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ERNST,M.L. Region 2, Ofc of the Director
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TUCKER,H.B. Duke Power Co.

88-28

SUBJECT: Forwards summary of 881006 enforcement conference re potential degraded capabilities of RBCU.

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Duke Power Company
ATTN: Mr. H. B. Tucker, Vice President
Nuclear Production Department
422 South Church Street
Charlotte, NC 28242

Gentlemen:

SUBJECT: ENFORCEMENT CONFERENCE SUMMARY
(NRC INSPECTION REPORT NOS. 50-269/88-28, 50-270/88-28,
AND 50-287/88-28)

This letter refers to the enforcement conference conducted at our request on October 6, 1988. This meeting concerned activities authorized for your Oconee facility. The issues discussed at this meeting related to the potential degraded capabilities of the Reactor Building Cooling Units (RBCU), the corrective actions taken to date, and the continuing effort by Duke Power Company (DPC) to fully understand the degradation process.

It is our understanding that your conclusions are based on your present calculational model which you consider to be yielding conservative results. The degree of conservatism is not known, and additional data will be needed to resolve unknowns and differences. However, you are able to verify with your current method of analysis that the RBCUs are capable of performing their safety-related function, but for a shorter period of time than expected. We acknowledge your commitment for increased frequency of testing for Units 1, 2, and 3 RBCUs to assure component operability and to perform additional data collection. The analysis and updated information will be provided to NRC by December 15, 1988.

We consider the information you provided at the enforcement conference and your extensive activities to monitor the RBCUs sufficiently comprehensive to make reasonable judgements on operability. Therefore, should subsequent information indicate the coolers were degraded, no violation will be issued. In such a situation, the NRC would regard the fouling of the RBCUs as an equipment failure that could not reasonably have been anticipated. Licensees are not ordinarily cited for violations resulting from matters not within their control such as equipment failures that were not avoidable by reasonable quality assurance measures or management controls.

IE01

In accordance with Section 2.790 of NRC's "Rules of Practice," Part 2, Title 10, Code of Federal Regulations, a copy of this letter and its enclosures will be placed in the NRC Public Document Room.

Should you have any questions concerning this matter, please contact us.

Sincerely,

/S/

Malcolm L. Ernst
Acting Regional Administrator

Enclosures:
1. Enforcement Conference Summary
2. List of Attendees
3. Handout

cc w/encls:
M. S. Tuckman, Station Manager
State of South Carolina

bcc w/encls:
NRC Resident Inspector
DRS Technical Assistant
H. Pastis, NRR
Document Control Desk
J. Lieberman, Director, OE

RII	RII	RII	RII	RII	RII	RII
BBonser	TPeebles	VBrownlee	LReyes	AGibson	GJenkins	[redacted]
11/4/88	11/4/88	11/4/88	11/4/88	11/4/88	11/4/88	[redacted]

ENCLOSURE 1

ENFORCEMENT CONFERENCE SUMMARY

On October 6, 1988, representatives of Duke Power Company (DPC) met with the NRC at the NRC's request in the Region II office in Atlanta, Georgia. The topic of discussion was the Degradation of the Reactor Building Cooling Units (RBCU). The list of those attending the meeting is in Enclosure 2.

Following opening remarks given by M. Ernst, NRC, RII Acting Regional Administrator, DPC gave a presentation which addressed the specific concerns that the NRC had requested to be discussed. The presentation consisted of a description of the Low Pressure Injection (LPI) system and RBCUs, sequence of events, method of discovery, cause, consequences, corrective actions, and the safety significance of this issue.

The outline of the DPC presentation is attached as Enclosure 3.

Your presentation at this meeting was extremely beneficial in the understanding of this complex issue. It is especially noteworthy that DPC's performance testing of the RBCUs, in excess of that required by Technical Specifications, identified this issue. The NRC has been particularly interested and is following closely DPC's program to evaluate the heat exchanger fouling phenomenon and implement corrective measures to maintain component operability. We acknowledge DPC's efforts which are leading to improvements in the techniques employed to measure and analyze performance capabilities of heat exchangers.

