Florida Power
CORPORATION

INTEROFFICE CORRESPONDENCE

Nuclear Engineering (OFFICE) | C2I (MAC) | 5858 (PHONE)

SUBJECT: Crystal River Unit No. 3
Quality Document Transmittal - Analysis/Calculations
File: CALC

TO: Records Management - NR2A

The following analysis/calculation package is submitted as the QA Record copy:

DOCNO (FPC DOCUMENT IDENTIFICATION NUMBER)	REV	SYSTEM(S)	TOTAL PAGES TRANSMITTED
M94-0056	0	SW / RN	FPC 11/30/94 32 33

TITLE
ALLOWABLE SWHE TUBE BLOCKAGE VS. UHS TEMPERATURE

KWDS (IDENTIFY KEYWORDS FOR LATER RETRIEVAL)
HEAT EXCHANGER, BLOCKAGE, UHS, GULF OF MEXICO

DXREF (REFERENCES OR FILES - LIST PRIMARY FILE FIRST)

EQUIP 5-3B	
~~CS94-014~~ NRC 11/30/94 CLOSED 12/5/94	
CS94-015	

VEND (VENDOR NAME)	VENDOR DOCUMENT NUMBER (DXREF)	SUPERSEDED DOCUMENTS (DXREF)
FPC (CAMPBELL)	N/A	N/A
TAG		
SWHE-1A		
SWHE-1B		
SWHE-1C		
SWHE-1D		
PART NO.		

COMMENTS (USAGE RESTRICTIONS, PROPRIETARY, ETC.)
- THIS DATA WILL PROVIDE INPUT TO THE SWHE SURVEILLANCE PROCEDURE.
- THIS CALCULATION MAY REQUIRE REVISION FOLLOWING COMPLETION OF M94-0050.

NOTE:
Use Tag number only for valid tag numbers (i.e., RCV-8, SWV-34, DCH-99), otherwise; use Part number field (i.e., CSC14599, AC1459). If more space is required, write "See Attachment" and list on separate sheet.

DESIGN ENGINEER	DATE	VERIFICATION ENGINEER	DATE	SUPERVISOR, NUCLEAR ENG.	DATE
[signature]	11/29/94	[signature]	11/29/94	[signature]	12/6/94

cc: MAR Office (If MAR Related) ☐ Yes ☒ No
MAR/Project File
Mgr., Nucl. Config. Mgt.
File (CALC) -- FPES - "Original" w/attach
Mgr., Site Nucl. Eng. Serv. w/attach

Supervisor, Nuclear Document Control w/Plant Doc. Rev. Eval. and Analysis / Calc. Summary
Plant Document Review Required ☒ Yes ☐ No
A/E _____ ☐ Yes ☒ No
(If Yes, Transmit w/attach)

RET: Life of Plant RESP: Nuclear Engineering 900 628

Florida Power Corporation

PLANT DOCUMENT REVIEW EVALUATION

DOCUMENT TYPE / NUMBER TO BE EVALUATED

M94-0056 Rev. 0

PART I

INSTRUCTIONS: Calculations, Document Change Notices, and Plant Equipment Equivalency Replacements have the potential to affect plant documents. The Originator of any of these documents is required to determine which, if any, plant organizations should review the subject document for impact. The Originator should use the best judgment to make this determination based on the nature of the changes. If in doubt as to whether or not a plant organization should review a particular document, it is suggested that the subject organization be contacted.

The Originator is to check the appropriate boxes below and attach to the subject package as follows:

Calculations - Insert behind Analysis/Calculation Transmittal
DCNs - Insert behind DCN page 1
PEEREs - Insert behind PEERE page 2
CIDPs - Insert behind CIDP page 1

The above referenced document must be distributed as follows:

- ☐ No Review Required
- ☐ Senior Radiation Protection Engineer
- ☐ Manager, Site Nuclear Services
- ☐ Supervisor, Operations Engineering & Support
- ☐ Manager, Nuclear Maintenance
- ☐ Manager, Nuclear Plant Technical Support
- ☑ Other(s): BILL BREWER

ORIGINATOR / DATE	SUPERVISOR / DATE
K R Cafell 11/22/94	11/29/94

Upon completion of Part I, attach to the subject document, check "Plant Document Review Required" block, as applicable, and give to Nuclear Engineering Clerk for distribution.
CIDPs - Distribute with Attachments
Calcs - Distribute with Transmittal Memo, Summary - PEERE - Distribute with Attachments - DCNs - Distribute with Attachments and Drawings

PART II

INSTRUCTIONS: Upon receipt of the subject document, the assigned Reviewer enters the "Reviewing Department" name below, reviews the subject document for impact on plant procedures, and completes the evaluation below.

REVIEWING DEPARTMENT

PLANT REVIEW IMPACT EVALUATION: The above referenced document has been reviewed and evaluated as follows:

- ☐ No Action Required
- ☐ Action Required: The below listed document(s) is affected and requires revision and/or other actions as indicated (i.e., generate a new procedure, void a procedure, etc.)

DOCUMENTS / ACTIONS

REVIEWER / DATE	SUPERVISOR / DATE *

Upon completion, forward evaluation form only to Nuclear Document Control (NR2A)
* If the Supervisor or designee acts as the Originator or Reviewer, the applicable "Originator/Reviewer" block should be NA'd.

Florida Power Corporation

ANALYSIS/CALCULATION SUMMARY

DOCUMENT IDENTIFICATION NUMBER	DISCIPLINE	CONTROL NO.	REVISION LEVEL
	M	94-0056	0

TITLE

Allowable Tube Blockage vs. UHS Temperature

CLASSIFICATION (CHECK ONE)

☒ Safety Related

☐ Non Safety Related

MAR/SP NUMBER/FILE

EQUIP 5-38

VENDOR DOCUMENT NUMBER

N/A

	REVISION APPROVALS		ITEMS REVISED
Design Engineer	K R Bell		Initial Issue
Date	11/28/94		
Verification Engineer	Craig Miller		
Date/Method*	11/29/94	R	
Supervisor	Barry Litton		
Date	12/6/94		

***VERIFICATION METHODS:** R - Design Review; A - Alternate Calculation; T - Qualification Testing

DESCRIBE BELOW IF METHOD OF VERIFICATION WAS OTHER THAN DESIGN REVIEW

PURPOSE SUMMARY

The purpose of this calculation is to identify when a second SWHE heat exchanger should be cleaned based upon the amount of blockage that is noted during the cleaning of the first SWHE. This decision is a function of the Gulf of Mexico (UHS) temperature

RESULTS SUMMARY

A graph of percent of blockage detected vs. UHS temperature is identified in Attachment #6.

DOCUMENT IDENTIFICATION NO.	REVISION	REF/MAR/SP NUMBER/FILE
M94-0056	0	equip 5-38

SECTION 1 - PURPOSE

The purpose of this analysis is to calculate the percent of macrofouling (tube pluggage and blockage) that is acceptable for the SWHE's. If the blockage noted by visual inspection during the weekly cleaning of the first heat SWHE is greater than that allowed per Attachment #6, for the identified UHS temperature, a second SWHE should be cleaned.

SECTION 2 - DESIGN INPUTS

1. The amount of heat required to be removed from the SW system is 140.38 E6 btu/hr. (Ref. 2)

2. Three (3) heat exchangers are required to be in service. (Ref. 3)

SECTION 3 - ASSUMPTIONS

1. RW flow rate decreases with an increase in the amount of tube blockage.

2. The RW flow rates for various percentages of inlet side tube blockage are taken from Ref. 1 (preliminary), and are as follows:

Percent Blocked	Total RW Flow Rate (gpm)	Flow per HX (gpm)
0%	13,900	4633
20%	13,600	4533
30%	13,150	4383
40%	12,550	4183
50%	11,700	3900

If the subject calculation is issued with the RW flow rate resulting from blockage being less than that identified above, a revision to this calculation is necessary. This assumes equal flow to each heat exchanger.

3. No "second pass" tubes in any heat exchanger are clogged.

4. Three (3) of the four (4) SWHE's are in service.

SECTION 4 - REFERENCES

1. M94-0050, SWHE Heat Removal Capacity with Partially Clogged Tubes. (preliminary).

2. M94-0052, Post LOCA NSCCC Heat Loads, Rev. 0.

3. CR3 Technical Specification, Section 3.7.7.

SECTION 5 - DETAILED ANALYSES/CALCULATIONS

The amount of available heat exchanger area can be calculated using the following formula:

$$\text{Available Area } (ft^2) = 8600 - \{(\text{blockage}(\%))/2\}*(8600)$$

Percent Blocked	Available Area
10%	8170
20%	7740
30%	7310
40%	6880
50%	6450

The maximum UHS temperature which can occur for the defined available area is determined using SWHE.KRC. Validated 11/14/94.

The spreadsheets are attached, as Attachment 1 for 10% blockage through Attachment #5 for 50% blockage

SECTION 6 - RESULTS/CONCLUSIONS

The maximum allowable UHS temperatures and allowable percent of clogging are identified in Attachment's 1 through 5.

The graph of allowable UHS temperature vs. allowable blockage is Attachment #6.

It should be noted that in order to make the analysis more conservative, a second plot of UHS temperature vs. percent blockage is included. This plot should be used when deciding whether a second heat exchanger should be cleaned. The 5°F margin was chosen on the basis of engineering judgement to provide additional margin when considering the unknowns associated with SW/RW heat removal capability (e.g. tube and

shell side fouling, the condition of the other heat exchangers, and the possible temperature changes in the UHS that could occur prior to the next heat exchanger surveillance.)

The graph is used as follows:

1. If the first SWHE was 40% blocked and the Gulf Temperature (UHS) was 93°F (pt. 1), then a second heat exchanger should be cleaned. If the first SWHE was 40% blocked, but the gulf was only 90°F (pt. 2), a second SWHE does not need to be cleaned.

2. If the first SWHE was 50% blocked or greater, the Gulf Temperature (UHS) is insignificant, and the second SWHE should be cleaned because of the likely blockage that has already occurred in the remaining SWHE's.

SECTION 7 - ATTACHMENTS

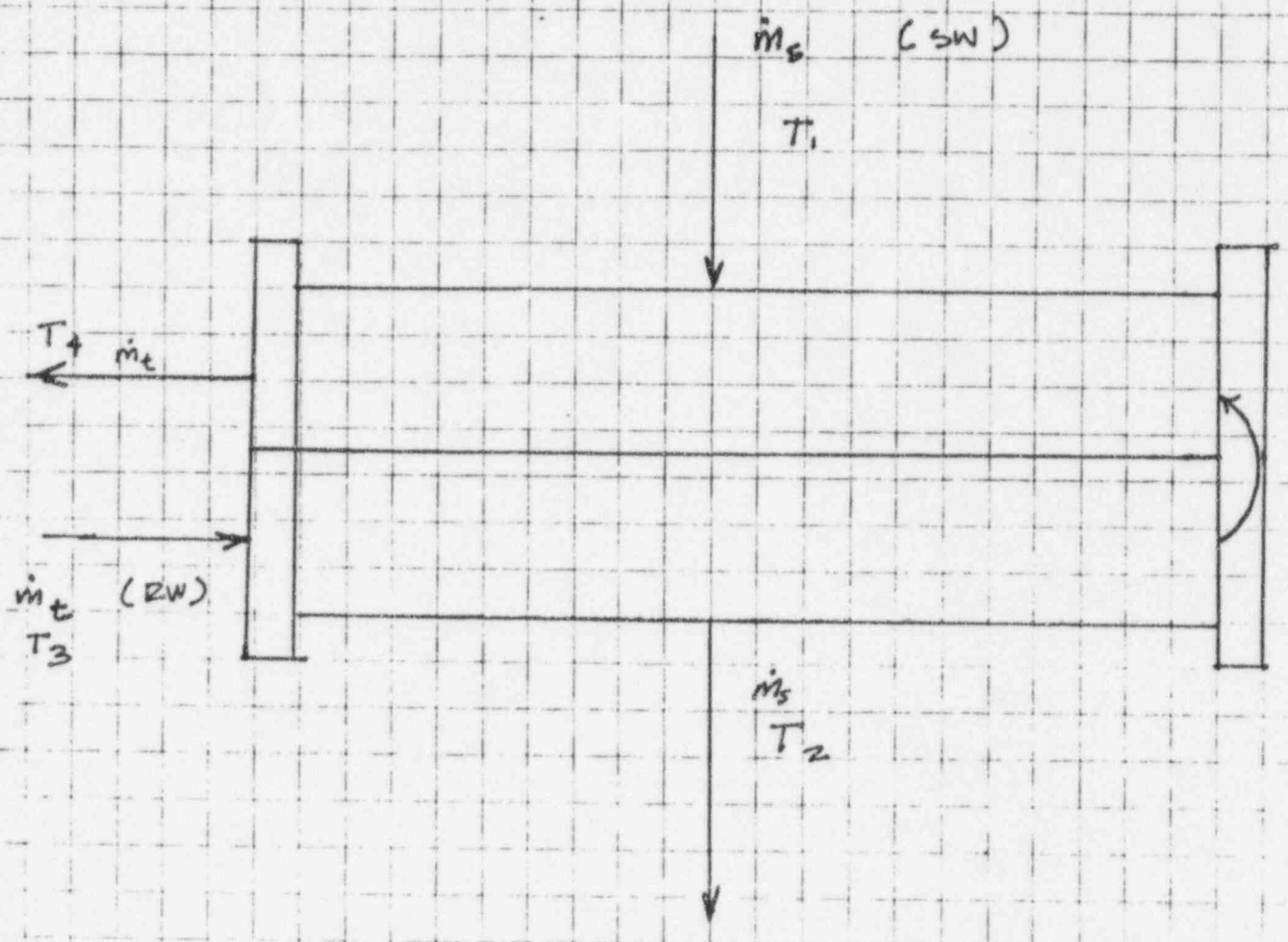
Attachment #1, SWHE performance with 10% Blocked (5 sheets)
Attachment #2, SWHE performance with 20% Blocked (5 sheets)
Attachment #3, SWHE performance with 30% Blocked (5 sheets)
Attachment #4, SWHE performance with 40% Blocked (5 sheets)
Attachment #5, SWHE performance with 50% Blocked (5 sheets)
Attachment #6, UHS Temperature vs. Allowable Blockage (1 sheet)

Florida Power CORPORATION

DESIGN ANALYSIS/CALCULATION

Crystal River Unit 3

DOCUMENT IDENTIFICATION NUMBER	REVISION	REI/MAR/SP NUMBER/FILE
M94-0056	0	EQUIP 5-38



SWHE FLOW RATE AND TEMPERATURE CONFIGURATION

HEAT EXCHANGER THERMAL BALANCING MODEL [SWHE-1A/1B]
FLORIDA POWER CORPORATION-CRYSTAL RIVER UNIT 3

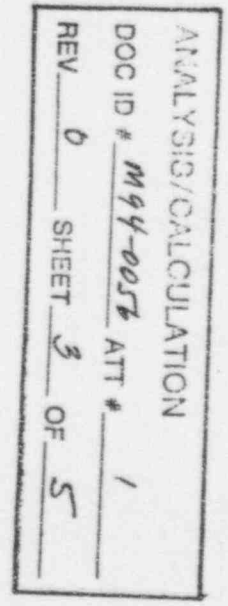
OPERATING CONDITIONS	
SW System Inlet Temperature (T1)(Deg. F	142.58
SW System Outlet Temperature (T2)(Deg.F	110.00
RW System Inlet Temperature (T3)(Deg.F)	100.10
RW System Outlet Temperature (T4)(Deg.F	120.32
SW Heat Exchanger Heat Load (Q)(Btu/Hr)	4.68E+07
SW Flowrate (GPM)	2800
kW Flowrate (GPM)	4633

HEAT EXCHANGER PHYSICAL PARAMETERS	
Number of Tubes (n)	1090
Tube OD (Do)(inches)	0.75
Tube ID (Di)(inches)	0.62
Tube Wall Thickness (tw)(inches)	0.065
Tube Thermal Conductivity (kw)(Btu/Hr-Ft-Deg	30.00
Tube Fluid Density (pt)(lbm/Ft^3)	64.00
Tube Fluid Heat Capacity (Cpt)(Btu/lbm-DegF)	0.94
Shell Fluid Density (ps)(lbm/Ft^3)	62.10
Shell Fluid Heat Capacity (Cps)(Btu/lbm-DegF	1.00
Cleanliness Factor (CF)	0.80
Effective Heat Transfer Area (A)(Ft^2)	8170.00

Q calc	% Diff	Q(Btu/Hr)
4.66E+07	0.4722	4.68E+07
4.67E+07	0.2076	4.68E+07
4.68E+07	-0.0567	4.68E+07
4.70E+07	-0.3207	4.68E+07
4.71E+07	-0.5844	4.68E+07
4.72E+07	-0.8479	4.68E+07
4.73E+07	-1.1111	4.68E+07
4.74E+07	-1.3740	4.68E+07
4.76E+07	-1.6366	4.68E+07
4.77E+07	-1.8990	4.68E+07
4.78E+07	-2.1611	4.68E+07

