

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS
WASHINGTON, DC 20555

August 4, 2003

NRC INFORMATION NOTICE 2003-10: CRITICALITY MONITORING SYSTEM
DEGRADATION AT BWX TECHNOLOGIES, INC.,
NUCLEAR PRODUCTS DIVISION,
LYNCHBURG, VA

Addressees:

All U.S. Nuclear Regulatory Commission (NRC) licensees authorized to possess a critical mass of special nuclear material.

Purpose:

NRC is issuing this information notice (IN) to inform addressees of a safety concern in EC1-X and EC2-X Thermo Electron (formerly Eberline) analog monitors. The safety concern arises when these systems, used as either in-line monitors or criticality monitors, are exposed to power surges, such as in a lightning storm, causing a failure of the alarm function of the EC1-X and EC2-X monitors without indication. It is expected that licensees will review this information, and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this IN are not NRC requirements; therefore, no specific action nor written response is required.

Background:

Under 10 CFR 70.24(a), certain licensees are required to maintain, "in each area in which such licensed material is handled, used, or stored, a monitoring system...using gamma- or neutron-sensitive radiation detectors that will energize clearly audible alarm signals if accidental criticality occurs."

Description of Circumstances:

Recently, a lightning storm triggered several alarms in a fuel facility's criticality monitoring system. A storm watch procedure was in effect at the time and the criticality monitoring system alarms had been disabled to prevent inadvertent activation by the lightning storm. The storm watch procedure is a compensatory measure, whereby individuals are stationed throughout the facility with monitors, to compensate for loss of detection or inadvertent alarm sounding because of a lightning strike. After the storm, all alarms were reset except one, which had been damaged to the point of failure. After replacement of the failed monitor/detector pair, there was no indication of any further problems and the system was released for operation.

ML032160016

Later, a criticality monitor trouble indication was received. A technician's subsequent investigation revealed that the lightning strike on May 10 had damaged the alarm circuitry of six EC1-X and EC2-X monitors, causing a failure in the ability to generate alarms, but had not affected the ability of the analog meters to accurately indicate radiation levels. The licensee's investigation revealed that the lightning "surge" caused the logic chip in the A6 location to fail.

After the investigation, the licensee took the following corrective actions: 1) evaluated the placement of criticality monitoring components and modifications to prevent lightning damage; 2) evaluated other potential causes for failure of the alarm circuits; 3) established procedures to source-check all monitors after a lightning storm or whenever the operability of a single monitor was in question; and 4) implemented a formalized checklist that contains step-by-step instructions for use following a storm or system component failures. At the time of this IN, analysis was continuing to determine if additional actions were needed to address this safety concern.

Discussion:

The EC1-X and EC2-X monitors have a Thermo Electron modification for criticality detection, the main feature of which is a "saturation" circuit, which provides an alarm signal caused by high GM detector current in a high gamma field. In the monitor, the criticality signal is jumpered from pin 7 to the OR gate on the A6B chip. If damaged by lightning, the defect allows the monitors to indicate radiation levels, but the monitors will not alarm. During this failure, the monitors' "NORMAL" indicator light remains lit. These devices fail to operate in a "fail safe" mode and give external indications after becoming disabled.

NRC is aware that other licensees use the Thermo Electron equipment discussed in this notice for similar purposes. Therefore, licensees should consider actions, as appropriate, to mitigate this vulnerability. These actions could include consulting technically qualified individuals for recommendations to mitigate this vulnerability, implementing changes to the hardware, and revising the procedures for responding to these events.

This IN requires no specific action nor written response. Questions about this matter may be referred to the technical contact listed below or the appropriate NRC facility Project Manager.

/RA/

William D. Beckner, Chief
Reactor Operations Branch
Division of Inspection Program Management
Office of Nuclear Reactor Regulation

/RA/

Robert C. Pierson, Director
Division of Fuel Cycle Safety and Safeguards
Office of Nuclear Material Safety and Safeguards

Technical Contact: Billy Gleaves, NMSS
301-415-5848
E-mail: bcg@nrc.gov

Attachments:

1. List of Recently Issued NMSS Information Notices
2. List of Recently Issued NRC Information Notices

Later, a criticality monitor trouble indication was received. A technician's subsequent investigation revealed that the lightning strike on May 10 had damaged the alarm circuitry of six EC1-X and EC2-X monitors, causing a failure in the ability to generate alarms, but had not affected the ability of the analog meters to accurately indicate radiation levels. The licensee's investigation revealed that the lightning "surge" caused the logic chip in the A6 location to fail.

After the investigation, the licensee took the following corrective actions: 1) evaluated the placement of criticality monitoring components and modifications to prevent lightning damage; 2) evaluated other potential causes for failure of the alarm circuits; 3) established procedures to source-check all monitors after a lightning storm or whenever the operability of a single monitor was in question; and 4) implemented a formalized checklist that contains step-by-step instructions for use following a storm or system component failures. At the time of this IN, analysis was continuing to determine if additional actions were needed to address this safety concern.

Discussion:

The EC1-X and EC2-X monitors have a Thermo Electron modification for criticality detection, the main feature of which is a "saturation" circuit, which provides an alarm signal caused by high GM detector current in a high gamma field. In the monitor, the criticality signal is jumpered from pin 7 to the OR gate on the A6B chip. If damaged by lightning, the defect allows the monitors to indicate radiation levels, but the monitors will not alarm. During this failure, the monitors' "NORMAL" indicator light remains lit. These devices fail to operate in a "fail safe" mode and give external indications after becoming disabled.