ENCLOSURE 2

List of Attendees

U.S. Nuclear Regulatory Commission

M. L. Ernst, Acting Regional Administrator
L. A. Reyes, Director, Division of Reactor Projects (DRP)
E. W. Merschoff, Deputy Director, Division of Reactor Safety (DRS)
G. R. Jenkins, Director, Enforcement and Investigation Coordination Staff (EICS)
T. A. Peebles, Section Chief, DRP
B. Uryc, Enforcement Coordinator, EICS
P. Skinner, Senior Resident Inspector, Oconee, DRP
L. Wert, Resident Inspector, Oconee, DRP
F. Jape, Section Chief, DRS
H. Pastis, Project Manager, NRR
V. L. Brownlee, Branch Chief, DRP
J. S. Wermiel, Plant Systems Branch, Nuclear Reactor Regulation (NRR)
S. E. Sparks, Reactor Inspector, DRS

Duke Power Company

H. B. Tucker, Vice President, Nuclear Production Department
M. S. Tuckman, Station Manager, Oconee
C. L. Harlin, Compliance Engineer, Oconee
J. M. Davis, Superintendent Technical Services
D. M. Hubbard, Performance Engineer
R. R. Weidler, Senior Engineer
J. E. Birchfield, Design Engineer, Safety Analysis
P. F. Guill, Nuclear Engineer, Licensing

