

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

April 15, 1991

NRC INFORMATION NOTICE NO. 91-29: DEFICIENCIES IDENTIFIED DURING ELECTRICAL
DISTRIBUTION SYSTEM FUNCTIONAL INSPECTIONS

Addressees:

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

Purpose:

This information notice is intended to alert addressees to deficiencies identified during recently performed electrical distribution system functional inspections (EDSFIs). 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 do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

During multidisciplinary inspections, the U.S. Nuclear Regulatory Commission (NRC) has identified many deficiencies related to the electrical distribution system. To address these deficiencies, the NRC has developed an inspection to specifically evaluate the electrical distribution system. During the last year, the NRC completed eight EDSFIs, performing at least one in each of the five NRC geographical regions. During these inspections, the staff found several common deficiencies in the licensees' programs and in the electrical distribution systems as designed and configured at each plant. These deficiencies included inadequate ac voltages at the 480 Vac and 120 Vac distribution levels, inadequate procedures to test circuit breakers, and inadequate determinations and evaluations of setpoints.

Discussion:

Inadequate Voltage

During inspections conducted at the San Onofre Nuclear Generating Station (Inspection Reports 50-361/89-200 and 50-362/89-200), the Susquehanna Steam Electric Station (Inspection Reports 50-387/90-200 and 50-388/90-200), and the

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Waterford Steam Electric Station (Inspection Report 50-382/90-23), the staff found that, under certain conditions, the voltage available at the safety buses would be inadequate to operate safety-related loads and associated equipment. These conditions could occur when the plant's electrical distribution systems were being supplied from an offsite grid that had become degraded but that continued to supply voltages that remained above the setpoints at which the degraded grid relays would be activated.

At San Onofre, the numerous voltage drops throughout the system could cause the voltage to 120 Vac contactors to drop below the voltage range for which these contactors were certified as acceptable by their manufacturers. To resolve this problem the licensee has performed testing that established a lower acceptable voltage range for this equipment.

At Susquehanna, the degraded grid relay setpoint was set at 84 percent on the 4160 Vac buses. This setpoint could have allowed inadequate voltage to be delivered to numerous safety-related loads at both the 480 Vac and 120 Vac levels. The licensee calculated that setpoints of at least 93 percent would be required to ensure adequate voltage to all safety-related equipment. To resolve this problem, the licensee has raised the setpoints of the degraded grid relays and has initiated a modification to install 120 Vac regulating transformers.

At the Waterford nuclear plant, the degraded grid relays were set at 87.5 percent as sensed on the 4160 Vac buses. Although this setting was found to be marginally adequate for equipment connected to the 4160 Vac buses, the setting was too low to ensure that adequate voltage would be maintained at the 480 Vac and 120 Vac levels. The licensee is evaluating solutions to this problem and has instituted a procedure to manually separate from the grid if the voltage falls to unacceptable levels but remains above the relay setpoints.

The function of the degraded grid relays is to ensure that adequate voltage is available to operate all Class 1E loads at all distribution levels. In order to ensure that all required Class 1E loads will remain operable during degraded voltage conditions, some licensees are currently reanalyzing the basis for the degraded grid relay setpoints. The new analyses consider all required Class 1E loads and include the assumption that the voltage on the buses being sensed by these relays can remain at a level just above the relay setpoints.

Inadequate Circuit Breaker Testing Procedures

During recent EDSFIs and previously on other NRC inspections, the staff identified repetitive deficiencies in licensees' programs to test circuit breakers. These deficiencies included inadequate procedures, inadequate test acceptance criteria, inadequate test equipment, and inadequate control of testing. At the Susquehanna plant (Inspection Reports 50-387/90-200 and 50-388/90-200), the staff found that the licensee was testing dc molded case circuit breakers with a procedure written for testing ac breakers. The licensee had not established specific acceptance criteria for the dc breakers.