NRC is aware that other licensees use the Thermo Electron equipment discussed in this notice for similar purposes. Therefore, licensees should consider actions, as appropriate, to mitigate this vulnerability. These actions could include consulting technically qualified individuals for recommendations to mitigate this vulnerability, implementing changes to the hardware, and revising the procedures for responding to these events.

This IN requires no specific action nor written response. Questions about this matter may be referred to the technical contact listed below or the appropriate NRC facility Project Manager.

/RA/

William D. Beckner, Chief
Reactor Operations Branch
Division of Inspection Program Management
Office of Nuclear Reactor Regulation

/RA/

Robert C. Pierson, Director
Division of Fuel Cycle Safety and Safeguards
Office of Nuclear Material Safety and Safeguards

Technical Contact: Billy Gleaves, NMSS
301-415-5848
E-mail: bcg@nrc.gov

Attachments:

1. List of Recently Issued NMSS Information Notices
2. List of Recently Issued NRC Information Notices

ADAMS ACCESSION NUMBER:

*See previous concurrence

DOCUMENT NAME: G:\RORP\OES\Staff Folders\Petrone\Gen Com\INs\ML032160016.wpd

| | | | | | |
|--------|---------------|------------------|-------------|--------------|------------|
| OFFICE | FCFB:NMSS | FCFB:NMSS | FCFB:NMSS | FCFB:NMSS | IROB:DIPM |
| NAME | BGleaves* | JMuszkiewicz* | LRoché* | SFrant* | CDPetrone |
| DATE | 07/21/2003 | 07/22/2003 | 07/22/2003 | 07/22/2003 | 07/17/2003 |
| OFFICE | Tech Editor | SC:OES:IROB:DIPM | D:FCFB:NMSS | BC:IROB:DIPM | |
| NAME | EKraus-email* | TReis* | RCPierson* | WDBeckner | |
| DATE | 07/15/2003 | 07/28/2003 | 08/04/2003 | 08/04/2003 | |

OFFICIAL RECORD COPY

LIST OF RECENTLY ISSUED
NMSS INFORMATION NOTICES

| Information Notice No. | Subject | Date of Issuance | Issued to |
|------------------------|--|------------------|--|
| 2003-09 | Source Positioning Errors and System Malfunctions During Administration of Intravascular Brachtherapy | 07/16/2003 | All medical licensees. |
| 2002-31, Sup 1 | Potentially Defective UF ₆ Cylinder Valves (1-inch) | 03/24/2003 | All U.S. Nuclear Regulatory Commission (NRC) licensees authorized to possess and use source material and/or special nuclear material for heating, emptying, filling, or shipping 30- and 48-inch cylinders of uranium hexafluoride (UF ₆). |
| 2002-36 | Incomplete or Inaccurate Information Provided to the Licensee and/or NRC By Any Contractor or Subcontractor Employee | 12/27/2002 | All materials and fuel cycle licensees and certificate holders. |
| 2002-35 | Changes to 10 CFR Parts 71 and 72 Quality Assurance Programs | 12/20/2002 | All holders of 10 CFR Part 71 quality assurance program approvals and all 10 CFR Part 72 licensees and certificate holders |
| 2002-33 | Notification of Permanent Injunction Against Neutron Products Incorporated of Dickerson, Maryland | 11/21/2002 | All teletherapy and radiation processing licensees. |

Note: NRC generic communications may be received in electronic format shortly after they are issued by subscribing to the NRC listserver as follows:

To subscribe send an e-mail to <listproc@nrc.gov>, no subject, and the following command in the message portion:

subscribe gc-nrr firstname lastname

LIST OF RECENTLY ISSUED
NRC INFORMATION NOTICES

| Information Notice No. | Subject | Date of Issuance | Issued to |
|------------------------|---|------------------|--|
| 2002-26, Sup 1 | Additional Failure of Steam Dryer after a Recent Power Uprate | 07/21/2003 | All holders of operating license or construction permits for nuclear power reactors, except those that have permanently ceased operations and have certified that fuel has been permanently removed from the reactor. |
| 2003-09 | Source Positioning Errors and System Malfunctions During Administration of Intravascular Brachtherapy | 07/16/2003 | All medical licensees. |
| 2003-08 | Potential Flooding Through Unsealed Concrete Floor Cracks | 06/25/2003 | All holders of operating licenses or construction permits for nuclear power reactors. |
| 2003-07 | Water in the Vent Header/vent Line Spherical Junctions | 06/24/2003 | All holders of operating licenses for boiling water reactors (BWRs) with a Mark I containment. |
| 2003-06 | Failure of Safety-related Linestarter Relays at San Onofre Nuclear Generating Station | 06/19/2003 | All holders of operating licenses or construction permits for nuclear power reactors, except those that have permanently ceased operations and have certified that fuel has been permanently removed from the reactor. |
| 2003-05 | Failure to Detect Freespan Cracks in PWR Steam Generator Tubes | 06/05/2003 | All holders of operating licenses or construction permits for pressurized-water reactors (PWRs). |

Note: NRC generic communications may be received in electronic format shortly after they are issued by subscribing to the NRC listserver as follows:

To subscribe send an e-mail to listproc@nrc.gov, no subject, and the following command in the message portion:
subscribe gc-nrr firstname lastname