

**SEP 24 2003**



**LR-N03-0391**

**U. S. Nuclear Regulatory Commission  
Document Control Desk  
Washington, DC 20555**

**LER 272 / 03- 002- 00  
Salem Generating Station Unit 1  
Facility Operating License DPR- 70  
Docket No. 50-272**

**This Licensee Event Report entitled "Reactor Trip due to Turbine Trip Caused by a 500KV Switchyard Breaker Trip" is being submitted pursuant to the requirements of 50.73(a)(2)(iv)(A) and 50.73(a)(2)(v). The attached LER contains no commitments.**

**Should there be any questions regarding this matter please contact Courtney Smyth at 856-339-5298.**

**Sincerely,**

A handwritten signature in black ink, appearing to be "C. Fricker", written over the word "Sincerely,".

**C. Fricker  
Salem Plant Manager**

**Attachment**

**C     Distribution  
     RTL 3E.111**

*JE22*

Estimated burden per response to comply with this mandatory information collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records Management Branch (T-6 E6), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to bis1@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202 (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the

**LICENSEE EVENT REPORT (LER)**

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

1. FACILITY NAME <b>SALEM GENERATING STATION UNIT 1</b>	2. DOCKET NUMBER <b>05000272</b>	3. PAGE <b>1</b> OF <b>4</b>
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## 4. TITLE

**Reactor Trip due to Turbine Trip Caused by a 500KV Switchyard Breaker Trip**

6. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MO	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO	MO	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
07	29	2003	2003	002	00	09	24	2003	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE	1	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 5: (Check all that apply)							
10. POWER LEVEL	100	20.2201(b)	20.2203(a)(3)(ii)	50.73(a)(2)(ii)(B)	50.73(a)(2)(ix)(A)				
		20.2201(d)	20.2203(a)(4)	50.73(a)(2)(iii)	50.73(a)(2)(x)				
		20.2203(a)(1)	50.36(c)(1)(i)(A)	X 50.73(a)(2)(iv)(A)	73.71(a)(4)				
		20.2203(a)(2)(i)	50.36(c)(1)(ii)(A)	X 50.73(a)(2)(v)(A)	73.71(a)(5)				
		20.2203(a)(2)(ii)	50.36(c)(2)	X 50.73(a)(2)(v)(B)	OTHER				
		20.2203(a)(2)(iii)	50.46(a)(3)(ii)	X 50.73(a)(2)(v)(C)	Specify in Abstract below or in NRC Form 366A				
		20.2203(a)(2)(iv)	50.73(a)(2)(i)(A)	X 50.73(a)(2)(v)(D)					
		20.2203(a)(2)(v)	50.73(a)(2)(i)(B)	50.73(a)(2)(vii)					
		20.2203(a)(2)(vi)	50.73(a)(2)(i)(C)	50.73(a)(2)(viii)(A)					
		20.2203(a)(3)(i)	50.73(a)(2)(ii)(A)	50.73(a)(2)(viii)(B)					

## 12. LICENSEE CONTACT FOR THIS LER

NAME <b>C. Smyth, Licensing Engineer</b>	TELEPHONE NUMBER (Include Area Code) <b>856-339-5298</b>
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## 13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU- FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU- FACTURER	REPORTABLE TO EPIX
X	FK	BKR	W120	Yes					

## 14. SUPPLEMENTAL REPORT EXPECTED

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

On July 29, 2003 at 1329 Salem Unit 1 reactor tripped automatically due to generator protection and turbine trip. The cause of this event was an indicated ground fault on the 500KV 1-5 breaker which caused protective relaying to actuate which resulted in isolating the Unit 1 generator causing a generator and turbine trip which lead to a reactor trip. In addition, loss of bus section 1 caused the loss of the 14 station power transformer (SPT) which was feeding the 1B and 1C vital busses. The 1B and 1C vital busses transferred as designed to the 13 SPT, which was feeding the 1A vital bus. In addition, three of the Circulating Water (CW) pumps transferred to the 13 SPT as designed. As a result of the event, the 4KV vital bus voltages dropped below the second level undervoltage setting of 95.1%. Voltage on the Salem Unit 1 4KV vital busses did not recover to the reset setpoint before the relay timeout caused the relay logic to separate the vital busses from offsite power. The Emergency Diesel Generators (EDG) started and loaded as expected and all systems responded as designed. Salem Unit 2 responded as expected throughout the transient.

