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)
Salem Generating Station - Unit 2	0 5 0 0 0 3 1 1	1 OF 0 4

TITLE (4)
Reactor Trip From 74% - Loss of No. 22 Station Power Transformer

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)
										0 5 0 0 0
0 9	1 1	8 6	8 6	— 0 0 9	— 0 1	0 9	3 0	8 7		0 5 0 0 0

OPERATING MODE (9)	1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
POWER LEVEL (10)	0 7 4	20.402(b)	20.405(c)	X 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 (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
M. J. Pollack - LER Coordinator	6 0 9 3 3 9 - 4 0 2 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
AS	F K	S P T	W 1 2 0	Y	AS	F K	T R A N	I 0 0 5	Y

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	X NO				

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

On 9/11/86, at 1858 hours, during routine power operation, a reactor trip occurred. The First Out Annuciator was "Reactor Coolant Low Flow/Reactor Coolant Pump Breaker Open and P-8 (reactor above 36% power)". The plant was stabilized in Mode 3 (Hot Standby). The initiating cause of the reactor trip/turbine trip was isolation of No. 22 Station Power Transformer (SPT) 13/4KV, due to Phase A and Phase B differential relay protection operation. The loss of No. 22 SPT resulted in the loss of "F" & "G" 4KV Group Busses. Loss of these busses caused the loss of No. 23 and No. 24 Reactor Coolant Pumps (RCP's) resulting in the reactor trip/turbine trip. Simultaneously, an electrical fault in 2F 4160/230V Transformer occurred. The fault resulted in the operation of overcurrent relay protection which opened the 4KV breaker 2F5D supplying the 2F 4160/230V Transformer. Testing of No. 22 SPT confirmed the transformer sustained an internal fault. Investigation of the two failed transformers revealed damage attributable to turn-to-turn faults in both transformers. The direct cause of the turn-to-turn faults could not be identified. Corrective actions included clarification and expansion of required inspections for oil filled and dry type transformers and periodic oil and gas sampling of oil filled transformers.

IE22
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PLANT AND SYSTEM IDENTIFICATION:

Westinghouse - Pressurized Water Reactor

Energy Industry Identification System (EIIS) codes are identified in the text as {xx}

IDENTIFICATION OF OCCURRENCE:

Reactor Trip From 74% - Loss of No. 22 Station Power Transformer (SPT)

Event Date: 09/11/86

Report Date: 09/30/87

This report was initiated by Incident Report No. 86-294

CONDITIONS PRIOR TO OCCURRENCE:

Mode 1 - Reactor Power at 74% - Load 750 MWe

DESCRIPTION OF OCCURRENCE:

On September 11, 1986, at 1858 hours, during routine power operation, a reactor trip occurred. First out annunciation was "Reactor Coolant Low Flow/Reactor Coolant Pump Breaker Open and P-8 (reactor power above 36%)".

The Unit was stabilized in Mode 3 (Hot Standby), and at 1908 hours, in accordance with the requirements of the Code of Federal Regulations, 10CFR 50.72(b)(2)(ii), the Nuclear Regulatory Commission was notified of the automatic actuation of the Reactor Protection System {JC}.

APPARENT CAUSE OF OCCURRENCE:

The initiating cause of the reactor trip/turbine trip was isolation of No. 22 Station Power Transformer (SPT) {FK} 13/4KV (an oil type forced oil/air cooled transformer), due to Phase A and Phase B differential relay protection operation. The loss of No. 22 SPT resulted in the loss of "F" & "G" 4KV Group Busses. Loss of these busses caused the loss of No. 23 and No. 24 Reactor Coolant Pumps (RCP's) {AB} resulting in the reactor trip/turbine trip. Simultaneously, an electrical fault in 2F 4160/230V Transformer {FK} (a dry type forced air cooled transformer). The fault resulted in the operation of overcurrent relay protection which opened the 4KV breaker 2F5D supplying the 2F 4160/230V Transformer.

As part of the investigation regarding the failure of No. 22 SPT, testing was performed which confirmed the transformer sustained an internal fault (see Corrective Actions section for summary of test results).