ENCLOSURE 3

OCONEE NUCLEAR STATION

REACTOR BUILDING COOLING UNITS
LOW PRESSURE INJECTION COOLERS

NRC ENFORCEMENT CONFERENCE
OCTOBER 6, 1988

AGENDA
OCTOBER 6, 1988
DISCUSSION OF RBCU FOULING

* *INTRODUCTION*

* *SYSTEM DESCRIPTION / DESIGN BASES*

* *HISTORY*

* *NATURE OF FOULING ENCOUNTERED*
  - *WATER SIDE*
  - *AIR SIDE*
  - *FOULING RATE DETERMINATION*

* *OPERABILITY DETERMINATION*
  - *METHODOLOGY*
  - *RESULTS*

* *SUMMARY / CONCLUSIONS*
  - *U-3 REPORTABLE*
  - *R/D EFFORT*

* *CLOSING REMARKS*

SYSTEM DESCRIPTIONS

LOW PRESSURE INJECTION SYSTEMS - LPI

** SYSTEM PROVIDES BOTH NORMAL AND ACCIDENT FUNCTIONS*

** TWO FULL CAPACITY ENGINEERED SAFEGUARDS ACTUATED TRAINS*

- *1 PUMP AND 1 COOLER PER TRAIN*

- *INITIAL PHASES OF ACCIDENT USE WATER FROM BWST*

- *LATER PHASES OF ACCIDENT RECIRC WATER FROM REACTOR BUILDING SUMP*

- *SYSTEM REJECTS HEAT TO LOW PRESSURE SERVICE WATER SYSTEM LPSW*

