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

July 5, 1991

NRC INFORMATION NOTICE NO. 91-45: POSSIBLE MALFUNCTION OF WESTINGHOUSE ARD, BFD, AND NBFD RELAYS, AND A200 DC AND DPC 250 MAGNETIC CONTACTORS

Addressees:

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

Purpose:

This information notice is intended to alert addressees and vendors of equipment used by the addressees to the possibility that Westinghouse ARD, BFD, and NBFD relays and A200 DC and DPC 250 magnetic contactors could malfunction. These devices have been widely used in the design of systems for nuclear power plants which have Nuclear Steam Supply Systems supplied not only by Westinghouse but also by other vendors. 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:

On June 24, 1991, Westinghouse issued a 10 CFR Part 21 report (Attachment 1) concerning the potential for certain Westinghouse supplied products to malfunction due to an epoxy compound becoming semi-fluid when the coil is energized for extended periods. The components covered by the Westinghouse report are used in safety-related applications within equipment manufactured by Westinghouse and other vendors. The type of malfunction mentioned may degrade safety by disabling or delaying a function. The NRC will be discussing the adequacy of the recommendations in Attachment 1 with Westinghouse and, as appropriate, with licensees.

IDAR-11C

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 NRR project manager.

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

Technical Contacts: Nancy E. Campbell, NRR
(301) 492-0836

Paul Loeser, NRR
(301) 492-0825

Attachments:
1. Westinghouse Part 21 Report
2. List of Recently Issued NRC Information Notices

Westinghouse Electric Corporation Energy Systems

Box 355
Pittsburgh Pennsylvania 15230-0355

June 24, 1991
NS-NRC-91-3600

Document Control Desk
United States Nuclear Regulatory Commission
Washington, DC 20555

Attention: Dr. Thomas E Murley, Director
Office of Nuclear Reactor Regulation

Dear Dr. Murley:

The following information is provided pursuant to the requirements of 10 CFR Part 21 to report a substantial safety hazard as communicated by Ms. P. A. Loftus of Westinghouse to Mr. C. E. Rossi of the Nuclear Regulatory Commission by telephone on June 20, 1991. This issue concerns the potential for certain Westinghouse supplied products utilizing DC coil assemblies to malfunction due to an epoxy compound becoming semi-fluid when in service.

BACKGROUND

Westinghouse was informed by Brookhaven National Lab (BNL) via a returned relay (February 2, 1991) that two 12V ARD relays in a normally energized application failed to reset properly after deenergization. The epoxy that encapsulates the coil had softened (due to heat from energization) and flowed into the area of the return spring causing sticking of the plunger assembly. Reset occurred in about six seconds versus the expected tenths of a second. Relays from date codes slightly before and after this batch were energized and did not exhibit epoxy softening. The BNL relays were shipped the 44th week of 1990 and the other date codes tested were the 39th, 45th and 48th week of 1990. Westinghouse had received no prior reports of similar behavior of any other ARD relays. Therefore, it was felt that the problem was isolated to this one batch.

Westinghouse was notified of a similar problem on an ARD relay supplied to the Palo Verde nuclear plant (April 9, 1991). The relay returned from that plant had evidence of epoxy having flowed into the plunger cavity and it would not properly change state until it had been energized for about 30 minutes to soften the epoxy. It was also employed in a normally energized application. This relay, which had been procured from Westinghouse as a spare part, had a 1987 date code which indicated that the problem was not isolated to a single batch as initially concluded.

June 24, 1991
NS-NRC-91-3600

EVALUATION

Westinghouse performed a search of available data to identify incidents which would appear to be due to the the same phenomenon as described here. Combined with the recent reports, the total number of incidents which can be identified as having exhibited the phenomenon is about 15. This is out of a total population of such relays estimated to be at least a few thousand in active service.

The commercial grade devices are manufactured in Coamo, Puerto Rico. The Westinghouse Asheville, North Carolina office has the engineering/design responsibility and has postulated that there are several possibilities that may contribute to the semi-fluid state of the potting compound: 1) the mix ratio as dispensed by the filling machine may not be constant, 2) the mixing of the two materials may not be complete, and 3) the shelf life of the two mixing materials may have been exceeded. Although the data is limited, it appears that the failures are scattered and not batch related. This would indicate that a poor mix is the probable cause leading to the potential for a few assemblies from any suspect batch being susceptable to this failure mode.

The process specification for the epoxy compound is also used for NBFD and BFD relays plus A200DC and DPC 250 magnetic contactors. The AC version of these items uses different materials in a molding process for coil encapsulation. Since the mold is removed while it is still hot any degradation in the process would be immediately determined. No failures due to epoxy softening have been reported on AC products.

The issue is limited to devices manufactured after May, 1975 when the epoxy potting process was introduced. The prior potting compound did not involve mixing two parts, only heating resin coated sand particles.

The issue is also limited to devices that are normally energized or that may be energized for an extended period of time to perform a specific function. Devices that are normally deenergized and operate only for a short period (a few minutes) would not develop enough heat to cause the epoxy to flow. The reported malfunctions occurred in recently installed relays with relatively few hours of operation.

