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UNION ELECTRIC

May 29, 1996

Donald F. Schnell
Senior Vice President
Nuclear

U. S. Nuclear Regulatory Commission
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Gentlemen:

ULNRC-3382

CALLAWAY PLANT
DOCKET NUMBER 50-483
MAIN FEEDWATER CONTROL AND BYPASS VALVES
UNREVIEWED SAFETY QUESTION

Union Electric Company herewith transmits an application for amendment to Facility Operating License Number NPF-30 for the Callaway Plant.

This amendment application describes an unreviewed safety question associated with a plant modification that will reduce the single failure trip potential for the main feedwater control and bypass valves. The modification results in a slight reduction in calculated core damage frequency and a small increase in the probability of occurrence of a malfunction of equipment important to safety. Pursuant to 10CFR50.59(c)(2), this amendment application is required since this modification constitutes an unreviewed safety question.

Attachments 1 through 4 provide the Safety Evaluation, Significant Hazards Evaluation, Environmental Consideration, and proposed FSAR changes, respectively, in support of this amendment request. We have determined that, although this amendment application is required since it involves an unreviewed safety question, there is no significant hazard consideration as determined per 10CFR50.92. Pursuant to 10CFR51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of this amendment.

A001

Review and approval of this amendment application is requested by September 1, 1996 to support the Refuel 8 outage schedule. If you have any questions concerning the amendment application, please contact us.

Very truly yours,

Alan C. Passwater
for Donald F. Schnell

WEK/

Attachments: 1) Safety Evaluation
2) Significant Hazards Evaluation
3) Environmental Consideration
4) Proposed FSAR Changes

STATE OF MISSOURI)
) S S
COUNTY OF CALLAWAY)

Alan C. Passwater, of lawful age, being first duly sworn upon oath says that he is Manager, Licensing and Fuels (Nuclear) for Union Electric Company; that he has read the foregoing document and knows the content thereof; that he has executed the same for and on behalf of said company with full power and authority to do so; and that the facts therein stated are true and correct to the best of his knowledge, information and belief.

By Alan C. Passwater
Alan C. Passwater
Manager, Licensing and Fuels
Nuclear

SUBSCRIBED and sworn to before me this 29th day of May, 1996.

Barbara J. Pfaff
BARBARA J. PFAFF
NOTARY PUBLIC — STATE OF MISSOURI
MY COMMISSION EXPIRES APRIL 22, 1997
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ATTACHMENT 1

SAFETY EVALUATION

SAFETY EVALUATION

Introduction

This amendment application reflects an unreviewed safety question associated with a plant modification that will reduce the single failure trip potential for the main feedwater control and bypass valves. Reducing the single failure trip potential for these valves increases the probability of occurrence of a malfunction of equipment important to safety. Pursuant to 10CFR50.59(c)(2), this amendment application is required since this modification constitutes an unreviewed safety question. Commission approval is required prior to implementation.

Background

Each of the four steam generator feedwater lines contains a main feedwater isolation valve (MFIV) and a main feedwater control valve (MFCV) in series. Each MFCV has a main feedwater bypass valve (MFBV) in parallel with it. The MFCVs are air-operated angle valves that control feedwater flow to the steam generators between 20% and full power. The MFBVs are air-operated globe valves used to control flow to the steam generators up to approximately 25% power. The main feedwater control and bypass valves (MFC&BVs) are located in the turbine building.

The safety function of the MFC&BVs credited in accident analysis is to provide a backup to the MFIVs for the potential failure of an MFIV to close. This safety function is accomplished on receipt of a feedwater isolation actuation signal (FWIS) via an emergency closure signal from the Engineered Safety Feature Actuation System (ESFAS). For emergency closure, solenoid valves on each MFC&BV release air pressure and cause the valve to close.

The MFIV is a 14-inch gate valve with a dual-redundant hydraulic actuator. Two separate pneumatic/hydraulic power trains are provided for each MFIV, each receiving a signal from a separate ESFAS channel. Either of the dual-redundant power trains is capable of closing the MFIV. The assumed single failure of one of the redundant MFIV actuation trains will not prevent the MFIV from closing.

Since proper operation of the MFIVs is assumed, the functions performed by the MFC&BVs are considered backup and diverse functions to the MFIVs and, therefore, are non-primary success

path functions in the context of criterion 3 of the NRC Policy Statement on Technical Specifications.

Existing Configuration

The existing pneumatic valve control configuration for the MFC&BVs consists of two normally-closed ASCO three-way solenoid valves energized from separate Class 1E, 125 VDC sources. FWIS actuation causes solid state protection system (SSPS) slave relays to energize and open normally-closed contacts. This interrupts power to the two normally-energized solenoid valves in the MFC&BV pneumatic control system.

The solenoid valves are connected in series so that de-energizing either valve (1/2 logic) opens a path from the booster relay (for the MFCVs) or valve actuator (for the MFBVs) to atmosphere. This results in depressurizing the associated reverse-acting actuator, which allows a spring to force the control valve to a closed position. Valve closure time is $\leq$ 5 seconds.

Modified Configuration

The modified pneumatic valve control configuration for the MFC&BVs will consist of two ASCO universal solenoid valves connected in parallel. Either valve must be energized to align the air source to the booster relay or valve actuator. De-energization of both solenoid valves (2/2 logic) will be required to vent the booster relay or valve actuator to atmosphere, which in turn will allow a spring to force the control valve to a closed position. This configuration will prevent a single solenoid or power supply failure from causing a plant trip.

