ENCLOSURE 1

Report Nos.: 50-269/87-08, 50-270/87-08, and 50-287/87-08

Licensee: Duke Power Company
422 South Church Street
Charlotte, NC 28242

Docket Nos: 50-269, 50-270, and 50-287

License Nos.: DPR-38, DPR-47 and DPR-55

Facility Name: Oconee Nuclear Station

Enforcement Conference at the Region II Office: December 22, 1986

Inspector: C. W. Burger — 2/5/87
C. W. Burger — Date Signed

Approved by: T. A. Peebles — 2-5-87
T. A. Peebles, Section Chief — Date Signed
Division of Reactor Projects

SUMMARY

An Enforcement Conference was held on December 22, 1986, to brief NRC on the assessments and actions taken regarding the Safety System Functional Inspection (SSFI) findings. Details of the event are described in NRC Inspection Report Nos. 50-269,270,287/86-16.

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PDR ADOCK 05000269
Q PDR

REPORT DETAILS

1. Personnel Attending Enforcement Conference

Duke Power Company

H. B. Tucker, Vice President, DPC
M. S. Tuckman, Station Manager, Oconee
N. Rutherford, System Engineer, Licensing
R. B. Priory, Vice President, Design Engineering
B. L. Peele, Principal Engineer, Design Engineering
D. W. Murdock, Principal Engineer, Design Engineering
F. E. Owens, Shift Supervisor, Compliance

Nuclear Regulatory Commission

J. N. Grace, Regional Administrator, RII
M. L. Ernst, Deputy Regional Administrator, RII
L. A. Reyes, Deputy Director, Division of Reactor Projects (DPR), RII
V. W. Panciera, Deputy Director, Division of Reactor Safety (DRS), RII
G. E. Edison, Deputy Director, Project Directorate #6, NRR
H. N. Pastis, Project Manager - Oconee/PWR-6/NRR
T. A. Peebles, Section Chief, DRP, RII
J. C. Bryant, Senior Resident Inspector - Oconee
C. W. Burger, Project Inspector, DPR, RII
L. J. Callan, Chief, Performance Appraisal Section, IE
T. O. Martin, Inspection Specialist, IE
G. R. Jenkins, Director, Enforcement Investigation and Coordination Staff, RII
B. Uryc, Enforcement Specialist, RII
L. Trocine, Enforcement Specialist, RII

2. Event Discussion

The NRC staff opened the discussions concerning the SSFI findings and the associated safety implications. Duke Power Company (DPC) provided a description of the findings, assessment of the findings and the associated actions. The meeting summary notes are described below. The details are discussed in NRC Inspection Report Nos. 50-269,270,287/86-16.

a. Meeting Summary

The following findings were discussed at the meeting:

Emergency Feedwater Pump Runout - This finding could occur if the flow control valves stayed in the fully open position. This situation had not been previously analyzed by DPC.

Undersized Relief Valve - This finding relates to the relief valve in the steam supply line to the turbine - driven Emergency Feedwater (EFW) Pump. The DPC assessment determined the valve to be undersized for the resultant transient in which the upstream control valve fails in the full open position. The result would be to exceed the design pressure of that segment of piping.

Lack of Design Analysis - This finding deals with modifications that were performed without completed critical design analysis involving EFW total discharge head, EFW net positive suction head, Standby Shutdown Facility (SSF) Auxiliary Service Water (ASW) System total discharge head, EFW System flow, High Pressure Injection (HPI) Orifice Calculations and EFW Orifice calculations.

Inadequate Design Analysis - This finding relates to errors found in design analysis calculations involving: EFW minimum and maximum flows and Keowee dynamic analysis.

Operability of Turbine Driven Emergency Feedwater Pump (TDEFWP) - The finding is a concern of the inspection team that the Unit 3 TDEFWP did not meet Technical Specification (TS) operability requirements from June 7 - June 22, 1984. The sequence of events and summary are included in the handouts. DPC concluded that the pump was operable as required.

Inadequate Testing of Batteries - This finding involves a TS requirement of an annual one-hour discharge service test and the inspection team interpretation requiring a stepped discharge current one-hour profile in lieu of the constant current one-hour test presently used by DPC. DPC maintains that their testing program intent is supported in their licensing documentation.

Inoperable Keowee Batteries - This finding involves spacer material which was not added between the batteries as required for seismic qualification. DPC maintains this occurred due to personnel error in transmitting the drawing for implementation.

Check Valve Testing - This finding involves the ASME Code Section XI requirement "To verify operational readiness for valves which are required to perform a specific function in shutting down a reactor to cold shutdown or in mitigating the consequences of an accident." The inspection team is concerned that full cycling and flow verification of two check valves were not performed in accordance with the provisions of the ASME Code as required by TS 4.0.4.

Another concern by the team involves two other check valves which are not periodically tested in the reverse flow direction. DPC maintains that provisions for reverse flow testing were not provided in the original design, that the valves are tested in accordance with the inservice inspection program and that cost of the modification required for reverse flow testing is not warranted compared to benefits gained by the ability to test for back flow.

b. Summary

The NRC discussed each of the findings in detail with DPC and advised DPC that a decision regarding each finding would be forthcoming. The NRC thanked DPC for their very candid and comprehensive presentation and their positive response to NRC concerns.