The types of devices to which this issue applies have been widely used by Westinghouse in the design of safety systems supplied for nuclear power plants. It is known that they have also been widely used by other suppliers of safety related systems for plants which have Nuclear Steam Supply Systems supplied by Westinghouse and other vendors. This generally widespread use of the potentially affected devices makes it impossible for Westinghouse to determine which nuclear power plants might be affected. Therefore, all nuclear power plants will be informed of this issue.

June 24, 1991
NS-NRC-91-3600

SAFETY SIGNIFICANCE

The ARD, BFD, and NBFD relays are utilized in Westinghouse safeguards systems. These relays along with the A200DC and DPC 250 contactors are also used in other applications not specified by Westinghouse. For devices that deenergize to perform a safety function, it is possible that the function would be significantly delayed or not performed at all. For other functions, where the device is normally deenergized but could be energized for an extended period, it might not reset when demanded or it might not perform the function the next time. Periodic testing of these functions serves to verify performance and also provides confidence that the devices will perform as expected upon actual demand.

The small number of identified relay malfunctions due to this issue combined with the large population of such devices in safety related service demonstrates that the the malfunction of individual devices is unlikely. The malfunction of a redundant pair of such devices is even less likely. Therefore, it is very unlikely that a complete safety function would be unavailable on demand due to this issue prior to the time that corrective actions could be reasonably scheduled.

RECOMMENDED CORRECTIVE ACTION

Westinghouse Energy Systems Business Unit (ESBU) has updated the processses and procedures it uses to dedicate these devices (after they are procured as commercial grade devices) for safety-related nuclear service to incorporate steps which check for flowing epoxy and reject any which do evidence such behavior.

If the performance of normally energized applications has been verified through at least two surveillance periods, it is the judgement of Westinghouse that the probability of common mode failures in redundant systems has been reduced to the extent that any subsequent failure could be considered random. This judgement is based on the indication of early failure due to heating of the coil assembly and the probable cause of poor mixing which reduces concern with regard to devices from the same batch being installed in redundant functions.

It will be recommended to all affected customers that one of the following corrective actions be implemented to resolve this issue for relays currently in-service:

1) For normally energized devices that have not been through two surveillance periods or for those in a normally deenergized function that may be more than intermittently energized and spares for these applications: Following energization for at least two hours in service, or in simulated service conditions, deenergize the device and perform an immediate inspection of the potting compound. The epoxy compound should be probed before the device cools. Any evidence of softening should be considered reason for removal of the device from service.

June 24, 1991
NS-NRC-91-3600

2) Replace all suspect devices with a new device.

The list of suspect devices includes any of the following products manufactured by Westinghouse after May, 1975.

ARD Relays
BFD Relays
NBFD Relays
A200DC Magnetic Contactors
DPC 250 Magnetic Contactors

The manufactured date is identified by the coded five letter sticker on the side of the coil part of the device. Suspect coils from 1975 on would have a fourth digit of an A or an E or fourth and fifth digits of GC, GH, GG, GE or GA.

Until one of the above recommendations is implemented, it would be prudent to increase the surveillance frequency of circuits containing these devices to reduce the potential for simultaneous failures in redundant systems. For normally energized functions, this increase would only be necessary through the equivalent of two normal surveillance periods.

If you have any questions regarding this matter, please contact Mr. P. J. Morris of my staff at (412) 374-5761, or myself.

S. R. Tritch, Manager
Nuclear Safety Department

RBM/sa

# LIST OF RECENTLY ISSUED NRC INFORMATION NOTICES

| Information Notice No. | Subject | Date of Issuance | Issued to |
|---|---|---|---|
| 91-44 | Improper Control of Chemicals in Nuclear Fuel Fabrication | 07/08/91 | All nuclear fuel facilities. |
| 91-43 | Recent Incidents Involving Rapid Increases in Primary-to-Secondary Leak Rate | 07/05/91 | All holders of OLs or CPs for pressurized-water reactors (PWRs). |
| 91-42 | Plant Outage Events Involving Poor Coordination Between Operations and Maintenance Personnel During Valve Testing and Manipulations | 06/27/91 | All holders of OLs or CPs for nuclear power reactors. |
| 91-41 | Potential Problems with The Use of Freeze Seals | 06/27/91 | All holders of OLs or CPs for nuclear power reactors. |
| 88-63, Supp. 2 | High Radiation Hazards from Irradiated Incore Detectors and Cables | 06/25/91 | All holders of OLs or CPs for nuclear power reactors, research reactors, and test reactors. |
| 91-40 | Contamination of Non-radioactive System and Resulting Possibility for Unmonitored, Uncontrolled Release to the Environment | 06/19/91 | All holders of OLs or CPs for nuclear power reactors. |
| 91-39 | Compliance with 10 CFR Part 21, "Reporting of Defects and Noncompliance" | 06/17/91 | All Nuclear Regulatory Commission (NRC) material licensees. |
| 91-38 | Thermal Stratification in Feedwater System Piping | 06/13/91 | All holders of OLs or CPs for nuclear power reactors. |
| 91-37 | Compressed Gas Cylinder Missile Hazards | 06/10/91 | All holders of OLs or CPs for nuclear power reactors. |
| 91-36 | Nuclear Plant Staff Working Hours | 06/10/91 | All holders of OLs or CPs for nuclear power reactors. |

OL = Operating License
CP = Construction Permit