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July 7, 1982
5211-82-150

Office of Nuclear Reactor Regulation
Attn: J. F. Stolz
Division of Licensing
Operating Reactor Branch No. 4
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Sir:

Three Mile Island Nuclear Station, Unit 1 (TMI-1)
Operating License No. DPR-50
Docket No. 50-289
Emergency Feedwater System - Seismic

In response to your letter of April 5, 1982 enclosed please find the clarification of the EFW seismic boundary and the clarification of the extent of our response to various bulletins and notices as they apply to the EFW System (Enclosure 1).

In our letter of December 8, 1981 (L1L 354) we agreed to provide an evaluation of the TMI-1 condensate supply in order to insure its applicability for EFW System function for various plant events. The modifications resulting from this evaluation (Enclosure 2) are directly responsive to the NRC Generic Letter No. 81-14 dated February 10, 1981 and will increase the reliability of the EFW system as discussed in ASLB-Partial Initial Decision Section Q dated December 14, 1981.

Finally, our letter of December 8, 1981 (L1L 354) indicated that our EFW Valve SSE functional operability was expected to be completed by June 1, 1982. Due to contractual delays, this evaluation is now expected to be completed in September, 1982.

Sincerely,

H. D. Hukill
Director, TMI-1

HDH:LWH:vjf
cc: R. C. Haynes
R. Jacobs

A001

Enclosure 1

Question 1:

Enclosure 1 of Generic Letter 81-14 (GL 81-14) defines the auxiliary feedwater (AFW) system to be considered as:

(a) "The AFW system boundary from suction to discharge (including the water source and heat sink) shall include those portions of the system required to accomplish the AFW system function and connected branch piping up to and including the second valve which is normally closed or capable of automatic closure when the safety function is required."

(b) "The AFW system boundary shall also include any portion of branch piping that is structurally coupled to the AFW system boundary such that the seismic response of the branch piping transmits loads to the AFW system. As a minimum, this includes the branch lines outside the AFW system boundary to a point of three orthogonal restraints."

(c) "All mechanical and electrical equipment, piping (e.g., instrument air), conduits and cable trays, which are necessary or contain items which are necessary for the operation of the AFW system, shall also be considered."

(d) "In addition, the structures housing these systems and components shall be included."

Clarify the extent to which your emergency feedwater (EFW) system boundary, considered in your December 8, 1981 response letter, coincides with the boundary defined in GL 81-14, especially parts (a) and (b) above.

Response:

The seismic boundary for the EFW System is indicated in the attached figures:

Figure 1 - TMI-1 EFW System
Figure 2 - River Water Supply to EFW
Figure 3 - EFW and MS Valve 2 Hour Backup Supply Air

Additionally, Table AA with legend is provided which supplements our response of February 16, 1982 (82-018) concerning the electrical portion of the EFW System.

Further, the seismic break points for the attached figures 1 and 2 have been analyzed for three directional seismic restraints after each transition. All indicated seismic breaks have three directional support after the class change.

Branch lines one inch size and smaller (vents and drains) of the Emergency Feedwater System piping which are within the Seismic I boundary of the main piping system and whose seismic classification is indicated on drawings (302-081 and 302-101 in TMI-1 Restart Report) have not been evaluated as part of our response to IEB 79-14. Note that the vent stacks for the main steam safeties and the atmospheric dump valves are not Seismic I. The vent stack for the main steam safeties is judged to be adequate for seismic events. The stack for the atmospheric dump valves is still under evaluation. Results will be provided in September, 1982.

Finally, the River Water System piping was analyzed to be seismiclly qualified for the portion shown in Figure 2.

