Florida Power
CORPORATION

July 6, 1983
3F-0783-04

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Crystal River Unit 3
Docket No. 50-302
Operating License No. DPR-72
Supplemental Information in Support of Technical Specification Change Request No. 82

Dear Mr. Denton:

This provides information requested in a telephone conversation with members of your staff on July 1, 1983, regarding Cycle 5 operation with Reactor Coolant Pump Power Monitors (RCPPM's).

Testing of all of the Reactor Coolant Pump Power Monitor (RCPPM) strings prior to Cycle 5 Startup will consist of checking the time delays from the Bistables to the CRD. This excludes the Potential Transformers (PT)/Current Transformer (CT), the Watts Transducer and the CRD in the test string.

Attached are the references supporting the determination of trip delay time which were requested during the conversation.

Please advise if there are any further questions.

Sincerely,

G. R. Westafer
Manager
Nuclear Licensing and Fuel Management

Attachment

DMO:mm

A001
1/1

FILE: PD-533

GENERAL ELECTRIC

METER BUSINESS

DEPARTMENT

GENERAL ELECTRIC COMPANY, MAIN STREET, SOMERSWORTH, NEW HAMPSHIRE 03878
Phone (603) 692-2100

March 5, 1982

Mr. Steve Ulm
Florida Power Corp.
P.O. Box 14042
St. Petersburg, FL 33733

Dear Mr. Ulm

Several years ago, you had requested response time calculations for the JCM-4 and JVM-4 instrument transformers- This information was furnished via telephone on 6/20/80.

We apologize for not having followed up with written documentation at the time. We would be pleased to do so now.

We will define response time as the time constant or time for the secondary output to decay to 66% of the original value when the primary input is interrupted.

For the 1200:5 AMP JCM-4 response time will vary between 3.7 and 14.8 milliseconds depending on the point of interruption on the primary waveshape.

For the 7200:120 Volts JVM-4, response time at Z Burden is 3.8 milliseconds max. and for Y Burden it is 3.0 milliseconds max.

Let us know if you need any further information.

Katherine A. Wezowicz
Product Sales Engineer

/lm

copies: J.R. Gunter, MBD
R. Stetson, MBD
J. Kelly, Tampa Office

FILE: PD-533

Babcock & Wilcox

a McDermott company

Nuclear Power Generation Division

3315 Old Forest Road
P.O. Box 1260
Lynchburg, Virginia 24505
(804) 384-5111

June 8, 1982
FPC-82-192

Mr. E.C. Simpson
Nuclear Operations Engineering Manager
Florida Power Corporation
P.O. Box 14042
St. Petersburg, FL 33733

Attention: Mr. S.F. Ulm

Reference: Task 352 - Calculations and Data Required to Determine Minimum Trip Setpoint and Maximum Trip Time Delay for the Pump Monitor

Gentlemen:

The minimum trip setpoint has been determined to be 80 watts ± 5 watts (watt transducer output) and the maximum trip time delay allocated to the RC Pump Power Monitor (all instrumentation prior to the RPS input) is 1.175 seconds. These data and their bases is contained in B&W Document 32-1134603-00.

B&W Document 51-1132614-00 contains the results of our analysis of the Visicorder graphs on starting a fourth RC Pump and transfer of RC Pumps from the startup bus to the auxiliary bus and back to the startup bus. A review of these graphs indicates that if the changes recommended by B&W Document 32-1134603-00 are made, the RC Pump Power Monitor would be able to "ride through" the bus power dips without tripping the reactor.

If you have any questions, please call me.

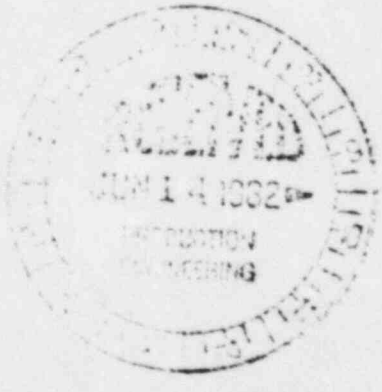
Very truly yours,

John A. Castanes

J.A. Castanes
Engineering Product Manager

JAC/kjb

cc: T.C. Lutkehaus
P.Y. Baynard
W.P. Ellsberry



CALCULATION DATA/TRANSMITTAL SHEET

DOCUMENT IDENTIFIER

CALC. 32 -1134603 - 00

TRANS. 86 - _____ - _____

TYPE: ___RESEARCH & DEVELOPMENT ___SAFETY ANALYSIS REPORT ___NUC. SERV. INPUT ___DESIGN RQMT. ___DESIGN VERIF. X OTHER Recommended RCPPM Settings

