Official

June 5, 1992

Docket No. 50-302
License No. DPR-72

Florida Power Corporation
Mr. Percy M. Beard, Jr.
Senior Vice President, Nuclear
Operations
ATTN: Manager, Nuclear Operations
Licensing
P. O. Box 219-NA-2I
Crystal River, FL 32629

Gentlemen:

SUBJECT: FPC MEETING SUMMARY

This letter refers to the meeting conducted at your request on May 18, 1992, in the Nuclear Regulatory Commission Region II office. The purpose of the meeting was to discuss the failure of emergency feedwater valve EFV-14 to completely close as reported to the NRC on April 28, 1992, event number 23352.

It is our opinion that this meeting was beneficial and provided a better understanding of the issue.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosures will be placed in the NRC Public Document Room.

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

Sincerely,

Original signed by
Ellis W. Merschoff/for

Albert F. Gibson, Director
Division of Reactor Safety

Enclosures: (See page 2)

IE01

Enclosures:
1. List of Attendees
2. Meeting Summary
3. Handout

cc w/encls:
G. L. Boldt
Vice President, Nuclear Production
Florida Power Corporation
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Crystal River, FL 32629

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Nuclear Plant Operations
Florida Power Corporation
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Nuclear Operations Site Support
Florida Power Corporation
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(cc w/encls cont'd - See page 3)

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Chairman
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F. Jape, RII
H. Silver, NRR
Document Control Desk

(bcc w/encls cont'd - See page 4)

(bcc w/encls cont'd)
NRC Resident Inspector
U.S. Nuclear Regulatory Commission
6745 N. Tallahassee Road
Crystal River, FL 32629

RII:DRS	RII:DRS	RII:DRP
FJape:ser	CJulian	KLandis
06/3/92	06/5/92	06/5/92

Enclosure 1

Meeting Attendees

P. R. Tanguay, Director Nuclear Operations Engineering and Projects, FPC
G. L. Bolt, Vice President, Nuclear Productions, FPC
G. M. Halnon, Manager Nuclear Plant Systems Engineering, FPC
K. R. Wilson, Manager Nuclear Licensing, FPC
E. W. Merschoff, Deputy Director, Division of Reactor Safety, NRC, RII
F. Jape, Chief, Test Programs Section, Division of Reactor Safety, NRC, RII
P. Holmes-Ray, Senior Resident Inspector, Crystal River 3, NRC, RII
K. D. Landis, Chief, Projects Section 2B, NRC RII
F. Rinaldi, Project Engineer, NRC, NRR

Enclosure 2

Meeting Summary

The failure of emergency feedwater valve EFV-14 to completely close as reported to the NRC on April 28, 1992, was discussed.

Two main topics discussed were the chronology of events leading to the reportable event and a description of how the emergency feedwater system works and its control logic. The handout material used during the discussion is included as Enclosure 3.

Enclosure 3

Overview and Chronology

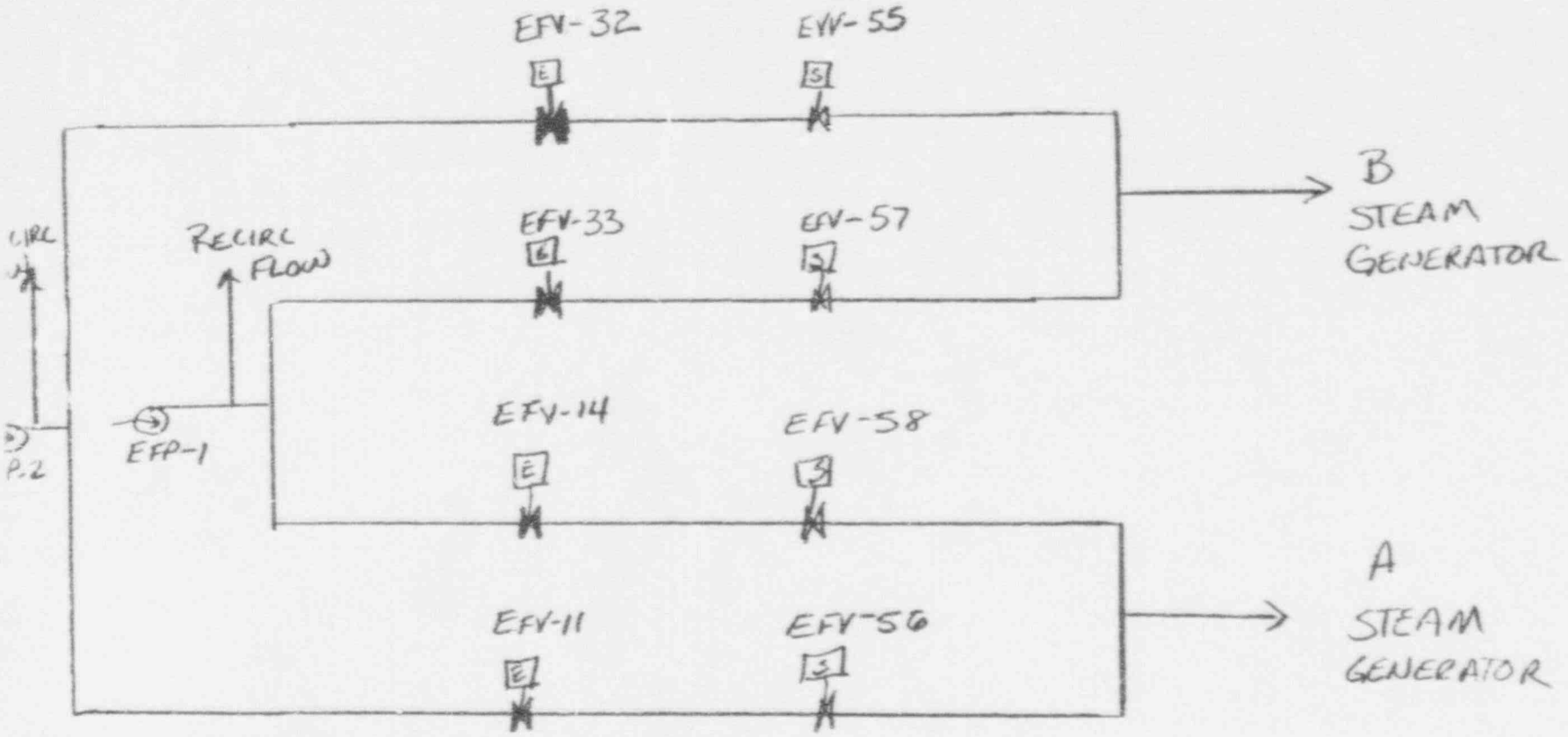
Chronology of Events

EFV-14

09/19/87	EFV-14 opened and closed against 1265 psid for 85-03 testing.
10/10/91	Shutdown for Midcycle 8 outage commence.
10/12/91	Baseline static test performed to verify thrust settings.
10/13/91	Open dP test performed at 1445 psid. Valve opened sat.
10/13/91	Closed dP test performed at 1445 psid, 245 gpm. Valve failed to fully close, flow reduced to 160 gpm.
10/15/91	Limitorque provides instructions to increase actuator rating by 40% (24,000# to 33,600#)
10/16/91	Problem Report SYPR 91-0025 issued.
10/15 thru 10/30	Maintenance performed to increase actuator rating.
10/30/91	Baseline test performed to verify new thrust settings.
11/16/91	Closed dP test performed at 1445 psid, 245 gpm. Valve failed to fully close, flow was reduced to 0 on Control Room indication but did not receive the closed indication.
11/17/91	Test procedure revised to set up 1300-1367 psid per the B&W calculation. (Prior dP was being used to be conservative.) Valve failed to fully close, flow was reduced to 0 gpm on the Control Room indication but did not receive the closed indication.
11/17 thru 12/15	CR-3 experienced 3 reactor trips
12/11/91	MOV group issues letter to Manager, Nuclear Plant Systems Engineering (NPSE) describing proposed schedule for future dP tests.
12/16/91	Manager, NPSE issues letter to engineering groups prioritizing the dP calculations. Set due date for EFV-14 by 1/31/92.
12/20/91	Secondary System Supervisor assigns the Emergency Feedwater System Engineer the calculation requirement with associated due dates.
1/6/92 thru 1/10/92	NRC Entrance for MOV (GL89-10) Inspection.
2/5/92	EF System Engineer completes revision 0 of EFV-11,14 calculation, new dP is calculated at 1215 psid.
2/24/92	Calculation Verification Engineer completes verification. (Same Engineer was verifying other calculations from remaining System

Engineers).

about 3/6	Test procedure for dP test in revision.
3/19/92	Meetings held with Licensing/Operations to determine valve condition. New dP was lower but not significant as first thought. Results, valve ok since new revised dP was lower than 85-03 tested value of 1265 psid where it passed. Need to ensure test during Refuel 8 outage in April.
3/24/92	Letter issued to Refuel 8 Outage Coordinator describing importance of EFV-14 dP test schedule.
4/92	Test procedure engineer questions the calculation assumption of 1000 gpm flow. During the revision of the procedure and validation on the simulator, it appeared this was not conservative.
4/14/92	Simulator run confirms that 200 gpm recirculation flow should be used.
Week of 4/20	Calculation was revised with new assumptions to 1501 psid.
4/25/92	Management team met to discuss results, determined valves should be closed.
4/28/92	Final calculation issued, Problem report re-classified as reportable, report made.


EFV-32
EFV-55
B
STEAM
GENERATOR
CIRC
RECIRC
FLOW
EFV-33
EFV-57
EFP-1
P-2
EFV-14
EFV-58
A
STEAM
GENERATOR
EFV-11
EFV-56

EMERGENCY FEEDWATER BLOCK VALVE SAFETY SIGNIFICANCE

The EFW block valves (EFV-11, -14, -32 and -33) are aligned as shown on FD 302-082.

Each of two EFW pumps supplies each of two OTSG's through two independent flowpaths.

Each flow path contains a block and control valve.

EFIC controls these valves to provide a wide variety of protection features.

The control valves provide rate of fill, pump runout, and other variable flow functions.

The block valves principal safety is to open to allow EFW flow.

No DBE with concurrent single active failure will result in the inability to provide EFW when called upon.

The block and control valves close to isolate each flowpath when EFIC identifies a faulted OTSG or imminent OTSG overfill.

The actual safety significance of NOT isolating EFW to a faulted OTSG is very minor and can be corrected by operator action.