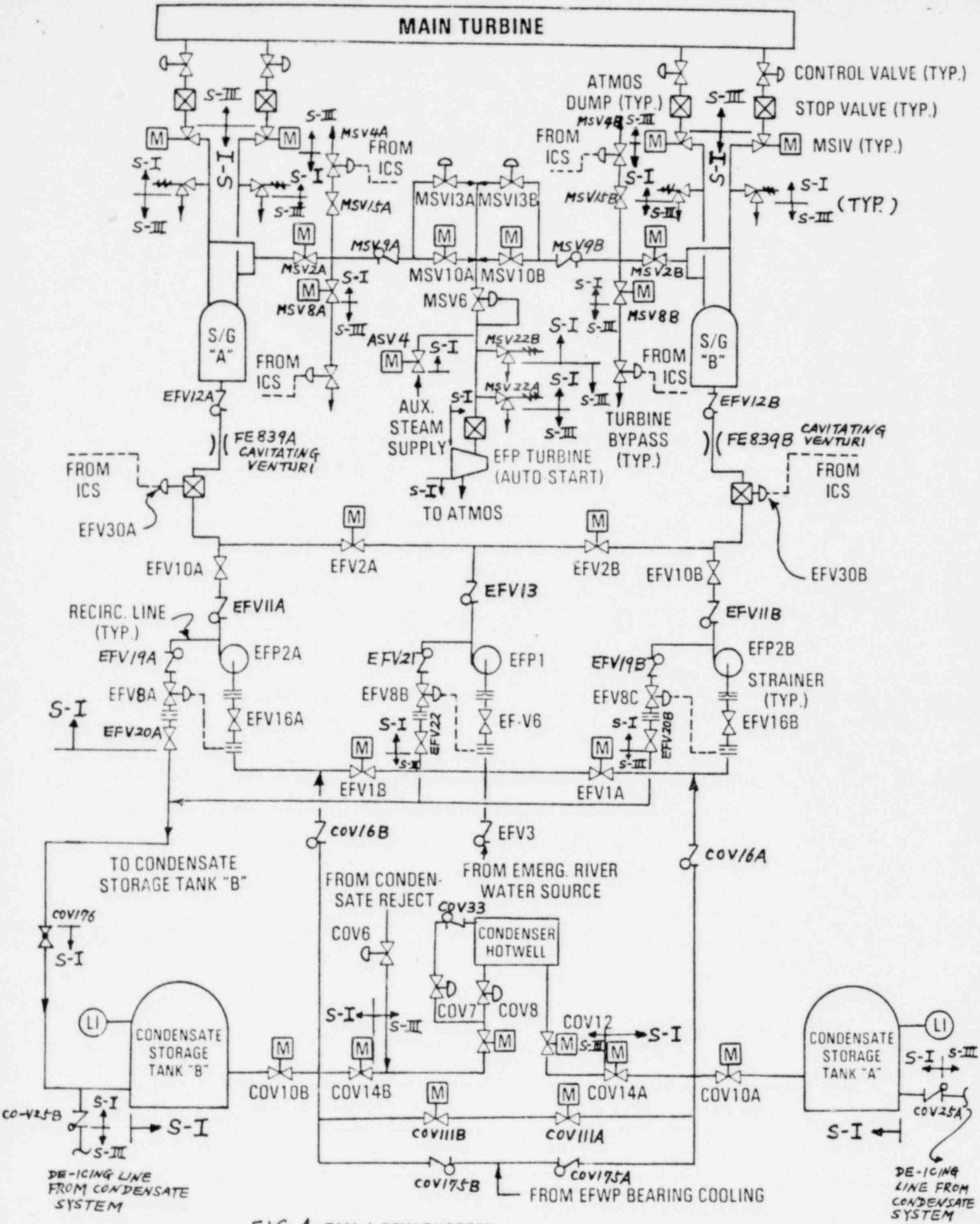


FIG. 1 TMI-1 EFW SYSTEM

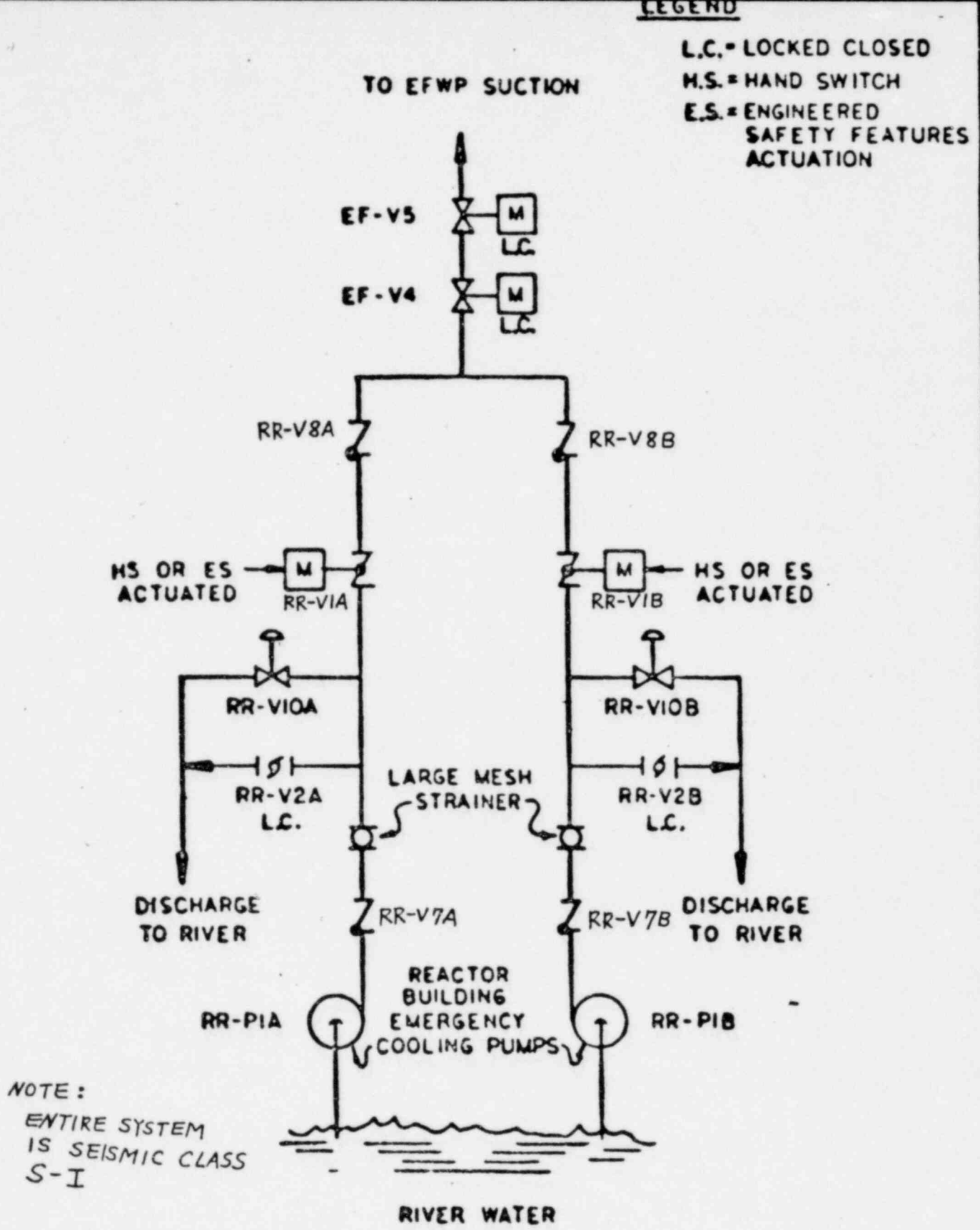


FIG. 2. RIVER WATER SUPPLY TO EFWS - TMI-1

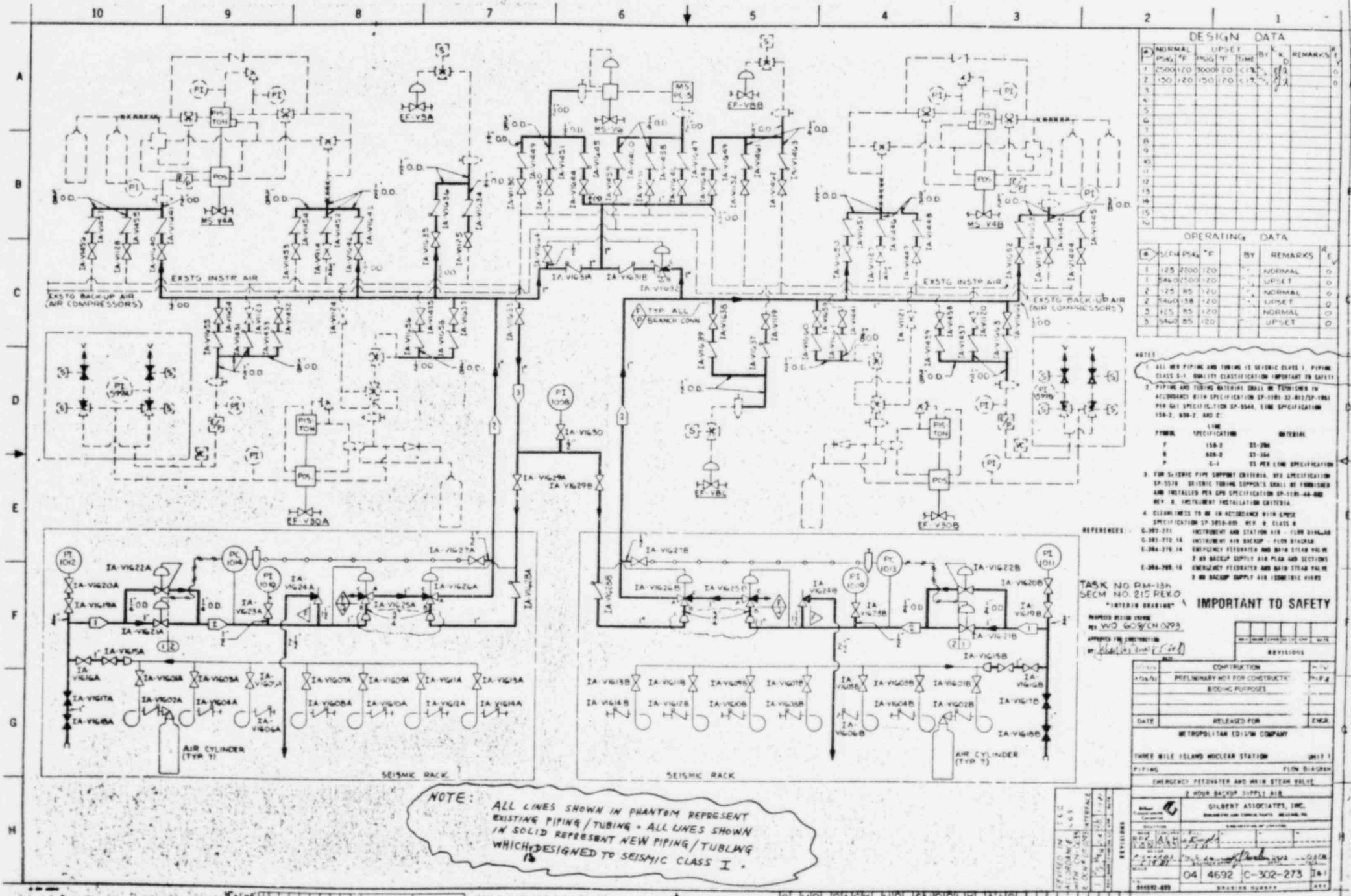

DESIGN DATA
OPERATING DATA
EXSTG INSTR AIR
EXSTG BACK-UP AIR (AIR COMPRESSORS)
TYP. ALL BRANCH CONN.
SEISMIC RACK
AIR CYLINDER (TYP 7)
NOTE: ALL LINES SHOWN IN PHANTOM REPRESENT EXISTING PIPING / TUBING - ALL LINES SHOWN IN SOLID REPRESENT NEW PIPING / TUBING WHICH IS DESIGNED TO SEISMIC CLASS I.
2 HR BACK UP SUPPLY AIR
IMPORTANT TO SAFETY
METROPOLITAN EDISON COMPANY
