

# ACCELERATED DISTRIBUTION DEMONSTRATION SYSTEM

## REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR: 9205010133      DOC. DATE: 92/04/24      NOTARIZED: NO      DOCKET #  
 FACIL: 50-389 St. Lucie Plant, Unit 2, Florida Power & Light Co.      05000389  
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 SAGER, D.A.      Florida Power & Light Co.  
 RECIP. NAME      RECIPIENT AFFILIATION  
                          Document Control Branch (Document Control Desk)

SUBJECT: In-House Event Rept 92-023: on 920421, turbine generator failed to trip during manual reactor trip. Root cause analysis still in progress. Solenoid valves removed & sent to independent lab for analysis.

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APR 24 1992

L-92-129

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

RE: St. Lucie Unit 2  
Docket No. 50-389  
Event Date: April 21, 1992  
Turbine Trip Failure

Please find attached the preliminary internal problem report of our plant event which occurred on April 21, 1992. Pursuant to 10 CFR 50.73 a Licensed Event Report will be submitted within 30 days of the event date.

Please contact us if there are any questions about this submittal.

Very truly yours,

D. A. SAGER

By *H. G. Bousy*  
D. A. Sager  
Vice President  
St. Lucie Plant

DAS/JJB/kw

cc: Stewart D. Ebnetter, Regional Administrator, Region II, USNRC  
Senior Resident Inspector, USNRC, St. Lucie Plant

DAS/PSL #681-92

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PDR ADDCK 05000389  
S PDR

*Handwritten signature/initials*

**ST. LUCIE PLANT  
IN HOUSE EVENT REPORT 92-023**

**TURBINE GENERATOR FAILED TO TRIP FOLLOWING MANUAL REACTOR TRIP**

**UNIT: 2**

**DATE: APRIL 21, 1992**

**I. INITIAL PLANT CONDITIONS**

On April 21, 1992, St. Lucie Unit 2 was shutting down for a scheduled refueling outage. Reactor power was at approximately 12%.

**II. EVENT DESCRIPTION**

A scheduled Reactor-Turbine shutdown was in progress on Unit 2. During the shutdown, power moved to the top of the core as expected. Existing procedural guidance on Axial Shape Index (ASI) was being employed to minimize its affects. When three out of four Local Power Density Pre-Trips on the Reactor Protection System came in, the Nuclear Plant Supervisor (NPS) instructed the Reactor Control Operators to manually trip the Unit. A manual reactor trip was initiated, but the turbine did not trip. Several attempts were made to trip the turbine using the Turbine Trip push button with no success and the Nuclear Watch Engineer tripped the turbine from the front standard.

**III. EVENT SEQUENCE**

St. Lucie Unit 2 was performing a scheduled reactor shutdown for refueling purposes. During the plant shutdown ASI approached its upper (negative) limit. Coordination at controlling ASI within limits and maintaining reactor coolant temperature due to Xenon building in became more difficult. When reactor power was decreased to about 12%, control rod insertion had no effect on making ASI less negative and three of the four Reactor Protection System Local Power Density pre-trips came in. At this point, the NPS instructed the Reactor Control Operators to manually trip the unit and the manual reactor trip pushbuttons on RTGB (Reactor Turbine Guage Board) 204 and RTGB 201 were depressed at 0238 with the turbine trip pushbutton on RTGB 201 being depressed approximately two seconds later; however, the turbine did not trip. Standard Post Trip Actions from Emergency Operating Procedure (EOP) 1 were implemented.

When the turbine trip pushbutton was depressed, the Governor Valves indicated closed but the Throttle Valves, Reheat Valves, and Intercept Valves indicated open. Auto Stop Oil and the Emergency Trip Header indicated pressures of approximately 100 psi and 2000 psi, respectively. The megawatt recorder indicated ninety megawatts. Several more attempts were made to trip the turbine using the pushbutton, but they were unsuccessful. At this point, the Reactor Control Operator opened the Generator output Breakers 8W52 and 8W49, secured the voltage regulator, stopped the Digital Electrohydraulic (DEH) pumps, closed the Main Steam Isolation Valves (MSIV), and broke condenser vacuum.

### III. EVENT SEQUENCE (cont'd)

The Assistant Nuclear Plant Supervisor instructed the Nuclear Watch Engineer to trip the turbine from the Front Standard. At 0241 all the turbine valves closed.

EOP-2, Reactor Trip Recovery, was then completed with two sets of satisfactory Safety Function Status Checks, the plant was stabilized, and the Turbine Shutdown Procedure was re-entered.