The only scenario that can cause the EFW block valves to see a 1500# dP is the complete failure (if it partially closes it will take some of the dP) of the associated block valve concurrent with the HELB.

The test failures did isolate significant EFW flow even if complete isolation was not achieved.

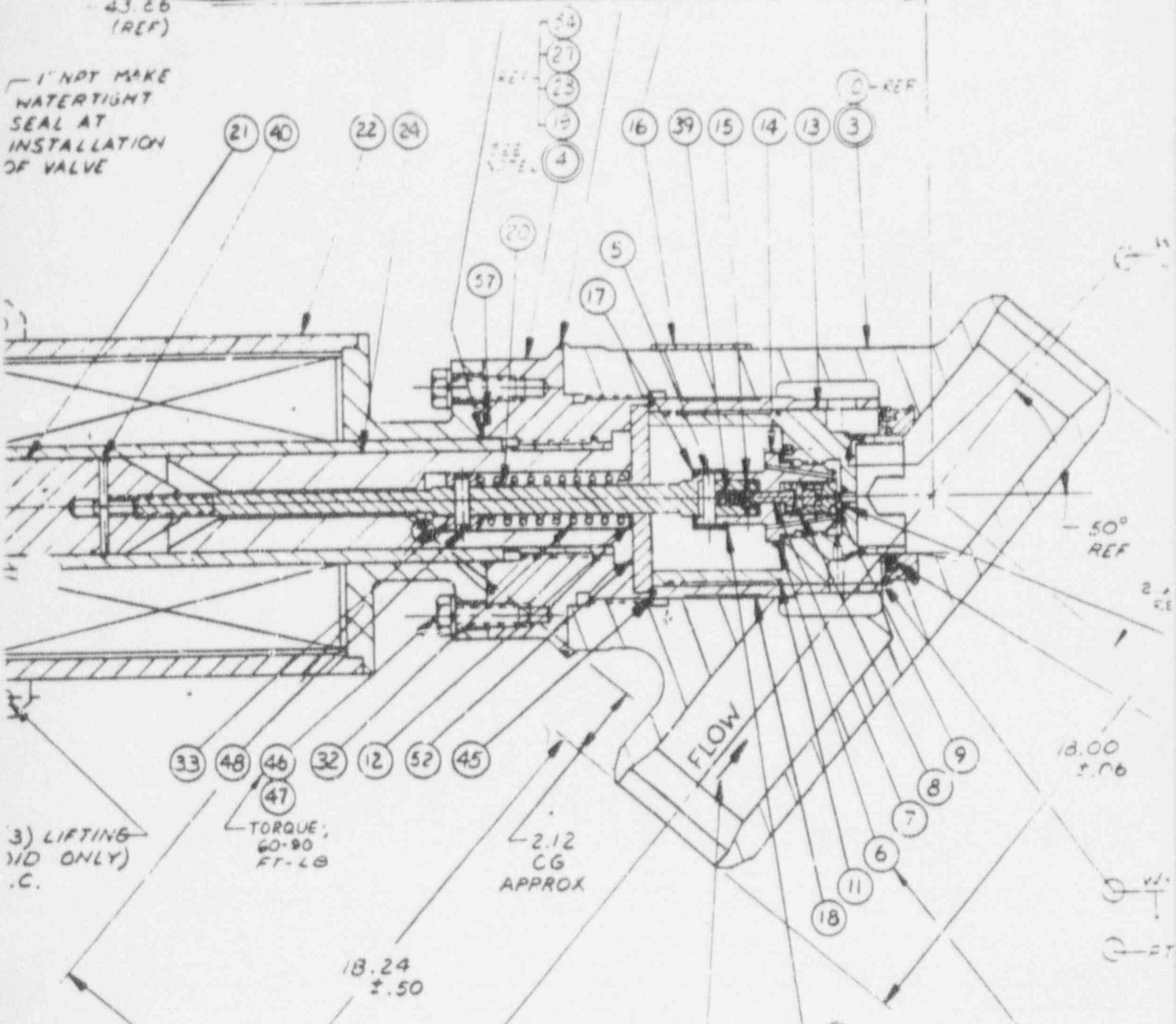
EE PROJECT
ONTROL DWG

Control Valve

TIG TACKWELD 4 CORNERS USING AWS 5.9 FILLER TYPE ER 308, FOR SS TYPE ER 309, FOR CS

43.66 (REF)

1" NPT MAKE WATERTIGHT SEAL AT INSTALLATION OF VALVE



3) LIFTING
OID ONLY)
.C.

TORQUE; 60-90 FT-LB

VIBROTOOL "FLOW", .50 HIGH & ARROW 1.12 LONG IN APPROX LOCATION SHOWN (OUTSIDE DIA)

REFER TO PROJECT CONTROL DWG

FIND NO	QTY REQ	PART NO	DESCRIPTION

Correspondence

Problem Report No. SVPR-91-0025
Title EFV-14 Closing Failure
Resp. Organization EPMC
Closeout Organization EPMC

PLEASE RETURN THIS PROBLEM REPORT TO CONNIE BELL IN THE NUCLEAR ADMINISTRATION BUILDING (230-4509) IF IT BECOMES MISPLACED. THANK YOU.

SIGNATURE ANALYSIS VALVE REPORT
FOR
Florida Power Corporation
Crystal River Unit 3
January 19, 1988

Test I.D. 302-120887-EFV-014

COMMENTS

MOV DATA REPORT

THRUST SIGNATURE ANALYSIS

PLOTS

THREE POINT TEST

INTERPRETATION GUIDE

CONFIDENTIAL

****
* Test I.D. 302-120887-EFV-014 *
* Crystal River Unit 3 *
****

****
********** NOTE #1 **********
****

The open and close torque switch settings were adjusted to achieve the target thrust values provided by Plant Engineering.

****
********** NOTE #2 **********
****

A torque switch balance test was conducted, and the torque switch was found to be balanced.

****
********** NOTE #3 **********
****

The torque switch in this operator is without a thrust setting limiter plate.

****
********** NOTE #4 **********
****

This valve opened and closed satisfactorily against both differential pressures of 620 psig on September 19, 1987 and 1,265 psig on September 22, 1987 respectively.

****
********** NOTE #5 **********
****

Prior to "as-left" testing the spring pack was removed, degreased and reinstalled.

****
********** NOTE #6 **********
****

Prior to "as-left" testing, the valve was repacked, which reduced the running load to less than preload.

MOV DATA REPORT PREPARED FOR
FLORIDA POWER CRYSTAL RIVER UNIT 3
VALVE ID : EFV-014
ON 01-06-1988

SYSTEM

System	: EF	Design Diff Press	: 1510 PSI
Flow	: ZERO	Pressure	: ATMOSPHERIC
Temp	: AMBIENT	Sfty Rel'd	: YES

OPERATOR

Type	: SMB	Size	: 0
Serial Number	: 229988	Order Number	: 385715A
Orientation	: HORIZONTAL	Manufacturer	: LIMITORQUE

VALVE

Manufacturer	: CRANE	Type	: GATE
Size	: 6 IN	Body Orientation	: VERTICAL
itial Position	: CLOSED	Final Position	: CLOSED
ve Orifice Size	: 5.75 IN	Stem Thread Pitch	: 0.333 IN
em Lead	: 0.333 IN	Stem Diameter	: 1.625 IN
Packing Type	:	Packing Depth	:

ELECTRICAL

Control Cir Volts	: 125	AC/DC	: DC
Open Control	: LIMIT	Close Control	: TORQUE
MCC	: DPDP-80	SW Sensing Cir.	: VOLTAGE

TORQUE SWITCH

Open T.S. Setting	: 2.125	Close T.S. Setting	: 2.125
Limiter Plate	: NONE	TS Balanceable	: YES

MOTOR

Motor Volts	: 125	Rated Amps	: 14.5
Speed	: 1900	Horsepower	: 1.805
Unit Ratio	: 51.80:1	Motor Start Torque	: 25 FT-LBS

MOVATS TEST EQUIPMENT

Load Cell#	: ST-386	Amp Probe #	: TI-1475
Mainframe #	: ST-310	TMD #	: TI-1474

PROBLEM REPORT

Report Category: SYPR
Report Number: 91 - 0025
Page: 1

PART 1: INITIATION, REVIEW, AND SIGNIFICANCE EVALUATION BY THE ORIGINATING DEPT/ORG

Title/Subject: EFV-14 CLOSING DIFFERENTIAL PRESSURE TEST FAILURE

Detailed Description of the Condition/Event (a thru g below):

a) Description:
DURING THE CLOSING DIFFERENTIAL PRESSURE TEST ON EFV-14, THE MOTOR OPERATED VALVE FAILED TO CLOSE.

[ ] Continued

b) Immediate Impact: NONE. PLANT IS IN A SCHEDULED MIDCYCLE B. OUTAGE.

[ ] Continued

c) Immediate Actions Taken: MOV IS RED TAGGED. DISASSEMBLY OF THE MOV STARTED ON 10-14-91 FOR ROOT CAUSE DETERMINATION.

[ ] Continued

d) Suspected Cause: [X] Unknown [ ] Personnel Error [ ] Inadequate Proc/Document [ ] Equipment Failure
[ ] Other (describe):

e) Recommendations (if any): PURCHASE A SMB-1/40 FT LB. MOTOR OPERATOR.

[ ] Continued

f) Method of Discovery: PT-405B EFV-14 CLOSING DP TEST

g) Discovery Date/Time: 10-13-91 Event Date/Time (if known): APPROX 0530 HR.

Requirements/Commitments Violated: NRC GENERIC LETTER 89-10.