ENCLOSURE 2

OCONEE MEETING HANDOUTS

DUKE POWER COMPANY
OCONEE NUCLEAR STATION
ENFORCEMENT CONFERENCE
DECEMBER 22, 1986

| | |
|---|---|
| Opening Remarks | H. B. Tucker |
| Duke Discussion Of Safety System Functional Inspection (SSFI) Findings | |
| • Inadequate Design & Implementation Of Design | B. L. Peele<br>D. W. Murdock<br>R. B. Priory<br>M. S. Tuckman |
| • Failure To Meet LCO's | M. S. Tuckman<br>D. W. Murdock |
| • Miscellaneous SSFI Findings | M. S. Tuckman |
| • Duke Discussion Of The Emergency Condenser Circulating Water System | M. S. Tuckman |
| • Closing Remarks | H. B. Tucker |

# PUMP RUNOUT

## UNRESOLVED ITEM 50-269, 270, 287/86-16-14

## SSFI REFERENCE PARAGRAPHS 2.1.3/3.4.3

### SUMMARY OF FINDING

- EMERGENCY FEEDWATER PUMP RUNOUT COULD OCCUR DURING NORMAL EFW ACTUATION IF FLOW CONTROL VALVES STAYED FULLY OPEN.
- DESIGN ANALYSIS ON PUMP RUNOUT HAD NOT BEEN PREVIOUSLY PERFORMED.

### BACKGROUND

- DUKE ADVISED NRC, IN 5-7-80 RESPONSE TO IE BULLETIN 80-04, THAT AUXILIARY FEEDWATER RUNOUT WAS NOT EXPLICITLY ADDRESSED BY THE FSAR ANALYSIS, AND THAT OPERATOR ACTION WAS TO BE USED TO MITIGATE THE TRANSIENT.
- DUKE TRAINING PERSONNEL HAD NOTED THAT OCONEE SIMULATOR WAS MODELING UNDESIRABLY HIGH EFW FLOW RATES; CALCULATIONS CONCERNING EFW FLOW CAPACITY WERE INITIATED 1/86.

### DUKE ASSESSMENT

- EXISTING EFW SYSTEM, WITH OPERATOR ACTION, FULFILLS INTENDED FUNCTION.
- ADDED MARGIN IS PRESENT DUE TO OTHER DIVERSE SYSTEMS AVAILABLE (AUXILIARY SERVICE WATER, STANDBY SHUTDOWN FACILITY, MAIN FEEDWATER)

### PLANNED ACTION

- OPERATING PROCEDURE REVISIONS AND TRAINING HAVE BEEN COMPLETED TO ALERT OPERATORS TO THE EFW FLOW LIMITATIONS, AS SPECIFICALLY RELATED TO THE PUMPS.

# UNDERSIZED RELIEF VALVE

## UNRESOLVED ITEM 50-269, 270, 287/86-16-15

## SSFI REFERENCE PARAGRAPHS 2.1.2/3.4.4, 3.4.7(5)

### SUMMARY OF FINDING

- RELIEF VALVE IN STEAM SUPPLY LINE TO TURBINE-DRIVEN EFW PUMP WAS REPLACED VIA MODIFICATION DESIGNED 11-85, BUT SYSTEM DESIGN PARAMETERS WERE NOT RECALCULATED.
- RELIEF VALVE IS UNDERSIZED.

### DUKE ASSESSMENT

- VALVE CHANGEOUT WAS INTENDED TO BE REPLACEMENT WITH AN EQUIVALENT VALVE, THEREFORE USE OF ORIGINAL COMPONENT PARAMETERS WAS PROPER.
- CALCULATION WAS PERFORMED TO VERIFY EQUIVALENCE.
- ORIGINAL RELIEF VALVE WAS UNDERSIZED FOR ANTICIPATED TRANSIENT OF UPSTREAM CONTROL VALVE FAILING FULLY OPEN.
- RESULT WOULD BE TO EXCEED STATED DESIGN PRESSURE OF PIPING SEGMENT, POSSIBLE DAMAGE TO TWO STEAM TRAPS.

### PLANNED ACTION

- DUKE HAS INITIATED MOD TO RAISE DESIGN PRESSURE RATING OF PIPING AND REPLACE STEAM TRAPS.
- OVERPRESSURE-DESIGN REFRESHER COURSE WILL BE CONDUCTED.

# LACK OF DESIGN ANALYSIS
# EFW/SSF SYSTEM FLOW CALCULATIONS
# UNRESOLVED ITEM 50-269, 270, 287/86-16-17
# SSFI REFERENCE PARAGRAPHS 2.2.3/3.4.7 (1,2,4)

## SUMMARY OF FINDING

- MODIFICATIONS WERE DONE WITHOUT RELATED CRITICAL DESIGN ANALYSES BEING PERFORMED OR COMPLETED:
  - -EFW TOTAL DISCHARGE HEAD
  - -EFW NET POSITIVE SUCTION HEAD
  - -SSF ASW TOTAL DISCHARGE HEAD
  - -EFW SYSTEM FLOW

## DUKE ASSESSMENT

- CALCULATIONS HAD BEEN PERFORMED ON SYSTEM PARAMETERS, BUT WERE NOT PROPERLY DOCUMENTED AND FILED.
- PRE-OPERATIONAL TESTING SUBSTANTIATED SSF TOTAL DISCHARGE HEAD.
- EFW PUMPS HAVE PERFORMED ADEQUATELY IN SERVICE SINCE THEIR INSTALLATION.
- LACK OF DOCUMENTATION IS UNTYPICAL OF CURRENT DUKE DESIGN PRACTICE.

# LACK OF DESIGN ANALYSIS
# EFW/SSF SYSTEM FLOW CALCULATIONS
# (CONTINUED)

## PLANNED ACTIONS

- FORMAL, DOCUMENTED CALCULATIONS DEMONSTRATING SSF ASW CAPABILITY WERE COMPLETED 12/15/86.
- FORMAL, DOCUMENTED CALCULATIONS DEMONSTRATING EFW CAPABILITY WILL BE COMPLETED BY 3/31/87.

# LACK OF DESIGN ANALYSIS
# HPI ORIFICE CALCULATIONS
# UNRESOLVED ITEM 50-269, 270, 287/86-16-17
# SSFI REFERENCE PARAGRAPHS 2.3.2(1)/3.4.7(3)

## SUMMARY OF FINDING

- ORIFICE SIZING CALCULATIONS WERE EITHER NOT DONE OR NOT DOCUMENTED DURING MODIFICATIONS TO INSTALL CROSSOVER FLOW PATHS AND SAFETY RELATED FLOW INDICATION IN THE HIGH-PRESSURE INJECTION SYSTEM.

