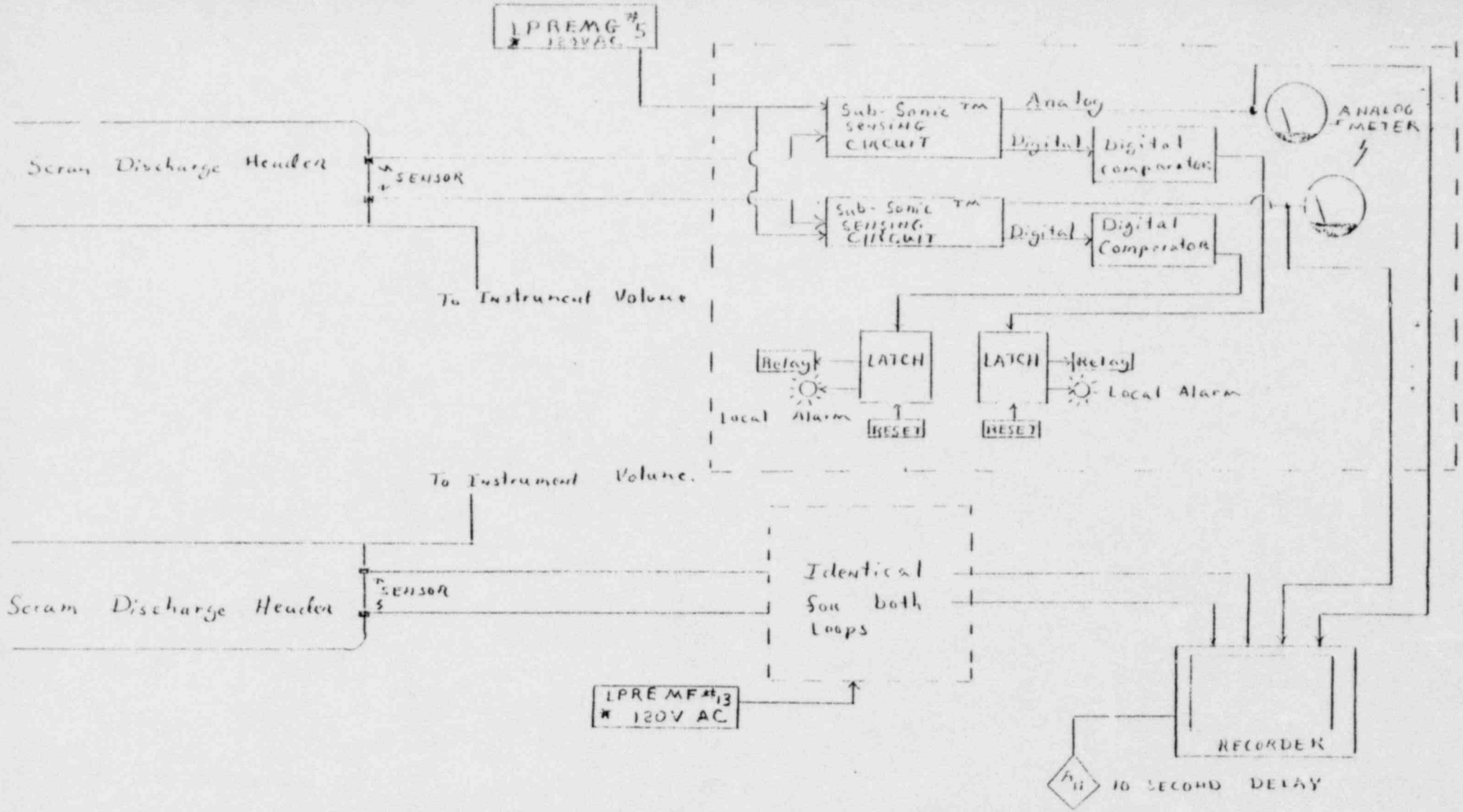
Approximately 30 manhours were expended in the preparation of this report.

If there are any additional questions concerning the above statements, please contact the originator.

Sincerely,

J. M. Pilant
Director of Licensing
and Quality Assurance

JMP:PFD:cg
Attach.




* Power is emergency power from independant sources.

Cooper Nuclear Station

Constant Monitoring System

Schematic

ATTACHMENT