

**LICENSEE EVENT REPORT (LER)**

(See reverse for required number of digits/characters for each block)

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1)  
SALEM GENERATING STATION, UNIT 1

DOCKET NUMBER (2)  
05000272

PAGE (3)  
1 OF 4

TITLE (4)  
Potential Hydrogen Embrittlement on 4KV Breaker Parts

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
07	17	96	96	014	00	08	16	96	Salem unit 2	05000311
										05000

OPERATING MODE (9)	N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)								
		20.2201(b)		20.2203(a)(2)(v)	X	50.73(a)(2)(i)		50.73(a)(2)(viii)		
POWER LEVEL (10)	0	20.2203(a)(1)		20.2203(a)(3)(i)		50.73(a)(2)(ii)		50.73(a)(2)(x)		
		20.2203(a)(2)(i)		20.2203(a)(3)(ii)		50.73(a)(2)(iii)		73.71		
		20.2203(a)(2)(ii)		20.2203(a)(4)		50.73(a)(2)(iv)	X	OTHER		
		20.2203(a)(2)(iii)		50.36(c)(1)		50.73(a)(2)(v)		Specify in Abstract below or in NRC Form 366A Part 21		
		20.2203(a)(2)(iv)		50.36(c)(2)		50.73(a)(2)(vii)				

LICENSEE CONTACT FOR THIS LER (12)

NAME  
Dennis V. Hassler, LER Coordinator

TELEPHONE NUMBER (Include Area Code)  
609-339-1989

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS

SUPPLEMENTAL REPORT EXPECTED (14)

YES (if yes, complete EXPECTED SUBMISSION DATE). X NO

EXPECTED SUBMISSION DATE (15)  
MONTH DAY YEAR

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On July 17, 1996 a failure of a roll pin securing a spring for a latch pawl on a 4KV breaker was reviewed and a determination made that the failure of this pin could cause the breaker to fail. Further investigation revealed that the roll pin failed as a result of hydrogen embrittlement. The roll pin failure was an unexpected occurrence and consequently determined that this condition could place the plant in an unanalyzed condition. Later, an issue involving permanently applied lubricant which was inadvertently removed from the breakers was identified. This also could potentially affect breaker operation.

The cause of the cracked roll pin was the lack of knowledge of plating induced hydrogen embrittlement. The Nuclear Logistics Incorporated (NLI) personnel involved in the NLI procedure development were not aware that zinc plating of hardened steel parts could produce hydrogen embrittlement and subsequent cracking. The cause of the lubricant being inadvertently removed from breaker parts is also due to the lack of knowledge by NLI personnel. NLI is a PSE&G approved vendor for safety related work. Corrective actions include issuance of a stop work order on NLI's breaker activities and replacement of the affected parts and reapplication of the lubricant.

This event is reportable in accordance with 10 CFR 50.73(a)(2)(ii); any event or condition that resulted in the plant being in an unanalyzed condition and in accordance with 10 CFR 21.2(c).

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		96	- 014	- 00	

TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

PLANT AND SYSTEM IDENTIFICATION

Westinghouse - Pressurized Water Reactor

4KV Breakers {-/BKR}\*

\* Energy Industry Identification System (EIIS) codes and component function identifier codes appear as (SS/CCC)

CONDITIONS PRIOR TO OCCURRENCE

At the time of identification, Salem Units 1 and 2 were shutdown and defueled.

DESCRIPTION OF OCCURRENCE

On July 17, 1996 a failure of a roll pin securing a latch pawl on a 4KV breaker was reviewed and a determination made that the failure of this pin could cause the breaker to fail. Further investigation revealed that the roll pin failed as a result of hydrogen embrittlement. The roll pin failure was an unexpected occurrence, and consequently determined that this condition could place the plant in an unanalyzed condition.

Public Service Electric & Gas (PSE&G) contracted with Nuclear Logistics Incorporated (NLI) to overhaul/refurbish 4 KV breakers for Salem Units 1 and 2. NLI is a PSE&G approved vendor for safety related work. NLI utilized clear zinc plating on a number of breaker parts that had been heat treated to a hardness of RC 60. The plated areas should have been masked off so that the hardened surfaces were not subjected to the acid and zinc plate baths. Acid cleaning and electroplating generates hydrogen, which can diffuse into the metal. This can result in instant cracking or delayed cracking. The cracking is not normally dependent on the operating load.

On May 1, 1996 a lockwasher holding the breaker lower arc chutes cracked and broke on site. The remainder of the breaker washers were visually checked and no other similar washers were found. The crack appeared to have been caused by hydrogen embrittlement induced when the lockwasher was zinc plated. This condition was reported to the industry through INPO OE 7875 dated June 5, 1996.