ANALYSIS/CALCULATION
DOC ID # M94-0057 ATT # 1
REV 0 SHEET 2 OF 5

Ms(lbm/Hr)	Mt(lbm/Hr)	delTs	delTt	T1	T2	T3	T4	GTD	LTD
1.44E+06	2.45E+06	32.58	20.32	142.58	110.00	100.10	120.42	22.16	9.90
1.44E+06	2.45E+06	32.58	20.32	142.68	110.00	100.10	120.42	22.26	9.90
1.44E+06	2.45E+06	32.58	20.32	142.78	110.00	100.10	120.42	22.36	9.90
1.44E+06	2.45E+06	32.58	20.32	142.88	110.00	100.10	120.42	22.46	9.90
1.44E+06	2.45E+06	32.58	20.32	142.98	110.00	100.10	120.42	22.56	9.90
1.44E+06	2.45E+06	32.58	20.32	143.08	110.00	100.10	120.42	22.66	9.90
1.44E+06	2.45E+06	32.58	20.32	143.18	110.00	100.10	120.42	22.76	9.90
1.44E+06	2.45E+06	32.58	20.32	143.28	110.00	100.10	120.42	22.86	9.90
1.44E+06	2.45E+06	32.58	20.32	143.38	110.00	100.10	120.42	22.96	9.90
1.44E+06	2.45E+06	32.58	20.32	143.48	110.00	100.10	120.42	23.06	9.90
1.44E+06	2.45E+06	32.58	20.32	143.58	110.00	100.10	120.42	23.16	9.90



LMTD	P	R	F	LMTD'	Ttavg	Tsavg	Twavg	tfo	Vmo	ho
15.22	0.48	1.60	0.87	13.24	110.26	126.29	118.28	122.28	2.91	8.61E+02
15.26	0.48	1.61	0.87	13.27	110.26	126.34	118.30	122.32	2.91	8.61E+02
15.29	0.48	1.61	0.87	13.31	110.26	126.39	118.33	122.36	2.91	8.61E+02
15.33	0.48	1.62	0.87	13.34	110.26	126.44	118.35	122.40	2.91	8.61E+02
15.37	0.47	1.62	0.87	13.37	110.26	126.49	118.38	122.43	2.91	8.61E+02
15.41	0.47	1.63	0.87	13.41	110.26	126.54	118.40	122.47	2.91	8.61E+02
15.45	0.47	1.63	0.87	13.44	110.26	126.59	118.43	122.51	2.91	8.61E+02
15.49	0.47	1.64	0.87	13.47	110.26	126.64	118.45	122.55	2.91	8.62E+02
15.53	0.47	1.64	0.87	13.51	110.26	126.69	118.48	122.58	2.91	8.62E+02
15.56	0.47	1.65	0.87	13.54	110.26	126.74	118.50	122.62	2.91	8.62E+02
15.60	0.47	1.65	0.87	13.57	110.26	126.79	118.53	122.66	2.91	8.62E+02

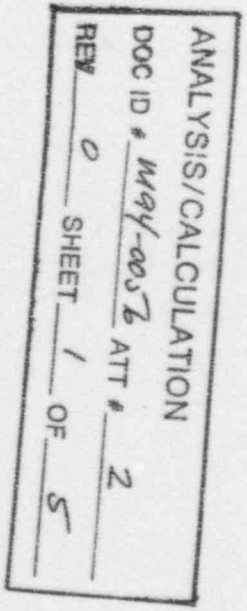
rw	tfi	Vai	hi	U	Uact	Q calc
1.98E-04	114.27	9.03	2.43E+03	538.33	430.66	4.66E+07
1.98E-04	114.28	9.03	2.43E+03	538.39	430.71	4.67E+07
1.98E-04	114.29	9.03	2.43E+03	538.44	430.75	4.68E+07
1.98E-04	114.31	9.03	2.43E+03	538.50	430.80	4.70E+07
1.98E-04	114.32	9.03	2.43E+03	538.55	430.84	4.71E+07
1.98E-04	114.33	9.03	2.43E+03	538.61	430.89	4.72E+07
1.98E-04	114.34	9.03	2.43E+03	538.66	430.93	4.73E+07
1.98E-04	114.36	9.03	2.43E+03	538.72	430.98	4.74E+07
1.98E-04	114.37	9.03	2.43E+03	538.78	431.02	4.76E+07
1.98E-04	114.38	9.03	2.43E+03	538.83	431.06	4.77E+07
1.98E-04	114.39	9.03	2.43E+03	538.89	431.11	4.78E+07

ANALYSIS/CALCULATION
DOC ID # MDP-0057 ATT # 1
REV 0 SHEET 5 OF 5

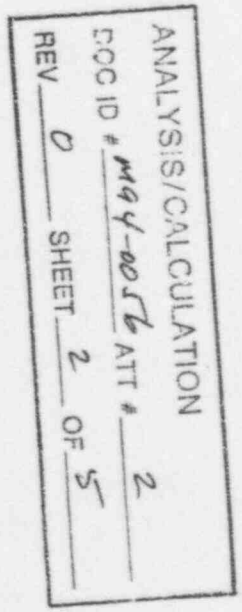
HEAT EXCHANGER THERMAL BALANCING MODEL [SWHE-1A/1B]
FLORIDA POWER CORPORATION-CRYSTAL RIVER UNIT 3

OPERATING CONDITIONS	
SW System Inlet Temperature (T1)(Deg. F	142.58
SW System Outlet Temperature (T2)(Deg.F	110.00
RW System Inlet Temperature (T3)(Deg.F)	99.00
RW System Outlet Temperature (T4)(Deg.F	119.77
SW Heat Exchanger Heat Load (Q)(Btu/Hr)	4.68E+07
SW Flowrate (GPM)	2800
RW Flowrate (GPM)	4533

HEAT EXCHANGER PHYSICAL PARAMETERS	
Number of Tubes (n)	1090
Tube OD (Do)(inches)	0.75
Tube ID (Di)(inches)	0.62
Tube Wall Thickness (tw)(inches)	0.065
Tube Thermal Conductivity (kw)(Btu/Hr-Ft-Deg	30.00
Tube Fluid Density (pt)(lbm/Ft^3)	64.00
Tube Fluid Heat Capacity (Cpt)(Btu/lbm-DegF)	0.94
Shell Fluid Density (ps)(lbm/Ft^3)	62.10
Shell Fluid Heat Capacity (Cps)(Btu/lbm-DegF	1.00
Cleanliness Factor (CF)	0.80
Effective Heat Transfer Area (A)(Ft^2)	7740.00



Q calc	% Diff	Q(Btu/Hr)
4.67E+07	0.2590	4.68E+07
4.68E+07	0.0038	4.68E+07
4.69E+07	-0.2511	4.68E+07
4.70E+07	-0.5057	4.68E+07
4.72E+07	-0.7600	4.68E+07
4.73E+07	-1.0141	4.68E+07
4.74E+07	-1.2680	4.68E+07
4.75E+07	-1.5216	4.68E+07
4.76E+07	-1.7749	4.68E+07
4.77E+07	-2.0280	4.68E+07
4.79E+07	-2.2808	4.68E+07



Ms(lbm/Hr)	Mt(lbm/Hr)	delTs	delTt	T1	T2	T3	T4	GTD	LTD
1.44E+06	2.40E+06	32.58	20.77	142.58	110.00	99.00	119.77	22.81	11.00
1.44E+06	2.40E+06	32.58	20.77	142.68	110.00	99.00	119.77	22.91	11.00
1.44E+06	2.40E+06	32.58	20.77	142.78	110.00	99.00	119.77	23.01	11.00
1.44E+06	2.40E+06	32.58	20.77	142.88	110.00	99.00	119.77	23.11	11.00
1.44E+06	2.40E+06	32.58	20.77	142.98	110.00	99.00	119.77	23.21	11.00
1.44E+06	2.40E+06	32.58	20.77	143.08	110.00	99.00	119.77	23.31	11.00
1.44E+06	2.40E+06	32.58	20.77	143.18	110.00	99.00	119.77	23.41	11.00
1.44E+06	2.40E+06	32.58	20.77	143.28	110.00	99.00	119.77	23.51	11.00
1.44E+06	2.40E+06	32.58	20.77	143.38	110.00	99.00	119.77	23.61	11.00
1.44E+06	2.40E+06	32.58	20.77	143.48	110.00	99.00	119.77	23.71	11.00
1.44E+06	2.40E+06	32.58	20.77	143.58	110.00	99.00	119.77	23.81	11.00

LMTD	P	R	F	LMTD'	Ttavg	Tsavg	Twavg	tfo	Vmo	ho
16.19	0.48	1.57	0.87	14.09	109.39	126.29	117.84	122.07	2.91	8.60E+02
16.23	0.48	1.57	0.87	14.12	109.39	126.34	117.86	122.10	2.91	8.60E+02
16.27	0.47	1.58	0.87	14.16	109.39	126.39	117.89	122.14	2.91	8.60E+02
16.31	0.47	1.58	0.87	14.19	109.39	126.44	117.91	122.18	2.91	8.60E+02
16.35	0.47	1.59	0.87	14.23	109.39	126.49	117.94	122.22	2.91	8.61E+02
16.39	0.47	1.59	0.87	14.26	109.39	126.54	117.96	122.25	2.91	8.61E+02
16.43	0.47	1.60	0.87	14.30	109.39	126.59	117.99	122.29	2.91	8.61E+02
16.47	0.47	1.60	0.87	14.33	109.39	126.64	118.01	122.33	2.91	8.61E+02
16.51	0.47	1.61	0.87	14.36	109.39	126.69	118.04	122.37	2.91	8.61E+02
16.55	0.47	1.61	0.87	14.40	109.39	126.74	118.06	122.40	2.91	8.61E+02
16.59	0.47	1.62	0.87	14.43	109.39	126.79	118.09	122.44	2.91	8.61E+02

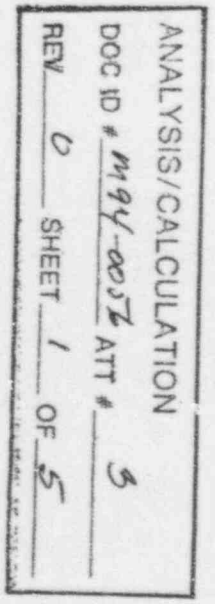
ANALYSIS/CALCULATION
DOC ID # 1194-0052 ATT # 2
REV 0 SHEET 4 OF 5

rw	tfi	Vai	hi	U	Uact	Q calc
1.98E-04	113.61	8.84	2.38E+03	535.05	428.04	4.67E+07
1.98E-04	113.62	8.84	2.38E+03	535.10	428.08	4.68E+07
1.98E-04	113.64	8.84	2.38E+03	535.16	428.13	4.69E+07
1.98E-04	113.65	8.84	2.38E+03	535.21	428.17	4.70E+07
1.98E-04	113.66	8.84	2.38E+03	535.27	428.21	4.72E+07
1.98E-04	113.67	8.84	2.38E+03	535.32	428.26	4.73E+07
1.98E-04	113.69	8.84	2.38E+03	535.38	428.30	4.74E+07
1.98E-04	113.70	8.84	2.38E+03	535.43	428.35	4.75E+07
1.98E-04	113.71	8.84	2.38E+03	535.49	428.39	4.76E+07
1.98E-04	113.72	8.84	2.38E+03	535.54	428.43	4.77E+07
1.98E-04	113.74	8.84	2.38E+03	535.60	428.48	4.79E+07

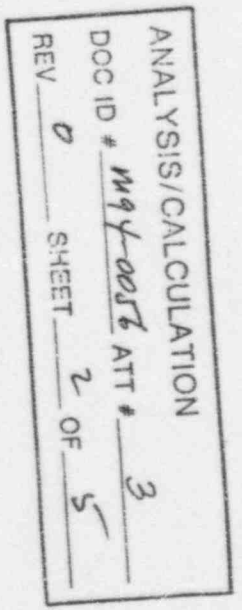
HEAT EXCHANGER THERMAL BALANCING MODEL [SWHE-1A/1B]
FLORIDA POWER CORPORATION-CRYSTAL RIVER UNIT 3

OPERATING CONDITIONS	
SW System Inlet Temperature (T1)(Deg. F	142.58
SW System Outlet Temperature (T2)(Deg.F	110.00
RW System Inlet Temperature (T3)(Deg.F)	97.60
RW System Outlet Temperature (T4)(Deg.F	119.08
SW Heat Exchanger Heat Load (Q)(Btu/Hr)	4.68E+07
SW Flowrate (GPM)	2800
RW Flowrate (GPM)	4383

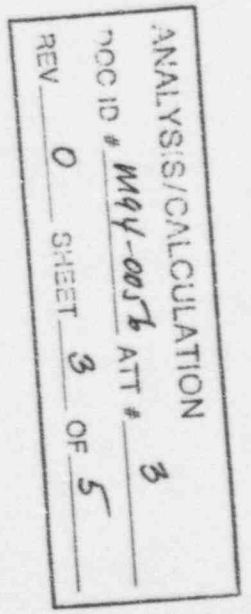
HEAT EXCHANGER PHYSICAL PARAMETERS	
Number of Tubes (n)	1090
Tube OD (Do)(inches)	0.75
Tube ID (Di)(inches)	0.62
Tube Wall Thickness (tw)(inches)	0.065
Tube Thermal Conductivity (kw)(Btu/Hr-Ft-Deg	30.00
Tube Fluid Density (pt)(lbm/Ft^3)	64.00
Tube Fluid Heat Capacity (Cpt)(Btu/lbm-DegF)	0.94
Shell Fluid Density (ps)(lbm/Ft^3)	62.10
Shell Fluid Heat Capacity (Cps)(Btu/lbm-DegF	1.00
Cleanliness Factor (CF)	0.80
Effective Heat Transfer Area (A)(Ft^2)	7310.00



Q calc	% Diff	Q(Btu/Hr)
4.68E+07	-0.0827	4.68E+07
4.70E+07	-0.3284	4.68E+07
4.71E+07	-0.5739	4.68E+07
4.72E+07	-0.8190	4.68E+07
4.73E+07	-1.0640	4.68E+07
4.74E+07	-1.3087	4.68E+07
4.75E+07	-1.5531	4.68E+07
4.76E+07	-1.7973	4.68E+07
4.78E+07	-2.0413	4.68E+07
4.79E+07	-2.2850	4.68E+07
4.80E+07	-2.5285	4.68E+07

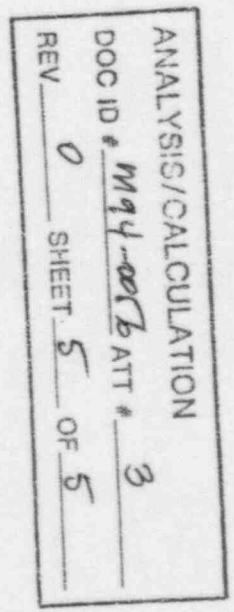


Ms(lbm/Hr)	Mt(lbm/Hr)	delTs	delTt	T1	T2	T3	T4	GTD	LTD
1.44E+06	2.32E+06	32.58	21.48	142.58	110.00	97.60	119.08	23.50	12.40
1.44E+06	2.32E+06	32.58	21.48	142.68	110.00	97.60	119.08	23.60	12.40
1.44E+06	2.32E+06	32.58	21.48	142.78	110.00	97.60	119.08	23.70	12.40
1.44E+06	2.32E+06	32.58	21.48	142.88	110.00	97.60	119.08	23.80	12.40
1.44E+06	2.32E+06	32.58	21.48	142.98	110.00	97.60	119.08	23.90	12.40
1.44E+06	2.32E+06	32.58	21.48	143.08	110.00	97.60	119.08	24.00	12.40
1.44E+06	2.32E+06	32.58	21.48	143.18	110.00	97.60	119.08	24.10	12.40
1.44E+06	2.32E+06	32.58	21.48	143.28	110.00	97.60	119.08	24.20	12.40
1.44E+06	2.32E+06	32.58	21.48	143.38	110.00	97.60	119.08	24.30	12.40
1.44E+06	2.32E+06	32.58	21.48	143.48	110.00	97.60	119.08	24.40	12.40
1.44E+06	2.32E+06	32.58	21.48	143.58	110.00	97.60	119.08	24.50	12.40



LMTD	P	R	F	LMTD'	Ttavg	Tsavg	Twavg	tfo	Vmo	ho
17.36	0.48	1.52	0.87	15.11	108.34	126.29	117.32	121.80	2.91	8.59E+02
17.40	0.48	1.52	0.87	15.14	108.34	126.34	117.34	121.84	2.91	8.59E+02
17.45	0.48	1.53	0.87	15.18	108.34	126.39	117.37	121.88	2.91	8.59E+02
17.49	0.47	1.53	0.87	15.21	108.34	126.44	117.39	121.92	2.91	8.60E+02
17.53	0.47	1.54	0.87	15.25	108.34	126.49	117.42	121.95	2.91	8.60E+02
17.57	0.47	1.54	0.87	15.28	108.34	126.54	117.44	121.99	2.91	8.60E+02
17.61	0.47	1.54	0.87	15.32	108.34	126.59	117.47	122.03	2.91	8.60E+02
17.65	0.47	1.55	0.87	15.35	108.34	126.64	117.49	122.07	2.91	8.60E+02
17.69	0.47	1.55	0.87	15.39	108.34	126.69	117.52	122.10	2.91	8.60E+02
17.73	0.47	1.56	0.87	15.42	108.34	126.74	117.54	122.14	2.91	8.60E+02
17.77	0.47	1.56	0.87	15.46	108.34	126.79	117.57	122.18	2.91	8.60E+02

rw	tfi	Vai	hi	U	Uact	Q calc
1.98E-04	112.83	8.55	2.31E+03	530.20	424.16	4.68E+07
1.98E-04	112.84	8.55	2.31E+03	530.25	424.20	4.70E+07
1.98E-04	112.85	8.55	2.31E+03	530.31	424.25	4.71E+07
1.98E-04	112.87	8.55	2.31E+03	530.36	424.29	4.72E+07
1.98E-04	112.88	8.55	2.31E+03	530.42	424.33	4.73E+07
1.98E-04	112.89	8.55	2.31E+03	530.47	424.38	4.74E+07
1.98E-04	112.90	8.55	2.31E+03	530.53	424.42	4.75E+07
1.98E-04	112.92	8.55	2.31E+03	530.58	424.47	4.76E+07
1.98E-04	112.93	8.55	2.31E+03	530.64	424.51	4.78E+07
1.98E-04	112.94	8.55	2.31E+03	530.69	424.55	4.79E+07
1.98E-04	112.95	8.55	2.31E+03	530.75	424.60	4.80E+07