TITLE FPC RCPPM RECOMMENDED SETTINGS

PREPARED BY L. M. Smith REVIEWED BY S. L. Eschbach

TITLE Supervisory ENG DATE 6/7/82 TITLE Supv. Engr. DATE 6/7/82

PURPOSE:

Determine: Bistable low watt setpoint
RCPPM sensor time delay allocation

SUMMARY OF RESULTS (INCLUDE DOC. ID'S OF PREVIOUS TRANSMITTALS & SOURCE CALCULATIONAL PACKAGES FOR THIS TRANSMITTAL)

Bistable low watt setpoint - 80 watts ± 5 watts
RCPPM time delay allocation - 0.190 sec. isolator,
0.020 sec. current/voltage transformers, 0.115 sec.
watt transducer/bistable, 0.890 sec. time delay relay (1.175 sec. total)

References used here in

86-1103844-01, 582-7087
51-1132614-00, 582-7087
32-1134068-00, 582-7087
51-1128452-03, 582-7087
Telecon record 6/3/82, T3.13.1, 582-7087
32-1119698-00, 620-0007

DISTRIBUTION

1.0 BISTABLE LOW WATT SETPOINT

Given :

- No load watts at watt transducer output 11.46 watts (86-1103844-01, "Power Rating of RCPPM, 582-7087)

Then :

A conservative valve 80 watts ± 5 watts selected by the preparer as the watt meter bistable low setpoint because:

1. 80 watts is 19.5% of the highest normal operating watts of 410 watts observed in 51-1132614-00, "Pump Power Monitor Visigraph Analysis," 582-7087
2. 80 watts is also above the no load watts

2.0 PREPARER'S COMMENT - RECOMMENDED DELETION OF WATT METER BISTABLE HIGH SETPOINT FUNCTION

There are no safety analysis requirements for a RC pump trip on high watts (i.e., locked rotor) (see 86-1103844-01 "Power Rating of RCPM, 582-7087 and references for details)

No high watt trip function is recommended. The function should be deleted.

If a high watt trip function is used for reasons other than safety analysis, caution should be used to avoid spurious trips. The caution is based on 700 watt indications observed in 51-1132614-00 "Pump Power Monitor Visigraph Analysis," 582-7087.

The 700 watt observation occurred on starting a fourth RC pump.

3.0 RCPPM SENSOR TIME DELAY ALLOCATION CALCULATION

Given :

RCPPM sensor time delay requirement of 1.175 seconds (32-1134068-00, "CR-3 Cy4 operation for revised pump monitor delay time," 582-7087 and 51-1128452-03, "FPC pump monitor delay time relaxation," 582-7087). The sensor delay includes all instrumentation prior to RPS.

Find :

How the 1.175 second requirement is alloacted in the RCPPM sensor

$$1.175 - 0.150 - 0.020 = 1.005 \text{ seconds} \quad (1)$$

where

0.150 - maximum isolator delay, 32-1130545-00, "Response Time for Pump Monitor Trip Equipment," 582-7087.

0.020 = maximum current and voltage transformer delay suggested by FPC (S. ULM) in a 6/3/82 telecon, record, 582-7087, T3.13.1

1.005 = delay to be allocated to watt transducer/bistable time delay relay

Preparer Assumption - RCPPM sensor is all instrumentation prior to RPS. The RCPPM sensor consists of current transformers, potential transformers, watt transducer, bistable, isolator. No credit taken for deletion of Clare relays that once existed in the RCPPM sensor.