[ ] Continued

Associated/Related Documents:

[ ] Continued

Equip Tag Number(s): EFV-14

Vendor Name & Number (if known): LIMITORQUE CORP (804)-845-9787

Originated By: John J. Miller Supv/Mgr Concurrence: M. J. Fitzgerald

ORIGINATING DEPT/ORG SIGNIFICANCE EVALUATION

CLASSIFICATION (Mark the Appropriate Box - ONLY ONE)

[ ] (R) Reportability or Plant Personnel Safety Concern
Immediately Notify/Discuss with the NSS
Name of NSS Notified : _____
Date and Time Notified: _____
Forward (preferably Hand-Carry) to the NSS for Processing (Attachment A required)

[X] (S) Significant Problem (Attachment B required)

[ ] (N) Non-Significant Problem (Attachment C required)

[ ] (P) Procurement Problem (Attachment D required - Process per the NP&SM)

Problem Investigation and Development of the CAP (Response) is DUE No Later Than:

CLASSIFICATION REVISED TO:
[ ] Repl - Immediately Notify/Discuss with NSS
[ ] Sig [ ] Non-Sig [ ] Procurement
Requested By/Date: _____

The Problem Report is: Safety Related: [ ] NO [X] YES (if unsure check Yes);
Hardware Related: [ ] NO [X] YES ; A "Suspected" Design Basis Issue: [ ] NO [X] YES

10CFR21 Review Requested: [X] NO ; [ ] YES - Referred to:

Responsible Dept/Org: NPSE NTTS Code: EPMC Accepted By: [illegible]

Closeout Dept/Org: NPSE NTTS Code: EPMC Contacted: [illegible]

Problem Report Reviewer (PRR): Michael J. Fitzgerald PR Issue Date: 10/16/91

Rev. 2P1

RET: Life of Plant RESP: Quality Programs 20.973

PROBLEM REPORT

Report Category: SYPR
Report Number: 91-0025
Page: 2

ATTACHMENT B - Significant Problem

PART 2: RESPONSIBLE DEPT/ORG INVESTIGATION AND CORRECTIVE ACTION PLAN

Assigned to: JOHN J. MIELE — Date Assigned: 10-30-91

Problem Investigation and Development of the Corrective Action Plan (CAP) is due NO LATER THAN: 11-16-91

Concurrence of the "Significance Classification" is given by: Michael J. Fitzgerald / John J. Miele

Review and Determination of Problem Extent and Generic Impact:
A REVIEW OF THE MAX. DIFFERENTIAL PRESSURE CALCULATION E90-1019 HAS DETERMINED THE MAX DP CALCULATED FOR ERV-14 WAS IN ERROR. CALCULATION E90-1019 MUST BE REVIEWED TO PRECLUDE THIS TYPE OF SITUATION FROM RECURRING.

10CFR21 Review Requested: [X] NO ; [ ] YES - Referred to:

Describe and Justify the ROOT Cause Determination: NTTS Cause Code:
SEE ATTACHED DOCUMENTS ; LETTER DATED 11-17-91 TO W.M. MARSHALL FROM R.E. FULLER
ATTACHMENT TO SYPR 91-0025 FROM G.N. HALNON DATED 11-17-91

[ ] Continued

Corrective Action Plan (CAP) - Include all Immediate, Interim, and Remedial Actions, and any Actions to Prevent Recurrence and their Completion Dates or Schedule:

Number and Describe each Corrective Item	Dept/Org	Completion Date
1) 1. PM178 (6YR) WR#288939 PREVENTIVE MAINT PERFORMED FOR ANY DEGRADATIONS (NONE FOUND)	1) ELEC. SHOP	1) 10-14-91 (START) 10-29-91 (COMP.)
2. ACTUATOR THRUST RATING INCREASED PER LIMITORQUE	2. ENGR.	2. 10-21-91
3. ACTUATOR BOLTING RETORQUED PER LMTQ. WR# 290003	3. ENGR. ELEC SHOP	3. 10-29-91
4. ACTUATOR THRUST VALUES RESET WR# 274130	4. ENGR. ELEC SHOP	4. 10-29-91
5. REA 91-1478 (ENGR. RECOMMENDATIONS FOR SOLUTION)	5. ENGR.	5. 11-20-91

[X] Continued — Final Scheduled Completion Date:

Indicate Hardware Disposition(s):
[ ] N/A or N/R [ ] Accept-As-Is* [ ] Repair* [ ] Rework [ ] Return to Vendor [ ] Salvage for N-S Use
[ ] Scrap [X] Other (describe): REA 91-1478 WRITTEN TO UPGRADE ACTUATORS
* Engineering Justification and Approval Required for these Dispositions

Approved By: M.J. Fitzgerald — Date: 11/24/91

PART 3: CLOSEOUT ORGANIZATION CONCURRENCE WITH THE CAP AND SCHEDULE

[X] ACCEPTABLE; [ ] PARTIALLY ACCEPTABLE; [ ] UNACCEPTABLE
Remarks/Comments:

Revised/Additional Response Due By:

Evaluated By: [signature] — Date: 11/29/91

PART 4: RESPONSIBLE DEPT / ORG SATISFACTORY COMPLETION OF ALL CORRECTIVE ACTIONS

Approved By: — Date:

PART 5: REVIEW AND CLOSEOUT ACTIVITIES BY THE CLOSEOUT ORGANIZATION

Results of the Review/Verification of Completed Corrective Actions:
[ ] UNACCEPTABLE By: — Date:
Document the Unacceptable Items (Use a Continuation Sheet) and Inform the Responsible Dept/Org.

[ ] All Corrective Actions ACCEPTABLE By: — Date:

Final Package Review and Problem Report Closeout

Closeout Approved By: — Date:

PROBLEM REPORT

Report Category: SYPR
Report Number: 91 - 0025

CONTINUATION SHEET

IDENTIFY THE BLOCK BEING CONTINUED AND RECORD THE ADDITIONAL DATA/INFORMATION

Summary of Corrective Action Plan	Dept.	Completion Date
Specific for EFY-14		
1. Evaluate actual assumptions for determination of worst case DP.	NPSE	End of RFB
2. Calculate the worst case DP	NPSE	End of RFB
3. Revise test procedure to establish actual test assumptions and DP	NPSE	End of RFB
4. Evaluate previous test data to verify valve operator is adequate	NPSE	End of RFB
5. Test valve operator to new actual worst case DP values	NPSE	End of RFB
6. An option may be exercised to replace this operator with one that will allow a higher margin to maximum	NPSE	End of RFB

OTHER ACTIONS:

1. Include calculation E90-1019 in the scope of Problem Report SYPR 91-0025 (covers all Generic Letter 89-10 valves)	NPSE	End of RFB
2. Perform detailed System Engr review of all valve DP calculations prior to any further DP testing	NPSE	End of RFB
3. Revise ~~MOV~~ DP tests as necessary	NPSE	End of RFB

11/29/94

INTEROFFICE CORRESPONDENCE

Florida Power
CORPORATION

Nuclear Licensing	NA2I	230-4547
Office	MAC	Telephone

SUBJECT: EFV-14 Differential Pressure Issue

TO: W. M. Marshall DATE: November 17, 1991

The failure of EFV-14 to pass the recent differential pressure testing is not considered to be a restraint to escalation of Modes during startup from 8M. The Emergency Feedwater (EFW) system is capable of meeting its design safety function to mitigate the consequences of an event with the loss of normal feedwater. The system is considered operable since the components and flow paths are capable of providing EFW flow to the steam generators.

Engineering and Licensing are evaluating the differential pressure testing requirements, and the potential degraded function of EFV-14, EFV-11, EFV-32, and EFV-33 with respect to EFW control logic on the worst case Feed Only Good Generator (FOGG) event. The initial conclusion is that the calculation establishing the worst case differential pressure contains questionable assumptions and incorrect arithmetic results. Therefore, it is unclear whether the recent testing of the EFW block valves has identified a problem with the valves or not. Additional data searches and discussions with B&W are necessary to fully resolve the issue. I will keep you informed of the results of our investigations.

R. E. Fuller

EFV-14:

This valve is designed to close upon a "Feed Only Good Generator" (FOGG) signal from the Vector Logic of EFIC. It therefore must be capable of closing against worst case differential pressure (dP) experienced during such an event. This dP was calculated and documented in FPC calculation E90-1019 which was based on a B&W Document 51-1164140-00. The proceduralized test conditions were established and EFV-14 failed to completely close against the dP from the calculation. Reviewing the test and calculation, the calculation has some apparent problems and discrepancies. In general, the actual worst case dP is presently indeterminate from the assumptions and equations used in this calculation. The questionable areas are outlined below.

1. In the narrative, the accident assumed to give worst case dP is the Steam Generator Tube Rupture. It is stated this accident depressurizes the OTSG and will cause the FOGG logic to be imposed.
   This is obviously incorrect. The OTSG Tube Rupture will not depressurize the OTSG unless RCS pressure is less than secondary pressure. This assumption was either in error or some accident scenario assumptions are not obvious.

2. In the parameters for each component, the value of 3100' was used at 1175 gpm. This number is the total head added by the pump.
   The Technical Manual pump curve shows a head of 2450' at 1175 gpm. This translates into a reduction in dP of approximately 20%.

3. A conservative assumption was made to neglect line losses or elevation changes.
   The flow path contains two check valves and several branch connections. The cumulative effects will reduce the worst case dP. The magnitude of such a reduction will need to be calculated.

4. The calculation utilized in determining the discharge pressure of the pump subtracted the height of water on the suction side from the total dynamic head.
   The actual equation in the calculation is incorrect. The numbers equate to a value lower than concluded on paper. The number, if calculated as shown, equates to 1264 psid. Arranging the equation correctly and using the assumptions of the calculation equate to 1316 psid. Both results do not match the 1367 value listed in the calculation.

To further add to the questions, the actual operation of the FOGG logic was not taken into consideration. The effects of the downstream control valve reducing the dP across the block valve will be significant. The control valve will be at some intermediate position thus increasing the pressure between the block valve and the control valve. This will work to decrease the dP across the block valve.

The flow limiter circuit will cause the control valves to close from the full open position to the 50% open position upon EFIC actuation. This circuit is

designed to limit the condition in which a single EFW pump is feeding OTSGs or conditions of low OTSG pressure caused by steam or feed leaks.

Subsequently, the circuit enables additional closure from 50% up to 80% when the total OTSG flow changes from 0 to 100% of it's range. From 600 gpm to 1000 gpm, control valve position will decrease from 50% to 80% closed further reducing the dP across the block valve.

As can be inferred from the above discussions, it appears more thought and evaluation needs to be factored into the determination of worst case dP for the EFW block valves. The complexity of the EFIC systems precludes using basic methods in determining this value. Further testing at potentially high dP values, runs the real risk of damaging both the valve and operator. In September of 1987, EFV-14 was successfully tested at a dP of 1267 psid during the performance of MAR 87-07-01-01, TP #2. This supports the engineering judgement that the system is not significantly degraded by not having a conclusive dP test during 8M. It must be noted that the smallest dP used during 8M was 1320 psid at which the valve would not fully close. The valve is being required to operate with very little margin to it maximum achievable thrust.