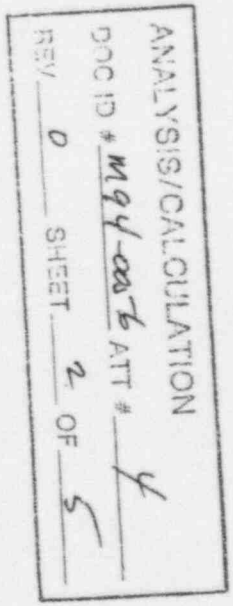
HEAT EXCHANGER THERMAL BALANCING MODEL [SWHE-1A/1B]
FLORIDA POWER CORPORATION-CRYSTAL RIVER UNIT 3

OPERATING CONDITIONS	
SW System Inlet Temperature (T1)(Deg. F	142.58
SW System Outlet Temperature (T2)(Deg.F	110.00
RW System Inlet Temperature (T3)(Deg.F)	96.00
RW System Outlet Temperature (T4)(Deg.F	118.50
SW Heat Exchanger Heat Load (Q)(Btu/Hr)	4.68E+07
SW Flowrate (GPM)	2800
RW Flowrate (GPM)	4183

HEAT EXCHANGER PHYSICAL PARAMETERS	
Number of Tubes (n)	1090
Tube OD (Do)(inches)	0.75
Tube ID (Di)(inches)	0.62
Tube Wall Thickness (tw)(inches)	0.065
Tube Thermal Conductivity (kw)(Btu/Hr-Ft-Deg	30.00
Tube Fluid Density (pt)(lbm/Ft^3)	64.00
Tube Fluid Heat Capacity (Cpt)(Btu/lbm-DegF)	0.94
Shell Fluid Density (ps)(lbm/Ft^3)	62.10
Shell Fluid Heat Capacity (Cps)(Btu/lbm-DegF	1.00
Cleanliness Factor (CF)	0.80
Effective Heat Transfer Area (A)(Ft^2)	6880.00

ANALYSIS/CALCULATION
DOC ID # M94-0078 ATT # 4
REV 0 SHEET 1 OF 5

Q calc	% Diff	Q(Btu/Hr)
4.66E+07	0.4170	4.68E+07
4.67E+07	0.1814	4.68E+07
4.68E+07	-0.0539	4.68E+07
4.69E+07	-0.2890	4.68E+07
4.70E+07	-0.5238	4.68E+07
4.72E+07	-0.7584	4.68E+07
4.73E+07	-0.9928	4.68E+07
4.74E+07	-1.2270	4.68E+07
4.75E+07	-1.4609	4.68E+07
4.76E+07	-1.6946	4.68E+07
4.77E+07	-1.9281	4.68E+07



Ms(lbm/Hr)	Mt(lbm/Hr)	delTs	delTt	T1	T2	T3	T4	GTD	LTD
1.44E+06	2.21E+06	32.58	22.51	142.58	110.00	96.00	118.51	24.07	14.00
1.44E+06	2.21E+06	32.58	22.51	142.68	110.00	96.00	118.51	24.17	14.00
1.44E+06	2.21E+06	32.58	22.51	142.78	110.00	96.00	118.51	24.27	14.00
1.44E+06	2.21E+06	32.58	22.51	142.88	110.00	96.00	118.51	24.37	14.00
1.44E+06	2.21E+06	32.58	22.51	142.98	110.00	96.00	118.51	24.47	14.00
1.44E+06	2.21E+06	32.58	22.51	143.08	110.00	96.00	118.51	24.57	14.00
1.44E+06	2.21E+06	32.58	22.51	143.18	110.00	96.00	118.51	24.67	14.00
1.44E+06	2.21E+06	32.58	22.51	143.28	110.00	96.00	118.51	24.77	14.00
1.44E+06	2.21E+06	32.58	22.51	143.38	110.00	96.00	118.51	24.87	14.00
1.44E+06	2.21E+06	32.58	22.51	143.48	110.00	96.00	118.51	24.97	14.00
1.44E+06	2.21E+06	32.58	22.51	143.58	110.00	96.00	118.51	25.07	14.00

LMTD	P	R	F	LMTD'	Ttavg	Tsavg	Twavg	tfo	Vmo	ho
18.58	0.48	1.45	0.87	16.17	107.25	126.29	116.77	121.53	2.91	8.58E+02
18.63	0.48	1.45	0.87	16.21	107.25	126.34	116.80	121.57	2.91	8.58E+02
18.67	0.48	1.46	0.87	16.24	107.25	126.39	116.82	121.61	2.91	8.59E+02
18.71	0.48	1.46	0.87	16.28	107.25	126.44	116.85	121.64	2.91	8.59E+02
18.75	0.48	1.47	0.87	16.31	107.25	126.49	116.87	121.68	2.91	8.59E+02
18.79	0.48	1.47	0.87	16.35	107.25	126.54	116.90	121.72	2.91	8.59E+02
18.84	0.48	1.47	0.87	16.39	107.25	126.59	116.92	121.76	2.91	8.59E+02
18.88	0.48	1.48	0.87	16.42	107.25	126.64	116.95	121.79	2.91	8.59E+02
18.92	0.48	1.48	0.87	16.46	107.25	126.69	116.97	121.83	2.91	8.59E+02
18.96	0.47	1.49	0.87	16.50	107.25	126.74	117.00	121.87	2.91	8.59E+02
19.00	0.47	1.49	0.87	16.53	107.25	126.79	117.02	121.91	2.91	8.60E+02

ANALYSIS/CALCULATION
DOC ID # M94-00Tb ATT # 4
REV 0 SHEET 4 OF 5

rw	tfi	Vai	hi	U	Uact	Q calc
1.98E-04	112.01	8.16	2.21E+03	523.70	418.96	4.66E+07
1.98E-04	112.03	8.16	2.21E+03	523.75	419.00	4.67E+07
1.98E-04	112.04	8.16	2.21E+03	523.81	419.05	4.68E+07
1.98E-04	112.05	8.16	2.21E+03	523.86	419.09	4.69E+07
1.98E-04	112.06	8.16	2.21E+03	523.92	419.13	4.70E+07
1.98E-04	112.08	8.16	2.21E+03	523.97	419.18	4.72E+07
1.98E-04	112.09	8.16	2.21E+03	524.02	419.22	4.73E+07
1.98E-04	112.10	8.16	2.21E+03	524.08	419.26	4.74E+07
1.98E-04	112.11	8.16	2.21E+03	524.13	419.30	4.75E+07
1.98E-04	112.13	8.16	2.21E+03	524.18	419.35	4.76E+07
1.98E-04	112.14	8.16	2.21E+03	524.24	419.39	4.77E+07

HEAT EXCHANGER THERMAL BALANCING MODEL [SWHE-1A/1B]
FLORIDA POWER CORPORATION-CRYSTAL RIVER UNIT 3

OPERATING CONDITIONS	
SW System Inlet Temperature (T1)(Deg. F	142.58
SW System Outlet Temperature (T2)(Deg.F	110.00
RW System Inlet Temperature (T3)(Deg.F)	93.70
RW System Outlet Temperature (T4)(Deg.F	117.84
SW Heat Exchanger Heat Load (Q)(Btu/Hr)	4.68E+07
SW Flowrate (GPM)	2800
RW Flowrate (GPM)	3900

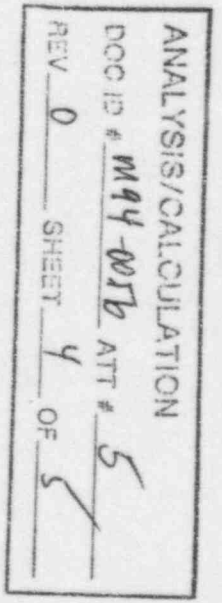
HEAT EXCHANGER PHYSICAL PARAMETERS	
Number of Tubes (n)	1090
Tube OD (Do)(inches)	0.75
Tube ID (Di)(inches)	0.62
Tube Wall Thickness (tw)(inches)	0.065
Tube Thermal Conductivity (kw)(Btu/Hr-Ft-Deg	30.00
Tube Fluid Density (pt)(lbm/Ft^3)	64.00
Tube Fluid Heat Capacity (Cpt)(Btu/lbm-DegF)	0.94
Shell Fluid Density (ps)(lbm/Ft^3)	62.10
Shell Fluid Heat Capacity (Cps)(Btu/lbm-DegF	1.00
Cleanliness Factor (CF)	0.80
Effective Heat Transfer Area (A)(Ft^2)	6450.00

Q calc	% Diff	Q(Btu/Hr)
4.67E+07	0.2878	4.68E+07
4.68E+07	0.0622	4.68E+07
4.69E+07	-0.1632	4.68E+07
4.70E+07	-0.3883	4.68E+07
4.71E+07	-0.6133	4.68E+07
4.72E+07	-0.8380	4.68E+07
4.73E+07	-1.0625	4.68E+07
4.74E+07	-1.2867	4.68E+07
4.75E+07	-1.5108	4.68E+07
4.76E+07	-1.7346	4.68E+07
4.77E+07	-1.9583	4.68E+07

ANALYSIS/CALCULATION
DOC ID # M94-0078 ATT # 5
REV 0 SHEET 2 OF 5

Ma(lbm/Hr)	Mt(lbm/Hr)	delTs	delTt	T1	T2	T3	T4	GTD	LTD
1.44E+06	2.06E+06	32.58	24.14	142.58	110.00	93.70	117.84	24.74	16.30
1.44E+06	2.06E+06	32.58	24.14	142.68	110.00	93.70	117.84	24.84	16.30
1.44E+06	2.06E+06	32.58	24.14	142.78	110.00	93.70	117.84	24.94	16.30
1.44E+06	2.06E+06	32.58	24.14	142.88	110.00	93.70	117.84	25.04	16.30
1.44E+06	2.06E+06	32.58	24.14	142.98	110.00	93.70	117.84	25.14	16.30
1.44E+06	2.06E+06	32.58	24.14	143.08	110.00	93.70	117.84	25.24	16.30
1.44E+06	2.06E+06	32.58	24.14	143.18	110.00	93.70	117.84	25.34	16.30
1.44E+06	2.06E+06	32.58	24.14	143.28	110.00	93.70	117.84	25.44	16.30
1.44E+06	2.06E+06	32.58	24.14	143.38	110.00	93.70	117.84	25.54	16.30
1.44E+06	2.06E+06	32.58	24.14	143.48	110.00	93.70	117.84	25.64	16.30
1.44E+06	2.06E+06	32.58	24.14	143.58	110.00	93.70	117.84	25.74	16.30

LMTD	P	R	F	LMTD'	Ttavg	Tsavg	Twavg	tfo	Vmo	ho
20.23	0.49	1.35	0.87	17.60	105.77	126.29	116.03	121.16	2.91	8.57E+02
20.27	0.49	1.35	0.87	17.64	105.77	126.34	116.06	121.20	2.91	8.57E+02
20.32	0.49	1.36	0.87	17.67	105.77	126.39	116.08	121.24	2.91	8.57E+02
20.36	0.49	1.36	0.87	17.71	105.77	126.44	116.11	121.27	2.91	8.58E+02
20.40	0.49	1.37	0.87	17.75	105.77	126.49	116.13	121.31	2.91	8.58E+02
20.45	0.49	1.37	0.87	17.79	105.77	126.54	116.16	121.35	2.91	8.58E+02
20.49	0.49	1.37	0.87	17.83	105.77	126.59	116.18	121.39	2.91	8.58E+02
20.53	0.49	1.38	0.87	17.86	105.77	126.64	116.21	121.42	2.91	8.58E+02
20.58	0.49	1.38	0.87	17.90	105.77	126.69	116.23	121.46	2.91	8.58E+02
20.62	0.48	1.39	0.87	17.94	105.77	126.74	116.26	121.50	2.91	8.58E+02
20.66	0.48	1.39	0.87	17.98	105.77	126.79	116.28	121.54	2.91	8.58E+02



rw	tfi	Vai	hi	U	Uact	Q calc
1.98E-04	110.90	7.60	2.08E+03	513.90	411.12	4.67E+07
1.98E-04	110.91	7.60	2.08E+03	513.95	411.16	4.68E+07
1.98E-04	110.93	7.60	2.08E+03	514.00	411.20	4.69E+07
1.98E-04	110.94	7.60	2.08E+03	514.05	411.24	4.70E+07
1.98E-04	110.95	7.60	2.08E+03	514.11	411.28	4.71E+07
1.98E-04	110.96	7.60	2.08E+03	514.16	411.33	4.72E+07
1.98E-04	110.98	7.60	2.08E+03	514.21	411.37	4.73E+07
1.98E-04	110.99	7.60	2.08E+03	514.26	411.41	4.74E+07
1.98E-04	111.00	7.60	2.08E+03	514.32	411.45	4.75E+07
1.98E-04	111.01	7.60	2.08E+03	514.37	411.50	4.76E+07
1.98E-04	111.03	7.60	2.08E+03	514.42	411.54	4.77E+07

ATTACHMENT # 6

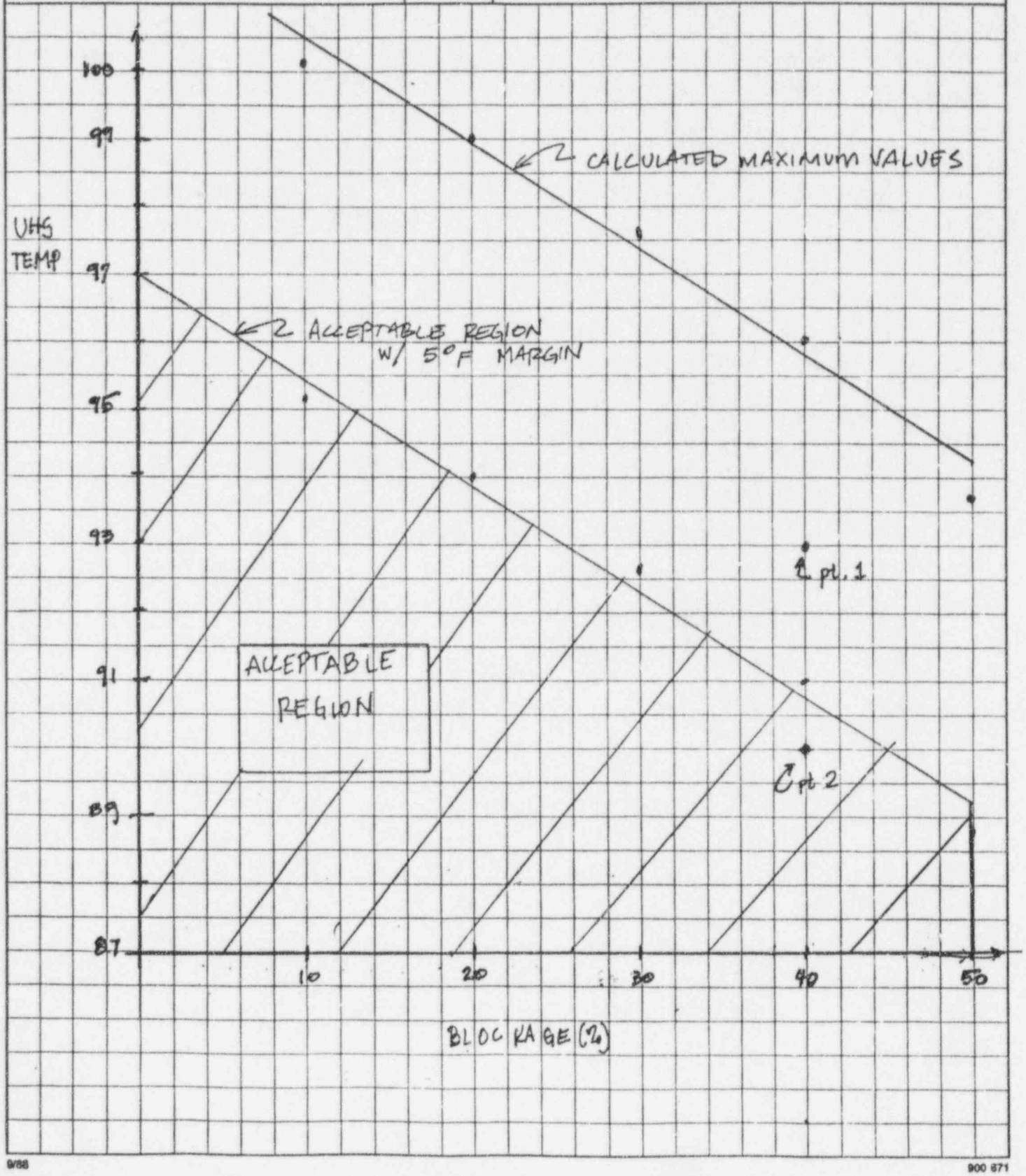
Florida Power CORPORATION

DESIGN ANALYSIS/CALCULATION

Crystal River Unit 3

Sheet 1 of 1

DOCUMENT IDENTIFICATION NUMBER	REVISION	REV/MAR/SP NUMBER/FILE
M94-0056	0	EQUIP 5-3B



Manager, Nuc. Lic.

