

LICENSEE EVENT REPORT (LER)

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

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNB 7714), 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)
Indian Point 3

DOCKET NUMBER (2)
05000286

PAGE (3)
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TITLE (4) 480 Volt Bus Inoperable Due to a Failure of the 32 Residual Heat Removal Pump Circuit Breaker to Open; A Condition Prohibited by Technical Specifications

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
12	18	97	97	-- 032 --	00	01	16	98	FACILITY NAME	DOCKET NUMBER 05000
									FACILITY NAME	DOCKET NUMBER 05000

OPERATING MODE (9)	N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)			
POWER LEVEL (10)	100	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
		20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)
		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	OTHER
		20.405(a)(1)(iii)	✓ 50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	(Specify in Abstract below and in Text, NRC Form 366A)
		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
Angelo Vai, Design Analysis, Electrical Engineering Supervisor

TELEPHONE NUMBER (Include Area Code)
(914) 788-2647

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
X	ED	BKR	W120	Yes					

SUPPLEMENTAL REPORT EXPECTED (14)

X	YES (If yes, complete EXPECTED SUBMISSION DATE).	NO	EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
				April	17	1998

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

On December 18, 1997, with reactor power at 100 percent, a plant shutdown was initiated in accordance with the Technical Specifications (TS). Following a surveillance test, the breaker used to power the 32 Residual Heat Removal (RHR) pump could not be opened. Operations concluded that the breaker was not capable of opening and shedding the 32 RHR pump from its associated safety bus following a safety injection or undervoltage signal. Without knowing the cause of the breaker problem, Operations concluded the safety bus could be rendered inoperable. Because the TS do not provide an allowed outage time for an inoperable safety bus, the plant was brought to hot shutdown. On December 22, during testing of additional breakers, another breaker was determined to be potentially degraded. Engineering determined that other breakers could be subject to failure. Because failure of the breakers assigned to the four safety buses could result in overload of the three emergency diesel generators (EDG), Operations declared the three EDGs inoperable and brought the plant to cold shutdown. The cause of the breaker failure has not been determined, and further investigations are being performed. Corrective actions included breaker replacement and testing of like breakers. An Equipment Failure Evaluation (EFE) is being performed. There was no effect on public health and safety.

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Note: The Energy Industry Identification System Codes are identified within the brackets { }

DESCRIPTION OF EVENT

On December 18, 1997, at approximately 1050 hours, with reactor power at 100 percent, operators attempted to secure the 32 Residual Heat Removal (RHR) {BP} pump {P} from the control room after completing a monthly functional test. The electrical circuit breaker {BKR} (52/RHR2) used to power the pump from 480 volt AC {ED} bus 6A {BU} would not open. Operators attempted to secure the pump locally from the 480 volt AC switchgear room without success. Operations concluded the breaker was not capable of opening and shedding the 32 RHR pump from its associated safety bus following a safety injection or loss of offsite power signal. Without knowing the cause of the breaker problem, Operations concluded the RHR pump and its safety bus could be rendered inoperable. The 32 RHR pump and 480 volt bus 6A were declared inoperable at approximately 1050 hours. The Technical Specifications (TS) do not provide an allowed outage time (AOT) for an inoperable safety bus, therefore TS 3.0 was entered. At approximately 1145 hours, Operations initiated a plant shutdown in accordance with the TS. Emergency Diesel Generator (EDG) {EK} 32, which supplies emergency power to bus 6A, was declared inoperable at approximately 1308 hours, and its control switch taken to trip pull out. At approximately 1233 hours, Operations provided a one-hour non-emergency notification to the NRC reporting a TS required shutdown (See ENS Report No. 33425). At approximately 1324 hours, the 32 RHR pump breaker opened without operator assistance. Operations declared bus 6A operable at approximately 1344 hours. In accordance with normal plant operating procedures the turbine was manually tripped at approximately 1352 hours, the reactor was shut down and the hot shutdown condition was achieved at approximately 1428 hours. The 32 EDG was declared operable at 1540 hours. Although declared inoperable, bus 6A remained energized during this time period.