The modification will not change the conditions that initiate a FWIS, nor will it affect the basic function of feedwater isolation. The modification does not add to or delete from the equipment actuated by a FWIS.

Unreviewed Safety Question Evaluation

Operation of Callaway Plant in accordance with these changes would:

(1) Involve an increase in the probability of occurrence or the consequences of an accident or malfunction of equipment important to safety previously evaluated in the Safety Analysis Report.

The Callaway safety analysis assumes the MFC&BVs close during certain events in order to terminate fluid inventory addition to faulted steam generators and preclude the diversion of auxiliary feedwater to the main feedwater system. This feature is necessary because each feedwater line at Callaway is equipped with only one MFIV. It should be noted that the safety analysis simply requires the MFC&BVs to close and does not prescribe a mechanism for accomplishing that action.

The following are accidents that credit feedwater isolation or AFW addition. There is no impact on the consequences of each accident by the proposed modification.

- Feedwater System Malfunctions That Result In An Increase In Feedwater Flow
- Inadvertent Opening Of A Steam Generator Relief or Safety Valve
- Steam System Piping Failure
- Loss of Nonemergency AC Power to the Station Auxiliaries
- Loss of Normal Feedwater Flow
- Feedwater System Pipe Break
- Decrease in Reactor Coolant Inventory

This modification will not change the radiological consequences of FSAR Chapter 15 accidents because the NSSS response is unaffected. Therefore, there will be no increase in the consequences of an accident evaluated previously in the FSAR.

An analysis was performed to quantify the impact of the proposed modification on the probability of MFCV failure (closure) during normal plant operation. Comparison of this failure probability for the existing design (1.20E-1 per year) versus the proposed design (6.99E-2 per year) indicates that the percentage reduction in the system failure probability at power is 41.75%. Thus, the proposed design results in a reduction in the probability of inadvertent main feedwater control valve failures at power and hence, a reduction in the probability of a reactor trip and subsequent challenges to other safety systems.

While this modification reduces the probability of a reactor trip, it slighty increases the unavailability of the feedwater isolation function. This is because the original design required actuation of only one FWIS train to close the MFC&BVs, whereas the new design requires actuation of both trains. The impact of the modification on the probability of incurring a feedwater isolation failure was therefore

quantified, utilizing PRA techniques. Fault trees were developed for both the new and existing designs. Failure probabilities for each event were then obtained from the IPE and utilized to calculate failure probabilities for the feedwater isolation safety function. This calculation considered hardware failures only, i.e., failure of an MFIV to close after receiving an actuation signal. The failure probability of feedwater isolation, based on the proposed design, was determined to be 6.1E-5 per demand (1 event every 16,400 demands). The existing design was found to have a failure probability of 2.8E-5 per demand (1 event every 35,700 demands). Since the PRA calculations result in a small increase in the feedwater isolation failure probability, it will be presumed that the modification results in an unreviewed safety question.

(2) Not create the possibility for an accident or malfunction of equipment of a different type than any previously evaluated in the Safety Analysis Report.

The modification maintains the present de-energize-to-actuate configuration of the MFC&BV trip solenoid valves.

The MFIVs are not affected by this modification since their contribution to the feedwater isolation safety function is unchanged. MFC&BV malfunctions considered in the FSAR include failure of a main feedwater regulating valve that results in overfeeding a steam generator (fail-open), and valve malfunctions that result in a loss of normal feedwater flow to the steam generators (fail-close).

Reconfiguring the MFC&BV trip solenoids from series to parallel will have no impact on these malfunctions because the control valves themselves will not be modified. While not explicitly considered in the safety analysis, the only other failure mode possible would be fail-as-is. This failure mode is bounded by those identified above.

Thus, the proposed modification does not create the possibility of an accident of a different type than any previously evaluated or create the possibility of a different type of feedwater isolation malfunction.

(3) Not involve a reduction in the margin of safety as defined in the basis for any technical specification.

Credit is taken in the accident analyses for the MFIVs to close on demand for feedwater isolation. Because of this, the MFIVs have been incorporated into the Callaway Technical Specifications. Action Statements and surveillance

requirements have been developed to assure the availability of the valves when needed.

The MFC&BVs are not addressed by any of the Callaway Technical Specifications or their bases. Therefore, this modification will not reduce the margin of safety as defined in the basis for any technical specifications.

Justification for Approval of Proposed Change

The licensing and design basis for the MFC&BVs is to provide a diverse backup to the MFIVs, thereby assuring feedwater isolation following feedwater system malfunctions or main steam/feedline breaks.

While this modification reduces the probability of a reactor trip, it also increases the failure probability of the feedwater isolation function. This occurs because the new design requires actuation of both FWIS trains, whereas the original design requires actuation of only one train to close the MFCBVs. The impact of the modification on the probability of incurring a feedwater isolation failure was therefore quantified utilizing PRA techniques.

While the feedwater isolation failure on demand probability increases due to the proposed modification, the probability is still low. In fact, when the feed and steam line break event trees, from the Callaway PRA, were requantified, there was no discernible increase in core damage frequency (CDF). Further, the proposed modification will result in a slight reduction in the CDF because of the decreased probability of a spurious reactor trip.

Conclusion

Based on the information presented above, the proposed amendment will not adversely affect or endanger the health or safety of the general public.