During the first week of May, the circuit breakers which were at the Texas facility of NLI were inspected and no problems related to plating or lockwashers were found. PSE&G then asked for a complete list of breaker parts that were zinc plated. The list was developed but it did not include the roll pins used on the breakers, including the ratchet drive pawl roll pins. During the same time frame, the vendor reported that the ratchet drive pawl in some circuit breakers was chipping. Efforts then were started to remove all hardened steel parts which were zinc plated by NLI with the intention of replacing them with new unplated parts. When the new parts became unavailable, NLI and PSE&G agreed on an alternate solution to the plating problem: the parts would be heat treated to relieve hydrogen induced stress and reinstalled in the circuit breakers. Both NLI and PSE&G agreed that no further zinc plating would be performed. Circuit breakers were then delivered to Salem and some were installed in the plant.

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DESCRIPTION OF OCCURRENCE (CONT'D)

On July 16, 1995, a circuit breaker in the Salem breaker shop was being tested prior to installation in the plant. A circuit breaker was found to have its inner latch pawl spring hanging down. The latch pawl itself was not engaging the ratchet wheel. Further inspection revealed that the roll pin that fits inside the bottom of the pawl return spring had broken along its longitude axis. The roll pin that broke normally serves to keep the bottom of the pawl return spring in the proper position. The support plate in which the roll pin is mounted and the roll pin itself appear to have been plated.

Subsequent to the above, an issue involving inadvertently removed lubricant was identified. This was identified during a visual inspection of an NLI rebuilt circuit breaker. The procedures for refurbishment of 4KV circuit breakers included acid cleaning and zinc plating of some mechanical parts. The original equipment manufacturer design included a lubricant which was baked-on some moving parts. The baked-on lubricant (molybdenum disulfide) was meant to last the life of the circuit breaker. The molybdenum disulfide is a dry baked-on lubricant that is applied to various rotating and rubbing surfaces on the breaker. This lubricant is applied to minimize component wear. The acid cleaning and zinc plating performed by NLI removed the original baked on lubricant. After the zinc plating of parts was discontinued, the cleaning/polishing process used by NLI still resulted in the removal of the original baked on lubricant.

The effect of the above described problems is that all NLI circuit breakers which had parts zinc plated must be removed from the plant for parts replacement. There were 15 breakers that were involved in the plating issue, and an additional four breakers involving the inadvertent removal of the lubricant. Eleven of the 19 breakers were installed in the plant in vital load cubicles. The buses where these breakers were installed were not operable but were considered available. One of the 11 installed breakers, 2B4D, is currently installed in a vital application and is supplying loads (e.g. spent fuel pool cooling pump). At the time the broken roll pins were found, it was not considered prudent, based on existing plant conditions, to remove this breaker. Also, an evaluation determined that failure of the plated roll pins in the breaker would not preclude this breaker from opening/tripping. A contingency plan has been approved for replacement of this breaker and it is expected to be removed in the near future.

CAUSE OF OCCURRENCE

The cause of the cracked roll pin was the lack of knowledge of plating induced hydrogen embrittlement. The NLI procedure development and subsequent reviews failed to associate zinc plating of hardened steel parts with hydrogen embrittlement. The NLI personnel involved in the NLI procedure were not aware that zinc plating of hardened steel parts could produce hydrogen embrittlement and the subsequent cracking. The cause of the lubricant being inadvertently removed from breaker parts is also due to the lack of knowledge by NLI personnel.

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PRIOR SIMILAR OCCURRENCES

In the past two years, there has been one Salem LER that addressed breaker failures. LER 272/96-009-00 addressed a potential common mode failure mechanism for 4KV breakers due to misalignment of the breaker mechanism. The plating and lubrication issues discussed in this LER (272/96-014-00) were discovered as a result of the same overhaul work that identified the plating problem discussed above.

SAFETY CONSEQUENCES AND IMPLICATIONS

There were no safety consequences for this occurrence since the breaker failures were found while the plant was in a defueled condition and the buses are not operable. However, the implications are that this is a potential common mode failure which could jeopardize the operability of safety related circuit breakers. The operability of the AC Power Sources insures power will be available to supply safety related equipment. In the event safety related equipment is required to start, but is prevented from starting due to a single circuit breaker failing, redundant safety equipment would be available. However, it is possible that during an event, more than one channel of safety related equipment could be affected.

The breaker installed in 2B4D was in the closed position and the roll pin was not cracked or missing. The capability to open or trip the circuit breaker was reviewed and was determined not to be compromised. The health and safety of the public were not affected by this occurrence.

CORRECTIVE ACTIONS

1. Removed all NLI refurbished breakers, except 2B4D, from vital loads. Breaker 2B4D will be removed when its loads are available to be transferred to another bus.
2. A QA stop work order was issued to NLI on July 26, 1996.
3. The circuit breakers will be sent for replacement and refurbishment. This will be completed for each breaker prior to that breaker being required to be operable.
4. Further corrective actions will be taken as a result of the root cause evaluation currently being conducted. Significant corrective actions that affect the discussion in this LER, if any, will be reported in a supplement to this LER.

10CFR21 REPORTING

10CFR21 reporting requirements are met by this LER.