5/31/79 Rev 2

TT/0/A/325/02

DUKE POWER COMPANY

OCONEE NUCLEAR STATION

EMERGENCY FEEDWATER FLOW TEST

1.0 Purpose

To test the ability of the emergency feedwater pumps to start automatically and supply emergency feedwater to Units 1, 2 and 3 at the required flow rates. The procedure also tests the stability of the emergency feedwater system under different conditions.

2.0 References

2.1 EP/0/A/1800/14, Loss of Steam Generator Feedwater.

2.2 OP/1,2,3/A/1106/06, Emergency Feedwater System.

2.3 P. O. Drawings:

121A-1, 121B-1, 121B-1B
121A-2, 121B-2, 121B-2A
121A-3, 121B-3, 121B-3A

3.0 Time Required

3.1 Four hours - 14 people

4.0 Prerequisite Tests

_____4.1 PT/1/A/600/11 (Emergency Feedwater System) has been completed at the latest required test interval.

_____4.2 PT/2/A/600/11 (Emergency Feedwater System) has been completed at the latest required test interval.

_____4.3 PT/3/A/600/11 (Emergency Feedwater System) has been completed at the latest required test interval.

_____4.4 PT/3/A/251/05 (Emergency Feedwater to OTSG Flow Test) has been completed.

5.0 Test Equipment

5.1 Oconee 1, 2 and 3 plant computer

5.1.1 Oconee 1, 2 and 3 Plant Computer Performance Typers

5.1.2 Oconee 1, 2 and 3 Utility Typers

5.2. Photo-tachs (3)

5.3 EFWP Recirc. Flow Meters (3)

5.4 EFWP ΔP Meters (3)

5.5 Emergency Feedwater Line Flow Instrumentation on Oconee 1, 2 and 3 with portable test recorders

5.6 1, 2 and 3 FW 315 and 316 Valve Stem Position Indicators

5.7 01, 02 and 03 Transient Monitors

6.0 Limits and Precautions

6.1 Take control of (3)(2)(1) FDW-315 and (3)(2)(1) FDW-316 to prevent an RC System transient that may result in a reactor trip.

6.2 Maintain Reactor Power Level between 5% and 25%.

6.3 Maintain Reactor control rod positions within limits of PT's/1,2,3/A/600/01.

6.4 The reactor shall not be critical unless Reactor Coolant Temperature is above 525° F.

6.5 The test will be secured if any valid loose parts monitor alarms/ indications are received.

6.6 The test will be secured if an indication of increased OTSG primary to secondary leakage occurs.

7.0 Required Station (or Unit) Status

7.1 Unit #1 reactor at 15% ± 3%

7.2 Unit #2 reactor at 15% ± 3%

7.3 Unit #3 reactor at 15% ± 3%

7.4 All three main generators off line with turbine stop valves closed.

8.0 Prerequisite System Conditions

____8.1 Units 1, 2 and 3 generators off line (PCB's 20 and 21, 23 and 24 and 58 and 59 open).

8.2 Unit 1 Conditions

____8.2.1 Reactor Power Level at 15% ± 3%.

_____8.2.2 Main turbine M.S. stop valves closed.

_____8.2.3 Main feedwater block valves FDW-31 and FDW-40 blocked closed. Auxiliary feedwater block valves FDW-38 and FDW-47 blocked closed, FDW-36 and FDW-45 blocked open.

_____8.2.4 1A and 1B OTSG's at minimum level and level controlled by FDW-35 and FDW-44 through the main feedwater headers.

_____8.2.5 Upper Surge Tank level $\geq$ 8 feet.

_____8.2.6 Reactor Coolant System T_{ave} at 579° F $\pm$ 8° F.

_____8.2.7 OTSG pressure at 900 psia $\pm$ 10 psi.

_____8.2.8 HP-7 closed to obtain minimum letdown flow.

_____8.2.9 Manual handwheel stops have been backed out 100% on FDW-315 and FDW-316.

8.3 Unit 2 Conditions

_____8.3.1 Reactor power level at 15% $\pm$ 3%.

_____8.3.2 Main turbine M.S. Stop Valves Closed.

_____8.3.3 Main feedwater block valves 2FDW-31 and 2FDW-40 blocked closed. Auxiliary feedwater block valves 2FDW-38 and 2FDW-47 blocked closed, 2FDW-36 and 2FDW-45 blocked open.

_____8.3.4 2A and 2B OTSG's at minimum level and level controlled by 2FDW-35 and 2FDW-44 through the main feedwater headers.

_____8.3.5 Upper Surge Tank level $\geq$ 8 feet.

_____8.3.6 Reactor Coolant System T_{ave} at 579° F $\pm$ 8° F.

_____8.3.7 OTSG pressure at 900 psia $\pm$ 10 psi.

_____8.3.8 2HP-7 closed to obtain minimum letdown flow.

_____8.3.9 Manual handwheel stops have been backed out 100% on 2FDW-315 and 2FDW-316.

8.4 Unit 3 conditions

_____8.4.1 Reactor power level at 15% $\pm$ 3%.

_____8.4.2 Main turbine M.S. stop valves closed.

_____8.4.3 Main feedwater block valves 3FDW-31 and 3FDW-40 blocked closed. Auxiliary feedwater block valves 3FDW-38 and 3FDW-47 blocked closed, 3FDW-36 and 3FDW-45 blocked open.

