NRC Form 366 (9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/85

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
INDIAN POINT, UNIT 2	0 5 0 0 0 2 4 7	1 OF 0 4

TITLE (4)
T.G. FIRE : S.I. PUMPS MALFUNCTION

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 NAMES	DOCKET NUMBER(S)
1 2	1 9	8 4	8 4	— 0 2 5	— 0 0	0 1	1 8	8 4		0 5 0 0 0
										0 5 0 0 0

OPERATING MODE (9): 1

POWER LEVEL (10): 1 0 0

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)

20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
20.405(a)(1)(i)	X 50.36(c)(1)	50.73(a)(2)(v)	73.71(c)
20.405(a)(1)(ii)	50.36(c)(2)	X 50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)
20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
20.405(a)(1)(iv)	50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)	
20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (AREA CODE)
	9 1 4 5 2 6 - 5 1 8 2

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
D	B P	P	P 0 2 5	N					
X	B P	S H V	A 2 0 0	N					

SUPPLEMENTAL REPORT EXPECTED (14)

☐ YES (If yes, complete EXPECTED SUBMISSION DATE) ☐ NO

EXPECTED SUBMISSION DATE (15): MONTH | DAY | YEAR

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

On the evening of December 19, 1984, with the unit at full power, a fire occurred at the generator exciter end seal due to seal failure and hydrogen leakage. During operator-initiated shutdown the reactor tripped on low steam generator level and safety injection occurred on a High Steam Flow signal (coincident with a low average temperature of the Reactor Coolant System) due to actuation of the steam dump valves. The Boron Injection Tank injected its contents into the Safety Injection System. There was no injection of borated water into the Reactor Coolant System since the Reactor Coolant System was at a pressure greater than the Safety Injection System shutoff head.

During the subsequent week, repairs were made to the generator and the reactor brought critical. On the morning of December 28, 1984 two Safety Injection Pumps were declared inoperable after they malfunctioned in an attempt to top off the ECCS Accumulators; the third Safety Injection Pump would not manually turnover. The reactor was manually tripped and an orderly cooldown commenced. By January 1, 1985, the three Safety Injection Pumps were verified to be operable and the reactor brought critical.

The cause of the malfunction of the Safety Injection Pumps is attributed to a combination of solidified boric acid preventing suction flow and gas binding of the pumps. Flushing procedures have been modified to ensure better flushing of lines where the potential exists for high boric acid concentration, and the function of associated equipment is being monitored to preclude further similar events.

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On December 19, 1984 at 8:00 p.m. a previously observed oil leak under the main generator intensified. The source of the oil leak was traced to the Generator Exciter End. An interim oil catcher, fabricated from aluminum flashing, inadvertently touched the generator shaft and produced a spark, igniting leaking hydrogen. The resulting fire was extinguished in 30 seconds. Steps were then taken to eliminate the hydrogen leak by isolating the hydrogen supply to the generator and adjusting the seal oil pressure. Following the latter adjustment, the hydrogen side seal oil pressure rose and oil started leaking from the outboard and inboard generator seals. A loud noise was heard and a second fire was seen in the generator outboard bearing. This occurred at approximately 10:00 p.m and an operator-initiated rapid shutdown was implemented. At 10:02 the unit tripped on a low steam generator level, and safety injection actuation occurred due to high steam flow coincident with low average temperature of the Reactor Coolant System.

The second fire was extinguished in approximately thirty minutes. Due to the Safety Injection signal, the Safety Injection Pumps ran in the recirculation mode prior to being secured from operation. The Boron Injection Tank performed as designed and delivered approximately 1500 gallons of concentrated (nominally 13%) boric acid to the Safety Injection System. The Boron Injection Tank valves opened automatically on Safety Injection and closed on a low Boron Injection Tank level signal as designed.

The plant remained in a hot shutdown condition following the generator fire while repairs were in progress to the Exciter End Hydrogen Seal. An electrical short circuit which caused the seal failure was corrected and therefore the hydrogen and seal oil leak was eliminated. On December 26, 1984 one safety Injection Pump, #22 was run to top off the Accumulator Tanks. On the morning of December 28, 1984 with the reactor critical, #23 Safety Injection Pump was started to top off the Accumulator Tanks. The pump developed a discharge head of 1100 psig and then dropped to approximately 700 psig corresponding to the pressure in the Accumulator Tanks. The pump was secured from operation and the valve lineup verified. The pump was vented and the suction and discharge pressure taps inspected. Liquid was observed at each point with a momentary emission of gas. A second Safety Injection Pump, #22, was inspected and found to be solid with water. The suction pressure was satisfactory at 30 psig. #22 Safety Injection Pump was started to maintain level in the Accumulators. After filling two Accumulators and while in the process of topping off the third, #22 pump was observed to drop in discharge pressure from 1500 to 700 psig. The pump was secured from operation. The piping to the third Safety Injection Pump, #21, precluded its use to top off the Accumulators. An unsuccessful attempt was made to manually roll the pump.