### IV. EVENT EVALUATION

#### A) PLANT RESPONSE

The plant response to this event was as expected with the exception of the failure of the turbine to trip. Upon the reactor trip signal, the four Control Element Drive Mechanism (CEDM) Bus undervoltage relays should de-energize. This should energize (open) the 20 ET solenoid valve and drain the electro-hydraulic fluid from the emergency trip header ( See attachment #1). The 20 AST trip solenoid coil should simultaneously energize, pull down the mechanical trip lever, and dump the auto-stop oil header. Decreasing auto stop oil pressure allows the Interface valve to open and dump the electro-hydraulic fluid emergency trip header. When auto stop oil pressure decreases to 45 psi, pressure switches 63-1 AST and 63-2 AST should lock in, actuating a generator primary lockout which trips the generator output breakers. The same result should be obtained when attempting to trip the turbine via the Turbine Trip Pushbutton. A multi-discipline team is investigating to determine why the turbine failed to trip when the trip signals were initiated.

#### B) SAFETY SIGNIFICANCE

The plant response to this event is bounded by section 15.1.5 of the PSL Unit 2 Final Safety Analysis Report (FSAR), "Increased Heat Removal by the Secondary System" as further described below..

#### ANALYSIS OF POSSIBLE SCENARIOS

- 12% Power Trip, No Operator Action Scenario.
  - \* MSIV's auto close at 600 psig. Cooldown terminated.
  - \* Core decay heat released via Main Steam Safety Valves (MSSV)
  - \* Cooldown rate bounded by limiting FSAR cooldown event.
  
- 100% Power Trip, No Operator Action Scenario.
  - \* Possible Safety Injection Actuation Signal (SIAS) but no actual injection.
  - \* Automatic MSIV closure after 66 seconds.
  - \* Fuels RETRAN analysis validates that no core damage will occur.
  
- 100% Power Trip with multiple FSAR Chapter 15 Accident Scenario.
  - \* Operators trained on the simulator for multiple failure events beyond design basis.
  - \* Excess steam demand events are simulated and procedurally addressed by the EOP's.

#### **IV. EVENT EVALUATION (cont'd)**

##### **C) ROOT CAUSE ANALYSIS**

A multi-discipline Turbine Investigation Team is performing a root cause analysis of this event. A Letter of Instruction, 2-LOI-T-67, "Evaluation of Turbine Solenoid Trip Function," was written to evaluate the operation of the turbine manual and automatic trip functions. Deficiencies identified are noted below. Root cause analysis is still in progress.

##### **D) DEFICIENCIES IDENTIFIED**

Testing of the 20 ET Trip solenoid, 20 AST solenoid valve, and the 20 OPC 1 and 2 solenoid valves was performed in accordance with 2-LOI-T-67. The results of this evaluation are as follows:

**1) 20 ET Solenoid valve**

The original solenoid valve was removed to preserve the "as found" condition of the valve. A new solenoid valve was installed and tested satisfactorily. This verified the 20 ET electrical circuits did not contribute to the failures.

**2) 20 AST Trip Solenoid**

The solenoid was tested numerous times with two of the tests indicative of intermittent circuit problems. A loose connection was found on relay 62 ASTX / pin 6. This connection is in the circuit for all 20 AST trip functions. Further troubleshooting is continuing.

**3) 20 OPC 1 and 2 Solenoid Valves**

One OPC solenoid valve was removed prior to testing for potential failure mode analysis. Testing of one original and one replacement OPC solenoid valve indicated acceptable operation of the OPC circuits.

#### **V. CORRECTIVE ACTIONS**

- 1. The original 20 ET, 20 OPC-1 and 20 OPC-2 Solenoid valves have been removed and were sent to an independent laboratory for analysis.**
- 2. Maintenance is continuing to investigate the root cause of the intermittent electrical problems of the 20 AST Trip Solenoid. The circuits of the 20 ET and 20 OPC 1 and 2 Solenoids are also being evaluated to ensure similar problems do not exist.**
- 3. Nuclear Fuels is evaluating additional guidance for ASI control at the end of core life.**
- 4. Operations is evaluating additional guidance for EOP-1, "Standard Post Trip Actions", on actions to take for a reactor trip with no subsequent turbine trip.**