At the Shearon Harris Nuclear Power Plant (Inspection Report 50-400/90-200), the staff identified that the licensee was testing molded case circuit breakers against National Electrical Manufacturers Association (NEMA) acceptance criteria, which were less stringent than the manufacturer's time-current curves for these breakers. In addition, the staff identified that the licensee was testing 480 V air circuit breakers with test equipment that applied a test signal (secondary injection) to the solid state trip units in the circuit breakers. Although this method adequately verified that the trip units functioned properly, it did not verify that the breaker's current transformer functioned properly or that the wiring and connectors were adequate between the current transformer and the solid state trip units. Other licensees have performed testing by primary current injection or by individually checking each component of the circuit breaker, including the wiring and connectors to demonstrate that the circuit breaker functions properly.

Inadequate Determinations and Evaluations of Setpoints

Many of the findings identified during recent EDSFIs were related to inadequate setpoint determinations. Useful guidance for determining setpoints is provided by Instrument Society of America Standard 67.04-1982, "Setpoints for Nuclear Safety-Related Instrumentation used in Nuclear Power Plants," which the NRC staff has endorsed by Regulatory Guide 1.105 Revision 2 - 1986, "Instrument Setpoints for Safety-Related Systems." This guidance applies both to process instrumentation and, in part, to certain relays that perform a safety function.

Some licensees have operated equipment outside of acceptable limits because they did not determine proper setpoints and did not evaluate and account for instrument drift. Operating the equipment under these conditions could compromise the safety functions of the equipment. The staff has identified these circumstances primarily for those instruments in which the licensee has determined the setpoints as opposed to those instruments for which the setpoints were determined by the architect/engineer or the nuclear safety system supplier. Those setpoints not contained in the plant technical specifications were also more frequently found to be deficient. During recent EDSFIs, the staff identified deficiencies in setpoints for diesel day tank level indicators, diesel air start compressor controllers and alarms, inverter low voltage shutdown circuitry, degraded grid relays, and diesel overcurrent relays.

In addition to identifying deficiencies in the setpoints themselves, the NRC has determined that not all the licensees are typically verifying that the magnitude of instrument drift that was assumed in the original setpoint calculation coincides with the magnitude of drift observed in the plant. Some licensees have corrected this deficiency by verifying the magnitude of instrument drift by trending, (comparing "as found" calibration data to previous "as left" data). This is particularly important for the degraded grid relay setpoints, which often require very tight calibration tolerance bands, and for which very low drift values are often assumed.

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

Technical Contact: Jeffrey B. Jacobson, NRR
(301) 492-0996

Attachment: List of Recently Issued NRC Information Notices

LIST OF RECENTLY ISSUED
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
91-28	Cracking in Feedwater System Piping	04/15/91	All holders of OLs or CPs for pressurized water reactors (PWRs).
91-27	Incorrect Rotation of Positive Displacement Pump	04/10/91	All holders of OLs or CPs for nuclear power reactors.
89-90, Supp. 1	Pressurizer Safety Valve Lift Setpoint Shift	04/10/91	All holders of OLs or CPs for nuclear power reactors.
91-26	Potential Nonconservative Errors in the Working Format Hansen-Roach Cross-Section Set Provided with The Keno and Scale Codes	04/02/91	All fuel cycle licensees and other licensees, including all holders of operating licenses for nuclear power reactors, who use physics codes to support criticality safety in the use of fissile material.
91-25	Commercial-Grade Structural Framing Components Supplied As Nuclear Safety-Related Equipment	04/01/91	All holders of OLs or CPs for nuclear power reactors.
91-24	Recent Operating Experience Involving Reactor Operation Without A Licensed Reactor Operator or Senior Reactor Operator Present in the Control Room	03/26/91	All holders of OLs or CPs for nuclear power, test, and research reactors, and all Part 55 licensed operators.
91-23	Accidental Radiation Over-exposures to Personnel Due to Industrial Radiography Accessory Equipment Malfunctions	03/26/91	All Nuclear Regulatory Commission (NRC) licensees authorized to use sealed sources for industrial radiography.

