

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

May 9, 1994

NRC INFORMATION NOTICE 94-33: CAPACITOR FAILURES IN WESTINGHOUSE EAGLE 21
PLANT PROTECTION SYSTEMS

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 two different types of capacitor failures that can cause loss of power to portions of Eagle 21 reactor protection systems manufactured by Westinghouse Electric Corporation. 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

During the past year, Commonwealth Edison Company (CECo) experienced several instances of partial loss of electrical power within the Westinghouse Eagle 21 plant protection system at Zion Station, Unit 1, during normal plant operation. Two types of failures were identified, and these were reported by CECo under Part 21 of Title 10 of the Code of Federal Regulations (10 CFR) on April 8, 1994.

One type of failure involved Series RS 300 and RT 300 dc power supplies manufactured by ASTEC America, with Westinghouse part numbers 2D33574G07 and 2D33574G09. Electrolytic capacitors C2 and C7 failed, causing complete loss of dc power to the connected loads. Unit 1 at Zion Station has 10 racks of Eagle 21 equipment. Each rack contains two power supplies. One provides power to the tester subsystem, which is not essential for performing the system design safety function. The other power supply provides power for the loop processor subsystem, which includes reactor protection and engineered safety features channels and logic, and may include some control room indication channels. On loss of power, a loop processor channel fails to the de-energized state, which normally is the tripped state. Containment spray, however, is an energize-to-actuate function, and loss of power would prevent the channel from tripping. In certain racks, loss of power would also defeat some control room indications required by Regulatory Guide 1.97.

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The other failure type involved type TDA40DM time delay relays manufactured by Douglas-Randall, with Westinghouse part number PS12800H02. Ceramic capacitor C2 failed, causing either repetitive cycling or complete loss of ac power to the connected loads. The time delay relays are used in the Eagle 21 ac power distribution panels to sequentially load the power supplies during protection system startup. The failure consequences are similar to those for the power supply capacitors described above.

Discussion

The failed capacitors in the ASTEC America dc power supplies were type SR65, Z5U manufactured by AVX Corporation. The failed capacitors had date codes from 9130 to 9136 where the first two digits of the date code indicate the year of manufacture and the last two digits indicate the week within that year. The capacitors were used in power supplies manufactured in 1991, with date codes 9134 through 9147. Westinghouse determined that several capacitors with the suspect date codes shorted or exhibited electrical leakage, and were cracked or ruptured. The Zion power supplies were returned to Westinghouse, the capacitors with the suspect date codes were replaced, and the power supplies were tested and returned to service. The ASTEC America power supplies are used in the following Westinghouse systems:

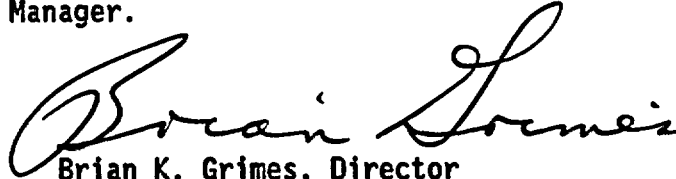
- Neutron flux monitoring system (NFMS)
- Auxiliary Shutdown Indication System (ASIS)
- Plant Safety Monitoring System (PSMS)
- Qualified Display Processing System (QDPS)
- Reactor Vessel Level Instrumentation System - 86 (RVLIS-86)
- Inadequate Core Cooling Monitor System (ICCM)
- ATWS Mitigating System Actuation Circuitry (AMSAC)
- Eagle 21

CECo and Westinghouse determined that the capacitors in the Douglas-Randall time delay relays were failing prematurely because of excessive heat dissipated in the epoxy potted module by nearby resistor R1. The problem was corrected by returning the relays to Westinghouse, where the resistors were relocated outside the relay module. The relays were tested and returned to service.

The Zion failures were discussed at an Eagle 21 owners group meeting in November 1993, but the causes had not been identified at that time. Because the failures are detectable and a Westinghouse failure analysis determined that they are aging related and likely to be random rather than simultaneous, Westinghouse elected not to submit a notification under 10 CFR Part 21. For the power supply failures, Westinghouse advised the NRC that it issued an Infogram to all customers with Eagle 21 or other affected equipment on April 29, 1994. For the relay failures, only four of the five Eagle 21 customers are affected, since Sequoyah does not have the relays. Zion is fully aware of the concerns, and the hardware has been corrected. The Diablo Canyon system will be corrected before it is shipped to the site. Westinghouse advised that it was preparing plant-specific followup letters to Watts Bar, Turkey Point, and Diablo Canyon for issue on April 29, 1994.

This information notice is being sent to all power reactor licensees because AVX capacitors and Douglas-Randall time delay relays may be used in other applications at nuclear power plants.

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 Office of Nuclear Reactor Regulation (NRR) Project Manager.