From 51-1132614-00, "Pump Power Monitor Visigraph Analysis", 582-7087, the highest normal operating watts is 410 watts as shown on attachment II.1 and II.2. The C and D RC pump initial watts are neglected on Attachments II.1 and II.2 because starting marker may have been late. The 410 watts has margin in that the normal operating watts appears in 375 to 400 watt region.

$$\underbrace{410 - 75}_{(80-5)} = 335 \text{ watts} = \text{trip set span (2)}$$

From 32-1119698-00, "Pump Monitor Response Time," 620-0007, Figure 1, a 335 watts - trip set span on Y axis results in about 0.112 second delay on the X - axis using the maximum time curve. 0.115 seconds is selected by the preparer as a conservative value for the delay of the watt transducer bistable.

$$1.005 - 0.115 = 0.890 \text{ seconds} \quad (3)$$

0.890 seconds is allocated for time delay relay. The preparer's recommended acceptance criteria for setting the time delay relay is 0.840 seconds nominal, 0.890 seconds maximum to allow for tolerances.

4.0 SUMMARY

- Bistable low watt setpoint 80 watts $\pm$ 5 watts
- No high watt function required
- Time delay relay acceptance criteria

  0.840 seconds nominal
  0.890 seconds maximum

- Time delay allocation

  1.175 seconds requirement

0.150 seconds, isolator
0.020 seconds, current/voltage transformers
0.115 seconds, watt transducer/bistable
0.890 seconds, time delay relay, maximum

1.175 seconds allocated

5.0 REVIEWER COMMENTS

None

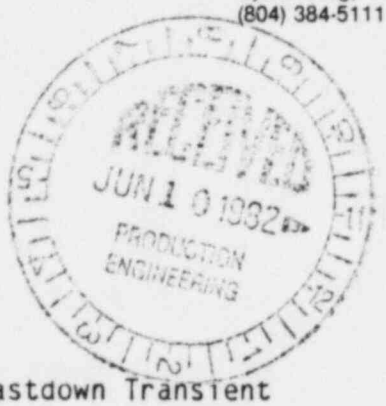
Babcock & Wilcox

a McDermott company

Nuclear Power Generation Division

3315 Old Forest Road
P.O. Box 1260
Lynchburg, Virginia 24505
(804) 384-5111

June 4, 1982
FPC-82-188



Mr. E.C. Simpson
Nuclear Operations Engineering Manager
Florida Power Corporation
P.O. Box 14042
St. Petersburg, FL 33733

Attention: Mr. S.F. Ulm

Reference: Task 385 - Reanalysis of Four-Pump Coastdown Transient

Gentlemen:

The objective of Task 385 was to perform a four RC Pump Coastdown analysis to justify a relaxation in the current Pump Monitor delay time of 0.349 seconds. The result of this analysis has determined that the FPC Pump Monitor delay time requirement can be relaxed to 1.175 seconds (reference B&W Document 32-1134068-00). To support this Pump Monitor delay time requirement, the RC Pump coastdown analysis with pump status trip protection assumed a total trip delay time of 1.50 seconds. The bases for the 1.50 second pump status trip total delay time, and the Pump Monitor delay are as follows:

The total trip delay time for the pump status trip is the time period from the existence of the trip condition in the process variable (i.e., loss of AC power to the pump) to the initiation of control rod drop (or the time when the rods are free to fall). The basic components are:

Pump Monitor Delay	+	RPS Delay	+	Breaker Delay	+	CRD Release Delay	=	Total Trip Delay Time

The FSAR analysis assumes that the Pump Monitor delay time is the time from the onset of a RC Pump coastdown (due to the sudden loss of AC power to the pump) to the time that the RPS (Reactor Protection System) receives the Pump Monitor signal. This equipment breakdown assumes the pump monitor delay includes delays caused by all instrumentation before the RPS.

The 1.175 second Pump Monitor delay time is based upon a 1.50 second pump status trip total trip delay time. This total trip delay time will provide minimum DNBR greater than 1.43 and permits the four pump coastdown to be classed as the limiting RC Pump coastdown event. These results have been demonstrated through analysis for FPC power levels up to and including 2,544 MWt.

