

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

June 29, 1990

NRC INFORMATION NOTICE NO. 90-44: DOSE-RATE INSTRUMENTS UNDERRESPONDING
TO THE TRUE RADIATION FIELDS

Addressees:

All NRC licensees.

Purpose:

This information notice is intended to alert addressees to potential problems resulting from dose-rate survey instruments underresponding to the true radiation fields. 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:

The Department of Energy (DOE) recently issued a Safety Action Notice that described an underresponse of two Bicron RSO-5 dose-rate instruments by a factor of about 100 on the second range (0-50 mR/h). The problem occurred when two radiation protection personnel were providing radiation protection coverage at a DOE contractor facility. A normal reading was observed on the dose-rate instrument's third range (0-500 mR/h). No personnel were overexposed to radiation when these instruments failed. Other instruments which have the same type of magnet arm switching design as the RSO-5 can have this same type of problem.

The instruments were removed from service and were returned to the manufacturer. Bicron's examination confirmed the effect and found that the failure had been caused by a change in positioning of the magnet that activates reed switches in the ion chamber. This magnet moves on a cam-actuated arm, and the cam is attached to the range switch. Figure 1 illustrates typical magnet arm positions for the Bicron RSO series of instruments. At the zero position (one end) of the range switch rotation, the arm moves the magnet over the zero reed switch and shorts the electronic input for zeroing. Switching from zero to the first (0-5 mR/h) and second (0-50 mR/h) ranges, the cam moves the end of the magnet arm to the center position between the zero and high-range reed switches, and neither reed switch is closed. If the magnet arm is not properly aligned with the cam at the point of contact, the extra room allowed (play) for movement of the magnet arm with respect to the cam can result in the magnet at

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the other end of the magnet arm being placed sufficiently past the center position to close the high-range reed switch upon range switching between the first (0-5 mR/h) and the second (0-50 mR/h) of the lower two ranges even though the magnet arm is not supposed to move.

Because of this possible mechanical problem, severe underresponse to the true radiation fields for these dose-rate survey instruments can occur as a result of switching between these lower two ranges. This is because when the high-range reed switch is in the closed position, a different electronic circuit is actuated which reduces the sensitivity on these ranges by a factor of about 100. This reduced sensitivity requires a true dose rate of 5,000 mR/h to produce a full-scale deflection on the second-range (0-50 mR/h) scale or a true dose-rate of 500 mR/h to produce a full-scale deflection on the first-range (0-5 mR/h) scale.

The Instrument Engineering Department of Bicron has included an additional quality assurance (QA) test to ensure the proper alignment of the magnet arm with respect to the reed switch and latitude for minor position changes that might occur. This QA test is to be performed during the final acceptance test of a new instrument and again before the new instrument is calibrated for shipment.

Discussion:

All licensees need to be aware of the potential for underresponse at the lower two ranges for all magnet arm switching dose-rate instruments. Failure (i.e., high-range reed switch in the open position) at the high-range settings (0-500 mR/h, 0-5,000 mR/h) can only result in overresponse of the instrument. If, when performing a survey with the instrument, the operator is not sure that he/she is in a high radiation field, the operator can verify that the instrument is not underresponding during these situations by switching to the high-range settings to quantify the upper limit of the radiation field before switching to the lower range settings.

This type of instrument problem reinforces the importance of source checking the instrument for each range before use, consistent with good ALARA (as low as reasonably achievable) practices.

It is important that licensees also be aware that use of this type of magnet arm switching instrument in areas with high magnetic fields can inadvertently actuate the reed switches in the instrument without movement of the magnet arm. For more information, refer to ANSI N42.17A, "Performance Specifications for Health Physics Instrumentation Portable Instrumentation for Use in Normal Environmental Conditions."

In addition to the Bicron Model RS0-5, malfunctions may also occur for the following instruments;

- Bicron Model RS0-50
- Eberline Model R0-2
- Eberline Model R0-2A

Since 1982, Eberline has added a pilot hole to the switch shaft to allow the set screw to align the collar which actuates the magnet arm. Additionally, in the Eberline design, the magnet arm is straight and the distance between adjacent positions is greater than in the Bicron instrument. This feature reduces the probability for indirect switching of a reed switch (as happened with the two instruments at the DOE contractor facility).

Although the magnet arm is aligned properly at the time of production, this alignment can shift with time and normal field usage. Therefore, the Department of Energy Safety Action Notice recommends that all magnet arm switching dose-rate instruments be inspected at regular intervals for proper alignment of the magnet arm. Both Bicron and Eberline have prepared new inspection procedures for their instruments. For copies of revised maintenance procedures and other technical information concerning their instrument, contact the appropriate manufacturer at one of the following addresses:


Bicron Corporation
12345 Kingman Road
Newbury, Ohio 44065
Joseph G. Bellian
(216) 564-8000

Eberline Instrument Corporation
504 Airport Road
P.O. Box 2108
Santa Fe, New Mexico 87504-2108

Customer Service, Santa Fe, New Mexico
Robert Montaya
1-800-234-4212

Customer Service, Columbia, South Carolina
John Witzell
1-800-274-4212

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact the technical contact listed below or the appropriate NRR project manager.