THREE MILE ISLAND NUCLEAR STATION UNIT 1
EMERGENCY FEEDWATER AND MAIN STEAM VALVE
2 HOUR BACKUP SUPPLY AIR
GILBERT ASSOCIATES, INC.
04 4692 C-302-273 IA1

FIG. 3

TABLE A-A

Device	Function	Seismic Qualification Reference				Comment
		Device	Location	Power Supply	Cable Routing	
MS-V1A	Main Steam Isolation Valve A Motor Operator	D1	L1	P5	R5	-
MS-V1B	Main Steam Isolation Valve B Motor Operator	D1	L1	P5	R5	-
MS-V1C	Main Steam Isolation Valve C Motor Operator	D1	L1	P5	R5	-
MS-V1D	Main Steam Isolation Valve D Motor Operator	D1	L1	P5	R5	-
MS-V4A	Atmospheric Relief Valve A control System	See Comment	----------→	----------→	----------→	C18
MS-V4B	Atmospheric Relief Valve B Control System	See Comment	----------→	----------→	----------→	C18
RR-P1A	Reactor Bldg. Emerg. Cooling River Water Pump Motor A	D3	L5	P1	R6	C19
RR-P1B	Reactor Bldg. Emerg. Cooling River Water Pump Motor B	D3	L5	P2	R6	C19
RR-V1A	RBECRW Pump Discharge Valve A Motor Operator	D1	L5	P13	R7	C19
RR-V1B	RBECRW Pump Discharge Valve B Motor Operator	D1	L5	P14	R7	C19

LEGEND

D1. Limitorque valve motor operators, SMB-000 to SMB-5, have been seismically qualified up to 6g's per Limitorque Report B-0037.