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ATTACHMENT 2

SIGNIFICANT HAZARDS EVALUATION

SIGNIFICANT HAZARDS EVALUATION

This amendment application reflects an unreviewed safety question associated with a plant modification that will reduce the single failure trip potential for the main feedwater control and bypass valves. Reducing the single failure trip potential for these valves increases the probability of occurrence of a malfunction of equipment important to safety. Pursuant to 10CFR50.59(c)(2), this amendment application is required since this modification constitutes an unreviewed safety question. Commission approval is required prior to implementation.

Background

Each of the four steam generator feedwater lines contains a main feedwater isolation valve (MFIV) and a main feedwater control valve (MFCV) in series. Each MFCV has a main feedwater bypass valve (MFBV) in parallel with it. The MFCVs are air-operated angle valves that control feedwater flow to the steam generators between 20% and full power. The MFBVs are air-operated globe valves used to control flow to the steam generators up to approximately 25% power. The main feedwater control and bypass valves (MFC&BVs) are located in the turbine building.

The safety function of the MFC&BVs credited in accident analysis is to provide a backup to the MFIVs for the potential failure of an MFIV to close. This safety function is accomplished on receipt of a feedwater isolation actuation signal (FWIS) via an emergency closure signal from the Engineered Safety Feature Actuation System (ESFAS). For emergency closure, solenoid valves on each MFC&BV release air pressure and cause the valve to close.

The MFIV is a 14-inch gate valve with a dual-redundant hydraulic actuator. Two separate pneumatic/hydraulic power trains are provided for each MFIV, each receiving a signal from a separate ESFAS channel. Either of the dual-redundant power trains is capable of closing the MFIV. The assumed single failure of one of the redundant MFIV actuation trains will not prevent the MFIV from closing.

Since proper operation of the MFIVs is assumed, the functions performed by the MFC&BVs are considered backup and diverse functions to the MFIVs and, therefore, are non-primary success path functions in the context of criterion 3 of the NRC Policy Statement on Technical Specifications.

Existing Configuration

The existing pneumatic valve control configuration for the MFC&BVs consists of two normally-closed ASCO three-way solenoid valves energized from separate Class 1E, 125 VDC sources. FWIS actuation causes solid state protection system (SSPS) slave relays to energize and open normally-closed contacts. This interrupts power to the two normally-energized solenoid valves in the MFC&BV pneumatic control system.

The solenoid valves are connected in series so that de-energizing either valve (1/2 logic) opens a path from the booster relay (for the MFCVs) or valve actuator (for the MFBVs) to atmosphere. This results in depressurizing the associated reverse-acting actuator, which allows a spring to force the control valve to a closed position. Valve closure time is $\leq$ 5 seconds.

Modified Configuration

The modified pneumatic valve control configuration for the MFC&BVs will consist of two ASCO universal solenoid valves connected in parallel. Either valve must be energized to align the air source to the booster relay or valve actuator. De-energization of both solenoid valves (2/2 logic) will be required to vent the booster relay or valve actuator to atmosphere, which in turn will allow a spring to force the control valve to a closed position. This configuration will prevent a single solenoid or power supply failure from causing a plant trip.

The modification will not change the conditions that initiate a FWIS, nor will it affect the basic function of feedwater isolation. The modification does not add to or delete from the equipment actuated by a FWIS.

Evaluation

The proposed changes do not involve a significant hazards consideration because operation of Callaway Plant in accordance with these changes would not:

1. Involve a significant increase in the probability or consequences of an accident previously evaluated.

The Callaway safety analysis assumes the MFC&BVs close during certain events in order to terminate fluid inventory addition to faulted steam generators and thereby preclude the diversion of auxiliary feedwater to the main feedwater system. This feature

is necessary because each feedwater line at Callaway is equipped with only one MFIV. It should be noted that the safety analysis simply requires the valves to close and does not prescribe a mechanism for accomplishing that action.

The following are accidents that credit feedwater isolation or AFW addition. There is no impact by the proposed modification on the consequences of each accident.

- Feedwater System Malfunctions That Result In An Increase In Feedwater Flow
- Inadvertent Opening Of A Steam Generator Relief or Safety Valve
- Steam System Piping Failure
- Loss of Nonemergency AC Power to the Station Auxiliaries
- Loss of Normal Feedwater Flow
- Feedwater System Pipe Break
- Decrease in Reactor Coolant Inventory

The modification will not change the radiological consequences of FSAR Chapter 15 accidents because the feedwater isolation function (and NSSS break response) has not changed. Therefore, there will be no increase in the consequences of an accident evaluated previously in the FSAR.

An analysis was performed to quantify the impact of the proposed modification on the probability of MFCV failure (closure) during normal plant operation. Comparison of this failure probability for the existing design (1.20E-1 per year) versus the proposed design (6.99E-2 per year) indicates that the percentage reduction in the system failure probability at power is 41.75%. Thus, the proposed design results in a reduction in the probability of inadvertent MFCV failures at power and hence, a reduction in the probability of a reactor trip and subsequent challenges to other safety systems.

