

## LICENSEE EVENT REPORT (LER)

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

FACILITY NAME (5) <b>PRAIRIE ISLAND NUCLEAR GENERATING PLANT UNIT 2</b>									DOCKET NUMBER (2) <b>05000 - 306</b>	PAGE (3) <b>1 OF 6</b>		
TITLE (4)  Sudden Pressure Lockout of No. 10 Transformer Resulting in Auto Load Rejection/Restoration on Safety Related Bus												
EVENT DATE (6)			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		
11	17	97	97	005	00	12	17	97	FACILITY NAME	DOCKET NUMBER 05000		
OPERATING MODE (9)		1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)									
			20.402(b)			20.405(c)			<input checked="" type="checkbox"/> 50.73(a)(2)(iv)	73.71(b)		
POWER LEVEL (10)		100 %	20.405(a)(1)(i)			50.36(e)(1)			<input type="checkbox"/> 50.73(a)(2)(v)	73.71(e)		
			20.405(a)(1)(ii)			50.36(e)(2)			<input type="checkbox"/> 50.73(a)(2)(vii)	OTHER		
			20.405(a)(1)(iii)			50.73(a)(2)(i)			<input type="checkbox"/> 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)			<input type="checkbox"/> 50.73(a)(2)(viii)(B)			
			20.405(a)(1)(v)			50.73(a)(2)(iii)			<input type="checkbox"/> 50.73(a)(2)(x)			
LICENSEE CONTACT FOR THIS LER (12)												
NAME <b>John Stanton</b> Licensing Engineer						TELEPHONE NUMBER (Include Area Code) <b>612-388-1121</b>						
COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)												
CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPPDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPPDS		
SUPPLEMENTAL REPORT EXPECTED (14)										EXPECTED SUBMISSION DATE (15)		
<input type="checkbox"/> YES IF YES, ENTER EXPECTED SUBMISSION DATE	<input checked="" type="checkbox"/> NO									MONTH	DAY	YEAR

ABSTRACT (LIMIT TO 1400 SPACES, I.E. APPROXIMATELY 15 SINGLE-SPACED TYPEWRITTEN LINES) (16)  
NRC FORM 366 (4-98)

On Monday, November 17, 1997, at 12:04 with Unit 2 in Mode 1 at 100% power, the Prairie Island No. 10 Transformer (10 Transformer), locked out on Sudden Pressure. The 4.16 KV Safeguards Bus 26, which was being supplied by 10 Transformer via 13.8 KV Bus CT12, automatically transferred to its 2RY Transformer source by Bus Sequencer actuation. All automatic switching occurred as expected without any equipment malfunctions. The NSP transmission system experienced no other transients or perturbations.

A Limiting Condition for Operation was entered at 12:04 per TS 3.7.B.2 due to the loss of one of the two required paths from the grid to the unit 4 KV safeguards distribution system. The LCO was exited at 15:15 after the CT12 Source to Bus 26 was restored by energizing it from 4.16 KV Bus CT11 via Breaker CTBT112.

The 10 Transformer locked out from an apparent sudden pressure. There is no indication of the source of the sudden pressure event. Testing and inspection concluded that there is no significant damage to the transformer. The 10 Transformer Sudden Pressure Relay, 63T10, was replaced as precautionary measure.

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

EVENT DESCRIPTION

On Monday, November 17, 1997, at 12:04 with Unit 2 in Mode 1 at 100% power, the Prairie Island No. 10 Transformer<sup>1</sup> (10 Transformer), locked out. Breakers<sup>2</sup> 8H9, 8H15, 8H18, 6H2 and 1H2 tripped, deenergizing 345 KV Bus 2 and 13.8 KV Bus CT12<sup>3</sup>. Breakers 1H1 and 1H3 were already tripped with their disconnects open for maintenance. The Prairie Island Emergency Response Computer Alarm Printer Log records MOD 10TR, 10 Transformer Motor Operated Disconnect Switch (MOD)<sup>4</sup>, opening 8 seconds after the initial trip. Breakers 8H9, 8H15 and 8H18 reclosed 15 to 19 seconds later. All automatic switching was as expected. The NSP transmission system experienced no other transients or perturbations.