Brian K. Grimes, Director
Division of Operating Reactor Support
Office of Nuclear Reactor Regulation

Technical contact: Richard C. Wilson, NRR
(301) 504-3220

Attachment:
List of Recently Issued NRC Information Notices

LIST OF RECENTLY ISSUED
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
93-53, Supp. 1	Effect of Hurricane Andrew on Turkey Point Nuclear Generating Station and Lessons Learned	04/29/94	All holders of OLs or CPs for nuclear power reactors.
94-32	Revised Seismic Hazard Estimates	04/29/94	All holders of OLs or CPs for nuclear power reactors.
94-31	Potential Failure of Wilco, Lexan-Type HN-4-L Fire Hose Nozzles	04/14/94	All holders of OLs or CPs for nuclear power reactors.
90-68, Supp. 1	Stress Corrosion Cracking of Reactor Coolant Pump Bolts	04/14/94	All holders of OL or CPs for pressurized water reactors.
94-30	Leaking Shutdown Cooling Isolation Valves at Cooper Nuclear Station	04/12/94	All holders of OLs or CPs for nuclear power reactors.
94-29	Charging Pump Trip during a Loss-of-Coolant Event Caused by Low Suction Pressure	04/11/94	All holders of OLs or CPs for pressurized water reactors.
92-51, Supp. 1	Misapplication and Inadequate Testing of Molded-Case Circuit Breakers	04/12/94	All holders of OLs or CPs for nuclear power reactors.
94-28	Potential Problems with Fire-Barrier Penetration Seals	04/05/94	All holders of OLs or CPs for nuclear power reactors.
94-27	Facility Operating Concerns Resulting from Local Area Flooding	03/31/94	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License
CP = Construction Permit

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Original signed by
 Brian K. Grimes

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* Previous concurrence

OFFICE	VIB/DRIL	SC/VIB/DRIL	BC/VIB/DRIL	BC/ICB DRCH	
NAME	RWILSON*	GCWALINA*	LNORRHOLM*	JWERMEIL*	
DATE	4/20/94	4/20/94	4/21/94	4/25/94	
OFFICE	TECH ED	GCB/DORS	D/DRIL/NRRS	BC/GCB/DORS*	D/DORS
NAME	MMEJAC*	DKIRKPATRICK*	CEROSI*	AKUGLER	BKGRIMES
DATE	4/18/94	4/18/94	4/28/94	4/29/94	5/4/94

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Document Name: 94-33.IN

This information notice is being sent to all power reactor licensees because it is possible that the AVX capacitors and the Douglas-Randall time delay relays may be used in other applications at nuclear power plants.

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OFFICE	TECH ED	GCB/DORS	D/DRIL/NRRS	BC/GCB/DORS	D/DORS
NAME	MMEJAC*	DKIRKPATRICK*	CEROSI*	AKUGLER <i>AK</i>	BKGRIMES <i>BK</i>
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DATE	4/20/94	4/20/94	4/21/94	4/25/94	
OFFICE	TECH ED	GCB/DORS	D/DRIL/NRRS	BC/GCB/DORS	D/DORS
NAME	MMEJAC*	DKIRKPATRICK*	CROSSI <i>20</i>	AKUGLER	BKGRIMES
DATE	4/18/94	4/18/94	4/24/94	4/ /94	4/ /94

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Document Name: EAGLE21.IN

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NAME	RWILSON <i>RCW</i>	GCHALINA <i>GC</i>	LEBRHOLM <i>LE</i>	JWERMEIL <i>JW</i>	
DATE	4/20/94	4/20/94	4/21/94	4/25/94	
OFFICE	TECH ED	GCB/DORS	D/DRIL/NRRS	BC/GCB/DORS	D/DORS
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DATE	4/ /94	4/ /94	4/ /94	4/ /94	4/ /94
OFFICE	*TECH ED	GCB/DORS	D/DRIL/NRRS	BC/GCB/DORS	D/DORS
NAME		DKIRKPATRICK	CEROSI	AKUGLER	BKGRIMES
DATE	7/19/93	4/18/94 <i>DK</i>	4/ /94	9/ /93	4/ /94

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NAME	RWILSON	CDOUTT	GCWALINA	LNORRHOLM	JWERMEIL
DATE	4/ /94	4/ /94	4/ /94	4/ /94	4/ /94
COPY	YES	YES	YES	YES NO	YES NO
OFFICE	TECHED	GCB/DORS	D/DRIL/NRRS	BC/GCB/DORS	D/DORS
NAME	<i>M. ME JAC</i>	DKIRKPATRICK	CEROSI	AKUGLER	BKGRIMES
DATE	<i>7/19/93 4/18/94</i>	4/ /94	4/ /94	9/ /93	4/ /94
COPY	YES	YES NO	YES NO	YES NO	YES NO