STEAM BYPASS CONTROL SYSTEM

OVERALL FINAL REPORT

MAY 6, 1989

PREPARED BY : J.S.SUMMY

REVIEWED BY : G.W.SOWERS

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EVALUATION OF THE STEAM BYPASS CONTROL SYSTEM AT PALO VERDE NUCLEAR GENERATING STATION

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PURPOSE AND OBJECTIVES

As a result of the March 3, 1989 electrical grid disturbance, the Unit 3 Steam Bypass Control System (SBCS) was actuated in response to a large load reject. The SBCS under these conditions is designed to respond by immediately opening all eight SBCS valves to route the steam load directly to the condenser and to atmosphere. This immediate response is to counter the effects of the reduced steam flow which had previously been flowing through the Turbine Generator. Once the steam load is stabilized the system will manipulate the SBCS valves so that the plant will remain critical at a lower power. The SBCS was unable to perform its design function due to a failed component within the control system.

The purpose of the attached study is to investigate the design, startup, maintenance, and operation of the controls portion of the SBCS and was performed by a "team" of personnel assigned that responsibility. This indepth evaluation was made to ensure prompt and effective actions were taken in response to the faulty operation of the SBCS on March 3, 1989. The team consisted of personnel from various departments both onsite and offsite with support of the original vendor and Quality Assurance.

The evaluation was performed in three stages as follows:

1. As a result of the failure a "Troubleshooting Action Plan" consisting of a detailed failure analysis, events and causal factors review, and a detailed approach to in field troubleshooting was performed. (Ref Attachment 1 for details)

2. As identified in the Troubleshooting Action Plan an indepth design and maintenance review was required in order to ensure a complete Root Cause of Failure was performed. This was performed as the Steam Bypass Control System Detailed System Investigation Action Plan. (Ref Attachment 2 for details)

PURPOSE AND OBJECTIVES CONT

3. As a portion of the detailed system investigation, described in item 2 above, an independent Design Basis Review was conducted by the Nuclear Engineering Department. This also included recommendations as a result of this review. (Ref Attachment 3 for details)

The objectives of this evaluation were as follows :

1. To determine and correct the condition which caused the malfunction of the Unit 3 Steam Bypass Control System during the March 3, 1989 transient.

2. To determine the Root Cause of Failure for the March 3, 1989 transient.

3. Review the history for the SBCS .in the areas of design, startup, maintenance, and operation to ensure no additional root cause of failures exist within the system which might lead to similar events in the future.

4. Review the Preventative Maintenance and Functional Tests to insure adequacy.

ANALYSIS AND EVALUATION

The attachments which comprise the body of this study consist primarily of 3 separate reports representing the overall findings / recommendations in the various areas and may be summarized as listed below:

1. *SBCS Troubleshooting Action Plan* - This document was the overall controlling document used for actual in-plant testing to determine the cause of the failure of the SBCS. It is organized as follows:
   - Description of Issue - A brief description of the events as they apply to the SBCS
   - Summary of Information Supporting Probable Cause - This provides an Events and Causal Factors Chart and the analysis to attempt to determine the problem prior to the troubleshooting effort.
   - Potential Root Cause - Provides a brief overview of all potential root cause of failure mechanisms.
   - Review of Maintenance, Surveillance Testing and Modification History - This section was expanded in the SBCS Detailed System Investigation Action Plan.
   - Findings of Troubleshooting - Provides facts supporting the results of determining that a failed Group X Permissive Timer would have caused the events as exhibited by the SBCS.
   - Conclusions - This provides a short overview of the troubleshooting and draws conclusions as to the method of failure.
   - Recommended Corrective Actions - Provides a list of corrective actions resulting from troubleshooting plan.

ANALYSIS AND EVALUATION CONT

2. *Steam Bypass Control System Detailed System Investigation Action Plan* - this document delineated the scope, method, responsibilities, and final products of the indepth evaluation of the SBCS. When performing these investigations data was reviewed dating back to January 1982. This indepth evaluation provides certain recommendations, however, no changes to the Control System have been recommended. It provides details of the investigation as described below.

Engineering Evaluation Requests (EER's) - 51 EER's were evaluated in total with only 6 which were of significance. The focus of these Engineering Evaluations were in the fine tuning are.

Preventative and Maintenance Testing - Reviewed for adequacy and periodicity. Resulted in recommendation to evaluate the feasibility of performing online testing of control system.

Temporary Modifications, Site Modifications, and Plant Change Requests - Review was performed to ensure no outstanding system modifications are required and the effectiveness of any that were implemented previously. No major changes have been performed on the control system and none are recommended.

Work Order / Work Requests - A thorough review was conducted to evaluate for possible maintenance trends in the control system components. None were identified as a result.

Post Core Testing - A review of power ascension testing applicable to SBCS was conducted to evaluate effectiveness of testing performed on the SBCS. These test results indicate no significant problems with the control system.

Preoperational Tests - A review of the preop testing was conducted to ensure adequacy of testing to prove design of the system. This test was felt to be inclusive for statically checking the system.

ANALYSIS AND EVALUATION CONT

Post Trip Reports - These event write ups were reviewed to determine the overall effectiveness of the SBCS during transient events. Three events involved improper operation of SBCS and corrective actions were incorporated into the system as a result of each. One event which occurred in Unit 3 had identified what appears to have been a failure of the same permissive timer, however, no investigation was performed to correct this problem.

3. *Steam Bypass Control System Design Basis Review and Restart Recommendations* - this report summarizes the design basis investigation and makes recommendations as a result. This report provides detailed evaluations in the following areas:

Purpose of SBCS
Function of SBCS
Interfaces
Testing History
Operating History
Recommendation Basis
Evaluation Summary and Results

SUMMARY OF RESULTS

The purpose of this section is to outline those activities which as a result of the detailed investigation have been recommended to be accomplished.

RESTART ITEMS

Rework Unit 3 Permissive Timer Problem
Test the Unit 1 and 2 Permissive timers
Reconnect the SBCS valve positions to T-Das Unit 2
Perform 18 Month PM of control system
Perform SBCS Functional Test
Perform live steam stroke time testing on each valve
Implement twice monthly SBCS valve testing
Replace Rosemount Steam Flow Transmitters Unit 1 only

POST RESTART ITEMS

180 days - Evaluate the feasibility of performing an on-line functional SBCS test with appropriate periodicity - In the past this was considered a "High Risk" test due to effects on the plant if the SBCS was needed and was not available due to testing. A modular functional test is being evaluated so that only portions of the system are removed from service for relatively short periods of time to perform this testing. A probability and risk assessment will be performed after a proposed testing program is agreed upon. The basis for not requiring this as a restart item is the fact that a complete 18 month calibration and functional tests will be performed prior to restart and this would satisfy any testing requirements for at least 180 days.

18 months - SBCS valve position indication to the Main Control Board - A Plant Change Request has been approved by the Plant Modification Committee and is with Design Engineering. This will require additional cabling and changeout of equipment on the main control panel. This is not a restart item as it is definitely an operator aid and the current indication can be used until this is completed.

SUMMARY OF RESULTS CONT.

120 days - Establish PM for calibration of SBCS valve position inputs - Since these indications have only been temporary to the T-DAS no formal calibration procedure has been formulated. If questions of data validity of these signals arose a work request was written to check and recalibrate the inputs. With these signals now planned to be used on a permanent basis to ERFDADs a formal calibration is required. An Instruction Change Notice has been issued to I&C Standards to write this procedure. The time was chosen to be acceptable since all position indications will be calibrated per work requests prior to restart.

180 days - Third party review for SBCS optimization - This will involve a significant review of data and design information. This is not a restart concern since the evaluations performed as a result of this study indicate that the control system has performed satisfactorily per its design.

45 days - Add permissive timer testing to PM program - This is a reasonable time in order that Standards personnel may perform the necessary word processing, review and approval steps needed to change the procedure. The permissive timers will be checked in each unit prior to restart.

120 days - Perform Root Cause Failure on Unit 3 Permissive Timer Card - This will allow sufficient time to properly perform the Root Cause and complete the required documentation. This timer has not been a high failure item therefore, the exact cause of the internal circuit board failure is not required as a restart item.

120 days - Perform reliability and probability assessment to determine enhancements / recommendations of possible component replacement - As recommended in the Design Review conducted by Nuclear Engineering certain recommended circuit boards should be replaced at the specified intervals to provide a 95% confidence level. None of these periods have passed. The data used to make these recommendations was on a relatively small population. This item will make a more thorough evaluation and provide recommendations for replacement of components as necessary.

CONCLUSIONS AND ACTION PLANS

As a result of the Troubleshooting Action Plan testing it has been determined that the Group X Permissive Timer circuit card in the SBCS had failed sometime prior to the March 3, 1989 transient. The failure of this circuit card would have resulted in the exact operation as exhibited by the SBCS during that transient. The Allen-Bradley permissive timer card has been replaced in Unit 3 and the defective card will have a root cause failure analysis performed to determine which component on the card failed.

The SBCS design basis, system design, and industry practices / designs were reviewed. As a result of this review it was concluded that although the SBCS in use at Palo Verde is somewhat unique in the industry it is performing as designed and that the design utilized is felt to be consistent with the overall design objectives of the plant.

A large number of documents were thoroughly reviewed dating back to initial system commissioning. The results of these reviews found no significant deficiency in the method of system startup, commissioning, maintenance, or operation. A few minor tuning design changes were made to the control system during initial system testing as is common for most control systems.

As a result of these conclusions certain recommendations have been made. These recommendations are primarily in the area of early performance of scheduled PM tasks on all units to insure that all aspects of the system have been recently calibrated prior to restart. These PM's will perform an entire SBCS calibration and functional test. Additionally, each SBCS valve will be stroked under live steam conditions and the proper timing of each verified / adjusted.

Other long term recommendations involve evaluation of functional online testing with appropriate periodicity and the potential for making fine tuning adjustments for optimum system performance. A system enhancement will involve adding SBCS valve position indication to the Main Control Board to provide additional information to the Control Room Operator.

SBCS TROUBLESHOOTING ACTION PLAN
Rev 1

ACTION LIST DESCRIPTION : STEAM BYPASS CONTROL SYSTEM

TEAM LEADER : JEFF SUMMY

PREPARED BY JEFF SUMMY DATE : MARCH 4, 1989

REVISED BY GARY ANDERSON DATE : MARCH 10,1989

DESCRIPTION OF ISSUE :

This action plan addresses the failure of the Steam Bypass Control System (SBCS) to respond properly to a "large load rejection" as a result of the electrical disturbance on Palo Verde Unit 3 on 3/3/89.

The SBCS senses a large load rejection due to inputs to the system from S/G steam flow transmitters. At a predetermined setpoint a rate detection circuit activates a "Quick Open" signal to open all 8 SBCS valves simultaneously. Additionally, with a larger load reject a signal is generated to produce a Reactor Power Cutback (RPCS). These 2 initiating events worked properly as evidenced by the proper initiation of quick opening of all SBCS valves and the initiation of a reactor power cutback.

The quick open of the SBCS valves is to counter the effects of reduced steam flow due to the load reject. Once steam flow has been established through the quick open sequence, the valves begin to close and a modulation signal based on steam header pressure controls the valves. This modulation signals works to begin opening/closing the SBCS valves as Reactor Power lowers as a result of the cutback. The overall result of these events is that the Reactor is stabilized at approximately 45% power dumping steam through the modulating SBCS valves to the condenser.

On 3/3/89, at approximately 01:02 AM the Unit 3 SBCS received a load reject initiation signal due to decrease in steam flow. The system responded properly by initiating a Quick Open signal to all SBCS valves. The valves responded by going full open (reference attached T-DAS graphs). The next event that should have occurred would have been that a modulating signal based on steam header pressure would begin to modulate the SBCS valves. This signal began to accomplish this on the Y1 and Y2 valves 1002, 1005, 1007, and 1008. The modulating signal for the X1 and X2 valves 1001, 1003, 1004, and 1006 was pre-empted by the loss of permissive and the valves quick closed. As a result of the step change in steam flow resulting from the quick closure of 4 valves, another quick open signal resulted. Successive cycling of all 8 valves continued until a quick open block signal prevented further cycling. The quick open block signal was generated as a result of Reactor Trip Signal and Tavg low and is designed to prevent overcooling of the primary.

SUMMARY OF INFORMATION SUPPORTING PROBABLE CAUSE:

Refer to attached EVENTS AND CAUSAL FACTORS CHART. A detailed evaluation of the control circuitry for the SBCS was performed. The logic was evaluated in order to attempt to recreate a failure such that operation of the SBCS would have resulted in what was observed. The logic is common for both valve trains X and Y for both Quick Open and Modulation until the Automatic Permissive Timer for the two different valve trains is encountered.

Failure of this particular timer would have caused the open permissive to be removed from the circuit sooner than per design. This would have prevented the modulation signal to X1 and X2 valves from accomplishing its' function to keep the valves open and the valves would have gone full shut. This cycle would have continued as seen in the actual event until such time as quick open signals would have been terminated. This single failure is believed to be the cause of the faulty operation of the SBCS.

The original system vendor was asked to perform an independent analysis of the event for the SBCS and has arrived at the same failure device. The internal APS Design Engineering group was also able to independently arrive at this same conclusion.

POTENTIAL ROOT CAUSE

The primary potential root cause of the SBCS malfunction is a single failure of the Automatic Permissive Timer for the X valve Group. A more detailed Root Cause of Failure will be performed on this component after removal from the system.

Potential root cause, contributing to the timer failure are :

1. Isolated component failure
2. Operation of that component outside of design
3. Failure of the circuitry associated with that component

These contributing factors will require that the actual failure be more closely evaluated to make a final determination.

REVIEW OF MAINTENANCE, SURVEILLANCE TESTING AND MODIFICATION HISTORY

The SBCS is a non- safety- related system, therefore it requires no Surveillance testing. A comprehensive maintenance and modification history, Steam Bypass Control System Detailed System Investigation Action Plan is attached with its' appendices. The appendices include reviewed document lists, summary and conclusions from EED and NED.

OUTLINE OF TROUBLESHOOTING PLAN

The scope of this plan involves the injection of simulated test signals via the SBCS Installed Test Panel to simulate a "load rejection" to the SBCS. Indications on the test panel will be monitored to provide indications of the failing component in the system. This detailed test plan with Precautions, Limitations, As found data collection, and actual definition of inputs to accomplish this testing is delineated in Work Order 00345657, attached.

FINDINGS OF TROUBLESHOOTING

On 3/9/89, troubleshooting as specified in Work Order 00345657 found that with a simulated load rejection the permissive lamp indicators for valves 1001, 1003, 1004, & 1006 (Group X) extinguished in 7 seconds and that the permissive lamp indicators for valves 1002, 1005, 1007 & 1008 (Group Y) extinguished in the expected 15 seconds. The Group X Timer was found set at 15 seconds and the Group Y Timer was found set at 15 seconds, as expected. The simulated load rejection was repeated four times with the same results.

CONCLUSIONS

The findings of the troubleshooting proved that the Group X Timer had degraded (failed) such that the permissive signal would be removed from the Group X valves sooner than expected, 7 seconds instead of 15 seconds. Evaluation of TDAS Graphs of the event showed that the Group X valves quick closed after approximately 7 seconds of modulation. Quick closing of the valves is only possible by the removal of the permissive signal to those valves. Review of the Control Room Alarms during the event shows the Group X permissive in and out several times during the event. The Group Y permissive was in for the entire event.

The failure of the Group X Timer card was the cause of the multiple quick openings of the Steam Bypass Valves. The Timer is an Allen Bradley Logic Card part number 1720-L440.

RECOMMENDED CORRECTIVE ACTIONS

1) The failure has been proven to be the Group X Timer card, therefore the quarantine on the SBCS components should be lifted and normal work practices resumed..

2) Replace the Group X Timer card and repeat the testing delineated in Work Order 00345657 to verify the replacement card corrects the problem. This corrective action will be initiated by Work Request 353366.

3) Perform a Root Cause Failure Analysis on the failed timer card. This corrective action will be tracked by EER 89-SF-014. This action is to include a review of maintenance, modification history and evaluation of the circuit design and associated circuitry once the individual failure is identified.

4) A review of SBCS testing procedures found that the Permissive Off Delay Timers are not timed to ensure correct response. Instruction Change Request #05233 has been submitted to add necessary instructions to the SBCS Functional Test to accomplish the timimg.

5) The actions of this Troubleshooting Action Plan have been completed. Subsequent actions delineated under the Recommended Corrective Actions will be tracked by other site documents. It is recommended that this Action Plan be closed.

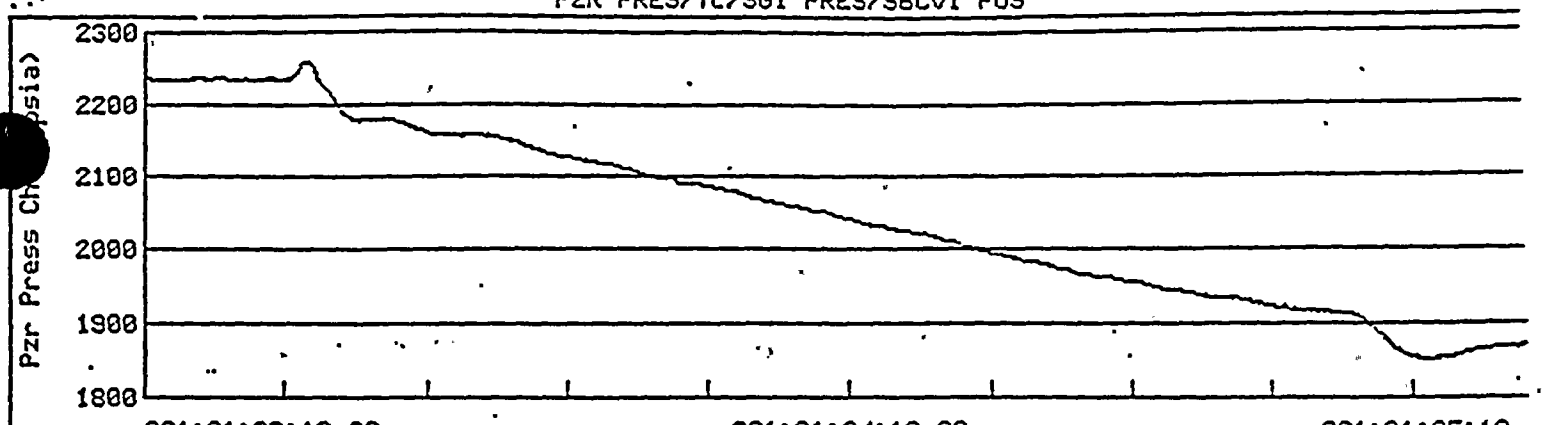
REVIEWED BY : David Leog 5-3-89 DATE
SYSTEM ENGINEER

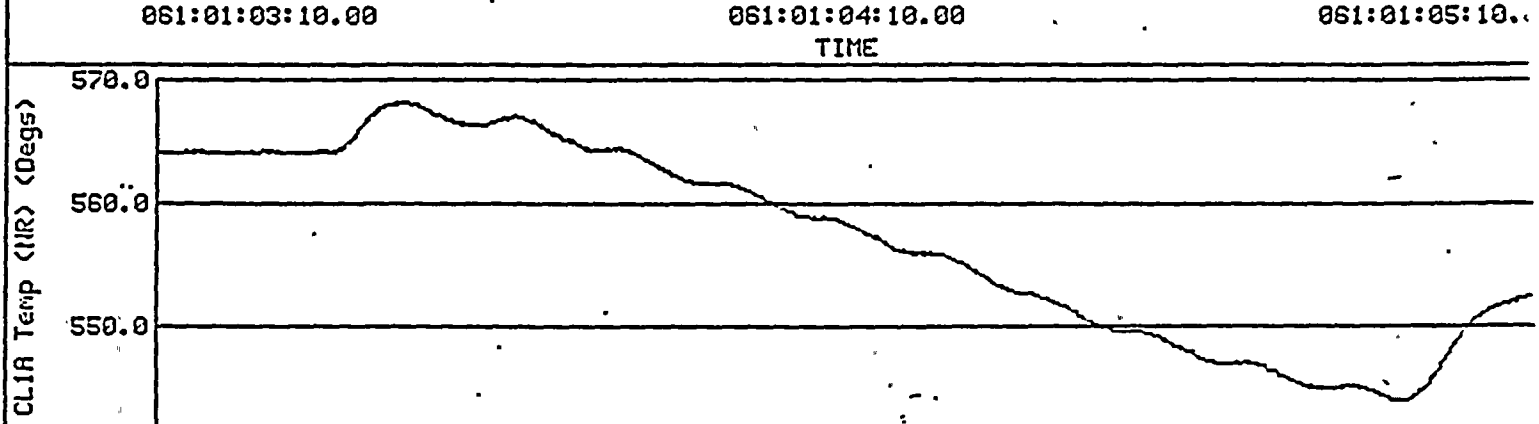
APPROVED BY : [signature] 5-2-89 DATE
ENGINEERING TEAM LEADER

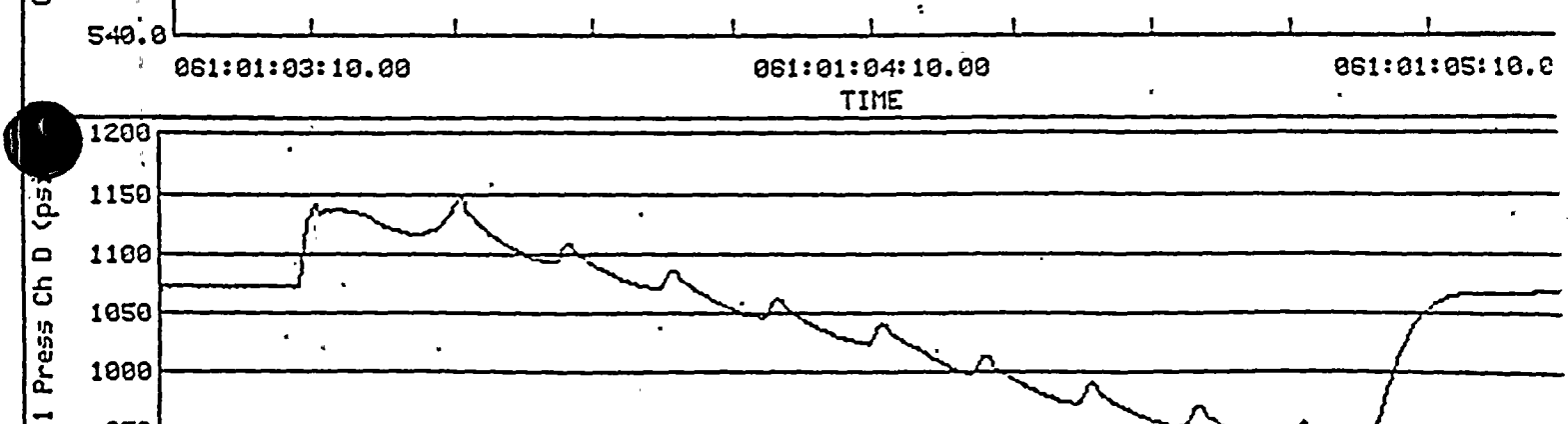
RELEASED FOR
IMPLEMENTATION BY : _____ DATE
INVESTIGATION DIRECTOR

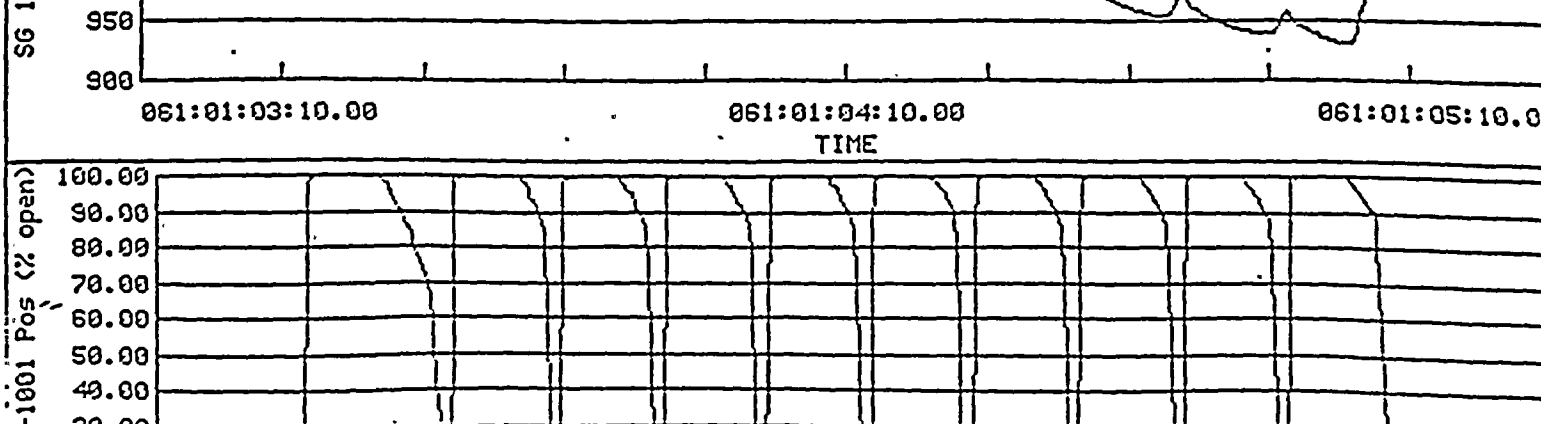
FINAL CLOSURE
APPROVAL BY : _____ DATE
INVESTIGATION DIRECTOR

PZR PRES/Tc/SG1 PRES/SBCV1 POS









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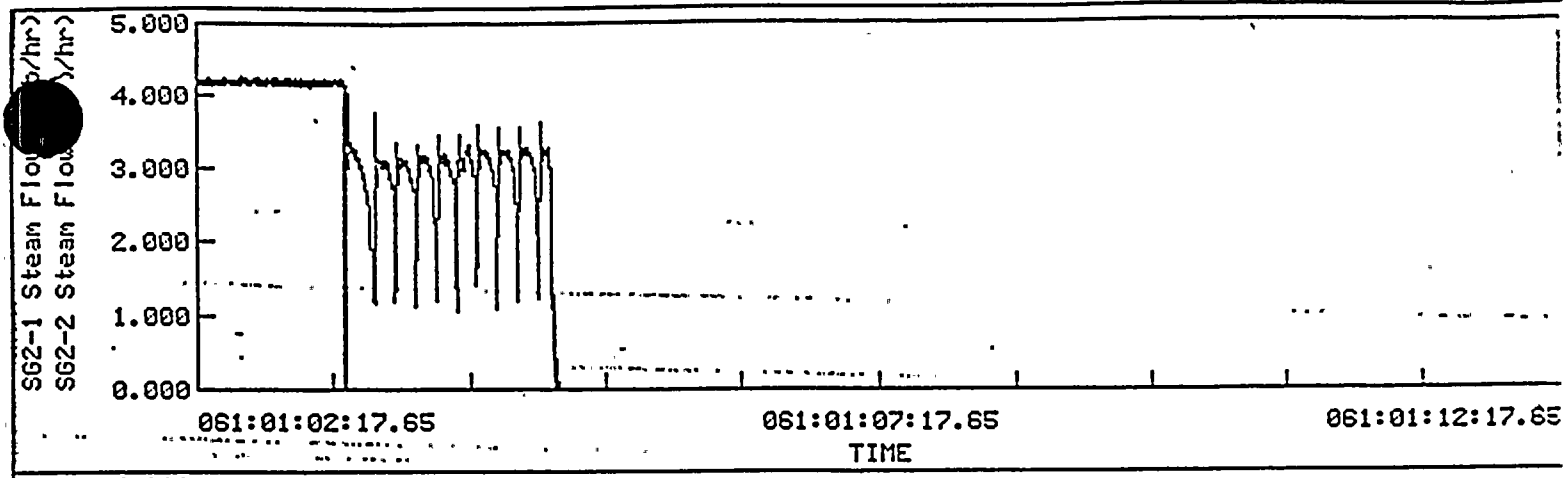

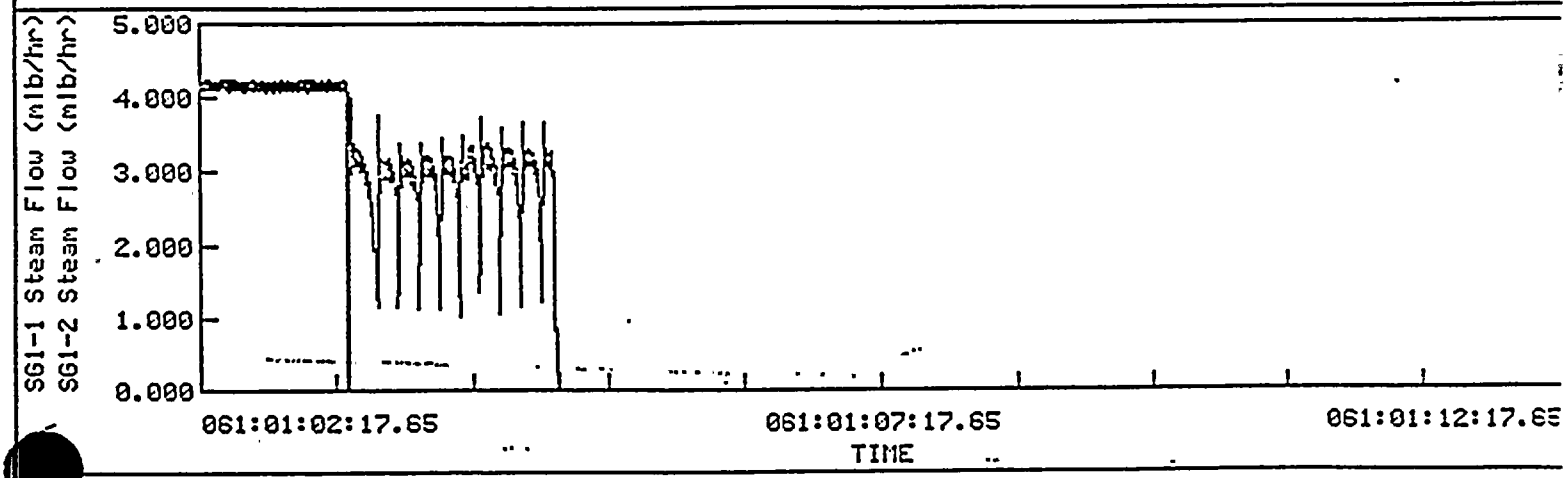

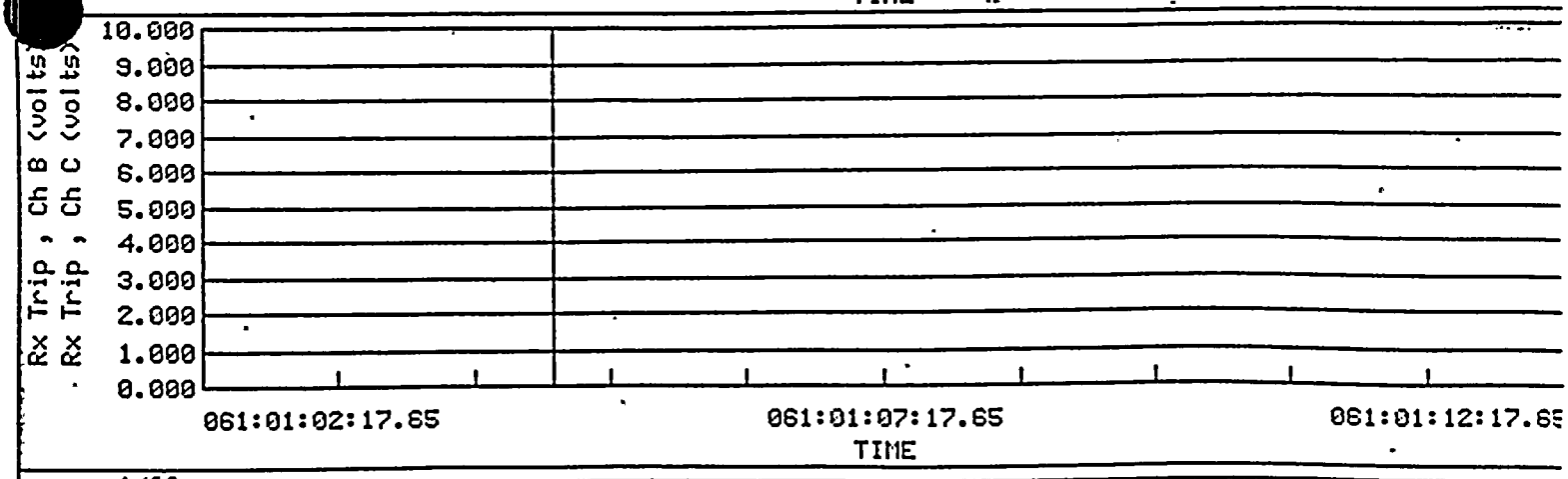

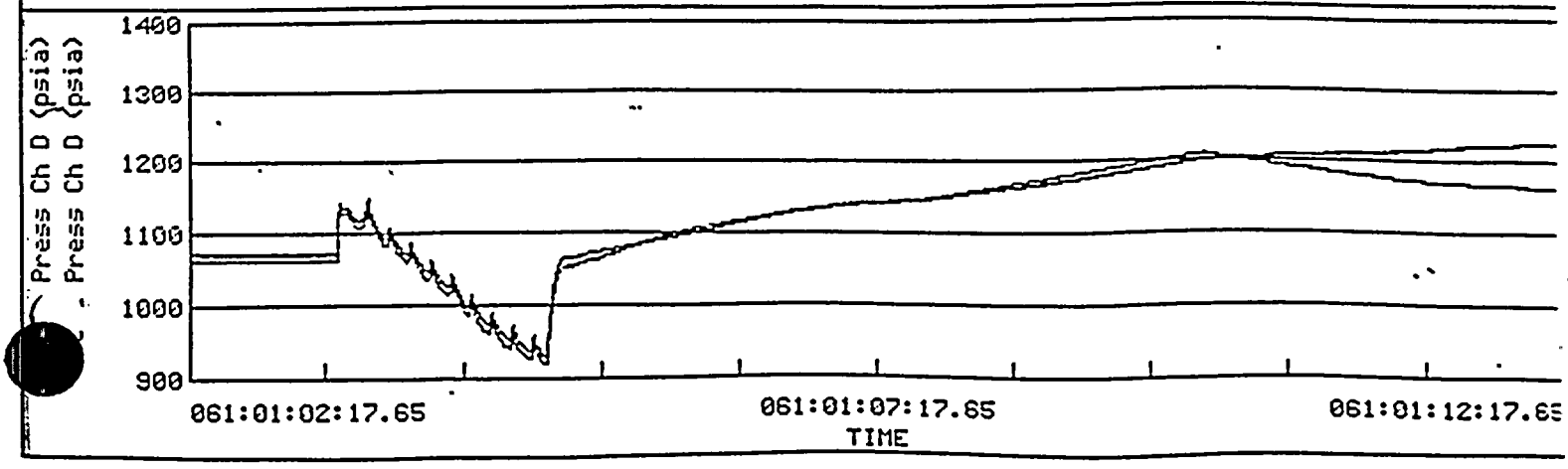

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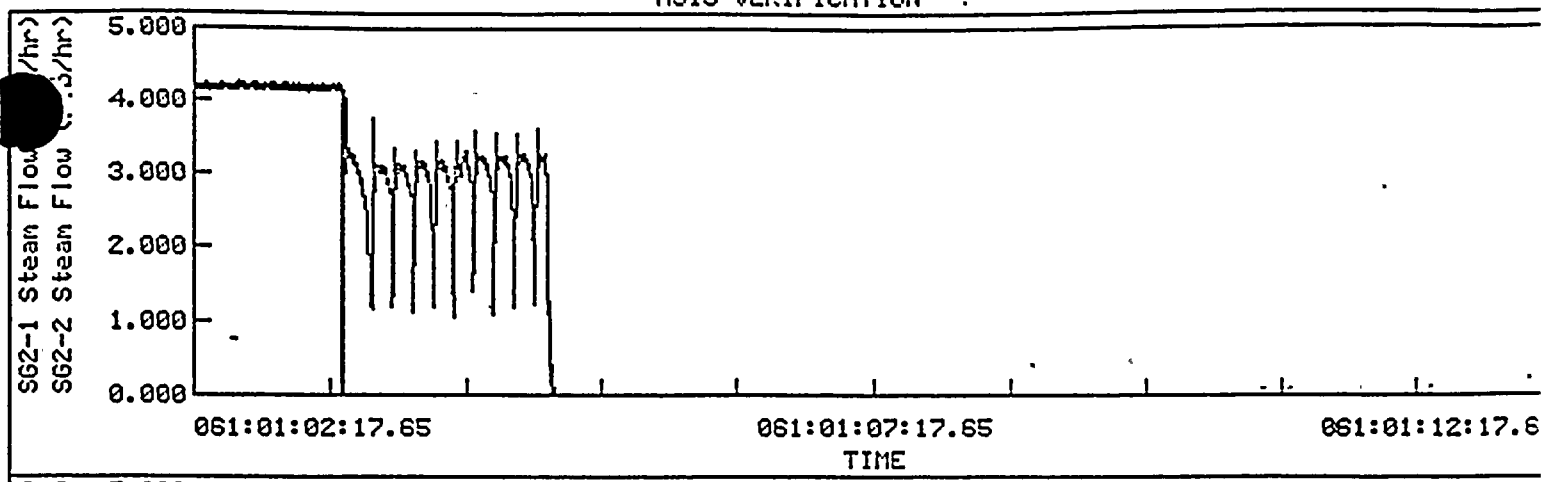