D3. The Reactor Building Emergency Cooling River Water pump motor is a seismic Class 1 component per FSAR section 5.1.1.1d and FSAR Table 5-7.

L1. The Intermediate Building is a seismic Class 1 structure per FSAR section 5.1.1.1a and FSAR Table 5-7.

L5. The Intake Screen and Pump House is a seismic Class 1 structure per FSAR section 5.1.1.1a and FSAR Table 5-7.

P1. 1D 4160v ES Switchgear is a seismic Class 1 component per FSAR sections 5.1.1.1e 8.2.2.10c and FSAR Table 5-7.

P2. 1E 4160v ES Switchgear is a seismic Class 1 component per FSAR sections 5.1.1.1e and 8.2.2.10c and FSAR Table 5-7.

P5. ICES 480v Motor Control Center is a seismic Class 1 component per FSAR sections 5.1.1.1e and 8.2.2.10d and FSAR Table 5-7.

P13. 1AES Screen House 480v Motor Control Center is a seismic Class 1 component per FSAR sections 5.1.1.1e and 8.2.2.10d and FSAR Table 5-7.

P14. IBES Screen House 480v Motor Control Center is a seismic Class 1 component per FSAR sections 5.1.1.1e and 8.2.2.10d and FSAR Table 5-7.

R5. Cable is routed in conduit, ES cable trays, non-ES cable trays in seismic Class 1 structure, non-ES cable trays in non-seismic structures, and underground encased conduit between the Control Building and Intermediate Building. ES cable trays are seismic Class 1 components per FSAR section 5.1.1.1e and FSAR Table 5-7. The seismic qualification of non-ES cable trays in seismic Class 1 structures is equivalent to that of ES cable trays. The design of the underground encased conduit has been evaluated as remaining serviceable after a seismic event.

R6. Cable is routed in conduit, ES cable trays, non-ES cable trays in seismic Class 1 structures, and underground encased conduit between the Auxiliary Building and the Intake Screen and Pump House. ES cable trays and the underground encased conduit between the Auxiliary Building and the Intake Screen and Pump House are seismic Class 1 per FSAR section 5.1.1.1e and FSAR Table 5-7. The seismic qualification of non-ES cable trays in seismic Class 1 structures is equivalent to that of ES cable trays.

R7. Cable is routed in conduit, ES cable trays, and underground encased conduit between the Auxiliary Building and the Intake Screen and Pump House, all of which are seismic Class 1 per FSAR section 5.1.1.1e and FSAR Table 5-7.

C18. Components of the atmospheric relief valve control system are located in the Control Building and Intermediate Building, both seismic Class 1 structures. Normal control of the atmospheric relief valves is by the Integrated Control System (ICS), a non-seismic system. Recent plant modifications provide:

a) automatic transfer of control to a manual loader station in the Control Room upon loss of normal electrical power to the ICS. The electrical power source is switched to a bus powered from a non-ES uninterruptible power supply.

b) remote manual transfer of control to the Remote Shutdown Panel (a seismic Class 1 component), which is powered by ES electric power supplies.

Certain components (e.g. the current to pneumatic converter and manual loader) are not seismically qualified, but were the best available equipment at that time. There is a continuing effort to evaluate the ability to upgrade this valve control system.

C19. In addition to the sources of condensate normally available to the emergency feed pump suction, river water can be substituted as a last resort via the redundant emergency reactor building cooling water pumps.

Question 2:

Generic letter 81-14, Enclosure 1, Part A states: "Specify whether your AFW system is (a) designed, constructed, and maintained (and included within the scope of seismic related Bulletins 79-02, 79-04, 79-07, 79-14, and 80-11, and IE Information Notice 80-21), in accordance with Seismic Category I requirements (e.g., conformance to Regulatory Guides 1.29 and the applicable portions of the Standard Review Plan or comparable criteria) or (b) designed, constructed and maintained (and included wihtin the scope of seismic related Bulletins 79-02, 79-04, 79-07, 79-14, and 80-11, and IE Information Notice 80-21) to withstand a Safe Shutdown Earthquake (SSE) utilizing the analytical, testing, evaluation methods and acceptable criteria consistent with other safety-grade systems in your plant."

Clarify the extent to which your EFW system is included within the scope of seismic related Bulletins 79-04, 79-07, and 80-11, and IE Information Notice 80-21.