An Unusual Event (UE) was declared at 1401 due to a loss of offsite power for greater than 15 minutes to the vital busses. The UE was exited at 2201 after restoring normal power to the Unit 1 vital busses.

Troubleshooting of the 1-5 breaker "Breaker Failure Scheme" circuitry found a shorted cable. The "Breaker Failure Scheme" circuitry was repaired using spare conductors to restore the 1-5 breaker to service. The automatic transfer of Circulating Water busses was temporarily disabled to permit plant restart.

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TEXT CONTINUATION**

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Salem Generating Station Unit 1	05000272	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	2 OF 4
		2003	- 002 -	00	

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

**PLANT AND SYSTEM IDENTIFICATION**

Westinghouse – Pressurized Water Reactor

Reactor Protection System {JC}  
Switchyard System {FK}  
500KV breaker {BKR}

\* Energy Industry Identification System {EIS} codes and component function identifier codes appear as {SS/CCC}

**IDENTIFICATION OF OCCURRENCE**Event Date: July 29, 2003  
Discovery Date: July 29, 2003**CONDITIONS PRIOR TO OCCURRENCE**

The plant was in MODE 1 (POWER OPERATION) at the time of the event. No other structures, systems or components were inoperable at the start of this event that contributed to the event.

**DESCRIPTION OF OCCURRENCE**

On July 29, 2003 at 1329 Salem Unit 1 reactor tripped automatically due to Generator Protection and Turbine Trip. A short circuit in the ground fault protection circuitry on the 500KV 1-5 breaker {BKR} caused protective relaying to actuate which resulted in isolating the Unit 1 generator causing a generator and turbine trip which led to a reactor trip. The actuation of the 500KV 1-5 breaker protective relaying results in a loss of 500KV bus section 1 and isolation of the Unit 1 generator from the transmission network. The isolation of bus section 1 caused the loss of No. 2 station power transformer (SPT) resulting in the loss of Unit 1 non-vital busses "F" and "G". In addition, loss of bus section 1 caused the loss of the 14 station power transformer (SPT) which was feeding the 1B and 1C vital busses. The 1B and 1C vital busses transferred as designed to the 13 SPT, which was feeding the 1A vital bus. The loss of 14 SPT also caused three of the Circulating Water (CW) pumps to transfer to the 13 SPT as designed. As a result of the event, the 4KV vital bus voltages dropped below the second level undervoltage setting of 95.1%. Voltage on the 4KV busses did not recover to the reset setpoint before the relay timeout caused the relay logic to separate the vital busses from offsite power. The Emergency Diesel Generators (EDG) started and loaded as expected. Salem Unit 2 responded as expected and remained at power.

An Unusual Event (UE) was declared at 1401 due to a loss of offsite power for greater than 15 minutes to the vital busses. The UE was exited at 2201 after restoring normal power to the vital busses.

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

**DESCRIPTION OF OCCURRENCE (Continued)**

Unit 1 responded as expected except for the failure of the 13 SPT to recover voltage. Degraded voltage relays cleared the bus and loaded the vital buses on the EDGs. The EDGs performed as designed.

**ANALYSIS OF OCCURRENCE**

The initiating fault was identified as a 500KV breaker 1-5 breaker ground relay "B" phase target. This fault invokes the "Breaker Failure" scheme and isolates the 1-5 breaker from the 500KV grid. Isolating the 1-5 breaker causes the Unit 1 generator to be isolated from the 500KV grid and de-energizes bus section 1. Troubleshooting found a current transformer (CT) control cable "B" and "C" phase conductor for breaker 1-5 shorted and grounded together. Breaker 1-5 was tested and found to operate correctly. Bus relays were checked and were in calibration.