_____8.4.4 3A and 3B OTSG's at minimum level and level controlled by 3FDW-35 and 3FDW-44 through the main feedwater headers.

_____8.4.5 Upper surge tank level $\geq$ 8 feet.

_____8.4.6 Reactor coolant system T_{ave} at 579°F $\pm$ 8°F.

_____8.4.7 OTSG pressure at 900 psig $\pm$ 10 psi.

_____8.4.8 3HP-7 closed to obtain minimum letdown flow.

_____8.4.9 Manual handwheel stops have been backed out 100% on 3FDW-315 and 3FDW-316.

_____8.5 All 3 units emergency feedwater systems aligned per OP/1/A/1106/06, OP/2/A/1106/06 and OP/3/A/1106/06 valve checklists.

_____8.6 Auxiliary boiler in operation at normal operating temperature and pressure.

9.0 Test Method

All three emergency feedwater pumps will be automatically started by simulating a loss of main feedwater on Unit 3. The emergency feedwater valves on Units 1, 2 and 3 will be manually closed. Unit #3 EFWP's will be stopped and FDW-315 and FDW-316 will be opened to obtain decay heat removal flow rates. Unit #3's steam driven EFWP and (2) motor driven EFWP's will be started and Unit #1 EFWP secured. Valve postions will again be determined to obtain decay heat removal flow rates. Emergency Feedwater Flows will be measured and any required changes in emergency feedwater valves (1, 2, FDW-315, 316) documented.

10.0 Data Required

10.1 The following computer points will be placed on the Oconee 1, 2 and 3 Performance Typer Digital Trend:

A1470	MS OTSG A Press 1
A1471	MS OTSG A Press 2
A1466	MS OTSG B Press 1
A1467	MS OTSG B Press 2
A1024	FDW SG A S/V LVL 1
A1029	FDW SG B S/V LVL 1
A1027	FDW SG A OP LVL 1
A1048	FDW SG B OP LVL 1
A1898	FDW SV Flow A
A1901	FDW SV Flow B
A0122	UST A Wtr Temp
A0123	UST B Wtr Temp

10.2 The following computer points will be placed on the Oconee 1, 2 and 3 Utility Typer Digital Trends:

A0158	UST LVL
A1887	RCS T_{ave}
A1632	RC Hot Let A WR Temp
A1633	RC Hot Leg B WR Temp
A1637	RC Cold Leg A1 WR Temp
A1639	RC Cold Leg B1 WR Temp
A1495	RC Cold Leg B1 WR Temp
A1047	RC Cold Leg B2 WR Temp
A1416	RC Loop A WR Press
A1417	RC Loop B WR Press
A1547	NI 8 PR Flux
P0889	%FP Thermal Power Best

10.3 Record the following data at each of the EFWP's:

10.3.1 Turbine driven EFWP start time (Time from loss of FWP signal initiated until EFWP is at rated speed).

10.3.2 Turbine driven EFWP Speed (from photo-tach)

10.3.3 Turbine driven and motor driven EFWP Δ P

10.3.4 Turbine driven and motor driven EFWP Recirc Flow

10.4 Record emergency feedwater flow from the local instrumentation on each of the 6 emergency feedwater lines (to 1A, 1B, 2A, 2B, 3A and 3B OTSG's).

10.5 Record valve positions of 1 FDW-315, 1 FDW-316, 2 FDW-315, 2 FDW-316, 3FDW-315 and 3FDW-316 indicators.

10.6 The Oconee 1, 2 and 3 Transient Monitoring Systems may be used for backup data logging.

11.0 Acceptance Criteria

The basis for acceptability of test results is that the emergency feed pumps will start and supply emergency feedwater to Units 1, 2 and 3 at the required flow rates for decay heat removal during all test cases.

11.1 Automatic valve opening positions for FDW-315 and FDW-316 are established and documentated that will provide the required decay heat removal flow rates.

11.2 Each unit's total emergency feedwater flow rate is $\geq$ 720 gpm.

11.3 Insure all components taken out of normal condition for the test are returned to normal by double verification.

12.0 Procedure

_____12.1 All prerequisite system conditions are met.

_____12.2 Bypass the Unit #3 loss of FDW-Reactor Trip Function to prevent a reactor trip when loss of main feedwater pumps is simulated.

_____12.3 Run the valve positioners for FDW-315, FDW-316, 2FDW-315, 2FDW-316, 3FDW-315 and 3FDW-316 to 0% (valves closed) and select manual on the selector switches.

CAUTION: If main feedwater is lost during the test, manually maintain minimum level in OTSG's with 1FDW-315, 1FDW-316, 2FDW-315, 2FDW-316, 3FDW-315 and 3FDW-316. If RC pumps are lost, manually maintain OTSG's level at 50% on operating range.