4.16 KV Safeguards Bus 26, which was being supplied by 10 Transformer via 13.8 KV Bus CT12, automatically transferred to its 2RY Transformer source by Bus Sequencer<sup>5</sup> actuation. This was the only actuation of Safeguards equipment that occurred as a result of this event. The transfer occurred as designed and without problems.

A Limiting Condition for Operation was entered at 12:04 per TS 3.7.B.2 due to the loss of one of the two required paths from the grid to the unit 4 KV safeguards distribution system. The LCO was exited at 15:15 after the CT12 Source to Bus 26 was restored by energizing from 4.16 KV Bus CT11 via Breaker CTBT112.

CAUSE OF THE EVENT

Previous to the lockout the 10 Transformer had been taken out of service for maintenance. The transformer was double tested. The Load Tap Changer (LTC)<sup>6</sup> was opened and inspected. No problems were found and no adjustments were made. The transformer was returned to service on November 8, 1997.

Two lockouts occurred, the 86-2/POT PAR, Bus 2 Pot Paralleling Lockout<sup>7</sup>, and the 86T10-2/10TR, 10 Transformer Lockout Relay 2<sup>8</sup>. 86-2/POT PAR tripped due to reverse power flow through the 345 KV Bus 2 Bus Pot<sup>9</sup> when the bus deenergized. This lockout is expected

<sup>1</sup> (EIIS System Identifier: FK; EIIS Component Identifier: XFMR)<sup>2</sup> (EIIS System Identifier: FK; EIIS Component Identifier: BKR)<sup>3</sup> (EIIS System Identifier: FK; EIIS Component Identifier: BU)<sup>4</sup> (EIIS System Identifier: FK; EIIS Component Identifier: MOD)<sup>5</sup> (EIIS System Identifier: EA; EIIS Component Identifier: ASU)<sup>6</sup> (EIIS System Identifier: FK; EIIS Component Identifier: TTC)<sup>7</sup> (EIIS System Identifier: FK; EIIS Component Identifier: 32)<sup>8</sup> (EIIS System Identifier: FK; EIIS Component Identifier: 86)<sup>9</sup> (EIIS System Identifier: FK; EIIS Component Identifier: XPT)

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from the loss of Bus 2 and serves to protect the Bus Pots from damage due to overcurrent in the event of a Bus loss.

The 86T10-2/10TR tripped from relay 63OI/10TR, 10 Transformer Sudden Pressure Relay<sup>10</sup>. 63OI/10TR is tripped from relay 63T10, 10 Transformer Sudden Pressure Relay<sup>11</sup> at the 10 Transformer. 63OI/10TR provides an indicating target and a seal-in circuit to 86T10-2/10TR. Relay Specialists tested 63T10 using a hand operated pump and a precision digital pressure gauge. It consistently tripped at about 3.5 psi time differential pressure above whatever rest pressure it was pumped to. There is no reason to believe the relay tripped inadvertently. The relay was replaced as precautionary measure.

The circuit 63OI/10TR features 63T10 normally open contacts in series with and normally closed contacts shorting the 63OI/10TR coil. With this arrangement both contact pairs of 63T10 would have to move in order to pick up 63OI/10TR. This eliminates the possibility of any single circuit fault, either a short or an open, from actuating 63OI/10TR. Relay Specialists wire checked the circuit and found it to be correct.

The removed 63T10 relay was disassembled and inspected. The relay consists of a switch and bellows assembly. The bellows is filled with silicone oil and is immersed in the transformer oil. At the top of the bellows is a piston which raises to close the switch. A bleed hole in the top of the piston serves to equalize pressure between the bellows and the switch compartment of the relay for slow changes in pressure. Rapid pressure changes force the piston up to close the switch. All components are sturdy. Enough force is required to close the switch to preclude actuation due to vibration or moderate bumping. When the bellows was compressed manually, forcing the piston up, the pressure equalized and the piston relaxed to its rest position within a few minutes. No apparent cause of relay misactuation was found.

63OI/10TR is a vertically mounted relay with a hinged armature. The armature is below the coil and is held away from the coil by gravity. There are two normally open contacts separated by about 3/16". Both contacts have to close in order to maintain the seal-in. Relay Specialists tested 63OI/10TR and found that it picked up at 57 VDC and dropped out at 25 VDC. The at rest voltage on the coil was 0.4 VAC and 0.03 VDC. Due to the relay's construction and circuitry it is highly unlikely that it picked up from anything other than an operation of 63T10.

