

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

February 10, 1992

NRC INFORMATION NOTICE 92-12: EFFECTS OF CABLE LEAKAGE CURRENTS ON INSTRUMENT SETTINGS AND INDICATIONS

Addressees

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

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert addressees to a safety problem that could result from inaccuracies introduced into safety-related instrument loops because of increased leakage currents from instrument cables when subjected to a harsh environment. 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 are not NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances

On May 15, 1989, while reviewing instrument loop accuracies, test technicians of the Virginia Electric and Power Company (VEPCO), the licensee for the Surry Power Station, determined that during a harsh environmental condition, the leakage currents in cables could prevent performance of safety functions (Licensee Event Report 50-280/89-20). These potential failures would be caused by reduction in the cables' insulation resistance (IR) in the harsh environment. Such a harsh environment could be produced inside containment by a loss of coolant accident (LOCA) or by a high energy line break (HELB) event. The instrument cables installed at the Surry plant were environmentally qualified, but the previous safety system calculations for the accuracy of the instrument loops and for trip setpoints did not account for the additional uncertainties that could be introduced by the reduced IR values.

In particular, the licensee noted that this phenomenon could potentially mask the reactor trip signal for steam generator low level and the safety injection signal for pressurizer low pressure and, thus, prevent the required protective actions. Furthermore, the licensee also noted that the pressurizer level and reactor coolant system wide range pressure instrument systems could be adversely affected by leakage currents.

The licensee reviewed all safety-related instrument loops and replaced, where appropriate, affected cables in both units with new cables having a higher IR value. The licensee reviewed setpoint calculations and verified the margins

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taking into consideration errors caused by cable leakage currents. The licensee also reviewed the loop accuracy calculations for indication loops and revised affected emergency operating procedures to address errors in indications caused by leakage currents.

The NRC is aware that many licensees are revising instrument setpoints using the latest industry standards and are assessing the effects of leakage currents. However, since most licensees for operating plants may not have addressed these effects in their original design calculations, the problem described above for Surry may be generic.


Discussion

Under conditions of high humidity and temperature associated with either a LOCA or a HELB, the IR may decrease in components of the instrument loop such as cables, splices, connectors, terminal blocks, and containment penetrations. Consequently, leakage currents increase and measurement of process variables becomes more uncertain. In a normal environment, however, leakage currents are small enough to be essentially calibrated out of consideration.

The instruments of a safety-related system provide monitoring and control to ensure the system will perform its intended safety function. The decreased IR of the instrument loop components may disable such monitoring and control.

In June 1984, the NRC issued Information Notice (IN) 84-47, "Environmental Qualification Tests of Electrical Termination Blocks." In this information notice, the staff identified the potential for errors caused by leakage currents at terminal blocks when these blocks are subjected to a harsh environment.

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 Office of Nuclear Reactor Regulation (NRR) project manager.


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

Technical contacts: S. V. Athavale, NRR
(301) 504-2974

Jerry L. Mauck, NRR
(301) 504-3248

Attachment: List of Recently Issued NRC Information Notices

LIST OF RECENTLY ISSUED
 NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
92-11	Soil and Water Contamination at Fuel Cycle Facilities	02/05/92	All uranium fuel fabrication and conversion facilities.
92-10	Brachytherapy Incidents Involving Iridium-192 Wire Used in Endobronchial Treatments	01/31/92	All Nuclear Regulatory Commission (NRC) licensees authorized to use iridium-192 for brachytherapy; manufacturers and distributors of iridium-19 wire for use in brachytherapy.
92-09	Overloading and Subsequent Lock Out of Electrical Buses During Accident Conditions	01/30/92	All holders of OLs or CPs for nuclear power reactors
92-08	Revised Protective Action Guidance for Nuclear Incidents	01/23/92	All fuel cycle and materials licensees authorized to possess large quantities of radioactive material.
92-07	Rapid Flow-Induced Erosion/Corrosion of Feedwater Piping	01/09/92	All holders of OLs or CPs for pressurized water reactors.
92-06	Reliability of ATWS Mitigation System and Other NRC Required Equipment Not Controlled by Plant Technical Specifications	01/15/92	All holders of OLs or CPs for nuclear power reactors.
92-05	Potential Coil Insulation Breakdown in ABB RXMH2 Relays	01/08/92	All holders of OLs or CPs for nuclear power reactors.
92-04	Potter & Brumfield Model MDR Rotary Relay Failures	01/06/92	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License
 CP = Construction Permit

taking into consideration errors caused by cable leakage currents. The licensee also reviewed the loop accuracy calculations for indication loops and revised affected emergency operating procedures to address errors in indications caused by leakage currents.

The NRC is aware that many licensees are revising instrument setpoints using the latest industry standards and are assessing the effects of leakage currents. However, since most licensees for operating plants may not have addressed these effects in their original design calculations, the problem described above for Surry may be generic.

Discussion

Under conditions of high humidity and temperature associated with either a LOCA or a HELB, the IR may decrease in components of the instrument loop such as cables, splices, connectors, terminal blocks, and containment penetrations. Consequently, leakage currents increase and measurement of process variables becomes more uncertain. In a normal environment, however, leakage currents are small enough to be essentially calibrated out of consideration.

The instruments of a safety-related system provide monitoring and control to ensure the system will perform its intended safety function. The decreased IR of the instrument loop components may disable such monitoring and control.