_____12.4 Simulate loss of Unit #3 main feedwater pumps by opening links _____.

_____12.5 Verify all three units emergency feedwater pumps start automatically. Record start time of each pump on Enclosure 13.2. Throttle FDW-89, 2FDW-89 and 3FDW-89 to obtain an EFWP recirc of 100 gpm.

_____12.6 Stop the Unit #3 turbine driven EFDW pump and (2) motor driven EFDW pumps.

_____12.7 Slowly open 1FDW-315, 1FDW-316, 2FDW-315, 2FDW-316, 3FDW-315 and 3FDW-316 adjust reactor power level to minimize cooldown rate and prevent reactor trip. Open valves in parallel to 60% on controllers, record data on Enclosures 13.1 and 13.2. If flow is < 720 gpm total to either units OTSG's, open valves to obtain between 720 gpm and 750 gpm, record data on Enclosures 13.1 and 13.2

_____12.8 To test emergency feedwater systems stability under different flow conditions, the test coordinator will cover the position indications on 1FDW-315, 1FDW-316, 2FDW-315, 2FDW-316, 3FDW-315 and 3FDW-316 and manually establish a flow imbalance in the Units 1, 2, and 3 emergency feedwater system. Record the method of the established imbalance on Enclosure 13.3 after test completion. During the flow imbalance test conditions, maintain flow to each OTSG at the same rate as before initiation of the flow imbalance.

_____12.9 Record 1FDW-315, 1FDW-316, 2FDW-315, 2FDW-316, 3FDW-315 and 3FDW-316 valve positions and each OTSG's emergency FDW flow rate following recovery of the flow imbalance on Enclosures 13.1 and 13.2.

____12.10 Adjust flow on affected unit to establish $\geq$ 720 gpm on the lone OTSG while maintaining constant flow to the other units. Record data on Enclosures 13.1 and 13.2.

____12.11 Re-establish 60% open on 1FDW-315, 1FDW-316, 2FDW-315, 2FDW-316, 3FDW-315 and 3FDW-316 to obtain flow to each OTSG. Slowly open each valve to 100% (full open), record data on Enclosures 13.1 and 13.2.

____12.12 Reposition FDW-315, FDW-316, 2FDW-315, 2FDW-316, 3FDW-315 and and 3FDW-316 to 20% on controllers.

____12.13 Start the Unit #3 steam driven emergency feedwater pump and (2) motor driven emergency feedwater pumps.

____12.14 Stop the Unit #1 EFDW pump.

____12.15 Record data on Enclosures 13.1 and 13.2 with all valves positioned at 20% on controllers. Slowly open each valve to 60% on controllers recording data on Enclosures 13.1 and 13.2. Continue opening each valve to 100% (full open) and data on Enclosures 13.1 and 13.2.

____12.16 Close 1FDW-315, 1FDW-316, 2FDW-315, 2FDW-316, 3FDW-315 and 3FDW-316 and verify that the normal startup feedwater valve operate to maintain minimum level in OTSG's.

____12.17 Stop the emergency feedwater pumps on all units.

____12.18 Close the links opened in step 12.4.

____12.19 Return to normal the Unit #3 Loss of FDW-Reactor Trip Function.

____12.20 Place all EFDW pump control switches in automatic.

____12.21 Place Units 1, 2 and 3 FDW-315 and FDW-316 in the automatic position and set controllers to preset position as appropriate.

____12.22 Return valves positioned in 8.2.3 and 8.3.3 to their pre-test positions per OP's/1,2,3/A/1106/06.

13.0 Enclosures

13.1 Emergency FDW Flow Data Sheet

13.2 EFWP Data Sheets

13.3 EFDW Flow Imbalance Method Description

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Enclosure 13.1

EFDW FLOW DATA

Unit # 1

Time/Step	FDW-315 Position (% open)	"1A" OTSG EFDW Flow (GPM)	FDW-316 Position (% open)	"1B" OTSG EFDW Flow (GPM)	T_{ave} (^{o}F)	Reactor Power (%)

Recorded By: _____

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Enclosure 13.1

EFDW FLOW DATA

Unit # 2

Time/Step	2FDW-315 Position (% open)	"2A" OTSG EFDW Flow (GPM)	2FDW-316 Position (% open)	"2B" OTSG EFDW Flow (GPM)	T_{ave} (^{o}F)	Reactor Power (%)

Recorded By: _____

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Enclosure 13.1

EFDW FLOW DATA

Unit # 3

Time/Step	3FDW-315 Position (% open)	"3A" OTSG EFDW Flow (GPM)	3FDW-316 Position (% open)	"3B" OTSG EFDW Flow (GPM)	T_{ave} (^{o}F)	Reactor Power (%)

Recorded By: _____

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Enclosure 13.2

EFWP DATA SHEET

Unit # _____ Run # _____ Date _____

EFWP Start Time: _____

TIME/STEP	EFWP Speed	EFWP ΔP		EFWP Recirc
		Suction Pressure	Discharge Pressure	

Recorded By _____

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Enclosure 13.3

EFDW Flow Imbalance

Method Description

Description of method to cause Emergency Feedwater System flow imbalance.

Date _____ Time _____

Completed By: _____

Test Coordinator: _____

Witnessed By: _____