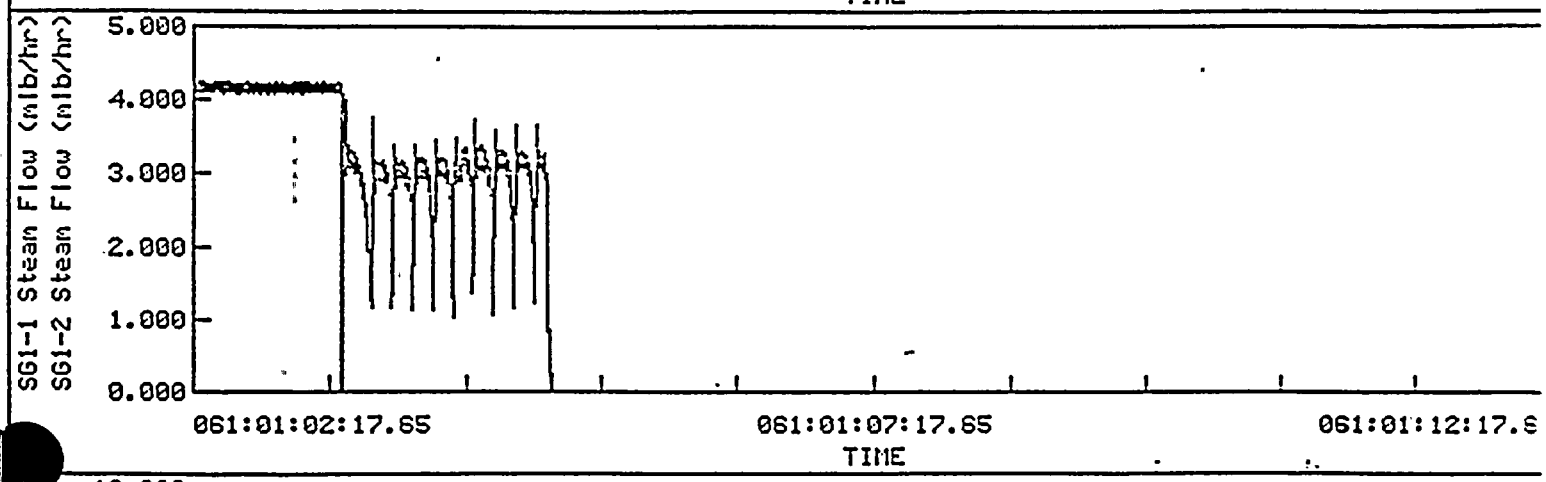

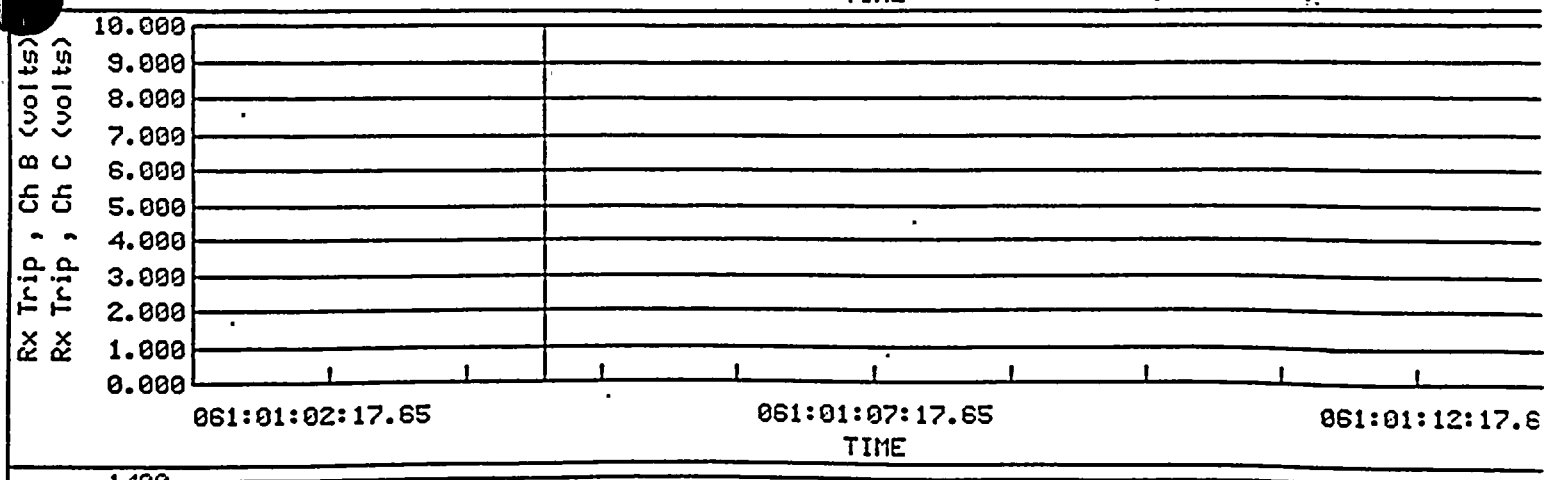

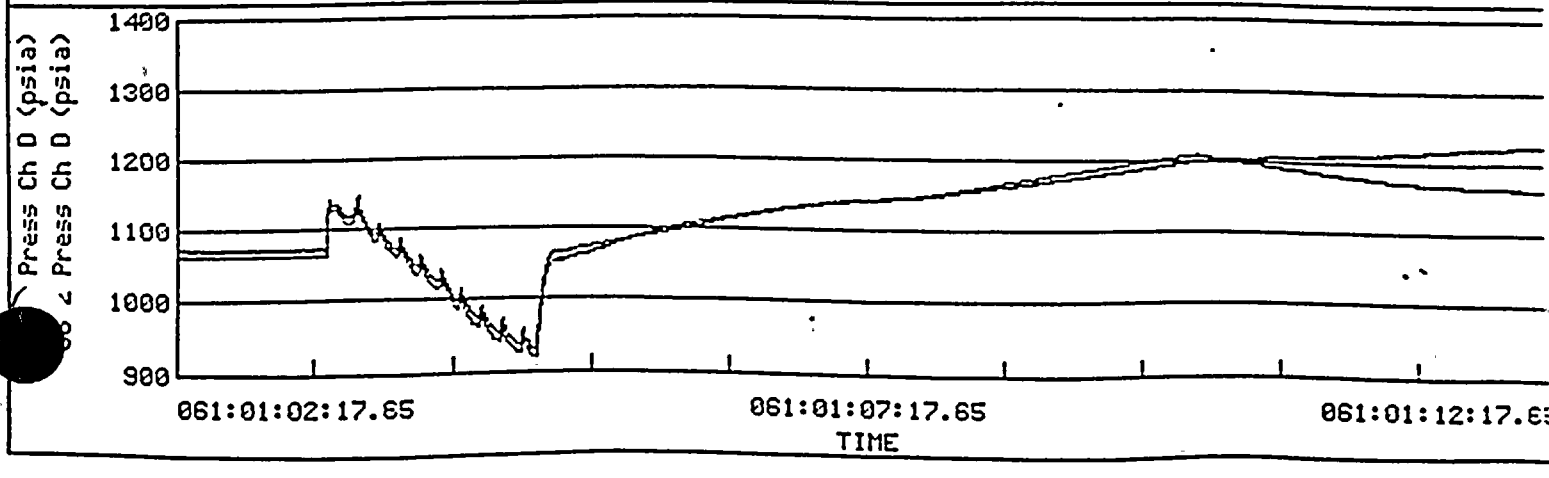

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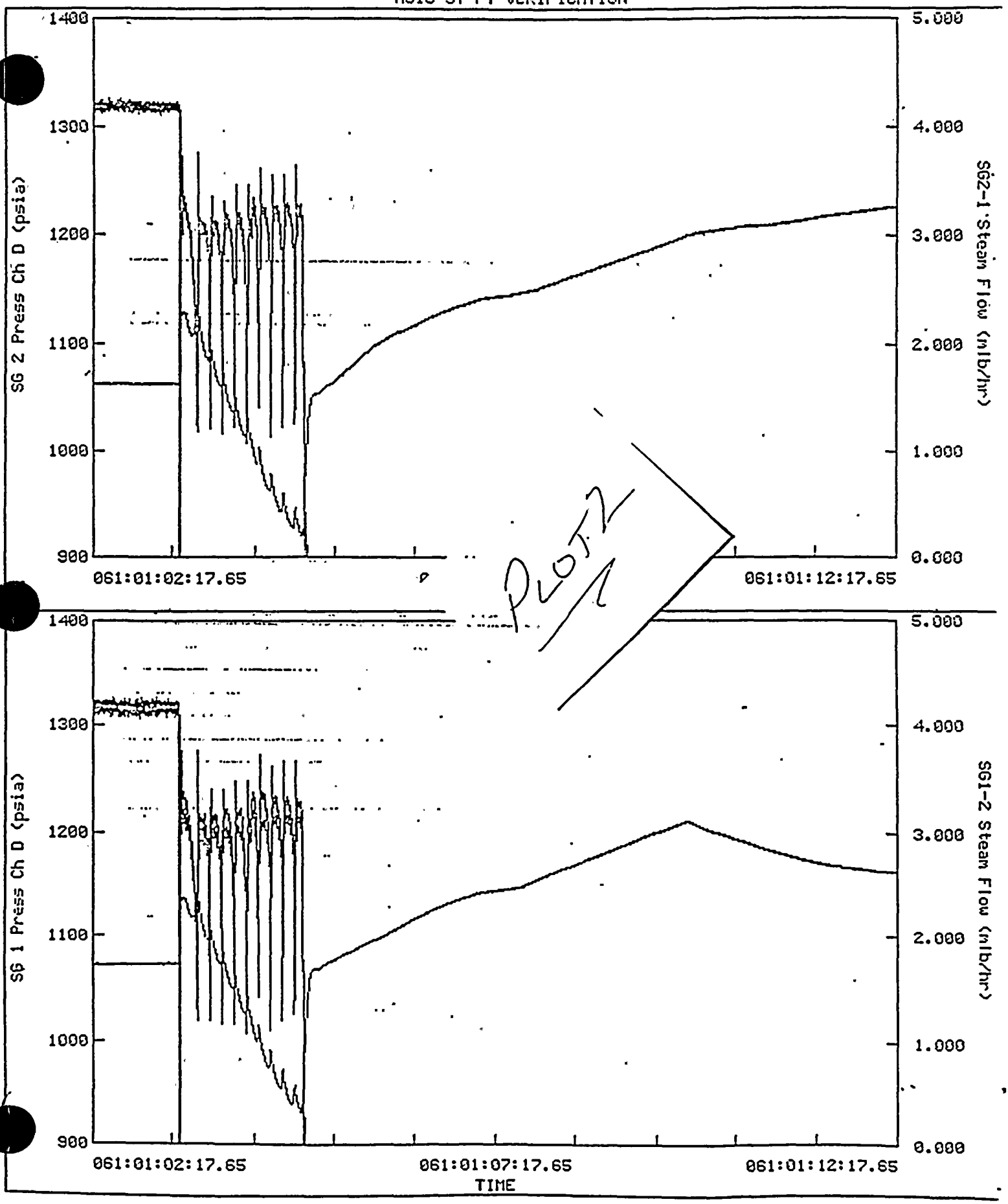

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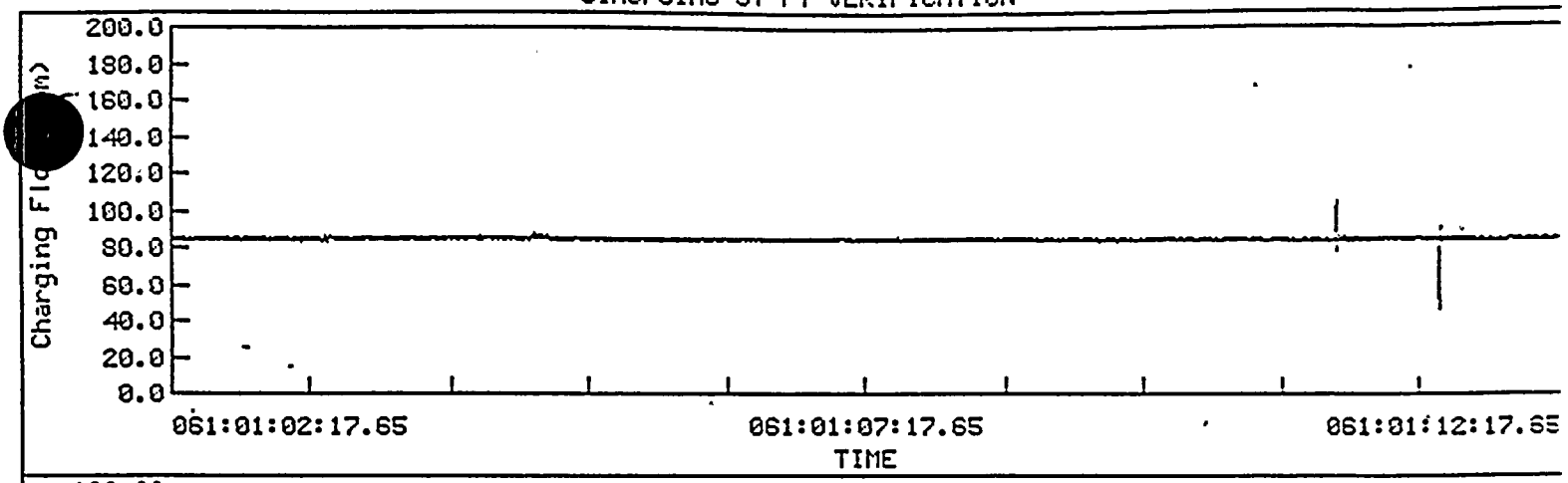

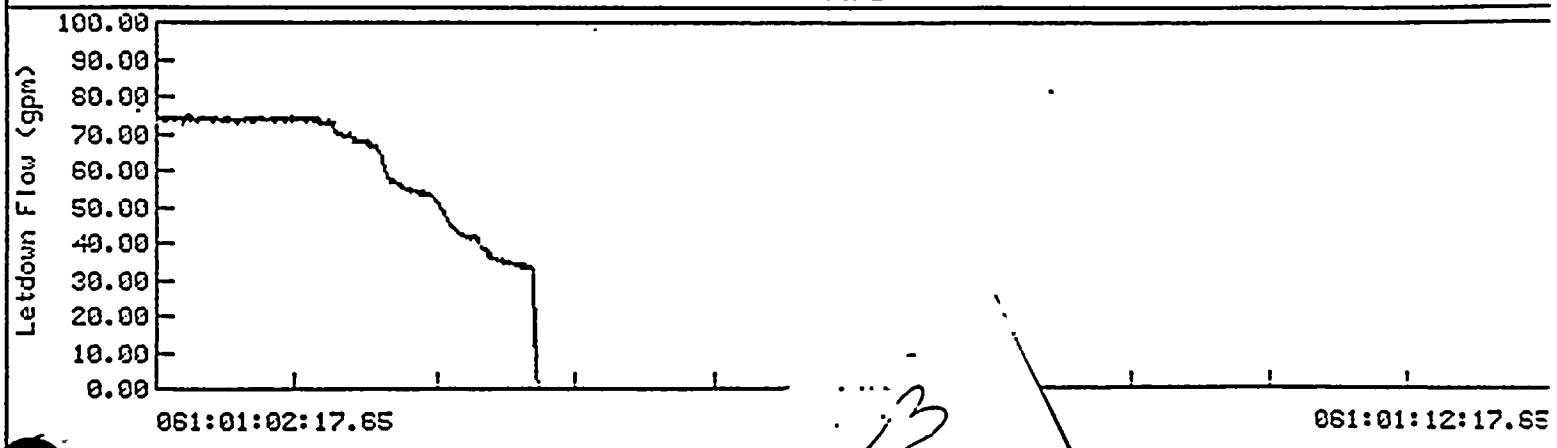

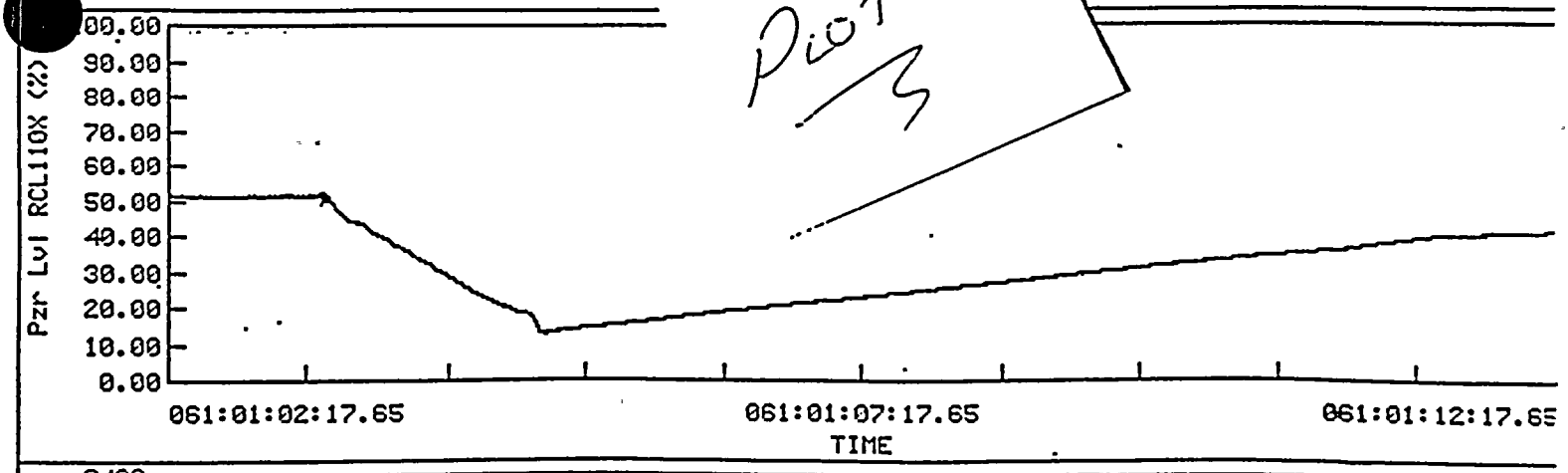

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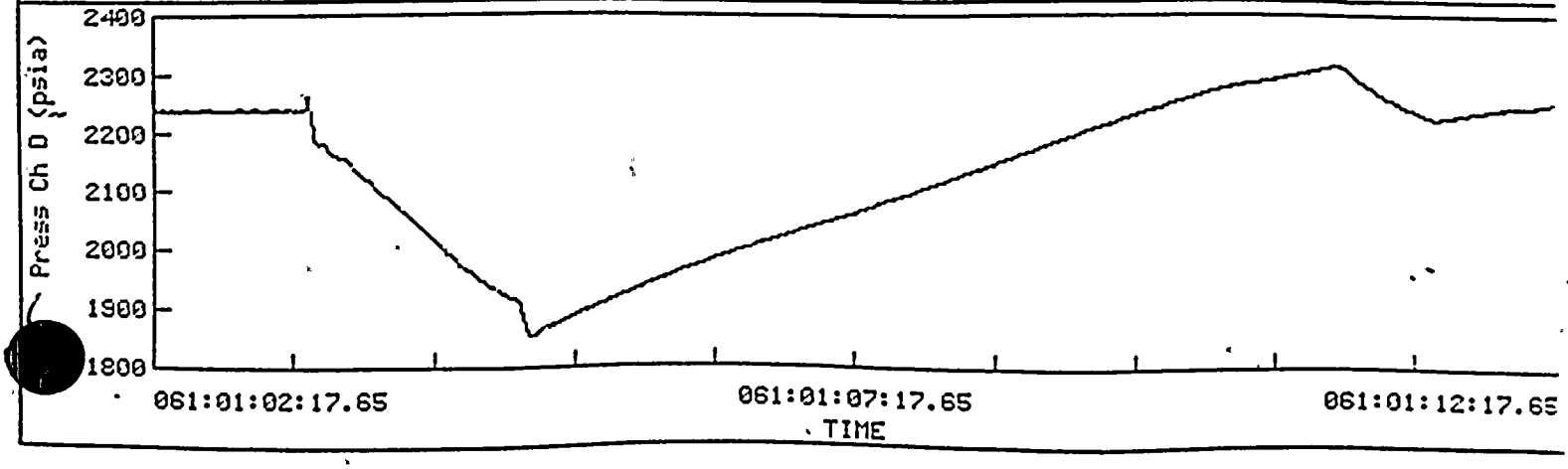
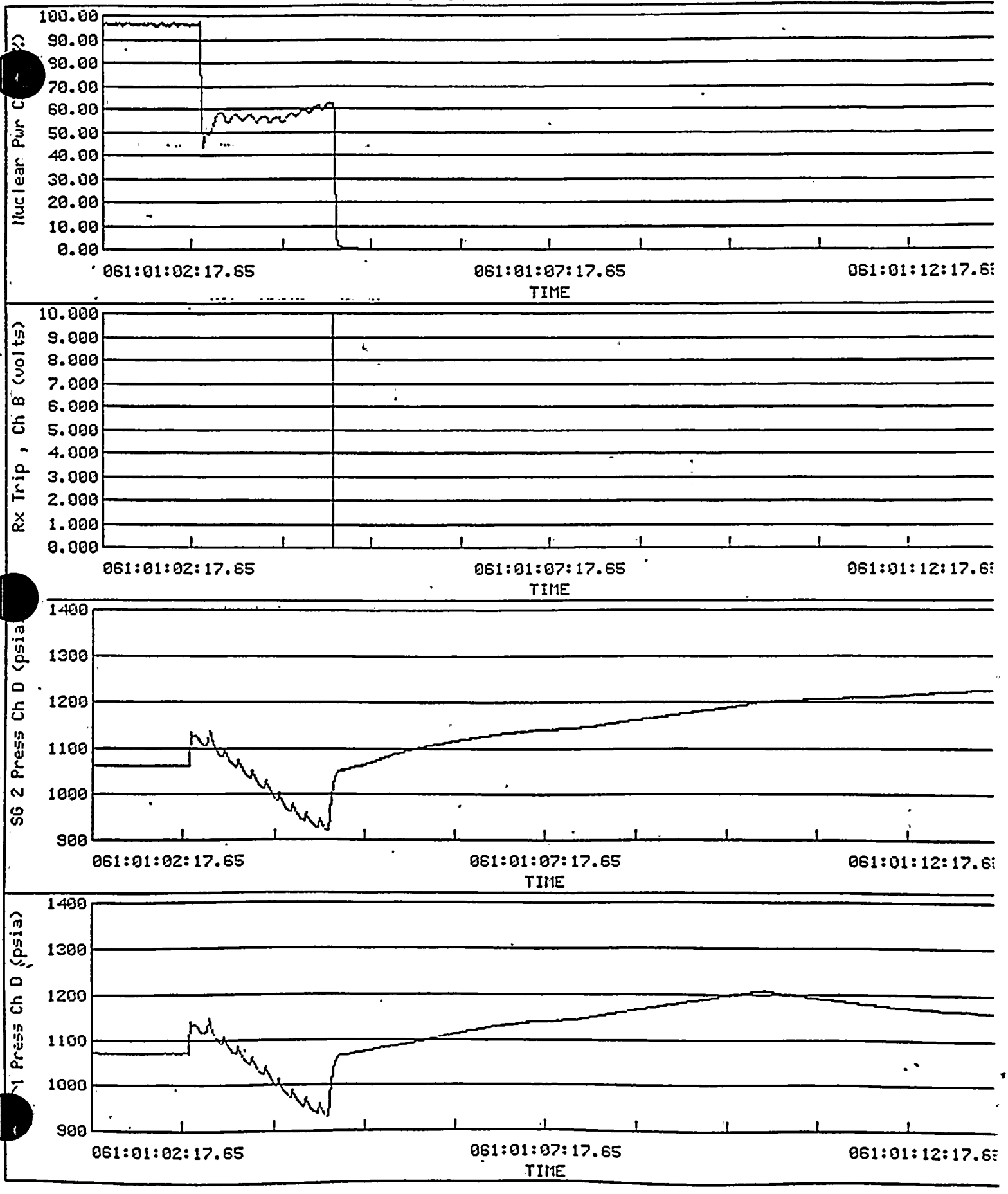
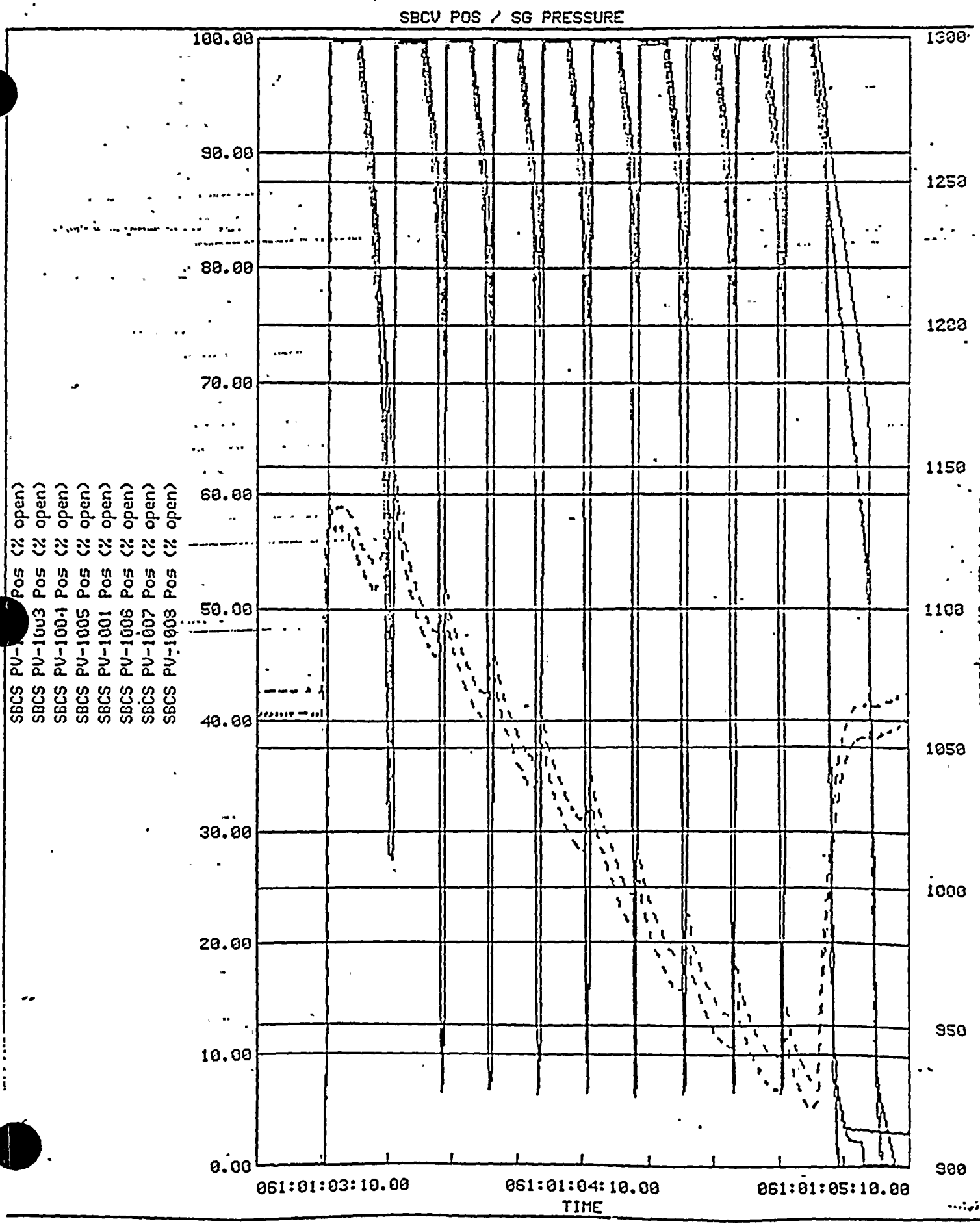


STM GEN PRES/RX TRIP




SBCV POS / SG PRESSURE
100.00
90.00
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60.00
50.00
40.00
30.00
20.00
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0.00
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1200
1150
1100
1050
1000
950
900
SBCS PV-1 Pos (% open)
SBCS PV-1003 Pos (% open)
SBCS PV-1004 Pos (% open)
SBCS PV-1005 Pos (% open)
SBCS PV-1001 Pos (% open)
SBCS PV-1006 Pos (% open)
SBCS PV-1007 Pos (% open)
SBCS PV-1008 Pos (% open)
SG 1 Press Ch D (psia)
061:01:03:10.00
061:01:04:10.00
061:01:05:10.00
TIME

ARIZONA NUCLEAR POWER PROJECT
P V N G S WORK ORDER

WO#: 00345657 WR#: 328568 Sys: SF Work Center: MNTC
Eq: 3JSFNC03 INSTRU

Priority: 5A2
Due: 03/06/89

Eq Desc NSSS CONTROL SYSTEMS CAB Loc 01WJB14NJ02140

WK QR:	Y	QC Rqrd:	Y
Seismic Cat:	1	Matls Rqrd:	N
Plant Mode:	1234X67890	Eng Rqrd:	Y
Eq Mode:	INS	Safety Rqrd:	N
Eq List:	Y	Doc#:	II 2-3-89-01
ASME XI Repair:	N	Est Dur Hrs:	10

Problem Desc: SBCS VALVES 1, 4, 3, 6 DID NOT FUNCTION IN THE MODULATE MODE.

Work Desc: TROUBLESHOOT/INVESTIGATE/TEST THE STEAM BYPASS CONTROL SYSTEM TO DETERMINE WHY IT DID NOT FUNCTION IN THE MODULATE MODE IAW THE EED ACTION PLAN.

Special/Retest Reqmnts: SEE ATTACHMENTS

Optest Rqrd: N Code/Unq Test Rqrd: N
SS CONCURRENCE FOR OPERABILITY TEST: _____

TSCCR#

Clear Rqrd: N	Scty Rqrd: N	Procedure#: N/A
Clear #:	Scty Prm:	
Clear #:		
Clear #:	Confnd Space Rqrd: N	Drawing#: SEE ATTACHMENTS
	Confnd Space Prmt #:	
REP Rqrd: N		
REP #:	W/B Rqrd: N	
	W/B Prm:	Tech Man#: SEE ATTACHMENTS

Discp: I&C

Preparer Conrad Cauthen Date 3-8-89 CAUTHEN,CONRAD Ext: 3860	Technical Review / Date 3/8/89
Work Group Supervisor / Date 3/9/89 Ext: 3361	Redundant Trains Operable Y, N, N/A Ext:
Quality Review / DATE 3-8-89	Releasing Organization / Date 3-9-89 Ext:

Number of Attachments: ____

WO# 00345657 WR# 328568 Work Center MNTC ATTACHMENT ____ OF ____
Work Desc TROUBLESHOOT/INVESTIGATE/TEST THE STEAM BYPASS CONTROL SYSTEM TO DETERMINE WHY IT DID NOT FUNCTION IN THE MODULATE MODE IAW THE EED ACTION PLAN.
Eq 3JSFNC03 INSTRU
Eq Desc NSSS CONTROL SYSTEMS CAB Loc 01WJB14NJ02140
Work Type CM

==========
*** INFORMATION ***
==========

1.0 GENERAL INFORMATION:

1.1 DURING THE PLANT TRIP, THE STEAM BYPASS CONTROL VALVES PV-1001, PV-1003, PV-1004, AND PV-1006 DID NOT FUNCTION AS DESIGN IN THE MODULATE MODE. DURING THE PERIOD OF TIME FOLLOWING LARGE LOAD REJECTION AND JUST PRIOR TO THE RESULTING REACTOR TRIP, DATA RECORDED FROM THE TRANSIENT DATA ACQUISITION SYSTEM (T-DAS) INDICATES THAT DURING THIS PERIOD OF TIME (9) COMPLETE CYCLES OF "QUICK OPENINGS" OF THESE VALVES OCCURED. EVENTS AND CASUAL FACTORS HAVE INDICATED THAT A MALFUNCTION EXISTS IN THE AUTO PERMISSIVE TIMER "X". TESTING WILL ATTEMPT TO ISOLATE THE FAILURE TO THIS SUSPECTED COMPONENT.

