

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) Hope Creek Generating Station		DOCKET NUMBER (2) 05000354	PAGE (3) 1 OF 6
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TITLE (4)
Struthers-Dunn 219NE Series Relay Failures Due to Thermal Degradation of Magnetic Vinyl Plastic Bearing Pad Material

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
04	07	97	97	-- 007	-- 00	05	07	97		05000
										05000

OPERATING MODE (9)	1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)								
POWER LEVEL (10)	100	20.2201(b)		20.2203(a)(2)(v)		50.73(a)(2)(i)(B)		50.73(a)(2)(viii)		
		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)		X 50.73(a)(2)(v)		Specify in Abstract below or in NRC Form 366A		
		20.2203(a)(2)(iv)		50.36(c)(2)		50.73(a)(2)(vii)				

LICENSEE CONTACT FOR THIS LER (12)

NAME Paul Duke, Sr. Staff Engineer	TELEPHONE NUMBER (Include Area Code) (609) 339-1466
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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
B	BI	RLY	S440	Y					

SUPPLEMENTAL REPORT EXPECTED (14)

YES (If yes, complete EXPECTED SUBMISSION DATE).	X	NO	EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
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ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On April 7, 1997, Public Service Electric & Gas Co. (PSE&G) completed its evaluation of an increase in the failure rate of Struthers-Dunn 219NE series relays with 120 VAC and 24 VAC coils and concluded that the failures were due to the use of magnetic vinyl plastic for the bearing pad material in normally energized relays. Based upon the extent of the condition, PSE&G concluded that, if undiscovered, it could have caused one or more safety systems to fail to perform their intended function. A four hour notification was made to the NRC at 1848 on April 7, 1997, pursuant to 10CFR50.72(b)(2)(iii). This LER is being submitted pursuant to 10 CFR 50.73(a)(2)(v) and 10 CFR 21. The apparent cause of the high failure rate was thermal degradation of the magnetic vinyl plastic bearing pad material in Struthers-Dunn 219NE series 24 VAC and 120 VAC relays. Panels containing the degraded relays are being inspected weekly to assure continued operability until the relays are replaced. The degraded relays will be replaced before the end of Hope Creek's seventh refueling outage. There were no actual safety consequences associated with this condition. There was no impact on public health and safety.

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PLANT AND SYSTEM IDENTIFICATION

General Electric - Boiling Water Reactor (BWR/4)
 Station Service Water System - EIIS Identifier {BI}
 Intake Structure HVAC System - EIIS Identifier {UA}
 Remote Shutdown Panel - EIIS Identifier {JL}

IDENTIFICATION OF OCCURRENCE

Discovery date: 04/07/97
 Problem Report: 970306444

CONDITIONS PRIOR TO OCCURRENCE

The plant was in OPERATIONAL CONDITION 1 (POWER OPERATION) at 100% of rated thermal power. There were no other structures, systems, or components that were inoperable at the beginning of the event that contributed to the event.

DESCRIPTION OF OCCURRENCE

On April 7, 1997, PSE&G completed its evaluation of an increase in the failure rate of Struthers-Dunn 219NE series relays with 120 VAC and 24 VAC coils and concluded that the failures were due to the use of magnetic vinyl plastic for the bearing pad material in normally energized relays. A walkdown of the Class 1E panels containing 219NE series relays identified 170 relays with magnetic vinyl plastic bearing pads. Forty eight (48) of these relays had degraded bearing pads. Based upon the extent of the condition, PSE&G concluded that, if undiscovered, it could have caused one or more safety systems to fail to perform their intended function. A four hour notification was made to the NRC at 1848 on April 7, 1997, pursuant to 10CFR50.72(b)(2)(iii).

The bearing pad functions as a silencer at the pivot point of the hinged armature plate. It is mounted on a metal frame with the relay coil and the armature. Failure of the bearing pad affects the alignment between the armature and the AC relay coil and causes rapid oscillatory motion of the relay armature and contacts. The rapid motion is observable as a loud buzzing or chattering from the relay. Relay failure eventually results. The length of time from the onset of rapid oscillatory motion and eventual failure cannot be precisely quantified. However, it is on the order of weeks based on experience with relays observed to be buzzing.

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DESCRIPTION OF OCCURRENCE (continued)

PSE&G conducted a walkdown of the fifty one Class 1E panels containing 219NE series relays. A total of forty eight (48) relays with degraded bearing pads were identified in the following applications:

- Forty four (44) relays in the Remote Shutdown Panel (RSP);
- Three (3) relays in the Station Service Water System (SSWS) vacuum breaker controls; and
- One (1) relay in the Traveling Screen Motor Room Ventilation System controls.

One of the relays with degraded bearing pads in the RSP was observed to be buzzing and was replaced. Degraded bearing pads were observed only in AC relays with magnetic vinyl plastic bearing pad material. The walkdown also identified a total of 122 relays that have magnetic vinyl plastic bearing pads that are not degraded and two (2) relays were found to have been assembled with no bearing pad. None of these relays were observed to be chattering or buzzing.

With the exception of the relays in the SSWS vacuum breaker controls, all of the degraded relays are located in mild EQ environments. The SSWS vacuum breaker control relays are located in a harsh environment, but they were not included in the Hope Creek Equipment Qualification (EQ) program. The qualified life for these relays is calculated to be 11.6 years (expires November 24, 1997).