# WESTINGHOUSE ELECTRO-HYDRAULIC CONTROL SYSTEM AND AUTO-STOP OIL SYSTEM

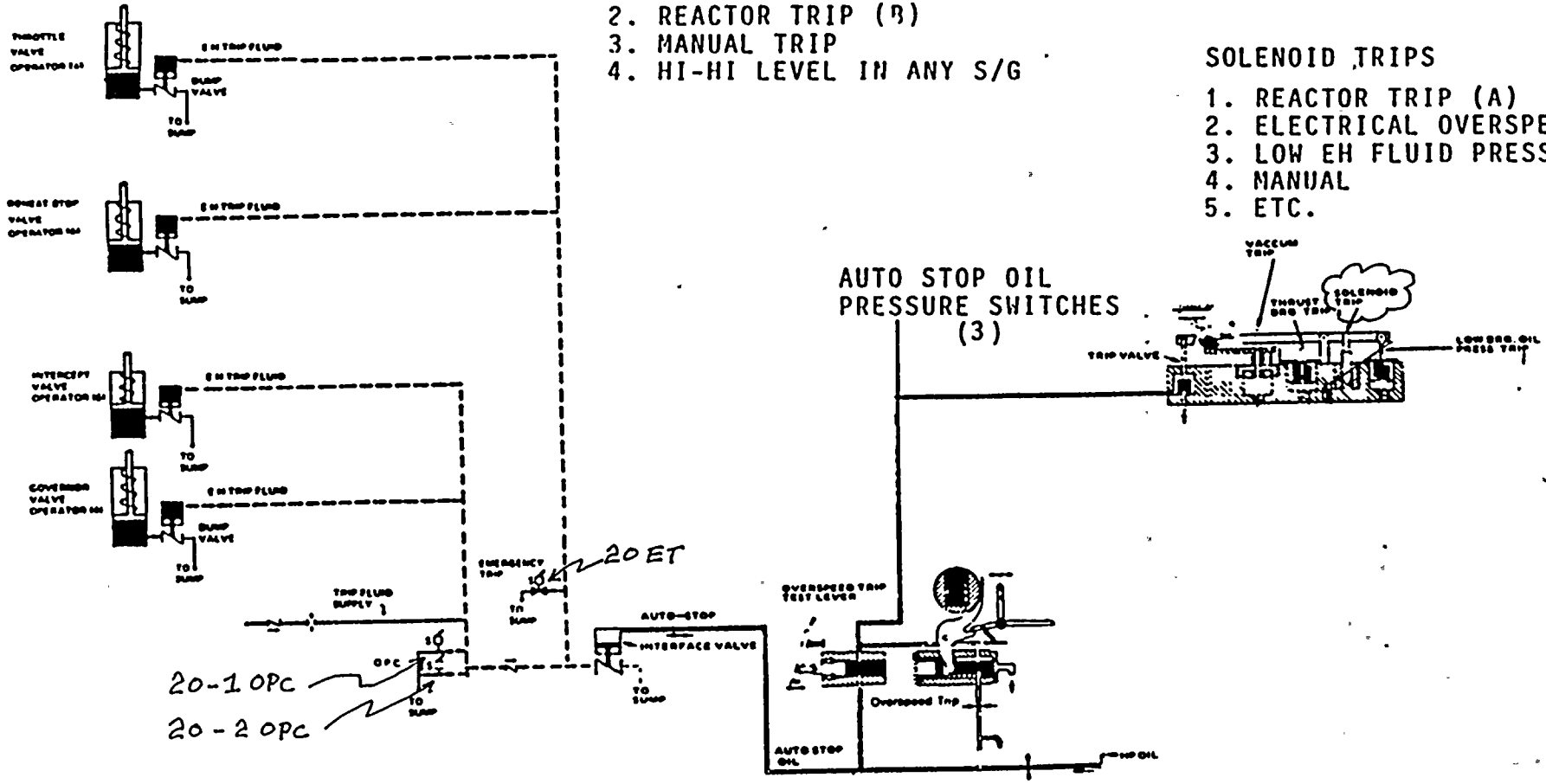
## EMERGENCY TRIPS

1. LOW AUTO-STOP OIL PRESSURE (2/3)
2. REACTOR TRIP (R)
3. MANUAL TRIP
4. HI-HI LEVEL IN ANY S/G

## SOLENOID TRIPS

1. REACTOR TRIP (A)
2. ELECTRICAL OVERSPEED
3. LOW EH FLUID PRESSURE
4. MANUAL
5. ETC.

ATTACHMENT # 1, IHE # 92-023  
SHEET 1 OF 1



## OVERSPEED PROTECTION CONTROLLER

1. 103% OF NORMAL SPEED
2. GENERATOR OUTPUT BREAKERS OPEN ABOVE A PRESET POWER LEVEL
3. CHANGE IN GENERATOR OUTPUT AND TURBINE INLET PRESSURE

EH FLUID SYSTEM

AUTO-STOP OIL SYSTEM