It is important to note that the 1.50 second Pump Monitor delay time is based upon two key assumptions normally outside the FPC licensing bases: (1) that the 1.5 second Pump Monitor delay time is expected to be acceptable at an FPC power level of 2,772 MWt (an estimate - not a calculation) and (2) it is desireable to maintain the four RC pump coastdown as the limiting coastdown event. To illustrate the first assumption, a Pump Monitor delay time of 1.88 seconds could be permitted, if power were limited to 2,544 MWt. A 0.38 second penalty is added to the 1.88 second delay to provide flexibility for future 2,772 MWt operation, yielding a 1.5 second delay. The second assumption is illustrated in Table 1. The four pump coastdown results in a lower minimum DNBR (i.e., is more limiting) for total trip delay times less than 1.88 second. However, the three pump coastdown (from three pump operation) results in a lower minimum DNBR for total trip delay times greater than 1.88 second. A total trip delay time of 2.52 seconds could be permitted, as both the four and the three pump coastdown have a minimum DNBR of 1.43 or greater (minimum DNBR values of 1.59 and 1.43 respectively). However, a significant analysis and licensing effort would be required to permit the three pump coastdown to be the limiting coastdown event. To maintain the present licensing concept of the four pump coastdown being the most limiting coastdown event, a total trip delay time of 1.88 seconds or less must be required. Hence, a penalty of 0.64 seconds is added to the 2.52 second delay, to ensure that the four pump coastdown is limiting. For clarity, these two penalties (for 2,772 MWt operation, and the four pump coastdown as the limiting event) are illustrated below.

2.52 seconds	Total trip delay time at 2,544 MWt with minimum DNBR $\geq$ 1.43 for both four and three pump coastdown.
less 0.64 seconds	Penalty to guarantee that four pump coastdown has lowest minimum DNBR (i.e., is limiting coastdown event).
less 0.38 seconds	Penalty to provide acceptable DNB results for four pump coastdown at 2,772 MW (estimate not supported by analysis).
1.50 seconds	Recommended total trip delay time.

TABLE 1

Four and Three Pump Coastdown Minimum DNBR Results for FPC at 2,544 MWt

Coastdown	Delay Time (Sec.)	Minimum DNBR
4 pump coastdown from 4 pump operation	2.52	1.59
3 pump coastdown from 3 pump opeation	2.52	1.43

TABLE 1
(continued)
Four and Three Pump Coastdown Minimum
DNBR Results for FPC at 2,544 MWt

Coastdown	Delay Time (Sec.)	Minimum DNBR
4 pump coastdown from 4 pump operation	1.88	1.83
3 pump coastdown from 3 pump operation	1.88	1.83
4 pump coastdown from 4 pump operation	1.50	1.97
3 pump coastdown from 3 pump operation	1.50	2.04

Attached are B&W Documents 32-1134068-00 (CR-3 CY4 Operation for Revised Pump Monitor Delay Time) and BAW-1684 Revision 3 dated June, 1982 (Crystal River Unit 3 Cycle 4 Reload Report). Document 32-1134068-00 provides the documentation to support the revised delay time for the Power/Pump Monitor Trip and BAW-1684 Revsion 3 modifies the Cycle 4 Reload Report to reflect the revised delay time. This submittal completes the deliverables for Task 385.

Should you have any questions, please contact me.

Very truly yours,

J.A. Castanes
Engineering Product Manager

JAC/kjb

cc: T.C. Lutkehaus
P.Y. Baynard
W.P. Ellsberry

CALCULATION DATA/TRANSMITTAL SHEET

DOCUMENT IDENTIFIER

CALC. 32 - 1134068 - 00

TRANS. 86 - _____ - _____

TYPE: ___RESEARCH & DEVELOPMENT ✓SAFETY ANALYSIS REPORT ___NUC. SERV. INPUT ___DESIGN RQMT. ___DESIGN VERIF. ___OTHER

TITLE CR-III CY.4 OPERATION FOR REVISED PUMP MONITOR DELAY TIME.