While this modification reduces the probability of a reactor trip, it slighty increases the unavailability of the feedwater isolation function. This is because the original design required actuation of only one FWIS train to close the MFC&BVs, whereas the new design requires actuation of both trains. The impact of the modification on the probability of incurring a feedwater isolation failure was therefore quantified, utilizing PRA techniques. Fault trees were developed for both the new and existing designs. Failure probabilities for each event were then obtained from the IPE and utilized to calculate failure probabilities for the feedwater isolation safety function. This

calculation considered hardware failures only, i.e., failure of an MFIV to close after receiving an actuation signal. The failure probability of feedwater isolation, based on the proposed design, was determined to be 6.1E-5 per demand (1 event every 16,400 demands). The existing design was found to have a failure probability of 2.8E-5 per demand (1 event every 35,700 demands). Therefore, this modification will not significantly increase the probability or consequences of an accident evaluated previously in the FSAR.

2. Create the possibility of a new or different kind of accident from any previously evaluated.

The modification maintains the present de-energize-to-actuate configuration of the MFC&BV trip solenoid valves.

Thus, the proposed modification does not create the possibility of an accident of a different type than any previously evaluated.

3. Involve a significant reduction in a margin of safety.

Credit is taken in the accident analyses for the MFIVs to close on demand for feedwater isolation. Because of this, the MFIVs have been incorporated into the Callaway Technical Specifications. Action Statements and surveillance requirements have been developed to assure the availability of the valves when needed.

The MFC&BVs are not addressed by any of the Callaway Technical Specifications or their bases. Therefore, this modification will not involve a significant reduction in the margin of safety as defined in the basis for any technical specifications.

Conclusion

Based upon the preceding information, it has been determined that the proposed changes to the Final Safety Analysis Report do not involve a significant increase in the probability or consequences of an accident previously evaluated, create the possibility of a new or different kind of accident from any accident previously evaluated, or involve a significant reduction in a margin of safety. Therefore it is concluded that the proposed changes meet the requirements of 10CFR50.92(c) and do not involve a significant hazards consideration.

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ATTACHMENT 3

ENVIRONMENTAL CONSIDERATION

ENVIRONMENTAL CONSIDERATION

This amendment application reflects an unreviewed safety question associated with a plant modification that will reduce the single failure trip potential for the main feedwater control and bypass valves. Reducing the single failure trip potential for these valves increases the probability of occurrence of a malfunction of equipment important to safety. Pursuant to 10CFR50.59(c)(2), this amendment application is required since this modification constitutes an unreviewed safety question. Commission approval is required prior to implementation.

The proposed amendment involves changes with respect to the use of facility components located within the restricted area, as defined in 10 CFR 20. Union Electric has determined that the proposed amendment does not involve:

(1) A significant hazard consideration, as discussed in Attachment 2 of this amendment application;

(2) A significant change in the types or significant increase in the amounts of any effluents that may be released offsite;

(3) A significant increase in individual or cumulative occupational radiation exposure.

Accordingly, the proposed amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or enviromental assessment need be prepared in connection with the issuance of this amendment.

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ATTACHMENT 4

PROPOSED FSAR CHANGES

FSAR Page 7.1-13
Figure 7.2-1 (Sheet 13)
Figure 7.2-1 (Sheet 14)
FSAR Page 10.4-23
Table 10.4-7
Figure 10.4-6 (Sheet 1)

FSAR CN 95-043

b. Main turbine trip system

Testing of the main turbine trip function under power operation is discussed in Section 10.2.3.6.

c. Closing the main steam isolation valves

See Table 7.1-3.

d. Closing the main feedwater isolation valves

See Table 7.1-3.

e. Closing the feedwater control valves

These valves are routinely tested during refueling outages. To close them at power would adversely affect the operability of the plant. The verification of operability of feedwater control valves at power is ensured by confirmation of proper operation of the steam generator water level control system. The actuation function of the solenoids, which provides the closing function, is periodically tested at power, as discussed in Section 7.3. The operability of the slave relay which actuates the solenoid, which is the actuating device, is verified during this test. Although the closing of these control valves is blocked when the slave relay is tested, all functions are tested to ensure that no electrical malfunctions have occurred which could defeat the protective function. It is noted that the solenoids work on the de-energize-to-actuate principle, ~~so that~~ The feedwater control valves will fail close ~~upon~~ on ~~either~~ the loss of electrical power to both of the solenoids or loss of air pressure.

Based on the above, the testing of the isolating function of feedwater control valves meets the guidelines of Regulatory Position D.4 of Regulatory Guide 1.22.