## ASSESSMENT

- THE 1979 CALCULATIONS TO SIZE THE SUBJECT FLOW ORIFICES HAVE BEEN RETRIEVED.

## PLANNED ACTIONS

- CALCULATIONS ARE BEING RE-PERFORMED, DOCUMENTED AND CONTROLLED IN ACCORDANCE WITH OUR CURRENT QUALITY ASSURANCE PROGRAM.
- CONFIRMATORY CALCULATIONS INDICATE THAT NO CHANGES ARE NECESSARY TO THE ORIGINALLY SPECIFIED ORIFICE SIZES.

# INADEQUATE DESIGN ANALYSIS
# EFW ORIFICE CALCULATIONS
# UNRESOLVED ITEM 50-269, 270, 287/86-16-18
# SSFI REFERENCE PARAGRAPHS 2.3.2 (1)/3.4.8 (1)

## SUMMARY OF FINDING

- ORIFICE SIZING CALCULATIONS WERE NOT CHECKED OR VERIFIED AND THE PREPARER WAS NOT IDENTIFIED.
- DESIGN ANALYSES DID NOT HAVE FILE IDENTIFIERS AND WERE NOT IDENTIFIED AS QA CONDITION 1.

## ASSESSMENT

- DUKE POWER ACKNOWLEDGES THAT THE RETRIEVED CALCULATIONS PERFORMED IN 1979 WERE LACKING IN THE SIGNATURES AND OTHER AREAS DESCRIBED ABOVE.

## PLANNED ACTION

- CALCULATIONS ARE BEING RE-PERFORMED, DOCUMENTED AND CONTROLLED IN ACCORDANCE WITH OUR CURRENT QUALITY ASSURANCE PROGRAM.
- CONFIRMATORY CALCULATIONS INDICATE NO CHANGES ARE NECESSARY TO THE ORIGINALLY SPECIFIED ORIFICE SIZES.

# INADEQUATE DESIGN ANALYSIS
# EFW MINIMUM AND MAXIMUM FLOWS
# UNRESOLVED ITEM 50-269, 270, 287/86-16-18
# SSFI REFERENCE PARAGRAPHS 2.3.2/3.4.8(2)

## SUMMARY OF FINDING

- CALCULATION OF BEST-ESTIMATE EFW FLOWS CONTAINED ERRORS:
  - -FRICTION FACTOR OF 0.015 INSTEAD OF 0.0168.
  - -LOCAL DISCREPANCIES IN PIPING GEOMETRY MODEL.
  - -TILTING DISC CHECK INSTEAD OF SWING CHECK VALVE.

## DUKE ASSESSMENT

- DUKE ACKNOWLEDGES THESE DETAIL ERRORS WERE PRESENT.
- NEGLIGIBLE EFFECT ON CONCLUSIONS OF THE CALCULATION; CORRECTED ANALYSIS YIELDED FLOW RATE DIFFERENCE OF NO MORE THAN 1.2% -- WELL WITHIN ACCURACY OF METHOD.
- CALCULATION INCORPORATED ACTUAL, MEASURED OPERATING DATA WHICH IMPROVED THE ACCURACY OF OVERALL FLOW MODEL.

## ACTION TAKEN

- CALCULATION WAS REVISED AND CORRECTED DURING AUDIT.

# INADEQUATE DESIGN ANALYSIS

## KEOWEE DYNAMIC ANALYSIS

## UNRESOLVED ITEM 50-269, 270, 287/86-16-18

## SSFI REFERENCE PARAGRAPHS 2.3.2(1)/3.4.8(3)

## SUMMARY OF FINDING

- FOCUSED ON A 1980 DYNAMIC ANALYSIS OF THE MOTOR STARTING CAPABILITY OF THE STANDBY POWER SUPPLY FED THROUGH THE UNDERGROUND FEEDER FROM KEOWEE HYDRO STATION FOR A NON-LOCA LOSS OF OFFSITE POWER EVENT.
- ANALYSIS WAS CONSIDERED DEFICIENT IN THE FOLLOWING AREAS:
  - (A) DID NOT INCLUDE IMPEDANCES FROM THE 600 VOLT BUSSES TO THE TERMINALS OF 600 VOLT LOADS.
  - (B) REACTOR BUILDING COOLING UNIT FAN B WAS NOT INCLUDED IN THE ANALYSIS.
  - (C) ANALYSIS WAS NOT TREATED AS A DESIGN CALCULATION AND WAS NOT CHECKED OR DESIGN VERIFIED.

## ASSESSMENT

- CABLE IMPEDANCE TO 600V LOADS WAS NOT CONSIDERED SIGNIFICANT IN THE ORIGINAL ANALYSIS AND THUS WAS NOT EXPLICITLY CONSIDERED.
- RBCU FAN B IS NOT A NORMALLY RUNNING LOAD AND WOULD NOT BE AUTOMATICALLY STARTED UPON A NON-LOCA TRANSFER TO THE KEOWEE SOURCE.
- DUKE ACKNOWLEDGES THAT THE ANALYSIS WAS NOT TREATED AS A DESIGN CALCULATION AND WAS NOT SIGNED AS BEING CHECKED OR DESIGN VERIFIED.

ACTIONS TAKEN

- THE DYNAMIC ANALYSIS WAS REPERFORMED USING THE ORIGINAL COMPUTER MODEL TO SPECIFICALLY INCLUDE THE WORST CASE 600V LOAD CABLE IMPEDANCE AND THE RESULTS WERE ACCEPTABLE.

- SINCE RBCU FAN B COULD BE RUN IN OFF NORMAL SITUATIONS, THE ANALYSIS WAS REPERFORMED USING THE ORIGINAL COMPUTER MODEL ASSUMING DIFFERENT RUNNING COMBINATIONS OF FANS A, B, AND C AND THE RESULTS WERE ACCEPTABLE.