PRC # 1229

ATTACHMENT A-3
(Page 1 of 3)

OPERABILITY EVALUATION FORM

1. Initiating Individual: W. MARSHALL Date: 12-6-93

2. Initiating Document: NA

3. Affected Item (System, Subsystem or Component)
SW - Nuclear Services Closed Cycle Cooling System

4. System Designation(s)
SW

5. Tag Number(s)
SWHE-1A SWHE-1B SWHE-1C
SWHE-1D

6. Specified Safety Function(s) of Affected Item
Provide cooling water for removal of heat from (SW) supplied loads. Following design basis accident

ATTACHMENT A-3
(Page 2 of 3)

7. Operability Concern

Would the SW system perform its design basis function under design accident condition With identified fouling of the SWHE-1A and SWHE-1D.

8. References (List)

PR 94-0322

9. Recommendation (Check as Applicable)

[X] Operable

[ ] Inoperable

10. Basis for Determination (Use Additional Sheets, if Necessary)

Based on unverified eng. calculations the required heat removal capacity of the SWHEs was not compromised because the cooler gulf water temperature increased the heat exchanger effectiveness. The design basis assumes a 95°F inlet gulf water temp. The recorded gulf water temp. has been in the low 70°F's. The affect approximately doubling the heat removal capacity, offsetting the fouling of approximately 30%/60% of SWHE-1A and SWHE-1D. SEE EREH ATTACHMENT. #941322

ATTACHMENT A-3
(Page 3 of 3)

11. Required Actions:

[ ] Execute applicable Action Statement(s)

_____ _____

[ ] Establish immediate compensatory measures:

Continue opening and cleaning SWHE's until a heat exchanger reveals less than 25% blockage.

[ ] Not Applicable

12. Develop basis for continued operation:

[ ] Internal Position for Continued Operation

[ ] Discretionary Enforcement (Relief from TS)

[X] Not Applicable

13. List of participants:

Ken Wilson
Paul Fleming
Jerry Campbell
Scott Stewart
Mike Donovan
Carl Bergstrom
Ed McLeod
Richard Jackson
Bruce Hickle

Chair: W. Marshall Date: 12/6/94

SSOD: [signature] Date: 12-6-94

NOTE: Attach copy to associated Problem Report.

PRC Mtg. #94-49
Ken Vogel
12/8/94

REQUEST FOR ENGINEERING ASSISTANCE(REA)
***** EMERGENCY REA *****

ORIGINATING DEPARTMENT/ORGANIZATION	REA NUMBER	
SITE NUCLEAR ENGINEERING	941322	Page: 1

Part 1 TO BE COMPLETED BY THE ORIGINATING DEPARTMENT / ORGANIZATION

THIS IS A REQUEST FOR

☐ PLANT ENHANCEMENT ☒ OTHER

SYSTEM | EQUIPMENT TAG NO SWHE-1A

REFERENCES / ASSOCIATED DOCUMENTS

Prob Rpt# _____ MAR Number _____ Vendor Manual No. _____ _____

REA Number _____ PCN Number _____ PEERE No. _____

Procedure No. _____ WR Number NA IOC Number _____

Calibration Data Sheet No. _____ Instrument Data Sheet No. _____

OTHERS NOD-14 ASSESSMENT

DESCRIPTION OF REQUEST

DETERMINE IF THE SHWE'S WERE ABLE TO REMOVE THE DESIGN BASIS ACCIDENT HEAT LOAD WHEN SWHE-1A WAS APPROXIMATELY 60% CLOGGED, SWHE-~~1B~~ 1D WAS 30% CLOGGED, AND SWHE-1C WAS ONLY IN SERVICE ONE WEEK.

GRJ 12/6/94

☐ Continued

ATTACHMENTS

FOR REQUESTS FOR PLANT ENHANCEMENTS PROVIDE THE FOLLOWING(Optional for "OTHER" Requests)

PROPOSED SOLUTION

☐ Continued

REASONS AND BENEFITS

THIS EVALUATION WILL BE ADDED TO THE NOD-14 OPERABILITY ASSESSMENT OF THE HEAT EXCHANGERS.

☐ Continued

PROJECT EVALUATION

Public Relat. ____ Pers. Perf. ____

Reg. Issues ____ Reliability ____

Nuc. Safety ____ Support ____

Pers. Safety ____

ORIGINATOR	PHONE	DATE
JACKSON, G.RICHARD	240-3448	12/06/94
SUPERVISOR/MANAGER	PHONE	DATE
GUTHERMAN, BRIAN	231-4440	12/06/94

FORWARD THE REA TO THE "ENGINEERING CLERK" NUCLEAR ADMIN BLDG (NA - 1E)

REQUEST FOR ENGINEERING ASSISTANCE(REA)

SITE NUCLEAR ENGINEERING	REA NUMBER 941322	Page: 2

Part 2 -- ENGINEERING RESOLUTION

Does this REA Appear to Document a "PROBLEM" as Defined in CP-111

☒ NO - Continue to Process as an REA
☐ YES - Either Return the REA to the Originating Dept/Org for the Generation of a Problem Report, OR Generate a Problem Report. Record the Number of the PR in the REPONSE Block, and Return the REA to the Orginating Dept/Org.

This REA is ASSIGNED TO: G.R. JACKSON ☐ REJECTED BY Engineering;

TOTAL WEIGHTED PRIORITY: _____ (For Plant Enhancement only)

SUPERVISOR/MANAGER	PHONE	DATE
AUSTIN, TERRY V	240-3660	12/06/94

RESPONSE

THE GOVERNING EQUATION FOR THE HEAT EXCHANGER IS:
Q = U * A * LMTD

THE HEAT ABSORBED (Q) BY THE SW THAT MUST BE REJECTED TO THE RW SYSTEM DURING A DESIGN BASIS ACCIDENT IS 140.38E6 BTU/HR.

THE AVAILABLE SURFACE AREA (A) OF THE HEAT EXCHANGER IS REDUCED FROM 8600 SQ FEET TO 6450 SQ FEET PER HEAT EXCHANGER FOR A TWO PASS SPLIT FLOW HEAT EXCHANGER WITH 50% OF THE FIRST PASS TUBES COMPLETELY CLOGGED. (50% IS USED SINCE THE ONE HX ONLY HAS A FEW DAYS OF SERVICE, ONE IS APPR. 30% CLOGGED, AND THE THIRD IS APPR. 60% CLOGGED. ALSO, THE TUBES ARE ASSUMED TO BE COMPLETELY CLOGGED EVEN THOUGH ONLY A PORTION OF THEIR FLOW PATH MAY BE COVERED. IN REALITY, THE PERCENT OF CLOGGING IS PROBABLY MUCH LESS.)

NPRDS REVIEWED: ☒ YES ☐ NOT APPLICABLE

☒ Continued

If the above Response Disposition Requires a MAR to be issued -- An REA Part 3 is Required

DISPOSITIONING DOCUMENTS

PR Number _____ MAR Number _____ Vendor Manual No. _____
REA Number _____ FCN Number _____ PEERE No. _____
Procedure No. _____ WR Number _____ IOC Number _____
Calibration Data Sheet No. _____ Instrument Data Sheet No. _____
OTHERS _____

ATTACHMENTS

☐ Continued

Dispositioning Organization: ☒ SNES: ☐ NPSE: ☐ NOE: ☐ NCM: ☐ Other

ENGINEER	PHONE	DATE
JACKSON, G.RICHARD	240-3448	12/06/94
SUPERVISOR/MANAGER	**PHONE**	**DATE**
GUTHERMAN, BRIAN	231-4440	12/06/94

UPON RESPONSE APPROVAL -- RETURN THE REA TO THE ORIGINATING DEPT/ORG.

CONTINUATION FOR REA PART 2 RESPONSE:

BASED ON ENGINEERING JUDGEMENT AND PRESENTLY UNVERIFIED CALCULATIONS, WITH THE REPORTED SHELL CLOGGING, THE RW FLOW WILL BE APPROXIMATELY 12,000 GPM. (THE DESIGN POINT RW FLOW IS 14,100 GPM BUT IT HAS BEEN MEASURED TO BE 15,900 GPM WITH AN EXCEPTIONALLY CLEAN HEAT EXCHANGER).

THE RECENT GULF WATER TEMPERATURE HAS BEEN RECORDED IN THE LOW 70'S. THUS, THE RW INLET TEMPERATURE TO THE HX CAN BE CONSERVATIVELY CALLED 80 F. BASED ON THE RW FLOW, THE RW INLET TEMPERATURE, AND THE SYSTEM Q, ANALYSIS SHOWS THE RW OUTLET TEMPERATURE SHOULD BE APPROXIMATELY 104 F. THROUGH A SIMILAR APPROACH, THE SW TEMPERATURES WOULD BE ON THE ORDER OF 144 F IN AND 110 F OUT (LIMITING CONDITION). THE CORRESPONDING LMTD WOULD BE 34.8 F. APPLYING A CORRECTION FACTOR FOR A TWO PASS SPLIT FLOW HEAT EXCHANGER (0.965) REDUCES THE LMTD TO 33.6 F.

TAKING THE ABOVE INFORMATION AND SUBSTITUTING IT BACK INTO FIRST EQUATION, THE MINIMUM REQUIRED OVERALL HEAT TRANSFER COEFFICIENT U CAN BE CALCULATED:

U = Q / (A * LMTD)
= (140.38E6 BTU/HR) / (6450 SQ FT * 3 EACH * 33.6 F)
= 216 BTU/HR FT SQ F

PER RECENT SINGLE TUBE TESTING PERFORMED ON SITE, REFERENCE MOLLERUS ENGR CORP REPORT DATED 11/17/94, CR-3'S EFFECTIVE OVERALL HEAT TRANSFER COEFFICIENT WAS MEASURED TO BE AROUND 275 BTU/HR-FT SQ-F (HIGHER THAN THE MIN. REQ'D) WHILE THE TESTING FLOW RATE WAS ONLY 3.44 FT PER SECOND RATHER THAN 9.15 FT PER SECOND AT THE DESIGN POINT. (HIGHER FLOW RATES RESULT IN HIGHER HEAT TRANSFER COEFFICIENTS. THIS IS CONSERVATIVE.)

THEREFORE, IT CAN REASONABLY BE ASSUMED THAT THE AS-FOUND CLOGGED CONDITION WOULD NOT HAVE PREVENTED THE SW HEAT EXCHANGERS FROM PERFORMING THEIR REQUIRED SAFETY FUNCTION DURING A DESIGN BASIS ACCIDENT.

THIS CONCLUSION IS VERY CONSERVATIVE SINCE IT DOES NOT CONSIDER THE FOLLOWING:

1) RW TEMPERATURE IS ~10 F LOWER THAN ASSUMED
2) RWP-1 DISCHARGE PRESSURE DATA INDICATES LITTLE, IF ANY REAL DECREASE IN FLOW

REQUEST FOR ENGINEERING ASSISTANCE(REA)

SITE NUCLEAR ENGINEERING	REA NUMBER 941322	Page: 4

CONTINUATION SHEET - Identify the BLOCK being Continued and Record the Information / Data

CONTINUATION FOR REA PART 2 RESPONSE:

3) THE AVAILABLE HEAT TRANSFER SURFACE AREA IS ACTUALLY HIGHER, SINCE ALL TUBES ARE NOT 100% BLOCKED OFF.

BG NOTE: INDEPENDENT CONFIRMATION OF THE ADEQUACY OF HEAT TRANSFER ASSUMING THE SUBJECT CONDITIONS WAS PERFORMED BY A SECOND ENGINEER PRIOR TO APPROVING THIS REA. REF: SOFTWARE CS 94-015, M94-0056.

PRC# 1102

ATTACHMENT A-3
(Page 1 of 3)

OPERABILITY EVALUATION FORM

1. Initiating Individual: Scot A. Stewart Date: 11/9/94

2. Initiating Document: PR-94-0268, RW System Piping Urethane Liner Failures

3. Affected Item (System, Subsystem or Component)

RW Piping

4. System Designation(s)

RW SW DC

5. Tag Number(s)

SWHE-1A/1B/1C/1D DCHE-1A/1B RW-26, RW-28
RW-33, RW-70

6. Specified Safety Function(s) of Affected Item

Provide cooling water to the SW and DC systems for removal of heat following a design basis accident.

ATTACHMENT A-3
(Page 2 of 3)

7. Operability Concern

Problem Report 94-0268 describes the occassional degradation of the urethane liner. The lining may come off and block RW flow to the DC or SW heat exchangers. Delamination of lining may result in corrosion of piping.

8. References (List)

PM-164 MAR 83-01-27-01

9. Recommendation (Check as Applicable)

[✓] Operable

[ ] Inoperable

10. Basis for Determination (Use Additional Sheets, if Necessary)

See Attached

NOD-14, Evaluating Operability and Determining Safety Function Status

10. Basis for Determination

During the normal performance of PM-112 (DC, SW and SC Heat Exchanger Maintenance Inspection/Cleaning/Shooting) Mechanics remove any debris found in a heat exchanger and document the initial "as-found" conditions. If liner material is found, Engineering would be notified per step 4.2.1 of PM-112. If it is confirmed that a particular spool piece has lost the liner material, follow-up visual or UT thickness inspections are performed. The urethane liner is applied in various colors to help identify the location of an affected piping section if liner material is discovered. Since 1992, only a few small pieces of loose urethane have been found in a heat exchanger. No piece of the urethane was larger than approximately 4" x 6". The urethane pieces found were from spool pieces RW-26 and RW-28. The number of tubes that would have flow restricted was minimal. PR-94-0269 will determine allowable blocked tubes by shell, plugs, lining, etc. 11/10/94

The MAR that justified the application of the urethane coating was 83-06-27-01, Urethane Lining and Access Modifications for RW System. Design Input Record Item No. 8 states "Urethane has far superior bonding characteristics to steel than PVC has. It is highly abrasion resistant and therefore well suited for service in the RW system. Urethane has low water permeability which is needed to prevent corrosion of the pipe wall". The minimal number of lining failures since 1983 help confirm that the urethane is well suited for use in RW system and that it adheres well to pipe surface. In addition, there have not been any reports of large pieces of liner ending up in a heat exchanger. Due to the quality control of the urethane lining application, is it expected that any failure would be localized and would not result in full scale delamination. In the event of localized delamination, it is likely that the rubber would separate from the pipe wall and then tear off in small pieces from the surrounding material due to the water flow. Only minimal flow blockage would occur and that would be removed during the normal inspection & cleaning of the heat exchanger.

A complete internal inspection of the lined piping was performed during 1990. Only one of the urethane coated pieces was discovered to have a torn liner. The liner had delaminated in several areas, but had not come loose. It was replaced during the same outage. The remaining spool pieces were in good condition and provide confidence that the coating can remain intact on the pipe wall.

The liner degradation of the four RW spool pieces addressed by Problem Report 94-0268 has not resulted in a loss of any RW cooling flow path. Periodic visual inspections of lined piping have identified most liner deficiencies.

Spool pieces RW-26 and RW-28 are on the in inlet on SWHE-1C and SWHE-1D. Both 1[illegible]" spool pieces were discovered with delaminated urethane at the elbow. The loose section were removed to prevent potential flow blockage. Both pipe sections are inspected monthly. New coated spool pieces are being fabricated to replace the existing ones.

RW-33 is a 24" 90 Deg elbow on the discharge side of RWP-2B. A 2" stub-out developed a pin-hole leak during May 1994. The leak and repair was handled in accordance with the guidance in Generic Letter 90-05. The root cause of the leak was embrittlement of the lining in only the small stub-out section. There was no delamination or loose material associated with this piece.

RW-70 is located on the discharge of DCHE 1B heat exchanger. Any loose piece as a result of the localized delamination, can not impact heat exchanger flow. UT thickness monitoring of the affected areas will be performed. Replacement will occur as required.

ATTACHMENT A-3
(Page 3 of 3)

11. Required Actions:

[ ] Execute applicable Action Statement(s)

_____ _____

[ ] Establish immediate compensatory measures:

_____

_____

_____

_____

[✓] Not Applicable

12. Develop basis for continued operation:

[ ] Internal Position for Continued Operation

[ ] Discretionary Enforcement (Relief from TS)

[✓] Not Applicable

13. List of participants:

B. P. Wunderly _____

D. P. Jones _____

_____ _____

Chair: T. K. Sullivan Date: 11/10/94

SSOD: [illegible] Date: 11/10/94

PRC mtg. # 94-46

NOTE: Attach copy to associated Problem Report.

Ken Vogel
11/14/94

PROBLEM REPORT PR 94 - 0268

PART 1: INITIATION, REVIEW, AND ISSUANCE OF THE PROBLEM REPORT BY THE ORIGINATING ORGANIZATION

(1) **Title:** RW System Piping Urethane Liner Failures

SUPPORTING INFORMATION

(2a) Discovery Method:	Preparation for SWSOPI		
(2b) Plant Condition:	Normal Operation		
(2c) Occurrence Date:	9/14/94	Time: 0800	
(2d) Plant Location	Building: Auxiliary Bldg	Elevation: 95	Area/Room: Seawater Room
(2e) Equipment Tag Number(s):	RW-26, RW-28, RW-70, RW-33	(2f) Vendor Name::	Urethane Technologies Inc.(Application) & Technical Urethane Inc. (Manufacture)

(3) **Description of the Condition/Event:**

The RW system piping is coated with an urethane material called Techthane 90SS. The use of urethane as an acceptable RW pipe liner was provided in MAR-83-06-27-01 and the original coating was applied by Juno Industries (now known as Urethane Technologies Inc.).