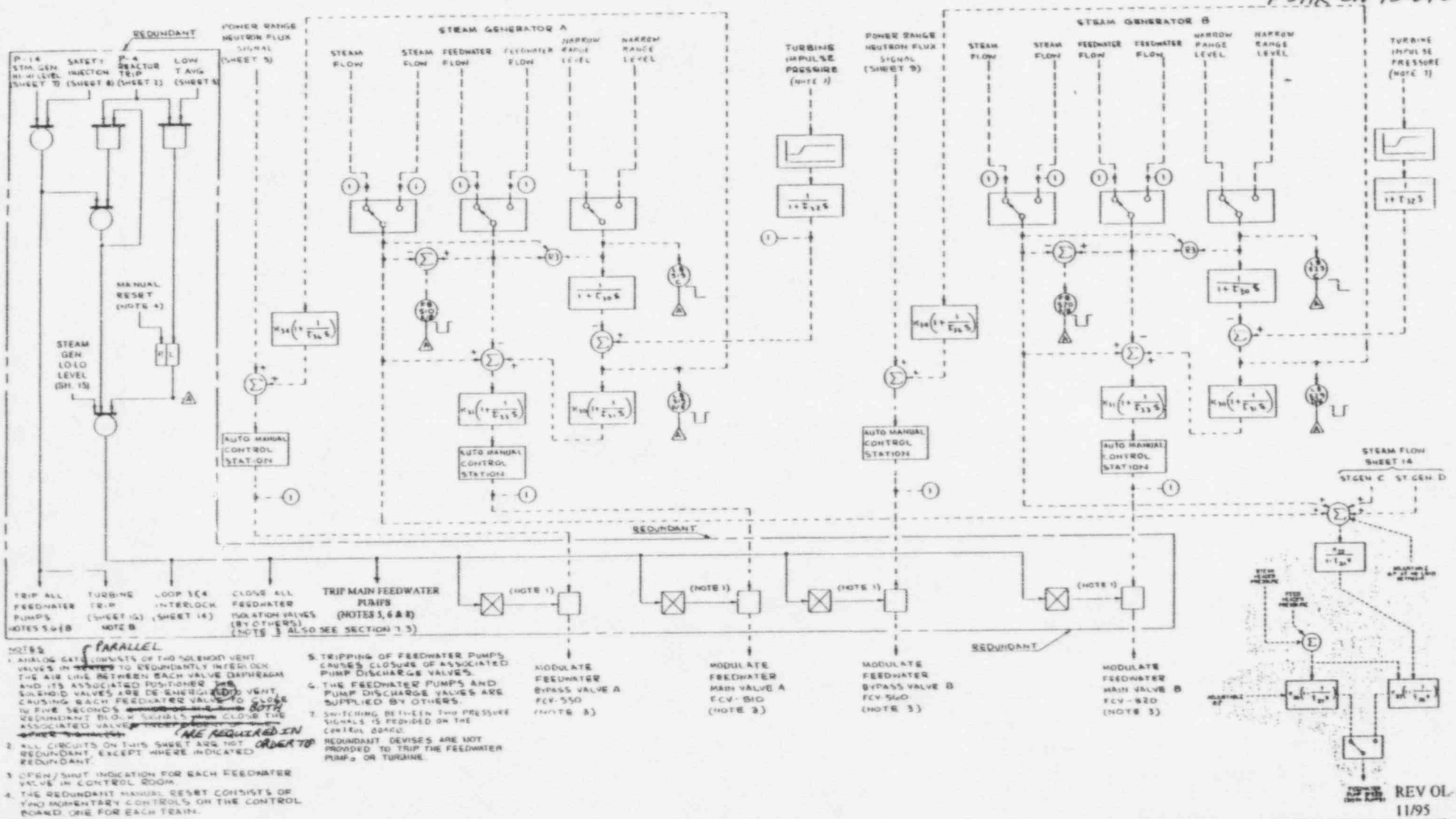
f. Main feedwater pump trip solenoids

No credit is taken for the automatic tripping of the feedwater pumps, and, therefore, this function does not require periodic testing.

g. Reactor coolant pump seal water return valves

Seal water return line isolation valves are routinely tested during refueling outages. Closure of these valves during operation would cause the seal water system relief valve to lift, with the possibility of

FSAR CN 95-043



NOTES

1. ANALOG GATE CONSISTS OF TWO SOLENOID VENT VALVES IN PARALLEL TO REDUNDANTLY INTERLOCK THE AIR LINE BETWEEN EACH VALVE DIAPHRAGM AND ITS ASSOCIATED POSITIONER. THE SOLENOID VALVES ARE DE-ENERGIZED TO VENT, CAUSING EACH FEEDWATER VALVE TO CLOSE IN FIVE SECONDS. BOTH REDUNDANT BLOCK SIGNALS ARE REQUIRED IN ORDER TO CLOSE THE ASSOCIATED VALVE.
2. ALL CIRCUITS ON THIS SHEET ARE NOT REDUNDANT, EXCEPT WHERE INDICATED REDUNDANT.
3. OPEN/SHUT INDICATION FOR EACH FEEDWATER VALVE IN CONTROL ROOM.
4. THE REDUNDANT MANUAL RESET CONSISTS OF TWO MOMENTARY CONTROLS ON THE CONTROL BOARD, ONE FOR EACH TRAIN.
5. TRIPPING OF FEEDWATER PUMPS CAUSES CLOSURE OF ASSOCIATED PUMP DISCHARGE VALVES.
6. THE FEEDWATER PUMPS AND PUMP DISCHARGE VALVES ARE SUPPLIED BY OTHERS.
7. SWITCHING BETWEEN TWO PRESSURE SIGNALS IS PROVIDED ON THE CONTROL BOARD.

REDUNDANT DEVISES ARE NOT PROVIDED TO TRIP THE FEEDWATER PUMPS OR TURBINE.