1.2 THE SCOPE OF THIS DOCUMENT IS TO ULTILIZE THE INSTALLED TEST FEATURES OF THE STEAM BYPASS CONTROL SYSTEM (SBCS) TO SIMULATE A LARGE LOAD REJECTION. THE TESTING WILL BE CONTROLLED TO ESTABLISH INITIAL CONDITIONS REQUIRED SUCH THAT THE "SBCS" WILL RECOGNIZE THE REQUIRED INPUTS TO RESULT IN A LOAD REJECTION SIGNAL BEING GENERATED AND OBSERVATIONS WILL BE MADE USING INSTALLED TEST LAMPS TO INDICATE THE PERFORMANCE OF THE SYSTEM. ACTUAL "QUICK OPEN" OF THE "SBCS" VALVES WILL BE INHIBITED BY PLACING THE VALVES IN "EMERGENCY OFF" POSITION ON THE OPERATOR CONTROL BOARD.

COMBUSTION ENGINEERING (CE) AND THE NUCLEAR ENGINEERING DEPARTMENT (NED), HAVE PERFORMED AN INDEPENDENT ANALYSIS AND CONCLUDED A FAILURE OF THE TIMER IS THE MOST LIKELY CAUSE OF THE FAULTY OPERATION OF OF THE "SBCS".

THIS WORK ORDER WILL COLLECT AND DOCUMENT FACTUAL INFORMATION TO AID IN DETERMINING THE PROBABLE CAUSES, CONDITIONS AND CIRCUMSTANCES PERTAINING TO THIS EVENT.

WO# 00345657 WR# 328568 Work Center MNTC ATTACHMENT ____ OF ____
Work Desc TROUBLESHOOT/INVESTIGATE/TEST THE STEAM BYPASS CONTROL SYSTEM TO DETERMINE WHY IT DID NOT FUNCTION IN THE MODULATE MODE IAW THE EED ACTION PLAN.
Eq 3JSFNC03 INSTRU
Eq Desc NSSS CONTROL SYSTEMS CAB Loc 01WJB14NJ02140
Work Type CM

EQUIPMENT FUNCTION:

1.3 THE TURBINE BYPASS VALVES PERMIT THE FULL RANGE OF THE TURBINE LOAD REJECTIONS TO OCCUR WITHOUT REQUIRING A REACTOR TRIP. THEY RECIEVE THE CONTROL INPUT FROM THE STEAM BYPASS CONTROL SYSTEM. THE VALVES MAY ALSO BE OPERATED MANUALLY FROM THE CONTROL ROOM. VALVES SGN-PV-1001 THROUGH 1006 DISCHARGE INTO THE CONDENSOR. VALVES SGN-PV-1007 AND 1008 DISCHARGE INTO THE ATMOSPHERE.

REFERENCE MATERIAL:

1.4 APPLICABLE DRAWINGS: 3-J-SFE-058 SHEETS 1 TO 39 (SBCS)

1.5 APPLICABLE TECHNICAL MANUAL: N001-13.02-136

*** SPECIAL NOTE ***

WHILE MAINTENANCE IS IN PROGRESS, THE SBCS SHOULD BE PLACED IN THE "EMERGENCY OFF" MODE, BY SWITCH HS-1010, PER THE SYSTEM ENGINEER, TO PREVENT INADVERTANT OPERATION OF THE STEAM BYPASS CONTROL VALVES. WHILE THE SYSTEM IS IN EMERGENCY OFF THE STEAM BYPASS CONTROL SYSTEM WILL NOT OPERATE DURING A LOAD REJECTION.

WO# 00345657 WR# 328568 Work Center MNTC ATTACHMENT ____ OF ____
Work Desc TROUBLESHOOT/INVESTIGATE/TEST THE STEAM BYPASS CONTROL SYSTEM TO DETERMINE WHY IT DID NOT FUNCTION IN THE MODULATE MODE IAW THE EED ACTION PLAN.
Eq 3JSFNC03 INSTRU
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Work Type CM

*** INSTRUCTIONS AND GUIDELINES ***

*** SPECIAL NOTE ***

WHILE PERFORMING THE TROUBLESHOOTING PLAN, IF CONDITIONS ARE ENCOUNTERED OTHER THAN THOSE EXPECTED AND UNSAFE CONDITIONS EXIST, RESTORE THE EQUIPMENT TO A SAFE CONDITION AND NOTIFY THE INVESTIGATION TEAM LEADER.

INITIAL DATE

2.0 PRECAUTIONS, LIMITATIONS, AND NOTIFICATIONS

2.1 NOTIFICATIONS

PL 3/9/89 2.1.1 NOTIFY THE CONTROL ROOM OPERATORS OF THE WORK TO BE PERFORMED AND THE FOLLOWING.

WHILE THIS WORK IS IN PROGRESS, THE STEAM BYPASS CONTROL VALVES WILL BE RENDERED INOPERABLE USING THE "EMERGENCY OFF" SWITCH. THE VALVES MAY BE RETURNED TO OPERATION BY USING THE "EMERGENCY-OFF/CONDENSER INTERLOCK RESET" SWITCH.

ANNUNCIATOR WINDOWS 6A16A & 4A10B AND PMS COMPUTER PTS SFSBAMI & SFYS5 WILL ALARM DURING THIS ACTIVITY.

PL 3/9/89 2.1.2 CONTACT THE ENGINEERING EVALUATION DEPARTMENT (X2620) FOR DIRECTION AND ASSISTANCE. ENGINEERING WILL BE PRESENT DURING ALL TROUBLESHOOTINGAND INVESTIGATION ACTIVITIES.

PL 3/9/89 2.1.3 CONTACT Q.C. PRIOR TO CONDUCTING TAILBOARD MEETING. Q.C. SHALL MONITOR ALL TROUBLESHOOTING AND INVESTIGATING ACTIVITIES.

WO# 00345657 WR# 328568 Work Center MNTC ATTACHMENT ____ OF ____
Work Desc TROUBLESHOOT/INVESTIGATE/TEST THE STEAM BYPASS CONTROL SYSTEM TO DETERMINE WHY IT DID NOT FUNCTION IN THE MODULATE MODE IAW THE EED ACTION PLAN.
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Work Type CM

**NOTE: A TAILBOARD MEETING WILL BE HELD BETWEEN THE ENGINEERING EVALUATIONS DEPARTMENT , ON-DUTY SHIFT SUPERVISOR, WORK GROUP SUPERVISOR, PLANNER/SCHEDULER, OPERATIONS STAFF, AND THE TECHNICIANS THAT WILL BE PERFORMING THE WORK TO DISCUSS THE APPROACH TO RESOLVING THE PROBLEMS ENCOUNTERED WITH THE "SBCS" AND THE EXPECTED RESULTS OF THE TROUBLESHOOTING ACTIVITY.

2.1.4 TEAM LEADER J.S. SUMMY TO VERIFY THAT APPROVAL FOR "PHYSICAL WORK" ON THE STEAM BYPASS CONTROL SYSTEM HAS BEEN GRANTED.

SIGNATURE/DATE: J.S. Summy 3/9/89

2.2 PRECAUTIONS, LIMITATIONS, OPERATIONAL CONSIDERATIONS, AND PREREQUISITES

R 3/9/89 2.2.1 PRIOR TO STARTING (OR RESUMING) ANY WORK, ENSURE THAT THE EQUIPMENT TO BE WORKED ON IS THE SAME EQUIPMENT SPECIFIED BY THIS WORK ORDER AND/OR ITS MULTI-EQUIPMENT LIST.

R 3/9/89 2.2.2 DOCUMENT ANY LIFTING, RELANDING, OR JUMPERING OF LEADS ON A DETERMINATION/RETERMINATION SHEET.

R 3/9/89 2.2.3 DOCUMENT REMOVAL AND REINSTALLATION OF CIRCUIT CARDS USING THE "COMPONENT REINSTALLATION SIGNOFF" SHEET.

R 3/9/89 2.2.4 MAINTAIN HOUSEKEEPING ZONE IV, IAW 30AC-9ZZ04.

R 3/9/89 2.2.5 BEFORE SELECTING A METER INPUT PUSHBUTTON, DEPRESS THE "TEST PROBE" PUSHBUTTON AND VERIFY THAT ALL OTHER PUSHBUTTONS HAVE PROPERLY RELEASED.

R 3/9/89 2.2.6 HAVE OPERATIONS SWITCH THE SBCS TO "EMERGENCY OFF". THIS WILL PREVENT SBCS VALVE CYCLING DURING THIS WORK ACTIVITY.

WO# 00345657 WR# 328568 Work Center MNTC ATTACHMENT ___ OF ___
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Work Type CM

3.0 INSTRUCTIONS

R 3/9/89 3.1 TROUBLESHOOT AND INVESTIGATE THE MOST PROBABLE CAUSE FOR THE STEAM BYPASS CONTROL VALVES TO FAIL IN THE MODULATE MODE, IAW THE FOLLOWING:

R 3/9/89 3.1.1 RECORD OBSERVATION OF CONDITIONS, SETTINGS, POSITION AS A MINIMUM FOR THE FOLLOWING:

1.) ON THE "SBCS" TEST PANEL, RECORD ALL ILLUMINATED LED'S, POSITION OF "SYSTEM MODE SELECTOR SWITCH", RECORD IF ANY VALVE SELECTION PUSHBUTTONS ARE DEPRESSED.

SBCS TEST PANEL LED'S G.O. Block Int Emerg OFF Condenser Unavailable 1 Condenser Unavailable 2 Condenser Interlock 1, Condenser Interlock 2. (cont.)
SYSTEM SELECTOR SWITCH POSITION SPRAY/TF
VALVE SELECTION PUSHBUTTONS "N" Depressed

2.) ON THE "B06" MAIN CONTROL BOARD, RECORD POSITIONS OF THE MASTER CONTROLLER (M/A, R/L), RECORD POSITIONS OF THE MANUAL/AUTO CONTROL VALVE STATION FOR ALL "SBCS"VALVES.

HIC 1001 M HIC1002 M HIC1003 M
HIC 1004 M HIC1005 M HIC1006 M
HIC 1007 M HIC1008 M

3.) AT THE SBCS BAY "U" RECORD THUMBWHEEL SWITCH POSITIONS AND THE ACOPIAN POWER SUPPY OUTPUT VOLTAGE.

THUMBWHEEL POSITION/ ACOPIAN OUTPUT
T/(Timer 1) 030 T/(Timer 2) 030
T/(Auto Permissive V) 015
T/(Aut Permissive V) 015
Upper Acopian PS Output 14.9 VDC
Lower Acopian PS Output 15.1 VDC

WO# 00345657 WR# 328568 Work Center MNTC ATTACHMENT ____ OF ____
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Work Type CM

R 3/9/89 3.1.2 DOCUMENT, ON A "WORK PERFORMED CONTINUATION" SHEET, ANY AS FOUND CONDITIONS, SUCH AS ANY MISSING, LOOSE OR DAMAGED COMPONENTS, AND NOTE THEIR POSITIONS (OPEN, CLOSED, UP, DOWN, KNOB SETTINGS, SWITCH POSITIONS, SETPOINTS, ETC.), AND ANY ABNORMAL ENVIROMENTAL CONDITIONS THE OPERATION OF COOLING DEVICES, WATER LEAKS, OIL LEAKS, LOOSE FITTINGS, CRACKS, EVIDENCE OF OVERHEATING OR WATER DAMAGE, CLEANLINESS, BENT TUBING FLUID LEVELS, JUMPERS, LIFTED WIRES, ETC. WHENEVER POSSIBLE, PHOTOGRAPHS SHOULD BE TO DOCUMENT AS-FOUND CONDITIONS.

AUTOMATIC PERMISSIVE DELAY TIMER FUNCTIONAL TEST

THIS TEST WILL USE THE INSTALLED TEST FEATURES ON THE "SBCS" TEST PANEL TO SIMULATE A LOAD REJECTION AND VERIFY THE PERMISSIVE TIMER HOLDS THE PERMISSIVE SIGNAL FOR APPROXIMATELY 15-20 SECONDS AFTER THE QUICK OPEN SIGNAL CLEARS THE "SBCS", IS DESIGNED TO PREVENT SYSTEM OUTPUTS TO REACTOR POWER CUTBACK SYSTEM AND THE "SBCS" VALVES DURING THIS TEST.

R 3/9/89 3.1.3 PLACE THE SYSTEM MODE SELECTOR SWITCH IN THE "TEST POSITION". (REFERENCE 36MT-9SF03)

R 3/9/89 3.1.4 VERIFY THE "CONTROLLER OUTPUT PERMISSIVE" INDICATION ON THE TEST PANEL IS EXTINGUSHED, IF NECESSARY PLACE PS1 AND PS2 TEST SWITCHES IN THE "TEST SIGNALS (TEST MODE)" POSITION (DOWN) AND ADJUST THE PS1 AND PS2 TEST POTS AS NECESSARY TO REMOVE THE CONTROLLER OUTPUT PERMISSIVE.

R 3/9/89 3.1.5 VERIFY THE "Q.O." BLOCK INDICATION ON THE TEST PANEL IS EXTINGUSHED , IF NECESSARY PLACE THE TAVG TEST SWITCH IN THE "TEST SIGNALS (TEST MODE)" POSITION (DOWN) AND ADJUST THE TAVG TEST POT AS NECESSARY TO CLEAR Q.O. BLOCK.

WO# 00345657 WR# 328568 Work Center MNTC ATTACHMENT ___ OF ___
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Work Type CM

R 3/9/89	3.1.6	PLACE THE WS/DP11 TEST SWITCH IN THE "TEST SIGNALS (TEST MODE)" POSITION (DOWN), SELECT THE WS/DP11 METER INPUT SELECTION PUSHBUTTON AND ADJUST THE WS/DP11 TEST POT FOR A DVM READING OF 3.5 VDC.
R 3/9/89	3.1.7	REPEAT THE ABOVE STEP FOR WS/DP12,WS/DP21 AND WS/DP22.
R 3/9/89	3.1.8	SIMULATANEOUSLY PLACE THE WS/DP11, WS/DP12, WS/DP21, AND WS/DP22 TEST SWITCHES IN THE UP POSITION. THIS SIMULATES A LARGE LOAD REJECTION. THE QUICK OPEN GROUP X1, Y1, X2, Y2 AND ALL 8 VALVE QUICK OPEN AND PERMISSIVE INDICATIONS SHOULD ILLUMINATE. (GROUP "X" CONSIST CONSIST OF "SBCS" VALVES PV-1001,1003,1004 AND 1006/ GROUP "Y" CONSIST OF "SBCS" VALVES PV-1002,1005,1007 AND 1008). THE QUICK OPEN LAMPS SHOULD EXTINGUISH AFTER A FEW SECONDS AND THE VALVE PERMISSIVE LAMPS SHOULD EXTINGUISH APPROXIMATELY 15-20 SECONDS LATER. RECORD THE TIME FROM WHEN THE QUICK OPEN LAMPS EXTINGUISH TO WHEN THE VALVE PERMISSIVE LAMPS EXTINGUISH. GROUP X 7.1 SECS. GROUP Y 14.8 SECS.
R 3/9/89	3.1.9	Q.C. MONITORING COMPLETE. MR#: MC-89-3012 3-9-8

4.0 RESTORATION

R 3/9/89	4.1	PLACE ALL "TEST SIGNAL" SWITCHES IN THE DOWN POSITION.
R 3/9/89	4.2	PLACE THE "SYSTEM MODE SELECTOR" SWITCH IN THE "DISCONNECT" POSITION.
R 3/9/89	4.3	MOMENTARILY DEPRESS THE "LIGHT AND TIMER TEST" PUSHBUTTON. (LOCATED ON THE FRONT OF THE TEST PANEL)
R 3/9/89	4.4	VERIFY BOTH "NOT IN OPERATE" LIGHTS GO OUT AND THEN COME BACK ON AFTER 30 SECONDS.

WO# 00345657 WR# 328568 Work Center MNTC ATTACHMENT ____ OF ____
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R 3/9/89	4.5	AFTER BOTH "NOT IN OPERATE" LIGHTS COME ON. PLACE "SYSTEM MODE SELECTOR" SWITCH IN "OPERATE".
		*** NOTE ***
		BOTH "NOT IN OPERATE" LIGHTS WILL REMAIN ON FOR A A SHORT PERIOD OF TIME. AFTER BOTH LIGHTS GO OUT THE "SBCS" IS IN THE OPERATE MODE.
R 3/9/89	4.6	REMOVE THE "SBCS" FROM THE EMERGENCY OFF POSITION, USING THE HANDSWITCH (HS-1010).
R 3/9/89	4.7	NOTIFY OPERATIONS THAT THE SBCS "EMERGENCY-OFF/CONDENSER INTERLOCK RESET" SWITCH MAY NOW BE USED TO ENABLE OPERATION OF THE SBCS VALVES.
R 3/9/89	4.8	NOTIFY THE CONTROL ROOM BOARD OPERATOR UPON THE COMPLETION OF WORK.

ARIZONA NUCLEAR POWER PROJECT
SIMS WORK ORDER ATTACHMENT
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WO# 00345657 WR# 328568 Work Center MNTC ATTACHMENT ____ OF ____
Work Desc TROUBLESHOOT/INVESTIGATE/TEST THE STEAM BYPASS
CONTROL SYSTEM TO DETERMINE WHY IT DID NOT FUNCTION IN THE
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Eq 3JSFNC03 INSTRU
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Work Type CM

*** WORK PERFORMED CONTINUATION SHEET ***

DATE:_____ SHIFT: D S M START TIME:_____ COMPL TIME:_____
(CIRCLE ONE)

NAME:	BADGE NO:	MAN HOURS/ DISCIPLINE:	NAME:	BADGE NO:	MAN HOURS/ DISCIPLINE:

SHIFT SUPERVISOR (SS)
OR ASSIST SS PERMISSION
TO COMMENCE WORK; NAME:_____ TSCCR NO:_____ QC:_____/_____
(IF NEEDED) (NAME) (TIME)

FULLY DOCUMENT BELOW, ALL WORK PERFORMED:

WO# 00345657 WR# 328568 Work Center MNTC ATTACHMENT ____ OF ____
Work Desc TROUBLESHOOT/INVESTIGATE/TEST THE STEAM BYPASS CONTROL SYSTEM TO DETERMINE WHY IT DID NOT FUNCTION IN THE MODULATE MODE IAW THE EED ACTION PLAN.
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Work Type CM

*** DETERMINATION/RETERMINATION SHEET ***

DETERMINATION							RETERMINATION			
LOCATION/ CABINET	CABLE# OR "VENDOR"	WIRE#/ COLOR	TERM BD/ DEVICE	TERM PT	PERFORMER INIT	PERFORMER DATE	PERFORMER INIT	PERFORMER DATE	2ND VERIF INIT	2ND VERIF DATE

JUMPER INSTALLATION							JUMPER REMOVAL			
LOCATION/ CABINET	FROM: TERM BD/ DEVICE	TERM PT	TO: TERM BD/ DEVICE	TERM PT	INSTALLER INIT	INSTALLER DATE	REMOVAL INIT	REMOVAL DATE	2ND VERIF INIT	2ND VERIF DATE

ARIZONA NUCLEAR POWER PROJECT
SIMS WORK ORDER ATTACHMENT
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WO# 00345657 WR# 328568 Work Center MNTC ATTACHMENT ____ OF ____
Work Desc TROUBLESHOOT/INVESTIGATE/TEST THE STEAM BYPASS
CONTROL SYSTEM TO DETERMINE WHY IT DID NOT FUNCTION IN THE
MODULATE MODE IAW THE EED ACTION PLAN.
Eq 3JSFNC03 INSTRU
Eq Desc NSSS CONTROL SYSTEMS CAB Loc 01WJB14NJ02140
Work Type CM

*** COMPONENT REINSTALLATION SIGNOFF SHEET ***

P.N./MODEL NO: ________ LOCATION: ________
PART DESCRIPTION: ________
S/N REMOVED: ________ | S/N REINSTALLED: ________
REMOVED BY: ________ | REINSTALLED BY: ________ DATE: ________
DATE: ________ | VERIFIED BY: ________ DATE: ________

P.N./MODEL NO: ________ LOCATION: ________
PART DESCRIPTION: ________
S/N REMOVED: ________ | S/N REINSTALLED: ________
REMOVED BY: ________ | REINSTALLED BY: ________ DATE: ________
DATE: ________ | VERIFIED BY: ________ DATE: ________

P.N./MODEL NO: ________ LOCATION: ________
PART DESCRIPTION: ________
S/N REMOVED: ________ | S/N REINSTALLED: ________
REMOVED BY: ________ | REINSTALLED BY: ________ DATE: ________
DATE: ________ | VERIFIED BY: ________ DATE: ________

P.N./MODEL NO: ________ LOCATION: ________
PART DESCRIPTION: ________
S/N REMOVED: ________ | S/N REINSTALLED: ________
REMOVED BY: ________ | REINSTALLED BY: ________ DATE: ________
DATE: ________ | VERIFIED BY: ________ DATE: ________

ARIZONA NUCLEAR POWER PROJECT
SIMS MULTI EQUIP LIST
THIS DOCUMENT IS PART OF A WORK CONTROL
PACKAGE AND IS NOT TO BE SEPARATED FROM IT
ATTACHMENT ____ OF ____

WO# 00345657 WR# 328568
Work Desc TROUBLESHOOT/INVESTIGATE/TEST THE STEAM BYPASS CONTROL SYSTEM TO DETERMINE WHY IT DID NOT FUNCTION IN THE MODULATE MODE IAW THE EED ACTION PLAN.
Eq 3JSFNC03 INSTRU
Eq Desc NSSS CONTROL SYSTEMS CAB Loc 01WJB14NJ02140
Work Type CM

Eq Eq Desc	Loc	Initials Complete
3JSGNPV1001 STEAM BYPASS CV-1 TO CONDENSER A	VALVEX 10ETD04ST02147	R
3JSGNPV1002 STEAM BYPASS CV-2	VALVEX 04WTD03ST04147	R
3JSGNPV1003 STEAM BYPASS CV-3	VALVEX 07WTE04ST02147	R
3JSGNPV1004 STEAM BYPASS CV-4	VALVEX 07ETE04ST02147	R
3JSGNPV1005 STEAM BYPASS CV-5	VALVEX 07WTF04ST02147	R
3JSGNPV1006 STEAM BYPASS CV-6	VALVEX 10ETF04ST02147	R
3JSGNPV1007 STEAM BYPASS CV-7	VALVEX 05ETA15ST02147	R
3JSGNPV1008 STEAM BYPASS CV-8	VALVEX 05ETA12ST05147	R

ANPP

PVNGS WORK REQUEST

ORIGINATOR

WR NO.:	ORIGINATOR NAME:	STA. NO.:	EXT.:	DATE:	TIME:
0328568	David Lego	6078	2620	3-4-89	0545

EQUIPMENT TAG NO.:	NPROS COMPONENT CODE:	EQUIPMENT FUNCTION DESCRIPTION:
J SFN C03	INSTRM	SBCS

LOCATION:	UNIT:	PLANT FAILURE MODE:	STATUS AT FAILURE:	FAILURE DETECTION:
140' CONTROL	3	N/A	N/A	N/A

PROBLEM DESCRIPTION:

SBCS VALVES 1, 4, 36 did NOT FUNCTION IN The modulate mode.

RECOMMENDED ACTION:

Test per the SBCS VALVE TEST PLAN. INCORPORATE A STEP TO PLACE SBCS IN Emergency OF AS Required By The SS or SE.

REFERENCES: (P&ID, TECH. MANUALS, ETC.)

ADDITIONAL INFORMATION ATTACHED: (CHECK ONE) ☒ YES ☐ NO

MAINTENANCE REQUIRED TAG HUNG? (CHECK ONE) ☐ YES ☒ NO ☐ CRDL

LOCATION OF MAINTENANCE REQUIRED TAG:

ORIGINATING SUPERVISOR

NAME: (PRINTED)	SIGNATURE/DATE/EXT./STA. NO.:	TECH. SPEC. RELATED? (CHECK ONE)
J Summy	D A Summy 3-4-89/A664/6078	☐ YES ☒ NO

RELEASING ORGANIZATION

ROOT CAUSE ANALYSIS REQUIRED? (CHECK ONE)	EER NO.:	RESTRICT MODE:	EFFECT ON SYSTEM:	EFFECT ON PLANT:	PLANT MODE:
☒ YES ☐ NO		Ø	B	B	1 2 3 4 ☒ 6 7 8 9 0

TSCCR/CROL NO.:	SIGNATURE/DATE/EXT.:	PRIORITY:	NEED DATE:
	Stephen W Ryan 3-4-89 3928	5A2	3-6-89

COMMENTS:

WORK CONTROL CENTER

RECEIVED AND INPUT BY:	DATE:	TIME:	SPECIAL CONDITIONS:	WORK CENTER:	DISCIPLINE:
[signature]	3-4-89	1241		MNTC	I&C

DISPOSITION (CHECK ONE)

- ☐ WR CANCELLED, DUPLICATE OF _____
- ☐ WR NOT APPROVED, SEE COMMENTS
- ☐ BLANKET WO ISSUED
- ☒ WO ISSUED. WO NO: 345657
- ☐ WR CANCELLED, SEE WO NO. _____

COMMENTS:

WORK ORDER ATTACHMENT

WORK ORDER # 345657 ATTACHMENT _____ OF _____

THIS DOCUMENT IS PART OF A WORK CONTROL PACKAGE AND IS NOT TO BE SEPARATED FROM IT.

WORK CONTROL REVIEWER: Conrad Cauthen EXT: 3860 DATE: 3-4-89

ORIGINAL Copy: WCC • PINK Copy: ENGINEERING • CANARY Copy: ORIGINATOR

PV419-07BA Rev 6-88

ANPP

PVNGS WORK REQUEST

ORIGINATOR

WR NO.:	ORIGINATOR NAME:	STA NO:	EXT:	DATE	TIME
353366	GARY ANDERSON	6078	2651	3/9/89	1300

EQUIPMENT TAG NO.:	NPROS COMPONENT CODE:	EQUIPMENT FUNCTION DESCRIPTION:
3JSFNC03	INSTRU	S & CS

LOCATION	UNIT	PLANT FAILURE MODE	STATUS AT FAILURE	FAILURE DETECTION
140' CONTROL	3			

PROBLEM DESCRIPTION:

GRAY X (FOR PV 1001, 1003, 1004 & 1006) IN 3JSFNC03 BATU HAS FAILED

RECOMMENDED ACTION:

REFERENCES: (P&ID, TECH MANUALS, ETC.)

ADDITIONAL INFORMATION ATTACHED (CHECK ONE) ☐ YES ☐ NO

MAINTENANCE REQUIRED TAG HUNG? (CHECK ONE) ☐ YES ☐ NO ☐ CRDL

LOCATION OF MAINTENANCE REQUIRED TAG

ORIGINATING SUPERVISOR

NAME (PRINTED)

SIGNATURE/DATE/EXT/STA NO.

TECH SPEC RELATED? (CHECK ONE) ☐ YES ☐ NO

RELEASING ORGANIZATION

ROOT CAUSE ANALYSIS REQUIRED? (CHECK ONE)	EER NO.:	RESTRICT MODE.	EFFECT ON SYSTEM	EFFECT ON PLANT	PLANT MODE
☐ YES ☐ NO					1 2 3 4 5 6 7 8 9 0

TSCCR/CRDL NO.:	SIGNATURE/DATE/EXT.:	PRIORITY	NEED DATE

COMMENTS:

WORK CONTROL CENTER

RECEIVED AND INPUT BY	DATE:	TIME	SPECIAL CONDITIONS	WORK CENTER	DISCIPLINE

DISPOSITION (CHECK ONE)

- ☐ WR CANCELLED, DUPLICATE OF _____
- ☐ WR NOT APPROVED, SEE COMMENTS
- ☐ BLANKET WO ISSUED
- ☐ WO ISSUED, WO NO _____
- ☐ WR CANCELLED, SEE WO, NO _____

COMMENTS:

WORK ORDER ATTACHMENT

WORK ORDER # 345657 ATTACHMENT _____ OF _____

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WORK CONTROL REVIEWER **EXT** **DATE**

ORIGINAL Copy: WCC • PINK Copy: ENGINEERING • CANARY Copy: ORIGINATOR

PV419-01FF Rev 6-88

WO NUMBER: [ ]

M&TE USAGE

ATTACHMENT [ ] OF [ ]

M&TE NUMBER: [ ]

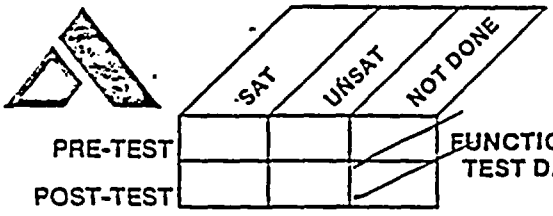
M&TE CAL DUE DATE: [ ]

CHECK-OUT DATE: [ ]

CHECK-IN DATE: 03-09-89

CHECKED-OUT BY: *(PRINT)*

THIS DOCUMENT IS PA
OF A WORK CONTROL
PACKAGE AND IS *NOT*
BE SEPARATED FROM I



SAFETY RELATED? ☑ YES ☐ NO

QUANTITATIVE ACCEPTANCE DATA? ☑ YES ☐ NO

TEMPERATURE

☐ °F ☐ °C

PRESSURE

☐ PSIG ☐ PSIA

☐ in/H₂O ☐ in/Hg

TORQUE

☐ in • lbs ☐ ft • lbs

OTHER *(Specify)*

☑ sec

ELECTRONIC

FUNCTION

☐ VDC	☐ mvdc	☐ KV	
☐ VAC	☐ mvac	☐ KV	
☐ OHMs	☐ KΩ	☐ MΩ	
☐ HZ	☐ KHZ	☐ MH	
☐ AMPs	☐ mamps	☐ di	

RANGE(S) SELECTED

[ ]

[ ]

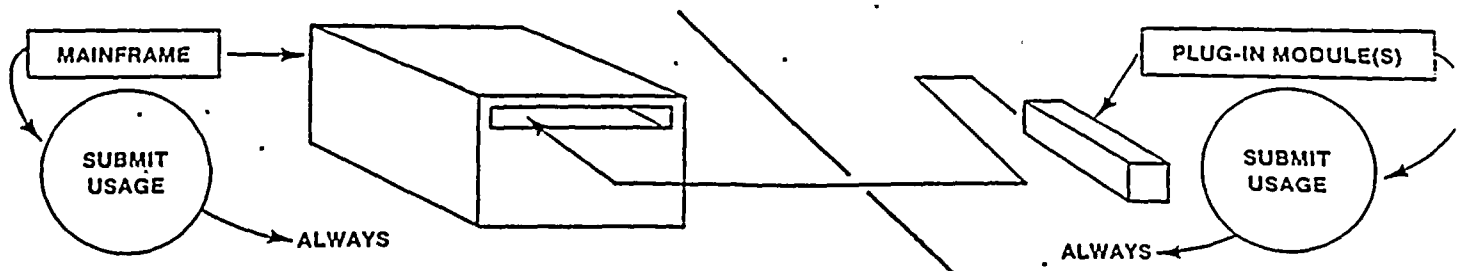
[ ]

ACTUAL READING(S) TAKEN

SPAN

	LO	HI		SINGLE POINT
S	7	16	or	
P			or	
A			or	
N			or	
			or	

MULTI-CHANNEL EQUIPMENT USAGE



NOTE: A SEPARATE USAGE FORM MUST BE SUBMITTED FOR MAINFRAME AND EACH MODULE USED. IF MODULES ARE CHANGED YOU MUST SUBMIT ANOTHER USAGE FORM.

CHANNEL/ SLOT	MODULE M&TE I.D. NO.

CHANNEL/ SLOT	MODULE M&TE I.D. NO.

CHANNEL/ SLOT	INSTRUMENT NO.

Comments: _____

M&TE USAGE

WO NUMBER: [ ] – [ ]

ATTACHMENT [ ] OF [ ]

M&TE NUMBER: [ ] – [ ]

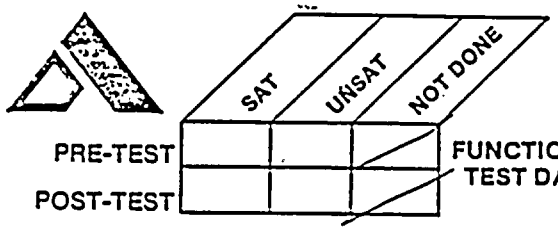
M&TE CAL DUE DATE: [ ] – [ ] – [ ]

CHECK-OUT DATE: [ ] – [ ] – [ ]

CHECK-IN DATE: 03 – 09 – 89

CHECKED-OUT BY: *(PRINT)*

THIS DOCUMENT IS PAR OF A WORK CONTROL PACKAGE AND IS *NOT* T BE SEPARATED FROM IT



SAFETY RELATED? ☒ YES ☐ NO

QUANTITATIVE ACCEPTANCE DATA? ☒ YES ☐ NO

ACTUAL READING(S) TAKEN

	LO	HI	SINGLE POINT
SPAN	7	16	or
			or
			or
			or
			or

FUNCTION

TEMPERATURE

☐ °F ☐ °C

PRESSURE

☐ PSIG ☐ PSIA

☐ in/H₂O ☐ in/Hg

TORQUE

☐ in • lbs ☐ ft • lbs

OTHER *(Specify)*

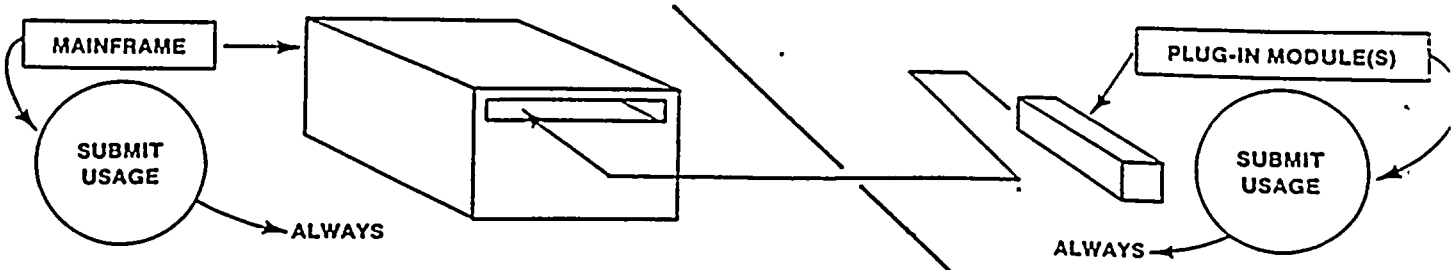
☑ Sec

ELECTRONIC

☐ VDC	☐ mvdc	☐ KV:	
☐ VAC	☐ mvac	☐ KV~	
☐ OHMs	☐ KΩ	☐ MΩ	
☐ HZ	☐ KHZ	☐ MH	
☐ AMPs	☐ mamps	☐ dt	

RANGE(S) SELECTED

MULTI-CHANNEL EQUIPMENT USAGE



NOTE: A SEPARATE USAGE FORM MUST BE SUBMITTED FOR MAINFRAME AND EACH MODULE USED. IF MODULES ARE CHANGED YOU MUST SUBMIT ANOTHER USAGE FORM.