PREPARED BY Michael J. Vehec REVIEWED BY L. B. Wemmer

TITLE CO-OP ENGINEER DATE 5/19/82 TITLE Principal Eng DATE 5/28/82

PURPOSE:

TO PROVIDE DOCUMENTATION OF A REVISED DELAY TIME FOR THE POWER / PUMP MONITOR TRIP. THIS ANALYSIS IS FOR AN OPERATING POWER LEVEL OF 2544 MWT., WITH PUMP MONITORS IN THE PLANT RPS SYSTEM. THIS IS A CY. 4 EVALUATION OF THE CR-III RPS-I SYSTEM. THE TOTAL DELAY TIME IS 1.5 SEC. THIS PROVIDES FOR 4 PUMP COASTDOWN PROTECTION, WHICH IS THE MOST LIMITING COASTDOWN EVENT, AND PROVIDES PROTECTION FOR DNBR.

SUMMARY OF RESULTS (INCLUDE DOC. ID'S OF PREVIOUS TRANSMITTALS & SOURCE CALCULATIONAL PACKAGES FOR THIS TRANSMITTAL)

RESULTS OF THIS FILE WILL BE TRANSMITTED IN DOCUMENTS: 86-1134069-00 AND 86-1134070-00

TOTAL POWER/PUMP MONITOR TRIP DELAY TIME = 1.5 SEC.

POWER/PUMP MONITOR SENSOR DELAY TIME = 1.229 SEC.

TECH. SPEC. VALUE FOR TRIP DELAY TIME = 1.44 SEC

THIS TECH. SPEC. DELAY TIME VALUE IS FOR INPUT TO TECH. SPEC. TABLE 3.3-2 FOR SURVEILLANCE TESTING.

DISTRIBUTION

SEE DRN

CONTENTS

1) PURPOSE

THIS FILE WILL ACCOUNT FOR THE PUMP MONITOR BEING RE-INSTATED INTO THE RPS SYSTEM FOR CR-III CYCLE 4 OPERATION, ALONG WITH A CHANGE IN THE DELAY TIME FOR THE POWER/PUMP MONITOR TRIP. THE ORIGINAL CR-III CYCLE 4 ANALYSIS WAS DONE WITH PUMP MONITORS PRESENT AND FOR A POWER LEVEL OF 2544 MWT. THIS FILE WILL ALSO USE THE 2544 MWT., AND WILL CLOSELY RESEMBLE THE ORIGINAL CYCLE 4 ANALYSIS. THE TECH. SPEC. DELAY TIME CALCULATED IN THIS FILE IS FOR INPUT TO TECH. SPEC. TABLE 3.3-2 FOR SURVEILLANCE TESTING.

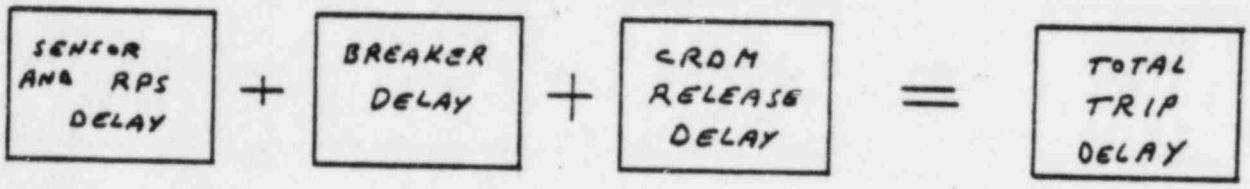
2) DESCRIPTION

THE DELAY TIME CALCULATION IN THIS FILE USES THE STANDARD RPS-I TRIP DELAY TIME METHODOLOGY. THIS METHOD IS TAKEN DIRECTLY FROM REFERENCE 2. THE METHOD USED PROVIDES DNBR PROTECTION FOR 4 AND 3 PUMP COASTDOWN. THE TOTAL DELAY TIME IS COMPOSED OF THE SENSOR, RPS, BREAKER, AND CROM RELEASE DELAY TIMES. A MORE DETAILED DESCRIPTION OF THE PUMP MONITOR TRIP IS FOUND IN REF. 4.