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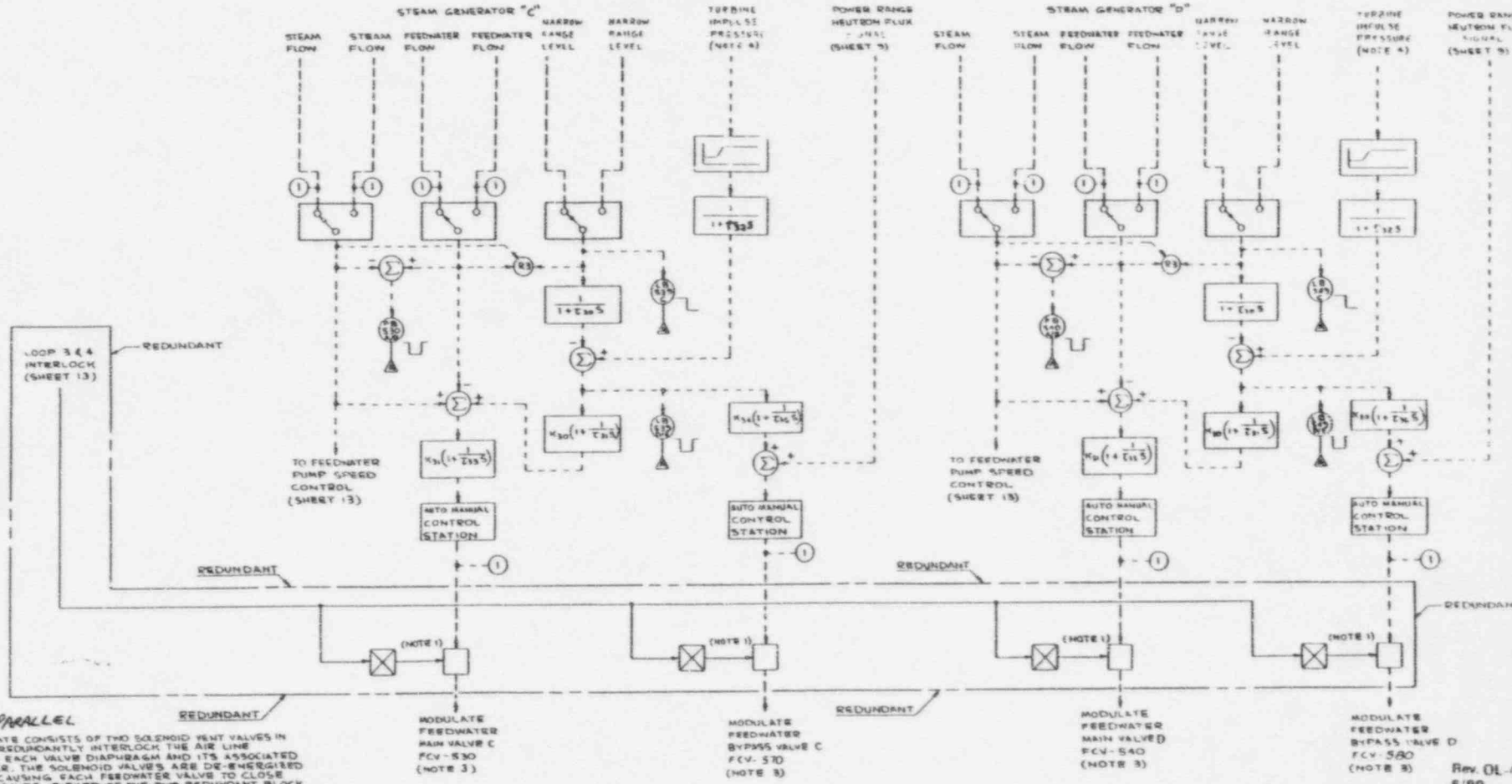
CALLAWAY PLANT

FIGURE 7.2-1
FUNCTIONAL DIAGRAMS
(FEEDWATER CONTROL AND ISOLATION)
(SHEET 13)

FSAR CN 95-093



NOTES:

1. ANALOG GATE CONSISTS OF TWO SOLENOID VENT VALVES IN ~~SERIES~~ PARALLEL TO REDUNDANTLY INTERLOCK THE AIR LINE BETWEEN EACH VALVE DIAPHRAGM AND ITS ASSOCIATED POSITIONER. THE SOLENOID VALVES ARE DE-ENERGIZED TO VENT CAUSING EACH FEEDWATER VALVE TO CLOSE IN FIVE SECONDS. ~~EITHER~~ BOTH REDUNDANT BLOCK SIGNAL~~S~~ ~~CLOSE~~ ARE REQUIRED IN ORDER TO CLOSE THE ASSOCIATED VALVE~~S~~ ~~INDEPENDENT OF THE OTHER SIGNAL (S)~~.
2. ALL CIRCUITS ON THIS SHEET ARE NOT REDUNDANT, EXCEPT WHERE INDICATED "REDUNDANT".
3. OPEN/SHUT INDICATION FOR EACH FEEDWATER VALVE IN CONTROL ROOM.
4. ~~SWITCHING~~ BETWEEN TWO PRESSURE SIGNALS IS PROVIDED ON THE ~~CONTROL~~ BOARD.

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CALLAWAY PLANT

FIGURE 7.2-1
FUNCTIONAL DIAGRAMS
(FEEDWATER CONTROL AND ISOLATION)
(SHEET 14)

FSAR CN 95-043

MAIN FEEDWATER CONTROL VALVES AND CONTROL BYPASS VALVES - The MF control valves are air-operated angle valves which automatically control feedwater between 20 percent and full power. The bypass control valves are air-operated globe valves, which are used during startup up to 25-percent power. The MF control valves and bypass control valves are located in the turbine building.