- THE ANALYSIS WILL BE REPERFORMED USING THE ORIGINAL OR AN ALTERNATE EQUIVALENT CALCULATIONAL TECHNIQUE AND WILL BE PERFORMED, CHECKED, APPROVED AND CONTROLLED IN ACCORDANCE WITH OUR CURRENT QUALITY ASSURANCE PROGRAM.

# OPERABILITY OF TDEFWP

## ITEM 3.1.4

## (UNRESOLVED ITEM 50-269, 270, 287/86-16-03)

NRC CONCERN: THE TEAM WAS CONCERNED THAT THE UNIT 3 TDEFW PUMP DID NOT MEET TECHNICAL SPECIFICATION OPERABILITY REQUIREMENTS FROM JUNE 7 THROUGH JUNE 22, 1984.

## SEQUENCE OF EVENTS

JUNE 7, 1984

| | | |
|---|---|---|
| 0930 | . | PUMP FAILED PERFORMANCE TEST ON FIRST ATTEMPT. |
| | . | DECLARED INOPERABLE (SRO LOG) |
| 1045 | . | PUMP ACHIEVED PROPER SPEED AND DISCHARGE PRESSURE BUT GOVERNOR WAS SLUGGISH. |
| 1310 | . | TDEFWP PASSED PERFORMANCE TEST. DECLARED OPERABLE. |
| 1640 | . | R & R ISSUED ON MAIN STEAM SUPPLY TO TDEFWP. TDEFWP LINED UP TO AUXILIARY STEAM SUPPLY. |

JUNE 7 THROUGH JUNE 13

| | | |
|---|---|---|
| | . | MAINTENANCE PERFORMED ON 3MS-87 (MAIN STEAM SUPPLY) |

JUNE 13

| | | |
|---|---|---|
| 1539 | . | TDEFWP TESTED SUCCESSFULLY, BUT NOTICEABLY SLOW. WORK REQUEST ISSUED TO INVESTIGATE SLUGGISH RESPONSE. |
| 1700 | . | CLEARED R & R. REALIGNED MAIN STEAM SUPPLY TO TDEFWP. |

JUNE 22

| | | |
|---|---|---|
| 1356 | . | TDEFWP MAINTENANCE, GOVERNOR CLEANED, AND TESTING. |
| | . | TDEFWP DECLARED INOPERABLE (SRO LOG) |
| 2300 | . | SUCCESSFUL PUMP TEST. TDEFWP DECLARED OPERABLE ON BOTH MAIN AND AUXILIARY STEAM SUPPLIES. |

SUMMARY:

- PROBLEMS WITH TDEFWP RESPONSE WERE ENCOUNTERED.
- MAINTENANCE WAS PERFORMED TO SYSTEMATICALLY CORRECT SUSPECTED PROBLEMS.
- TESTING WAS PERFORMED TO VERIFY PROPER OPERATION AFTER MAINTENANCE.
- TDEFWP WAS DECLARED OPERABLE/ INOPERABLE AS APPROPRIATE (NOTED IN SRO/RO LOGS) FOLLOWING EVALUATION BY ENGINEERING.

CONCLUSION:

THE UNIT 3 TDEFW PUMP WAS OPERABLE AS REQUIRED BY TECHNICAL SPECIFICATIONS AND MAINTENANCE WAS SYSTEMATICALLY PERFORMED AS REQUIRED.

# INADEQUATE TESTING OF BATTERIES

## UNRESOLVED ITEM 50-269, 270, 287/86-16-12
## SSFI REFERENCE PARAGRAPH 3.3.8

### SUMMARY OF FINDING

- TECH SPEC 4.6.10 REQUIRES AN ANNUAL ONE-HOUR DISCHARGE SERVICE TEST.
- AUDITORS INTERPRETATION WOULD REQUIRE A STEPPED DISCHARGE CURRENT 1-HOUR PROFILE IN LIEU OF CONSTANT CURRENT 1-HOUR TEST PRESENTLY USED BY DUKE.

### BACKGROUND

- DUKE'S INTENT WAS TO VERIFY BATTERY CAPABILITY BY DEMONSTRATING ADEQUATE STORED ENERGY CAPACITY (AMPERE-HOURS).
- TECH SPECS ARE COMPLICATED BY DISCUSSION OF DIFFERENT CAPACITY CATEGORIES.
- TECH SPEC 3.7 BASES LISTS DC SYSTEM CAPACITIES UNDER TWO CATEGORIES:

  (A) WITH AC POWER (IN AMPS)

  (B) WITHOUT AC POWER (IN AMPERE-HOURS)

- FSAR CHAPTER 8 (SECTION 8.3.2.2) REITERATES TEST INTENT.

### ASSESSMENT

- WE BELIEVE OUR TESTING PROGRAM INTENT IS SUPPORTED IN OUR LICENSING DOCUMENTATION.
- WE ACKNOWLEDGE THAT USING A STEPPED DISCHARGE CURRENT 1-HOUR PROFILE IS A TECHNICALLY SUPERIOR TEST METHOD.

### PLANNED ACTIONS

- WE PLAN TO REVIEW OUR TEST PROGRAM, TECH SPECS, AND RECENT INPO GUIDANCE TO IDENTIFY DESIRABLE CHANGES TO OUR PRESENT TEST METHODS AND TECH SPECS.

4.6.10 Annually, a one hour discharge service test at the required maximum load shall be made on the instrument and control batteries, the Keowee batteries, and the switching station batteries.

4.6.11 Monthly, the operability of the individual diode monitors in the Instrument and Control Power System shall be verified by imposing a simulated diode failure signal on the monitor.

4.6.12 Semiannually, the peak inverse voltage capability of each auctioneering diode in the 125 VDC Instrument and Control Power System shall be measured and recorded.