ANALYSIS OF OCCURRENCE:

The loss of No. 22 SPT resulted in the loss of 2F and 2G 4KV Group Busses. These busses power Nos. 23 and 24 RCP's, respectively. The loss of any RCP will result in a reduction of forced coolant flow through the core, to 90% of full nominal flow, such that with the Unit above 36% power (P-8) a reactor trip/turbine trip will result. This reactor trip ensures that the departure from nucleate boiling ratio (DNBR) remains greater than 1.30 for all design transients in the event of a loss of one or more RCP's with the reactor above 36% power.

The Reactor Protection System functioned as designed. This occurrence involved no undue risk to the health or safety of the public. However, because of the automatic actuation of the Reactor Protection System, this event is reportable in accordance with the Code of Federal Regulations, 10CFR 50.73(a)(2)(iv).

CORRECTIVE ACTION:

As identified in the Apparent Cause of Occurrence section, the No. 22 SPT sustained an internal fault. A summary of the tests which provide this conclusion include:

1. Excitation Electrical Test - This test indicated high excitation current;

2. Turns Ratio Test - The no load tap changer and the load tap changer were set in a configuration which will give a specific ratio of voltage change (the acceptable range is $\pm$0.5%); one voltage phase could not be balanced on a test set due to high excitation current;

3. Combustible Gas Test - A sample of oil was drawn to determine gas content; The maximum amount of acetylene gas which can be expected is 10 ppm; 37 ppm was found.

Also, all applicable relays associated with the two (2) transformers were tested. No discrepancies were found.

The failed transformers were replaced. Investigation into the cause of the transformer failures has been completed.

PSE&G Engineering Evaluation No. S-C-E130-EEE-0157 addresses the failure of the 4160/240 volt transformer. Significant damage to the primary side of the low voltage end of the "A" phase was observed. No damage was identified on the remaining high voltage and low voltage phase coils. The damage to the "A" phase was attributed to a turn-to-turn fault. A specific cause of the fault could not be identified. Examination of the unwound coil revealed undamaged parts to be in excellent condition thereby eliminating aging as a possible failure mechanism.

CORRECTIVE ACTION: (cont'd)

PSE&G Engineering Evaluation No. S-C-E170-ESE-0676 addresses the failure of No. 22 SPT. Significant damage was observed on high voltage "A" phase coil. No damage was identified on the remaining high voltage and low voltage phase coils. No. 22 SPT had failed as a result of a turn to turn fault on the high voltage "A" phase winding. However, no specific single cause of the turn to turn fault could be identified. Possible causes of the fault include:

a. a deterioration in the turn insulation due to normal and abnormal stresses experienced by the transformer during its operation over a time period; or

b. a localized weak spot in the turn insulation which could not sustain either thermal or mechanical or both stresses expected to be present due to a through fault experienced by this transformer during the failure of the dry type transformer.

Operating and spare oil filled transformer inspection and sampling requirements have been reviewed. Operating transformers now require semi-annual oil and gas samples and expanded inspection and sampling during refueling outages. The spare transformers quarterly, annual and triannual inspections were expanded and annual sampling was added.

The preventive maintenance procedure for "Miscellaneous Dry Type Power Transformer Maintenance", MP2.4, was revised to clarify inspection requirements.

General Manager -
Salem Operations

MJP:pc

SORC Mtg. 87-077

PSEG

Public Service Electric and Gas Company P.O. Box E Hancocks Bridge, New Jersey 08038

Salem Generating Station

September 30, 1987

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

Dear Sir:

SALEM GENERATING STATION
LICENSE NO. DPR-75
DOCKET NO. 50-311
UNIT NO. 2
SUPPLEMENTAL LICENSEE EVENT REPORT 86-009-01

This Supplemental Licensee Event Report (LER) is being submitted pursuant to the requirements of 10CFR 50.73. The LER has been updated to detail the results of investigations and the corrective actions taken. Editorial corrections were also incorporated.

Sincerely yours,

J. M. Zupko, Jr.
General Manager-
Salem Operations

MJP:pc

Distribution

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