In the event of a secondary cycle pipe rupture inside the containment, the main feedwater control valve (and associated bypass valve) provide a diverse backup to the MFIV to limit the quantity of high energy fluid that enters the containment through the broken loop. For emergency closure, ~~either of two separate~~ solenoids, when de-energized, will result in valve closure. Electrical solenoids are energized from separate Class IE sources.

both

MAIN FEEDWATER CHECK VALVES - The main feedwater check valves are located inside the containment, downstream of the auxiliary feedwater connection. In the event of a secondary cycle pipe rupture, inside the containment, the main feedwater check valves provide a diverse backup to the MFIV to ensure the pressure boundary of any intact loop not receiving auxiliary feedwater.

In the event of a feed line rupture between the containment and the main feedwater check valve, the feedwater check valve will close and terminate blowdown from the steam generator.

CHEMICAL ADDITION LINE CHECK VALVES AND ISOLATION VALVES -The check valves are located downstream of the isolation valves in the chemical addition lines. The check valves provide a diverse backup to the isolation valves to ensure the pressure boundary. The normally closed isolation valves are air-operated valves which fail closed.

CONDENSATE PUMPS - The three condensate pumps are motor driven and operate in parallel. Valving is provided to allow individual pumps to be removed from service. Pump capacity is sufficient to meet full power requirements with two of the three pumps in operation.

LOW-PRESSURE FEEDWATER HEATERS - Parallel strings of closed feedwater heaters are located in the condenser necks. The No. 1, 2, 3, and 4 heaters have integral drain coolers, and their drains are cascaded to the next lower stage feedwater heater in each case. The drains from No. 1 heaters are dumped to the main condenser. Feedwater leaving the No. 4 heaters is headered and goes to the steam generator feed pumps. The heater shells are carbon steel, and the tubes are stainless steel.

HIGH-PRESSURE FEEDWATER HEATERS - Parallel strings of three high-pressure feedwater heaters with integral drain coolers in