Response:

IEB

79-04: Swing Check Valves - No Velan Swing Check Valves of the 3, 4, or 5 inch diameter are installed in or planned to be installed in the EFW System (Ref: Met Ed letter dated May 1, 1979 (GQL 0611).)

79-07: Seismic Stress Analysis - Pipe Stress Analysis (M003) was used in the seismic analysis of EFW piping at TMI-1. This program does not use algebraic summation of either codirectional spatial components or intermodal responses in a response spectrum analysis. Time history analysis was not used in seismic stress analysis of the piping. (Ref: Met Ed Letter dated July 3, 1979 (GQL 0866) FSAR Chapter 5, Section 5.4.4 and 5.4.5.1).

80-11: Block Walls - No EFW equipment is located on block walls. (Ref: Met Ed Letter dated August 31, 1981 (L1L 185).)

IEN

80-21: Anchorage for Safety Related Electrical Equipment - At the time of this notice safety related systems were generally reviewed with particular attention to Control Building Equipment Support (338'6" elev). Details concerning the EFW System were addressed in our letter of February 16, 1982 (82-018).

EVALUATION OF THE TMI-1 CONDENSATE SUPPLY FOR EMERGENCY FEEDWATER

I. INTRODUCTION

The purpose of this evaluation is to determine if modifications are required to the condensate supply system from the condensate storage tanks (CST) in order to assure the availability of condensate for the Emergency Feedwater (EFW) System safety functions during various plant events.

II. RESULTS

1. During a seismic event with a concurrent loss of offsite power, the present condensate system arrangement and valve line ups and their power supplies do not properly protect the CST water inventory, which is required for the EFW function.

2. A loss of offsite power and/or loss of instrument air event would not result in the loss of water inventory for EFW utilization. However, these events may require an operators response which would include re-alignement of valves to allow the EFW pumps to take suction from the condenser hotwell.

3. Tornado missiles or aircraft impact may cause a loss of water inventory in either of the two condensate storage tanks. However, assuming 20 minutes for an operator action to isolate the damaged Condensate Storage Tank from the EFW system, the water inventory of the intact Condensate Storage Tank will provide the water source for EFW operation and allow cooldown of the plant to the conditions permitting operation of Decay Heat Removal System to achieve further cooling within 8 hours.

4. In order to mitigate the loss of condensate from the CST, which could result from a seismic event, modifications to the system design and changes to the plant operating procedures are required.

III. CONCLUSION

This evaluation concludes that modifications to the condensate system piping as shown on Sketch No. 1 and changes of operating procedures are required in order to achieve a safety grade condensate supply to the Emergency Feedwater System. These changes will be implemented prior to startup from the next (Cycle No. 6) refueling.

IV. MODIFICATIONS

Modifications of the condensate system, as shown on the attached sketch no. 1, are required to provide the following features:

1. A new check valve should be installed in the EFW pumps recirculation line to the CST "B". This check valve should be installed as close as possible to the CST "B" in order to establish a seismic class boundary for the CST. (This will not be necessary if the EFW Pump recirculation line is upgraded to Seismic I criteria.) (See Met Ed letter, 9/29/81, LIL 269)

2. The power supply to motor operated valves CO-V-111A&B for the cross tie between both tanks should be changed from the existing non-vital power sources to vital power sources.

3. Cable routing for the power supply to motor operated valves CO-V-14A&B should be upgraded to meet Seismic Class I requirements.

4. Plant operating procedures for EFW system should be changed to provide guidance to the operator to isolate the damaged CST from the EFW system by closing valves CO-V-111A&B and CO-V-14A&B from the control room whenever the condensate storage tanks reach the Tech Spec limit following EFW initiation.

V. DISCUSSION

The following is an evaluation of the existing CST system as it relates to the Emergency Feedwater function:

1. Loss of Instrument Air and/or Loss of Offsite Power

The air operated condenser normal makeup valve (CO-V-7) and condenser emergency makeup valve (CO-V-8) will fail open on loss of instrument air and the air operated condensate reject valve (CO-V-6) will fail closed. The motor operated condenser hotwell isolation valves (CO-V-14A&B) are powered from the Class 1E power source, while the motor operated valves (CO-V-111A&B) for the cross-tie between both tanks are powered from the Non-Class 1E power source. Therefore, in the event of a loss of instrument air and/or loss of offsite power, the water in both storage tanks would drain out to the condenser hotwell and result in a loss of water inventory from the CST for the Emergency Feedwater System. However, the probability of a significant loss of water inventory is extremely low because of the following:

a. Both main instrument air compressors can be manually loaded onto the Diesel Generator from the control room in the event of loss of offsite power. Therefore, the air supply to valves CO-V-7&8 will be available.