OL = Operating License
CP = Construction Permit

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Original Signed by
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*SEE PREVIOUS CONCURRENCES

D/DOEA-NRR CERossi 04/9/91	*C/OGCB:DOEA:NRR*RPB:ADM CHBerlinger 04/08/91	TechEd 03/20/91	*C/SICB:DST:NRR SNewberry 03/18/91	*C/SELB:DST:NRR FRosa 03/18/91
OGCB:DOEA:NRR PCWen 04/ /91	*RSIB:DRIS:NRR JBJacobson:bt 02/08/91	*SC/RSIB:DRIS:NRR EVIbro 02/08/91	*C/RSIB:DRIS:NRR WDLanning 02/19/91	*D/DRIS:NRR BKGrimes 02/27/91

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Licensees have operated equipment outside of acceptable limits because they did not determine proper setpoints and did not evaluate and account for instrument drifts. Operating the equipment under these conditions could compromise the safety functions of the equipment. The staff has identified these circumstances primarily for those instruments in which the licensee has determined the setpoints as opposed to those instruments for which the setpoints were determined by the architect/engineer or the nuclear safety system supplier. Those setpoints not contained in the plant technical specifications were also more frequently found to be deficient. During recent EDSFIs, the staff identified deficiencies in setpoints for diesel day tank level indicators, diesel air start compressor controllers and alarms, inverter low voltage shutdown circuitry, degraded grid relays, and diesel overcurrent relays.

In addition to identifying deficiencies in the setpoints themselves, the NRC has determined that licensees are not typically verifying that the magnitude of instrument drift that was assumed in the original setpoint calculation coincides with the magnitude of drift observed in the plant. Licensee can verify the magnitude of instrument drift by trending, (comparing "as found" calibration data to previous "as left" data). This is particularly important for the degraded grid relay setpoints, which often require very tight calibration tolerance bands, and for which very low drift values are often assumed.

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RSIB:DRIS JBJacobson*:bt 02/08/91	SC:RSIB:DRIS EVImbro* 02/08/91	C:RSIB:DRIS WDLanning* 02/19/91	D:DRIS BKGrimes* 02/27/91	C:SELB:DST FRosa* 03/18/91	C:SICB:DST SNewberry* 03/18/91

Inadequate Setpoint Determinations and Evaluations

Many of the findings identified during recent EDSFIs were related to inadequate setpoint determinations. In order to properly determine an appropriate instrument setpoint, all associated inaccuracies and tolerances must be accounted for. Useful guidance for determining setpoints is provided by 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 guidance is applicable not just for instrumentation but is also applicable for certain relays and other control oriented pieces of equipment.

The setpoint problem has been identified primarily with those instruments in which the licensee has determined the setpoints as opposed to those setpoints determined by the NSSS vendor. Those setpoints not contained in the plant technical specifications are also likely to be suspect. During recent EDSFIs, deficiencies in setpoints related to diesel day tank level indicators, diesel air start compressor controllers and alarms, inverter low voltage shutdown circuitry, degraded grid relays, and diesel overcurrent relays have been identified.

In addition to the deficiencies identified in the setpoints themselves, the NRC has determined that licensees are not typically verifying that the magnitude of setpoint drift that was assumed in the original setpoint calculation is indeed correct. This verification can be performed by trending, i.e., by comparing "as found" calibration data to previous "as left" data. This is particularly important for the degraded grid setpoints where very tight calibration tolerance bands are often required and where very low drift values are often assumed. Failure to evaluate and account for instrument drifts has led to the operation of equipment outside of acceptable limits which could compromise the safety functions of the equipment.

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The setpoint problem is most prevalent for those instruments in which the licensee has determined the setpoints as opposed to those setpoints determined by the NSSS vendor. Those setpoints not contained in the plant technical specifications are also likely to be suspect. During recent EDSFIs, deficiencies in setpoints related to diesel day tank level indicators, diesel air start compressor controllers and alarms, inverter low voltage shutdown circuitry, degraded grid relays, and diesel overcurrent relays have been identified.

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