Bases

The Keowee Hydro units, in addition to serving as the emergency power sources for the Oconee Nuclear Station, are power generating sources for the Duke system requirements. As power generating units, they are operated frequently, normally on a daily basis at loads equal to or greater than required by Table 8.5 of the FSAR for ESF bus loads. Normal as well as emergency startup and operation of these units will be from the Oconee Unit 1 and 2 Control Room. The frequent starting and loading of these units to meet Duke system power requirements assures the continuous availability for emergency power for the Oconee auxiliaries and engineered safety features equipment. It will be verified that these units will carry the equipment of the maximum safeguards load within 25 seconds, including instrumentation lag, after a simulated requirement for engineered safety features. To further assure the reliability of these units as emergency power sources, they will be, as specified, tested for automatic start on a monthly basis from the Oconee control room. These tests will include verification that each unit can be synchronized to the 230 kV bus and that each unit can energize the 13.8 kV underground feeder.

The interval specified for testing of transfer to emergency power sources is based on maintaining maximum availability of redundant power sources.

Starting a Lee Station gas turbine, separation of the 100 kV line from the remainder of the system, and charging of the 4160 volt main feeder buses are specified to assure the continuity and operability of this equipment. The one hour time limit is considered the absolute maximum time limit that would be required to accomplish this.

REFERENCE

FSAR Section 8

if furnished by the underground circuit or 30 MVa (limited by CT1 or CT2) if furnished through the 230 kV off-site transmission lines. Capacity available from the backup 100 kV off-site transmission line (Lee Station Gas Turbine Generator) is 20 MVa (limited by CT5).

Thus, the minimum available capacity from any one of the multiple sources of AC power, 20 MVa, is adequate.

The adequacy of the Oconee electrical distribution system voltages has been evaluated. Under the conservative assumptions of the analysis, it has been established that a single startup transformer should not be shared between two operating units. In the event a startup transformer becomes inoperable, it effectively causes one onsite emergency power path to the affected unit to become inoperable. The time frames for the degraded mode of an inoperable startup transformer are thus consistent with those for an inoperable onsite emergency power path. Because the preferred mode of unit shutdown is with reactor coolant pumps providing forced circulation and because of the low likelihood of an accident during a 72 hour period, the unit which is being shut down is allowed to share a startup transformer with another unit until the unit is in cold shutdown with loads being powered from the standby buses.

Capacity of DC Systems

Normally, for each unit AC power is rectified and supplies the DC system buses as well as keeping the storage batteries on these buses in a charged state. Upon loss of this normal AC source of power, each unit's DC auxiliary systems important to reactor safety have adequate stored capacity (ampere-hours) to independently supply their required emergency loads for at least one hour. One hour is considered to be conservative since there are redundant sources of AC power providing energy to these DC auxiliary systems. The loss of all AC power to any DC system is expected to occur very infrequently, and for very short periods of time. The following tabulation demonstrates the margin of installed battery charger rating and battery capacity when compared to one hour of operation (a) with AC power (in amps) and (b) without AC power (in ampere hours) for each of the three safety-related DC systems installed at Oconee:

A. 125 VDC Instrumentation and Control Power System

| | |
|---|---|
| Charger XCA, XCB, or XCS | a. 600 amps each |
| Battery XCA or XCB Capacity (X = 1, 2, or 3) | b. 600 ampere-hours each |
| Combined total connected loads on both 125 VDC I & C buses XDCA and XDCB during 1st hour of LOCA (x = 1, 2, or 3) | a. Inrush (2 sec) - 1160 amps<br>next 59 min. - 506 amps |
| | b. 516.9 ampere-hours |

B. 125 VDC Switching Station Power System

| | |
|---|---|
| Charger SY-1, SY-2, or SY-s Rating | a. 50 amps each |
| Battery SY-1 or SY-2 Capacity | b. 14.4 ampere-hours |
| Active load per battery during 1st hour of LOCA | a. Inrush (2 seconds) - 130 amps<br>next 59 min. - 10 amps |

b. 12 ampere-hours

C. 125 VDC Keowee Station Power System

| | |
|---|---|
| Charger No. 1, No. 2 or Standby Rating | a. 200 amps each |
| Battery No. 1 or No. 2 Capacity | b. 200 ampere-hours |
| Active load per battery during 1st hour of LOCA | a. Inrush (14 seconds) - 1031 amps<br>next 59 min. - 179.4 amps |
| | b. 193.6 ampere-hours |

Redundancy of AC Systems

There are three 4160 V engineered safety feature switchgear buses per unit. Each bus can receive power from either of the two 4160 V main feeder buses per unit. Each feeder bus in turn can receive power from the 230 kV switchyard through the startup transformers, through the unit auxiliary transformer by backfeeding through the main step-up transformer, or from the 4160V standby bus. Another unit's start-up transformer serving as an alternate supply can be placed in service in one hour.

The standby bus can receive power from the hydro station through the underground feeder circuit or from a combustion turbine generator at the Lee Steam Station over an isolated 100 kV transmission line. The 230 kV switchyard can receive power from the on-site Keowee hydro station or from several off-site sources via transmission lines which connect the Oconee Station with the Duke Power system power distribution network.

Redundancy of DC System

A. 125 VDC Instrumentation and Control Power System

The 125 VDC Instrumentation and Control (I&C) Power System consists of two batteries, three battery chargers, and two I&C distribution centers per unit. All reactor protection and engineered safety features loads on this system can be powered from either the Unit 1 and Unit 2 or Unit 2 and Unit 3 or Unit 3 and Unit 1 125 VDC I&C distribution centers. The 125 VDC I&C distribution centers are normally supplied from their associated battery and charger. For one unit, in the event that only one of its batteries and associated chargers are operable, both I&C distribution centers will be tied together allowing operation of the DC loads from the unit's operable battery and charger. As shown above, one I&C battery (e.g., ICA) can supply both I&C distribution centers (e.g., IDCA and IDCB) and their associated panelboard loads. Also, one of the three battery chargers for each unit can supply all connected ESF and reactor protection loads.