The reactor was manually tripped and an orderly approach to cold shutdown implemented.

An investigation of the status of the Safety Injection System was commenced. #22 pump was vented and a continuous flow of gas and water were observed. At the same time #23 pump was vented with only water flow observed. #21 pump was vented and only gas was observed; otherwise the pump internals were dry. An analysis of a gas sample from #21 pump indicated the major constituent to be nitrogen (97%).

Other points in the system were also opened. Water and gas were observed in the suction line from the RWST and in the discharge line from the Boron Injection Tank. Venting of pump #22 continued for a few hours until gas evolution ceased. Further investigation of pump #21 identified the suction line immediately upstream of the pump to be completely plugged with boric acid.

It is believed that precipitated boric acid had partially blocked the suction to pumps #22 and #23 causing partial suction loss. This, together with gas entrapment resulted in the observed drop in discharge pressure when the accumulators were topped off. In the case of pump #21 total blockage of the suction line occurred.

An evaluation program was initiated to identify the sources of boric acid and gas. Samples were taken from the piping downstream of the Boron Injection Tank, the discharge side of pump #21, the Refueling Water Storage Tank and the Accumulators. Based on the analysis of the samples, a log indication of the 220 gallons of make up added to the Boron Injection Tank during the prior week and the operating history of the Safety Injection Pumps, it is known that the Boron Injection Tank was leaking across closure valves 1822 A and 1822 B. This is considered to be the source of the boric acid. It is believed that the boric acid precipitated in the pumps since they are not heat traced.

Potential sources of the nitrogen in the system were the Accumulators, nitrogen used for the post-LOCA sealing of two isolation valves in the Safety Injection System and the Boron Injection Tank (which operates under a nitrogen cover gas but at a lower pressure than the Accumulators). Nitrogen from the sealing system was eliminated from further consideration through test isolation of the nitrogen source to that system branch which serves the two isolation valves. No pressure loss was observed. The Accumulators were eliminated as a suspected source after a test simulating conditions of backleakage across the check valves on the pump discharge failed to produce detectable nitrogen on the pump suction side. By a process of elimination the Boron Injection Tank is the most likely source of the nitrogen. The nitrogen dissolves in the tank liquid until equilibrium is achieved at 90 psig. Due to either leakage or injection, dissolved gas will evolve in the lower pressure discharge line.

Since all factors contributing to the malfunction of the Safety Injection pumps cannot be positively identified at this time, reliance has been placed on system monitoring and procedure revision to preclude further similar events. The Boron Injection Tank discharge line is being monitored on a daily basis and is flushed upon detection of increasing boric acid; it is maintained at a concentration no greater than 300 ppm above the RWST boron level. Similarly the pump vents are monitored for gas evolution. The emergency procedure for recovery from a spurious safety injection has been clarified to provide for adequate flushing of the discharge line from the Boron Injection Tank.

Subsequent to the events of December 28, 1984, the suction side of the pumps was flushed through the pump vents until no more gas evolution occurred. Similar operations were performed at other points in the system. Pump #21 was replaced with a spare pump. All pumps were subjected successfully to a surveillance test and declared operable before reactor criticality.

Since the Safety Injection System would have performed its function as designed on the date of the generator fire no actual safety hazard was involved. On the date of the malfunction of the Safety Injection Pumps, they were not called upon to perform their safety function.

John D. O'Toole
Vice President

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January 18, 1985

Re: Indian Point Unit No. 2
Docket No. 50-247
LER-84-025-00

Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Sirs:

The attached Licensee Event Report LER-84-025-00 is hereby submitted in accordance with the requirements of 10 CFR Part 50.73.

Very truly yours,

John D. O'Toole

attach.
cc: Dr. Thomas E. Murley,
Regional Administrator - Region I
U. S. Nuclear Regulatory Commission
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