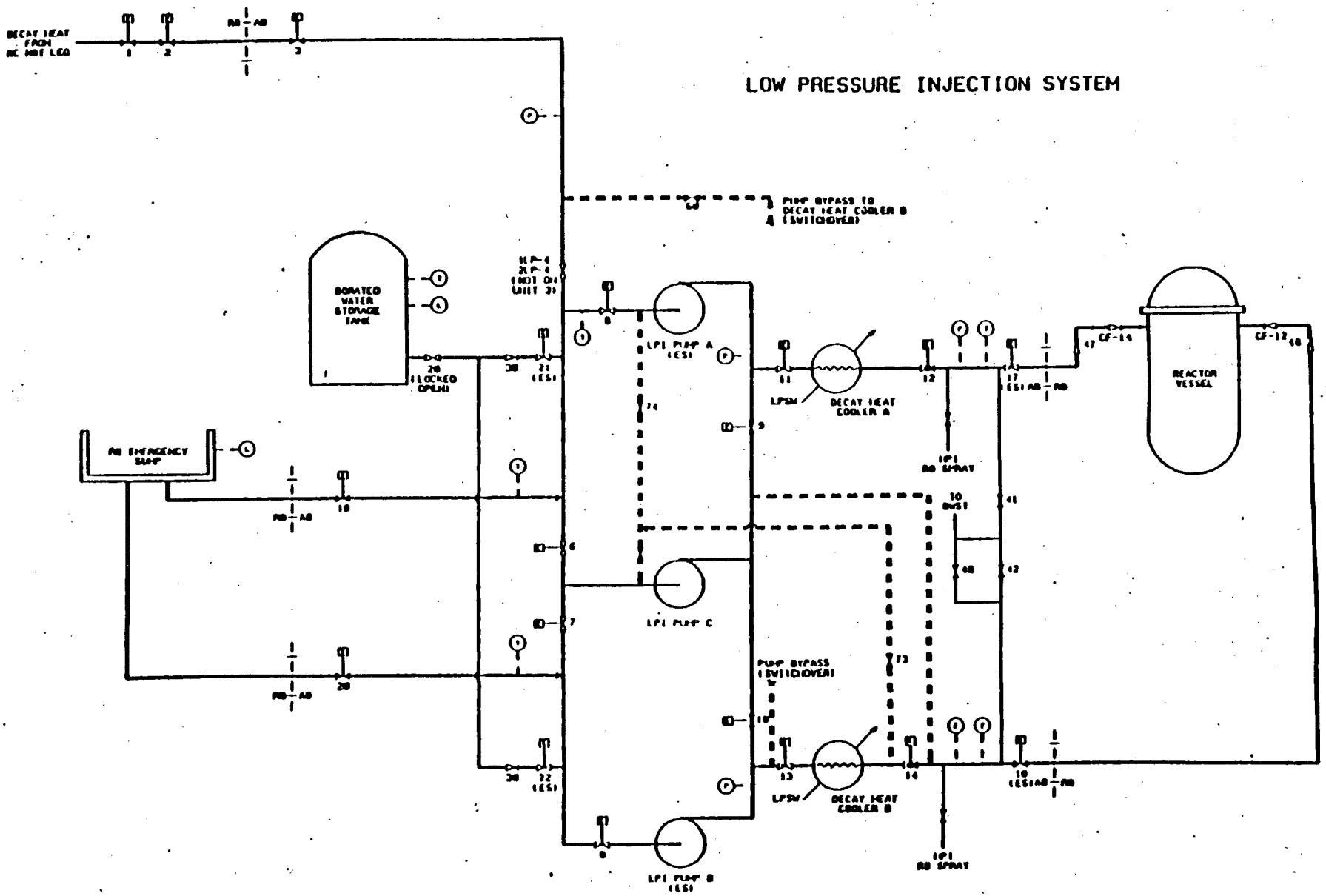
** A THIRD NON-ES PUMP IS PROVIDED*

** NORMAL FLOW IS 3,000 GPM LPSW FOR EACH TRAIN IN ACCIDENT CONDITIONS*

** TWO TRAINS REQUIRED OPERABLE WHEN REACTOR IS ABOVE 250 DEGREES OR 350 PSI*

** COOLERS ARE SHELL AND TUBE TYPE WITH RAW WATER ON SHELL SIDE*

LOW PRESSURE INJECTION SYSTEM



REACTOR BUILDING COOLING UNIT SYSTEM - RBCU

** SYSTEM PROVIDES BOTH NORMAL AND ACCIDENT FUNCTIONS*

** THREE FULL CAPACITY ES INDEPENDENT TRAINS PROVIDED*

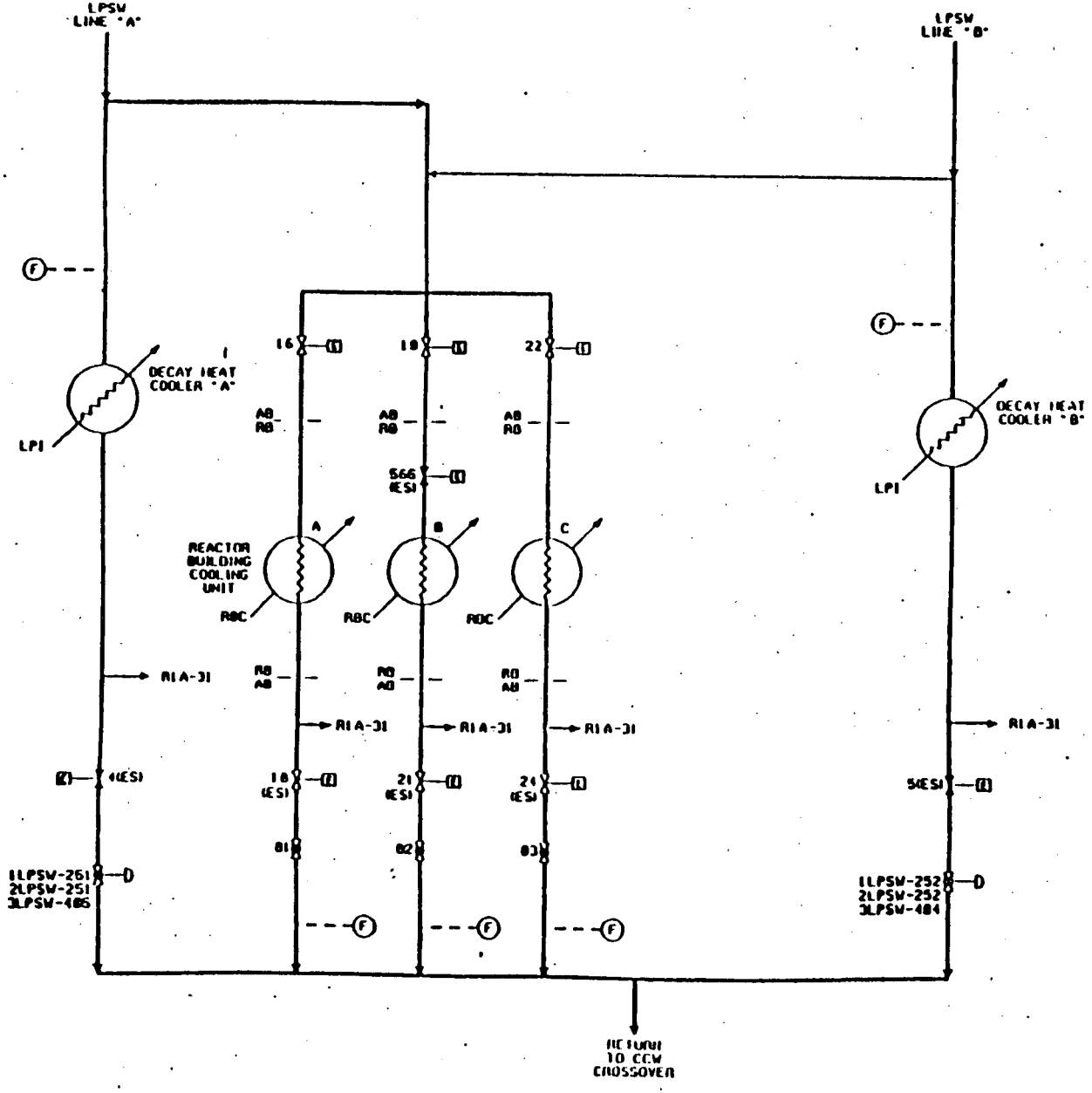
** SYSTEM REJECTS REACTOR BUILDING HEAT TO LOW PRESSURE SERVICE WATER SYSTEM*

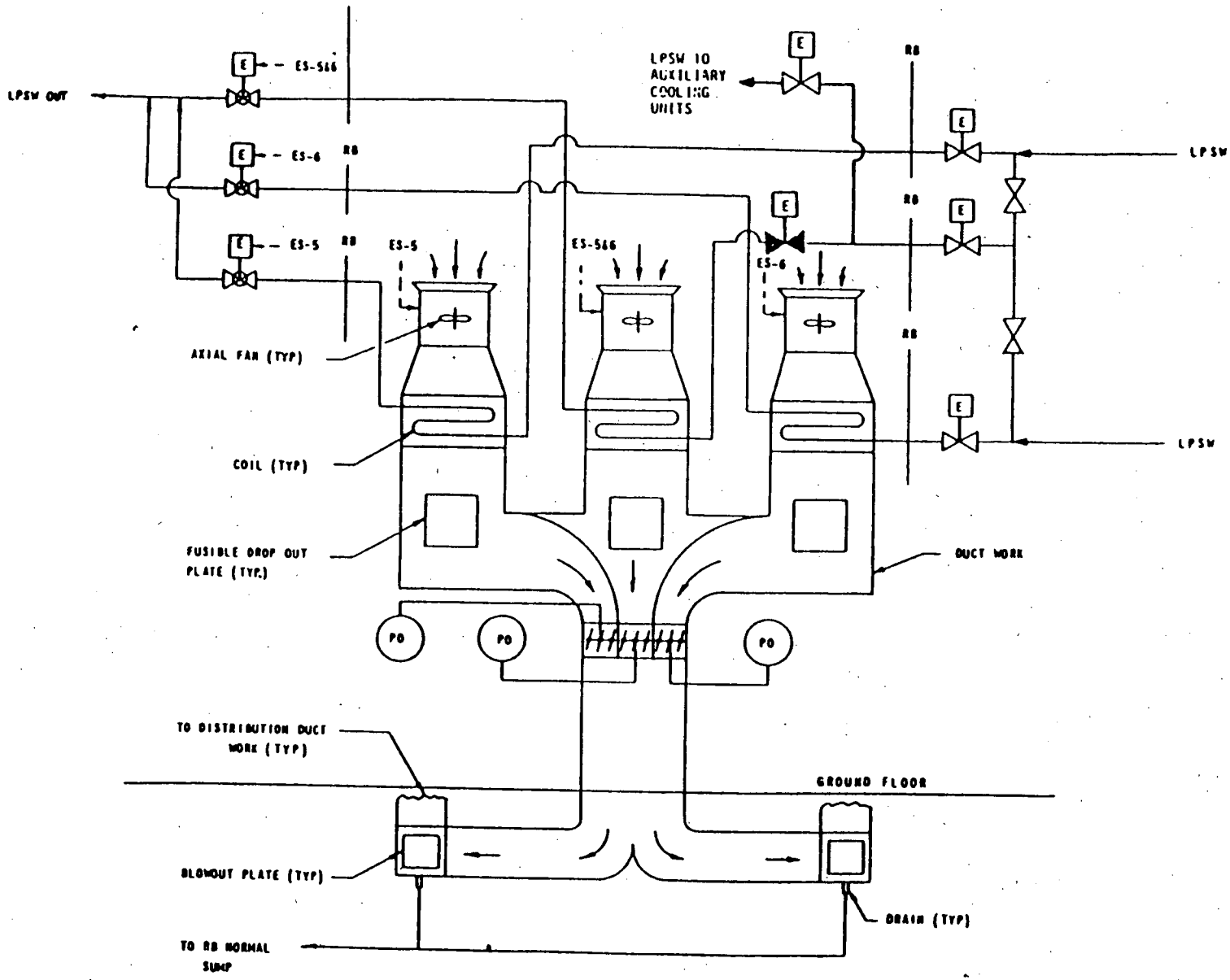
** NORMAL FLOW IS 1400 GPM LPSW FOR EACH COOLER IN ACCIDENT CONDITIONS*

** TWO COOLERS ARE REQUIRED WHEN REACTOR IS ABOVE 250 DEGREES OR 350 PSI*

** THREE COOLERS ARE REQUIRED WHEN THE REACTOR IS CRITICAL*

LOW PRESSURE SERVICE WATER SYSTEM
(REACTOR BUILDING & AUXILIARY BUILDING)





REACTOR BUILDING