In June 1984, the NRC issued Information Notice (IN) 84-47, "Environmental Qualification Tests of Electrical Termination Blocks." In this information notice, the staff identified the potential for errors caused by leakage currents at terminal blocks when these blocks are subjected to a harsh environment.

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Original Signed by

Charles E. Rossi

Charles E. Rossi, Director
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Office of Nuclear Reactor Regulation

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Document Name: IN 92-12

*SEE PREVIOUS CONCURRENCES

D/DOEA:NRR

*C/OGCB:DOEA:NRR

*RPB:ADM

*C/RSIB:DRIS:NRR *C/OEAB:DOEA:NRR

CE Rossi

CHBerlinger

TechEd

EVIbro

AChaffee

02/17/92

12/10/91

11/04/91

08/29/91

11/05/91

OGCB:DOEA:NRR

*SC/SICB:DST:NRR

*C/SICB:DST:NRR

*OEAB:DOEA:NRR

*SC/OEAB:DOEA:NRR

CVHodge

JLmauck

SNewberry

SVAthavale

BDennig

12/09/91

08/20/910

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08/19/91

08/29/91

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consideration errors caused by cable leakage currents. The licensee also reviewed the loop accuracy calculations for indication loops and revised affected emergency operating procedures to address errors in indications caused by leakage currents.

Discussion

Under conditions of high humidity and temperature associated with either a LOCA or a HELB, the IR may decrease in components of the instrument loop connections such as cables, splices, connectors, terminal blocks, and the containment penetrations. Consequently, leakage currents increase and measurement of process variables becomes more uncertain. In a normal environment, however, leakage currents are small enough to be essentially calibrated out of consideration.

The instruments of a safety-related system provide monitoring and control to ensure the system will perform its intended safety function while not exceeding the applicable technical specifications. The decreased IR of the instrument loop components may disable such monitoring and control. In such instances, careful evaluation of setpoints and setpoint margins may be appropriate to ensure adequately safe operation of the systems.

In June 1984, the NRC issued Information Notice (IN) 84-47, "Environmental Qualification Tests of Electrical Termination Blocks." In this information notice, the staff identified the potential for errors caused by leakage currents at terminal blocks when these blocks are subjected to a harsh environment.

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Attachment: List of Recently Issued NRC Information Notices

Document Name: LEAKCURR

*SEE PREVIOUS CONCURRENCES *CHB*

D/DOEA:NRR	C/OGCB:DOEA:NRR	*RPB:ADM	*C/RSIB:DRIS:NRR	*C/OEAB:DOEA:NRR
CERossi <i>gh</i>	CHBerlinger	TechEd	EVIbro	ACHaffee
12/ /91 <i>wh</i>	1/10/92	11/04/91	08/29/91	11/05/91
*OGCB:DOEA:NRR	*SC/SICB:DST:NRR	*C/SICB:DST:NRR	*OEAB:DOEA:NRR	*SC/OEAB:DOEA:NRR
CVHodge	JLmauck	SNewberry	SVAthavale	BDennig
1/09/92	08/20/910	09/19/91	08/19/91	08/29/91

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Charles E. Rossi, Director
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Attachment: List of Recently Issued NRC Information Notices

Document Name: IN/ATHAVALA

D/DOEA:NRR	C/OGCB:DOEA:NRR	RPB:ADM	*C/RSIB:DRIS:NRR
CERossi	CHBerlinger	TechEd	EVImbro
10/ /91	10/ /91	10/ /91	08/29/91
*OEAB:DOEA:NRR	*SICB:DST:NRR	*C/SICB:DST:NRR	*SC/OEAB:DOEA:NRR
SVAthavale	JLMauck	SNewberry	BDennig
08/19/91	08/20/91	09/19/91	08/29/91
			ACHaffee
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Attachment: List of Recently Issued NRC Information Notices

Document Name: SVA-IN NOTICE 1

D/DOEA:NRR	C/OGCB:DOEA:NRR	RPB:ADM	*C/RSIB:DRIS:NRR
CERossi	CHBerlinger	TechEd <i>JMain</i>	EVIbro
10/ /91	10/ /91	10/ /91 <i>11/91</i>	08/29/91
*OEAB:DOEA:NRR	*SICB:DST:NRR	*C/SICB:DST:NRR	*SC/ OEAB:DOEA:NRR
SVAthavale	JLMauck	SNewberry	C/ OEAB:DOEA:NRR
08/19/91	08/20/91	09/19/91	BDennig
			08/29/91
			ACHaffee
			10/ /91

No specific action or written response is required by this information notice. If you have any questions about this matter, please contact one of the technical contacts listed below or the Regional Administrator of the appropriate regional office.

Charles E. Rossi, Director
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Attachment:
List of recently issued NRC Information Notices

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OFC :OEAB:DOEA:NRR :SICB:NRR: ^{P-10}OEAB:DOEA:NRR: OEAB:DOEA:NRR: RSIB:NRR
NAME :SVAhavale :JMauck : BDennig : AChaffee : EVImbro
DATE :8/19/91 :8/20/91 : 8/29/91 : 8/ /91 : 8/25/91
OFC :SICB:NRR :Tech Editor :OGCB:DOEA:NRR:D:DOEA:NRR
NAME :SNewberry : :CHBerlinger :CERossi
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