During the shutdown all control rods {AA} fully inserted and no engineered safety feature actuated as a result of the event. Primary systems functioned properly, except during plant shutdown, at approximately 1230 hours, control rod (CR) {AA} F-2 in control bank "D" dropped to zero steps at approximately 70 percent reactor power. Operators observed a flux tilt of greater than the TS limit of 1.09 from the Nuclear Instrumentation System (NIS) {IG} power range high flux detectors {DET} and control room alarms {ALM}, "NIS Power Range Dropped Rod - Rod Stop," and "Rod Bottom - Rod Stop." Operations entered the appropriate procedures for a dropped rod.

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Also, at 1230 hours, a turbine runback occurred from approximately 70 percent to approximately 61 percent reactor power. The FSAR section for a dropped rod (14.1.4) states that a turbine runback is prevented below 70 percent reactor power. Engineering recorded the CR drop and runback event in deviation event reports (DER 97-2876 and 97-2885) and initiated an investigation.

Operators recorded the failed breaker event in DER 97-2872, commenced a post trip/transient evaluation (Report No.97-6), and initiated equipment failure evaluations (EFE) and investigations of the event. Maintenance removed the failed breaker from its cubicle in 480 volt Switchgear bus 6A and replaced it with a spare breaker. After testing the replacement breaker, the 32 RHR pump was declared operable and its Limiting Condition for Operation (LCO) action statement exited on December 18, at 2229 hours. The failed breaker was visually inspected, tested and evaluated by an inspection team, which included plant and vendor personnel, to determine the cause of the failure.

Instrumentation and Control (I&C) personnel performed troubleshooting of the dropped CR and verified electrical circuit integrity from the CR power cabinet to the CR coil stacks. A failed movable gripper coil blocking diode CR1 (A26 Assembly) was discovered in CR power cabinet 1BD. Further troubleshooting discovered a total of 12 additional failed diodes in other movable gripper assemblies. I&C postulated, with assistance from Westinghouse, that the failure of the 12 diodes was caused by parallel voltage traps which were not functional. I&C further postulates that the diode associated with control rod F-2 was an intermittent failure which may have caused an interruption in the current flow to the movable gripper assembly. Westinghouse also postulated that the dropped rod may have been the result of a particle interfering with the required movement of the movable gripper assembly.

Engineering's investigation of the turbine runback concluded that the setpoint on the pressure switches {PS} associated with the load limit valves (LLV1 and LLV2) of the turbine control oil system {TG} for runback termination were set too low.

The faulty breaker (52/RHR2) for the 32 RHR pump is a 480 volt AC safety related electrical circuit breaker, model DS 416, manufactured by Westinghouse {120} (Westinghouse ID No. A1033). The initial investigation of the faulty breaker did not yield a specific cause, but possible causal factors. To address the possibility that the condition may be present in other similar breakers, Engineering developed a sampling plan and a test procedure to determine if there was an extent of condition.

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The test procedure required cycling the breakers open and closed, with and without the breaker's pole shaft reset spring installed. Testing a breaker without its pole shaft reset spring, which provides additional forces to open the breaker, is not a normal configuration for a DS-416 breaker. Engineering concluded that testing without the breaker pole shaft reset spring provided an indication of the additional margin of assurance that the breaker would open when a trip signal was initiated. The pole shaft reset spring is part of the breaker design configuration, but removal for testing was based on a suggestion by an employee of the breaker manufacturer, based on a Westinghouse Technical Bulletin for a different type breaker.

On December 20, Engineering initiated testing of breakers in accordance with the sample plan to determine if they were functioning properly. On December 23, 1997, Operations was notified that a DS-416 breaker (52/PBU3) did not trip with its pole shaft reset spring removed. The breaker (A1042) normally powers the 33 pressurizer backup heater (AB). Engineering could not, at that time, provide a reasonable expectation of operability for other DS-416, 480 volt AC safety related electrical circuit breakers used to power plant safety equipment. Without test results for the remaining 480 volt DS-416 breakers, Operations concluded there were an unknown number of breakers that may have been in a degraded condition. The plant design requires that plant loads be shed and then sequenced onto their assigned 480 volt AC safety buses for proper Emergency Diesel Generator (EDG) operation. Without assurance of proper breaker operation, on December 23, at approximately 0300 hours, Operations conservatively declared the three EDGs inoperable and initiated plant cooldown to the cold shutdown condition. Cold shutdown was achieved on December 24, 1997, at approximately 0240 hours.