Procedure PM-164 is currently in place and provides for the inspection of the RW piping. Visual inspection per PM-164 as well as video taping of the piping has shown liner degradation of various forms (e.g., bubbling, erosion, tears, missing pieces-delamination-). Also, some leaks in the system piping have occurred due to failure of the urethane coating. Failure could be due either to improper urethane application or failure of the Techthane itself.

The RW piping inspection program needs tighter controls to be implemented, via revision of PM-164, for the inspection, and subsequent monitoring of degraded sections, of RW piping.

Cause of liner failures and adequacy of urethane coatings needs to be determined.

(4) **Is this problem a Radiological Safety Concern?**
[XX] NO
[ ] YES Immediately contact HP Supervisor for proper documentation.

(5) **Requirement(s) Violated:** NONE

(6) **Associated/Related Documents:** PM-164, MAR-83-06-27-01

(7) **Immediate Actions Taken:**

Contacted Urethane Vendors

Recommendations for Resolving the Problem:

1) Contact vendor to determine if failure due to application errors
2) Contact urethane manufacture to determine causes of urethane failures versus currently exhibited signs
3) Contact other utilities who may be using urethane liners in similar applications and discuss problems they may be encountering
4) Based on above determine whether urethane is appropriate for application
5) Ensure adequate inspections and subsequent monitoring is in place along with appropriate corrective actions should liner fail

(9) **Originator** (print name): Les Harris Date: 9/15/94

Originating Department Supervisor/Manager Review, DBI Review and PR CLASSIFICATION DETERMINATION:

(10) **PR is:**
[ ] a KNOWN Design Basis Issue [ ] SUSPECTED Design Basis Issue [XX] Not a Design Basis Issue

(11) Recommended Responsible Organization:	NPTS	Accepted By: J.W. Campbell Date: 9/15/94
Responsible Manager:	J W Campbell	CAP Assignment (if applicable): IELSAS

(12) Originating Supv/Mgr (print & sign):	C A Lee / C O Lee for IEL	(13) PR Issue Date: 9/15/94
(14) [ ] SOTA review required	(Deliver to SOTA and notify SSOD)	
[X] SOTA review NOT required.	(Send to Director, Quality Programs)	
(15) DIRECTOR, QUALITY PROGRAMS:	P. F. McGee	Date: 9/15/94

PROBLEM REPORT TRANSMITTED TO THE RESPONSIBLE ORGANIZATION [ ] By:_____ Date/Time:

Rev. 3/94

RET: Life of Plant RESP: Quality Programs 900 973

PROBLEM REPORT PR 94 - 0268

Page: __

PART 3 - SECTION A: PROBLEM INVESTIGATION AND CAUSE ANALYSIS

(1) **Method of Performing Cause Analysis:** [ ] Structured Analysis [xx] Deductive Logic

(2) CHECK ALL CAUSES THAT APPLY:

Human Performance

[ ] Verbal Communication	[ ] Work Schedule	[ ] Supervisory Methods	[ ] Environmental Conditions
[x] Written Communication	[ ] Work Organization/Planning	[x] Managerial Methods	[ ] Interface Design or Equipment Condition
[ ] Training/Qualification	[ ] Work Practices	[ ] Change Management	
		[ ] Resource Management	

Equipment Performance

[x] Plant/System Operation	[x] Maintenance/Testing	[ ] External	[ ] Design Configuration/Analysis
[x] Equipment Spec/Mfg/Construction			

(3a) **Primary Cause(s):** There are three possible causes associated with the failure of the Techthane 90SS coatings in the RW piping; improper application, material failure and normal service. The 2" stub out on spool RW-33 has failed before. The vendor stated that they have had problems in the past with application of the urethane specifically on the 2" stub outs. The bubbling and wear of the liner are both normal service life conditions. The manufacturer of Techthane (Technical Urethanes) was contacted to discuss the various liner conditions. The vendor stated that bubbling of the urethane was caused by water permeation and that it was a normal occurrence with urethane liners. The vendor said that urethane does have a defined life in this application and it depends on the fluid being piped and the conditions (temperature, pressure, etc.). The wearing as well as the bubbling are part of that defined life. In addition, any tears that are identified are due to sharp objects (i.e. shells) that may be in the water. The delamination of the urethane liner is being investigated as part of the corrective action plan and the appropriate steps will be taken following the determination of cause.

(3b) **Secondary Cause(s):**

(3c) **Contributing Factor(s)** : There are two contributing factors associated with the leaking spool piece RW-33. Inadequate resolution or failure to identify a problem (thereby having no resolution) contributed to the failure as no actions to identify and correct the problem were taken. Also, due to inadequate liner inspections (PM) urethane degradation was not identified until a leak had occurred. Also, there is not a program in place to more closely monitor the condition of the piping as well as the linear if a degraded condition is identified, thus allowing it to continue until failure.

(4) **SUPPORTING INFORMATION** (IF APPLICABLE):

LER No:		PROCEDURE No:	PM-164	WR No:		NRC VIOLATION No:	

OTHER: MAR-89-07-01-01, Juno Ind PO F770532V

(5) **Nuclear Safety Consequences Analysis:** N/A

(6) Previous Similar Events/Conditions: N/A

(7) **Manufacturer/Nameplate Data:** N/A

(8) **Nonconforming Equipment/Material Disposition:**

[ ] N/A (no nonconforming equipment or material involved) [ ] Accept-As-Is* [ ] Repair* [ ] Rework

[ ] Other (describe): _____

* Engineering Justification and Approval Required for these Dispositions (obtain documentation and attach)

(9) **Maintenance Preventable Functional Failure (MPFF):**

[X] No [ ] INITIAL [ ] REPETITIVE

PROBLEM REPORT PR 94 - 0268

Page: ___

PART 3 - SECTION B: Corrective Action Plan (CAP)

(1) Corrective Action Plan:

ACTIONS	SCHEDULED COMPLETION DATE	ASSIGNED ORGANIZATION/INDIVIDUAL
Contact urethane coating supplier (Technical Urethane Inc.) to determine if coating failure can occur, life of coatings, recommendations for alternatives.	Completed	NPTS, Les Harris
2. Contact urethane application vendor (Urethane Technologies Inc.) and arrange for vendor to inspect spool RW-33 and determine cause of failure. Discuss other urethane liner failures (delamination). Obtain vendor evaluate recommendations for corrective actions.	11/30/94	NPTS, Scot Stewart
3. Based on the vendor recommendations obtained in step 3, review for impact on QA inspection and acceptance procedures for urethane lined piping.	01/31/95	SNES J. E. Colby, per phone conversation 9/28
4. Perform a failure analysis of spool piece RW-33.	1/31/95	SNES, J. E. Colby, per phone conversation 9/28
5. Recommend needed revisions to PM-164 considering the following: adequacy of acceptance criteria; revised spool piece drawings; response to degraded or failed liners, initiate WR to monitor (UT) spools with liner failure; periodically reinspect (UT) spool; typos; enclosure; documentation.	04/30/95	NPTS, Scot Stewart
6. Revise PM-164 to incorporate CAP #5	07/30/95	Planning, C. H. Long
7. Have replacement spool pieces for RW-26 and RW-28 fabricated (WR# 321596 & WR 318869)	3/1/95	Scheduling, B. Moore, per conversation 9/28
8. Replace spool pieces RW-26 & RW-28 (WR# 319963 & WR# to be planned)	3/1/95	Scheduling, B. Moore, per conversation 9/28
9. Perform initial UT of RW-70 elbow (WR# 321598) and periodic UT inspections (90 days interval). Provide results to System Engineer.	11/30/94	Scheduling, B. Moore
10. Evaluate alternative material (i.e., Techthane products (9855), flame spray, etc.) for pipe lining. (REA 94-1107)	3/1/95	SNES, T. Petrowsky, per phone conversation 9/28
11. Write RPA to fund inspection of RW piping ("A" DC, "B" DC, SW/RW) (See CS 977, Control Sheet 949)	03/31/95	NPTS, Scot Stewart
12. Review appropriate documentation and plant configuration and issue CIDPs & DCNs as necessary to have all RW spool pieces included in CMIS and to revise incorrect data for existing spools.	6/1/95	NOE, B. Gutherman, per conversation 9/29
13. Evaluate results of CAP and develop additional steps if necessary.	9/30/95	NPTS, Scot Stewart

(2) ADDITIONAL CAP INFORMATION:
In a discussion with Jose Gines at BG&E the subject of urethane liner failures (delamination) was raised. He stated BG&E failure analysis of the same problem concluded that delamination as seen on the inner portion of elbows was due to unstable flow conditions. At this point in the piping the flow is going through a cyclic action; it attaches in laminar flow to the pipe wall then breaks free in turbulent flow and then reattaches. This cyclic action over time causes the layer of urethane to break loose eventually tearing in a sheet.

(3) Developed by (print & sign): Les Harris Date: 09/29/94

(4) Responsible Organization Approval by (print & sign): Jerry W. Campbell Date: 9/30/94

IF THE PROBLEM IS CLASSIFIED AS REPORTABLE OR A TECHNICAL SPECIFICATION VIOLATION, THEN OBTAIN THE FOLLOWING APPROVALS

(5) PRC: MTG No:

(6) DNPO: Date:

WHEN COMPLETE, TRANSMIT TO SUPERVISOR, QUALITY SYSTEMS.

Rev: 3/94 RET: Life of Plant RESP: Quality Programs 901 215 (2 of 2)

PROBLEM REPORT

PR 94 - 0268

PART 4: EVALUATION OF CAUSE, CAP, AND COMPLETION SCHEDULE BY THE QUALITY PROGRAMS TECHNICAL REVIEWER

Comments:

0 CLOSED M.W. DONOVAN SUPVR, SITE NUCL ENGINEERING SVCS (NPSE PRI ME

PERFORM PROBLEM INVESTIGATION, CAUSE ANALYSIS, AND CORRECTIVE ACTION PLAN (CAP) DEVELOPMENT

1 CLOSED J. W. CAMPBELL MGR, NUCL PLANT TECHNICAL SUPPORT

CONTACT URETHANE COATING SUPPLIER (TECHNICAL URETHANE INC.) TO DETERMINE HOW COATING FAILURE CAN OCCUR, LIFE OF COATINGS, RECOMMENDATIONS FOR ALTERNATIVES

2 OPEN J. W. CAMPBELL MGR, NUCL PLANT TECHNICAL SUPPORT

CONTACT URETHANE APPLICATION VENDOR (URETHANE TECHNOLOGIES INC.) AND ARRANGE FOR VENDOR TO INSPECT SPOOL RW-33 AND DETERMINE CAUSE OF FAILURE. DISCUSS OTHER URETHANE LINER FAILURES (DELAMINATION). OBTAIN VENDOR EVALUATION RECOMMENDATIONS FOR CORRECTIVE ACTIONS.

3 OPEN J. E. COLBY MGR, NUCL PROCUREMENT ENGINEERING SERVICES

BASED ON THE VENDOR RECOMMENDATIONS OBTAINED IN STEP 3, REVIEW FOR IMPACT ON QA INSPECTION AND ACCEPTANCE PROCEDURES FOR URETHANE LINED PIPING.

4 OPEN J. E. COLBY MGR, NUCL PROCUREMENT ENGINEERING SERVICES

PERFORM A FAILURE ANALYSIS OF SPOOL PIECE RW-33.

5 OPEN J. W. CAMPBELL MGR, NUCL PLANT TECHNICAL SUPPORT

RECOMMEND NEEDED REVISIONS TO PM-164 CONSIDERING THE FOLLOWING: ADEQUACY OF ACCEPTANCE CRITERIA; REVISED SPOOL PIECE DRAWINGS; RESPONSE TO DEGRADED OR FAILED LINERS, INITIATE WR TO MONITOR (UT) SPOOLS WITH LINER FAILURE; PERIODICALLY REINSPECT (UT) SPOOL; TYPOS; ENCLOSURE; DOCUMENTATION.

6 OPEN C. H. LONG NUCL MAINTENANCE WORK CONTROLS MGR

REVISE PM-164 TO INCORPORATE CAP #5.

7 OPEN B. C. MOORE MGR, NUCL INTEGRATED SCHEDULING

HAVE REPLACEMENT SPOOL PIECES FOR RW-26 AND RW-28 FABRICATED (WR 321596 & WR 318869).

8 OPEN B. C. MOORE MGR, NUCL INTEGRATED SCHEDULING

REPLACE SPOOL PIECES RW-26 & RW-28 (WR 319963 & WR TO BE PLANNED).

9 OPEN B. C. MOORE MGR, NUCL INTEGRATED SCHEDULING

PERFORM INITIAL UT OF RW-70 ELBOW (WR 321598) AND PERIODIC UT INSPECTIONS (90 DAY INTERVALS). PROVIDE RESULTS TO SYSTEM ENGINEER.

10 OPEN A. PETROWSKY SUPERVISOR, MECHANICAL/STRUCTURAL

EVALUATE ALTERNATIVE MATERIAL (I. E., TECHTHANE PRODUCTS (9855), FLAME SPRAY, ETC.) FOR PIPE LINING. (REA 94-1107)

11 OPEN J. W. CAMPBELL MGR, NUCL PLANT TECHNICAL SUPPORT

WRITE RPA TO FUND INSPECTION OF RW PIPING ("A" DC, "B" DC, SW/RW) (SEE NOCS 977, CONTROL SHEET 949)

12 OPEN B. GUTHERMAN NUCL ENGINEERING SUPERVISOR (MECH/STRUCT)

REVIEW APPROPRIATE DOCUMENTATION AND PLANT CONFIGURATION AND ISSUE CIDPs & DCNs AS NECESSARY TO HAVE ALL RW SPOOL PIECES INCLUDED IN CNIS AND TO REVISE IN CORRECT DATA FOR EXISTING SPOOLS.

13 OPEN J. W. CAMPBELL MGR, NUCL PLANT TECHNICAL SUPPORT

EVALUATE RESULTS OF CAP AND DEVELOP ADDITIONAL STEPS IF NECESSARY.

(1) Quality Programs Review (print & sign): Date:

R. Nicholas 10/04/94

PRC# 1103

ATTACHMENT A-3
(Page 1 of 3)

OPERABILITY EVALUATION FORM

1. Initiating Individual: B P. Wunderly Date: 11/9/94

2. Initiating Document: PR94-032C

3. Affected Item (System, Subsystem or Component)
CONTROL COMPLEX CHILLER, PASS SAMPLE COOLERS,
NORMAL DUTY SW PUMP, NORMAL DUTY RW PUMP

4. System Designation(s)
SW/RW CH CA

5. Tag Number(s)
CHHE-1A CHHE-1B CAHE-8
CAHE-5 CAHE-6 SWP-1C & RWP-1

6. Specified Safety Function(s) of Affected Item
CHHE: Remove heat from control complex to
support personnel habitability and functionality
of safety-related equipment.
PASS Sample Cooler: Only safety function is ~~RW~~ SW
pressure boundary

ATTACHMENT A-3
(Page 2 of 3)

7. Operability Concern

SW flow to subject components may be inadequate for components to perform safety function. This condition potentially impacts Operability requirements for Technical Specification equipment

8. References (List)

EDBD 6/22 (CA) EDBD 6/11 (SW) PT-136 (Working copy from ER)
NRC Letter 3N1293-30 SP-459

9. Recommendation (Check as Applicable)

[X] Operable

[ ] Inoperable

10. Basis for Determination (Use Additional Sheets, if Necessary)

CHHE: ITS LCO 3.7.12 "CREVs" does not address the temperature control function of system (Ref. NRC letter 3N1293-30 and 'LCO' Section of Bases). Temperature in control room monitored on shiftly basis with no observed degradation in system performance. Thus,

(continued)

Continuation of #10 from NOD-14

equipment (RPS, ES, VBITs) supported by chiller operation continues to be OPERABLE. NPTS installed ~~flow~~ pressure gauges and temporary ultrasonic flow meter to confirm present flow. Measured flow provides high confidence flow to chillers would be adequate following an ES actuation.

PASS Sample Coolers: No applicable ITS LCO. ITS 5.6.2.6 requires administrative controls to ensure the capability to obtain and analyze post-accident samples. Sample coolers are continuously on line with SW supplied. Actual data on sample cooler outlet temperature was obtained as part of this evaluation for CAHE-8 (first, hottest cooler). Results indicate entire heat load being removed by SW thus affirming adequate SW flow.

Normal duty SW/RW pumps: Non safety related pumps - not addressed by Technical Specifications.

- Based upon results of evaluation, Task Force recommends revising PR design basis issue determination to be "Suspected design basis issue" to allow for further evaluation of discrepancies between measured flow and assumed flow.

ATTACHMENT A-3
(Page 3 of 3)

11. Required Actions:

[ ] Execute applicable Action Statement(s)

_____ _____

[ ] Establish immediate compensatory measures:

_____

_____

_____

_____

[X] Not Applicable

12. Develop basis for continued operation:

[ ] Internal Position for Continued Operation

[ ] Discretionary Enforcement (Relief from TS)

[X] Not Applicable

13. List of participants:

S. Stewart — J. Lane

D.M Porter — B. Wunderly

B. Gutherman — J Maseda

Chair: B Brindisi Date: 11/9/94

SSOD: _____ Date: NOV - 9 1994

NOTE: Attach copy to associated Problem Report.