Summary of Corrective Action Plan:

Specific for EFV-14:

1. Evaluate actual assumptions for determination of worst case dP.
2. Calculate the worst case dP.
3. Revise test procedure to establish actual test assumptions and dP.
4. Evaluate previous test data to verify valve operator is adequate.
5. Test valve operator to new actual worst case dP values.
6. An option may be exercised to replace this operator with one that will allow a higher margin to maximum.

Other Actions:

1. Include calculation E90-1019 in the scope of problem report SYPR 91-0025 (covers all Generic Letter 89-10 valves).
2. Perform detailed System Engineer review of all valve dP calculations prior to any further dP testing.
3. Revise/write dP tests as necessary.

All actions will be satisfied by the end of Refuel 8.

G. H. Hairnon, Manager 11/12/91
Nuclear Plant Systems Engineering

Attachments:
1. MAR 87-07-01-01 TP#2
2. Test Report 302-120887-EFV-014
3. Calc E90-1019 Rev 0, p 91 of 147
4. Pump Curve for EFP-1
5. SYPR 91-0025

CURVE NO. N-
DATE 7-19-

CURVES ARE APPROXIMATE. PUMP GUARANTEED FOR ONE SET OF CONDITIONS CAPACITY, HEAD AND EFFICIENCY GUARANTEES ARE BASED ON SHOP TEST AND WHEN HANDLING CLEAR, COLD, FRESH WATER AT A TEMPERATURE OF NOT OVER 85° F. AND NOT OVER 15 FOOT SUCTION LIFT.

IMPELLER PATT NO. 4X9N3 DIA. 8 1/2"

DIFFUSOR PATT. NO.

FLORIDA POWER CORPORATION
CRYSTAL RIVER STATION UNIT NO. 3
P.O. BR3-1374
EMERGENCY FEEDWATER PUMP

THIS CERTIFIES THAT THIS CURVE IS BASED ON ACTUAL TEST PERFORMANCE

W. D. Albert

W. D. Albert 7/20/77

CHARACTERISTIC CURVE

NO. 4X9 TYPE N-7 PUMP

4050 R.P.M.

PUMP NO. 10701 ORDER NO. 312-36006

INGERSOLL-RAND COMPANY ITEM # 1

CAMERON PUMP DIVISION

DATE 7-19-77 CURVE N-9-10

REVISION 01

TOTAL HEAD IN FEET

PER CENT EFFICIENCY

BRAKE HORSE POWER

NPSH

EFFICIENCY

TOTAL HEAD

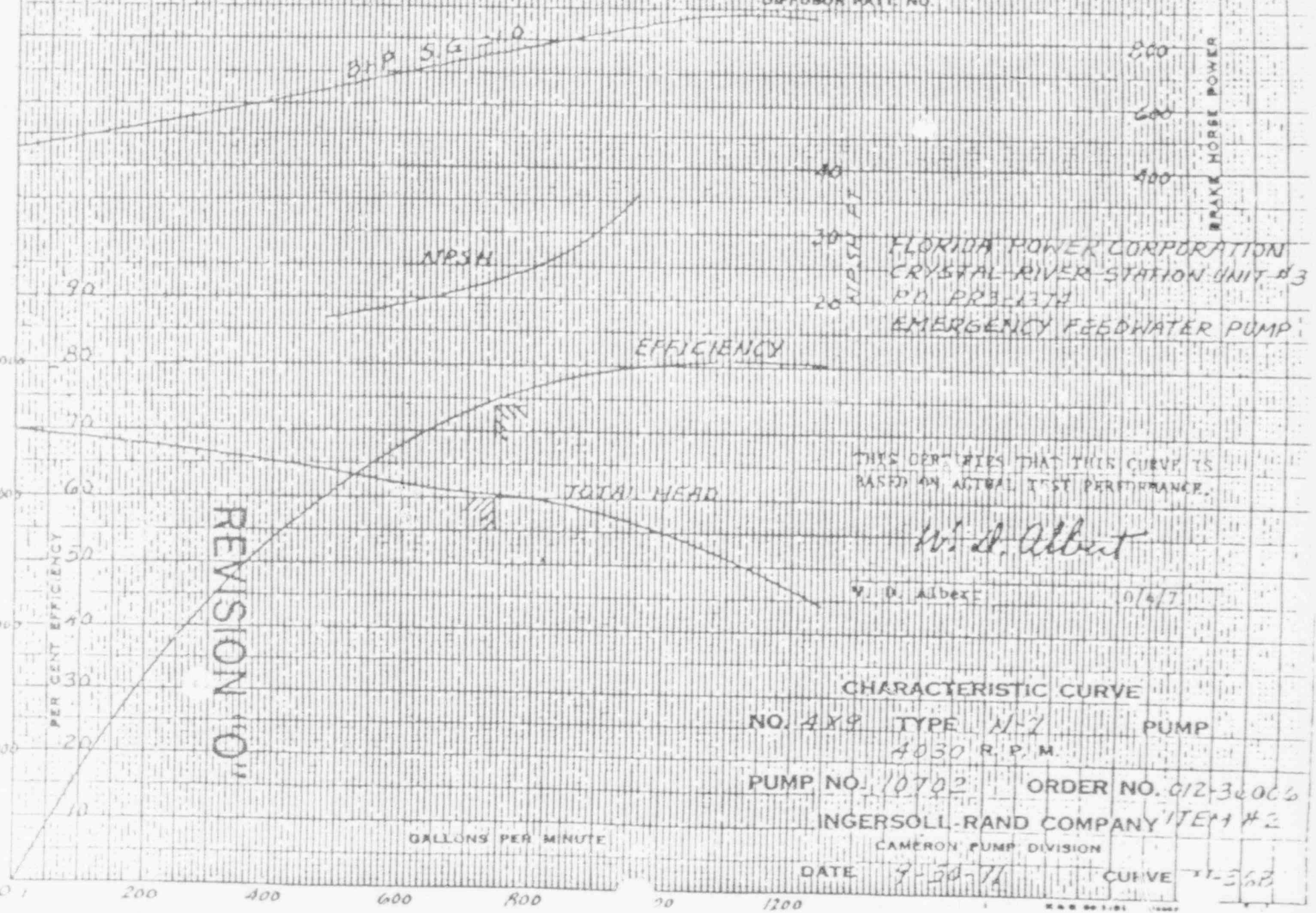
GALLONS PER MINUTE

CURVE NO. N-3(
DATE 9-30-

C AS ARE APPROXIMATE. PUMP GUARANTEED FOR ONE SET OF CONDITIONS CAPACITY, HEAD AND EFFICIENCY GUARANTEES ARE BASED ON SHOP TEST AND WHEN HANDLING CLEAR, COLD, FRESH WATER AT A TEMPERATURE OF NOT OVER 85° F. AND NOT OVER 15 FOOT SUCTION LIFT.

IMPELLER PATT. NO. 4X9N3 A/B DIA. 9 1/4

DIFFUSOR PATT. NO.



FLORIDA POWER CORPORATION
CRYSTAL RIVER STATION UNIT #3
P.O. PR3-137H
EMERGENCY FEEDWATER PUMP

THIS CERTIFIES THAT THIS CURVE IS BASED ON ACTUAL TEST PERFORMANCE.

W. D. Albert

W. D. Albert 10/6/71

CHARACTERISTIC CURVE

NO. 4X9 TYPE M-2 PUMP

4030 R.P.M.

PUMP NO. 10702 ORDER NO. 612-36026

INGERSOLL-RAND COMPANY ITEM #2

CAMERON PUMP DIVISION

DATE 9-30-71 CURVE N-3(B)

INTEROFFICE CORRESPONDENCE

Florida Power CORPORATION

Nuclear Plant Systems Engineering Office | NA1E MAC | 230-4724 Telephone

SUBJECT: CR-3 Motor Operated Valve Program
Differential Pressure Testing Schedule

TO: G H. Halnon

DATE: December 11, 1991
NPSE91-0418

The following is a listing of Motor Operated Valves which should be tested during the next three scheduled outages. This listing is a recommendation only, and is subject to change following the system engineering review.

Suggested Refuel 8 Differential Pressure Tests

BSV-3 or 4	Reactor Building Spray Header Inlet ISO
BSV-16 or 17	Reactor Building Spray Pump ISO to Pump
DHV-5 or 6	Low Pressure Injection Cont. ISO From DHP-1A/1B
DHV-34 or 35	DHP-1A/1B Suction From Borated Water Storage Tank
DHV-41	Decay Heat Removal Outlet Containment Isolation
DHV-42 or 43	Decay Heat Suct From Reactor Bldg Sump to DHP-1A/1B
DHV-75 or 76	DHP-1A/1B Isolation From MUFL
DHV-91	PZR Spray ISO
DHV-105 or 106	DHP-1A/1B ISO From Makeup Prefilter
DHV-110 or 111	Outlet of DHHE-1A/1B
EFV-32 or 33	EFP-2 Isolation (DC)/Mtr Driven Emerg FWP EFP-1 to Stm Gen
FWV-28	Feedwater Disch Crosstie
FWV-29 or 30	Main Feedwater Block to Stm Gen RCSG-1B
MUV-3 or 9	Disch ISO Vlv Between MUP-1C and MUP-1B
MUV-23, 24, 25 & 26	Hp Inj Control Valve to RX Inlet Lines Loop A/B
MUV-27	HP Inj Control Valve to RX Loop B
MUV-38	Inlet Isolation MUHE-1A

MUV-39	Inlet Isolation MUHE-1B
MUV-40 or 41	Disch Isolation For MUHE-1A/1B
MUV-58	Hi Press Suction From Borated Wtr Storag. Tank Valve
MUV-73	hi Press Suction From Borated Wtr Storage Tank Valve
MUV-257	Makeup Pump Recirc Valve
MUV-258, 259, 260 & 261	Controlled Bleedoff RCP-1A/1B/1C/1D

The above list will complete all the NRC I.E.B. 85-03 MOV's.