As a result of finding the 33 pressurizer backup heater breaker (A1042) potentially degraded, Engineering developed a revised sampling plan that included additional breaker testing and measurements of breaker components. Testing and evaluation of the failed breaker (A1033) revealed that it would not repeat its failure in its design configuration (pole shaft reset spring installed). With the breaker's pole shaft reset spring removed, the failed breaker (A1033) would repeatedly fail to trip. Testing of the expanded sample breaker population showed that the remaining DS-416 breakers in the test sample satisfactorily tripped in their design configuration. Four breakers were identified as potentially degraded when tested with their pole shaft reset spring removed and they were replaced.

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On December 26, Engineering performed an operability determination which concluded the breakers were operable. Operations declared the EDGs operable and exited the LCO on December 26, at approximately 1925 hours.

As a result of troubleshooting and assessment of the dropped rod event, the control rod movable gripper coil diodes and VR-10 voltage traps were replaced for all of the control rods. Control rod F-2 drop test timing was performed satisfactorily. The F-2 rod drop test results were compared to previously performed rod drop tests for rod F-2 and no anomalies were identified. All control rod banks were successfully exercised. Exercising the control rod would have dislodged any particle interfering with the proper operation of the control rod.

I&C adjusted the setpoints on the pressure switches associated with the turbine control oil system load limit valves (LLV1/LLV2) to terminate turbine runback at 70 percent reactor power.

CAUSE OF EVENT

The cause of the event was a failure of the 32 RHR pump circuit breaker (A1033) to open on demand. The cause of the breaker failure (A1033) has not been determined. An equipment failure evaluation (EFE) is being performed to determine the cause of the breaker failure. The results of current investigations identified the following observations:-

- The failed breaker will not repeat its failure mode in its design configuration (pole shaft reset spring installed).
- With the breaker's pole shaft reset spring removed, the linkages between the moving contact arms and the pole shaft lock up and do not drop out when the breaker is actuated to trip.
- When the breaker is in the closed position, it has a gap between the pole shaft close stop tab and the breakers main drive mechanism close stop pin.
- The manufacturer's specified lubricant was missing from several pivot points in the breaker linkages.

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- Adjustment of the breaker linkage lengths affects the breakers' ability to achieve a position where the linkage will lock up.

The apparent cause of the breaker failure that can be derived from the current investigation is that a unique combination of friction and adjustment contributed to the breaker linkages moving to a position where they lock up and would not drop out to trip. The Authority will supplement this LER after completion of a review of the breaker EFE/root cause investigation.

The cause of the EDGs being declared inoperable was the failure of breaker A1042 to open with its pole shaft reset spring removed, which called into question the operability of the remaining DS-416 breakers.

CORRECTIVE ACTIONS

The following corrective actions have been or will be performed to address the causes identified for this event and prevent recurrence:

- The breaker for the 32 RHR pump was replaced with a spare breaker and satisfactorily tested.
- A sample set of model DS-416 480 volt AC electrical circuit breakers were tested, and a sample of breakers had detailed measurements of selected components and parameters. Four breakers failed to open with their pole shaft reset spring removed and they were replaced and satisfactorily tested. Engineering concluded, based on its investigations and testing, that a unique combination of circumstances existed with the 32 RHR pump breaker.
- The breaker for the 32 RHR pump (A1033) was initially inspected then shipped to Westinghouse for a detailed EFE and root cause investigation. The EFE/root cause is scheduled to be completed by March 6, 1998.