PRC Mtg. # 94-46
Ken Vogel
11/14/94

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

December 20, 1993

J. ALEDORT	NA2C
M.W. ARNETT	C2M
M.F. BAILEY	DUKE
F.M. BOARD, JR.	A7E
J.L. BURÉ	NA2I
DOCKET FILE	C2M
J.P. GIBSON	NA2B
W.B. GRAY	BWNS
D. HASELER	GPUN
D. JAMES	ANO
F. KENNEDY	TE
L.C. KELLEY	NUM7
L.W. MOFFATT	NA2G
NCSC SUBCOMM. 141	Q&RV
C. OBERNDORFER	SA2D
RECORDS MGMT	NR2A
P.R. TANGUAY	C2I
S.R. WILSON	NA7
B.P. WUNDERLY	NA2I

Docket No. 50-302

Mr. Percy M. Beard, Jr.
Senior Vice President,
Nuclear Operations
Florida Power Corporation
ATTN: Manager, Nuclear
Licensing (NA2I)
Crystal River Energy Complex
15760 W Power Line Street
Crystal River, Florida 34428-6708

ISSUANCE OF AMENDMENT 149
(TSCR# 171)
SUBJECT:
FILE NO.: 3N12.93-30
RECEIVED: 12/21/93
ACTION BY: B.P. WUNDERLY
DUE DATE: EFFECTIVE IMMEDIATELY
IMPLEMENTATION - 7/13/94

Dear Mr. Beard:

SUBJECT: CRYSTAL RIVER UNIT 3 - ISSUANCE OF AMENDMENT RE: IMPROVED TECHNICAL SPECIFICATIONS (TAC NO. M74563)

The Commission has issued the enclosed Amendment No. 149 to Facility Operating License No. DPR-72 for the Crystal River Unit No. 3 Nuclear Generating Plant (CR-3). This amendment consists of changes to the Technical Specifications (TS) in response to your application dated August 25, 1989.

This amendment replaces in its entirety the current Technical Specifications (TS) with a set of TS based on the new Babcock & Wilcox Standard Technical Specifications, NUREG-1430.

A copy of the Safety Evaluation is also enclosed. Also enclosed is the Notice of Issuance which has been forwarded to the Office of the Federal Register for publication.

As noted in the Safety Evaluation, an audit will be performed following implementation to ensure that you have established effective controls for the requirements that are being relocated from the existing TS to other licensee-

controlled documents. We suggest that you perform your own audit to ensure that the commitments in your letter dated November 23, 1993 have been fully accomplished.

Sincerely,

B Mattson for

Harley Silver, Senior Project Manager
Project Directorate II-2
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Enclosures:
1. Amendment No. 149 to DPR-72
2. Safety Evaluation
3. Federal Register notice

cc w/enclosures:
See next page

within the response time credited in the MFW line break analysis. Two valves are provided for isolation, to provide redundant isolation devices.

The staff has evaluated the above LCO additions and concludes that they comply with the existing Crystal River licensing basis and are therefore acceptable.

FPC has proposed not to add NUREG-1430 Specifications 3.7.11, "Control Room Emergency Air Temperature Control System," 3.7.12, "Emergency Ventilation System;" and 3.7.13, "Fuel Storage Pool Ventilation System," to the improved Crystal River TS. The reasons are as follows:

1. Specification 3.7.11 - The temperature in the Control Complex/Control Room is maintained at a pre-determined setpoint (~70°F) during normal operations. The Chilled Water System is relied upon to accomplish this function and also fulfills this function post-accident (same system configuration in both cases). A heat balance analysis was performed which showed that Control Complex heat loads are approximately the same during normal and accident operations, so that the difference between the two conditions is negligible. Based upon this line of reasoning, if the Chilled Water System is capable of maintaining temperature during steady-state operations, it is considered capable of controlling temperature post-accident. Any significant increase in Control Complex temperature will be detected by the Control Room operators well in advance of approaching any real operational limit, be it equipment operability or operator habitability.

2. Specifications 3.7.12 and 3.7.13 - The Auxiliary Building Ventilation System provides the temperature maintenance function of these systems at Crystal River. For Crystal River, the ventilation filtration aspect of these systems is not credited as part of any accident analysis.

Based on the licensing basis, the accident analysis, and/or determination of an adequate level of safety, and the above discussion, the staff accepts the deletion of NUREG-1430 specifications 3.7.11, 3.7.12 and 3.7.13 for the improved Crystal River TS.

2.3.8 Electrical (Section 3.8)

The licensee did not include some of the requirements of NUREG-1430, Section 3.8 related to certain diesel generator surveillance tests. The staff concludes that these specifications are outside of the Crystal River licensing basis, are not in the existing Crystal River TS, and that an adequate level of safety is ensured by the existing electrical systems surveillances which are included in the improved Crystal River TS. The staff concludes that these differences do not warrant backfitting of the NUREG-1430 surveillance provisions. Therefore, not including these items in the Crystal River

PART 1: INITIATION, REVIEW, AND ISSUANCE OF THE PROBLEM REPORT BY THE ORIGINATING ORGANIZATION

(1) Title: PT-136 Flow Balance Inconsistencies

SUPPORTING INFORMATION

(2a) Discovery Method:	SWSOPI Assessment			
(2b) Plant Condition:	Normal Operation			
(2c) Occurrence Date:	11/4/94	Time: 0900		
(2d) Plant Location:	Building: NA	Elevation: NA	Area/Room: NA	
(2e) Equipment Tag Number(s):	NA	(2f) Vendor Name:	NA	

(3) Description of the Condition/Event:

The purpose of PT-136 is to verify that KW loading of the emergency pump motors are within acceptable values for the diesel generators. The procedure also verifies that adequate cooling water from the SW and DC systems will be available to designated safety related components following an accident. There is no set frequency for the procedure and it is performed whenever there is a change in the post accident system line-up or thermal hydraulic analysis indicate a change is required. The procedure was last performed in June of 1992 and was performed on only the SW system. Review of the test results as part of the SWSOPI Assessment has identified several areas of concern including final system flow balance, procedure assumptions, utilization of results and instrument accuracies. The following outlines the various areas of concern:

1) Temporary procedural changes made during performance of procedure are confusing, making results difficult to determine.
2) Some of the flows are not measured but are assumed not to have been effected since last balancing. This may lead to some flow being below the required limit (CHHE-1A, 1B).
3) The procedure does not account for reduced flow due to pump degradation.
4) Non-ES flows that receive SW flow following an accident were not balanced. Included is uncertainty whether SWV-12 flow should be considered. Also, flow to the RCPs was not balanced.
5) Instrumentation accuracy is not directly determined, rather an assumed value is used with no justification.
6) Flow balancing results were not factored into affected calculations.

(4) Is this problem a Radiological Safety Concern?

[X] NO

[ ] YES Immediately contact RP Supervisor for proper documentation.

(5) Requirement(s) Violated: None identified at this time.

(6) Associated/Related Documents: PT-136, "RDC and SW Flow Measurements and EGDG-1A KW Loading Due to ES Pumps"

(7) Immediate Actions Taken:

None

(8) Recommendations for Resolving the Problem:

1) Requested NOE to perform operability review of current SW system lineup and expected post accident flow rates.
2) Further detailed review of PT-136 test results to identify all missing and suspect flow rates.
3) Determine actual system flow rates.
4) Factor actual system flow rates into corresponding calculations.
5) Revise PT-136 to incorporate resolution of above concerns (validate assumptions, develop instrument accuracies, clarify confusing steps, evaluate on-line testing using flow model, etc.).
6) Perform PT-136 during Refuel 10 and reevaluate for Design Basis Issue.
7) Reevaluate diesel generator KW loading.

(9) Originator (print name): Lee Harris Date: 11/4/94

Originating Department Supervisor/Manager Review, DBI Review and PR CLASSIFICATION DETERMINATION:

(10) PR is:

[ ] a KNOWN Design Basis Issue * [X] SUSPECTED Design Basis Issue [ ] Not a Design Basis Issue

(11) Recommended Responsible Organization:	Nuclear Plant Technical Support	Accepted By: M.J. Fitzgerald for J.W. Campbell	Date: 11/4/94
Responsible Manager:	J.W. Campbell	CAP Assignment (if applicable): MWD/JEL	

(12) Originating Supv/Mgr (print & sign): James E. Lane James E. Lane	(13) PR Issue Date: 11/4/94
(14) [X] SOTA review required	(Deliver to SOTA and notify SSOD)
[ ] SOTA review NOT required.	(Send to Director, Quality Programs)
(15) DIRECTOR, QUALITY PROGRAMS: P.F. McGee	Date: 11/7/94

PROBLEM REPORT TRANSMITTED TO THE RESPONSIBLE ORGANIZATION [ ] By: _____ Date/Time: _____

* Changed PR classification to Suspected Design Basis Issue after some questions were discussed during NOD-14 evaluation on 11/9/94.

PROBLEM REPORT: PH-94-0320 Page: 2

PART 2 - SECTION A1: REVIEW BY THE SOTA

(1) This Problem Report is:
REPORTABLE: [X] NO [ ] YES (Section B of this attachment is required if YES)
A TECHNICAL SPECIFICATION VIOLATION: [X] NO [ ] YES
AN UNPLANNED RELEASE: [X] NO [ ] YES

SOTA (print & sign): Walter G. Keenan III Date/Time: 11/8/94 1700

IF REPORTABLE THEN COMPLETE PART 2 SECTION B. *R.Sweeney 11/9/94

PART 2 - SECTION A2: PLANT CONDITIONS AND IMMEDIATE NOTIFICATIONS BY THE SOTA (if required)

(1) Plant Conditions:
Mode: _____ RX PWR: _____ MWe: _____ RCS Temperature: _____ Pressure: _____

Occurrence Date: _____ Occurrence Time: _____ Identified Date/Time: _____

Other (describe):

(2) Redundant Equip Available:

(3) SP/Maint:

(4) Tech Spec Affected:

(5) Action Statement Summary:

(6) Action Entry Date: Time:

(7) Evaluate Immediate Notification (use EM-202 if Emergency Declared)

Emergency Plan Implemented: NO ____ YES ____ Classification _____

(8) CP-111 Reference	Phone Call Required YES	NO	Time Limit	Organization
a. 10CFR50.72	____	____	1 HOUR OR 4 HOUR	NRC OPERATIONS CENTER
b. 10CFR20.1906	____	____	IMMEDIATE	NRC REGION II
c. 10CFR20.2201	____	____	IMMEDIATE	NRC OPERATIONS CENTER
d. 10CFR20.2202	____	____	IMMEDIATE OR 24 HOUR	NRC OPS CENTER/DHRS
e. 10CFR50.36	____	____	1 HOUR	NRC OPS CENTER
f. NPDES PERMIT	____	____	IMMEDIATE	FPC SUPERVISOR, WATER PROGRAMS
g. TS 2.2.5	____	____	24 HOUR	NRC OPS CENTER/FPC SR.VP/NGRC
h. EPP	____	____	24 HOUR	NRC REGION II/FPC ENVIRONMENTAL SERVICES
i. ANI/FPC RISK	____	____	IMMEDIATE	NRC OPERATIONS CENTER/ANI/FPC RISK
j. 10CFR70.52a	____	____	1 HOUR	NRC OPERATION CENTER
k. 29CFR1904.8	____	____	IMMEDIATE	FPC NUCLEAR SAFETY SPECIALIST
CP-141 Reference				
a. 10CFR73.71	____	____	1 HOUR	NRC OPERATIONS CENTER

(9) NOTIFICATIONS:	NAME	TITLE	DATE/TIME	EVENT #
a. SSOD				
b. STATE				
c. NRC(ENS)				
d. NRC (REG II)				
e. FPC				
f. DHRS				
g. OTHER				

(10) NOTIFICATION OF THE DNPO COMPLETED: [ ] YES [ ] NO Performed by (Initial): Date:

(11) SOTA (print & sign): Date & Time:

PART 2 - SECTION B NSM Comments/Recommendations

(1) Nuclear Shift Manager (print & sign): R.G. Sweeney R.Sweeney Date/Time: 11/9/94 1830

FORWARD THIS SECTION TO THE DIRECTOR, QUALITY PROGRAMS

Rev 3/94

RET Life of Plant RESP: Quality Programs 900 974 (1)

PRC# 1101

ATTACHMENT A-3
(Page 1 of 3)

OPERABILITY EVALUATION FORM

1. Initiating Individual: Brian Guilkerman Date: 11/10/94

2. Initiating Document: PR 94-0269, PR94-322

3. Affected Item (System, Subsystem or Component)
Nuclear Services Closed Cycle Cooling Water
Decay Heat Closed Cycle Cooling Water
Nuclear Services/Decay Heat Seawater

4. System Designation(s)
SW DC RW

5. Tag Number(s)
SWHE-1A SWHE-1B SWHE-1C
SWHE-1D DCHE-1A DCHE-1B

6. Specified Safety Function(s) of Affected Item
Remove containment heat, decay heat, and component heat loads and transfer to the ultimate heat sink, during a design basis accident
Decay Heat Removal for normal shutdown

ATTACHMENT A-3
(Page 2 of 3)

7. Operability Concern

The ability of the heat exchangers to remove design basis heat loads considering blocked tubes (shell, plugs and other debris)

8. References (List)

PR 94-0269 PM-112 SP-300 Logs
PR 94-0322 MP-299 SP-340 A/B
SP-344 A/B

9. Recommendation (Check as Applicable)

[✓] Operable

[ ] Inoperable

10. Basis for Determination (Use Additional Sheets, if Necessary)

See Attached

ATTACHMENT A-3
(Page 3 of 3)

11. Required Actions:

[ ] Execute applicable Action Statement(s)

_____ _____

[ ] Establish immediate compensatory measures:

_____

_____

_____

_____

[√] Not Applicable

12. Develop basis for continued operation:

[ ] Internal Position for Continued Operation

[ ] Discretionary Enforcement (Relief from TS)

[√] Not Applicable

13. List of participants:

See Attached. _____

_____ _____

_____ _____

Chair: [signature] Date: 11/10/94

SSOD: [signature] Date: 11-10-94

NOTE: Attach copy to associated Problem Report.

PRC mtg. # 94-46
Ken Vogel
11/14/94

Design Basis UHS Temperature = 95°F
Current UHS Temperature = 75°F

CALCULATION (UNVERIFIED) SHOWS SWHEs CAN REMOVE DESIGN BASIS HEAT LOAD WITH 25% FIRST PASS TUBE COMPLETELY BLOCKED AND 95°F UHS TEMP.

AS FOUND HX CONDITION HAS GIVEN CONSISTENT RESULTS ≤ 25% (ON AVERAGE) TUBES BLOCKED. (SEE ATTACHED)
CONTINUED SATISFACTORY PERFORMANCE OF RWP-2A/B AND RWP-3A/B (DURING SPs)

FOR RWP-2A/B, RWP-1 DISCHARGE PRESSURE POST SP RUN RETURNS TO PRE-SP PRESSURE PER ATTACHED FIGURES.