CALLAWAY - SP

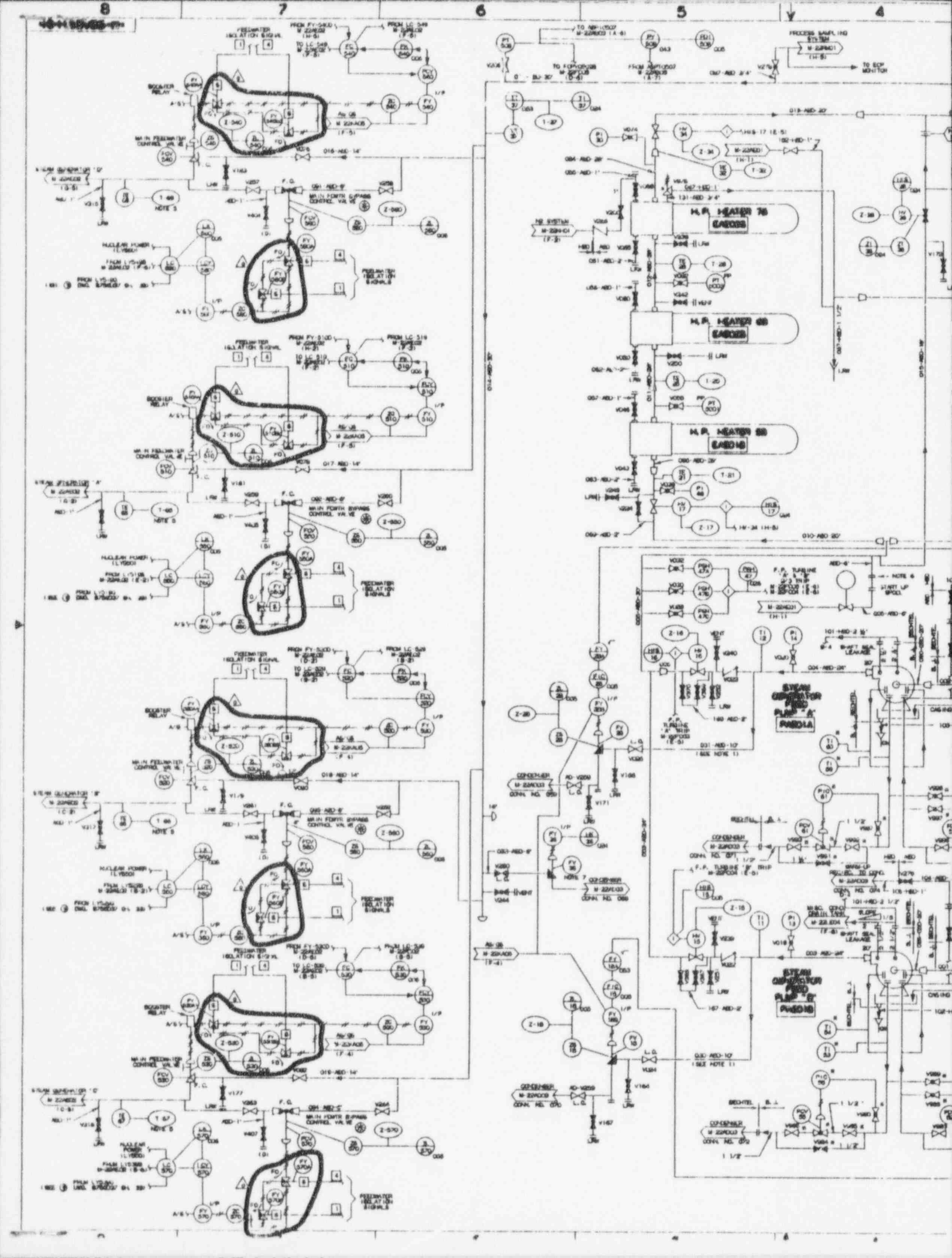
TABLE 10.4-7

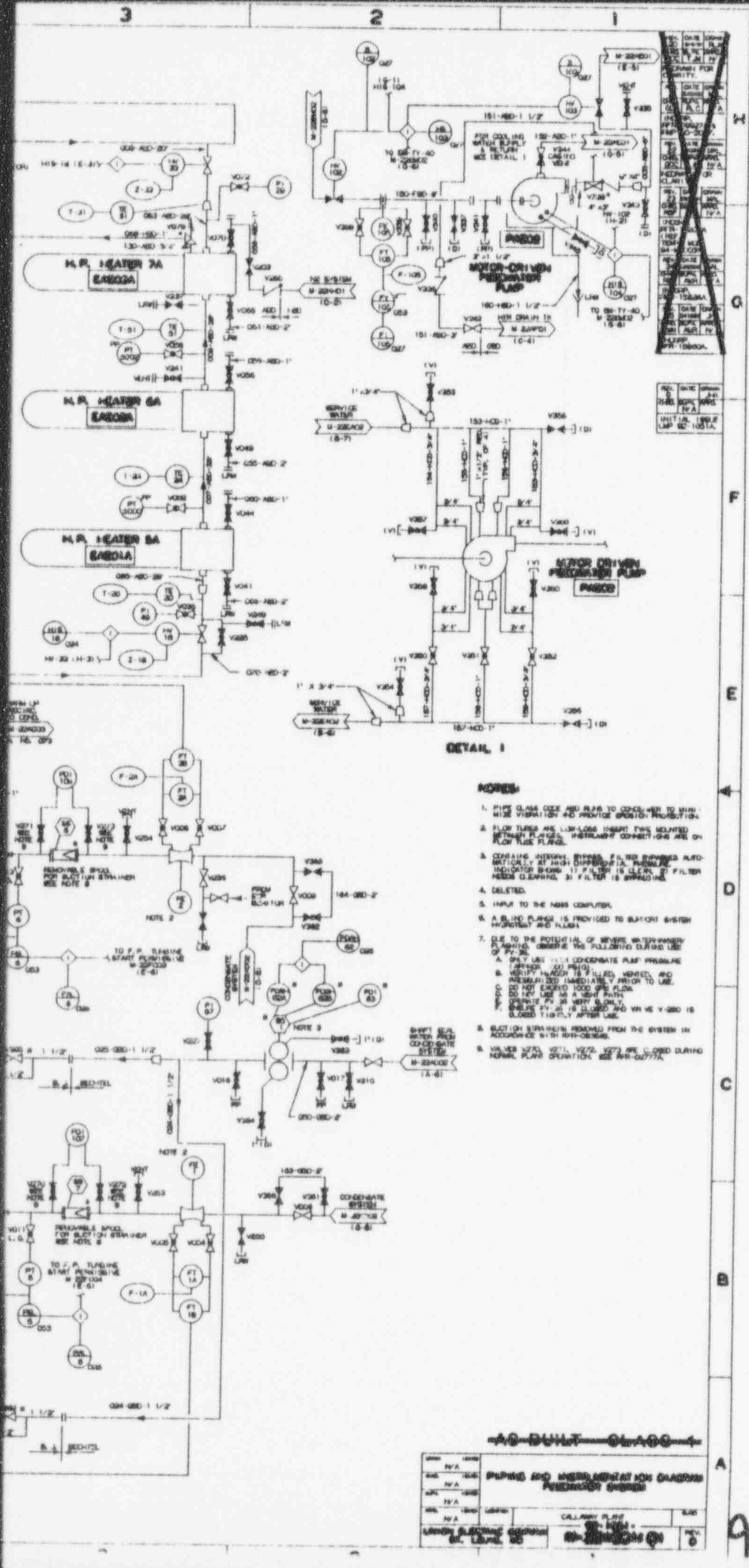
FEEDWATER ISOLATION SINGLE FAILURE ANALYSIS

Component	Failure	Comments
Main feedwater control valve (MFCV) (1)	Valve fails to close upon receipt of automatic signal (FIS)	MFIV will close, providing adequate isolation to limit high energy fluid addition
	Loss of power from one power supply	Valve fails ~~closed~~ as is upon loss of either train of power; however, MFIV can be closed providing adequate isolation to limit high energy fluid addition. BSM 5/16/96
Main feedwater bypass control valve. MFBCU (1)	Same as main feedwater control valve	Same as main feedwater control valve
Main feedwater isolation valve (MFIV)	Valve fails to close upon receipt of automatic signal (FIS)	MF control valve and MF check valve close as required to isolate. The MF control valve (and bypass control valve) serve to limit the addition of high energy fluid into the containment following a main feedwater line rupture inside the containment or a main steam line break.
	Loss of power from one power supply	Valve fails closed upon loss of either train of power
Main feedwater check valve	Valve fails to close	MFIV will close, providing adequate isolation

(1) Valve is only required following pipe rupture of feedwater line inside containment or following a MSLB.

FSAR CN 95-043


8
7
6
5
4
H.P. HEATER 7B
H.P. HEATER 6B
H.P. HEATER 5B
STEAM GENERATOR 2 PLANT "A"
STEAM GENERATOR 2 PLANT "B"
BECHTEL



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