3)

CALCULATION

THE TOTAL TRIP DELAY TIME USED IN FSAR CHAP. 14 ACCIDENT ANALYSIS IS THE TIME FROM WHEN THE PROCESS VARIABLE EXCEEDS THE TRIP SETPOINT UNTIL THE CONTROL RODS BEGIN TO FALL DUE TO GRAVITY. THE BASIC COMPONENTS FOR THE DELAY TIME ARE LISTED BELOW:



THIS METHODOLOGY IS TAKEN FROM REF. 2 AND 4, B&W IS STANDARD FOR ALL 177 FA PLANT TOTAL TRIP DELAY TIME CALCULATIONS. THE KNOWN VALUES FOR THE POWER / PUMP MONITOR TRIP DELAY ARE AS FOLLOWS:

RPS DELAY = .131 SEC. (REF. 2)

BREAKER DELAY = .08 SEC. (REF. 2)

CRDM RELEASE DELAY = .06 SEC. (REF. 2)

ASSUMED TOTAL TRIP DELAY = 1.5 SEC. (REF. 3)

THE ASSUMED TOTAL TRIP DELAY TIME OF 1.5 SEC. IS USED TO PROVIDE FOR DNB PROTECTION FOR 4 AND 3 PUMP COASTDOWN. THIS CALCULATION IS CONSISTENT WITH NORMAL RPS CALCULATIONS. AN ALLOCATED MARGIN OF 0.054 SEC. IS ASSUMED (ALLOCATED FOR POTENTIAL CHANGES IN THE

CALCULATIONAL OR EQUIPMENT ACCURACIES).

WITH THE DATA OF THE PREVIOUS PAGE, IT IS ESTIMATED THAT A 1.175 SEC. PUMP MONITOR SENSOR DELAY REQUIREMENT WILL SUPPORT THE 1.5 TOTAL TRIP DELAY TIME THIS WILL ALSO AID FPC OPERABILITY (i.e., REDUCE PROBABILIT OF SPURIOUS PUMP STATUS TRIPS).

THE 1.5 SEC. TOTAL TRIP DELAY TIME WILL NOW BE VERIFIED THROUGH A TIME DELAY CALCULATION:

TOTAL TRIP DELAY TIME = SENSOR + RPS + BREAKER + CROM + MARGIN
= 1.175 + .131 + .08 + .06 + .054
= 1.5 SEC
1.5 SEC = 1.5 SEC

∴ TOTAL TRIP DELAY TIME = 1.5 SEC

ANOTHER RESULT OF THIS CALCULATION IS THE PUMP MONITOR SENSOR DELAY TIME BEING VERIFIED AS:

PUMP MONITOR SENSOR REQUIREMENT = 1.175 SEC.

FROM REF. 1, THE TECH. SPEC. VALUE OF THE PUMP MONITOR DELAY TIME IS ALSO CALCULATED:

TECH. SPEC VALUE = SENSOR + RPS + BREAKER
= 1.175 + .131 + .08
= 1.386 SEC.

THIS TECH. SPEC VALUE OF THE PUMP MONITOR DELAY TIME IS INPUT TO TECH. SPEC. TABLE 3.3-2 FOR SURVEILLANCE TESTING. NOTE THAT THE MARGIN AND THE CROM TIMES ARE NOT INCLUDED. THIS IS BECAUSE THEY DO NOT REFLECT THE ACCURACY OF THE EQUIPMENT TESTED DURING THE RESPONSE TIME SURVEILLANCE TESTING.

TECH. SPEC. RCPPM DELAY TIME = 1.286 SEC.

4) Q A COMMENTS

The 1.5 second delay provides the necessary time to reduce spurious pump trips and it meets acceptable safety criteria (DNB).

5) REFERENCES

1. MEMO: K.D. TULEY (SAFETY ANALYSIS) TO H. A. BAKER (PROJECT ENGINEERING) "RPS DELAY TIME INPUTS FOR TECH. SPECS." 7/8/81.

2. 32-1126004-00 "CR-3, CY. 3, PSC 47-80 RPS SETPOINT CALCULATIONS" 7/29/81. G.S. SHUKLA

3. 86-1132623-00 "INCREASED PPM DELAY FOR CR-3" 5/82 M.O. WALZ

4. 51-1128452-00 "FPC PUMP STATUS TRIP" 12/12/81 R.H. ELLISON
-01 "FPC P.M. DELAY TIME REV." 1/6/82 K.D. TULEY
-02 "FPC RPS REQT'S FOR RC FLOW" 1/18/82 K.D. TULEY