

UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
OFFICE OF NUCLEAR REACTOR REGULATION  
WASHINGTON, D.C. 20555-0001

August 12, 1996

NRC INFORMATION NOTICE 96-46: ZINC PLATING OF HARDENED METAL PARTS AND  
REMOVAL OF PROTECTIVE COATINGS IN REFURBISHED  
CIRCUIT BREAKERS

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 that inadequate licensee review of procedures employed by a circuit breaker refurbishing contractor resulted in breakage of hardened metal parts and potentially increased wear of other metal parts that could cause the refurbished breakers to fail to operate. 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

In May 1996, technicians employed by Public Service Electric & Gas (PSE&G) at its Salem Generating Station (Salem) observed broken lock washers in the arc chute holddown assembly of a General Electric (GE) 4.16-kV AM-type Magne-Blast circuit breaker during a receipt inspection. Nuclear Logistics Incorporated (NLI), a breaker refurbishing contractor, refurbished the breaker. NLI used a subcontractor, National Switchgear Systems (NSS), to perform the refurbishment. The licensee determined that NSS did not remove or mask the lock washers during the zinc-plating of the arc chute holddown assembly.

On July 16, 1996, during preinstallation testing of another Magne-Blast breaker, technicians at Salem noted that the inner latch pawl spring retainer roll pin of the spring charging mechanism was broken longitudinally. The pin had been zinc plated during refurbishment at NSS. Failure of the pin may cause the failure of the spring charging mechanism to charge the spring and cause the breaker to fail to operate on demand (open or close). However, if the springs were charged when the breaker was closed, failure of the pin would not prevent the breaker from opening.

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### Discussion

Low and medium voltage circuit breakers are refurbished periodically to assure reliable operation by implementing manufacturer maintenance recommendations. This service may be performed by the original manufacturer or by contractors who implement a quality assurance program that meets 10 CFR Part 50, Appendix B for safety-related equipment. In addition to establishing and maintaining an acceptable licensee/vendor interface program to remain current with manufacturer maintenance recommendations (in accordance with Generic Letters 83-28 and 90-03), licensees are expected to assure that vendors (or contractors) translate manufacturer recommendations into their procedures.

To enhance the appearance of some metal parts, NLI/NSS plated them with zinc without realizing that hydrogen generated during the plating process can diffuse into hardened metal parts. The diffusion of hydrogen into the hardened metal may cause embrittlement and result in cracking and breakage of the metal if heat treatment is not applied to desorb the hydrogen. Subsequent to problems identified at Salem, NLI deleted the zinc plating of metal parts from its breaker refurbishment procedure.

During an inspection at NLI, the NRC determined that NLI/NSS refurbished various types of low and medium voltage circuit breakers used in the nuclear power industry, including 4.16-kV and 480 V breakers made by GE and Westinghouse. In addition to the GE Magne-Blast breakers at Salem, NLI/NSS also plated several parts in a Magne-Blast breaker for Entergy Operations, Inc, GE model AK breakers for Northeast Utilities Company, and a Westinghouse DB-50 breaker for Carolina Power & Light Company. Work also was done for GPU Nuclear Corporation.

NLI has informed affected customers that the breakers with the identified zinc-plated parts should be returned to NLI so that the parts can be replaced. However, the NRC is concerned that NLI/NSS may not have identified all of the zinc-plated parts in all of the different breakers that it refurbished because the zinc-plating was performed on assemblies consisting of several smaller piece parts. Some of the piece parts may not have been identified. NLI is currently evaluating the implications of the plated parts and removal of the dry film lubricant on other projects.

Technicians at Salem also noticed that some metal parts on GE-refurbished breakers appeared darker than similar parts in the NLI/NSS-refurbished breakers. Upon inquiry, GE informed Salem that the darker color resulted from a dry film lubricant that GE applied to the parts to reduce wear between metal-to-metal contact surfaces in accordance with GE Service Advisory Letter (SAL) 354.1, "Lubrication Recommendations Type AM Circuit Breakers ML13 & ML 13A Mechanisms," dated August 25, 1995, which states, in part, "And finally, a spray-on, MoS<sub>2</sub> (molybdenum disulfide) dry film lubricant is also being made available, and it is recommended for use during general overhaul maintenance periods to lubricate certain hardened surfaces."