Loss of 500KV bus section 1 results in loss of the 500KV grid to No. 2 and No. 4 station power transformers (500/13.8KV). Loss of No. 2 Station Power Transformer results in loss of "1F" and "1G" Group Buses (non-vital). Loss of No. 4 station power transformer results in loss of 14 and 23 station power transformers (13.8/4.16KV). Unit 1 14 CW pump bus, 1B and 1C vital buses also auto-transferred to 13 station power transformer as designed; however, 4kV secondary voltage did not recover above the degraded grid reset value of 97% of 4160. After approximately 13 seconds the 95% UV relays timed out and SEC Mode 2 actuation occurred and the Unit 1 EDGs started and picked up vital loads.

The separation of the Unit 1 vital buses from the off-site power source occurred due to the combined transfer of the 14 Circulating Water pump bus and the 1B and 1C vital buses to the 13 station power transformer. Transfer of these bulk loads caused a greater than previously analyzed voltage drop on the SPT secondary. This in turn caused the 95% second level of under voltage protection relays to operate and time out before the transformer secondary voltage could recover above the relays' reset value of 97% or 4035 volts. Based on Plant Historian data, the bus voltages did recover to approximately "A" 4021 volts, "B" 3986 volts and "C" 4011 volts prior to separation from offsite power.

The automatic transfer of the CW busses between SPTs (breaker 1CW8AD) was disabled to prevent a recurrence of separation from the preferred power source. The reduction of non-vital loads from buses (approximately 6MVA total load) during bus transfers would allow voltage recovery to higher values. The automatic transfer of Circulating Water Busses was disabled for Unit 1 and Unit 2. An operability determination was issued to address the condition pending permanent corrective action. In addition, the lower operating limit of the Salem Unit 1 and Unit 2 vital busses was raised from 4.220KV to 4.275KV, based on revised calculations, to account for non-conservative calculation bias and other non-conservatisms.

The apparent cause of the failure of the safety busses to transfer as expected was inadequate calculations that supported the switchyard modifications made in 1992 to permit CW bus transfer.

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

**CAUSE OF OCCURRENCE**

The apparent cause for this event was failure of a current transformer (CT) control cable "B" and "C" phase conductors that were shorted and grounded together for the 1-5 500KV breaker leading to actuation of the protective relaying for this breaker. The apparent cause of the failure of the safety busses to transfer as expected was inadequate calculations that supported the switchyard modifications made in 1992 to permit CW bus transfer.

**PREVIOUS OCCURRENCES**

A review of reportable events in the last two years did not identify events of a similar nature.

**SAFETY CONSEQUENCES AND IMPLICATIONS**

There were no safety consequences associated with this event since all safety systems other than offsite power functioned as designed and operating procedures were adequate and properly implemented.

This event constitutes a Safety System Functional Failure (SSFF) as defined in NEI 99-02.

**CORRECTIVE ACTIONS**

1. The fault was isolated to the 1-5 Breaker "Breaker Failure Scheme" circuitry, the ring bus was restored and offsite power was restored to plant busses.
2. Troubleshooting of the 1-5 breaker "Breaker Failure Scheme" circuitry found a shorted cable. The "Breaker Failure Scheme" circuitry was repaired using spare conductors to restore the 1-5 breaker to service.
3. The automatic transfer of Circulating Water Busses was disabled for Unit 1 and Unit 2. An operability determination was issued to address the condition pending permanent corrective action.
4. The lower operating limit of the Salem Unit 1 and Unit 2 vital busses was raised from 4.220KV to 4.275KV.
5. The extent of condition of the "Breaker Failure Scheme" circuitry failure and inadequate design calculations will be evaluated for Salem Unit 1, Unit 2 and Hope Creek.

**COMMITMENTS**

The corrective actions cited in this LER do not constitute commitments.