Suggested Midcycle 9 Differential Pressure Tests

CAV-1 or 3	Pressurizer Steam/Water Space Sampling ISO
CAV-4 or 5	Steam Generator RCSG-1A/1B Sampling ISO
CAV-126	RC Letdown Sample
CFV-5 or 6	CFT-1A/1B Outlet ISO (Leakoff Connection)
CFV-11 or 12	CFT-1A/1B Sampling (Leakoff Connection)
CFV-15 or 16	CFT-1B/1A Vent to Waste Gas Decay Tank (Leakoff Connection)
FWV-31 or 32	Low Load Block Valves
FWV-33	Startup Block Valves
FWV-34 or 35	Emerg Feedwater Block to Stm Gen RCSG-1B/1A
FWV-36	Startup Block Valves

Suggested Refuel 9 Differential Pressure Tests

DHV-7 or 8	Discharge Crosstie
DHV-39 or 40	Decay Heat Isolation to DHP-1A/1B
RCV-11	PZR RCT-1 ISO to RVC-10
RCV-13	PZR RCT-1 Inlet Spray ISO
RCV-14	Spray Control For PZR RCT-1

RCV-53	DH Inj Line ISO to PZR RCT-1
WDV-3	Sump Pump Discharge Isolation
WDV-60	RC Drain Tank Vent Isolation
WDV-94	RC Drain Tank Isolation
WDV-405 or 406	RB Vent Header Isolation

Although this is an aggressive schedule, we must keep in mind that no DP testing was performed during Refuel 7. Also, once the system review is completed it may be determined that several MOV's may be impracticable to perform "in-situ" testing. A scheduling review is required for determination of testing on line and the respective outage. MOV's that have been identified as impracticable to test "in situ"; possibly the EPRI Performance Prediction Program may offer some assistance.

If you have any questions or if I can be of any further assistance please call me at 230-4724.

John J. Miele

J. J. Miele, Project Nuclear Engineer
Nuclear Plant Systems Engineering

M. J. Fitzgerald

M. J. Fitzgerald, Supervisor
Nuclear Plant Systems Engineering

JJM/ejc

xc: J. G. Brandely
G. Flakes
W. M. Marshall
S. C. Powell
J. H. Terry
G. D. Vaughn
G. W. Wilson
Records Management

INTEROFFICE CORRESPONDENCE

Florida Power
CORPORATION

Nuclear Plant Systems Engineering	NA1E	230-4493
Office	MAC	Telephone

SUBJECT: Differential Pressure Calculations for Generic Letter 89-10 Valves

TO: D. M. Czufin
M. J. Fitzgerald
R. L. Muzzi
R. L. Thompson

DATE: December 16, 1991
NPSE91-0430

Attached is a copy of Calculation E90-1019 giving the worse case differential pressures for GL 89-10 MOV's.

The overall plan is to split this calculation up into an individual calculation for each valve or valve grouping. I expect the four Supervisor's to meet to ensure all valves are being covered and would like a plan and schedule by December 31, 1991. I fully expect all calculations to be issued prior to March 15, 1992. Valves scheduled to be tested during Refuel VIII should be the top priority and finished first. I want EFV-14 calculation done by January 31, 1992.

Mike Fitzgerald has overall leadership in this effort and will be accountable for ensuring due dates are met. All questions should be referred to Mike.

G. H. Halnon, Manager
Nuclear Plant Systems Engineering

GHH/kar

xc: C. J. Bell (PL Entry)
R. L. Murgatroyd
G. D. Vaughn
Records Management

TO: G.M. WILLIAMS

DEC. 20, 1991

FROM: R L THOMPSON

SUBJECT: MOV DP CALCULATIONS

ATTACHED IS CORRESPONDENCE FROM GREG REQUESTING THAT SYSTEM ENGINEERS REVIEW AND REGENERATE SEPARATE CALCULATIONS FOR "LIKE" VALVES ASSIGNED TO YOU.

THE EXISTING CALCULATIONS ARE ATTACHED FOR THE EF SYSTEM(S).

THE REFUEL 8 MOV'S ARE FIRST PRIORITY WITH A DUE DATE OF 1/31/92.

THE REMAINING MOV'S ARE SECOND PRIORITY WITH A DUE DATE OF 2/28/92.

YOU DO CALC (GET # FROM CONNIE), FIT2.0 GROUP W'LL VERIFY & SIGN SUPV. SPOT. GREG IS VERY SERIOUS ABOUT THESE DUE DATES, SO PLEASE LET ME KNOW IF YOU ARE HAVING (OR HAVE) ANY PROBLEMS.

R L Thompson

INTEROFFICE CORRESPONDENCE

Florida Power
CORPORATION

Nuclear Plant Systems Engineering (Office) | NA1E (MAC) | 240-3444 (Telephone)

SUBJECT: EFV-14

TO: B. Wilson

DATE: March 24, 1992
NPSE 92-0169

In accordance with the requirements of NRC Generic Letter 89-10, a differential pressure test was performed on EFV-14 during the 8M outage. The results of this test indicated the valve would not close against a differential pressure o 1367 psid. Problem report SYPR-91-0025 was generated to evaluate the significance of the test results. The initial review of the problem report determined that the assumptions used in the design differential pressure calculations were not correct. Further evaluation was required to determine the actual design basis differential pressure the valve must close against. The following corrective action plan was generated;

1. Evaluate actual assumptions for determination of worst case dP.
2. Calculate the worst case dP
3. Revise test procedure to establish actual test assumptions and dP.
4. Evaluate previous test data to verify valve operator is adequate.
5. Test valve operator to new actual worst case dP values.
6. An option may be exercised to replace this operator with one that will allow a higher margin to maximum.

All actions were to be satisfied by the end of Refuel 8.

The revised differential pressure calculation has been completed. The required closing dP has been reduced from 1367 psid to 1219 psid. Although the pressure has been reduced, the change is not significant. A review of past test data, although not conclusive, indicates that modifications to the valve and/or operator are required to assure valve operability. Based on engineering evaluation and discussions with licensing, the following work must be completed during refuel 8 to assure operability of EFV-14, under design basis conditions. Modifications to EFV-11 should also be included due tc similarity of design and operating conditions. Performance of the dP test will only be required for EFV-14 during this outage.

Outage work plan/options;

Nuclear Plant Systems Engineering, Maintenance/Components in conjunct on with Site Nuclear Engineering Services is pursuing several options. The following is a listing and description of those options;

1. Replace the valve and operator with a new NRC Generic Letter 89-10 qualified valve and an upgraded motor operator. Lead times on the new valve and DC motor are the deciding factors for this option.

2. Rebuild the currently installed valve as close to original design specifications. Install a 40 ft-lb motor with a new 0501-184 springpack on the existing SMB-0 actuator. Write a MAR to control the close circuit with the limit switch (limit closed). Lead time for the 40 ft-lb motor and valve parts are the deciding factors.

3. Contract in place to send the rebuilt valve and upgraded actuator to a flow loop for differential pressure testing and diagnostic analysis during the outage. This will eliminate the testing being performed during startup and will verify operability.

As options are evaluated with respect to availability of replacement parts, a final decision will be made for course of action to correct this problem. As information becomes available, we will update you for scheduling requirements.

If you have any questions please call either A. M. Stern or John J. Miele at ext. 3724.

M.J. Fitzgerald for MTF
Supervisor NPSE

xc;
G.H. Halnon
J.J. Miele
F.V. Fusick
S.K. Balliet
A.M. Stern
K. Gardner
K.R. Wilson
G.M. Williams
G.D. Vaughn
Records Management

Calculations

Florida Power
CORPORATION

INTEROFFICE CORRESPONDENCE

Nuclear Engineering | | |
OFFICE | MAC | 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	DATE	SYSTEM(S) (CH, HS, LS, CH, CF, DH, DC, FF, FW, MS, PM, RC, WD	TOTAL PAGES IN PKG
E 90-1019	0	9-17-90 ~~7/24/90~~		148

TITLE
MAX DP CALCS FOR MOVS

KWDS (IDENTIFY KEYWORDS FOR LATER RETRIEVAL)
MOV - Motor Operated Valve, DP - Differential Pressure, G.L. 89-10

DXREF (REFERENCES OR FILES - LIST PRIMARY FILE FIRST)

MAR - 87-07-01-01	B & W 32-1168896-00
B & W 32-1168968-00	B & W 51-1168967-00
B & W 32-1168968-01	

VEND (VENDOR NAME)	VENDOR DOCUMENT NUMBER (DXREF)	SUPERSEDED DOCUMENTS (DXREF)
FPC	N/A	N/A

TAG		
DHV-1B,1C ASV-5,204 BSV-3,4,11,12,16,17,36,37	DWV-160 EFV-11,14,32,33 FWV-14,15,28,29,30,31,32,	RCV-11,13,14,53 WDV-3,60,04,405,406
CAV-1,3,4,5,126 CFV-5,6,11,12,15,16	FWV-33,34,35,36 MSV-55,56	
DHV-3,4,5,6,7,8,11,12,34 DHV-35,39,40,41,42,43,75	MUV-3,9,18,23,24,25,26,27 MUV-38,39,40,41,53,58,62	
DHV-76,91,105,106,110,111 DOV-210,238	MUV-69,73,257,258,259,260 MUV-261,498,505	

PARTNO		
N/A		

COMMENTS (USAGE RESTRICTIONS, PROPRIETARY, ETC.)
The results of the calculations have been tabulated in Section VI.

NOTE:
Use Tag number only for valid tag numbers (i.e., RCV-8, SWV-34, DCH-99) otherwise, use Part number field (i.e., CSC 4599, AC1459). If more space is required, write "See Attachment" and list on separate sheet.

DESIGNATOR DATE	VERIFICATION ENGINEER DATE	SUPERVISOR, NUCLEAR ENG DATE
9/17/90	9-20-90	9/17/90

cc: Reader's
MAR Project File
Mgr., Nucl. Config. Mgt.

Florida Power

ANALYSIS/CALCULATION SUMMARY

DOCUMENT IDENTIFICATION NUMBER	DISCIPLINE	CONTROL NO.	Sheet 1 of 147
	E	90-1019	

TITLE

MAX DP CALCS FOR MOVS

CLASSIFICATION (CHECK ONE)

☒ Safety Related
☐ Non Safety Related

MAR / REI / SP NUMBER / FILE

87-07-01-01

VENDOR DOCUMENT NUMBER

N/A

REVISION	0	1	2	3
Item(s) Revised				
Design Engineer	K. Bonnie			
Date	6/18/90			
Verification Engineer	J J Mike			
Date/Method*	6/20/90 R			
Supervisor	K L Dan			
Date	9/17/90			

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

DESCRIBE BELOW IF METHOD OF VERIFICATION WAS OTHER THAN DESIGN REVIEW

PURPOSE SUMMARY

Provide MAX DP Calculations for MOVS at CR-3.

RESULTS SUMMARY

The results of the calculations have been tabulated in Section VI.