COOLING SCHEMATIC
OCONEE NUCLEAR STATION
Figure 6.0-4

DESIGN CRITERIA

NORMAL PLANT OPERATIONS

** REACTOR BUILDING COOLING UNITS MAINTAIN CONTAINMENT ENVIRONMENT*

** RBCU OPERATE UNDER DRY AIR CONDITIONS USING PRIMARILY SENSIBLE HEAT TRANSFER*

** COMBINED HEAT REMOVAL OF BOTH TRAINS OF LPI CAN COOL REACTOR FROM 250 DEGREES TO 140 DEGREES IN 14 HOURS*

EMERGENCY PLANT OPERATIONS

** COMBINED HEAT REMOVAL CAPABILITY OF RBCU'S AND LPI CAN MEET ACCIDENT HEAT GENERATION IN CONTAINMENT*

- *LOSS OF COOLANT ACCIDENT - HEAT REMOVAL AT 30 MINUTE TIME FRAME (PERFORMANCE POINT, NOT REQUIRED TO MEET SAFETY FUNCTION)*

- *LOSS OF COOLANT ACCIDENT - HEAT REMOVAL LONG TERM TO ASSURE THAT CONTAINMENT TEMPERATURE PROFILE BOUNDED BY ENVIRONMENTAL QUALIFICATION REQUIREMENTS*

- *ABOVE CRITERIA ASSUMES THE LOSS OF THE BEST LPI COOLER, BEST REACTOR BUILDING COOLING UNIT, AS WELL AS OTHER CREDIBLE SINGLE FAILURES*

HISTORY