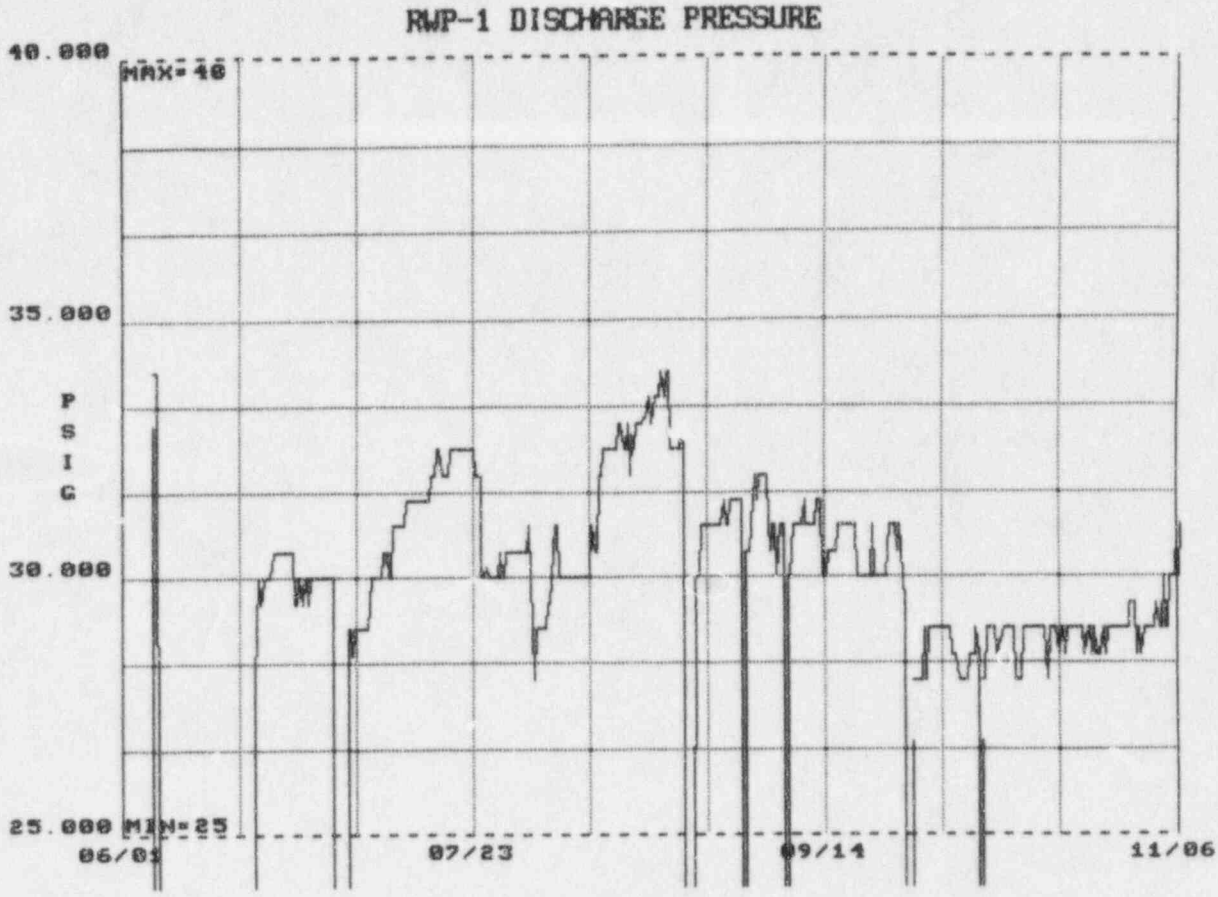
RATE OF RWP-1 DISCHARGE PRESSURE INCREASE IS SIGNIFICANTLY REDUCED SINCE 9R PIT CLEANING

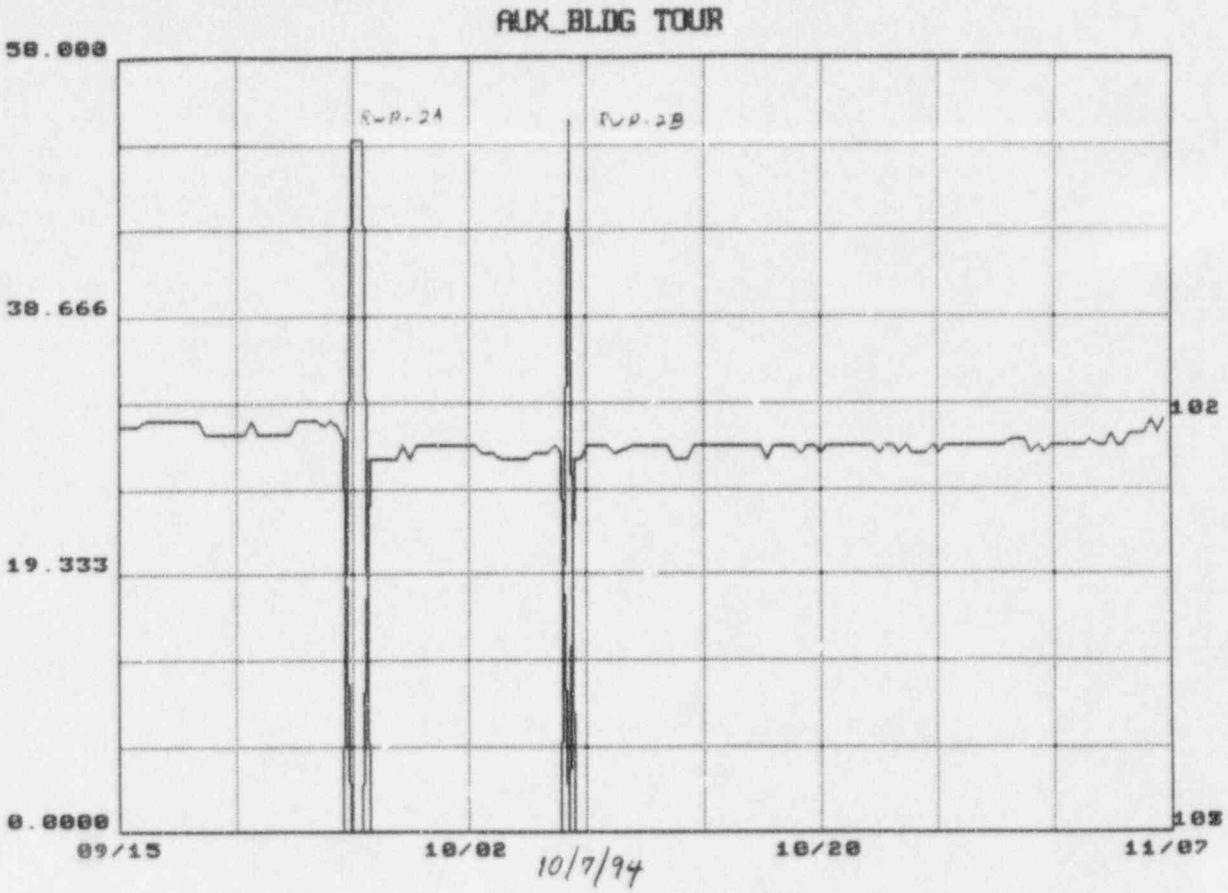
RWP-3A/B: NO LESS THROTTLED N1A VALVE TO ACHIEVE SP REFERENCE FLOW (INDICATES NO INCREASE IN BACKPRESSURE DUE TO HX BLOCKAGE).

CLEANED RW FLUMES AND PITS 7 MONTHS AGO.

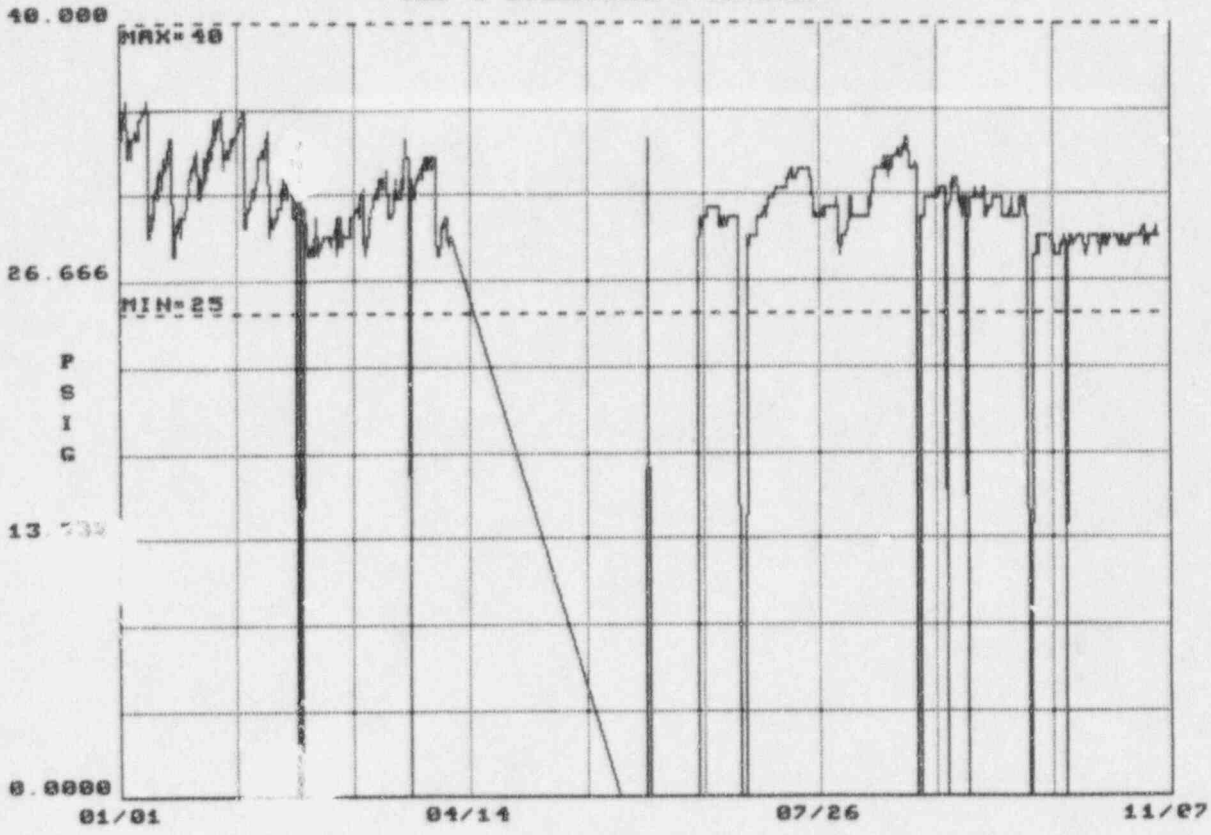
NOTE: MONITORING PUMP DISCHARGE PRESSURE IS ~~INDI~~ USED TO IDENTIFY TRENDS IN HX BLOCKAGE.

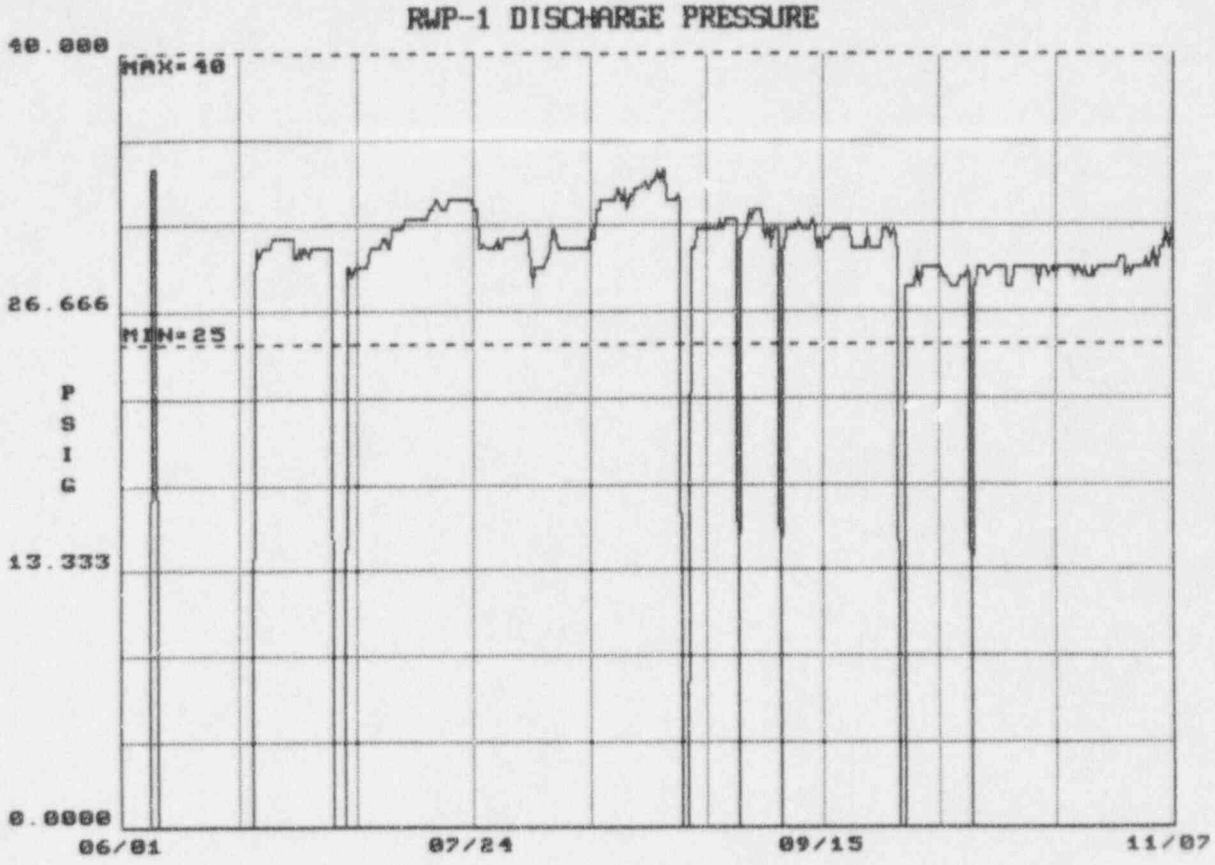
11/1/04


RWP-1 DISCHARGE PRESSURE
40.000
MAX=40
35.000
P
S
I
G
30.000
25.000
MIN=25
06/01
07/23
09/14
11/06



STA. NO.	DESCRIPTION	UNITS	MIN	MAX
101	RWP-2A DISCHARGE PRESSURE	PSIG	48	58
102	RWP-1 DISCHARGE PRESSURE	PSIG	25	40
103	RWP-2B DISCHARGE PRESSURE	PSIG	48	58


RWP-1 DISCHARGE PRESSURE
40.000
MAX=40
26.666
MIN=25
P
S
I
G
13.333
0.0000
01/01
04/14
07/26
11/07


RWP-1 DISCHARGE PRESSURE
40.000
MAX=40
26.666
MIN=25
P
S
I
G
13.333
0.0000
06/01
07/24
09/15
11/07

322149
SW HE-1A
10-3-94

ENCLOSURE 5

"AS-FOUND"

HEAT EXCHANGER CONDITION

Record the initial "as-found" conditions of the heat exchanger from Step 4.2.1

1 What type of debris was found: (ie) barnacles, oysters, grass, etc. BARNACLES, RUBBER

2 Estimate percent of tubes blocked by debris ie:10%,25%,50% etc. 20%

3 Estimate amount of debris: (ie) handfull, 1/2 gallon etc. 1/2 GAL

4 Inspect the expansion joints for cracks, breaks, or bulges. LOOKED GOOD FROM INSIDE ONLY. CANNOT INSPECT OUTSIDE

5 Visually check access door, channel head, tubes, tube sheet and channel divider for deterioration. Conditions: NO ABNORMAL CONDITIONS WERE FOUND.

6 Note any other problem area(s): NONE

WR# 322069

SWHE-1D

9/19/94 "AS-FOUND"

ENCLOSURE 5

HEAT EXCHANGER CONDITION

Record the initial "as-found" conditions of the heat exchanger from Step 4.2.1

1 What type of debris was found: (ie) barnacles, oysters, grass, etc. ~~1/2 GAL.~~ BARNACLES, SHELL, OYSTERS.

2 Estimate percent of tubes blocked by debris ie:10%,25%,50% etc. 15%

3 Estimate amount of debris: (ie) handfull, 1/2 gallon etc. 1/2 GAL.

4 Inspect the expansion joints for cracks, breaks, or bulges. APPEARS SATISFACTORY AT THIS TIME.

5 Visually check access door, channel head, tubes, tube sheet, and channel divider for deterioration. Conditions: APPEARS SATISFACTORY AT THIS TIME.

6 Note any other problem area(s): NONE

SWHE-1C
322066
9-19-94 ENCLOSURE 5

"AS-FOUND"

HEAT EXCHANGER CONDITION

Record the initial "as-found" conditions of the heat exchanger from Step 4.2.1

1 What type of debris was found: (ie) barnacles, oysters, grass, etc. BARNACLES + SCALE

2 Estimate percent of tubes blocked by debris ie:10%,25%,50% etc. 40%

3 Estimate amount of debris: (ie) handfull, 1/2 gallon etc. 1 GAL.

4 Inspect the expansion joints for cracks, breaks, or bulges. NONE AT THIS TIME.

5 Visually check access door, channel head, tubes, tube sheet, and channel divider for deterioration. Conditions: ARE SATISFACTORY AT THIS TIME.

6 Note any other problem area(s): NONE

SWHE-1A
321496
9-6-94

ENCLOSURE 5

"AS-FOUND"

HEAT EXCHANGER CONDITION

Record the initial "as-found" conditions of the heat exchanger from Step 4.2.1

1 What type of debris was found: (ie) barnacles, oysters, grass, etc. BARNACLES SHELL

2 Estimate percent of tubes blocked by debris ie:10%,25%,50% etc. 10%

3 Estimate amount of debris: (ie) handfull, 1/2 gallon etc. PAST

4 Inspect the expansion joints for cracks, breaks, or bulges. _____

5 Visually check access door, channel head, tubes, tube sheet, and channel divider for deterioration. Conditions: EVERYTHING ACCEPTABLE. Except BACK Bell Plastic Liner COMING OFF we cut it OFF Per Raliegh SMith

6 Note any other problem area(s): WHEN OPENING WEST END FOUND WHAT LOOKED LIKE OIL INSIDE.

SW HE-1B
321586
9-6-94

ENCLOSURE 5

"AS-FOUND"

HEAT EXCHANGER CONDITION

Record the initial "as-found" conditions of the heat exchanger from Step 4.2.1

1 What type of debris was found: (ie) barnacles, oysters, grass, etc. barnacles

2 Estimate percent of tubes blocked by debris ie (10%), 25%, 50% etc. 10% - 15%

3 Estimate amount of debris: (ie) handfull, 1/2 gallon etc. 1/2 gal

4 Inspect the expansion joints for cracks, breaks, or bulges. O.K

5 Visually check access door, channel head, tubes, tube sheet, and channel divider for deterioration. Conditions: O.K.

6 Note any other problem area(s): None

320360
DCHE-1B
9-7-94

ENCLOSURE 5

"AS-FOUND"

HEAT EXCHANGER CONDITION

Record the initial "as-found" conditions of the heat exchanger from Step 4.2.1

1 What type of debris was found: (ie) barnacles, oysters, grass, etc. OYSTER SHELL

2 Estimate percent of tubes blocked by debris ie:10%,25%,50% etc. 10%

3 Estimate amount of debris: (ie) handfull, 1/2 gallon etc. 1/4 GALLON

4 Inspect the expansion joints for cracks, breaks, or bulges. OK

5 Visually check access door, channel head, tubes, tube sheet, and channel divider for deterioration. Conditions: FAIR

6 Note any other problem area(s): NEED NEW PLUGS
PLUGS WORN OUT

WR 321434
SWHE-1D
8-22-94

ENCLOSURE 5

"AS-FOUND"

HEAT EXCHANGER CONDITION

Record the initial "as-found" conditions of the heat exchanger from Step 4.2.1

1 What type of debris was found: (ie) barnacles, oysters, grass, etc. _____
Very Little

2 Estimate percent of tubes blocked by debris ie:10%,25%,50% etc. Less than 10%

3 Estimate amount of debris: (ie) handfull, 1/2 gallon etc. _____

4 Inspect the expansion joints for cracks, breaks, or bulges. OK

5 Visually check access door, channel head, tubes, tube sheet, and channel divider for deterioration. Conditions: OK

6 Note any other problem area(s): _____

11/10/94

NOD-14 for PR94-0269

ATTENDEES

PAUL TANGUAY

JIM LANE

JACK TUNSTILL

W. BREWER

Scott STEWART

R.W. KNOLL

KEVIN CAMPBELL

JOE MASEDA

BRIAN GUTHERMAN

TERRY AUSTIN

MIKE DONOVAN

RICH IWACHOW

DON SHOOK

D.B. BLACK

ORIGINAL NOD-14 PACKAGE FOR PRC

ENCLOSURE 1 (Page 1

PROBLEM REPORT PR 94-0269

Page:

PART 1: INITIATION, REVIEW, AND ISSUANCE OF THE PROBLEM REPORT BY THE ORIGINATING ORGANIZATION

(1) Title: Recurring Raw Water Heat Exchanger Fouling

SUPPORTING INFORMATION

(2a) Discovery Method:	Preparation for SWSOPI		
(2b) Plant Condition:	Normal Operation		
(2c) Occurrence Date:	9/13/94	Time: 1400	
(2d) Plant Location	Building: Auxiliary Bldg	Elevation: 95	Area/Room: Seawater Room
(2e) Equipment Tag Number(s):	SWHE-1A, 1B, 1C, 1D & DCHE-1A, 1B	(2f) Vendor Name::	Struthers Wells

(3) Description of the Condition/Event:

FPC currently has a program of frequent regular heat exchanger maintenance in place to combat the problem of heat exchanger fouling and flow blockage in the RW system. This program includes cleaning and inspecting the intake canal and RW pits; cleaning and shooting of each SW heat exchanger every 28 days; cleaning and shooting a DC heat exchanger every ECCS system outage. These are adequate means of reducing heat exchanger fouling after fouling has occurred, but do not provide a method to reduce the level of fouling.