Florida Power

DESIGN ANALYSIS/CALCULATION

Crystal River Unit

DOCUMENT IDENTIFICATION NUMBER	REVISION	REI MAR/SP NUMBER/FILE
FPC E90-1019	0	87-07-01-01

SECTION I - PURPOSE

THE PURPOSE OF THE FOLLOWING ANALYSIS/CALCULATIONS IS TO DETERMINE THE MAXIMUM DIFFERENTIAL PRESSURE OF MOVS AT CR-3 IN BOTH THE OPENING AND CLOSING DIRECTIONS. THE MAX DIFFERENTIAL PRESSURES ARE IDENTIFIED IN SECTION V. THESE CALCULATIONS ARE REQUIRED TO SUPPORT THE MOV DIAGNOSTIC TESTING PROGRAM. THE RESULTS WILL BE USED TO ENSURE EACH MOV THRUST REQUIREMENTS AND TO ENSURE EACH MOV WILL OPERATE AS REQUIRED UNDER DESIGN BASIS CONDITION

SECTION II - DESIGN INPUTS

THE ANALYSIS/CALCULATIONS CONTAINED IN THIS DOCUMENT ARE ORGANIZED BY TAG NO. AND OBTAINED FROM B&W DOCUMENTS; NO'S. 51-1168967-00, 51-1164140-00, 32-1168896-00, 32-1168968-00, 32-1168968-01.

SECTION III - ASSUMPTIONS

N/A

SECTION IV - REFERENCES

1. B&W DOCUMENT 51-1164140-00 DATED 5/5/86
2. B&W DOCUMENT 32-1168896-00 DATED 11/19/87
3. B&W DOCUMENT 51-1168967-00 DATED 11/20/87
4. B&W DOCUMENT 32-1168968-00 DATED 8/30/88
5. B&W DOCUMENT 32-1168968-01 DATED 9/9/88

DOCUMENT IDENTIFICATION NO	REVISION	REF MAR/SP NUMBER/FILE
E90-1019	0	87-07-01-01

EFV-14

EFW PUMP DISCHARGE ISOLATION VALVE

GENERAL:

EFW-14 is a six inch Chapman Gate Valve actuated by a Limitorque SMB-0. Normally open, the design operation of this valve is to remain open to supply emergency feedwater to the steam generators. Also, the design of the EFW system is such that on a steam generator tube rupture that depressurizes a steam generator (SG) sufficiently to isolate the affected SG the EFW will be supplied only to the intact SG. This is achieved by closing the EFW discharge valve to the affected SG.

Design Line/Differential Pressure 1600 PSIG

Maximum Postulated Operating DP

COMPONENT	SOURCE	PARAMETER	COMMENT
EFV-14	51-1164140-00	97'0"	Elevation
EFT	FD-302-082	118'6"	Elevation
EFT	OP-450	37'2"	High level
TDEFWP	51-1164140-00	3400'	@ 200 gpm
TDEFWP	51-1164140-00	3100'	@ 1175 gpm
SG	EDBD	910 PSIG	Pressure

Conservative/Worst Case Assumptions

- No pressure reductions due to line losses or elevation changes.

Calculation:

Opening: Maximum DP = (3400' + 118.5' + 37.17' - 97')/2.31 - 910 PSIG
= 1497 PSIG - 910 PSIG
= **587 PSID**

Closing: Maximum DP = (3100' - 118.5' + 37.17' - 97')/2.31 - 0 PSIG
= 1367 PSIG - 0 PSIG
= **1367 PSI**

NOTE: The above information was compiled from B&W Document (51-1164140-00).

DOCUMENT IDENTIFICATION NO	REVISION	REI/MAR/SP NUMBER/FILE
E90-1019	0	87-07-01-01

EFV-11

EFW PUMP DISCHARGE ISOLATION VALVE

GENERAL:

EFW-11 is a six inch Chapman Gate Valve actuated by a Limitorque SMB-0. Normally open, the design operation of this valve is to remain open to supply emergency feedwater to the steam generators. Also, the design of the EFW system is such that on a steam generator tube rupture that depressurizes a steam generator (SG) sufficiently to isolate the affected SG the EFW will be supplied only to the intact SG. This is achieved by closing the EFW discharge valve to the affected SG.

Design Line/Differential Pressure 1600 PSIG

Maximum Postulated Operating DP

COMPONENT	SOURCE	PARAMETER	COMMENT
EFV-11	51-1164140-00	97'0"	Elevation
EFT	FD-302-0R2	118'6"	Elevation
EFT	OP-450	37'2"	High level
TDEFWP	51-1164140-00	3400'	@ 200 gpm
TDEFWP	51-1164140-00	3100'	@ 1175 gpm
SG	EDBD	910 PSIG	Pressure

Conservative/Worst Case Assumptions

- No pressure reductions due to line losses or elevation changes.

Calculation:

Opening: Maximum DP = (3400' + 118.5' + 37.17' - 97')/2.31 - 910 PSIG
= 1497 PSIG - 910 PSIG
= **587 PSID**

Closing: Maximum DP = (3100' - 118.5' + 37.17' - 97')/2.31 - 0 PSIG
= 1367 PSIG - 0 PSIG
= **1367 PSID**

NOTE: The above information was compiled from B&W Document (51-1164140-00).

DOCUMENT IDENTIFICATION NO.	REVISION	REFERENCE NUMBER/FILE
E90-1019	0	87-07-01-01

EFV-32

EFW PUMP DISCHARGE ISOLATION VALVE

GENERAL:

EFW-32 is a six inch Velan Gate Valve actuated by a Limitorque SMB-0. Normally open, the design operation of this valve is to remain open to supply emergency feedwater to the steam generators. Also, the design of the EFW system is such that on a steam generator tube rupture that depressurizes a steam generator (SG) sufficiently to isolate the affected SG the EFW will be supplied only to the intact SG. This is achieved by closing the EFW discharge valve to the affected SG.

Design Line/Differential Pressure 1600 PSIG

Maximum Postulated Operating DP

COMPONENT	SOURCE	PARAMETER	COMMENT
EFV-32	51-1164140-00	97'0"	Elevation
EFT	FD-302-082	118'6"	Elevation
EFT	OP-450	37'2"	High level
TDEFWP	51-1164140-00	3400'	@ 200 gpm
TDEFWP	51-1164140-00	3100'	@ 1175 gpm
SG	EDBD	910 PSIG	Pressure

Conservative/Worst Case Assumptions

- No pressure reductions due to line losses or elevation changes.

Calculation:

Opening: Maximum DP = (3400' + 118.5' + 37.17' - 97')/2.31 - 910 PSIG
= 1497 PSIG - 910 PSIG
= **587 PSID**

Closing: Maximum DP = (3100' - 118.5' + 37.17' - 97')/2.31 - 0 PSIG
= 1367 PSIG - 0 PSIG
= **1367 PSID**

NOTE: The above information was compiled from B&W Document (51-1164140-00).

DOCUMENT IDENTIFICATION NO	REVISION	REI/MAB/SP NUMBER/FILE
E 90-1019	0	87-07-01-01

EFV-33

FW PUMP DISCHARGE ISOLATION VALVE

GENERAL:

EFW-33 is a six inch Velan Gate Valve actuated by a Limitorque SMB-0. Normally open, the design operation of this valve is to remain open to supply emergency feedwater to the steam generators. Also, the design of the EFW system is such that on a steam generator tube rupture that depressurizes a steam generator (SG) sufficiently to isolate the affected SG the EFW will be supplied only to the intact SG. This is achieved by closing the EFW discharge valve to the affected SG.

Design Line/Differential Pressure 1600 PSIG

Maximum Postulated Opening DP

COMPONENT	SOURCE	PARAMETER	COMMENT
EFV-33	51-1164140-00	97'0"	Elevation
EFT	FD-302-082	118'6"	Elevation
EFT	OP-450	37'2"	High level
TDEFWP	51-1164140-00	3400'	@ 200 gpm
TDEFWP	51-1164140-00	3100'	@ 1175 gpm
SG	EDBD	910 PSIG	Pressure

Conservative/Worst Case Assumptions

- No pressure reductions due to line losses or elevation changes.

Calculation:

Opening: Maximum DP = (3400' + 118.5' + 37.17' - 97')/2.31 - 910 PSIG
= 1497 PSIG - 910 PSIG
= **587 PSID**

Closing: Maximum DP = (3100' - 118.5' + 37.17' - 97')/2.31 - 0 PSIG
= 1367 PSIG - 0 PSIG
= **1367 PSID**

NOTE: The above information was compiled from B&W Document (51-1164140-00).

Florida Power

ANALYSIS/CALCULATION SUMMARY

DOCUMENT IDENTIFICATION NUMBER	DISCIPLINE	CONTROL NO	Sheet 1 of 6
	E	92-0158	

TITLE
Maximum Differential Pressure Calculations EFV-11 and EFV-14

CLASSIFICATION (CHECK ONE)
[X] Safety Related
[ ] Non Safety Related

MAR / REI / SP NUMBER / FILE
N/A

VENDOR DOCUMENT NUMBER
N/A

REVISION	0	1	2	3
Item(s) Revised				
Design Engineer	G.H. Williams			
Date	2/5/92			
Verification Engineer				
Date/Method*	2/29/92 R			
Supervisor	M.J. Fitzgerald			
Date	3/6/92			

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

DESCRIBE BELOW IF METHOD OF VERIFICATION WAS OTHER THAN DESIGN REVIEW

PURPOSE SUMMARY: Determine the maximum differential pressure that the motor operated valves, EFV-11 and EFV-14, will encounter during actuation in either the open or closed direction.

RESULTS SUMMARY: Differential pressure testing should only be accomplished in modes 5 and 6. The differential pressure across the valves to open is 546 psig and to close is 1219 psig.

MAXIMUM DIFFERENTIAL PRESSURE CALCULATIONS
EFV-11 and EFV-14

SECTION I PURPOSE

The purpose of the following analysis/calculations are to determine the maximum differential pressure that the motor operated valve, EFV-11 or EFV-14, will encounter during actuation in either the open or close direction. These calculations are required to support the MOV diagnostic testing program. The results can be used to ensure MOV requirements are met and ensure that the MOV will operate as required under design basis conditions.

SECTION II DESIGN INPUT

EFV-11 and EFV-14 are six inch Chapman Gate Valves actuated by a limitorque SMB-0. Both valves are located at the same elevation in the Intermediate Building.

The design operation of these valves is to remain open to supply emergency feedwater to the steam generators. Also, the design of the EF system is such that on a steam generator tube rupture, as an example, that depressurizes a steam generator sufficiently to isolate the affected steam generator, the emergency feedwater will be supplied to the intact steam generator. This is achieved by remotely closing the emergency feedwater discharge valves, EFV-11 and or EFV-14 to the affected steam generator.