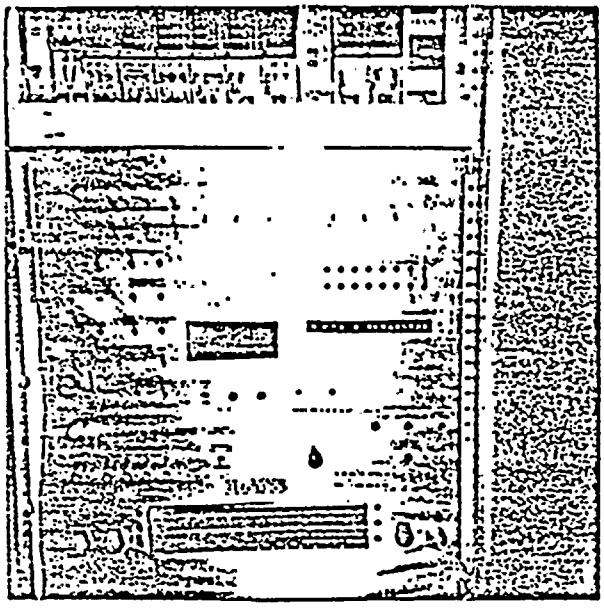
CHANNEL/ SLOT	MODULE M&TE I.D. NO.

CHANNEL/ SLOT	MODULE M&TE I.D. NO.

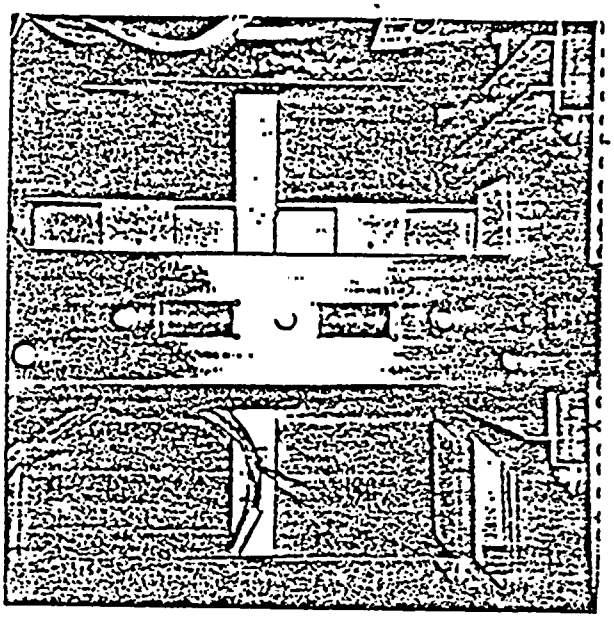
CHANNEL/ SLOT	INSTRUMENT NO

Comments:

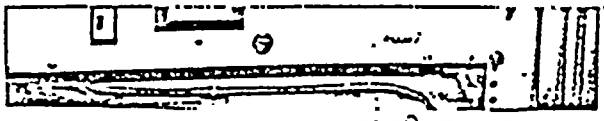
PV419-WL (10-85)



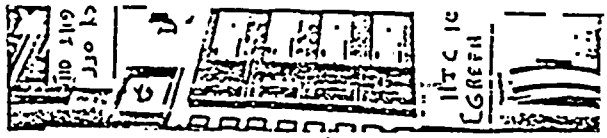
WO 345657 STEP 3.1.1 INITIAL CONDITIONS SBCS
3JSFNC03N TEST PANEL 1 OF 6



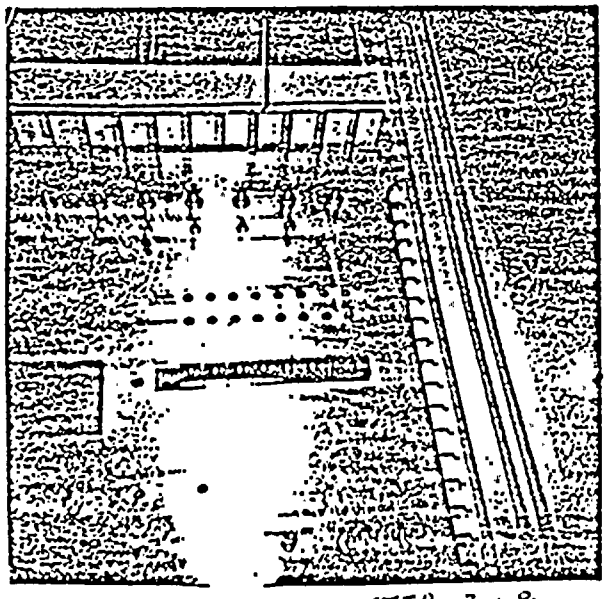
WO 345657 STEP 3.1.1 INITIAL CONDITIONS SBCS
3JSFNC03U TIMERS 2 OF 6



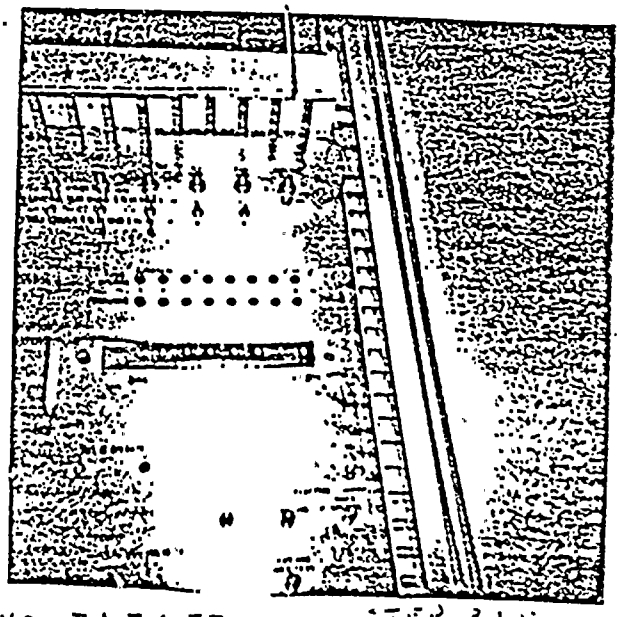
WO 345657 STEP 3.1.1 INITIAL CONDITIONS SBCS
3JSFNC03U ACOPIAN P/S 3 OF 6



WO 345657 STEP 3.1.1 INITIAL CONDITIONS SBCS
CONTROL ROOM CONTROL STATION 4 OF 6
BOG



WO 345657 STEP 3.1.8 ALL PERMISSIVE LAMPS ON SBCS
3JSFNC03N TEST PANEL 5 OF 6



WO 345657 STEP 3.1 GROUP 2 LAMPS OFF GROUP 1 LAMPS ON SBCS
3JSFNC03N TEST PANEL 6 OF 6

STEAM BYPASS CONTROL SYSTEM

FINAL REPORT

ATTACHMENT 2

STEAM BYPASS CONTROL SYSTEM

DETAILED SYSTEM INVESTIGATION ACTION PLAN

STEAM BYPASS CONTROL SYSTEM

DETAILED SYSTEM INVESTIGATION

ACTION PLAN

REVISION 0 MARCH 19, 1989

PREPARED BY: Jeffrey S. Timmy 3/20/89
Jeffrey S. Timmy Date

REVIEWED BY: William Simko 3/22/89
William Simko Date

STEAM BYPASS CONTROL SYSTEM
DETAILED SYSTEM REVIEW
ACTION PLAN
REV 0
3/13/89

PURPOSE:

Perform an indepth investigation of the Steam Bypass Control System (SBCS) as implemented at Palo Verde in conjunction with the Atmospheric Dump Valve investigation under the direction of Mr. William Simko.

GOAL:

Provide results, conclusions, and prepare recommendations as the product of the above described detailed investigation into the SBCS to address those concerns raised by Palo Verde Management and the NRC with regards to the overall design, maintenance, and operation of the SBCS.

SCOPE:

The SBCS portion of the overall investigation will encompass the components used in the sensing, measurement and control of the Steam Bypass Control System Valves up to the valve positioners located on the actual SBCS valves which are the components generally associated with the " SF " portion of the SBCS. A listing of those components may be found as Appendix A.

The documents which will, as a minimum, be used to perform this review are listed in Appendix B. Other source material may be added to this list as the investigation proceeds with the final conclusions and recommendations making use of as many references as is considered necessary to complete a thorough review of the SBCS.

It is anticipated that this review will require approximately 14 days and should be concluded with recommendations on April 3,1989 for inclusion into the overall effort as directed by Mr. Simko.

PROJECT ORGANIZATION :

The overall organization of the SBCS investigation will be per Appendix C and is a subset of Mr. Simko's main investigation team. The SBCS team will confer with Mr. Simko regularly to ensure that the overall goals and objectives are being met in a timely fashion and to ensure a crossdiscipline transfer of any interface data is promptly performed.

OVERALL PLAN AND SCHEDULE :

The SBCS investigation will occur in approximately 5 phases as listed below :

MAJOR TASK DESCRIPTION	*TIME TO COMPLETE*	*START DATE ESTIMATED*	*COMP DATE ESTIMATED*
DATA RETRIEVAL	3 DAYS	3/19/89	3/21/89
DATA REVIEW	5 DAYS	3/21/89	3/26/89
FORMULATE RESULTS	3 DAYS	3/26/8	3/29/89
CONCLUSIONS	2 DAYS	3/29/89	3/31/8
COMPLETE FINDINGS	1 DAY	3/31/89	4/3/89

The data retrieval phase will collect and assemble as much useful information on the SBCS as possible based on the sources outlined in Appendix B and organize that data into categories that will make data review and reduction as simple as possible.

The data review phase will completely review the data in each of the categories and reduce this data into an organized collection of facts pertaining to the individual components affected by that data. The results of this data reduction will provide a mechanism for which a component by component review will be accomplished.

The next phase will be a review of only the pertinent facts as a result of the data review phase and formulate detailed results based on these reviews. This phase should attempt to determine on a instrument basis all levels of activities performed and the results of those activities as they relate to the system.

The conclusion phase will result in answers to all pertinent design, maintenance, and system operation questions which have arose either as a result of the Unit 3 Reactor Trip of March 3, 1989 or additional concerns as a result of the detailed review conducted subsequent to that event.

This phase will also make recommendations in those areas which the investigation team has determined require additional emphasis. These recommendations should be as complete as possible and not of the nature that would involve continuing detailed studies unless absolutely necessary. These conclusions might be of the nature such that additional PM's are recommended, Plant Changes are recommended, etc..

The final phase will be a complete collection of all investigation team activities with a final report of those activities resulting. This final report will be provided to the main investigation team Mr. Simko for his review and final approval. It will in addition to providing details of the actual investigation provide lessons learned.

RESOURCES REQUIRED:

Many of those resources required by the main investigation team will provide the necessary input for SBCS as is required for the ADV investigation. These common areas are primarily in the data collection and reduction aspects of the investigation. Those resources unique to the SBCS only portions are organizationally outlined in Appendix A and are further described below.

I&C EVALUATIONS ENGINEERING PERSONNEL

Jeff Summy - I&C EED Supervisor - Overall coordinator
Jim Hebison - I&C EED Lead - Data and Results review
Dave Legg - SBCS System Eng - Data review and recommendations
Randy Black - Senior I&C Eng - Data collection and data review

I&C NUCLEAR ENGINEERING PERSONNEL

Jim Rowland - NED I&C Supervisor - Design review coordinator
Steve Garrett- Responsible Eng - Design review and recommendations

ORIGINAL SUPPLIER PERSONNEL

Steve Schey - C-E Onsite Rep - Coordinator original supplier
Carl Neilson - C-E Consulting Eng - Original Supplier SBCS Site Eng

APPENDIX A
STEAM BYPASS CONTROL SYSTEM EQUIPMENT

LOCATION	FOX. MODEL	C-E TAG NUMBER
N21	2AI-I2V	S201
		SPARE
N23	2AP+AVS	S325
		S326
N24	2AP+SUM	S301
N25	2AP+SUM	S303
N26	2AP+SUM	S304
N27	2AP+SSL	S320
N29	2AP+ALM-8R	S353
N210	2AP+ALM-AR	S311
		S313
N53	2AP+SUM	S307
N54	2AC+DYC-L	S114
N55	2AP+DLS	S339
		S340
N56	2AP+SLM	S366
N57	2AP+SLM	S367
N58	2AP+SUM	S308
N61	2AI-I2V	S202
		SPARE
N62	2AP+SSL	S321
N63	2AP+SSL	S322
N65	2AP+DLS	S331
		S332
N66	2AC+DYC-L	S112
N67	2AC-M2+A4+RS	S103
N69	2AP+ALM-AR	S318
		S319

APPENDIX A
STEAM BYPASS CONTROL SYSTEM EQUIPMENT

LOCATION	FOX. MODEL	C-E TAG NUMBER
R13	2AP+SUM	S305
R14	2AC+DYC-L	S113
R15	2AP+DLS	S337
		S338
R16	2AP+SLM	S364
R17	2AP+SLM	S365
R18	2AP+SUM	S306
R19	2AP+SSL	S324
R110	2AP+SSL	S323
N11	2AI-I2V	PSS1
N12	2AP+SUM	S302
N13	2AC+DYC-L	S110
N14	2AP+ALM-AR	S312
		S314
N15	2AP+DLS	S330
		S341
N16	2AC+DYC-L	S111
N17	2AC-M2+A4+RS	S102
N19	2AP+ALM-AR	S315
		S316
N110	2AP+ALM-AR	S317
		S310

APPENDIX A
STEAM BYPASS CONTROL SYSTEM EQUIPMENT

LOCATION	FOX. MODEL	C-E TAG NUMBER
N610	2AP+ALM-AR	S350
		S351
Y11	2AC-M2+A5	S104
Y13	2AP+ALM-AR	S352
Y14	2AX+DSS	S375
		S374
		SPARE
		SPARE
Y21	2AP+DLS	S333
	2AP+DLS	S334
Y22	2AP+SLM	S360
Y23	2AP+SLM	S361
Y24	2AP+DLS	S335
	2AP+DLS	S336
Y25	2AP+SLM	S362
Y26	2AP+SLM	S363
Y27	2AP+SLM	S368
Y45	2AO-V2I	S901
	2AO-V2I	S902
Y46	2AO-V2I	S903
	2AO-V2I	S904
Y47	2AO-V2I	S905
	2AO-V2I	S906
Y53	2AO-V2I	S907
	2AO-V2I	S908
Y54	2AP+ALM-CR	S354
Y63	2AI-I2V	PSS2
Y64	2AC-M2+A5-RS	S101
Y66	2AP+ALM-CR	S355

APPENDIX A

STEAM BYPASS CONTROL SYSTEM EQUIPMENT

LOCATION	ALLEN-BRADLEY MODEL	C-E TAG NUMBER
U209	1720-L440	N/A
U607	1720-L440	N/A
U608	1720-L440	N/A
U609	1720-L440	N/A
U212-1	1720-L410	N/A
U212-2	1720-L410	N/A
U610-1	1720-L410	N/A
U610-2	1720-L410	N/A

APPENDIX B
LIST OF DOCUMENTS TO BE REVIEWED

WORK / ENGINEERING DOCUMENTS

WORK REQUEST / WORK ORDERS
SWA's
PCR's
DCP's
S-MOD's
FCR
SFR
NCR
EER
T-MOD's
EAR/ECE
EQ
PM's

VENDOR DATA

VENDOR MANUALS
VENDOR DOCUMENTS
PO's
SDCN
SDDR
LETTERS
DRAWINGS

DESIGN BASES / REGULATORY COMMITMENTS

DESIGN BASES
FSAR
IEB
IEN
NUREG
LETTERS
RCTS
DER / RER

APPENDIX B
LIST OF DOCUMENTS TO BE REVIEWED (CONT)

INDUSTRY

OER / SOER's
NOMIS
NPRDS
FAILURE DATA TRENDING
LER / SPEER/ PTTR

START-UP / SUBSYSTEM TESTS

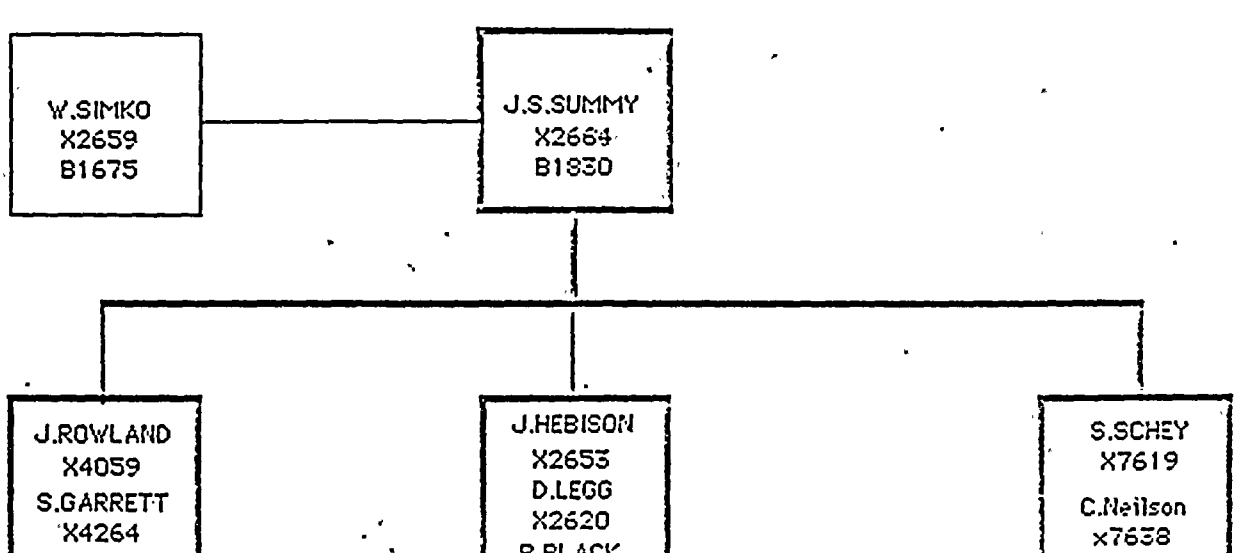
PRECP
HFT
PREREQ

OPERATIONAL TESTS

POST CORE
PAT

ADDITIONAL DOCUMENTS AS IDENTIFIED

STEAM BYPASS CONTROL SYSTEM



APPENDIX C

SYSTEM DETAILED INVESTIGATION

REVISION 0

3/19/89

SBCS DETAILED SYSTEM INVESTIGATION
EED I&C OVERVIEW

PURPOSE:

To provide an overview and summarize historical information and conclusions in support of the incident investigation SBCS Action Plan.

CONCLUSIONS:

Various documents as listed in appendix B were reviewed for malfunctions / problems with the SBCS from its process inputs to the electric to pneumatic (E to P) converter located on the valve.

Precore testing revealed numerous problems with component failures as would generally be expected with any new control system during initial startup and checkout. These failures were corrected, and the system was successfully tested.

Review of EERs indicated that most concerns dealt with fine tuning of the control system and have been adequately resolved previously.

T-Mods, Site-Mods and PCR review indicated additional areas that could improve system response. One S-Mod was accomplished to enhance the timing of the valves in the Modulate Mode.

Post trip reports generated during Power Ascension Testing after the units were operational, resulted in two additional system tuning setpoint changes to improve system response.

Work order-Work request reviews disclosed no abnormal failures other than what would be expected in normal operation of control systems..

The independent review performed by the system vendor, Combustion Engineering Inc., found no abnormal system operation that would have required a design change. The review also indicated that the normal tuning and timing expected of control systems was successfully accomplished during the Power Ascension Program.

Review of CE letters did not reveal any problems other than the normal tuning/timing expected with the startup and operation of a control system.

The historical review of the SBCS completed by Nuclear Engineering concluded that the present system design is satisfactory to perform its design function. This has been successfully demonstrated under actual system operating conditions on numerous occasions on all three units.

RECOMMENDATIONS RESULTING FROM INVESTIGATION:

PRIOR TO RESTART:

1) Correct the Auto Permissive Timer in Unit 3 and retest.

2) Perform the same retest on Auto Permissive Timers X and Y in Units 1 and 2 as was performed to determine improper operation of the Unit 3 timer under work order 345657.

3) Reconnect TDAS position indication for SBCS valves Unit 2.

4) Perform 18 Month PM of Control System

5) Perform Valve Stroke Tests of each SBCS valve with Steam

6) Implement twice monthly SBCS valve testing

ENHANCEMENTS:

1) Include Auto Permissive X and Y Timers testing into 36MT-9SF03 SBCS functional test. ICR 05233 submitted.

2) Review / Upgrade functional SBCS test to be performed on-line

3) Complete replacement of steam flow transmitters in U-1. Although these particular transmitters have not exhibited any indications of failure they should be replaced as a conservative measure as Rosemount Inc., original supplier, has identified these as potential problem transmitters.

4) Perform Root Cause of Failure on Unit 3 failed Permissive Timer Card

5) Recommend C.E. evaluate the reliability and probability risk assessment for NSSS Control Systems, SBCS, RRS,FWCS,and RPC with suggestions for any additional testing which might be identified. These systems are composed of like modules and are interconnected, therefore any reliability and risk assessment will be applicable to all the listed systems.

6) Provide SBCS valve position indication on the Main Control Board on the same controller as demand.

7) Calibrate TDAS inputs every refueling cycle.

8) Recommend C.E. evaluates SBCS for optimization to obtain margin to RX Trip Actuation for loss of load and loss of feed pump events.

PREPARED BY : _____ 5/2/89

REVIEWED BY : _____ 5-3-89

ENGINEERING EVALUATION REQUEST

PURPOSE: The EERs evaluated covered the period from 1982 to the present time. Of the 51 EERs evaluated, only six(6) were considered pertinent to the operation of the SF system. They are listed below.

SUMMARY:

DATE	UNIT	EER #	DESCRIPTION
5/5/83	1	83-SF-001	Installed pneumatic line filters per PCR.
9/23/85	ALL	85-SF-021	Changed Steam Flow transmitter time constant.
2/26/86	ALL	86-SF-007	Change T(ave) setpoint for Quick Open function.
5/15/86	1&2	86-SF-024	Replace XMTRs per SMOD (pressure span).
9/22/86	ALL	86-SF-041	Revise Q.O. timers to 15 seconds.
6/17/87	ALL	86-SF-033	Improve pneumatic control circuit response per SMOD.

CONCLUSIONS: As shown above, most EERs concerned fine-tuning of the Control System.

PREPARED BY : David Legg 5-3-89

REVIEWED BY : [signature] 5-3-89

PREVENTATIVE MAINTENANCE AND MAINTENANCE TESTS

STEAM BYPASS CONTROL SYSTEM
DETAILED SYSTEM INVESTIGATION

PURPOSE: Review PM tasks and MTs for testing adequacy.

SUMMARY: PM tasks for the pneumatic controls for SBCS valves are adequate but there are areas that can be improved. This is being evaluated presently and improvements will be submitted on ICRs.

Maintenance test 36MT-9SF03, SBCS FUNCTIONAL TEST is being revised to add a check for proper operation of the Auto Permissive X and Y timer testing in 36MT9SF03, ICR 05233 was submitted. 36MT-9SF04 is used as a SBCS CALIBRATION maintenance test on an 18 month interval and was determined to be complete and comprehensive.

CONCLUSION: PM's have been used for several years, and changes to problem areas are identified by field technicians and are corrected by EER/ICR process.

The MT's for SBCS have been used several times with changes being incorperated through the EER/ICR process. Most changes are procedure clarifications. This process is a continuing activity designed to enhance performance of the PM's.

No major changes have been made to the MT's and none appear to be required at this time. Current testing being conducted in Units 1 & 2 will be incorporated as necessary into the PM/MT program.

A review of the SBCS Functional test will be performed and a determination will be made as to the extent of on-line testing can safely be performed. After making this determination a PM or OP will be generated to provide on-line testing at some interval.

PREPARED BY : David Legg 5-3-89

REVIEWED BY : [signature] 5-3-89

T-MODS, S-MODS & PCR REVIEW (SF)

PURPOSE : Review the T-MOD, S-MOD, & PCR programs for historical information on SBCS.

SUMMARY:

S-MODS: No pertinent SF S-MODS were found. Site Mod. 1,2,3 SM-SG-009 replaced needle valve to two needle check valves to modify the controlibility of open and close modulation times.

T-MODS: #1-85-SF-325 (resulted in PCR 86-13-SF-008), changed the ranges of the Steam Flow transmitters to get better resolution for steam flow versus feed flow information.
#1-86-SF-001 (PCP 86-01-SF-001), pertained to uneven steam dispersion to the condenser to prevent damage to the condenser on quick open or modulation of SBCS.

PCRS: Only two (2) pertinent PCRs were found that actually affected the SBCS operation:

86-13-SF-001: Modified the modulate logic.

86-13-SF-006: Pertained to the Foxboro Dynamic Compensation Modules. Both PCRs were implemented in all three units.

CONCLUSIONS:

No changes to the systems made by the above documents have been detrimental to the systems. All changes made the system increase controllability or prevent damage to the condenser. No major redesign of the system was required. The needle check valve is being evaluated to determine if a smaller needle check valve will increase the control range for modulation times.

PREPARED BY : Dave Legg 5-3-89

REVIEWED BY : J.S. Hale 5-3-89

WORK ORDERS/WORK REQUESTS

PURPOSE: Review Work Order, Work Request History for any reoccuring failures for the SBCS (Steam Bypass Control System).

SUMMARY: All problem resolutions were applied to all three units. There were no reroccuring failures noted.

MAJOR REFERENCE: SIMS work order/work request sort.

CONCLUSION: No unordinary failures or problems were observed in reviewing work history. All failures appeared to be of the kind normally expected of control systems such as a failed Dynamic Compensator Card, loose conections and jumpers on Foxboro Control Gards.

PREPARED BY : David Legg 3-3-89

REVEIWED BY : J. [illegible] 5-3-89

POST CORE TESTING

PURPOSE: Review of post core tests for historical information on SBCS. The purpose of the testing was to demonstrate the proper operation of SBCS Control system utilizing actual plant conditions during actual Reactor Power Cutback System Tests.

SUMMARY: Post core testing was designed to demonstrate that the integrated control systems including SBCS would perform as designed.

CONCLUSIONS: SBCS in conjunction with the other NSSS Control Systems performed as designed. In all cases the system operated with all control valves functional or with one valve out of service. In certain tests, the valves had to be stroked due to maintenance being performed on the valves.

PREPARED BY : J. Kuhn 5-3-89

REVIEWED BY : David Legg 5-3-89

PREOPERATIONAL TESTS 92PE-1SF04
92PE-2SF04
92PE-3SF04

PURPOSE: To review the above preoperational test procedures for historical information on SBCS. The purpose was to demonstrate the proper operation of the SBCS Control System using simulated inputs to verify all indications, alarms and interlocks.

SUMMARY: The preop was designed to detect any problems that the control system may have before going into final operation. Several problems were encountered that would have reasonably been expected in a startup phase of testing.. They concerned component failures, grounding problems, valve timing and procedural problems.

CONCLUSIONS: Very little pertinent information can be derived from this preop as it does not check the system during dynamic conditions as was done during power ascension testing. As a result of this test the vendor (CCI) and CE(C. Neilsen) were involved in improving the valves' dynamic timing operation. CE also was involved in improving the Control System setpoints. The preop procedures did test the Auto Permissive Timers and Reconnection Timers successfully.

PREPARED BY : J. Hub 5-3-89

REVIEWED BY : David Legg 5-3-89

STEAM BYPASS CONTROL SYSTEM
DETAILED SYSTEM INVESTIGATION

POST TRIP REVIEW REPORTS

PURPOSE: Three (3) reports were reviewed. They concerned trips in 1985&1986.

SUMMARY:

10/24/85	1-85-007	Reactor tripped during performance of 73PA-1SF09. ADV-184 did not open, STM BYP valve 1004 did not operate properly.
1/9/86	1-86-001	Reactor trip resulted in SBCS being de-energized. Result was EER that shifted SBCS to 1E power.
2/3/86	1-86-003	Reactor trip on Lo S/G 2 Level. SBCS overcooled the reactor by Q.O. Result was EER that changed T(ave)-Lo setpoint. ADV-184 had erratic operation.

CONCLUSIONS: These trip reports revealed deficiencies in the Control System and the valve response under operating conditions. EERs were written to address the problems. Subsequent trips will show whether the EERs' resolutions were complete and proper.

PREPARED BY : _____ 5-3-89

REVEIWED BY : _____ 5/3/89

APPENDIX B

SMODS

1/18/89	SM-SF-001	CEDMECS	N/A
3/19/87	SM-SF-003	F.W. High Level overide setpoint	N/A
3/21/88	SM-SF-004	Rewire F.W. SG Levels	N/A
9/22/87	SM-SF-005	F.W. Pump Speed	N/A
3/21/88	SM-SF-006	S/G Low Level Alarm	N/A
	SM-SF-007	Foxboro 2AP & SGC relibility	Not issued
	SM-SF-008	Foxboro 2AX & DP10 relibility	Not issued
	SM-SF-002	SBCS Permissive Controller	Voided
	SM-SG-007	Replace Stm. Hdr. press. trans. U-3	Not worked
5/5/87	SM-SG-009	Needle check valves to allow timing of valves 15-20 sec.	Complete PTR-1-86-009 86-SF-033

SBCS DETAILED SYSTEM INVESTIGATIONS PM TASKS

PAST ACCOMPLISHMENT DATES	PM TASKS	PROCEEDURES
3/1/88	58117	36MJ-9SF04-1
8/23/88	58117	36MJ-9SF04-1
3/29/88	59194	36MT-9SF04-2
NONE	59195	36MT-9SF04-3
12/1/88	60614	36MT-9SF03-1
5/21/88	60615	36MT-9SF03-2
3/15/88	60616	36MT-9SF03-3

****BOTH MT's ARE ON A REFUELING INTERVAL****

U-1 WO# 00321701

U-2 WO# 00340817

APPENDIX B

EER LIST

UNIT	DATE	DOCUMENT	DESCRIPTION	CONCLUSIONS
ALL	9/21/83	83-SF-003	Reg. group 4 & 5 RPCB	N/A
1	5/5/83	83-SF-001	Trash in air lines. Installed filters	SFR 1-SF-049.
1	8/30/83	83-SF-001	CEDMCS cabinet cooling	N/A
ALL	12/8/84	84-SF-010	Reset of Foxboro alarm modules	No impact. Acc. criteria on module reset.
ALL	12/10/84	84-SF--13	Reset of Foxboro modules	Same as 84-SF-010
1	12/20/84	84-SF-014	CEDMCS	N/A. SFR 1SF-111
ALL	9/23/85	85-SF-021	RPCS. 50% Loss of Load Test	N/A. Adj. FT-1011,1012,1021,1022 TAU to .2 sec.
ALL	12/5/85	85-SF-033	CEDMCS Feeder breaker	N/A
ALL	12/20/85	85-SF-037	Pressurizer press. bias signal to SBCS	No change to SBCS inputs required.
ALL	7/24/86	86-SF-034	Allen Bradley logic cards not avail.	N/A. Documents site repair and dwgs' schematics.
ALL	6/17/86	86-SF-033	SBCS operation.	Pneumatic control ckt. mod. to improve responsiveness. SMOD 13-SM-SG-009 Letter V-CE-34125, 85-SF-037.
1	8/26/86	86-SF-037	S/G Flow XMTR sensitivity	No dampening can be tolerated. 86-SG-191
ALL	12/30/86	86-SF-052	Q.O. when SYS. Mode Sel. Sw. placed in Valve Test	Master controller should be in MAN: 420P-1SF05 does not comply. Info only.

ALL	7/30/86	86-SF-036	Setpoint for PSL1113A	N/A. Info. only. SFR 3SF-040.
1&2	5/15/86	86-SF-024	J-SGN-PT-1024 Cal to 900-, 1300. 400 PSI span capability.	SFR 3-SF-024. 1,2SM-SG-007. Rework/replace Rosemount XMTR.
2	5/8/86	86-SF-023	Eval. TCN 11 & TE 31 92PE2SF04	N/A. Info. only. Condensor interlock does not affect valves 1007 &1008.
2	4/30/86	86-SF-021	TE 13 & 14 of 92PE2SF04	Info. only. Alarm card setpoints were subsequently changed and retested on W.O. 148128. R326.
ALL	3/22/86	86-SF-018	Allen Bradley cardlock series 1720 modules no longer manufactured.	Info. only. Addressed on 86-SF-034.N/A
1	2/25/86	86-SF-010	TE01 for 92PE-1SF04	Accept as is. PM tasks completed and computer points verified. Cal. valve loop.
ALL	5/30/86	86-SF-025	Single failure of SGNPT1024	Open; under evaluation.
1	4/2/82	82-SF-001	CE setpoint doc. does not contain setpoints for SF06 (SUBSYS)	N/A. V-CE-14554 scheduled for document submittal.
1	4/1/82	82-SF-002	Foxboro Loop Drawings	N/A. Dwg. scheduled for submittal.
1	3/23/82	82-SF-003	CEDMCS	N/A.
1	3/23/82	82-SF-004	CEDMCS	N/A.
ALL	6/2/82	82-SF-005	Core mimic display	N/A.
1	7/13/82	82-SF-006	Foxboro +24 Volt power source spec (2AI-I2V).	N/A.
1	12/6/82	82-SF-007	No drawings available.	N/A.

1	12/6/82	82-SF-008	CEDM MG Set	N/A.
1	10/21/82	82-SF-009	CEDMCS	N/A.
ALL	1/7/88	86-SF-030	SBCS numbering scheme	No system changes. Info. only.
ALL	6/26/86	86-SF-031	SBCS not in remote auto alarm.	No system changes. Info. only. PTR 2-86-002 covered by OPS procedure 4X-XSF08
ALL	2/26/86	86-SF-007	SBCS successive Q.O. signals. Rx trip on 2/3/86.	Rework T (ave) setpoint to 55.8% to prevent Q.O. from less than 70%. W.O. 134914. PCR 86-13-SF-002 (PCO). Letter V-CE-33384.
ALL	7/9/86	86-SF-026	SBCS went to emergency OFF upon power failure.	Info. only. SBCS operated properly.
ALL	9/22/86	86-SF-041	SBCS Q.O. permissive timer time-out.	Info. only. Field set timers to 15 sec. Letter V-CE-21669. SFR 2SF-2227.
ALL	11/24/87	87-SF-032	SF test switches.	No impact on normal system operation; used only in test circuitry.
2	9/10/87	87-SF-026	SBCS permissive alarm.	Revised Lo limit setpoint. No system impact. ICR 654 to 36MT9SF04.
ALL	9/13/87	87-SF-025	CEDMCS power supplies fuses.	N/A.
ALL	7/31/87	87-SF-023	Three different setpoint documents.	Info. only. No system impact. Clarifies how AMI availibility is generated/displayed
ALL	4/29/87	87-SF-015	CEDMCS power supplies.	N/A.
1	4/7/87	87-SF-014	SBCS switch placed in VALVE TEST; got 8 valve permissive indications.	Rework W.R. 202960. System works properly. W.R. cancelled.