In order to find and correct a DC ground on the 125 VDC Instrumentation and Control system each unit's DC system must be separated from the other two units. This is due to the interconnected design of the system. With the backup function disabled the units would be in a degraded mode but would in fact have all of its own DC system available if needed. Each unit's batteries either CA or CB is capable of carrying all the 125 VDC Instrumentation and Control loads on that unit.

Each battery is sized to carry the continuous emergency load for a period of one hour in addition to supplying power for the operation of momentary loads during the one hour period.

In normal operation the batteries are floated on the buses, and assume load without interruption on loss of a battery charger or ac power source.

The lead-acid batteries are tested to prove their ampere-hour capacity. Inservice periodic checks of the status of each cell is made through battery hydrometer log readings and cell voltage. Temp rature readings are used to adjust hydrometer readings.

8.3.2.2.1 Single Failure Analysis of the 125 Volt DC Instrumentation and Control Power System

As shown in Table 8.3-3, the 125 Volt DC Instrumentation and Control Power System is arranged such that a single fault within either system does not preclude the Reactor Protective System, Engineered Safeguards Protective System, and the engineered safeguards equipment from performing their safety functions.

8.3.2.2.2 Single Failure Analyses of the 125 Volt DC Keowee Station Power System

The 125 Volt DC Keowee Station Power System is arranged such that a single fault within either unit's system does not preclude the other unit from performing its intended function of supplying emergency power.

8.3.2.2.3 Single Failure Analysis of the 120 Volt Vital Power Buses

The 120 Volt Vital Power System is arranged such that any type of single failure or fault will not preclude the Reactor Protective System, Engineered Safeguards Protective System, and engineered safeguards equipment from performing their safety functions. There are four independent buses available to each unit, and single failure within the system can involve only one bus. A single failure analysis is presented in Table 8.3-4.

# INOPERABLE KEOWEE BATTERIES

## UNRESOLVED ITEM 50-269, 270, 287/86-16-13
## SSFI REFERENCE PARAGRAPHS 2.1.7(2)/3.4.2(1)

### SUMMARY OF FINDING

- KEOWEE BATTERIES WERE REPLACED IN FALL OF 1985 WITH NEW GNB BRAND BATTERIES.
- GNB SEISMIC QUALIFICATION REQUIRES THE END CELL TO END STRINGER SPACING TO BE LESS THAN OR EQUAL TO 1/4" OR SPACER MATERIAL TO BE ADDED TO REDUCE THE FREE GAP TO LESS THAN OR EQUAL TO 1/4".
- KEOWEE BATTERIES HAD FREE GAP SPACING GREATER THAN 1/4" WITH NO SPACER MATERIAL INSTALLED.

### BACKGROUND

- GNB ORIGINAL DRAWINGS HAD NO END CELL TO END STRINGER FREE GAP REQUIREMENTS SPECIFIED.
- DUE TO MCGUIRE AND CATAWBA EXPERIENCE, THIS WAS QUESTIONED BY DUKE AND A DRAWING REVISION WAS MADE BY GNB.
- SPACER MATERIAL WAS NOT ADDED IN THE FIELD DUE TO DUKE PERSONNEL ERROR IN TRANSMITTING THE DRAWING FOR IMPLEMENTATION.

### ASSESSMENT

- AN ANALYSIS OF THE BATTERY SEISMIC CAPABILITY WITHOUT THE SPACER MATERIAL INSTALLED WAS PERFORMED BY DUKE WHICH DETERMINED THE INSTALLATION WAS ADEQUATE TO WITHSTAND A MAXIMUM HYPOTHETICAL EARTHQUAKE WITHOUT LOSS OF FUNCTION.
- THE TRANSMITTAL ERROR WAS DETERMINED TO BE AN ISOLATED INCIDENT.

### ACTION TAKEN

- UPON DISCOVERY, PROMPT ACTION WAS TAKEN BY DUKE TO INSTALL THE SPACER MATERIAL.

# CHECK VALVE TESTING

## ITEMS 3.3.2 AND 3.3.3

## UNRESOLVED ITEMS

## 50-269, 270, 287/86-16-07 & 08

ASME SECTION XI

IWV

REQUIREMENT: TO VERIFY OPERATIONAL READINESS FOR VALVES WHICH ARE REQUIRED TO PERFORM A SPECIFIC FUNCTION IN SHUTTING DOWN A REACTOR TO COLD SHUTDOWN OR IN MITIGATING THE CONSEQUENCES OF AN ACCIDENT.

# CHECK VALVE TESTING

## C-568

NRC CONCERN: FULL CYCLING AND FLOW VERIFICATION OF CHECK VALVES 2C-568 AND 3C-568 WERE NOT PERFORMED IN ACCORDANCE WITH THE PROVISIONS OF ASME CODE, SECTION XI, SUBSECTION IWV AS REQUIRED BY TECHNICAL SPECIFICATION 4.0.4.
NO RELIEF FOR THESE VALVES WAS REQUESTED IN THE OCONEE NUCLEAR STATION INSERVICE INSPECTION PROGRAM.