Continued operability of the affected systems is assured by performing panel walkdowns weekly to identify relays that have begun buzzing (an indicator of degradation to the point that rapid armature motion is occurring) and taking immediate action if any buzzing is detected.

The relay manufacturer, Struthers-Dunn, stated that magnetic vinyl plastic was used in 219NE series relays until April, 1983. The design was changed to use silicone rubber after that time. However, PSE&G has identified one relay with magnetic vinyl plastic bearing pad material that was manufactured in 1985. The bearing pad material can be identified by color: magnetic vinyl plastic is brown; silicon rubber is red; and Teflon is white.

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DESCRIPTION OF OCCURRENCE (continued)

This event is being reported pursuant to 10CFR50.73(a)(2)(iii) as a condition that could have prevented the fulfillment of a safety function. This report is also being submitted in accordance with 10 CFR 21 as a defect which could result in a loss of safety function necessary to mitigate the consequences of an accident.

The affected relays are Struthers-Dunn series 219NE 120 VAC (model number 219BBX222NE) and 24 VAC (model number 219BBX232NE) relays with magnetic vinyl plastic bearing pad material. The relays were supplied to PSE&G by Comsip, the vendor for many of the Hope Creek plant panels.

APPARENT CAUSE OF OCCURRENCE

The apparent cause of the high failure rate was thermal degradation of the magnetic vinyl plastic bearing pad material in Struthers-Dunn 219NE series relays with AC coils. The thermal degradation is due to exposure to high temperatures when the relay coils are energized. Thermal degradation causes the bearing pad to disintegrate and become dislodged from the relay frame.

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ASSESSMENT OF SAFETY CONSEQUENCES

Three (3) of the four (4) relays controlling the Station Service Water System (SSWS) vacuum breakers were found to have degraded magnetic vinyl plastic bearing pads. The SSWS is designed to operate during normal plant operation and during a design basis accident, including a LOCA, loss of offsite power (LOP), and a LOCA with LOP conditions. Normally closed solenoid operated valves, two per loop for redundancy, are located at the highest point of each SACS heat exchanger discharge pipe. Following a LOP, these valves fail open to admit air and close after a preset time delay following restoration of power. This arrangement reduces the pressure surge caused by the subsequent restart of all station service water pumps to within design limits.

Multiple failures of the degraded relays could prevent the vacuum breakers from remaining open for the preset time delay following restoration of power after a LOP. This could potentially increase pipe support loads beyond the current analyzed levels and result in failure of the pressure boundary. This could result in the loss of a SSWS loop. Quarterly testing of the SSWS vacuum breakers per the Hope Creek Inservice Testing (IST) program minimized the potential for undetected failures of the degraded relays.

Forty four (44) relays with degraded magnetic vinyl plastic bearing pads were found in the Remote Shutdown Panel (RSP). Of these, twenty seven relays supply indicators or alarms required by plant Technical Specifications. The Remote Shutdown System (RSS) provides the means for achieving and maintaining safe shutdown conditions from outside the main control room in the unlikely event the main control room becomes uninhabitable. The primary control station for the RSS is the remote shutdown panel (RSP). Multiple failures of the degraded relays could render the RSP inoperable. However, in the event of a failure at the RSP, sufficient redundant safety grade instrumentation and controls are available apart from both the main control room and the RSP to ensure that safe shutdown of the reactor can be achieved.

One (1) relay with a degraded magnetic vinyl plastic bearing pad was found in the damper controls for one train of the Traveling Screen Motor Room Ventilation System. The traveling screen room is provided with two 100 percent capacity supply fans, each with motorized outside air intake and return air dampers and one common exhaust opening with backdraft damper. Failure of the degraded relay would not affect the redundant train and would not prevent the system from performing its function.

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ASSESSMENT OF SAFETY CONSEQUENCES (continued)

There were no actual safety consequences associated with this condition. There was no impact on public health and safety. Therefore, the safety consequences associated with this event were negligible.

PREVIOUS OCCURRENCES

No previous occurrences similar to this condition were identified in a review of Hope Creek LERs.

CORRECTIVE ACTIONS

1. As of May 1, 1997, six (6) of the Struthers-Dunn 219NE series relays with degraded magnetic vinyl plastic bearing pad material have been replaced.
2. Panels containing Struthers-Dunn 219NE series relays with degraded magnetic vinyl plastic bearing pad material are being inspected weekly to ensure continued operability until the relays are replaced.
3. Struthers-Dunn 219NE series relays with degraded magnetic vinyl plastic bearing pad material will be replaced as soon as possible within the Hope Creek work week schedule. Replacement will be complete before the end of Hope Creek's seventh refueling outage.
4. Normally energized Struthers-Dunn 219NE series 120 VAC (model number 219BBX222NE) and 24 VAC (model number 219BBX232NE) relays with no bearing pad or with non-degraded magnetic vinyl plastic bearing pad material will be inspected to verify no degradation. The results of this inspection will be assessed to determine the need for additional inspections until the relays are replaced. This activity will be completed by August 29, 1997.
5. The SSWS vacuum breaker relays that were omitted from the EQ Program have been added to the program and will be replaced before the end of their qualified life (November 24, 1997).
6. Normally energized Struthers-Dunn 219NE series 120 VAC (model number 219BBX222NE) and 24 VAC (model number 219BBX232NE) relays with no bearing pad or with non-degraded magnetic vinyl plastic bearing pad material will be replaced before the end of their calculated service life (April 15, 1998).