ALL	1/7/88	88-SF-003	Total steam flow signal with loss of one XMTR (FWCS).	Info. only. If XMTR is lost, operator must take manual contol of FWCS and SBCS.
ALL	8/21/88	88-SF-040	Rx trip at 75% power.	SBCS and RPCS worked as designed.
ALL	6/29/88	88-SF-033	Rosemount XMTR random failures.	Rework/replace XMTRs. No operational problems have been attributed to XMTRs.
2	12/23/88	88-SF-055	XMTR data is out of tolerance.	Info. only. N/A . COLSS input.
2	12/23/88	88-SF-054	XMTR data is out of tolerance.	Info. only. N/A. COLSS input.
ALL	11/21/88	88-SF-050	Info. bulletin limit number of valves given manual permissives.	Info. only: Revise 4XOP-XSF05. No operational impact if bulletin is followed.
2	11/18/88	88-SF-047	COLSS input uncertainty.	N/A.
1	1/8/88	88-SF-004	SMOD 1SM--SG-009 cannot be closed.	Operations of valves cannot be assured without proper retest.
3	2/19/89	89-SF-010	FWCS valves.	N/A.
ALL	11/6/85	85-SF-029	Wrong problem description on EER.	N/A. Valve mod. reassignment.
ALL	1/10/87	87-SF-003	High S/G level. Adjust high level override.	N/A.

SBCS DETAILED SYS INVESTIGATION

PCR'S

APPENDIX B

DATE	DOCUMENT NUMBER	DESCRIPTION	STATUS
11/17/84	84-13-SF-003	AIR FILTER	DCP 10M-IA-058 VOIDED
11/23/84	84-13-SF-005	ALTERNATE TO RPC	DCP 10E-SF-018 TO BE CANCELLED
6/26/85	85-13-SF-013	PREV. LOSS OF PLANT ON LOSS OF CONT. SIGNAL	FWCS N/A
1/13/86	86-13-SF-001	MODIFY MODULATE LOGIC FOR SBCS	DCP 13-SF-022 COMPLETE
3/20/86	86-13-SF-006	INCLUDE FOXBORO DYC	DCP 13J-SF-023 COMPLETE
6/11/86	86-13-SF-010	F.W. PUMP SPEED CONTROL	N/A
6/11/86	86-13-SF-011	MODIFY SBCS MASTER AND CHANNEL CONTROL	CANCELLED
9/18/87	87-13-SF-004	CHANGE 3 AMP TO 5 AMP FUSES	COMPLETE SDCN A01135
9/24/87	87-13-SF-005	INCREASE RELIABILITY OF MODULE	AT D. V.
9/24/87	87-13-SF-006	REPLACE MODULES WITH DUAL POWER DISTRIBUTION MODULES	AT D.V.
10/19/87	87-13-SF-007	CORRECT P/N TO BURNS COMPONENT	CLOSED
4/21/88	88-13-SF-001	PROVIDE REDUNDANT VOLTAGE TO CURRENT MODULES	SMOD 13-SM-SF-007 COMPLETE UNIT 1,2
4/21/88	88-13-SF-002	PROVIDE REDUNDANT MODULES	SMOD 13-SM-SG-008 UNIT 1 COMPLETE
2/16/89	89-13-SF-002	REVISE TECH MAN NOO1-13.02-114	WITH J. BARROW

T-MODS

APPENDIX B

DATE	DOCUMENT NUMBER	DESCRIPTION	STATUS
6/20/85	1-85-SF-262	LOW POWER F.W.	CLOSED N/A
7/17/85	1-85-SF-308	F.W. TURBINE SPEED CONTROL	CLOSED N/A
7/23/85	1-85-SF-308	F.W. VALVE TRANSFER AT 15% PWR	CLOSED N/A
12/20/85	1-85-SF-468	F.W. POST TRIP REFILL FLOW DEMAND	CLOSED N/A
4/8/87	1-87-SF-026	OPTIMIZE F.W. PUMP SPEED PGM	CLOSED N/A
5/29/86	2-86-SF-028	F.W. POST TRIP REFILL FLOW DEMAND	CLOSED N/A
6/11/86	2-86-SF-031	CEDMCS UV RELAY	N/A
10/12/87	3-87-SF-040	CEDMCS UV RELAY	N/A
7/29/85	1-85-SF-325	STEAM FLOW TRANS. CALIB. RANGE TO GET BETTER STEAM FLOW FEED FLOW REACTOR POWER INDICATION	COMPLETE PCR 86-13-SF-008 8/1/85
1/3/86	1-86-SF-001	UNEVEN STEAM DISPERSION TO CONDENSER	COMPLETE DCP 10-J-SF-022 PCP 86-01-SF-001

SBCS DETAILED SYSTEM INVESTIGATION

PCR's

APPENDIX B

DATE	DOCUMENT NUMBER	DESCRIPTION	STATUS
11/17/84	84-13-SF-003	AIR FILTER	DCP 10M-IA-058 VOIDED
11/23/84	84-13-SF-005	ALTERNATE TO RPC	DCP 10E-SF-018 TO BE CANCELLED
6/26/85	85-13-SF-013	PREV. LOSS OF PLANT ON LOSS OF CONT. SIGNAL	FWCS N/A
1/13/86	86-13-SF-001	MODIFY MODULATE LOGIC FOR SBCS	DCP 13-SF-022 COMPLETE
3/20/86	86-13-SF-006	INCLUDE FOXBORO DYC	DCP 13J-SF-023 COMPLETE
6/11/86	86-13-SF-010	F.W. PUMP SPEED CONTROL	N/A
6/11/86	86-13-SF-011	MODIFY SBCS MASTER AND CHANEL CONTROL	CANCELLED
9/18/87	87-13-SF-004	CHANGE 3 AMP TO 5 AMP FUSES	COMPLETE SDCN A01135
9/24/87	87-13-SF-005	INCREASE RELIABILITY OF MODULE	AT D. V.
9/24/87	87-13-SF-006	REPLACE MODULES WITH DUAL POWER DISTRIBUTION MODULES	AT D.V.
10/19/87	87-13-SF-007	CORRECT P/N TO BURNS COMPONENT	CLOSED

4/21/88	88-13-SF-001	PROVIDE REDUNDANT VOLTAGE TO CURRENT MODULES	SMOD 13-SM-SF-007 COMPLETE UNIT 1,2
4/21/88	88-13-SF-002	PROVIDE REDUNDANT MODULES	SMOD 13-SM-SG-008 UNIT 1 COMPLETE
2/16/89	89-13-SF-002	REVISE TECH MAN NOO1-13.02-114	WITH J. BARROW

POST-CORE TESTS

UNIT	DATE	PROC.	DESCRIPTION	CONCLUSIONS
1	9/23/85	73PA-1SG01	Atmospheric and Steam Bypass Capacity Test	PV1005 did not stroke. Manually stroked valve and completed retest. WR#094785.
1	1/2/85	PLB-M-85-2	Foxboro Alarm Mod. Reset	EER #84-SF-010 changed reset from +/- 15mv to +/- 30mv.
2	9/10/86	73PA-2MA01	Unit Load Rejection Test	Rev. 0 failed due to lack of Fasr Bus Transfer. Rev.1 passed.
1	1/6/86	73PA-1SF10	RPCS TEST LOSS OF FEEDWATER PUMP AT 100% POWER	NSSS Control Systems performed as designed.
2	7/23/86	73PA-2SG01	Atmospheric and Steam Bypass Capacity Test	Test passed. All steam bypass valves were sat. ADVs were not tested.
1	10/19/85	73PA-1SF08	RPCS TEST AT 70% POWER	NSSS Control Systems performed as designed.
1	9/12/85	73PA-1SF07	RPCS TEST AT 50% POWER	First attempt failed due to lack of Fast Bus Transfer. On second attempt; NSSS Control Systems performed as designed.
1	10/24/85	73PA-1SF09	RPCS TEST AT 80% POWER	First attempt failed. On the second attempt, the NSSS Control Systems performed as designed with valve PV-1005 OOS.
1	1/24/86	72PA-1RX03	NATURAL CIRC. FROM 80% POWER	Used ADV B Train on N2 for cooldown. Met BTP RSB 5-1 for Residual Heat Removal for 13 hour/20 min. capability. Prereq. 4.20 cycled ADVs 10% open within 7 days of test, IA/N2 joints were tightened, IA/N2 check valves were tested sat.
1	5/3/85	73PE-1SG01	ADV TEST AT MODE 3	Test Exceptions 30&31 to 91HF-1SF02. ADVs-178,185 stroke smoothly. ADV-184

				opened only 3-5% at 100% demand. Therefore, exercised it manually 12-15 times, loosened packing, increased air supply from 80 to 96 psig and it passed on 5/15/85. ADV-179 opened only to 15%, and was jerky from 15-75%. Did same exercising and it passed on 5/11/85.
2	6/25/86	73PA-2NA01	LOSS OF OFFSITE POWER TEST AT 50% POWER	ADVs were slow to actuate and required 100% demand signal. EER #85-SG-160 indicates that 30-60 sec. are required for full opening. SBCS operated per design. Valves started to modulate until power loss, when the valves shut.
1	1/7/86	73PA-1MA01	UNIT LOAD REJECTION TEST @ 100% POWER	Test met all acceptance criteria with no unusual events. PV-1005 and 1008 stroked just prior to test due to repairs made.
3	12/29/87	73PA-3MA01	UNIT LOAD REJECTION TEST (100%). Proc. used data from an unplanned trip.	An unplanned turbine trip occured with all NSSS Control Systems responding properly (Rx did not trip). Approx. 45 min. later valve 1005 reopened out of sequence. No resolution in proc.
1	1/9/86	73PA-1MT02	TURBINE TRIP TEST	Rx tripped due to failure of the Fast Bus Transfer (FBT). The FBT was PCN'd out; the retest met acceptance criteria.

POST-CORE TESTS

UNIT	DATE	PROC.	DESCRIPTION	CONCLUSIONS
1	9/23/85	73PA-1SG01	Atmospheric and Steam Bypass Capacity Test	PV1005 did not stroke. Manually stroked valve and completed retest. WR#094785.
1	1/2/85	PLB-M-85-2	Foxboro Alarm Mod. Reset	EER #84-SF-010 changed reset from +/- 15mv to +/- 30mv.
2	9/10/86	73PA-2MA01	Unit Load Rejection Test	Rev. 0 failed due to lack of Fast Bus Transfer. Rev.1 passed.
1	1/6/86	73PA-1SF10	RPCS TEST LOSS OF FEEDWATER PUMP AT 100% POWER	NSSS Control Systems performed as designed.
2	7/23/86	73PA-2SG01	Atmospheric and Steam Bypass Capacity Test	Test passed. All steam bypass valves were sat. ADVs were not tested.
1	10/19/85	73PA-1SF08	RPCS TEST AT 70% POWER	NSSS Control Systems performed as designed.
1	9/12/85	73PA-1SF07	RPCS TEST AT 50% POWER	First attempt failed due to lack of Fast Bus Transfer. On second attempt; NSSS Control Systems performed as designed.
1	10/24/85	73PA-1SF09	RPCS TEST AT 80% POWER	First attempt failed. On the second attempt, the NSSS Control Systems performed as designed with valve PV-1005 OOS.
1	1/24/86	72PA-1RX03	NATURAL CIRC. FROM 80% POWER	Used ADV B Train on N2 for cooldown. Met BTP RSB 5-1 for Residual Heat Removal for 13 hour/20 min. capability. Prereq. 4.20 cycled ADVs 10% open within 7 days of test, IA/N2 joints were tightened, IA/N2 check valves were tested sat.
1	5/3/85	73PE-1SG01	ADV TEST AT MODE 3	Test Exceptions 30&31 to 91HF-1SF02.

				ADVs-178,185 stroke smoothly. ADV-184 opened only 3-5% at 100% demand. Therefore, exercised it manually 12-15 times, loosened packing, increased air supply from 80 to 96 psig and it passed on 5/15/85. ADV-179 opened only to 15%, and was jerky from 15-75%. Did same exercising and it passed on 5/11/85.
2	6/25/86	73PA-2NA01	LOSS OF OFFSITE POWER TEST AT 50% POWER	ADVs were slow to actuate and required 100% demand signal. EER #85-SG-160 indicates that 30-60 sec. are required for full opening. SBCS operated per design. Valves started to modulate until power loss, when the valves shut.
1	1/7/86	73PA-1MA01	UNIT LOAD REJECTION TEST @ 100% POWER	Test met all acceptance criteria with no unusual events. PV-1005 and 1008 stroked just prior to test due to repairs made.
3	12/29/87	73PA-3MA01	UNIT LOAD REJECTION TEST (100%). Proc. used data from an unplanned trip.	An unplanned turbine trip occured with all NSSS Control Systems responding properly (Rx did not trip). Approx. 45 min. later valve 1005 reopened out of sequence. No resolution in proc.
1	1/9/86	73PA-1MT02	TURBINE TRIP TEST	Rx tripped due to failure of the Fast Bus Transfer (FBT). The FBT was PCN'd out; the retest met acceptance criteria.

STEAM BYPASS CONTROL SYSTEM

FINAL REPORT

ATTACHMENT 3

STEAM BYPASS CONTROL SYSTEM

DESIGN BASIS REVIEW AND

RESTART RECOMMENDATIONS

PV40J-00AB (11-84)
4190-900124 (PK/250)

Arizona Nuclear Power Project

CORRECTED COPY
167-03602-JWR/RGK

DATE:

TO: G. W. Sowers
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Prepared by:
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Name/Ext./Sta. S. L. Garrett /4264/7010

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J. W. Rowland /4059/7010

Approved by:
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Name/Ext./Sta. E. C. Sterling /4176/7034

File: 89-161-419

SUBJECT: Steam Bypass Control System & Reactor Power Cutback System Design Basis Review & Restart Recommendations

Attachments: (1) SBCS Design Basis Review and Functional Requirements
(2) RPCB Design Basis Review and Functional Requirements

PURPOSE

The purpose of this memo is to summarize Nuclear Engineering's design basis review of the Steam Bypass Control System (SBCS) and the Reactor Power Cutback System (RPCS). As part of the review, recommendations were made on the subject systems to ensure they would perform their design basis functions. This effort was in support of the Unit Restart Program.

NOTE: The subject SBCS evaluation/review scope includes only the control system (i.e., not the Steam Bypass Valves). Due to the close relationship of the valves and the control system, some recommendations were made on the valves. However, the final valve recommendations are included in another report.

DISCUSSION

The details of the the subject reviews can be found in the attachments to this memo. A summary of each of the system reviews follows:

I. STEAM BYPASS CONTROL SYSTEM

RESTART RECOMMENDATIONS TO ENSURE FUNCTIONALITY

* Correct problem associated with the Auto Permissive X Timer in Unit 3. In addition, test the Auto Permissive X Timer in Units 1 & 2 and the Auto Permissive Y Timer in all Units.

POST RESTART RECOMMENDATIONS

* In addition to 36MT-9SF03 & 36MT-9SF04 include testing of the Permissive Timers and the modules listed below from the reliability analysis. The Pre-Operational test may be used as a guideline. Tests are to be completed every refueling or sooner if possible.

*. It is recommended that the following components be replaced at approximately the intervals shown or sooner:

Component	Interval
Foxboro 255PA	11 yrs.
Foxboro 2AI-I2V	17 yrs.
Foxboro 2AO-V2I	20 yrs.
Allen Bradley 1720-L440	5.5 yrs.

NOTE: Start time for these intervals is date of commercial operation (see the following dates:)

Unit 1: 1/28/86
Unit 2: 9/19/86
Unit 3: 1/8/88

Recommend re-evaluation of these intervals on a yearly basis as more failure data becomes available and revise as necessary.

* Verify/complete replacement of steam transmitters in all Units.

* Include steam bypass valve position on the Main Control Board. Also calibrate inputs to TDAS every refueling outage (i.e., SBCS valve position, etc.).

* Optimize the SBCS (see attachments for details).

* Obtain a sufficient number of spares of the components listed in this summary.

* Evaluate the impact of steam bypass valves out of service on the operation of the system in the modulation mode.

STEAM BYPASS VALVE RECOMMENDATIONS

* Continue testing steam bypass valves on a twice monthly basis as outlined in 41OP-1SF05.

* Verify closure of corrective action item B (Steam bypass valve root cause evaluation) associated with LER 88-021.

II. REACTOR POWER CUTBACK SYSTEM

RESTART RECOMMENDATIONS

* As shown in detailed evaluation, the design, maintenance, and operation of the RPCS is generally very good, and therefore there are no recommendations that must be implemented prior to restart.

POST RESTART TESTING RECOMMENDATIONS

As previously stated, the design, maintenance, and operation of the RPCS is generally very good, and therefore there are no recommendations that must be implemented prior to restart. However plant experience does seem to indicate that some fine tuning can be done to enhance the system. Also because this system plays a pivotal role during load rejections and loss of feed pump transients, two enhancements to the existing testing are recommended. The first involves a change in scope of the existing testing to include testing across various internal and external system interfaces. The second recommendation would increase the frequency of existing preventative maintenance and perform daily checks by Operators under 40DP-9OP05.

POST RESTART SYSTEM DESIGN MODIFICATION RECOMMENDATIONS

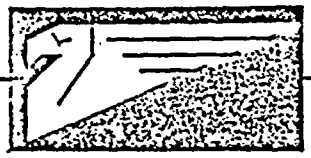
* There are no recommended design changes for the RPCS. Two different reactor trips could have been prevented by the RPCS if the RPCB Demand signals from the SBCS had been improved. Improvements to the SBCS are recommended in the SBCS evaluation.

* Recommend continuation of the evaluation of EER 88-SF-006 which will provide a disposition on RPCS availability in the event of loss of data link or COLSS.

Should any questions arise, contact S. L. Garrett or A. F. Swirbul at extension 4264 or 4599 respectively.

ECS/SLG/slg

cc: A. F. Swirbul
A. W. Hartwig
D. R. Legg
J. S. Summy
G. Anderson



STEAM BYPASS CONTROL SYSTEM

Design Basis Review

And

Functional Requirements

Arizona Nuclear Power Project

STEAM BYPASS CONTROL SYSTEM

Design Basis Review & Functional Requirements

TABLE OF CONTENTS

EXECUTIVE SUMMARY

This report was prepared following the recent reactor trips of Unit 1 & 3 and the shutdown of Unit 2. Concerns were raised by Palo Verde Management and the NRC with regards to the overall design, maintainence, and operation of the Steam Bypass Control System (SBCS). This report is intended to present the results of a high level review of the SBCS design basis and determine if any changes or additional periodic testing is required to ensure the system will perform its design function when necessary.

NOTE: The subject SBCS evaluation/review scope includes only the control system (i.e., not the Steam Bypass Valves). Due to the close relationship of the valves and the control system, some recommendations were made on the valves. However, the final valve recommendations are included in another report.

The results of the review are as follows:

RESTART RECOMMENDATIONS TO ENSURE FUNCTIONALITY

* Correct problem associated with the Auto Permissive X Timer in Unit 3. In addition, test the Auto Permissive X Timer in Units 1 & 2 and the Auto Permissive Y Timer in all Units.

POST RESTART RECOMMENDATIONS

* In addition to 36MT-9SF03 & 36MT-9SF04 include testing of the Permissive Timers and the modules listed below from the reliability analysis. The Pre-Operational test may be used as a guideline. Tests are to be completed every refueling or sooner if possible.

* It is recommended that the following components be replaced at approximately the intervals shown or sooner:

Component	Interval
Foxboro 255PA	11 yrs.
Foxboro 2AI-I2V	17 yrs.
Foxboro 2AO-V2I	20 yrs.
Allen Bradley 1720-L440	5.5 yrs.

NOTE: Start time for these intervals is the date of commercial operation (see the following dates:)

Unit 1 : 1/28/86
Unit 2 : 9/19/86
Unit 3 : 1/8/88

Recommend re-evaluation of these intervals on a yearly basis as more failure data becomes available and revise as necessary.

* Verify/complete replacement of steam transmitters in all Units.

* As a result of PTRR 3-87-001, include steam bypass valve position on the Main Control Board. Also calibrate inputs to TDAS every refueling outage (i.e., SBCS valve position, etc.)

* Reanalyze the SBCS control setpoints to increase margin to reactor trip actuation, loss of load, and loss of feedpump. The existing system valves need to be regrouped for quick open and modulation mode operation to allow a smoother response to load changes. The system optimization should consider operating characteristics of Unit 1, 2, and 3. The header pressure is different when steam flow is through turbine compared to the steam bypass valves. This occurs due to piping configuration. The system optimization should consider this during the evaluation. APS has requested CE to provide a current proposal for SBCS optimization.
  Points to consider in the evaluation of modifications to enhance SBCS performance should include:
  a) The SBCS valves cycle after load rejections. Typically this is caused by quick closing of valves leading to quick opening. Inhibiting the quick open function after the initial quick open of a turbine trip can minimize unnecessary cycling. Various methods for achieving this can be performed with minimal hardware impacts.
  b) Evaluate splitting of the Tavg block to allow one group of quick open to occur at low power. This will cause minor modification to hardware.

* Obtain a sufficient number of spares of the components listed in this summary.

* Evaluate the impact of steam bypass valves out of service on the operation of the system in the modulation mode.

STEAM BYPASS VALVE RECOMMENDATIONS

* Verify closure of corrective action item B (Steam bypass valve root cause evaluation) associated with LER 88-021.

* Continue testing steam bypass valves on a twice monthly basis as outlined in 41OP-1SF05.

PURPOSE OF THE SBCS

The main objective of the SBCS is to maximize plant availability by the selective use of the turbine bypass valves and dump valves to avoid unnecessary reactor trips and prevent the opening of secondary side safety valves, whenever these occurrences can be averted by the controlled release of steam.

The SBCS is designed to control 6 turbine bypass valves which divert main steam directly to the condenser and 2 atmospheric dump valves. The steam bypass and dump valves are provided to meet a required 55% steam flow capability without exceeding the capacity of the unit condenser.

The SBCS, operating in conjunction with the Reactor Power Cutback System (RPCS) and other control systems, automatically dissipates excess energy in the NSSS by regulating the flow of steam through the turbine bypass and atmospheric dump valves. The design objectives include the following:

A. Accommodate load rejections of any magnitude without tripping the reactor or lifting the pressurizer or steam generator safety valves.

B Provide a means of manually controlling the reactor coolant system temperature during plant heatup and cooldown.

C. Prevent the opening of safety valves after a unit trip, and affects a smooth transition to hot zero-power conditions.

D. Automatically control steam pressure, and thus controls reactor coolant temperature, to the hot zero-power value when in hot zero-power conditions.

E. Incorporate redundancy into the SBCS to prevent a single equipment malfunction from opening more than one turbine bypass or dump valve.

F. Minimize valve wear and improve controllability by operating the SBCS turbine bypass and atmospheric dump valves in a sequential manner.

G. Provide the capability of bumpless balanceless transfer from manual to automatic and from automatic to manual.Also provide individual valve control for flexibility in the use of the turbine bypass valves.

H. Produce a CEA Automatic Motion Inhibit (AMI) signal whenever reactor power falls below 15%; or when the turbine and reactor power fall below preselected thresholds and the SBCS can accommodate the excess reactor power.

I. Generate an Automatic Withdrawal Prohibit (AWP) signal to block CEA outward motion when a demand for turbine bypass exists.

J. Provide a means of relief for excess reactor power during startup, turbine sychronization, and initial loading.

K. Control steam header pressure during the loss of one-out-of-two feedwater pumps.

L. Provide a condenser interlock to block turbine bypass when condenser pressure exceeds a preset limit. This interlock has no effect on the atmospheric dump valve operation.

M. Provide testing capabilities to facilitate detection of equipment failures.

FUNCTIONS OF THE SBCS

The objectives outlined in the PURPOSE section are achieved through various functional features of the SBCS. Each objective, outlined in the PURPOSE section, and how it is met is briefly discussed below:

A. The small load changes are accommodated through the modulation of the turbine bypass valves to control main steam header pressure to a setpoint program that is somewhat higher than the steady state operating pressure at the corresponding power level. For larger load rejections, a quick opening of the turbine bypass valves is produced when the load rejection is too large to be accommdated by this slow modulation speed. Additionally a sizeable rapid reduction in reactor power is produced through the Reactor Power Cutback System if the magnitude of the load rejection is so large that it cannot be accommodated even by the quick opening of the valves. In this manner a 100% load rejection can be accommodated with the 55% turbine bypass and atmospheric dump valves capacity available.

B. The turbine bypass valves have individual manual control stations. The valves can be used to dissipate decay heat and reactor coolant pump energy and thereby control the RCS temperature for plant cooldown and heatup.

C. On a reactor or turbine trip from high power, the SBCS maximizes energy release by initially quick opening the valves to avoid safety valve actuation. After excess energy is dissipated, the SBCS modulates the valves to maintain the steam pressure at its hot standby conditions. A block is generated to prevent the quick opening of the SBCS Valves if a reactor trip occurs when the NSSS is operating at low temperatures, such as during stretch out or medium power operation. This is done because, with the increased NSSS additional heat storage capacity being able to accommodate more of the decay heat and reactor coolant circulating pump energy, a relatively slow valve speed is desirable. This is desirable because it minimize pressure and temperature swings and provide a smoother transition to the steady state hot zero power conditions.

D. Valve modulation is used to control relatively slow NSSS transients. The SBCS continuously monitors main steam header pressure. When an excessive increase in said pressure is detected, steam from the main steam lines is directly passed to the condenser through the turbine bypass valves which are modulated to control main steam header pressure to a programmed setpoint. Since the RCS temperature is equivalent to the saturation temperature corresponding to the steam pressure at zero power, RCS temperature is consequently maintained by controlling the steam header pressure.

E. To prevent a single failure from opening the bypass valves when not necessary, possibly causing an excess load incident, the SBCS has redundancy in its design, with the valve opening demand signals being required on a two-out-of-two basis for the valves to open. To prevent a single component failure from opening more than one valve, the coincidence of two independently generated demand signals is made necessary to open any one valve. For this, two parallel circuits (main and permissive) are used. Two Main Steam Header Pressure Setpoints are generated in an identical and independent fashion; one is selected for use in the Main Modulation Control Channel, which produces the valve control signals, and the other in the Permissive Modulation Control Channel, which produces the valve permissive signals. Since it is desirable that these signals come together as close to the valve as possible to minimize the possiblity that a single component failure open a valve, their coincidence is made to occur at the valve itself. In this manner the only single component failure which can produce the opening of one valve is a failure in the valve itself (See Figure 2 for conceptual diagram).

In addition, to offer a certain degree of protection to the turbine/condenser, the Turbine Bypass Valves are closed and prevented from opening whenever the main condenser conditions are unsatisfactory, normally indicated by a low condenser vacuum. This interlock also has redundancy in its design, with a one-out-of-two indication necessary to close the valves.

F. The SBCS has Five Valve Group Demand Programmers which are function generators which produce demand signals for the five groups into which the bypass valves are divided in the modulation control mode (See Figure 2). The purpose of these programmers is to produce a sequential opening of the valve groups in the desired proportionality to the Main Controller Demand signal. The main objectives of the sequential opening of the valves are to obtain good controllability and to minimize valve operation time in a highly throttled condition. Hence, Group 1 consists of Valve 1 alone to optimally meet the two objectives when the SBCS operates to dissipates decay heat and reactor coolant pump energy after a unit trip down to hot zero power conditions. To meet those objectives for control under 15% power only Valve 4 is assigned to Group 2.
Group 3, consisting of Valve 3 and Valve 6, and Group 4, consisting of Valve 2 and Valve 5, are assigned more than one valve because they are expected to control generally only in a transient fashion. Group 5 consisting of Valves 7 and 8 are the Atmospheric Dump Valves. These valves are the last to open and the first to close.

G. A Master Control Station is located on the Main Control Board (See Figure 2). This controller provides the operator with the capability to select Automatic or Manual control of the Turbine Bypass Valves in the pre-established sequence. Automatic bumpless control mode transfer in both directions is provided to facilitate its use.

There are individual M/A control stations which allow the operator to select manual or automatic operation of the turbine bypass and atmospheric dump valves. Figure 2 shows the M/A control stations. There are eight Valve Manual/Auto Control Stations on the Main Control Board, one for each valve. In "MANUAL" the operator controls the opening of the valve. In "AUTO" the valve is enslaved to the Master Control Station through the internal SBCS valve demand programs. Balancing of the "automatic" and "manual" signal during a control mode transfer is necessary.

H. The CEA Automatic Motion Inhibit feature allows the operator to select a reactor power level (AMI Setpoint) below which he desires that automatic reactor power control be blocked if turbine power is below another level (AMI Permissive Setpoint). The AMI Setpoint is automatically limited; however, to a maximum value corresponding to the steady state heat dissipating capacity of the SBCS/turbine combination, thus producing the AMI Threshold, which is the reactor power level below which the AMI will really occur. The AMI Threshold allows a quick reload of the unit by maintaining as high a reactor power as desired after occurrences such as turbine trips or load rejections to house load, which may be due to quickly correctable faults. However, regardless of what those values may be, the AMI action is always made to occur below approximately 15% reactor power, which is the lower boundary of the range of RRS automatic operation. This relieves the operator of the necessity to take immediate action whenever the turbine power decreases to below 15 percent.

The AMI generation is based on reactor power, AMI Setpoint, available SBCS capacity, Turbine Load Index, CEA Automatic Withdrawal demand, and status of the SBCS.

I. The AWP is produced whenever there is a steam bypass demand, since this is an indication of excess NSSS energy and a CEA withdrawal would be unwarranted. The logic to perform this function is based on valve modulation demands, Quick Open demands, and SBCS connect state. The AWP signal is sent to Control Element Drive Mechanism Control System (CEDMCS) to prevent withdrawal of the control rods.

J. During turbine startup, synchronization, and initial loading, the excess reactor power results in increased steam header pressure. The SBCS controls the steam header pressure by modulating the bypass valves and relieving the excess energy in the system. This allows the matching of the primary and secondary side power thereby minimizing the excursions in the NSSS parameters.

K. The SBCS supports the control actions of the RPCS to accommodate the loss of one-out-of-two operating feedwater pumps. On a loss of feedwater pump the RPCS simultaneously drops CEA's to cut reactor power and set the turbine back to reduce load. The turbine load is then runback to an even lower value or the SBCS opens Turbine Bypass Valves to balance reactor power and total load at a level where the remaining feedwater pump can provide adequate feedwater flow.

The SBCS has a "Quick Opening Block" which prevents the valves from being quickly opened when the turbine is set-back which results in a rapid decrease in steam flow. The quick opening of the valves would negate the desired rapid decrease in load. However, the valves are modulated based on steam header pressure, thereby balancing primary and secondary power.

L. The SBCS receives two binary Condenser Available signals. The absence of these signals produce Condenser Interlock which prevents the Turbine Bypass Valves from being opened. The Condenser Interlock must be reset manually by depressing the "EMERGENCY-OFF/CONDENSER-INTERLOCK RESET" pushbutton switch on either the MCB or the SBCS Test Panel.

M. The SBCS is normally expected to exercise all its design control actions rather infequently, allowing a failure to go undetected until the system is required to operate. To facilitate the detection of such failures, the SBCS has been designed with all the necessary built-in test capability to thoroughly test the system functions and equipment. The approach taken to test scheme design allows complete testing of the system from the SBCS cabinet Test Panel in three independent and overlapping phases: Input Tests, Function Tests, and Valve Tests. The test logic design has as an objective to minimize its impact on the availability of the system.

INTERFACES (REF. 2 and 3)

The SBCS interfaces with several other NSSS Control Systems. The relationship of the SBCS with the Feedwater Control System (FWCS), Reactor Regulating System (RRS), Control Element Drive Mechanism Control System (CEDMCS), and the Reactor Power Cutback System (RPCS) is given in Figure 1.

The interfacing of the SBCS with plant systems is shown in Figure 3. For sake of clarity, the control interface of only one turbine bypass valve is shown. The seven other turbine bypass valve interfaces are identical to the one shown.

TESTING HISTORY

DOCUMENT NO.	DOCUMENT DESCRIPTION	UNIT	COMMENTS
36MT-9SF03	SBCS FUNCTIONAL TESTING	ALL	Existing tests verify the the ability for the system to perform its function in accordance with 14273-ICE-6429. See Recommendation #1.
36MT-9SF04	SBCS CALIBRATION CHECK	ALL	See Recommendation #1
92PE-1SF04	SBCS TEST	1	Exhaustive Testing
73PA-1MA01	SBCS LOAD REJECTION	1	Actual testing by opening output breaker verified system operation.
92CM-2SF03	SBCS FUNCTIONAL	2	Preliminary tests on system very detailed.
41OP-1SF05	SBCS OPERATION	1	General guidance in placing system into operation is in accordance with 14273-ICE-6429 and is adequate.