ANALYSIS OF EVENT

The event is reportable under 10 CFR 50.73 (a)(2)(i)(B). The licensee shall report any operation or condition prohibited by the plants TS. This event meets the reporting criteria because bus 6A was declared inoperable. The cause of the breaker failure was not known and although the bus was energized in accordance with the TS, Operations conservatively concluded the failed breaker's assigned safety bus 6A could be rendered inoperable.

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Because TS 3.7 requires the four 480 volt buses 2A, 3A, 5A, and 6A to be energized above cold shutdown, but does not have an AOT for an inoperable 480 volt bus, Operations concluded the plant was in a condition that met the requirements of TS 3.0. TS 3.0, which is similar to Standard Technical Specification 3.0.3, requires that for LCOs where no exception time is specified for inoperable components, the time is assumed to be zero. Operators initiated plant shutdown in accordance with TS 3.0, with hot shutdown achieved on December 18, 1997, at approximately 1428 hours. Operations notified the NRC in accordance with 10 CFR 50.72(b)(1)(i)(A) of the initiation of a nuclear plant shutdown required by the plant's TS (i.e., TS 3.0). 480 volt bus 6A was declared operable at 1344 hours. The 32 RHR pump breaker was replaced, tested, and the pump declared operable on December 18, 1997, at approximately 2229 hours.

Subsequently, on December 22, Operations was notified that during testing of other breakers for extent of condition, another breaker was determined to be in a potentially degraded condition when tested in a modified configuration. Engineering determined that other 480 volt DS-416 breakers could be subject to failure. Because failure of the breakers assigned to the four safety buses could result in overload of the three EDGs, Operations declared the three EDGs inoperable on December 23, at approximately 0300 hours. Operations initiated action to bring the plant to cold shutdown, which was achieved at 0240 hours on December 24, 1997. TS 3.7.F.4 requires as a minimum, under all conditions including cold shutdown that two EDGs be operable. Because three EDGs were declared inoperable, the plant was in a condition prohibited by TS which would be reportable under 10 CFR 50.73 (a)(2)(i)(B). However, after successful testing of applicable breakers the three EDGs were determined to be operable on December 26, at approximately 1925 hours.

A review was performed of Licensee Event Reports (LER) over the last three years. No events reporting failure of 480 volt breakers to open were identified.

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SAFETY SIGNIFICANCE

This event had no significant effect on the health and safety of the public. There were no actual safety consequences for the event because the 32 RHR pump was running for a test, but not providing any required flow. The RHR system is not required to be operating during normal plant operation at power. An engineering evaluation determined that the run time of the 32 RHR pump during this event did not affect its operability or cause undue wear. The bus that powers the 32 RHR pump (bus 6A), although declared inoperable, remained energized in accordance with the TS and available for powering assigned loads. The bus was considered inoperable because it would not shed loads (i.e., 32 RHR pump) and sequence them in accordance with design for proper EDG operation (overloading).

There were no potential safety consequences for the event because an engineering evaluation determined that the 32 EDG will perform its design safety function during a DBA (LOCA with LOOP) with the 32 RHR motor continuously running due to a failure of its feeder breaker to trip (open). No overload condition would have occurred. Other DS-416 breakers would not have failed based on subsequent testing and investigation of a sample of 480 volt DS-416 breakers that demonstrated their operability. 480 volt bus overloading would not have occurred and proper EDG operation would have been maintained. The 32 RHR pump was running and capable of providing its required flow. The redundant pump (31 RHR) for the 32 RHR pump was operable and would have performed the required safety function.

There was no safety impact from the dropped F-2 control rod because the plant is analyzed for a dropped rod in FSAR Section 14.1 and the analysis shows that safety limits are not exceeded. The turbine runback did not have a safety impact because the plant is analyzed for the effects of a turbine runback and the analysis shows that safety limits are not exceeded. This analysis is based on a runback from 100 to 70 percent power. The event was a runback from 70 to 60 percent power which is bounded by the analysis because it was initiated at a lower power, which is a less limiting condition.

There was no actual or potential safety impact of the three EDGs being declared inoperable, based on the subsequent successful testing and evaluation of other DS-416 breakers. The EDGs remained available and functional even though they were administratively declared inoperable.