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

Technical Contact: Joseph C. Wang, NRR
(301) 492-1848

Attachments:

1. Figure 1, Typical Magnet Arm Position, RSO Instruments
2. List of Recently Issued NRC Information Notices

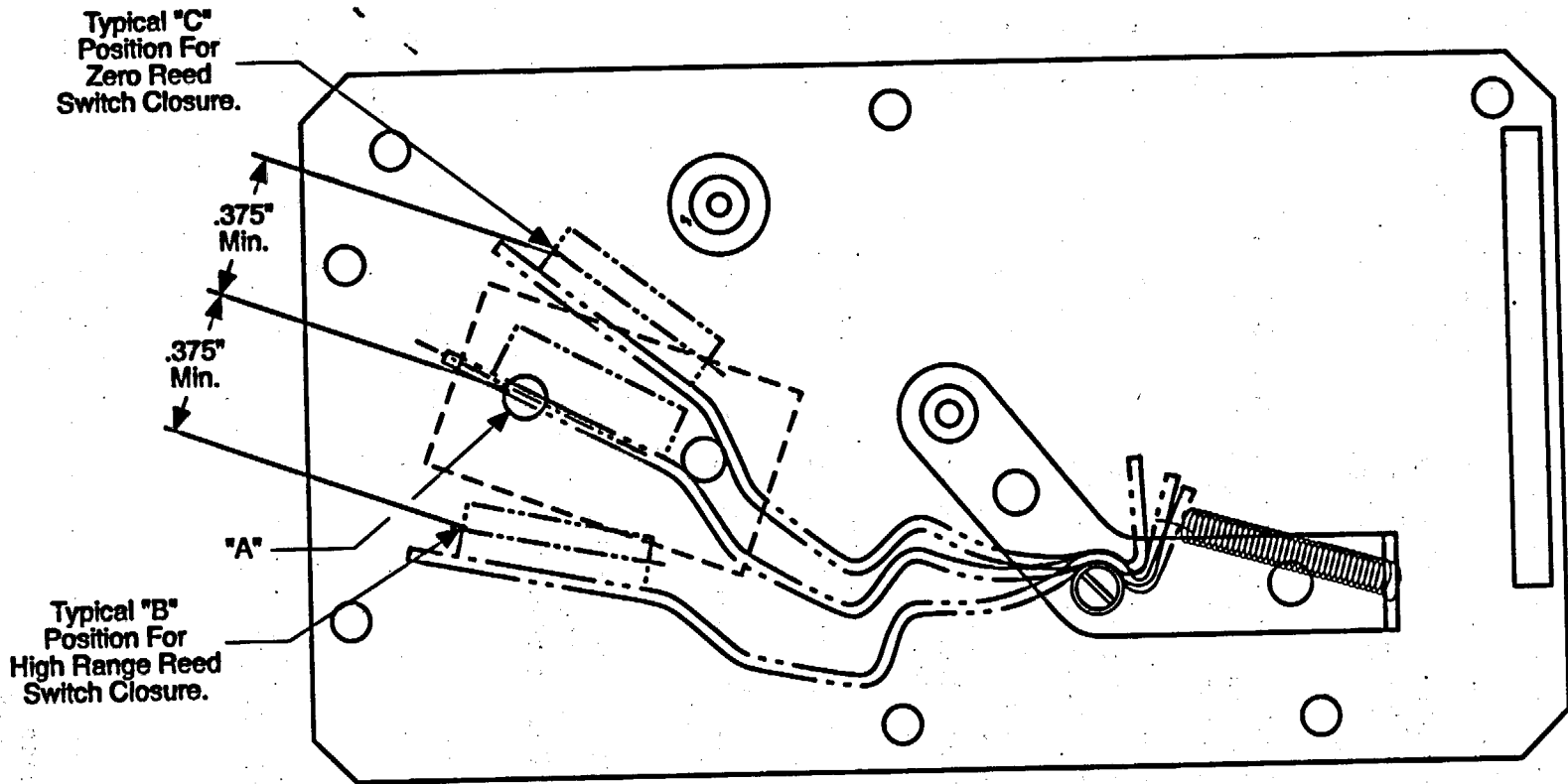


Figure 1, Typical Magnet Arm Position, RSO Instruments

LIST OF RECENTLY ISSUED
NRC INFORMATION NOTICES

| Information Notice No. | Subject | Date of Issuance | Issued to |
|------------------------|--------------------------------------------------------------------------------------------|------------------|--------------------------------------------------------------------------------|
| 90-43 | Mechanical Interference With Thermal Trip Function in GE Molded-Case Circuit Breakers | 6/29/90 | All holders of OLs or CPs for nuclear power reactors. |
| 90-32, Supp. 1 | Surface Crack and Subsurface Indications in the Weld of a Reactor Vessel Head | 6/19/90 | All holders of OLs or CPs for nuclear power reactors. |
| 90-42 | Failure of Electrical Power Equipment Due to Solar Magnetic Disturbances | 6/19/90 | All holders of OLs or CPs for nuclear power reactors. |
| 90-41 | Potential Failure of General Electric Magne-Blast Circuit Breakers and AK Circuit Breakers | 6/12/90 | All holders of OLs or CPs for nuclear power reactors. |
| 90-40 | Results of NRC-Sponsored Testing of Motor-Operated Valves | 6/5/90 | All holders of OLs or CPs for nuclear power reactors. |
| 90-39 | Recent Problems With Service Water Systems | 6/1/90 | All holders of OLs or CPs for nuclear power reactors. |
| 90-38 | Requirements for Processing Financial Assurance Submittals for Decommissioning | 5/29/90 | All fuel facility and materials licensees. |
| 90-37 | Sheared Pinion Gear-to-Shaft Keys in Limitorque Motor Actuators | 5/24/90 | All holders of OLs or CPs for nuclear power reactors. |
| 90-36 | Apparent Falsification of State of Connecticut Weight Certificates | 5/24/90 | All holders of OLs or CPs for nuclear power reactors, and 10 CFR 70 licensees. |

OL = Operating License
CP = Construction Permit

Since 1982, Eberline has added a pilot hole to the switch shaft to allow the set screw to align the collar which actuates the magnet arm. Additionally, in the Eberline design, the magnet arm is straight and the distance between adjacent positions is greater than in the Bicron instrument. This feature reduces the probability for indirect switching of a reed switch (as happened with the two instruments at the DOE contractor facility).

Although the magnet arm is aligned properly at the time of production, this alignment can shift with time and normal field usage. Therefore, the Department of Energy Safety Action Notice recommends that all magnet arm switching dose-rate instruments be inspected at regular intervals for proper alignment of the magnet arm. Both Bicron and Eberline have prepared new inspection procedures for their instruments. For copies of revised maintenance procedures and other technical information concerning their instrument, contact the appropriate manufacturer at one of the following addresses:

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Charles E. Rossi, Director
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Office of Nuclear Reactor Regulation

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Attachments:

1. Figure 1, Typical Magnet Arm Position, RSO Instruments
2. List of Recently Issued NRC Information Notices

Document Name: INFO NOTICE - WEN, WANG

*Transmitted by memo for C. E. Rossi from E. J. Congel dated May 23, 1990

**SEE PREVIOUS CONCURRENCES

~~D/DOEA/NRR~~
 CERossi
 06/21/90
 JEWigginton
 05/11/90

**C/OGCB:DOEA:NRR **RPB:ADM

CHBerlinger TechEd
 06/21/90 06/15/90
 *C/PRPB:DREP:NRR *D/DREP:NRR
 LJCunningham FJCongel
 05/21/90 05/23/90

**OGCB:DOEA:NRR*PRPB:DREP:NRR *SC/PRPB:DREP:NRR

PCWen JWang
 06/15/90 05/11/90

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Charles E. Rossi, Director
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Technical Contact: Joseph C. Wang, NRR
(301) 492-1147

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Document Name: INFO NOTICE - WEN, WANG

Joe Wang reviewed OGCB's
comments (minor); he had
no problems. PCW 4/5/90

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*SC/PRPB:DREP:NRR

JEWigginton

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W. H. Wood
C/OGCB:DOEA:NRR

CHBerlinger

06/1/90

*C/PRPB:DREP:NRR

LJCunningham

05/21/90

RPB:ADM

TechEd JMahn 9A

06/15/90

*D/DREP:NRR

FJCongel

05/23/90

PCW

OGCB:DOEA:NRR

PCWen

06/15/90

*PRPB:DREP:NRR

JWang

05/11/90

May 23, 1990

MEMORANDUM FOR: Charles E. Rossi, Director
 Division of Operational Events Assessment, NRR

FROM: Frank J. Congel, Director
 Division of Radiation Protection
 and Emergency Preparedness, NRR

SUBJECT: INFORMATION NOTICE: "DOSE-RATE SURVEY INSTRUMENTS
 UNDERRESPONDING TO THE TRUE RADIATION FIELDS"

Please issue the enclosed Information Notice.

All regional offices and NMSS have had the opportunity to comment on this document and all comments received have been considered in preparing the notice. In accordance with NRC Inspection Manual Chapter 0720, both vendors' (Bicron and Eberline) comments have also been considered.

Completed copies of the "Headquarters Daily Report Form" and the "Generic Communications Index Input Form" are also enclosed.

/s/
 Frank J. Congel, Director
 Division of Radiation Protection
 and Emergency Preparedness, NRR

Enclosures:
As stated

Contact: Joseph C. Wang, NRR
492-1147

DISTRIBUTION:

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| PRB R/F | R. Barrett | |

*See previous concurrence

| | | | | | | |
|------|-------------|-------------|--------------|--------------|---|---|
| JFC | :*DREP:PRPB | :*DREP:PRPB | :*DREP:PRPB | :D:DREP:PRPB | : | : |
| NAME | :JWang:sg | :JWigginton | :JCunningham | FCongel | : | : |
| DATE | :5/11/90 | :5/11/90 | :5/21/90 | :5/23/90 | : | : |

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