The concern arises with the fact that frequently the fourth SW heat exchanger (clean one in standby) must be placed in service in order for the RWSW pumps to pass their flow surveillance. Also, at times the DC heat exchanger must be cleaned for the RWDC pumps to pass their required flow. The purpose of the pump flow surveillances are to verify the capability of the pump to pass the required flow and not necessarily whether the system can pass the flow. However, when the above steps must be performed so the pumps can pass the required flow, it serves as an indicator that inadequate preventive maintenance (with specific regard to heat exchanger fouling) is in place to provide the necessary assurance that these safety related pumps will be able to provide design flow.

Based on system performance and maintenance there is inadequate control of the level of heat exchanger fouling.

(4) Is this problem a Radiological Safety Concern?
[XX] NO
[ ] YES Immediately contact HP Supervisor for proper documentation.

(5) Requirement(s) Violated: NA

(6) Associated/Related Documents: PR-92-0122, PM-112, NOCS #40438, PR-93-0114, PR-92-0169

(7) Immediate Actions Taken:

NONE

(8) Recommendations for Resolving the Problem:

1) Re-evaluate chlorination of RW supply
2) Utilize "clam-tron" to control growth
3) Increase frequency of RW pit cleaning
4) Install strainers/filters on pump discharge
5) Identify appropriate parameters to monitor and collect data correlating it to heat exchanger fouling rates
6) Perform an engineering study to evaluate all options and generate a recommendation
7) Establish criteria for acceptable level of heat exchanger fouling and subsequent flow blockage
8) Implement a program to monitor the effectiveness of any potential solution and revise the program as necessary

(9) Originator (print name): Les W. Harris Date: 9/14/94

Originating Department Supervisor/Manager Review, DBI Review and PR CLASSIFICATION DETERMINATION:

(10) PR is:
[ ] a KNOWN Design Basis Issue [ ] SUSPECTED Design Basis Issue [X] Not a Design Basis Issue

(11) Recommended Responsible Organization:	NPTS	Accepted By: J. W. Campbell	Date: 9/14/95
Responsible Manager:	J. W. Campbell	CAP Assignment (if applicable):	JEL/SAS

(12) Originating Supv/Mgr (print & sign): C. A. Lee / C. A. Lee for JEL

(13) PR Issue Date: 9/15/94

(14) [X] SOTA review required (Deliver to SOTA and notify SSCD)
[ ] SOTA review NOT required. (Send to Director, Quality Programs)

(15) DIRECTOR, QUALITY PROGRAMS: R. L. Jones

Date: 9/16/94

PROBLEM REPORT TRANSMITTED TO THE RESPONSIBLE ORGANIZATION [ ] By: _____ Date/Time:

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PART 2 - SECTION A1: REVIEW BY THE SOTA

(1) This Problem Report is:

REPORTABLE:	[X]	NO	[ ]	YES	(Section B of this attachment is required if YES)
A TECHNICAL SPECIFICATION VIOLATION:	[X]	NO	[ ]	YES	
AN UNPLANNED RELEASE:	[X]	NO	[ ]	YES	

SOTA (print & sign): Harvey H. Liles Harvey Liles Date/Time: 9/15/94 14:10

IF REPORTABLE, THEN COMPLETE PART 2 - SECTION B.

PART 2 - SECTION A2: PLANT CONDITIONS AND IMMEDIATE NOTIFICATIONS BY THE SOTA (if required)

(1) Plant Conditions:

Mode: _____ RX PWR: _____ MWe: _____ RCS Temperature: _____ Pressure: _____

Occurrence Date: _____ Occurrence Time: _____ Identified Date/Time: _____

Other (describe):

(2) Redundant Equip Available:

(3) SP/Maint:

(4) Tech Spec Affected:

(5) Action Statement Summary:

(6) Action Entry Date: Time:

(7) Evaluate Immediate Notification (use EM-202 if Emergency Declared)

Emergency Plan Implemented: NO ____ YES ____ Classification _____

(8)

CP-111 Reference	Phone Call Required YES	NO	Time Limit	Organization
a. 10CFR50.72	____	____	1 HOUR OR 4 HOUR	NRC OPERATIONS CENTER
b. 10CFR20.1906	____	____	IMMEDIATE	NRC REGION II
c. 10CFR20.2201	____	____	IMMEDIATE	NRC OPERATIONS CENTER
d. 10CFR20.2202	____	____	IMMEDIATE OR 24 HOUR	NRC OPS CENTER/DHRS
e. 10CFR50.36	____	____	1 HOUR	NRC OPS CENTER
f. NPDES PERMIT	____	____	IMMEDIATE	FPC SUPERVISOR, WATER PROGRAMS
g. TS 2.2.5	____	____	24 HOUR	NRC OPS CENTER/FPC SR.VP/NGRC
h. EPP	____	____	24 HOUR	NRC REGION II/FPC ENVIRONMENTAL SERVICES
i. ANI/FPC RISK	____	____	IMMEDIATE	NRC OPERATIONS CENTER/ANI/FPC RISK
j. 10CFR70.52a	____	____	1 HOUR	NRC OPERATION CENTER
k. 29CFR1904.8	____	____	IMMEDIATE	FPC NUCLEAR SAFETY SPECIALIST
CP-141 Reference				
a. 10CFR73.71	____	____	1 HOUR	NRC OPERATIONS CENTER

(9) NOTIFICATIONS:

	NAME	TITLE	DATE/TIME	EVENT #
a. SSOD				
b. STATE				
c. NRC(ENS)				
d. NRC (REG II)				
e. FPC				
f. DHRS				
g. OTHER				

(10) NOTIFICATION OF THE DNPO COMPLETED: [ ] YES [ ] NO Performed by (Initial): Date:

(11) SOTA (print & sign): Date & Time:

PART 2 - SECTION B NSM Comments/Recommendations

(1) Nuclear Shift Manager (print & sign): Date/Time:

FORWARD THIS SECTION TO THE DIRECTOR, QUALITY PROGRAMS

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PART 3 - SECTION A: PROBLEM INVESTIGATION AND CAUSE ANALYSIS

(1) **Method of Performing Cause Analysis:** [ ] Structured Analysis [XX] Deductive Logic

(2) **CHECK ALL CAUSES THAT APPLY:**

Human Performance

[ ] Verbal Communication
[ ] Written Communication
[ ] Training/Qualification
[ ] Work Schedule
[ ] Work Organization/Planning
[ ] Work Practices
[ ] Supervisory Methods
[x] Managerial Methods
[ ] Change Management
[ ] Resource Management
[ ] Environmental Conditions
[ ] Interface Design or Equipment Condition

Equipment Performance

[ ] Plant/System Operation
[x] Maintenance/Testing
[ ] External
[ ] Design Configuration/Analysis
[ ] Equipment Spec/Mfg/Construction

(3a) **Primary Cause(s):** The primary cause of heat exchanger fouling is due to marine growth in the intake, flumes and RW pits. This problem has been previously identified and some effort to reduce the amount of fouling has been undertaken via implementation of a program of regular cleaning and inspection of the RW pump intake and suction pit. However, as the problem report states, this cleaning and inspecting along with HX PM's attempts to control the problem after growth and fouling have occurred. In addition, the programs in place may be insufficient to ensure that the level of fouling is maintained within acceptable margins to ensure system operability. An area of concern that has not been fully addressed is the RW pit itself. Fouling of a DC heat exchanger has been documented in the past. Of concern is that this HX does not normally have flow and after being shot and cleaned per PM-112 is left in wet layup with demin water. As such, any blockage that prevents sufficient pump flow from being obtained is introduced at the time the surveillance is performed. Since the flow rate of the DC/RW pump is less than RWP-1, complete HX fouling due to additional debris coming off the walls is unlikely. Therefore, it is concluded that this sudden surge of debris resulting in heat exchanger fouling must also be coming from the loose debris in the RW pit floor. This, validates the conclusion that HX fouling is due to marine growth coming loose from the walls of the intake system and illustrates the complexity of the problem associated with HX fouling. The concern over HX fouling and flow blockage within the RW system is a well recognized problem by both the industry and the NRC, and additional work needs to be done in this area to ensure the our commitment to Generic Letter 89-13 is adequately met.

(3b) **Secondary Cause(s):** A secondary cause to heat exchanger fouling is that elimination of the source has not occurred. Rather all the steps implemented thus far are an attempt to control the problem once it has already occurred. Therefore, an adequate solution to correct the "root cause" of the SW and DC HX fouling problems has not been developed. The are numerous possible solutions to the problem and it may be that the most appropriate solution, due to the various factors surrounding the problem, is a combination of several control and elimination techniques.

(3c) **Contributing Factor(s) :**

(4) **SUPPORTING INFORMATION (IF APPLICABLE):**

LER No:	PROCEDURE No:	WR No:	NRC VIOLATION No:

OTHER:

(5) **Nuclear Safety Consequences Analysis:** N/A

(6) **Previous Similar Events/Conditions:** N/A

(7) **Manufacturer/Nameplate Data:** N/A

(8) **Nonconforming Equipment/Material Disposition:**
[ ]N/A (no nonconforming equipment or material involved) [ ] Accept-As-Is* [ ] Repair* [ ] Rework
[ ] Other (describe): _____
* Engineering Justification and Approval Required for these Dispositions (obtain documentation and attach)

(9) **Maintenance Preventable Functional Failure (MPFF):**
[ ] No [ ] INITIAL [X] REPETITIVE

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PART 3 - SECTION B: Corrective Action Plan (CAP)

(1) Corrective Action Plan:

ACTIONS	SCHEDULED COMPLETION DATE	ASSIGNED ORGANIZATION/INDIVIDUAL
1. Include the RW System in the existing biofouling study (90-07-07-00), which is evaluating methods for controlling marine biofouling (i.e., thermal, chemical, protective coatings, chlorine, filter/strainer at pump discharge, Clam-trol etc.)	6/1/95	NOE, B. Gutherman, per phone conversation 9/28
2. Develop a RW system operability curve that will allow HX operability (as determined by its ability to dissipate heat) to be determined based on a actual UHS temperature, RW system flow, and HX delta P. (See CAA N 90-024-43)	5/31/95	NOE, B. Gutherman, per phone conversation 9/28
3. Review SP-300 RWP discharge pump pressure acceptance range as indication of heat exchanger fouling and subsequent action in the event the range is exceeded. (REA 94-1093)	1/30/95	NPTS, Scot Stewart
4. Contact Seaward Marine Services to determine the buildup of marine growth in the RW pits from 8M to 9R.	Completed	NPTS, Les Harris
5. Review WR history to determine the number of HX fouling events that have occurred between the May 1993 (8M) recirc line fouling PR and the 4/94 (9R) flume cleaning.	3/15/95	NPTS, Scot Stewart
6. Revise SP-300 RWP-1 discharge pressure band to reduce fouling accumulation between weekly cleanings, per CAP #3.	4/15/95	Operations, Greg Halnon, per telecon 9/28
7. Have Divers inspect the condition of the "B" RW pit based on results of CAP #5 and #3.	8/15/95	Scheduling, B. Moore, per conversation 9/29
8. Obtain SWHE delta-P data for trending.	11/30/95	NPTS, Scot Stewart
9. Send IOC to operations requesting notification of the system engineer in the event the DC heat exchanger must be cleaned and/or the clean SW heat exchanger is placed in service before RW pumps can achieve the required flow.	11/31/94	NPTS, Scot Stewart
10. Perform a calculation to determine the number of HX tubes that may be plugged or partially blocked and the HX still be capable of removing the necessary heat.	4/30/95	NOE, B. Gutherman, per phone conversation 9/29
11. Evaluate the over-all adequacy of the HX flow blockage prevention and steps within this CAP for acceptability in controlling HX fouling and flow blockage. Establish additional Corrective Actions as necessary.	10/1/95	NPTS, Scot Stewart

(2) ADDITIONAL CAP INFORMATION:

(3) Developed by (print & sign): Les Harris Les Harris Date: 9/29/94

(4) Responsible Organization Approval by (print & sign): Jerry W. Campbell / Jerry W. Campbell Date: 9/30/94

IF THE PROBLEM IS CLASSIFIED AS REPORTABLE OR A TECHNICAL SPECIFICATION VIOLATION, THEN OBTAIN THE FOLLOWING APPROVALS

(5) PRC: NTG No:

(6) DNPO: Date:

WHEN COMPLETE, TRANSMIT TO SUPERVISOR, QUALITY SYSTEMS.

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PROBLEM REPORT

PR 94 - 0322

PART 1: INITIATION, REVIEW, AND ISSUANCE OF THE PROBLEM REPORT BY THE ORIGINATING ORGANIZATION

(1) **Title:** Lack of Proper Operability Assessment

SUPPORTING INFORMATION

(2a) **Discovery Method:**	SW/RW/DC Self Assessment		
(2b) **Plant Condition:**	Power Operation		
(2c) **Occurrence Date:**	11/09/94	**Time:** 1300	
(2d) **Plant Location:**	**Building:** NA	**Elevation:** NA	**Area/Room:** NA
(2e) **Equipment Tag Number(s):**	NA	(2f) **Vendor Name:**	NA

(3) **Description of the Condition/Event:**

During the course of the SW/RW/DC Self Assessment it was discovered that conditions exist or have existed for which an operability assessment should have been performed, and was not documented. Examples of this can be found in PR-92-0122, "Fouling of DC Heat Exchanger with Marine Organisms", PR-93-0114 "High Pressure Discharge on RWP-3B Renders the B DHR System Inoperable", PR-94-0269 "Recurring RW Heat Exchanger Fouling", PR-94-0320 "PT-136 Flow Balance Inconsistencies for KW Loading of the Emergency Diesel Generators.

(4) **Is this problem a Radiological Safety Concern?**

[x] NO

[ ] YES Immediately contact HP Supervisor for proper documentation.

(5) **Requirement(s) Violated:** CP-111, NOD-14

(6) **Associated/Related Documents:** NA

(7) **Immediate Actions Taken:**

Operability Assessment of PR-94-0320 was performed IAW NOD-14

(8) **Recommendations for Resolving the Problem:**

Ensure responsible personnel are knowledgeable of the requirements of CP-111 and NOD-14.

9) **Originator** (print name): R.A. [illegible]es/

Date:

Originating Department Supervisor/Manager Review, DBI Review and PR CLASSIFICATION DETERMINATION:

(10) **PR is:**

[ ] a **KNOWN Design Basis Issue** [ ] **SUSPECTED Design Basis Issue** [x] **Not a Design Basis Issue**

(11) **Recommended Responsible Organization:**	NPTS	**Accepted By:** _____ **Date:** _____
Responsible Manager:	J.W.Campbell	CAP Assignment (if applicable): _____

(12) **Originating Supv/Mgr** (print & sign):	(13) **PR Issue Date:**
(14) [ ] SOTA review required	(Deliver to SOTA and notify SSOD)
[ ] SOTA review NOT required.	(Send to Director, Quality Programs)
(15) **DIRECTOR, QUALITY PROGRAMS:**	**Date:**

PROBLEM REPORT TRANSMITTED TO THE RESPONSIBLE ORGANIZATION [ ] By: _____ **Date/Time:**