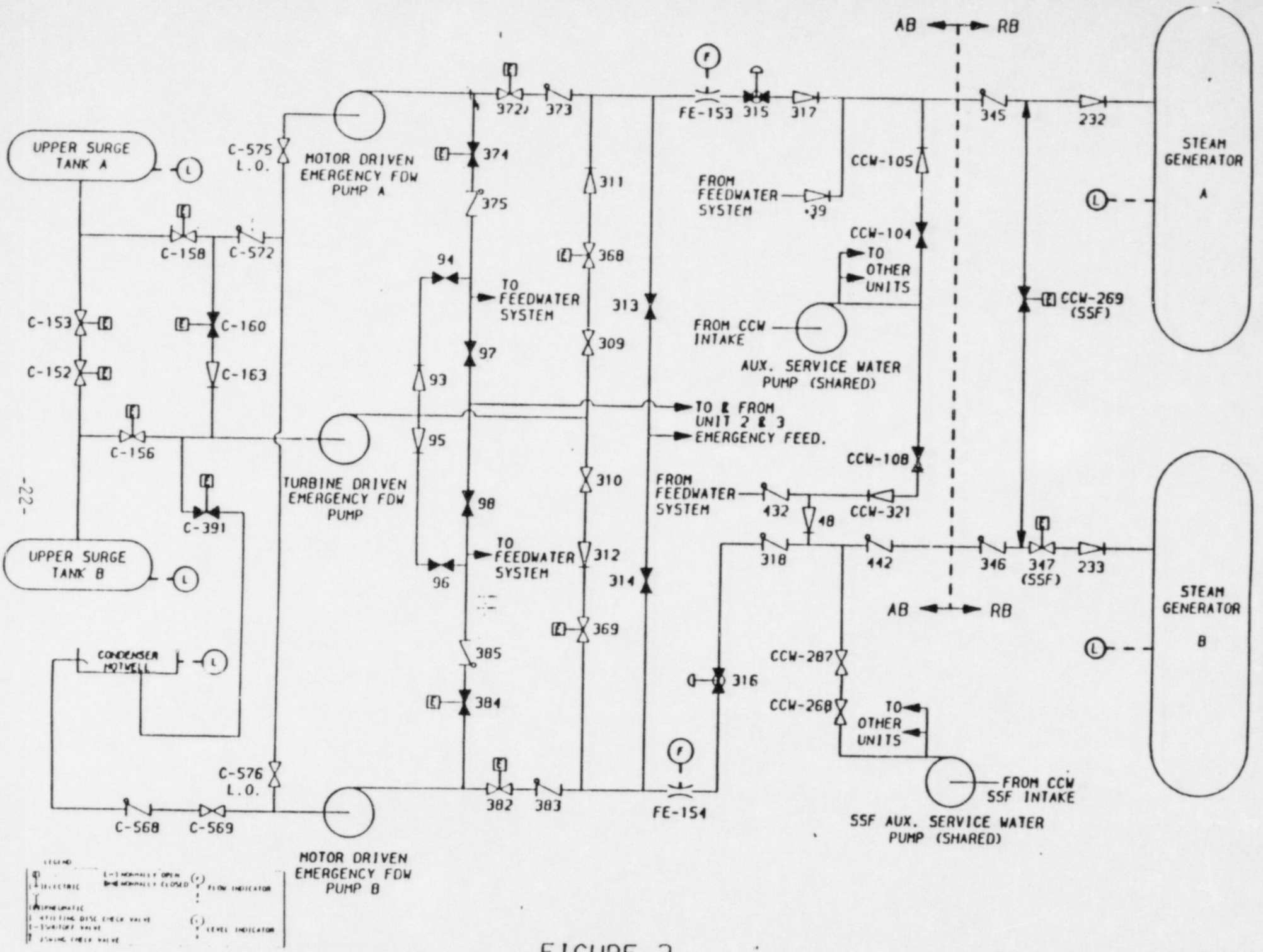
AB
RB
UPPER SURGE TANK A
UPPER SURGE TANK B
C-575 L.O.
MOTOR DRIVEN EMERGENCY FDW PUMP A
TURBINE DRIVEN EMERGENCY FDW PUMP
MOTOR DRIVEN EMERGENCY FDW PUMP B
C-158
C-572
C-153
C-152
C-160
C-163
C-156
C-391
C-576 L.O.
C-568
C-569
CONDENSER HOTWELL
372
373
374
375
94
93
95
98
96
97
385
384
382
383
311
368
313
309
310
312
314
369
FE-153
315
317
FE-154
316
FROM FEEDWATER SYSTEM
39
TO FEEDWATER SYSTEM
TO FEEDWATER SYSTEM
TO & FROM UNIT 2 & 3 EMERGENCY FEED.
FROM CCW INTAKE
AUX. SERVICE WATER PUMP (SHARED)
CCW-105
CCW-104
TO OTHER UNITS
CCW-108
CCW-321
FROM FEEDWATER SYSTEM
432
48
CCW-287
CCW-268
TO OTHER UNITS
FROM CCW SSF INTAKE
SSF AUX. SERVICE WATER PUMP (SHARED)
345
232
CCW-269 (SSF)
318
442
346
347 (SSF)
233
STEAM GENERATOR A
STEAM GENERATOR B
-22-

FIGURE 2.

PRIOR TO INSTALLATION OF EXTENDED MDEFWP SUCTION LINE

- C-568 WAS NOT ORIGINAL EQUIPMENT
- WHEN ADDED IT WAS NOT CONSIDERED A PART OF THE IIP
- UNDESIRABLE FLOW PATH
  - . LOSS OF VACUUM
  - . SMALL VOLUME OF WATER AVAILABLE
  - . POTENTIAL PUMP DAMAGE
- PROCEDURAL GUIDANCE TO AVOID USING THIS PATH. PROCEDURE PREFERS TDEFWP FOR HOTWELL SUCTION.
- DUE TO THE HIGH PROBABILITY OF PUMP DAMAGE DUE TO LOSS OF SUCTION WHILE TESTING, A CONSCIOUS DECISION WAS MADE NOT TO PERFORM FLOW VERIFICATION ON C-568.