2/6/86	*EVALUATION OF MCGUIRE HEAT EXCHANGER FOULING LED TO RECOMMENDATION TO PERIODICALLY TEST LPI AND RBCU COOLERS*
2/86 TO 3/87	*LPI AND RBCU COOLER DEGRADATION WAS OBSERVED AND ANALYZED USING BEST AVAILABLE ANALYTICAL METHODS. SOME LPI COOLERS NEEDED CLEANING. ANALYSIS RESULTS SHOWED ACCEPTABLE FOR FULL POWER OPERATIONS.*
3/30/87	*NEWLY DEVELOPED CAPABILITY TO ANALYZE RBCU UNDER <u>POST ACCIDENT CONDITIONS</u> INDICATED RBCU'S TO BE UNACCEPTABLE FOR FULL POWER OPERATION.*
4/10/87	*CONFIRMATORY ORDER ISSUED FOR UNITS 1, 2, AND 3* *- UNIT 1 LIMITED TO 91.5%* *- UNIT 2 LIMITED TO 81.7%* *- UNIT 3 CLEAN AND TEST RBCU AND LPI COOLERS PRIOR TO RESTART*
4/30/87	*LER 269/87-04 ISSUED FOR LPI AND RBCU FOULING. UNITS 1, 2, AND 3*
5/13/87	*MEETING HELD WITH REGION II TO DISCUSS COOLER FOULING*
7/13/87 TO 8/19/87	*DUKE PERFORMS SELF INITIATED TECHNICAL AUDIT (SITA) ON LPSW*
7/21/87	*MEETING HELD WITH ONRR TO DISCUSS COOLER FOULING*