The 10 Transformer has three oil filled compartments, the Reactor and Junction Compartment, the Main Tank, and the Tap Selector Compartment. The Reactor Compartment and Main Tank are open to each other. The Tap Selector Compartment is connected to the Reactor Compartment by a 1" valve to equalize pressure. Oil samples taken from the top and bottom of the Main Tank and the bottoms of the Tap Selector and Reactor Compartments tested negative for increased gasses.

<sup>10</sup> (EIIS System Identifier: FK; EIIS Component Identifier: 3 )<sup>11</sup> (EIIS System Identifier: FK; EIIS Component Identifier: 63))

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Turn to Turn Ratio and Double Bridge Resistance measurements of the 10 Transformer at each tap setting of the LTC were normal. Results from Doble testing of the windings and insulating oil were normal.

The manufacturer, contacted after some initial investigation and testing, recommended performing high voltage insulation testing, sampling the top as well as the bottom oil of the transformer, and opening the top for visual inspection. The manufacturer indicated that gasses may not be present in initial samples due to lack of oil motion.

Opening the transformer to inspect the top of the transformer core for signs of carbon formation would necessitate draining a significant amount of the oil, removing what covers are available on top of the transformer, and refilling after closure. This was not done because the new information gained from a visual inspection would not be sufficient to warrant the significant contamination risks associated with this inspection process. Only a small part of the top of the transformer core would be exposed for visual inspection and it was believed that the quantity of carbon formation sufficient to be detectable in a visual inspection of this area would already have been detected in the chemical analysis of the gasses in the transformer oil samples.

Oil samples were taken several times during the week. They show the gasses in the separate compartments migrating toward each other, indicating some motion of gasses in the oil. Additionally, the top and bottom samples were similar in gas content. None of the samples had excessive gasses.

The 10 Transformer was energized in the following sequence to test further for a cause of the lockout:

1. A Fluke Scopemeter was connected across the 63OI/10 TR coil, scaled to 150 VDC and operating in Min/Max mode.
2. All plant busses were removed from 161 KV Bus 1.
3. 10 Transformer was energized first via 6H2 with MOD 10TR open. This prevents Bus 2 from clearing if 10 Transformer faults. 6H2 would clear any fault. This switching was successful and did not reveal the presence of any transformer internal short.
4. After successfully energizing 10 Transformer through 6H2, the bank coolers were started to see if a pump start with cold oil might trip 63T10. No trips occurred.
5. 6H2 was then tripped, Motor Operated Disconnect 10TR closed, and 10 Transformer, now energized from 345 KV Bus 2, was synchronized to 161 KV Bus 1 via 6H2.
6. CT12 Transformer was restored to the 10 Transformer tertiary via BKR 1H2.

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7. 123 and 124 Cooling Tower Pump motors<sup>12</sup>, uncoupled from the pumps, were started simultaneously. This provided about 4 MVA of inrush to challenge the 10 Transformer tertiary winding. Inrush current exceeded 500 Amps on each motor. Inrush voltage dip was to approximately 3600 Volts from 4400 Volts. No trips occurred.

The 10 Transformer locked out from an apparent sudden pressure, but there is no indication of the source of the sudden pressure event. Testing and inspection concluded that there is no significant damage to the transformer.

#### ANALYSIS OF THE EVENT

When the 10 Transformer locked out from an apparent sudden pressure, the 4.16 KV Safeguards Bus 26, which was being supplied by 10 Transformer via 13.8 KV Bus CT12, automatically transferred to its 2RY Transformer source by Bus Sequencer actuation. This transfer occurred as expected and without any equipment failure, but the actuation of an engineered safety feature is reportable under 10 CFR 50.73(a)(2)(iv).

As a result of this transformer lockout only one of two paths from the grid to Safeguards Bus 26 was available for a period of three hours. The on site diesel generators were still available to provide a redundant source of emergency power and all equipment responded as designed. This event had no impact on the health or safety of the public.

#### CORRECTIVE ACTION

The 10 Transformer Sudden Pressure Relay, 63T10, was replaced as precautionary measure.

#### PREVIOUS SIMILAR EVENTS

LER 18604 reported the actuation of sudden pressure relay by an unknown cause.

<sup>12</sup> (EIIS System identifier: NN; EIIS Component Identifier: MO)

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