UNIT	DATE	DOC. TYPE & NO.	DESCRIPTION OF PROBLEM/EVENT	RESOLUTION/RESPONSE	CONCLU/COMMENT/SYS. IMPACTS
1	07/05/83	SFR 1SF-076	CE to provide official setpoints for SBCS Master Controller (tag no. S104)	Setpoints were provided for SBCS automatic performance for pre-core hot functional testing. Setpoints will have to be "retuned" during power ascension or during dynamic plant conditions.	See Recommendation #2
12	07/21/83	SFR 1SF-078	The present control system logic does not allow on-line testing of quick close feature for the SBCS valves.	Valve quick-close testing during power operation was not a design requirement of the SBCS. However, valve quick -closing can be tested at power levels of greater than 6% but less than 15% and greater than 26%. Test procedure provided.	None
2	12/06/84	SFR 2SF-3892	Tolerance for Foxboro modules	CE agreed for 10% tolerance on certain Foxboro modules.	None
2	05/01/85	SFR 2SF-5004	Request a tolerance of +/- 0.200 VDC on external limits of Foxboro control cards.	Disposition states that there are no tolerance requirements between the limiter voltage and the controller output voltage.	None
1,2	05/24/85	SFR 2SF-5135	Valve permissive computer printout didn't agree with valve permissive.	Resolved by DCP 1/2CJ-RJ-806.	None
1	08/02/85	EER 85-SF-013	Acceptance criteria for steam generator pressure variation during steady state is not achievable. Steam generator pressure not within +/- 15 psi.	CE concurs that the acceptance criteria is not acceptable. CE recommends retests & test guidelines be provided. Retest guidelines allow S.G. pressure to reach SBCS setpoints which ensure that SBCS performs its intended functions.	As stated in EER disposition, accomplishment of 73PA-1SG01 and and 73PA-1ZZ05 will test SBCS as indicated in CE's response.
1	09/05/85	EER 85-SF-018	SBCS modulation permissive available when main steam pressure is within expected range.	Permissive program setpoint is revised so that it is greater than expected main steam pressure over full range of operation.	Recommendation was implemented. No further action required. (Ref. Sec. 8.2.7 & 8.3.6 of 36MT-9CT01.)
13	10/04/85	Letter V-CE-32687	Current steam flow setpoints are not optimal based on testing.	Optimum settings to be implemented to insure that the largest possible design margins exist in the plant. CE provided the new setpoints.	None

	10/21/85	PTRR 1-85-007	The reactor was at 81%. The turbine was manually tripped in preparation for Load Rejection and Reactor Power tests. A reactor trip immediately followed due to low S/G level. A second Q.O. demand resulted in SIAS, CIAS,& MSIS. Also, all SBCS valves open except for PV-1001. In addition, this valve did not close & fully reopen during the second Q.O. demand. Second SBCS valve Q.O. demand caused by a) incorrect setpoints for S111(X1) & S112(Y1), b) one jumper on cards were found to be in the wrong position, c) bad chip was found in a dynamic comp. card.	Stroke valve to verify operability, compare TDAS position indication with actual valve position and initiate work request if no mechanical problem for I&C to troubleshoot.	Increase setpoint margins as stated in Recommendation #2. Recent calibration dates for each Unit are as follows: Unit 1: 3/1/88 & 8/23/88 Unit 2: 3/29/88 Unit 3: Not done, will be completed this outage.
.1	12/20/85	EER 85-SF-037	During the trip on 12/20/85, the contribution of pressurizer pressure bias signal to SBCS may need to provide a larger input value to modulate the SBCS valves more quickly. Also see PTRR 1-85-010.	Based on a 15-20 sec. opening time when in the modulating mode, the SBCS valves cannot respond fast enough to a rapid load reduction (approx. 24%) to prevent pressurizer pressure from reaching the trip setpoint. No change to SBCS required. (The limiting factor is the modulating stroke speed of the valves.)	None
1	12/20/85	PTRR 1-85-010	Reactor trip @ 10% on high pressurizer pressure after turbine runback. SBCS was not able to respond quickly enough to mitigate reactor coolant system heatup and therefore, resulted in high pressurizer pressure.	RPCS datalink failed, SBCS runback demand module out of calibration. EER 85-SF-037 has been issued to evaluate potential changes on the pressurizer pressure bias on the steam header. This bias is intended to help minimize effects of secondary plant transients on the primary plant.	See Recommendations #2.
13	01/22/86	Letter V-CE-33315	SBCS Valve modulation reassignment	Part of DCP 1/2/30J-SF-022	None

1	02/04/86	EER 86-SF-007 Ref: V-CE-33384	Loss of feed pump at 60% resulted in plant trip-followed by a quick open of the steam bypass valves. The valves closed after the Q.O., followed by a second Q.O. This resulted in over cooling causing SIAS.	CE recommends revising the the SBCS TAVG low setpoint (tag 8314). New value is 5.651 VDC. This change should prevent Q.O. of the SBCS valves following a trip from approx. 75% pwr. This value is low enough so that Q.O. block signal occurs in time to prevent second Q.O. following reactor trips from power levels above Q.O. block threshold. WO #134914 and FCO/FCR # 86-13-SF-C02 accomplished to change TAVG-LOW setpoint.	None
13	07/07/86	EER 86-SF-033	Potential deficiencies in the SBCS resulting in reactor trips.	Disposition proposing alternatives for more desirable quick-open operation.	Review proposal in conjunction with Recommendation #2.
13	09/18/86	EER 86-SF-041	Repetitive quick-open actuations in steam bypass control valves.	Disposition states that auto permissive timers are field set. EER recommends adjusting auto permissive timers T1 and T2 to 15 seconds from existing 10 second settings provided by CE. (see Letter V-CE-21669)	None
	12/20/86	EER 86-SF-052	Determine method of preventing quick-open signal to allow SBCS valves to be tested at power.	Per SBCS tech. manual, (M001-13.02-2009-2), SBCS master controller should be in manual. Operational procedures 410P-1SF05, 420P-2SF05, 430P-3SF05 show proper positioning.	None
13	01/01/86	SDCN S06432	Changes calibration fine tuning for proper valve response, particularly for smooth positive response below 10% (Bailey APS positioner). Ref: EER 85-SF-171. Paper change only. No FCR.	Incorporated by BR3. These changes may result in a greater demand signal from the control room being required to lift valve off seat. Cal. procedure should be checked for incorporation.	None

7	06/10/86	PTRR 2-86-003	Reactor power 10%, Turbine/ Generator trip on exciter problems. Reactor trip on high pressurizer pressure. Operators reported observing Q.O. lights on E06, and demand signals on the bypass valve controllers indicated 100% demand. TDAS shows valve did not respond to provide Q.O. but rather modulated open.	*Plant condition was such that Q.O. should have occurred. ICM card S103 found fully inserted, but was not functioning due to dirt in the card slot.	See Recommendation #1.
13	06/30/86	V-CE-34044	Analyze SBCS for optimum performance	Proposal to analyze SBCS setpoints.	See Recommendation #2 & proposal.
1	07/22/86	PTRR 1-86-007	Spurious S/G low flow trip. No concerns directly regarding the SBCS was stated, except that loss of control power to SBCS caused several control and indication anomalies. An EER will be generated to evaluate design adequacy of the transfer switch. Rx @ 100%. Trip on low RC flow. ESFAS on SIAS, CIAS, MSIS on excess steam demand.	No PICS or SBCS problems.	None
4	08/30/86	PCR 86-13-SF-11	100% load rejection test resulted in: *Fast bus transfer to offsite malfunctioned. *RCP coastdown caused reactor trip through the core protection calc. *Power was also momentarily interrupted to SBCS. *After power restoration, SBCS automatically initialized in manual at previous demand of 30%. The above responses resulted in "CYCLING" of the SBCS valves.	To prevent the situations encountered during the 100% load rejection test, modify SBCS master and permissive channel controllers such that upon loss of power and restoration of power, the SBCS returns in manual mode at 0% demand. NOTE: PCR 86-13-SF-11 was cancelled by OPS on 9/22/86. JUSTIFICATION: *SBCS troubleshooting revealed that power interruptions exceeding 2 seconds resulted in a transfer to a "fail safe" mode prohibiting anomalous system behavior. *Fast bus transfer in C-2 at 100% power was successful (Date 9/11/86).	SBCS auto switches to class power approx. 0.2 seconds after LOP.

13	08/22/88	SDRN #175 DCP 1/2/30J-ST-022	Regrouped SBCV's from 1001-1004 and 1005-1008 to 1001, 3,4,6 and 1002, 5, 7,8.	Incorporation of SDRN to be done after DCP closure.	None
[redacted]	08/21/88	PTRR 1-88-005	Rx @ 75% power, Turbine trip on stator cooling water flow. Rx trip on high Pzr pressure. Reactor tripped due to premature closing of SBCS PV-1001 and PV-1004, and malfunction of PV-1003.	Recommended action: 1) Disassemble PV-1003 2) Evaluate RPCB/SBCS response & make recommendation to enhance system response. 3) Implement DCP 13J-SG-095 (incorp. wave springs) 4) Troubleshoot valve positioner for PV-1001. 5) Reason for single RPCB demand from SBCS to be addressed by EER 88-SF-010. 6) Increase SBCV stroking to 2 times/month (41CP-1SF05)	EER 88-SF-010 determined that there is no problem with the SBCS. Slow response of SBCS valves is responsible for the reactor trip.
1	09/19/88	LER 88-021	Reactor trip due to high pressurizer pressure. Turbine trip accompanied by improper SBCV operation resulting in a reactor trip. Root cause of failure still under investigation.	None	Verify closure of corr. action item B associated with LER 88-021.
1	08/15/86	PTRR 1-86-009	Rx power 50%, Fast bus transfer test, generator/turbine trip. Reactor trip on high pressurizer pressure after turbine trip. SBCS operation inadequate to prevent reactor trip.	RPC not required. SBCS valves did not go full quick open. EER 86-SF-033 considers SBCS setpoints inadequate. Sending data from U-1 trip and U-2 turbine trip to CE to model plant response & evaluate the response of the SBCS.	See Recommendation #2.
13	08/19/86	Letter V-CE-33987	DCP input for the SBCS modification.	The DCP modifies the SBCS master channel controller (tag no. S104) and permissive channel controller (tag no. S101) output demand signals to be forced to zero when the steam header pressure signal is below the setpoint.	See Recommendation to PCR 86-13-SF-11.
1	09/12/85	PTRR 1-85-005	Reactor trip from 52% power, Loss of off-site power. Secondary control systems exhibited some instabilites and SBCS did not generate a O.O. signal in response to high S/G pressure.	SBCS as well as other non-control systems lose power during loss of off-site power(LOP). However, the loss of SBCS O.O. capability during a LOP will be reviewed.	SBCS auto switches to class power approx. 0.2 seconds after LOP. Valves and relays are DC powered for up to 8 hrs. after LOP.

4	08/25/86	PTRR 2-86-007	Reactor at 50% power. Exciter initiated turbine trip. Rx trip on high pressurizer pressure. Valve 1001 did not open upon Q.O. demand. After 2 mins., valve cycled open-close.	Operator interview indicate valve did open but limit switch was stuck shut. Corrective action was to troubleshoot faulty limit switch.	See recommendation #1.
2	03/28/86	PTRR 2-86-008	Reactor power 80%. Generator trip due to exciter. Reactor trip on high pressurizer pressure. Valve PV-1007 stayed open longer than the rest of the valves after receiving Q.O. signal.	RPCS did not drop CEA's on turbine trip. Only 1 RPC signal sent from SBCS-2 needed from RPC actuation. Steam flow instrument on SG #2 was slow. CORRECTIVE ACTION: 1) Isolate & stroke valve to insure proper operation. 2) Investigate valve operator linkage adjustment. 3) Recommend periodic stroking of SBCV's.	See Recommendation #3.
3	12/16/87	PTRR 3-87-001	Reactor power 50%, reactor trip by CTC's on DNBR. Valve PV-1005 indicated an open red light with no demand indicated, TDAS data indicated valve did not open. The valve should have had demand & been open as valve PV-1003.	Valve PV-1005 was exercised during Mode 3 & found to be erratic in movement due to mech. binding. No I&C concerns are associated with this problem as valve would maintain temperature while in auto. ACTION PLAN: 1) Troubleshoot valve control system - WR 252757-WO 265837 2) Exercise valve 3) Implement program to periodically exercise SBCV.	Include steam bypass valve position on the Main Control Board. Also calibrate inputs to TDAS every refueling outage (i.e., steam bypass valve position.)
1	05/30/87	PTRR 1-87-002	99.5% Rx power. MFWP-A overspeed trip. RPCB occurred. Rx trip/Turbine trip 12 seconds later on variable overpower trip. Loss of MFWP-A caused SBCS Q.O. block. 3 main steam valves lifted briefly and reseated after SBCS valves had modulated. After plant stabilization, PV-1001 did not operate with a manual permissive inserted & 100% demand signal. Valve was placed on off. A later attempt to use PV-1001 proved satisfactory operation with both manual & auto permissive	Further evaluation will be performed, if valve does not stroke, then troubleshooting and/or corrective maintenance will be initiated.	See recommendation #4.

RECOMMENDATION BASIS

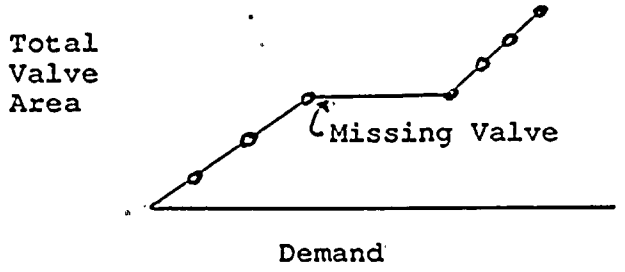
Recommendation	Basis
1. In addition to 36MT-9SF03 & 36MT-9SF04 include testing of the Permissive Timers and the modules listed in the reliability analysis summary. The Pre-Operational test may be used as a guideline.	NED report (File 89-001-545) on Unit 3 Electrical Grid Disturbance On 3/3/89 discusses failure of timer in SBCS. Note: Redundant Accpian power supplies are not currently tested but alarm in the Control Room. Foxboro power supplies for the RRS, FWCS, and the SBCS are tested in task #063423.
2. Reanalyze the SBCS control setpoints to increase margin to reactor trip actuation, loss of load and loss of feedpump. Evaluate the existing regions of power where the quick opening and modulation mode can be made to perform more optimally. The existing system valves need to be regrouped for quick open and modulation mode operation to allow a smoother response to load changes. The system optimization should consider operating characteristics of Units 1, 2 and 3. The header pressure is different when steam flow is through turbine compared to the steam bypass valves. This occurs due to piping configuration. The system optimization should consider this during the evaluation. APS has requested CE to provide a current proposal for SBCS optimization.	PTRR 1-85-007 - Trip from 81% power caused SIAS - Increased margin would have helped. PTRR 1-85-010 - Modulation mode was not fast enough to accommodate trip from 40% PTRR 1-85-005 - With setpoints modified RPC could have been initiated. PTRR 1-86-009 - No Q. O. capability between 25-40% power. EER 86-SF-033 suggests changes to setpoints.
Points to consider in the evaluation of modifications to enhance SBCS performance should include:	
a. The SBCS valves cycle after load rejections. Typically this is caused by quick closing of valves leading to quick opening. Inhibiting the quick open function after the initial Q.O. of a turbine trip can minimize unnecessary cycling. Various methods for achieving this can be performed with minimal hardware impacts.	a. PTRR 1-85-007, 1-86-009 and SPEER 88-03-003 all show cycling of the valves due to quick open and quick close.
b. Evaluate splitting of the Tav block to allow one group of quick open to occur at low power. This will cause minor modification to hardware.	b. PTRR 1-85-010 - Q. O. block prevented rapid SBCS action to accommodate a runback on loss a feedpump.

3. As a result of PTRR 3-87-001 continue testing steam bypass valves twice monthly as outlined in 41OP-1SF05 and verify/complete replacement of steam transmitters in all Units.

PTRR 3-87-001 and 2-86-008 have recommendations on exercising valves. SPEER 88-03-003 has recommendation on replacing all steam transmitters.

4. Evaluate the impact of steam bypass valves out of service on the operation of the system in modulation mode. The out of service valves introduce a flat spot in the valve vs. area demand curve.

PTRR 1-85-007 - had PV1004 out of service.
PTRR 1-87-002 - PV1001 out of service. This may have slowed the modulation mode response.
PTRR 2-86-007 - PV1003 unavailable.



EVALUATION SUMMARY & RESULTS

Review of the SBCS indicates that the system generally has performed as designed. However, the overall performance of the system can be enhanced by considering the as built plant characteristics including parameters like measured valve capacity, valve characteristics, and operating history.

NOTE: The subject SBCS evaluation/review scope includes only the control system (i.e., not the Steam Bypass Valves). Due to the close relationship of the valves and the control system, some recommendations were made on the valves. However, the final valve recommendations are included in another report.

A summary of the specific results of this evaluation follows:

REQUIREMENTS TO ENSURE FUNCTIONALITY FOR RESTART

* Correct problem associated with the Auto Permissive X Timer in Unit 3. In addition, test the Auto Permissive X Timer in Units 1 & 2 and the Auto Permissive Y Timer in all Units.

POST RESTART RECOMMENDATIONS

* In addition to 36MT-9SF03 & 36MT-9SF04 include testing of the Permissive Timers and the modules listed below from the reliability analysis. The Pre-Operational test may be used as a guideline. Tests are to be completed every refueling or sooner if possible.

* It is recommended that the following components be replaced at approximately the intervals shown or sooner:

Component	Interval
Foxboro 255PA	11 yrs.
Foxboro 2AI-I2V	17 yrs.
Foxboro 2AO-V2I	20 yrs.
Allen Bradley 1720-L440	5.5 yrs.

NOTE: Start time for these intervals is the date of commercial operation (see the following dates:)

Unit 1 : 1/28/86
Unit 2 : 9/19/86
Unit 3 : 1/8/88

* Verify/complete replacement of steam transmitters in all Units.

* As a result of PTRR 3-87-001, include steam bypass valve position on the Main Control Board. Also calibrate inputs to TDAS every refueling outage (i.e., SBCS valve position, etc.)

* Reanalyze the SBCS control setpoints to increase margin to reactor trip actuation, loss of load, and loss of feedpump. The existing system valves need to be regrouped for quick open and modulation mode operation to allow a smoother response to load changes. The system optimization should consider operating characteristics of Unit 1, 2, and 3. The header pressure is different when steam flow is through turbine compared to the steam bypass valves. This occurs due to piping configuration. The system optimization should consider this during the evaluation. APS has requested CE to provide a current proposal for SBCS optimization.
  Point to consider in the evaluation of modifications to enhance SBCS performance should include:
  a) The SBCS valves cycle after load rejections. Typically this is caused by quick closing of valves leading to quick opening. Inhibiting the quick open function after the initial quick open of a turbine trip can minimize unnecessary cycling. Various methods for achieving this can be performed with minimal hardware impacts.
  b) Evaluate splitting of the Tavg block to allow one group of quick open to occur at low power. This will cause minor modification to hardware.

* Obtain a sufficient number of spares of the components listed in this summary.

* Evaluate the impact of steam bypass valves out of service on the operation of the system in the modulation mode.

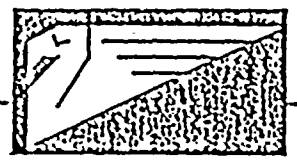
STEAM BYPASS VALVE RECOMMENDATIONS

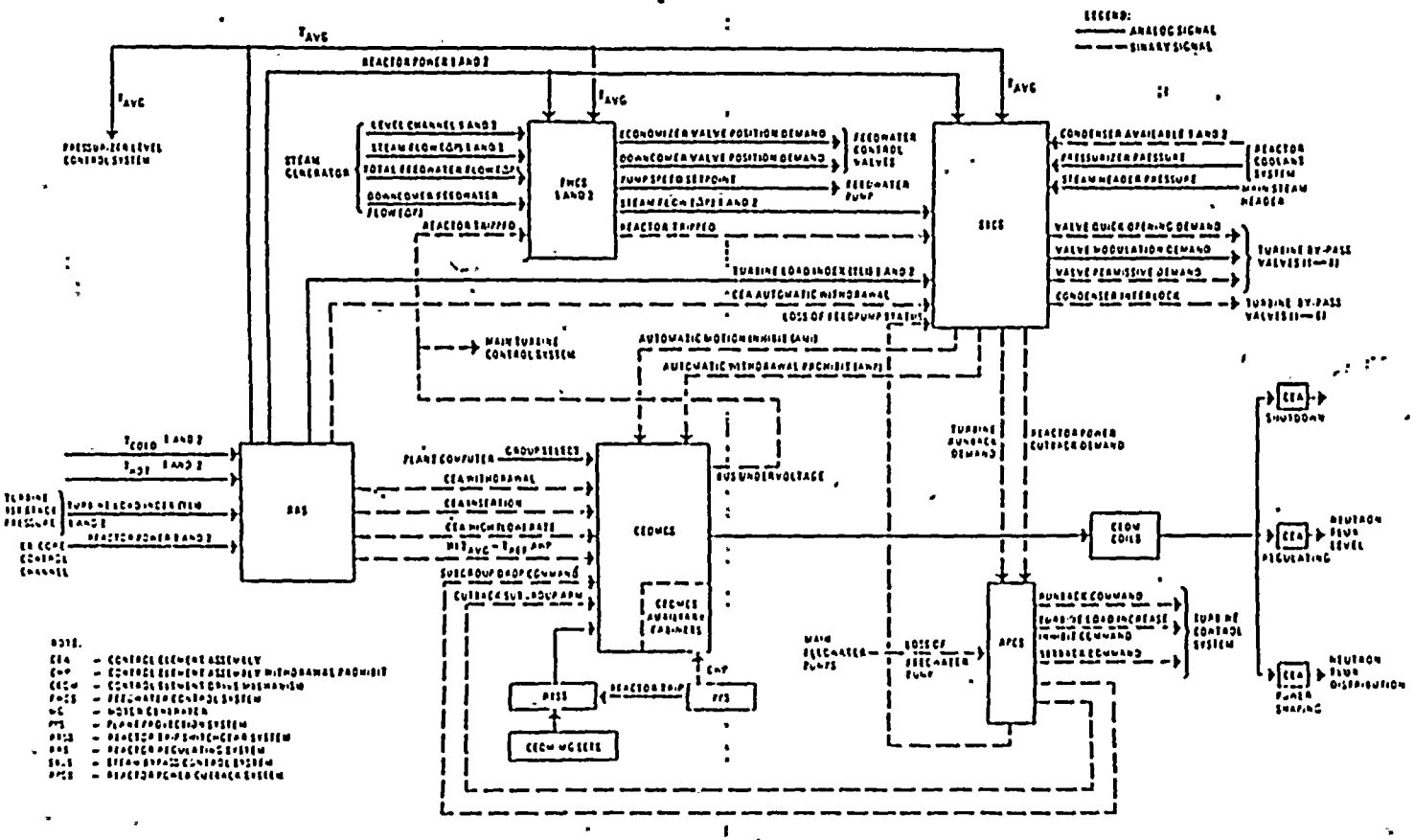
* Continue testing steam bypass valves on a twice monthly basis as outlined in 41OP-1SF05.

* Verify closure of corrective action item B (Steam bypass valve root cause evaluation) associated with LER 88-021.

REFERENCES

1. CE System 80 CESSAR
2. CE Steam Bypass Control System Technical Manual, 13-N001-13.02-2009-2.
3. System Description Manual, SF Chapter.
4. All documents included in "Operating History " section of this document.





REACTOR CONTROL SYSTEM OVERALL BLOCK DIAGRAM

FIGURE 1

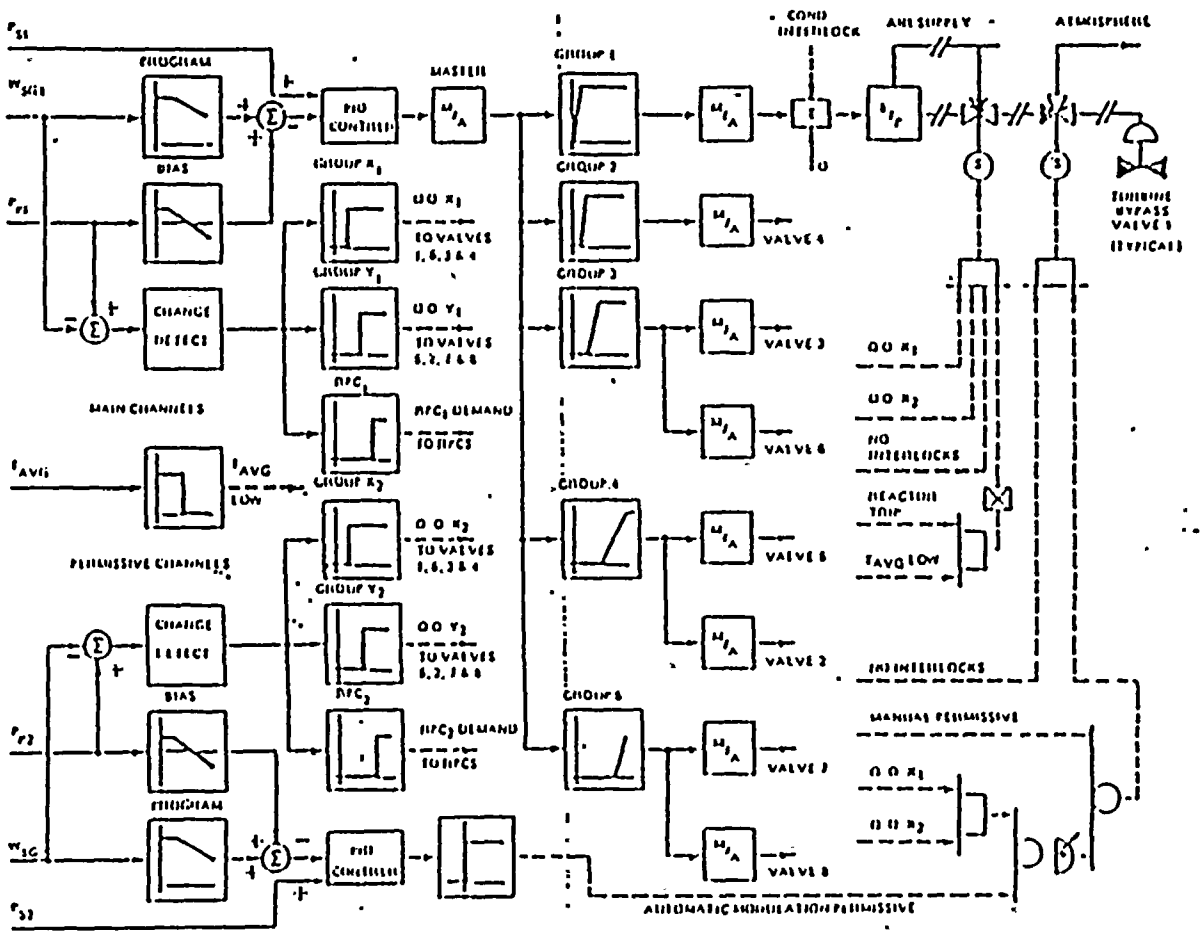


FIGURE 2
CONCEPTUAL BLOCK DIAGRAM

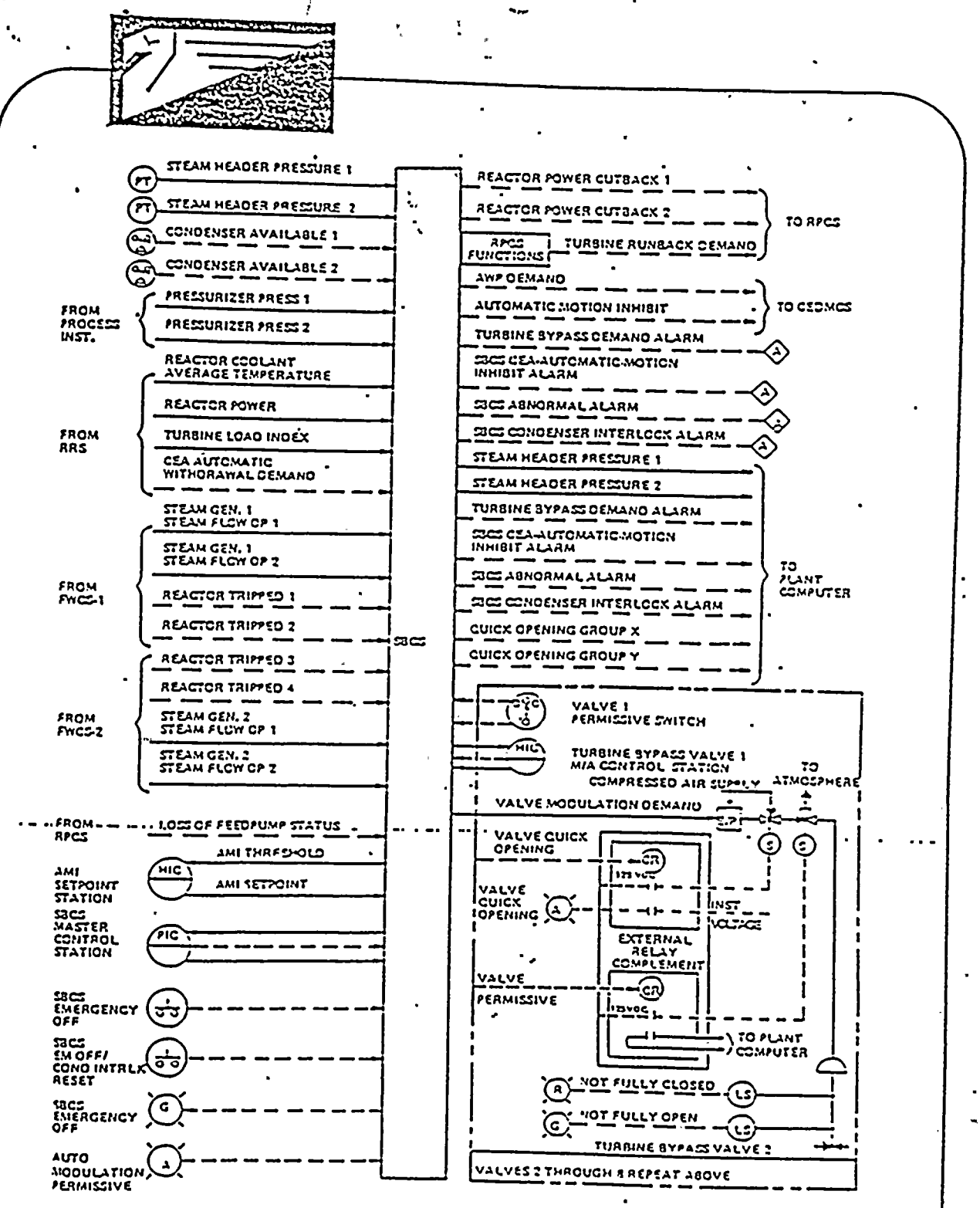


FIGURE 3:

SBCS INPUT/OUTPUT BLOCK DIAGRAM

REACTOR POWER CUTBACK SYSTEM

Design Basis Review
and
Functional Requirements

Arizona Nuclear Power Project

TABLE OF CONTENTS

EXECUTIVE SUMMARY

This report was prepared subsequent to the various reactor trips of Unit 3 and Unit 1 and the shutdown of Unit 2 in February and March of 1989. Concerns were raised by Palo Verde Management and the NRC with regards to the overall design, maintenance and operation of the Reactor Power Cutback System (RPCS). This report is intended to perform a high level review of the RPCS design basis and its operating to determine if any design changes or additional periodic testing are required to ensure the system will perform its design function when called on.

RECOMMENDATIONS

A. RESTART RECOMMENDATIONS

As shown in this report the design, maintenance and operation of the RPCS is generally very good, and therefore there are no recommendations that must be implemented prior to restart. However plant experience does seem to indicate that some fine tuning can be done to enhance the system. Also because this system plays a pivotal role during load rejections and loss of feed pump transients, some additional testing beyond the normal scope of a control grade system is recommended.

B. TESTING ENHANCEMENT RECOMMENDATIONS

As aforementioned, the design, maintenance, and operation of RCPS is generally very good. However plant experience does seem to indicate that some fine tuning can be done to enhance the system. Also because this system plays a pivotalrole during load rejections and loss of feed pump transients, some enhancements to the existing testing is recommended.

There are two recommended changes to the existing testing. The first involves a change in scope of the existing testing to include testing across various internal and external system interfaces. The second recommendation would increase the frequency of existing preventative maintenance and perform daily checks by Operators under 40DP-90P05.

C. SYSTEM DESIGN MODIFICATION RECOMMENDATIONS

There are no recommended design changes for the RPCS.

Two different reactor trips could have been prevented by RPCS if the RPCB Demand signals from the SBCS had been improved. Recommendations for SBCS improvements are discussed in the SBCS evaluation.

Recommend continuation of the evaluation of EER 88-SF-006 which will provide a disposition on RCPS availability in the event of loss of data link or COLSS.

ACRONYMS

AAOOS	-	Automatic Actuate Out Of Service
CEA	-	Control Element Assembly
CEDMCS	-	Control Element Drive Mechanism Control System
LFP	-	Loss of Feedpump
LLR	-	Large Load Rejection
LO	-	Lube Oil System
MCRAS	-	Main Control Room Annunciator System
MFP	-	Main Feed Pump
MT	-	Main Turbine System
NSSS	-	Nuclear Steam Supply System
PMS	-	Plant Monitoring System
PTRR	-	Post Trip Review Report
RCS	-	Reactor Control System
RJ	-	Plant Computer System
RK	-	Plant Annunciator System
RPCB	-	Reactor Power CutBack
RPCCP	-	Reactor Power Cutback Control Panel
RPCM	-	Reactor Power Cutback Module
RPCS	-	Reactor Power Cutback System
RRS	-	Reactor Regulating System
SBC	-	Steam Bypass Control
SBCS	-	Steam Bypass Control System
SE	-	Reactor Control System
TCS	-	Turbine Control System

RPCS PURPOSE

The NSSS normally operates with minor perturbations in power and flow. These can be handled by the control systems. However, certain large plant imbalances can occur, such as large load rejection, turbine trip or loss of one of two main feedwater pumps. Under these conditions maintaining the NSSS within the control band ranges can be accomplished by rapid reduction of NSSS power at a rate which is greater than that provided by a normal high speed CEA insertion (Ref A). Refer to Figure 1 and 2 (Ref B and C).

The RPCS is a control system designed to accommodate certain types of imbalances by providing a "step" reduction in reactor power. The step reduction in reactor power is accomplished by the simultaneous dropping of one or more preselected groups of full length regulating CEAs into the core. The RPCS also provides control signals to the turbine to rebalance power. The system is designed to accommodate either large load rejections [up to 100 % power] or the loss of one of two main feedwater pumps (Ref A, Sec 7.7.1.1.6).

RPCS FUNCTIONS (Ref B)

1. Automatically initiate, in response to signals generated in the main feedwater pump control systems, rapid reductions in reactor and turbine power to power levels which assure continued NSSS operation, without requiring action of safety equipment (i.e., the plant protection system or primary or secondary safety valves) on loss of one of the two operating feedwater pumps.

2. Produce, in response to signals generated by the SBCS, rapid reductions in reactor power to power levels which assure continued NSSS operation, without requiring action of safety equipment (i.e., the plant protection system or primary or secondary safety valves) following large turbine load rejections including turbine trips from full power.

3. Ensure that the reactor power reduction, commanded by the RPCS, is to a steady state level of between 20 percent and 75 percent of rated power.

4. Provide an operator interface to inform the reactor operator of automatic RPCS actions, and allow the operator to intervene and manually initiate a power reduction.