11/5/87	*U-1 RBCU COOLERS CLEANED AND TESTED, LPI COOLERS CLEANED AND TESTED. CONFIRMATORY ORDER LIFTED ON UNIT 1*
4/10/88	*U-2 RBCU COOLERS CLEANED AND TESTED. LPI COOLERS CLEANED AND TESTED. REANALYZED EQ ENVELOPE TO TAKE CREDIT FOR ADDITIONAL MARGIN. CONFIRMATORY ORDER LIFTED ON UNIT 2*
8/17/88	*PERFORMANCE TESTING INDICATED UNIT 3 RBCU'S FOULED. NRC NOTIFIED PER 10CFR50.72. U-3 LPI COOLER TESTING SHOWED NO DEGRADATION.*
8/18/88	*UNIT 1 COOLERS TESTED AND VERIFIED OPERABLE WITH SOME DEGRADATION. UNIT 2 COOLERS EVALUATED AS OPERABLE.*
9/8/88	*MEETING WITH NRR AND REGION II AT OCONEE NUCLEAR STATION*
9/22/88	*UNIT 3 RBCU'S TESTED AND VERIFIED OPERABLE. SOME FOULING INDICATED.*
9/27/88	*UNIT 1 RBCU'S TESTED AND SHOWED SOME IMPROVEMENT*
10/4/88	*UNIT 2 RBCU'S RETESTED*
10/6/88	*UNIT 3 RBCU'S RETESTED*
10/6/88	*MEETING WITH REGION II*

NATURE OF FOULING

WATER SIDE

- *KEOWEE LAKE TURBIDITY < 2.0 NTU AVG.*

- *DEPOSITS MOSTLY SILT (SILICA AND CLAY) AND TRACE BIOLOGICAL FOULING*

- *INITIAL DEPOSITS DETERMINATION*

- *DEPOSITS AFTER 18 MONTHS OPERATION*

AIR SIDE

- *BORON AND DUST*

- *INITIAL DEPOSITS DETERMINATION*

- *DEPOSITS AFTER 18 MONTHS OPERATION*

- *EMERGENCY CONDITIONS*

CONCLUSION

- *THE NATURE OF FOULING HAS NOT BEEN CHARACTERIZED AS TO AIR OR WATER SIDE CONTRIBUTION*

FOULING RATE DETERMINATION

** INITIAL PROJECTION OF 4% BASED ON INDUSTRY EXPERIENCE (KERN-SEATON MODEL) AND 15 YEARS OBSERVED FOULING.*

** USE OF MANUFACTURER'S ANALYSIS FOR TEST DATA DEVELOPED AND IS CONTINUING TO BE REFINED.*

** EACH UNIT TESTED TO VERIFY OPERABILITY PRIOR TO RESTART FROM REFUELING SINCE 5/87.*

** FOULING RATES MEASURED AFTER 16 MONTHS ON UNIT 3 AND 10 MONTHS ON UNIT 1 EXCEEDED PROJECTED FOULING ASSUMPTIONS.*

** FUTURE FOULING RATES ARE TO BE BASED ON SUCCESSIVE MEASUREMENTS.*

OPERABILITY DETERMINATIONS

METHODOLOGY

TESTING METHODS

** DATA GATHERED*
- AIR TEMPERATURE - INLET AND OUTLET
- AIR HUMIDITY - INLET AND OUTLET
- WATER TEMPERATURE - INLET AND OUTLET
- WATER FLOW

ANALYSIS METHODOLOGY

** COMPUTER CODE TAKES DATA AND CALCULATES FOULING FACTOR (COMBINATION OF AIR AND WATER SIDE FOULING)*

** COMPUTER CODE TAKES FOULING FACTOR AND CALCULATES LOCA ENVIRONMENT HEAT TRANSFER CAPABILITY*

OPERABILITY DETERMINATION

** ANALYSIS USES WORST LPI COOLER AND TWO WORST RBCU COOLERS*

** HEAT REMOVAL CAPACITY COMPARED TO HEAT REMOVAL REQUIRED*

UNIT 3 RESULTS

** USING AS FOUND LPI AND RBCU TEST DATA, UNIT 3 COULD HAVE ONLY JUSTIFIED 91% POWER AT END OF CYCLE BASED ON CURRENT CONSERVATIVE ANALYSIS.*