There are three basic sources of water for the Emergency Feedwater Pumps, EFP-1 and EFP-2. The primary source is the Emergency Feedwater Tank, EFT-2. Other sources are the Condensate Storage Tank, CDT-1, and the Condenser Hotwell. The two tanks are the only two sources of water that can supply a significant head for <u>these</u> calculations. The water in the Condenser Hotwell can only be used as a source after vacuum has been lost and the suction valves have been unlocked and opened.

Two Emergency Feedwater pumps EFP-1 and EFP-2 are able to independently supply the needed water to both steam generators. Both pumps are manufactured be Ingersoll-Rand and develop approximately the same discharge head for a given flow. The original pump curves were consulted for these calculations.

Conversion factor: Feet of water to pounds per square inch
(Feet of water/2.31) = psi

Tag Number	Reference Sect. IV	Parameter	Element
EFV-11	7	97'11"	Valve Elevation
EFV-14	7	97'11"	Valve Elevation
EFT-2	4	118'6"	Tank Elevation
EFT-2	3 & 11	37'2"	High Water Level Alarm
EFT-2	3	4 psig	High over press. alarm
EFP-1	5 & 11	3400'	TDH @ 200 gpm (Recirc.)
EFP-1	5, 11 & 3	2700'	TDH @ 1000 gpm (Orifice)
EFP-2	6 & 11	3400'	TDH @ 200 gpm (Recirc.)
EFP-2	6, 11 & 3	2750'	TDH @ 1000 gpm (Orifice)
CDT-1	9	119'	Tank Elevation
CDT-1	10	31'	High Water Level Alarm
OTSG	12	955 psig	MSSV Blowdown (Reseat) Pressure

SECTION III ASSUMPTIONS

No pressure reductions due to pipe (line) losses are considered in this conservative analysis.

Only single failure criteria is applied.

A review of the EFP-1 and EFP-2 pump curves show that the highest total discharge head, for either pump, is when it is operating in recirculation mode. Applying single failure criteria, both discharge isolation valves will be consicered closed. (Note: Both valves are closed when one train is in test mode.) Under this configuration, a 200 gpm minimum recirculation flow produces a Total Discharge Head (TDH) of 3400'. This TDH is considered to be the same for both pumps.

Credit is taken for operator action to identify, confirm, and restore lost Emergency Feedwater flow to the applicable steam generator(s) prior to complete blowdown.

The following Emergency Feedwater System response is considered the same for the following Safety Analysis accidents addressed in Chapter 14:

Steam Line Failures, Steam Generator Tube Failure, Small Primary Coolant Line Accident, Main Feedwater Line Break, and Loss of Coolant accidents.

Other accidents that are addressed in Chapter 14, but not listed here, are considered similar in Emergency Feedwater response if the system is actuated.

The following Scenarios reflect possible worse case conditions where the maximum differential pressure (DP), in the open and closed direction, may be achieved:

Scenario 1 *The Emergency Feedwater (FW) system is aligned in its' Emergency flow path configuration. Upon Emergency Feedwater System actuation EFV-11 and EFV-14, both pump discharge isolation valves, are normally open however, if inadvertently closed, must be capable of opening with the associated pump at recirculation flow plus suction head. The total head on the pump side of the closed valves would be 1501 psig. The outlet of the valve would be equivalent to the steam pressure in the unaffected steam generator(s) which is assumed to remain at above the MSSV blowdown (reseat) pressure of 955 psig.*

Scenario 2 *Upon Emergency Feedwater System actuation EFV-11 and EFV-14, both pump discharge isolation valves, are normally open. With the loss of pressure down stream of EFV-11 or EFV-14, due to a Emergency Feedwater or main steam line rupture, for an example, the valves must be capable of closing to isolate the affected steam generator. The total head on the pump side of the valve would be 1215 psig. The outlet of the valve would be equivalent to the pressure in the affected Emergency Feedwater line or steam generator and is assumed to fall to 0 psig., which is the worse case condition.*

SECTION IV REFERENCES

1. Dwg. FD 302-082, Sheet 1 of 3, Rev. 39
2. FSAR Chapter 14, Rev. 15
3. OP-450, Emergency Feedwater System, Rev. 7
4. Dwg. FD 302-082, Sheet 2 of 3, Rev. 5
5. Ingersoll-Rand Company Curve N-340 for pump no. 10701
6. Ingersoll-Rand Company Curve N-368 for pump no. 10702
7. Dwg. P 304-088, Sheet 1 of 1, Rev. 14
8. Cameron Hydraulic Data, 16th. edition
9. Dwg. FD-302-101, Sheet 3 of 3, Rev. 22

10. OP-603, Condensate System, Rev. 38
11. EDBD for EF Initiation & Control, Temporary Change 108, dated 10/11/90.
12. EDBD for Main Steam, Tab 6/10, rev. 3, Dated 1/31/90.

SECTION V DETAIL CALCULATIONS

OPENING: Based upon Scenario 1 assumptions. Also reference SECTION 2, DESIGN INPUT.

Maximum DP = (EFT-2 elevation + EFT-2 max. water level + Pump TDH @ 200 gpm)/2.31 + EFT-2 max. over pressure - min. steam generator blowdown (reseat) pressure.

Maximum DP = (118.50'+ 37.17'+ 3400' - 97.92')/2.31 + 4 psig - 955 psig
= 1497 psig + 4 psig - 955 psig

DP = 546 psig OPENING

CLOSING: Based upon scenario 2 assumptions. Also reference SECTION 2, DESIGN INPUT.

Maximum DP = (EFT-2 elevation + EFT-2 max. water level + Pump TDH @ 1000 gpm)/2.31 + EFT-2 max. over pressure - total pressure loss.

Maximum DP = (118.50'+ 37.17'+ 2750' - 97.92')/2.31 + 4 psig - 0 psig
= 1215 psig + 4 psig - 0 psig

DP = 1219 psig CLOSING

SECTION VI ATTACHMENTS

1. TESTING SUMMARY

ATTACHMENT 1

TESTING SUMMARY

Testing of these valves is not recommended during plant operation because of the possible injection of Emergency Feedwater into the steam generator which would result in a severe plant transient. Testing could be safely accomplished during Modes 5 or 6 when flow to the steam generator and appropriate down stream pressures could adequately be achieved.

Calculation recap

OPEN:	Pump side pressure	1501 psig
	Down stream pressure	955 psig
	Differential pressure	546 psig
	Testing temperature	90 °F
CLOSE:	Pump side pressure	1219 psig
	Down stream pressure	0 psig
	Differential pressure	1219 psig
	Testing temperature	90 °F

Florida Power
CORPORATION

INTEROFFICE CORRESPONDENCE

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

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

TO: Records Management - :R2A

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

DOCNO (FPC DOCUMENT IDENTIFICATION NUMBER)	REV	SYSTEM(S)	TOTAL PAGES TRANSMITTED
E-92-015E	1	EF	9

TITLE: Maximum Differential Pressure Calculation EFV-11 and EFV-14

KWDS (IDENTIFY KEYWORDS FOR LATER RETRIEVAL): MOV - motor operated valve; DP - Differential Pressure

DXREF (REFERENCES OR FILES - LIST PRIMARY FILE FIRST):
MAR 87-07-01-01
B&W 51-1164140-00

VEND (VENDOR NAME)	VENDOR DOCUMENT NUMBER (DXREF)	SUPERSEDED DOCUMENTS (DXREF)
FPC	NA	~~E-90-1014~~ E-92-0158 Rev 0

TAG		
EFV-11		
EFV-14		

PARTNO		
NA		

COMMENTS (USAGE RESTRICTIONS, PROPRIETARY, ETC.): none

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
R.L. Thompson	4/28/92	[illegible]	4/28/92	M.J. Totaro	4/28/92

cc: MAR Originator (If MAR Related) ☐ Yes ☒ No
MAR Project File
MAR Tracking Log

Supervisor, Nuclear Document Control: Add/Del Rec
Evaluate Analysis/Calc Summary
Part Document Review Required: X

PLANT DOCUMENT REVIEW EVALUATION

DOCUMENT TYPE / NUMBER TO BE EVALUATED

Analysis/Calculation E-92-0158

PART I

INSTRUCTIONS: Procedures, 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

The above referenced document must be distributed as follows:

- ☐ No Review Required
- ☒ Manager, Nuclear Plant Systems Engineering
- ☐ Nuclear Chem/Rad Protection Superintendent
- ☐ Senior Radiation Protection Engineer
- ☐ Nuclear Operations Superintendent
- ☐ Nuclear Maintenance Work Controls Superintendent
- ☐ Manager, Reliability Centered Maintenance
- ☐ Other(s):

ORIGINATOR / DATE: [signature] 4/28/92

SUPERVISOR / DATE: M.J. Fitzgerald 4/28/92

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.

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 required 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 designee acts as the Originator or Reviewer, the applicable "Originator/Reviewer" block should be N/A'd

Florida Power

ANALYSIS/CALCULATION SUMMARY

DOCUMENT IDENTIFICATION NUMBER	DISCIPLINE	CONTROL NO	REVISION LEVEL
	E	92-0158	1

TITLE
Maximum Differential Pressure Calculations EFV-11 and EFV-14

CLASSIFICATION (CHECK ONE):
X Safety Related
_ Non Safety Related

MAR SP NUMBER FILE
NA

VENDOR DOCUMENT NUMBER
NA

	REVISION APPROVALS	ITEMS REVISED
Design Engineer	J.G. Thompson	Revised calculation for maximum closing differential pressure.
Date	4/28/92	
Verification Engineer	D.M. Fite	
Date Method*	4/28/92 R	
Supervisor	M.J. Fitzgerald	
Date	4/28/92	

*VERIFICATION METHODS: R - Design Review; A - Alternate Calculation; T - Qualification Testing
DESCRIBE BELOW IF METHOD OF VERIFICATION WAS OTHER THAN DESIGN REVIEW

PURPOSE SUMMARY
Determine the maximum differential pressure that the motor operated valves EFV-11 and EFV-14 will encounter.

RESULTS SUMMARY
Differential pressure testing should only be accomplished in modes 5 and 6. The differential pressure across the valves to OPEN is 5401 psig and to close is 1501 psig.

Florida Power
CORPORATION

INTEROFFICE CORRESPONDENCE

Nuclear Engineering | NAIE | PHONE
OFFICE | MAC

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 IN PKG
~~11-92-0007~~ E-92-0158	0	EF	6

TITLE: Maximum Differential Pressure Calculations EFV-11 and EFV-14.