POST INSTALLATION TESTING

- MODIFICATION TO THE MDEFW PUMP SUCTION FROM THE HOTWELL
  - . #1, MARCH 1986
  - . #2, SEPTEMBER 1986
  - . #3, OCTOBER 1986
- C-568 WAS TESTED FOLLOWING MODIFICATIONS
  - . #1, APRIL 9
  - . #2, OCTOBER 12
  - . #3, OCTOBER 15

## POST INSTALLATION TESTING
(CONTINUED)

- C-568 ADDED TO IIP FOLLOWING TESTING AS REQUIRED BY THE INSERVICE INSPECTION PROGRAM WITHIN 60 DAYS OF THE END OF THE REFUELING OUTAGE

## CONCLUSION

- AT THE TIME OF SSFI, UNIT 1 C-568 HAD BEEN TESTED AND ADDED TO IIP
- PLANS WERE IN PLACE TO ADD 2C-568 AND 3C-568 TO IIP WHEN MODIFICATION WAS COMPLETE
- OCONEE HAS BEEN IN COMPLIANCE WITH THE PROVISIONS OF IWV FOR VALVES C-568

# CHECK VALVE TESTING

## MS-83 AND MS-85

NRC CONCERN: MS-83 AND MS-85 ARE NOT PERIODICALLY TESTED IN THE REVERSE FLOW DIRECTION. LOW STEAM FLOWS HAVE BEEN KNOWN TO CAUSE DEGRADATION OF CHECK VALVES IN SIMILAR APPLICATIONS (IEN 86-09).

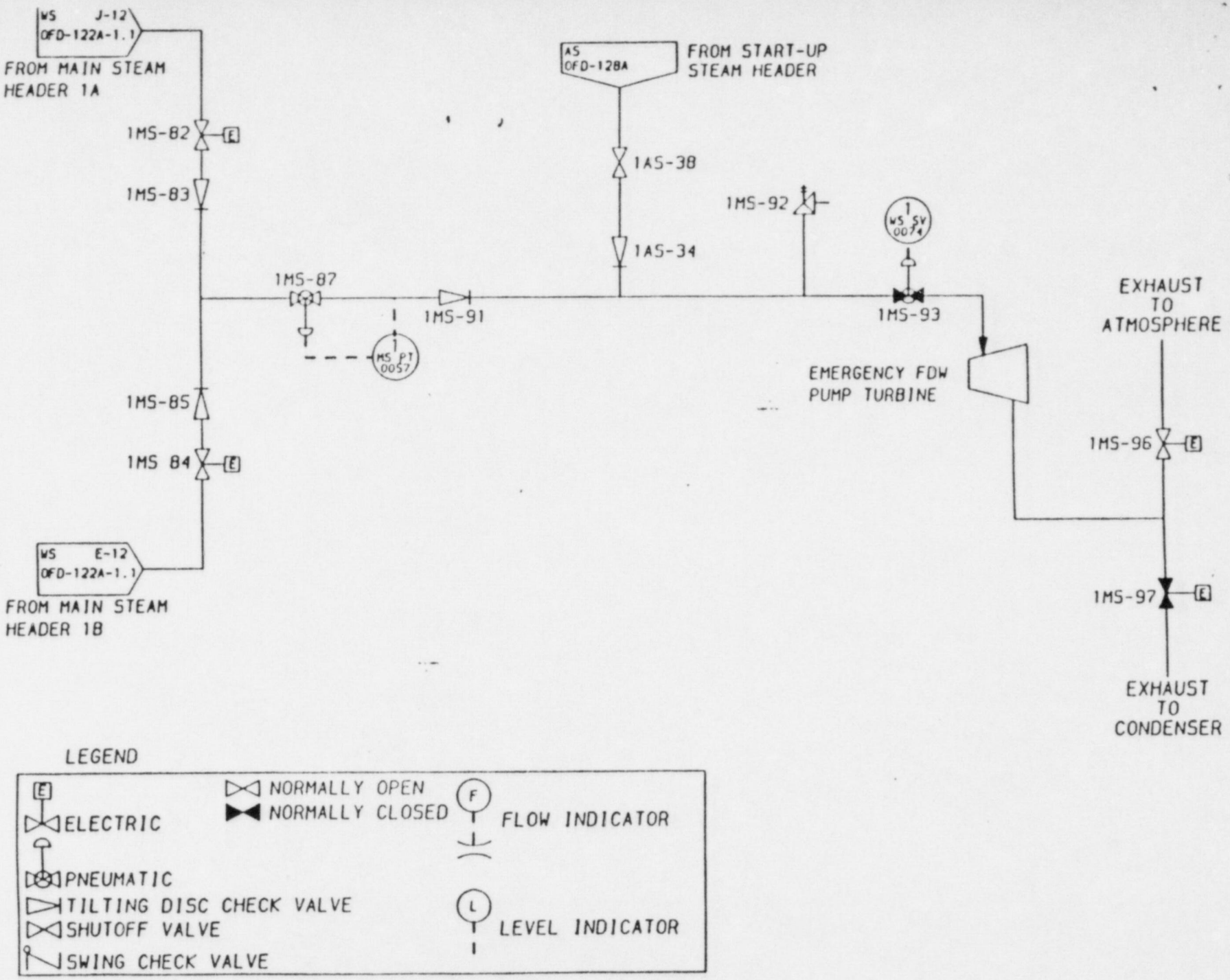


FIGURE 1.

STEAM SUPPLY FOR TURBINE DRIVEN EFW PUMP (UNIT 1.)

- PROVISIONS FOR REVERSE FLOW TESTING WERE NOT PROVIDED IN ORIGINAL DESIGN.

- IE INFORMATION NOTICE 86-09 WAS REVIEWED BY DESIGN ENGINEERING AND FOUND NOT TO BE A SIGNIFICANT CONCERN AT OCONEE.

- MS-83 AND MS-85 ARE TESTED (FORWARD FLOW) IN ACCORDANCE WITH THE INSERVICE INSPECTION PROGRAM.

- COST OF MODIFICATION REQUIRED FOR REVERSE FLOW TESTING IS NOT WARRANTED COMPARED TO BENEFITS GAINED BY THE ABILITY TO TEST FOR BACK FLOW.