5. Avoid initiating spurious power reductions which might be caused by credible equipment failures.

RPCS INTERFACES - INPUT (Ref C, Table 6-3 and Ref D)

Name	Source	System	Purpose
Reactor Power Cutback 1,2 (dual redundant signals)	SBCS	SF	Actuates RPCS for Large Load Reject event
Turbine Runback Demand	SBCS	SF	Calls for Turbine Runback signal to be transmitted to TCS
Loss of Feedpump A 1,2* (dual redundant signals)	MFP A	LO	Actuates RPCS for Loss of Feedpump A (Ref H)
Loss of Feedpump B 1,2* (dual redundant signals)	MFP B	LO	Actuates RPCS for Loss of Feedpump B (Ref H)
Subgroup Select* (serial data)	PMS	RJ	Selects CEA subgroups
Manual Large Load Reject	RPCCP	SF	Actuates RPCS for Large Load Reject event in Conjunction with Manual Drop
Manual Loss of Feedpump	RPCCP	SF	Actuates RPCS for Large Load Reject event in Conjunction with Manual Drop
Manual Drop Subgroups	RPCCP	SF	Actuates RPCS in conjunction with manual LLR or LFP
Manual Subgroup Select (1-24)	RPCCP	SF	Selects CEA subgroups
Auto Actuate/Out Of Service	RPCCP	SF	Removes Automatic Actuation capability when Out Of Service selected
Auto/Manual Select	RPCCP	SF	CEA Selection by Operator (Manual) or by System (Auto)

* See Reference D and E for engineering details

RPCS INTERFACES - OUTPUT (Ref C, Table 6-4 and Ref D)

Name	Destination	System	Purpose
CEA Subgroup Select (1-24)*	CEDMCS	SF	Arms selected CEA subgroups for drop
CEA Drop Signal*	CEDMCS	SF	Causes armed subgroups to drop
Turbine Setback*	TCS	MT	Causes turbine power to be set back to 60 %
Turbine Inhibit Increase*	TCS	MT	Prevents the increase of turbine power
Turbine Runback*	TCS	MT	Causes a ramp reduction in turbine power
Loss of Feedpump Status	SBCS	SF	Indicates a loss of feedpump event. Prevents a quick-open of the SBC valves
RPCS Actuation	MCRAS	RK	Indicates actuation of RPCS
RPCS Single Channel Trouble	MCRAS	RK	Indicates failure of input signal or RPCS hardware

* See Reference D and E for interface engineering details

RPCS HISTORICAL REVIEW

Event	Description
PTRR 1-85-007	A fault in the J-118 connector or cable which sends the RPCB #1 demand signal to the RPCS cabinet existed. Therefore only the RPCB # 2 demand signal was received, and no LLR event was initiated by RPCS. After repair, system verification was performed per 73PA-1SF09.
PTRR 1-85-010	The RPCS trouble annunciator was alarming due to data link failed/locked up. The RPCB Test/Reset button was depressed following reset of Auto Actuate Out Of Service and RPCS module initiated a loss of Feedwater Pump cutback. No rods were dropped. A "hard" runback signal to the RPCS due to an out of tolerance runback demand module setpoint existed. With one feedpump in service the RPCS also sees a "hard" loss of feedpump signal. The RPCS operated as designed. The Turbine Runback would not have initiated if the system was placed in "Auto Actuate" after reactor power was above 70 percent, as required by procedures existing now (Ref I and J).
PTRR 1-88-005	Because the rate of change of steam flow conditions sensed at the time the turbine trip occured were close to the threshold for a RPCB; SBCS properly sent only one demand signal to the RPCS calling for a cutback. The RPCS Trouble alarm was received ~2 minutes after the turbine trip. This alarm is to be expected if only one RPCB demand signal from SBCS to the RPCS module is received in a two minute period. The SBCS and RPCS were subsequently tested to ensure that the systems operated as designed. They functioned properly.
PTRR 2-86-007	The RPCS was in Auto Actuate Out Of Service (AAOOS) due to maintenance on a Control Element Assembly Calculator (CEAC) channel. Therefore the RPCS could not initiate any signals to help control the transient.
PTRR 2-86-008	Evaluation of TDAS data indicates that indicated steam flow change was insufficient to cause both the RPCB # 1 and # 2 demand signals to be generated. Both of the steam flow instruments for SG # 2 appeared to lag SG # 1 in both magnitude and rate of change of steam flow. Both RPCB demand signals must be generated for a cutback to occur however, only one was received.

RPCS TESTING, HISTORY AND RECOMMENDATIONS

Recommended Testing	Existing Testing	System Experience	Recommendation	Remarks
Routine Checkout Monthly (Ref C, Sec 8.1)	36MT-9SF05 Each Refueling Identical Scope	No Problems	Increase frequency, possibly to once a month	N/A
Power Supply Calibration Yearly (Ref C, Sec 8.2.1)	36MT-9SF06 Identical Scope* Each Refueling	No Problems	None required	N/A
Time Base and Watchdog Timer Calibration Yearly (Ref C, Sec 8.2.2)	36MT-9SF06 Identical Scope Each Refueling	No Problems	None required	N/A
Calibrating Time Delay Units Z1A and Z2A Yearly (Ref C, Sec 8.2.3)	36MT-9SF06 Identical Scope Each Refueling	No Problems	None required	N/A
Calibrating Serial Data Link Current Loops Yearly (Ref C, Sec 8.2.4)	36MT-9SF06 Identical Scope Each Refueling	No Problems	None required	N/A
N/A	N/A	PTRR review indicates fine tuning of CEA selection and steam decrease threshold values warrant a detailed study.		N/A
None	None	PTRR and testing review indicates that no testing is performed on system interfaces or the annunciator that checks for internal failures of the RPCS.		N/A
N/A	N/A	13-02-SF-018 was written to remove the RPCS, based on uncertainty of proper operation prior to startup. The system operates as designed, no physical changes are in effect, and the DCP is in the process of being cancelled.		N/A
N/A	N/A	No review conducted of previous DCPs		N/A

*This portion of the testing had the greatest difference between recommended and actual calibration. The CE recommendation explicitly requires the power supplies to warm up for 15 minutes. 36MT-9SF06 Section 8.1.7/8/9 makes no such requirement. It is understood that the subject power supplies are normally energized, thus requiring no warm up period. If in the event the power supplies are deenergized then the 15 minutes warm up criteria shall be observed.

RECOMMENDATIONS

A. RESTART RECOMMENDATIONS

None

B. TESTING ENHANCEMENT RECOMMENDATIONS

As the RPCS has been identified as a pivotal system, enhancements to the existing testing is recommended. The existing testing covers most of the internal functions of the system, but none of the interfaces. A fault in the J-118 connector (see PTRR 1-85-007), undetectable by existing testing, directly caused the RPCS to not properly respond to a valid cutback signal, and therefore did not prevent a trip. Many signals like this, that are generated in another system or another portion of the same system, are tested to ensure the signal is generated and sent, but it is never verified that it is properly received. It is is currently no verification that this occurs. It should be noted that the fault associated with connector J-118 has been corrected to eliminate any future inadvertent disconnections.

Also the testing frequency of the existing preventative maintenance could be improved. The RPCS Calibration (Reference G) frequency was recommended by CE to be yearly. It is currently performed every refueling, which is not an unreasonable change in order to mesh with the fuel cycle. However, the RPCS Test (Reference F) has a recommended period of one month, but it is only performed during refueling. No justification for this change in frequency was identified in this review. It should be noted that guidelines for RCPS checks are being incorporated into the Operator's daily log procedure # 40DP-90P05 which is performed during every 12 hour shift. Note: the aforementoined procedure is currently under review and is not approved. The RCPS checks are understood to be modified functional tests. We recommend a change in frequency to preventative maintenance and the issuance of the aforementioned RCPS checks to insure RCPS functionality.

C. SYSTEM DESIGN MODIFICATION RECOMMENDATIONS

The design of the RPCS does not allow any CEA subgroups to be dropped when power is below 75 percent. This is accomplished by the CEA selection algorithm not selecting any CEAs when NSSS power is below 75 percent. It is further stated that the SBCS in conjunction with the RRS can adequately accomodate load rejections of up to a 75 percent magnitude using the total bypass capacity of the SBCS and CEA reactivity rates (Ref B, Sec 2.3.3.1.C). However this appears to be so close to the maximum capability of the SBCS and the RRS, especially if one or more SBC Valves are out of service, that trips could occur. This problem is closely related to problems with the SBCS detecting the proper threshold of steam flow decrease to initiate a RPCB Demand signal. Without both demand signals from the SBCS the two out of two logic will not initiate a drop of the CEA subgroups. This problem was the reason that two plant disturbances resulted in reactor trips (see PTRR 1-88-005 and 2-86-008). These are not problems with the RPCS, but with the SBCS, therefore it is recommended that a detailed review and possible subsequent design

REFERENCES

A) CE System 80 CESSAR

B) System Description Manual, SF Chapter

C) CE Reactor Power Cutback System Technical Manual, N001-13.02-138

D) System 80 RPCS Interface Requirements, N001-13.08-14

E) Instrument Loop Diagram, Reactor Control System, 13-J-SFE-067

F) Reactor Power Cutback System Test, 36MT-9SF05

G) Reactor Power Cutback System Calibration, 36MT-9SF06

H) System Description Manual, LO Chapter, Section 2.2.3.2.46

I) Power Operation, 41OP-1ZZ05, Section 4.3.14 and 6.3.3

J) Operation of the RPCS, 41OP-1SF05

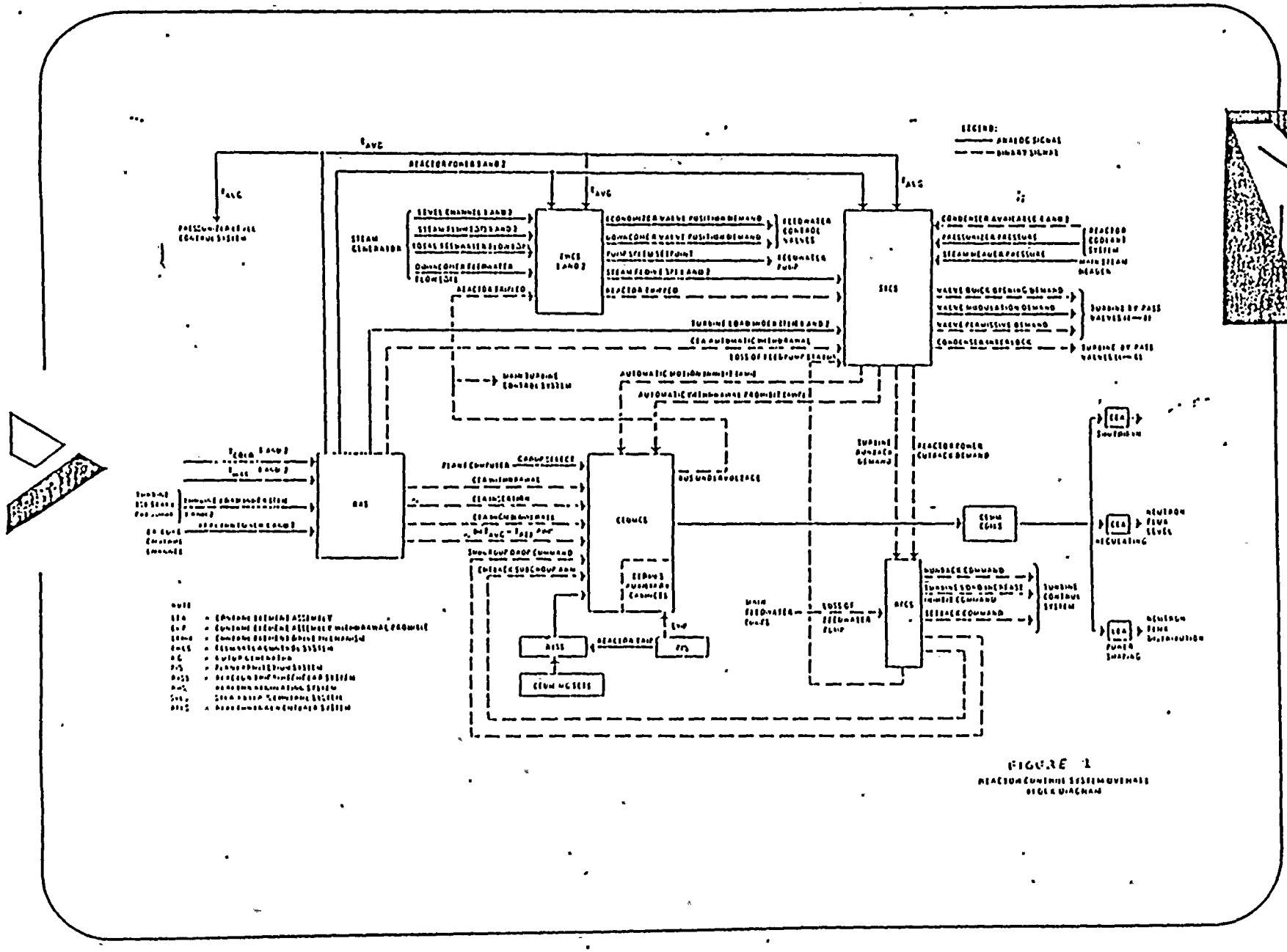


FIGURE 1
REACTOR CONTROL SYSTEM OVERALL
BLOCK DIAGRAM

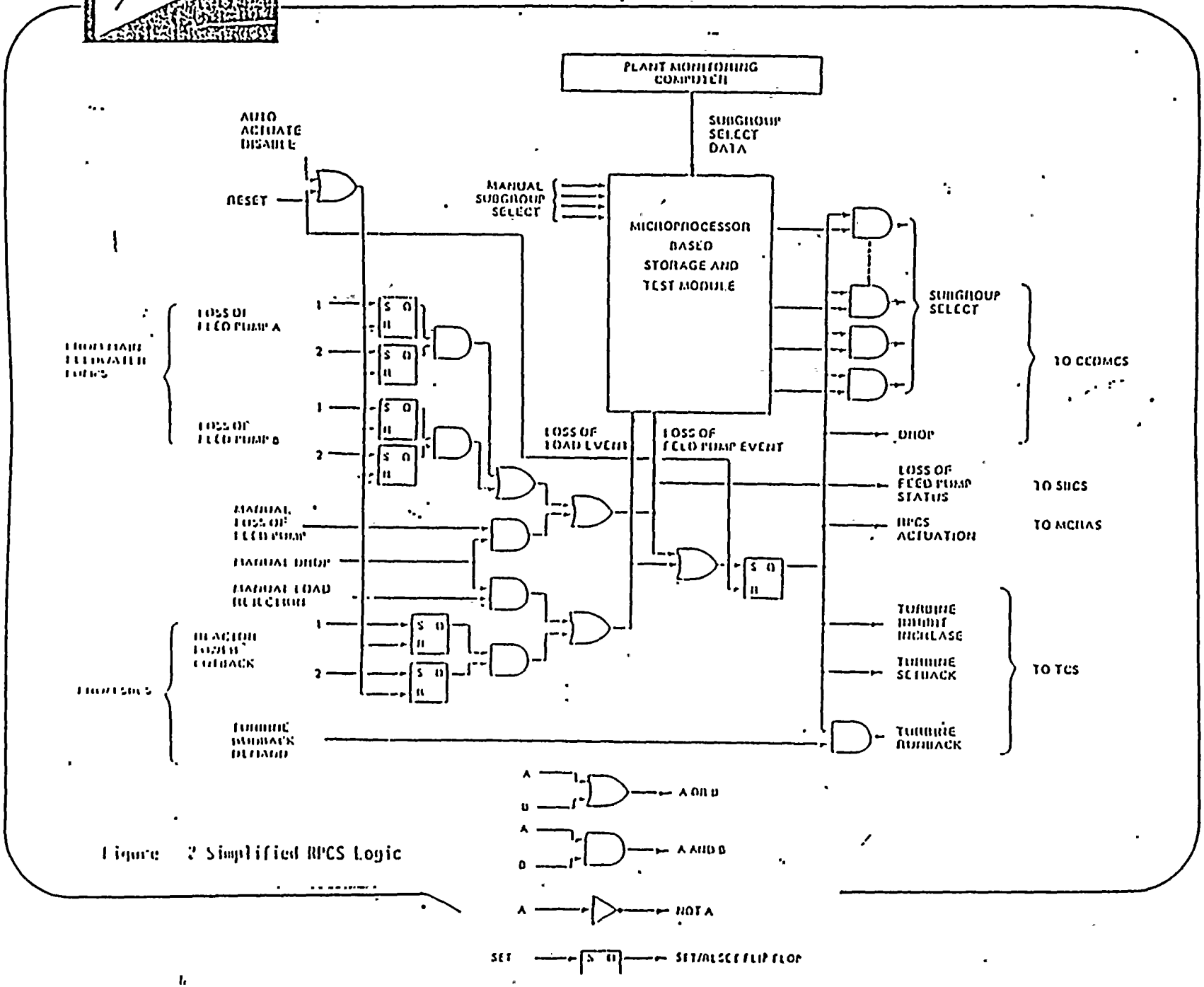


Figure 2 Simplified RPCS Logic

Attachment #1
SBCS

UNIT	DATE	DOCUMENT TYPE	DOCUMENT EVENT	TITLE	CONCLUSION
13	/ /	UFSAR/CESSAR	See title column	7.7 Control system not required for safety.	Two of the turbine bypass valves dump steam to the atmosphere. These valves are the last to open and first to close during steam bypass operation.
13	/ /	UFSAR/CESSAR	See title column	App. 7A Response to NRC Questions.	Steam bypass control system is one of the systems considered to have potential impact upon plant safety due to common power source or common sensor failures. Impact on SBCS due to loss of 120V AC panel E-NHN-D11: the control system cannot quick open and modulate open signals to open turbine bypass valves. Control room indication of automatic permissive signal lost.
13	/ /	UFSAR	See title column	App. 7A Response to NRC Questions.	Impact on SBCS due to loss of 125V-DC load center E-NKN-M45. Inability to actuate turbine bypass valve quick open. Loss of quick open indication in the control room. Control systems sharing a common sensor or common instrument tap: 1) SBCS, PPCS - Pressurizer pressure, 2) SBCS, FWCS - Main steam flow.

Attachment #1
SBCS

UNIT	DATE	DOCUMENT TYPE	DOCUMENT EVENT	TITLE	CONCLUSION
13	/ /	UFSAR	See title column	App. 7A Response to NRC Questions.	Evaluation of common sensor failures. 1. Pressurizer pressure sensor (SBCS, PPCS). Failure of this sensor cannot result in inadvertent operation of SBCS because the SBCS has two independent circuits, both of which must be activated. 2. Main Steam flow sensor (FWCS, SBCS). Similarly, failure of this sensor cannot result in inadvertent operation of the SBCS.
13	/ /	System description	See title column	Reactor control system, SF (SBCS)	The SBCS is to maximize plant availability by the selective use of the turbine bypass valves. A main steam header pressure set point program is generated as a function of NSSS power, with steam flow used as a power index. The turbine bypass valves are modulated by a PID controller operating on the comparison of the main steam header press. with said setpoint. A valve quick opening which overides the modulation action is produced when the load rejection exceeds a certain value.

Attachment #1
SBCS

UNIT	DATE	DOCUMENT TYPE	DOCUMENT EVENT	TITLE	CONCLUSION
13	/ /	System description	See title column	Reactor control system, SF (SBCS)	To prevent a single failure from opening the bypass valves, possibly causing an excess load incident, the SBCS has computed redundancy in its design with the valve opening demand signals being required on a two-out-of-two basis for the valves to open. To facilitate SBCS failure detection, it has been designed with all the built-in test capability to test the system function and equipment from input signals to the operation of the bypass valves.
13	/ /	4-1,2,3,OP-1,2,3,ZZ0 2	See title column	Secondary plant startup	Commitment Nos. 036082, 036083, 036084. LER 86-027 (Unit 2) Inadequacy in Procedure resulted in operator not placing master controller in "remote-auto" for SBCS which resulted in reactor trip on load reduction due to delay time in SBCVs. Procedure updated. No impact.

Attachment #1
SBCS

UNIT	DATE	DOCUMENT TYPE	DOCUMENT EVENT	TITLE	CONCLUSION
13	/ /	IE Notice 88-24	See title column	Failure of air-operated valves affecting safety related systems.	the IEN deals with the ability of the core spring in solenoid valves to overcome IA system or regulated pressure. Failure of the solenoid in this respect is being looked at by I&C (George Wilkersen). No impact for upstream of I/P converter.
13	/ /	IEN 82-25	See title column	Failure of Hiller actuators upon gradual loss of air pressure	No Hiller actuators on site.
13	/ /	ECE	See title column	ECE-SF-A001	Commercial grade purchase for Amphenol connectors for 1E circuits at elec. penetrations ESFC222 SP ESFD283. No impact on design.
13	/ /	ECE	See title column	ECE-SF-A004	Bourns trim pots models 3059Y-1-254-11 and 3059P-1-102-11 are acceptable substitutes for use in RPCM tag no. J-SFN-UY3.
13	/ /	SDCN 6374	See title column	N001-22.01-68	Incorporation in Rev 3 (see SDCN S06387) No changes to drawing. No impact.
13	/ /	NCR SJ-1269,1270,1271	See title column	Bad parts	Under warranty. Replaced parts. No impact.

Attachment #1
SBCS

UNIT	DATE	DOCUMENT TYPE	DOCUMENT EVENT	TITLE	CONCLUSION
13	/ /	NCR EJ-07143	See title column	Broken plastic on push button	Replaced. No impact.
13	02/26/75	Letter B/CE-E-344	See title column	Reactor power cutback system	System description for reactor power cutback system. No design impact.
13	05/11/77	Letter V-CE-2950	See title column	Steam bypass control system	CE responses to Bechtel comments on NSSS interface design requirements for steam bypass control system. No design impact.
13	06/02/77	Letter V-CE-3039	See title column	Feedwater and steam bypass control system	CE response to Bechtel comments on feedwater control system and steam bypass control system block diagrams. No design impact.
13	07/20/77	Letter V-CE-3335	See title column	CE contracts 14273, 14373, 14473	Price quote complying with items 2 and 3 of B/CE-E-1040 letter, regarding turbine bypass sytem. Quote includes costs necessitated by modifying steam bypass control system to accomodate dumping two valves to atmosphere. No design impact.
13	10/21/77	Letter V-CE-4037	See title column	Reactor regulating feedwater control and steam bypass control systems.	CE response to engineering specifications. No design impact.

Attachment #1
SBCS

UNIT	DATE	DOCUMENT TYPE	DOCUMENT EVENT	TITLE	CONCLUSION
13	11/14/77	Letter V-CE-4172	See title column	Reactor regulating, feedwater control and steam bypass control systems.	Discussion of Bechtel comments and CE responses regarding reactor regulating, feedwater control and steam bypass control systems. No design impact.
13	03/17/78	Letter V-CE-4811	See title column	Turbine bypass system	Description of operation of turbine bypass option. No design impact.
13	05/01/78	Letter V-CE-5155	See title column	Turbine bypass system	SBCS option discussed in BJ/CE-E-8003 incorporated into ANPP control system. No design impact.
13	02/01/79	Letter V-CE-7716	See title column	SBCS functional block diagram	CE responses to Bechtel comments. No design impact.
13	05/09/79	Letter V-CE-8207	See title column	SBCS functional block diagram	CE responses to Bechtel comments. No design impact.
13	04/22/80	Letter PVNGS-TLC-M80-42	See title column	Response to safety evaluation. Task force item #90.	Adopt operational procedure to place HS-1002 through HS-1008 in off position, as necessary, to avoid possible opening of all steam bypass control valves, if they reamin in their normal automatic position. No design impact.

Attachment #1
SBCS

UNIT	DATE	DOCUMENT TYPE	DOCUMENT EVENT	TITLE	CONCLUSION
13	06/19/81	Letter ANPM-11271-JMA/RGK	See title column	PVNGS safety task force item nos. 92, 178, 179, 180	NE review of steam bypass control system. No design impact.
13	07/01/82	Detailed Design Criteria	See title column	Reactor Control System (SF) (SBCS)	The SBCS selectively uses the main turbine bypass valves to remove NSSS thermal energy to avoid unnecssary reactor trips and cycling of secondary safety valves. The SF is designed by CE per requirements established in the NSSS contract No. N-001 and Standard Engineering Package (SEP) Vol. 1, Section 27.
13	09/14/82	Letter V-CE-17084	See title column	Control system (SBCS) preliminary setpoints	Provided missing setpoint list for SBCS. No impact.
13	09/20/82	Letter V-CE-20121	See title column	SBCS, RRS, FWS Preliminary setpoints.	Provided setpoints which were not previously available. No impact.
13	10/22/82	Letter V-CE-17272	See title column	Factory settings for steam bypass control system and reactor regulating system.	List of verified factory settings. No design impact.
13	11/10/82	Letter V-CE-17272	See title column	Preliminary control system setpoints	Revision to NSSS control system. No impact.
13	01/06/83	Letter V-CE-17639	See title column	Preliminary control system setpoints	Transmittal of control system setpoint list. No impact.

Attachment #1
SBCS

UNIT	DATE	DOCUMENT TYPE	DOCUMENT EVENT	TITLE	CONCLUSION
1	01/10/83	SFR 1SF-022	See title column	Recorders have wrong scale.	No impact.
1	01/17/83	SFR 1SF-024	See title column	Need vendor calibration info for SBCS test panel..	Done. No impact.
13	03/01/83	Letter V-CE-179995	See title column	Water hammer problem at SONGS Unit 2.	CE recommends that the steam bypass valve piping be carefully examined to avoid SCE problem, i.e., accumulation of water in the system.
1	03/16/83	SFR 1SF-034	See title column	Block vendor wiring doesn't identify contact wiring limit SW.	Done. No impact.
1	03/16/83	SFR 1SF-035	See title column	Correct drawing and EE580.	Done. No impact.
13	03/18/83	Letter V-CE-18115	See title column	NSSS control systems	Updated NSSS control systems setpoint list. No design impact.
13	03/22/83	Letter V-CE-18149	See title column	NSSS control system wiring changes	Corrected list of wiring changes. No system impact.
13	03/29/83	Letter V-CE-18189	See title column	NSSS control system wiring changes	Corrected list of wiring changes. No system impact.
13	04/07/83	MOC 248194	See title column	NSSS control system wiring changes	Bechtel incorporated wiring changes as requested by CE.

Attachment #1
SBCS

UNIT	DATE	DOCUMENT TYPE	DOCUMENT EVENT	TITLE	CONCLUSION
1	04/11/83	SFR 1SF-049	See title column	Trash in line to Ross valves. Request to add filters to PV1001-1008.	Considered as plant betterment.
1	04/25/83	SFR 1SF-052	See title column	SBC valves wouldn't close fast enough on quick close.	Removed needle valves. All valves closed in spec.
13	05/09/83	Letter V-CE-18415	See title column	Initial refil demand setpoint.	Change in ANPP preliminary setpoint report.
1	05/25/83	SFR 1SF-066	See title column	Trash in lines. See SFR-1SF-049 dt 4/11/83.	See SFR-1SF-049 dt 4/11/83.
1	06/10/83	SFR 1SF-064	See title column	Replace 100Vdc relays with 200Vdc relays.	Level X mitters. No impact.
1	06/11/83	FCR 64446N	See title column	Update drawing N001-22.01-62. Also, provide BOM for Ross valves.	No impact.
1	07/05/83	SFR 1SF-076	See title column	CE to provide official setpoints for SBCS master controller (tag no. S104)	Setpoints were provided for SBCS automatic performance for pre-core hot functional testing. Setpoints will have to be returned during power ascension or during dynamic plant conditions.

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UNIT	DATE	DOCUMENT TYPE	DOCUMENT EVENT	TITLE	CONCLUSION
13	07/21/83	SFR 1SF-078	See title column	The present control system logic does not allow on-line testing of quick close feature for the SBCS valves.	Valve quick-closing during power operation was not a design requirement of the SBCS. However, valve quick-closing can be tested at power levels of greater than 6% but less than 15% and greater than 26%. Test procedure provided. No design impact.
1	07/25/83	SFR 1SF-078	See title column	Request info for on-line testing of SBC valves.	CE response - Not a design feature but appears valves can be tested individually.
1	10/10/83	SFR 1SF-082	See title column	Change designated landing for pin.	Done. Corrected by DCPs on Unit 2 and 3. No impact.
2	01/13/84	SFR 2SF-1803	See title column	Spec. Bulletins not in manual. N001-13.02-136	Included Spec. Bulletins in manual. No impact.
2	01/18/84	SFR 2SF-1838	See title column	Potential continous alarm. Request setpoint change.	CE disagrees with suggested resolution for setpoint change.
13	01/24/84	Letter	See title column	V-CE-19651, V-CE-20436, B/CE-E-46273, B/CE-E-16293, BPC-CE (MOC 36256), B/CE-E-3514, BPC-CE (MOC 59756)	These letters have no impact on the SBCS.
2	04/06/84	SFR 2SF-2207	See title column	Request to change gain on channel A of Dual scaler card.	CE concurs. No impact.

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UNIT	DATE	DOCUMENT TYPE	DOCUMENT EVENT	TITLE	CONCLUSION
1	04/06/84	SFR 1SF-102	See title column	See SDCN S00090	See SDCN S00090. No impact.
2	04/10/84	SFR 2SF-2225	See title column	Request info from CE on tolerance of Allen Bradley Reset Card.	CE will provide for some money. APS says OK. No impact.
2	04/10/84	SFR 2SF-2227	See title column	Request CE provide setpoints for A-B reconnection timers.	CE did. No impact.
13	04/17/84	Letter	See title column	SBCS timers V-CE-21669	Provided base-line settings for use during plant startup.
13	04/17/84	SDCN S00090	See title column	N001-13.02-689-003	Change drawing to show correct power supply to module. No impact.
13	04/17/84	Letter V-CE-21669	See title column	SBCS timers	CE provided recommended list of preliminary settings of SBCS timers.
2	04/20/84	SFR 2SF-2226	See title column	2K-SFN-QY------ Foxboro Dynamic Compensator Cards	CE verified equation used on compensator cards. No impact.
2	05/01/84	SFR 2347	See title column	See SDCN S00450	See SDCN S00450. No impact.
3	05/07/84	SFR 3SF-001	See title column	Bias controllers have wrong scale (see 2SF-2407)	No impact.

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UNIT	DATE	DOCUMENT TYPE	DOCUMENT EVENT	TITLE	CONCLUSION
13	05/29/84	SDCN S00393	See title column	N001-13.02-125-3	Add "not" gate to turbine runback software output to provide correct output, correctly show the "loss of feed pump" and drop group inputs correctly, and interchange flip-flops for correct operation.
13	06/07/84	SDCN S00450	See title column	N001-13.02-718-2	Correct tag codes for Allen Bradley equipment. No impact.
2	06/15/84	SFR 2SF-2407	See title column	2J-SGN-FIC-1107, 1108	Change Bias scales on FW pump speed controllers (HIC). No impact in this effort.
2	07/10/84	SFR 2SF-2702	See title column	Requested jumper settings for Foxboro modules.	CE stated which settings to use and where they were. No impact.
13	07/26/84	Letter V-CE-30663	See title column	NSSS control systems response to turbine load index signal.	CE request of Bechtel to provide tag number, model number, range and signal dampening effects at output of Rosemount transmitters. Possibility of RRS and SBCS receiving a signal ripple of 215 PSI at 200 hertz.
13	07/26/84	Letter V-CE-21669	See title column	NSSS control systems response to turbine load index signal	CE addressed effects of pressure transmitter ripple signal to control system. CE asked for transmitter information for further evaluation on the effect on control system.

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UNIT	DATE	DOCUMENT TYPE	DOCUMENT EVENT	TITLE	CONCLUSION
13	08/07/84	FCR 82292N	See title column	Replacement parts for O-ring.	No impact.
2	08/10/84	SDCN S01109	See title column	N001-13.02-136-4	Add pages from supplier catalog to O-M manual (N001-13.02-136) to qualify for plant acceptance criteria. No impact.
2	08/10/84	SFR 2SF-2896	See title column	See SDCN S01109	See SDCN S01109. No impact.
13	08/11/84	FCR 82425N	See title column	Replacement parts for O-ring	No impact.
13	08/17/84	Letter V-CE-30790	See title column	HELBA effects on SBCS	Addressed partially HELBA effects on SBCS. No impact.
13	08/22/84	FCR 82779N	See title column	Specifies water grade to lubricate O-ring	No impact.
2	08/23/84	SFR 2SF-3130	See title column	See SDCN S01234	See SDCN S01234. No impact.
2	08/28/84	SDCN S01234	See title column	N001-13.02-257-1	Reflect as built to drawing which has duplicate wire no. P.C.O. No impact.
2	09/13/84	SFR 2SF-3643	See title column	Obtain replacement timers for FWCS.	No impact.
2	09/20/84	SFR 2SF-3344	See title column	See SDCN S01504	See SDCN S01504. No impact.
2	10/12/84	SDCN S01504	See title column	N001-13.02-852-1	Correct push button label. No impact.

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UNIT	DATE	DOCUMENT TYPE	DOCUMENT EVENT	TITLE	CONCLUSION
13	10/18/84	SFR 2SF-3504	See title column	See SDCNs S01911, S01912	See SDCNs S01911 and S01912. No impact.
2	10/25/84	SFR 2SF-3571 (NCR-SE5225)	See title column	Correctly rewire power supplies to correct changes from TCN-002	Done. No impact. (Statement says problem doesn't exist in U1 and "U2")
13	11/01/84	SDCN S01911	See title column	N001-13.02-253-2	Correct a wire termination. No impact.
13	11/01/84	SDCN S01912	See title column	N001-13.02-257-2	See SDCN S01911 11/1/84.
1	11/11/84	SFR 1SF-136	See title column	Resistor appears to be burnt.	CE says discolored resistor rating OK. Use as is. No impact.
2	11/13/84	SFR 2SF-3724	See title column	Reterminate wire to correct position.	Done. No impact.
1	11/17/84	SFR 1SF-138	See title column	Communication between RPCU and PMS computer not linking.	Clean board and use 8 bit signal. Done. No impact.
2	12/06/84	SFR 2SF-3892	See title column	Tolerance for Foxboro modules	CE agreed for 10% tolerance on certain Foxboro modules. No design impact.
2	03/14/85	SFR 2SF-4680	See title column	Manual master indicating lamp on M/A station would not light.	Install wire to get light. No impact.

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UNIT	DATE	DOCUMENT TYPE	DOCUMENT EVENT	TITLE	CONCLUSION
13	03/15/85	Letter APS 85-008-419 (SE	See title column	Inadvertent opening of SBCV'S.	Determined that power supply failures caused inadvertent opening of SBCV's loss of power to NSSS control system alarm added. (see letter VCE 32862 at 9/4/85)
2	04/18/85	SFR 2SF-4907	See title column	Wrong time duration on module during pre-op.	Replaced module. No impact.
2	05/01/85	SFR 2SF-5004	See title column	Request a tolerance of +/- .200V DC on external limits of Foxboro control cards.	CE does not concur.
1,2	05/24/85	SFR 2SF-5135	See title column	Valve permissive computer printout didn't agree with valve permissive.	Resolved by DCP 10/20 J-RJ-806. No impact.
2	05/24/85	SFR 2SF-5141	See title column	See SDCNs S03869 and S03870	See SDCNs S03869 and S03870. No impact.
2	05/26/85	SFR 2SF-5151	See title column	Can't locate wire/pin in bundle	CE says locate wire, do continuity and the hookup as originally required. No impact.
13	05/31/85	SDCN S03870	See title column	N001-13.02-729-1	Reflect as built (delete valves 7 and 8 from auto or off function). No impact.
13	05/31/85	SDCN S03869	See title column	N001-13.02-728-1	See SDCN S03870 above. No impact.