KWDS (IDENTIFY KEYWORDS FOR LATER RETRIEVAL): MOV - motor operated valve ; DP - Differential Pressure

DXREF (REFERENCES OR FILES - LIST PRIMARY FILE FIRST):
M.A.R. 87-07-01-01
B&W 51-1164140-00

VEND (VENDOR NAME)	VENDOR DOCUMENT NUMBER (DXREF)	SUPERSEDED DOCUMENTS (DXREF)
FPC	NA	E-90-1019

TAG		
EFV-11		
EFV-14		

PARTNO		
NA		

COMMENTS (USAGE RESTRICTIONS, PROPRIETARY, ETC.): none

NOTE:
Use Tag number only for valid tag numbers (i.e., RCV-8, SWV-34, DCH-9A) 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
G.M. Williams	2/5/92		2/24/92	M.J. Fitzgerald	3/6/92

cc: Readers
MAR/Project File
Mgr., Nucl. Config. Mgt.

Florida Power

ANALYSIS/CALCULATION SUMMARY

DOCUMENT IDENTIFICATION NUMBER	DISCIPLINE	CONTROL NO.	Sheet 1 of 6
	E	92-0158	

TITLE
Maximum Differential Pressure Calculations EFV-11 and EFV-14

CLASSIFICATION (CHECK ONE)
☒ Safety Related
☐ Non Safety Related

MAR / REI / SP NUMBER / FILE
NA

VENDOR DOCUMENT NUMBER
NA

REVISION	0	1	2	3
Item(s) Revised				
Design Engineer	G.M. Williams			
Date	2/5/92			
Verification Engineer	D. [illegible]			
ite/Method*	2/29/92 R			
upervisor	M.J. Fitzgerald			
Date	3/6/92			

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

DESCRIBE BELOW IF METHOD OF VERIFICATION WAS OTHER THAN DESIGN REVIEW

PURPOSE SUMMARY Determine the maximum differential pressure that the motor operated valves, EFV-11 and EFV-14, will encounter during actuation in either the open or closed direction.

RESULTS SUMMARY Differential pressure testing should only be accomplished in nodes 5 and 6. The differential pressure across the valves to open is 546 psig and to close is 1219 psig.

Florida Power
CORPORATION

ANALYSIS/CALCULATION

Crystal River Unit 3

Sheet 1 of 6

REVMAR NUM ~~M-92-0007~~ MJF 4/28/92

E-92-0158

PROJECT

MAXIMUM DIFFERENTIAL PRESSURE CALCULATIONS
EFV-11 and EFV-14

SECTION I PURPOSE

The purpose of the following analysis/calculations are to determine the maximum differential pressure that the motor operated valve, EFV-11 or EFV-14, will encounter during actuation in either the open or close direction. These calculations are required to support the MOV diagnostic testing program. The results can be used to ensure MOV requirements are met and ensure that the MOV will operate as required under design basis conditions.

SECTION II DESIGN INPUT

EFV-11 and EFV-14 are six inch Chapman Gate Valves actuated by a limitorque SMB-0. Both valves are located at the same elevation in the Intermediate Building.

The design operation of these valves is to remain open to supply emergency feedwater to the steam generators. Also, the design of the EF system is such that on a steam line rupture, as an example, that depressurizes a steam generator sufficiently to isolate the affected steam generator, the emergency feedwater will be supplied to the intact steam generator. This is achieved by automatic closure (fogg logic) of the emergency feedwater discharge valves, EFV-11 and or EFV-14 to the affected steam generator.

There are three basic sources of water for the Emergency Feedwater Pumps, EFP-1 and EFP-2. The primary source is the Emergency Feedwater Tank, EFT-2. Other sources are the Condensate Storage Tank, CDT-1, and the Condenser Hotwell. The two tanks are the only sources of water that can supply a significant head for these calculations. The water in the Condenser Hotwell can only be used as a source after vacuum has been lost and the suction valves have been unlocked and opened.

Two Emergency Feedwater pumps EFP-1 and EFP-2 are able to independently supply the needed water to both steam generators. Both pumps are manufactured by Ingersoll-Rand and develop approximately the same discharge head for a given flow. The original pump curves were consulted for these calculations.

DESIGN ENGINEER	DATE	VERIFICATION ENGINEER	DATE	SUPERVISOR NUCLEAR ENGINEER
	4/27/92		4/28/92	M.J. Fitzgerald 4-28-92

Conversion factor: Feet of water to pounds per square inch
(Feet of water/2.31) = psi

Tag Number	Reference Sect. IV	Parameter	Element
EFV-11	7	97'11"	Valve Elevation
EFV-14	7	97'11"	Valve Elevation
EFT-2	4	118'6"	Tank Elevation
EFT-2	3 & 11	37'2"	High Water Level Alarm
EFT-2	3	4 psig	High over press. alarm
EFP-1	5 & 11	3400'	TDH @ 200 gpm (Recirc.)
EFP-1	5, 11 & 3	2700'	TDH @ 1000 gpm (Orifice)
EFP-2	6 & 11	3400'	TDH @ 200 gpm (Recirc.)
EFP-2	6, 11 & 3	2750'	TDH @ 1000 gpm (Orifice)
CDT-1	9	119'	Tank Elevation
CDT-1	10	31'	High Water Level Alarm
OTSG	12	955 psig	MSSV Blowdown (Reseat) Pressure

SECTION III ASSUMPTIONS

No pressure reductions due to pipe (line) losses are considered in this conservative analysis.

Only single failure criteria is applied.

A review of the EFP-1 and EFP-2 pump curves show that the highest total discharge head, for either pump, is when it is operating in recirculation mode. Applying single failure criteria, both discharge isolation valves will be considered closed. (Note: Both valves are closed when one train is in test mode.) Under this configuration, a 200 gpm minimum recirculation flow produces a Total Discharge Head (TDH) of 3400'. This TDH is considered to be the same for both pumps.

The following Emergency Feedwater System responses were considered for the following Safety Analysis accidents addressed in Chapter 14:

Steam Line Failures, Steam Generator Tube Failure, Small Primary Coolant Line Accident, Main Feedwater Line Break, and Loss of Coolant accidents.

Other accidents that are addressed in Chapter 14, but not listed here, are considered similar in Emergency Feedwater response if the system is actuated.

The following Scenarios reflect possible worse case conditions where the maximum differential pressure (DP), in the open and closed direction, may be achieved:

Scenario 1 *The Emergency Feedwater (FW) system is aligned in its' Emergency flow path configuration. Upon Emergency Feedwater System actuation EFV-11 and EFV-14, both pump discharge isolation valves are normally open however, if closed for SP testing, they must be capable of opening with the associated pump at recirculation flow plus suction head. The total head on the pump side of the closed valves would be 1501 psig. The outlet of the valve would be equivalent to the steam pressure in the unaffected steam generator(s) which is assumed to remain at above the MSSV blowdown (reseat) pressure of 955 psig.*

Scenario 2 *Upon Emergency Feedwater System actuation EFV-11 and EFV-14, both pump discharge isolation valves, are normally open. With the loss of pressure down stream of EFV-11 or EFV-14, due to an Emergency Feedwater or main steam line rupture, the valves must be capable of closing to isolate the affected steam generator.*

The total head on the pump side of the valve, which leads to the affected steam generator, would reach 1501 psig. just prior to full closure. This is based on two conditions: A) the water level in the unaffected steam generator is above the 36" set point, therefore the control valve to the unaffected steam generator will go to the closed position and B) the control valve to the affected steam generator has failed wide open.

The outlet of the valve would be equivalent to the pressure in the affected Emergency Feedwater line or steam generator and is assumed to fall to 0 psig., which is the worse case condition.

SECTION IV REFERENCES

1. Dwg. FD 302-082, Sheet 1 of 3, Rev. 39
2. FSAR Chapter 14, Rev. 15
3. OP-450, Emergency Feedwater System, Rev. 7
4. Dwg. FD 302-082, Sheet 2 of 3, Rev. 5
5. Ingersoll-Rand Company Curve N-340 for pump no. 10701
6. Ingersoll-Rand Company Curve N-368 for pump no. 10702
7. Dwg. P 304-088, Sheet 1 of 1, Rev. 14
8. Cameron Hydraulic Data, 16th. edition
9. Dwg. FD-302-101, Sheet 3 of 3, Rev. 22
10. OP-603, Condensate System, Rev. 38
11. EDBD for EF Initiation & Control, Temporary Change 108, dated 10/11/90.
12. EDBD for Main Steam, Tab 6/10, rev. 3, Dated 1/31/90.

SECTION V DETAIL CALCULATIONS

OPENING: Based upon Scenario 1 assumptions. Also reference SECTION 2, DESIGN INPUT.

Maximum DP = (EFT-2 elevation + EFT-2 max. water level + Pump TDH @ 200 gpm - valve elevation)/2.31 + EFT-2 max. over pressure - min. steam generator blowdown (reseat) pressure.

Maximum DP = (118.50'+ 37.17'+ 3400'- 97.92')/2.31 + 4 psig - 955 psig
= 1497 psig + 4 psig - 955 psig

DP = 546 psig OPENING

CLOSING: Based upon Scenario 2 assumptions. Also reference SECTION 2, DESIGN INPUT.

Maximum DP = (EFT-2 elevation + EFT-2 max. water level + Pump TDH @ 200 gpm - valve elevation)/2.31 + EFT-2 max. over pressure - OTSG pressure.

Maximum DP = (118.50'+ 37.17'+ 3400'- 97.92')/2.31 + 4 psig - 0 psig
= 1497 psig + 4 psig - 0 psig

DP = 1501 psig CLOSING

SECTION VI ATTACHMENTS

1. TESTING SUMMARY

ATTACHMENT 1

TESTING SUMMARY

Testing of these valves is not recommended during plant operation because of the possible injection of Emergency Feedwater into the steam generator which would result in a severe plant transient. Testing could be safely accomplished during Modes 5 or 6 when flow to the steam generator and appropriate down stream pressures could adequately be achieved.

Calculation recap

OPEN:	Pump side pressure	1501 psig
	Down stream pressure	955 psig
	Differential pressure	546 psig
	Testing temperature	90 °F
CLOSE:	Pump side pressure	1501 psig
	Down stream pressure	0 psig
	Differential pressure	1501 psig
	Testing temperature	90 °F