** TESTING 9/22/88 ON UNIT 3, AFTER CLEANING, INDICATES CALCULATIONAL METHOD MAY OVERPREDICT FOULING AT HIGH LAKE TEMPERATURE*

**UNIT 1 TESTING 8/18/88 AND 9/27/88 ALSO INDICATES THAT METHOD MAY OVERPREDICT FOULING.*

REACTOR BUILDING COOLER RESULTS AFTER CLEANING

(X E6 BTUs/HR)

DATE	UNIT	A	B	C	LPSW TEMP.
5/87	3	80	80	80	53
11/87	1	79	83	97	68
4/88	2	78	86	78	53
9/88	3	45	45	49	80
AS FOUND TEST ON UNIT 3					
8/88		38	28	32	80

MID-CYCLE TEST RESULTS (RBCUs X E6 BTUs/HR)

8/88	1	56	63	81
9/88	1	68	61	79
10/4	2	60	68	79

UNIT 3 LPI RESULTS (X E6 BTUs/HR)

5/87	106	102	53
8/88	105	111	80

SUMMARY/CONCLUSIONS

** UNIT 1 & 2 RBCU'S ARE STILL CAPABLE OF PERFORMING THEIR SAFETY-RELATED FUNCTION.*

** UNIT 3 WAS DETERMINED TO BE REPORTABLE AND NRC WAS NOTIFIED VIA RED PHONE (8/17/88).*

** OVER THE LAST 2 YEARS DUKE HAS DEVELOPED THE INITIAL CAPABILITY TO MONITOR AND TO DETERMINE THE PREDICTED PERFORMANCE OF THE RBCU'S DURING AN ACCIDENT.*

** IMPROVEMENTS IN TECHNIQUES EMPLOYED TO MEASURE AND TO ANALYZE PERFORMANCE CAPABILITY IS STILL ON-GOING.*

** SURVEILLANCE FREQUENCIES FOR MONITORING RBCU'S PERFORMANCE CAPABILITY WERE ESTABLISHED BASED ON THE BEST INDUSTRY KNOWLEDGE AVAILABLE AT THAT TIME.*

** SURVEILLANCE FREQUENCIES ARE BEING REVISED BASED ON SUCCESSIVE MEASUREMENTS TO ESTABLISH THE SHAPE OF THE FOULING RATE CURVE.*

** FIELD MEASUREMENT OF HEAT TRANSFER FOR AIR TO WATER HEAT EXCHANGERS IS A NEW APPLICATION OF PRINCIPLES THAT ARE DIFFICULT TO SUCCESSFULLY APPLY UNDER THE BEST LABORATORY CONDITIONS.*

** CALCULATIONAL MODEL WAS DEVELOPED TO DESIGN COILS UNDER LIMITED CONDITIONS. USE FOR TEST DATA IS A RECENT APPLICATION THAT YIELDS CONSERVATIVE RESULTS. ADDITIONAL DATA WILL BE NEEDED TO RESOLVE DIFFERENCES.*

** BASED ON THE SUSPECTED ANALYSIS CONSERVATISM RELATED TO ELEVATED LAKE WATER TEMPERATURE, THE DETERMINATION THAT UNIT 3 WAS NOT JUSTIFIED FOR FULL POWER OPERATION AT EOC-10 MAY HAVE BEEN ERRONEOUS. FURTHER TESTING AND ANALYSIS AS THE LAKE TEMPERATURE GOES DOWN IS EXPECTED TO YIELD A HIGHER DEGREE OF CONFIDENCE IN THE ANALYSIS.*