The dry film lubricant is applied to the following parts: (1) the ratchet wheel, (2) the latch pawl tips, (3) the drive pawl tip, (4) the front and top surfaces of the prop, (5) the main cam outer surface, and (6) the spring motor limit switch cam. NLI/NSS inadvertently removed this lubricant when the metal parts were glass bead blasted as part of the cleaning process, and did not re-coat the parts with the lubricant.

The work performed by NLI/NSS was detailed in a procedure that was reviewed and approved by PSE&G prior to refurbishment of any of the Salem breakers. Ensuring that contractor procedures receive proper technical review, and that the latest vendor recommendations are incorporated before the procedures are approved, may help licensees avoid the type of problems described in this notice.

#### Related Generic Communications


NRC Generic Letter No. 83-28, "Required Actions Based on Generic Implications of Salem ATWS Events," issued July 8, 1983.

NRC Generic Letter No. 90-03, "Relaxation of Staff Position in Generic Letter 83-28, Item 2.2 Part 2 - Vendor Interface for Safety-Related Components," issued March 20, 1990.

NRC Generic Letter No. 90-03, Supplement 1, "Relaxation of Staff Position in Generic Letter 83-28, Item 2.2 Part 2 - Vendor Interface for Safety-Related Components," issued May 14, 1990.

NRC Information Notice 96-43, "Failures of General Electric Magne-Blast Circuit Breakers," issued August 2, 1996, alerted licensees to a failure of a Magne-Blast breaker to open on demand at Dresden Nuclear Power Station because of hardened grease, and a failure of Magne-Blast breakers at Salem Generating Station and Maine Yankee Atomic Power Plant to latch closed because of a problem with the prop not resetting under the prop pin during the closing cycle.

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.



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LIST OF RECENTLY ISSUED  
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Information Notice No.	Subject	Date of Issuance	Issued to
96-45	Potential Common-Mode Post-Accident Failure of Containment Coolers	8/12/96	All holders of OLs or CPs for nuclear power reactors
96-44	Failure of Reactor Trip Breaker from Cracking of Phenolic Material in secondary contact assembly	8/05/96	All holders of OLs or CPs for nuclear power reactors
96-43	Failures of General Electric Magne-Blast Circuit Breakers	08/02/96	All holders of OLs or CPs for nuclear power reactors
96-42	Unexpected Opening of Multiple Safety Relief Valves	08/05/96	All holders of OLs or CPs for nuclear power reactors
96-41	Effects of a Decrease in Feedwater Temperature on Nuclear Instrumentation	07/26/96	All holders of OLs or CPs for pressurized water reactors
96-40	Deficiencies in Material Dedication and Procurement Practices and in Audits of Vendors	07/25/96	All holders of OLs or CPs for nuclear power reactors
96-09, Supp. 1	Damage in Foreign Steam Generator Internals	07/10/96	All holders of OLs or CPs for pressurized-water reactors
96-39	Estimates of Decay Heat Using ANS 5.1 Decay Heat Standard May Vary Significantly	07/05/96	All holders of OLs or CPs for nuclear power reactors
96-38	Results of Steam Generator Tube Examinations	06/21/96	All holders of OLs or CPs for pressurized water reactors
96-37	Inaccurate Reactor Water Level Indication and Inadvertent Draindown During Shutdown	06/18/96	All pressurized water reactor facilities holding an operating license or a construction permit

OL = Operating License  
 CP = Construction Permit

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Original Signed by  
Brian K. Grimes

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OFC	PECB:DRPM	PSIB:DISP	C/PSIB:DISP	C/PECB:DRPM
NAME	D. Skeen*	K. Naidu*	R. Gallo*	A. Chaffee*
DATE	8/02/96	8/05/96	8/05/96	8/05/96

OFC	D/DRPM
NAME	B. Grimes
DATE	8/9/96

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NAME	D. Skeen	K. Naidu	R. Gallo	A. Chaffee
DATE	8/2/96	8/5/96	8/5/96	8/8/96

OFC	D/DRPM
NAME	B. Grimes
DATE	8/ /96

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