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UNIT	DATE	DOCUMENT TYPE	DOCUMENT EVENT	TITLE	CONCLUSION
13	07/02/85	SDCN S04109	See title column	N001-22.01-64-8	Add inlet and outlet info to control schematic for Ross valves for installation information. No impact.
13	07/02/85	SDCN S04108	See title column	N001-22.01-62-9	See SDCN S04109 above
1	08/02/85	EER 85-SF-013	See title column	Acceptance criteria for steam generator pressure variation during steady state is not achievable. Steam generator pressure not within setpoint +-15psi. (See conclusion for more info.)	Note that the established test condition, S.G. pressure stays below the SBCS setpoint pressure; therefore, all valves remained closed. CE concurs that the acceptance criteria is not acceptable. CE recommends retests. Test guidelines are provided. Retests will ensure that SBCS performs its intended functions - retest guidelines allow S.G. pressure to reach SBCS setpoints. No design impact.
2	08/06/85	SFR 2SF-5564 (NCR-SE5995)	See title column	See SDCN S04387	see SDCN S04387
13	08/12/85	Letter V-CE-32738	See title column	CE takes lead responsibility to provide recommendations for problems encountered with the SB valves.	Recommendations include: • Maintain a clean system. • Cycle valves once/month. • Add a spring under piston ring. • Increase pilot area. • Reduce corrosion. • Increase actuator size. • Increase supply pressure to actuator.

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UNIT	DATE	DOCUMENT TYPE	DOCUMENT EVENT	TITLE	CONCLUSION
13	08/21/85	SDCN S04387	See title column	N001-13.02-872-1	Change fuse from AGC Bussman to slo-blo to take in rush of current. No design impact.
13	08/23/85	DCP 10,2030J-FW-020	See title column	Revise low pressure setpoints	Feedwater system equipment. No design impact on SBCS.
13	08/30/85	Letter	See title column	Enhancement of steam bypass valves. B/ANPP-E-139615 MOC 399311	1. Add a wave spring under each valve. 2. Increase air supply pressure by replacing air supply filters.
13	09/04/85	Letter V-CE-32862	See title column	Loss of power alarm to NSSS control system cabinet	"Loss of power to NSSS cabinets" alarm provided.
1	09/05/85	EER 85-SF-018	See title column	SBCS modulation permissive available when main steam press. is within expected range.	Permissive program setpoint is revised so that it is greater than expected main steam pressure over full range of operation.

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UNIT	DATE	DOCUMENT TYPE	DOCUMENT EVENT	TITLE	CONCLUSION
1	09/23/85	EER 85-SF-021	See title column	Pressurize pressure response during the 50% loss of load test was different than CE's computer values.	Factors which would have contributed to the higher than predicted pressures: • TBV's quick opening delayed (5 sec. after turbine trip). • The controller setpoint is offset above the actual plant pressure. CE simulated these factors and the result confirmed the higher values. CE recommends actions to improve plant performance on loss of load transients. (for actions, see EER) OPS ACTION: W.O. #92322, W.O. #99133, 73PA-1SF09. Performed recommended actions via above documents.
1	10/03/85	Post trip review report	See title column	PTRR #1-85-005	Probable initiating event is a problem with the plant mutiplexer (PMUX). Due to the control power being lost momentarily and the lack of an open permissive, the SBCS did not generate a quick open signal. The SBCS loses power during a LOP. The system is not safety related. However, the loss of SBCS and its quick opening capability during a LOP needs to be reviewed.

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UNIT	DATE	DOCUMENT TYPE	DOCUMENT EVENT	TITLE	CONCLUSION
13	10/04/85	Letter V-CE-32687	See title column	Current steam flow setpoints are not optimal based on testing.	Optimum settings to be installed to insure that the longest possible design margins exist in the plant. CE provided the new setpoints.
1	10/17/85	EER	See title column	Missing data for steam flow vs. valve position (TER03).	This info. is not required. Not part of acceptance criteria.
1	10/24/85	Post trip review report	See title column	PTRR #1-85-007	During load rejection test, the steam bypass system over-reacted causing another quick open of the SBCV's. CE revised set point program for SBCS. See EER 85-SF-018.
13	12/20/85	SDCN S05580	See title column	Vendor (CE) FCR #1506 to install wave spring under piston ring of steam bypass valves. Ref: DCP 1,2,30M-SG-145	Incorporated by BR4.
1	12/20/85	EER 85-SF-037	See title column	During the trip on 12/20/85, the contribution of pressurizer pressure bias signal to SBCS may need to provide a larger input valve to modulate the SBCS valves more quickly.	Based on a 15-20 sec. opening time when in the modulating mode, the TBV's cannot respond fast enough to a rapid load reduction (~24%) to prevent pressurizer pressure from reaching the trip setpoint. No change to SBCS required. (The limiting factor is the modulating stroke speed of the valves.)

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UNIT	DATE	DOCUMENT TYPE	DOCUMENT EVENT	TITLE	CONCLUSION
1	12/23/85	Post trip review report	See title column	PTRR #1-85-010	While clearing annunicator alarm, the reactor tripped due to high pressurizer pressure. The SBCS was not able to respond quickly enough to mitigate Reactor Coolant System heatup. EER 85-SF-037 has been issued to evaluate potential changes.
13	01/22/86	Letter	See title column	SBCS grouping V-CE-33315	Regrouping of SBCV's.
13	01/23/86	SDCN S05739	See title column	Change bonnet bolt torque from 1125-1130 to 1650 FT-LBS. IAW CE memo KMS-60 DTG 1-21-86 (valves PV-1001 through PV-1008). Ref: PCR 86-13-SG-002. Paper change only.	Change incorporation by BR2. 50.59 not performed - probably due to old rules.
1	02/04/86	EER 86-SF-007	See title column	SBCS successive quick-open signals Rx trip 2-3-86.	WO #134914 and PCO/PCR #86-13-SF-002 accomplished to change TAVG-LCW setpoint for SBCV quick-open.

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UNIT	DATE	DOCUMENT TYPE	DOCUMENT EVENT	TITLE	CONCLUSION
1	02/04/86	EER 86-SF-007, V-CE-33384	See title column	Loss of feed pump at 60% resulted in plant trip-followed by a quick open of the steam bypass valves. The valves closed after the QO, followed by a second QO. This resulted in over cooling-causing SIS.	CE recommends revising the SBCS TAVE low set point (tag S314). New value is 56.51% (5.651V dc). This change should prevent Q.O. of the SBCS valves following a trip from ~75% power. This value is low enough that valves are modulating and high enough so that Q.O. block signal occurs in time to prevent second Q.O. following reactor trips from power levels above Q.O. block threshold.
1	02/10/86	LER 86-006	See title column	Reactor trip caused when a synchronization check blocked the transfer of non-essential loads during testing.	Commitment No. 035455 resulted in operators being instructed on how to respond to a loss of power to the SBCS instrument panel. No impact.
3	03/12/86	SFR 3SF-023	See title column	Logic cards not in acceptance criteria. Request change in tolerance.	CE justifies change to allow more tolerance.
13	03/21/86	SDCN S06251	See title column	SBCS wiring diagram	See SDCN S06387 - 4/1/86
13	03/21/86	SDCN S06250	See title column	SBCS Wiring diagram	See SDCN S06387 - 4/1/86
13	03/21/86	SDCN S06249	See title column	SBCS Wiring diagram	See SDCN S06387 - 4/1/86
13	03/21/86	SDCN S06248	See title column	SBCS Wiring diagram	See SDCN S06387 - 4/1/86

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UNIT	DATE	DOCUMENT TYPE	DOCUMENT EVENT	TITLE	CONCLUSION
13	03/21/86	SDCN S06247	See title column	SBCS Wiring diagram	See SDCN S06387 - 4/1/86
13	03/24/86	Letter	See title column	Turbine bypass valve document revision. V-CE-33569.	Marked up copies of SBCS engineering documents per request by S. Garret. No design impact.
13	04/01/86	SDCN S06387	See title column	SBCS hardware block diagram	DCP 10-SF-022 (attached to SDCN) provides for interchanging control functions to SBC valves to give more even steam loading for condenser - SDCN is for this change.
13	04/01/86	SDCN S06389	See title column	SBCS Hardware block diagram	See SDCN S06387 above.
13	04/01/86	SDCN S06385	See title column	SBCS Hardware block diagram	See SDCN S06387 above.
13	04/04/86	SDCN S06432	See title column	Changes calibration fine tuning for proper valve response, particularly for smooth positive response below 10% (Bailey AP2 Positioner). Ref: EER 85-SG-174. Paper change only. No PCR.	Incorporated by BR3. These changes may result in a greater demand signal from the control room being required to lift valve off seat. Cal. procedure should be checked for incorporation.

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UNIT	DATE	DOCUMENT TYPE	DOCUMENT EVENT	TITLE	CONCLUSION
2	05/25/86	Post trip review report	See title column	PTRR #2-86-001	Reactor power was reduced for main turbine overspeed testing. Inadequate operator control of feedwater caused reactor trip. SBCV 1007 may have opened with only the permissive signal, no modulation signal. (No further info./action was given by this PTRR)
13	05/26/86	SDCN S06895	See title column	N001-13.02-870-1	Correct reversed color coding on drawing. No design impact.
13	05/27/86	SDCN S06786	See title column	Incorporates vendor (Fisher) errata for calibration of type 546 and 546S electro-pneumatic transducers. Ref: PCR 86-13-SG-007. Paper change only.	Incorporated by BR3. 50.59 not performed - old rules. Cal procedure should be checked for incorporation.
13	06/03/86	SDCN S06862	See title column	Sys. Description, SBCS ANPP Units 1, 2, and 3	Updates which valves receive which signals. No impact.
3	06/06/86	SFR 3SF-032 (NCR-SE6561)	See title column	Refers to 3SF-023 resolution. Concern with excessively low voltage under full load now.	CE reviewed short and long term and said no effect.

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UNIT	DATE	DOCUMENT TYPE	DOCUMENT EVENT	TITLE	CONCLUSION
13	06/26/86	EER 86-SF-031	See title column	Add inputs to the SBCS TRBL alarm to indicate whether the SBCS master is "not in remote auto".	Disposition states that system design is adequate for plant operation and that no change is required. No design impact.
3	06/30/86	SFR 3SF-037	See title column	Missing wire and pin. (see 2SF-4680)	No impact.
13	06/30/86	V-CE-34044	See title column	Analyse SBCS for optimum performance.	Proposal to analyze SBCS setpoints. No impact.
2	07/01/86	Post trip review report.	See title column	PTTR #2-86-003	An exciter protection trip caused a generator and turbine trip. The SBCS did not generate a QO to the SBCV's and the reactor tripped. The SBCS did not function because there was dirt in the card slot which prevented the LCM card from making contact. No design impact.
13	07/07/86	EER 86-SF-033	See title column	Potential deficiencies in the SBCS resulting in reactor trips.	Info only disposition proposing alternatives for more desirable quick-open operation. Info only - no design impact.

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UNIT	DATE	DOCUMENT TYPE	DOCUMENT EVENT	TITLE	CONCLUSION
13	08/30/86	PCR86-13-SF-11, V-CE33629	See title column	100% load rejection test resulted in: 1) Fast bus transfer to offsite malfunctioned, 2) RCP coastdown caused reactor trip through trip through the core protection calc., (See next field for more info	3) Power was also momentarily interrupted to SBCS, 4) After power restoration, SBCS automatically initialized in manual and at 30% demand: The above responses resulted in "CYCLING" of the TBV's. To prevent the situations encountered during the 100% load rejection test, modify SBCS master and permissive channel controllers such that upon loss of power and restoration of power, the SBCS returns in manual mode at 0% demand. NOTE: PCR 86-13-SF-11 was cancelled by OPS on 9/22/86. JUSTIFICATION: • SBCS troubleshooting revealed that power interruption exceeds 2 seconds resulted in a transferred to "fail safe" mode prohibiting anomalous system behavior. • Fast bus transfer in U-2 at 100% power was successful

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UNIT	DATE	DOCUMENT TYPE	DOCUMENT EVENT	TITLE	CONCLUSION
13	09/18/86	EER 86-SF-041	See title column	Repetitive quick-open actuations in steam bypass control valves.	Disposition states that auto permissive timers are field set. EER recommends adjusting auto permissive timers T1 and T2 to 15 seconds from existing 10 second settings provided by CE. (see Letter V-CE-21669)
13	12/02/86	SDCN S07866	See title column	NSSS Control System Manual	Info to upgrade manual for new indicating recorder. No impact.
13	12/20/86	EER 86-SF-052	See title column	Determine method of preventing quick-open signal to allow SBCV's to be tested at power.	Per SBCS, tech manual (N001-13.02-2009-2), SBCS master controller should be in manual.. Cperational procedures 410P-1SF05, 420P-2SF05, 43OP-3SF05 shows proper positioning. No design impact.
13	12/30/86	FCR N-A4257	See title column	Added vendor part no. to drawing	No impact.
13	05/01/87	13SM-SG-009	See title column	Site Mod - Stm bypass control valves - Dwg 922701027, SBCV's 13JSGN-PV-1001-1006	Replaced needle valves with needle check valves for quicker open/close operation of SBPV's. Logs N001-2201-61, 62, 86, 125
13	05/05/87	SDCN #S08299	See title column	Log #N001-22.01-62	See site mod #13SM-SG-009. Improved open/close of SBPV's.
13	05/05/87	SDCN #S08301	See title column	Log #N001-22.01-125	See site mod #13SM-SG-009. Minor no impact.

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UNIT	DATE	DOCUMENT TYPE	DOCUMENT EVENT	TITLE	CONCLUSION
13	05/05/87	SDCN #S08300	See title column	Log #N001-22.01-64	See site mod #13SM-SG-009. Improved open/close of SBPV's.
13	05/05/87	SDCN #S08302	See title column	Log #N001-22.01-129	See site mod #13SM-SG-009. Minor no impact.
1	05/31/87	Post trip review	See title column	PTRR #1-87-002	SBCV PV-1004 did not operate as expected. The operator could not regain control after placing the master controller in local-auto and inserting a manual permissive. Later, valve 1004 was informally tested and responded as designed. No design impact.
13	06/08/87	Site Mod 1,2,3-SM-SF-008	See title column	Installation of transducers	Install lanyard transducers on steam bypass control valves for TDAS hookup. No design impact.
13	11/03/87	SDCN #S08966	See title column	Log #N001-22.01-125, Dwg 922701030, SBCV's 13JSGN, PV-1007,1008	Change type/model # of valve positioner. No impact. Logs N001-22.01-63, 64, 87, 129
13	11/03/87	SDCN #S08967	See title column	Log #N001-22.01-129	Change type/model # of valve positioner. No impact.

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UNIT	DATE	DOCUMENT TYPE	DOCUMENT EVENT	TITLE	CONCLUSION
13	11/03/87	SDCN S08468	See title column	Provides product specifications and instructions for Bailey AP4 positioner (replacement for old AP2 positioner). Ref: EER 87-SG-146, EAR 87-1933.	No ECE or 50.59 eval.
13	12/15/87	SDCN #A02117	See title column	Log #N001-22.01-125	See site mod #13SM-SG-009. Minor no impact.
13	12/15/87	SDCN #A02118	See title column	Log #N001-22.01-129	See site mod #13SM-SG-009. Minor no impact.
3	12/18/87	Post trip review report	See title column	PTRR #3-87-001	SBCV #5 did not open as required. The valve was sticking. No I&C concerns.
13	12/29/87	Letter 167-01819 - JWR/WM	See title column	Revisions of CE documents on SBCS.	Revise document to properly show as built plant configuration. No impact. (see also CE letter 33629 dt. 5/5/86 evaluation)
13	02/23/88	Letter V-CE-35620	See title column	Steam bypass control system documentation.	CE responds to document changes and questions not to modify SBCS controllers. No impact.
13	04/01/88	SDCN A00904	See title column	Reactor Power Cutback Module Assembly	Changed a part manufacturer from Dale to Bourns. (part is 1K +/- 5% trip pot)

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UNIT	DATE	DOCUMENT TYPE	DOCUMENT EVENT	TITLE	CONCLUSION
13	07/12/88	SDCN A01380	See title column	O&M Reactor Power Cutback System - 13-N001-13.02-138-8	Changed part no. for 5A power supply and changed part (dual mono. multivibrator) from Signetics to Fairchild.
13	07/12/88	SDCN A01378	See title column	Reactor Power Cutback Module Assembly - 13-N001-13.02-872-2	See SDCN A01380 above.
13	08/22/88	SDRN #175	See title column	DCP 10,20,30J-SF-022	Regrouped SBCV's from 1001-1004 and 1005-1007 to 1001, 3, 4, 6 and 1002, 5, 7, 8. No impact.
1	08/24/88	Post trip review report	See title column	PTRR #1-88-05	Main turbine tripped on a low stator cooling water flow signal, all SBCV's quick opened except for SBCV 1003. The apparent cause of the reactor trip was the premature closing of SBCV 1001 and 1004 and the malfunction of SBCV 1003. Evaluate RPCB/SBCS response per EER 85-SF-040.
1	09/19/88	LER 88-021	See title column	Reactor trip due to high pressurizer pressure	Turbine trip accompanied by improper SBCV operation resulting in reactor trip. Root cause of failure still under investigation.
13	11/01/88	SDCN #A01914	See title column	Log #N001-22.01-61	Transducer mounting bracket revision. No impact.

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UNIT	DATE	DOCUMENT TYPE	DOCUMENT EVENT	TITLE	CONCLUSION
13	11/01/88	SDCN #A01915	See title column	Log #N001-22.01-63	Transducer mounting bracket revision. No impact.
13	12/08/88	Site Mod 1,2,3-SM-SF-007	See title column	Installation of transmitters	Replace Foxboro E11GM-ISAE2-ELSP with Rosemont 1151GP9E2ZT0008FB. No design impact.
13	02/22/89	SDCN A02340	See title column	SBCS O-M Instruction Manual	A change to the Technical Manual to delete a modification CE anticipated to be implemented. Modification was not done so CE had to delete it from Tech. Man. No impact.
2	02/26/89	Post trip review report	See title column	PTTR #2-89-001	At 100% power, a FWCS malfunction resulted in a reactor trip. The SBCS responded as designed. No concerns regarding the SBCS.
13	06/26/81	Letter V-CE-14627	See title column	Addition of loss of feed pump status to SBCS (Hardware addition)	CE recommends testup using existing system. Procedure given in said document.

UNIT	DATE	DOCUMENT TYPE	DOCUMENT EVENT	TITLE	CONCLUSION
1	04/20/83	SBCV impact	SFR	1-SF-052	Quick-close needle valves were removed from SBCVs in order to meet close criteria times of 5 sec. Documents were changed.
1	07/06/83	SBCV impact	SFR	1-SG-163	SBCVs not operating during hot functional tests. Conclusion - debris - damage by debris necessitated repairs.
13	08/23/83	SBCV impact	Letter	V-CE-20421, V-SF-1068	Notification that CE is working on a test program proposal for testing SBCVs.
1	12/01/83	SBCV impact	SFR	1-SF-088	In-line filters were recommended for debris sensitive solenoid valves for turbine steam bypass control valves IF APS feels control air may not clean up quick enough.
1	10/08/84	SBCV impact	SFR	1-SG-328	Failure of SBCVs to operate. New lapped piston rings installed.
13	08/12/85	SBCV impact	Letter	V-CE-32738	Recommendation to improve SBCV operability. Includes CCI letter 7/26/85 which identifies high bonnet pressure as cause.
1	09/10/85	SBCV impact	EER	85-SG-123	No impact. Determining steam flow capabilities of SBCV.

NO. 2
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SBCV

UNIT	DATE	DOCUMENT TYPE	DOCUMENT EVENT	TITLE	CONCLUSION
13	09/20/85	SBCV impact	Letter	V-CE-32916	Report on operation of an SBCV at SONGS after modification of pilot valve to double capacity by increasing valve pilot area. This change is proposed by SMOD SG-019.
1,2	11/05/85	SBCV impact	Letter	V-CE-33087	CE quote for resurfacing steam bypass control valves' valve-plugs to reduce surface pitting. Unit 1. Letter implies Unit 2 was done previously.
2	08/28/86	SBCV impact	Plant Trip	PTRR 2-86-008	SBCV 02J-SGN-PV-1007 (bypass to ATM). Stayed open longer than expected. WR 181931 for valve op. investigation. Recommended PM to stroke SBCVs.
3	12/17/87	SBCV impact	Plant Trip	PTRR 3-87-001	SBCV #5 (03J-SGN-PV-1005) exhibited erratic behavior. Valve trouble shooting done by WR252757 - WO265837 indicated mechanical binding. Recommended increased PM stroke testing of SBCVs.
1	01/01/88	SBCV impact	SMOD	SM-SG-009	Installed needle valves in AU SBCV positioner air systems - to regulate open/close times of the SBCVs. Unit 1 - SMOD could not be completely closed because wave springs were not installed. Poor SBCV response contributed to Plant Trip No. 1-88-005.

UNIT	DATE	DOCUMENT TYPE	DOCUMENT EVENT	TITLE	CONCLUSION
3	01/01/88	SBCV impact	SMOD	SM-SG-009	Installed needle valves in AU SBCV positioner air systems - to regulate open/close times of the SBCVs.
n/a	05/13/88	SBCV impact	NRC IE Notice	NRC IEN 88-24	ASCO 83-14 SDVs - Not applicable to PVNGS - SBCVs or ADVs
2	07/01/88	SBCV impact	SMOD	SM-SG-009	Installed needle valves in AU SBCV positioner air systems - to regulate open/close times of the SBCVs.
1	08/21/88	SBCV impact	Plant Trip	PTRR 1-88-005	SBCS - Questionable response. Wave spring modification (PCP 13J-SG-045) was not complete and system timing tests (SMOD SM-SG-009) was not completely accomplished at the time of this trip. Not set optimumally. SBCV 1003 - W0300543 and/or W0285815 packing binding problem. EER 88-SF-040 to review system response deemed unique situation - no control sys changes needed - completion of valve modifications and setup were required. Recommended increasing SBCV stroking PM(410P-1SF05) frequency to 2 times monthly.

PALO VERDE
NUCLEAR GENERATING STATION

ATMOSPHERIC DUMP VALVE ENGINEERING ANALYSIS

March/April, 1989

REVISION 1

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ATMOSPHERIC DUMP VALVE ENGINEERING ANALYSIS

REVISION 1 SUMMARY

Figure VI-8:

Instructions:

Replace original Figure VI-8 with Revision 1 of Figure VI-8.

Summary of change:

Clarified assumptions made for packing gland follower friction for ADV-179

Table IX-1:

Instructions:

Replace original Table IX-1 with Revision 1 of Table IX-1

Summary of change:

Corrected typographical error on Page 2, Pneumatic Subsystem Corrective Action

UNIT 3 FAILURE ANALYSIS SUMMARY - REVISION 1

CONTRIBUTING FORCE	ADV-178	ADV-179	ADV-184	ADV-185
PLUG WEIGHT, LBf (1)	400	400	400	400
PISTON RING FRICTION, LBf (1)	635	635	635	635
UNBALANCED FORCE ON PLUG - INCLUDING BONNET PRESSURE, LBf (2)	3820	3820	3820	3820
TWO SPRING PRELOAD, LBf (1)	-------	1519	-------	-------
THREE SPRING PRELOAD, LBf (1)	3282	-------	3282	3282
PACKING AND/OR PACKING GLAND FOLLOWER FRICTION, LBf	3500 (3)	4600 (4)	1219 (1)	4600 (3)
TOTAL FORCE REQUIRED TO MOVE PLUG (LBf)	11,637	10,974	9,356	12,737
MAXIMUM FORCE AVAILABLE FROM ACTUATOR (95 psig nitrogen supply)	10,577	10,577	10,577	10,577
TOTAL POSSIBLE FORCE ON PLUG, LBf (With Maximum D/P of 95 psid) (positive is upward)	-1060	-397	1221	-2160
CALCULATED BONNET PRESSURE WHICH WOULD HAVE PRECLUDED VALVE OPERATION (psig) Regardless of Demand Signal & Time	Less Than 15 psig	Less Than 15 psig	Approximately 30 psig	Less Than 15 Psig

NOTES:
(1) THESE VALUES ARE BASED ON DESIGN VALUES
(2) THESE VALUES ARE BASED ON A 15 PSIG BONNET PRESSURE.
(3) THESE VALUES WERE DETERMINED DURING TESTING.
(4) NO TESTING WAS PERFORMED ON ADV-179 SINCE IT'S ACTUATOR WAS DAMAGED. TWO OTHER VALVES (ADV-178 AND ADV-185) ALSO HAD THEIR PACKING GLAND SEIZED TO THE VALVE STEM. ASSUMING THE HIGHEST OBSERVED VALUE OF FRICTION IS THE MOST CONSERVATIVE APPROACH. THIS WOULD BE THE FRICTION OBSERVED ON ADV-185, OR, 4600 LBf.

PROBLEMS NOTED DURING ADV INVESTIGATION	ROOT CAUSE(S)	CORRECTIVE ACTIONS	
		ACTIONS TO BE TAKEN PRIOR TO UNIT RESTART FROM CURRENT OUTAGES	ACTIONS TO BE TAKEN FOLLOWING CURRENT OUTAGES
ATMOSPHERIC DUMP VALVES			
A. EXCESSIVE BONNET PRESSURE REQUIRING HIGH FORCES TO OPEN VALVES (U1 ADV-184)	A1. PISTON RING LEAKAGE GREATER THAN RELIEVING CAPACITY OF THE PILOT VALVE RESULTING IN EXCESSIVE BONNET PRESSURE	A1. INCORPORATE CCI RECOMMENDED MODIFICATIONS a) Increase plug pilot capacity b) Modify piston ring c) Modify disk stack to provide a smooth Cv transition A2. INCREASE NITROGEN REGULATOR PRESSURE FROM 95 TO 105 PSIG A3. INSTALL BONNET PRESSURE TAPS IN UNIT 3 ADVs	A1. PERFORM MONTHLY STROKING PROGRAM (30% STROKE) and PERFORM WEEKLY BONNET PRESSURE CHECKS A2. EVALUATE DATA FROM STROKING PROGRAM/BONNET PRESSURE CHECKS AND ADJUST FREQUENCY OF PERFORMANCE AS REQUIRED A3. PERFORM QUARTERLY ST (100% STROKE)
B. HIGH FORCES TO OPEN VALVES (U3 ADV-178 & ADV-185)	B1. TESTING PROGRAM REVEALED EXCESSIVE PACKING/PACKING FOLLOWER FRICTION B2. DISASSEMBLY OF UNIT 3 ADV ACTUATORS REVEALED 3 OF 4 ACTUATORS CONTAINED 3 SPRINGS INSTEAD OF 2 (CURRENT DESIGN)	B1. INSPECT UNIT 1 AND 2 ACTUATORS AND REMOVE EXTRA SPRING IF FOUND B2. REMOVE EXTRA SPRINGS IN THE 3 UNIT 3 ADVs B3. INITIATE INCIDENT INVESTIGATION REPORT TO DETERMINE WHY THE EXTRA SPRING WAS IN THE ACTUATORS (Ref. IIR #3-1-89-030)	B1. EVALUATE DATA FROM STROKING PROGRAM TO ENSURE HIGH FORCES DO NOT OCCUR
C. VALVE OSCILLATIONS (U1 ADV-178, -184 and -179)	C1. MAJOR FACTORS THAT CONTRIBUTE TO THE OSCILLATIONS ARE: a) Cv transition in disk stack provides a high stepwise force input to plug b) Relatively low actuator "stiffness" due to 95 psig nitrogen supply pressure	C1. INCORPORATE CCI RECOMMENDED MODIFICATIONS a) Increase plug pilot capacity b) Modify piston ring c) Modify disk stack to provide a smooth Cv transition C2. INCREASE NITROGEN REGULATOR PRESSURE FROM 95 TO 105 PSIG	

PROBLEMS NOTED DURING ADV INVESTIGATION	ROOT CAUSE(S)	CORRECTIVE ACTIONS	
		ACTIONS TO BE TAKEN PRIOR TO UNIT RESTART FROM CURRENT OUTAGES	ACTIONS TO BE TAKEN FOLLOWING CURRENT OUTAGES
PNEUMATIC SUBSYSTEM			
A. NITORGEN REGULATORS EXHIBIT SEAT LEAKAGE CAUSING HIGH DOWNSTREAM PRESSURE	A1. WEAR AND/OR DEBRIS DAMAGED THE SOFT SEAT A2. NO PM EXISTED TO IDENTIFY PROBLEMS OR DEGREDATION OF SYSTEM	A1. REPLACED DAMAGED/WORN REGULATOR PARTS A2. VERIFY NITROGEN SUBSYSTEM CLEANLINESS A3. DEVELOP AND PERFORM A PM TASK TO ADJUST REGULATOR SETPOINT	A1. MONITOR PERFORMANCE OF REGULATORS DURING OPERATION OF ATMOSPHERIC DUMP VALVES A2. PERFORM PM AS REQUIRED A3. NUCLEAR ENGINEERING DEPARTMENT PERFORM OVERALL DESIGN REVIEW OF ADV SUBSYSTEM
B. EXCESSIVE NITROGEN LEAKAGE	B1. LEAKING FITTINGS B2. REGULATOR NOT CONTROLLING AT THE CORRECT PRESSURE B3. RELIEF VALVE LEAKING OR WEEPING AT LOWER THAN 125 PSIG SET PRESSURE B4. NO PERIODIC TESTING TO DETERMINE STATUS OF SYSTEM	B1. NITROGEN ACCUMULATOR DROP TEST TO BE PERFORMED ON ALL VALVES. LEAKING FITTINGS AND RELIEF VALVE PROBLEMS TO BE CORRECTED B2. INSTITUTE CORRECTIVE ACTIONS REQUIRED FOR REGULATORS B3. DEVELOP AND IMPLEMENT QUARTERLY NITORGEN LEAKAGE ST B4. DEVELOP ST AND TEST SECTION XI CHECK VALVES FOR LEAKAGE	B1. PERFORM QUARTERLY NITROGEN LEAKAGE ST B2. EVALUATE THE NEED FOR MODIFICATION TO INSTALL DOUBLE VALVE ISOLATION (INCLUDING A LEAKOFF VALVE) BETWEEN ACCUMULATOR AND HIGH PRESSURE NITROGEN SYSTEM. B3. NUCLEAR ENGINEERING DEPARTMENT PERFORM OVERALL DESIGN REVIEW OF ADV SUBSYSTEM
C. DIFFERENT POSITIONERS EXHIBIT DIFFERENT CONTROL CHARACTERISTICS	C1. NO PM EXISTED TO ADJUST OR MONITOR CALIBRATION OF POSITIONERS	C.1 DEVELOP AND PERFORM A PM TASK TO CALIBRATE AND ADJUST THE POSITIONERS	C1. MONITOR PERFORMANCE OF POSITIONERS DURING MONTHLY STROKING OF ADVs C2. PERFORM PM AS REQUIRED (if deficiencies are noted) AND DURING REFUELING OUTAGES
D. NITROGEN AND INSTRUMENT AIR SYSTEM CLEANLINESS – NITROGEN REGULATOR EXPERIENCED FAILURE DUE TO DEBRIS IN NITROGEN LINE	D1. INDETERMINATE - PROBABLE INSUFFICIENT FLUSH FOLLOWING MAINTENANCE OR CONSTRUCTION ACTIVITIES	D1. FLUSH/SAMPLE NITROGEN SUBSYSTEM, IA AND HIGH PRESSURE NITROGEN SUPPLIES TO VERIFY CLEANLINESS D2. INSTALL 3 MICRON INSTRUMENT AIR FILTER IN MSSS SUPPLY LINE TO ADVs. (UNIT 3 ONLY – COMPLETED IN UNITS 1 AND 2) D3. IMPLEMENT CORRECTIVE ACTIONS NOTED IN INSTRUMENT AIR REPORT (NED REPORT)	D1. IMPLEMENT COMMITMENTS MADE BY ANPP IN RESPONSE TO GENERIC LETTER 88-14
EQUIPMENT QUALIFICATION AND CONFIGURATION CONTROL ISSUES			
A. UNQUALIFIED GAGES LEFT ON POSITIONERS DURING OPERATION	A1. UNDER INVESTIGATION – SEE IIR #3-1-89-030	A1. REMOVE UNQUALIFIED GAGES PER VENDOR TECH. MANUAL	A1. UNDER INVESTIGATION -- SEE IIR #3-1-89-030
B. ADDITIONAL SPRING FOUND IN U-3 ACTUATORS	B1. UNDER INVESTIGATION – SEE IIR #3-1-89-030	B1. REMOVE ADDITIONAL SPRING FOUND IN ACTUATORS	B1. UNDER INVESTIGATION -- SEE IIR #3-1-89-030
C. BUNA-N "O" RINGS FOUND IN U-3 ACTUATORS (SHOULD HAVE BEEN CHANGED TO VITON BEFORE OPERATION)	C1. UNDER INVESTIGATION – SEE IIR #3-1-89-030	C1. REPLACE ANY UNIT 3 BUNA-N "O" RINGS WITH VITON	C1. UNDER INVESTIGATION -- SEE IIR #3-1-89-030

PROBLEMS NOTED DURING ADV INVESTIGATION	ROOT CAUSE(S)	CORRECTIVE ACTIONS	
		ACTIONS TO BE TAKEN PRIOR TO UNIT RESTART FROM CURRENT OUTAGES	ACTIONS TO BE TAKEN FOLLOWING CURRENT OUTAGES
PACKLESS ISOLATION VALVES			
A. CURRENT ORIENTATION OF VALVES CAN RESULT IN INABILITY TO OPERATE VALVES IN SOME OPERATIONAL CONDITIONS	A1. VALVE INSTALLED SO THAT IT EXPERIENCES BI-DIRECTIONAL FLOW	A1. NONE	A1. RE-ORIENT VALVES TO ELIMINATE BI-DIRECTIONAL FLOW THROUGH THE VALVES
ADV OPERATING PROCEDURES			
A. INCONSISTENT UNDERSTANDING OF ADV OPERATION AND OPERATING CHARACTERISTICS	A1. SEE INCIDENT INVESTIGATION REPORT IIR #2-3-89-001	A1. SEE INCIDENT INVESTIGATION REPORT IIR #2-3-89-001	A1. SEE INCIDENT INVESTIGATION REPORT IIR #2-3-89-001
B. PROBLEMS IN MANUALLY OPERATING THE ADVs	B1. SEE INCIDENT INVESTIGATION REPORT IIR #2-3-89-001	B1. SEE INCIDENT INVESTIGATION REPORT IIR #2-3-89-001	B1. SEE INCIDENT INVESTIGATION REPORT IIR #2-3-89-001
MISCELLANEOUS			
A. ADV BLOCK VALVES NEVER INSTALLED	A1. PREVIOUS DECISION	A1. NONE	A1. INSTALL BLOCK VALVES UPSTREAM ADVs