b. In the event the main instrument air is not available, the turbine building backup air supply powered from the Class 1E source will be available to these air operated valves.

c. The low level alarm (at 11.5') of each CST and condenser hotwell high level alarm (at 7'6") are provided in the control room. The power for these alarm signal are supplied from DC battery sources. In the event of a loss of offsite power, these level alarms are still able to alert the operator to take action so that the water level in both tanks can be maintained at Technical Specification requirement.

d. Valves CO-V-14A&B are powered from Class 1E busses and can be closed from the control room to isolate the non-EFW functions from the CST.

In addition to the above, the loss of CST inventory to the condenser hotwell still allows this water to be utilized by the EFW system to feed both Once Through Steam Generators (OTSG) and therefore, this event does not cause a safety concern.

2. Seismic Event Coincident With Loss of Offsite Power Without a Single Failure of an Active Component

During a postulated seismic event coincident with a loss of offsite power, a line break in the non-seismic piping downstream of either valve CO-V-14A or valve CO-V-14B could drain the water from both tanks through the broken lines to the Turbine Building Sump or Intermediate Building depending on the location of line break. However, the motor operated valves CO-V-14A&B, which are powered from Class 1E sources, can be remotely controlled from the control room to isolate the broken non-seismic lines. This maintains a sufficient water inventory for the EFW system safety function from both CSTs if the seismic event did not sever the power supply for these valves in the non-seismically designed portion of its cable routing. It assumes that both CSTs are at the Technical Specification water inventory levels and allows 20 minutes for an operator action.

3. Seismic Event Coincident With Loss of Offsite Power With a Single Failure of an Active Component

During this event, a postulated failure of either valve CO-V-14A or CO-V-14B to isolate the CST from the non-seismic line will drain the water inventory of both tanks through the broken lines at an approximate rate of 4,400 GPM. A low level (Technical Specification level) alarm of each tank will alert the operator to take action. The operator has sufficient time (20 minutes) to access the Intermediate Building to manually close either of the motor operated valves so that a sufficient quantity of water will be available from both CSTs for EFW system operation and sufficient to cool to the point of Decay Heat Removal initiation. However, if the valve is stuck open or the operator can not access the building to manually close the valve, water in both tanks will be drained out and cause a loss of water inventory for EFW system

function. Thus, in order to mitigate or prevent this gross loss of water inventory a modification to the Condensate System and Condensate Storage Tank is required.

4. Condensate Storage Tank De-icing and EFW Pumps Recirculation

A portion of the EFW pumps recirculation line through the de-icing line to the Condensate Storage Tank "B" is not designed to Seismic Class I requirements. A pipe break in this portion of piping will also drain out the CST water to the Intermediate Building through either or both of the following flow paths:

a. Flow from EFW pump discharge through the recirculation line

The CST water will be drained through this flow path to the Intermediate Building at a nominal rate of 340 GPM if all three (3) EFW pumps are in operation at flows less than their minimum flow rate or at a nominal rate of 170 GPM or 80 GPM if the recirculation control valve of the respective turbine or motor driven EFW pump fails to close. Thus, if EFW is being injected to the OTSGs, the recirculation control valves will normally close and only a minimal amount of water would be lost and presents no safety concern. With the Turbine Driven EFW pump recirculation valve failed open and EFW operating for 8 hours, then 81,600 gallons would be lost and this also presents no safety concern since 300,000 gallons would initially have been available from both CSTs.

b. Flow from CST "B" through its de-ice line

The water from CST "B" will be drained through this 4" de-ice line at a flow rate of 200 GPM and would result in a loss of 96,000 gallons in an 8 hour period. Thus, with an initial water inventory of 300,000 gallons, this loss would not present a safety concern.

However, the combined loss of water from both CSTs from the above items a & b (177,600 gallons) during 8 hours of EFW operation exceeds 150,000 gallons and would present a safety concern since the remaining inventory of 122,400 gallons will only allow EFW operation for 6.5 hours before an alternate water supply needs to be available or decrease the time by which the Reactor Coolant System needs to be cooled down to the point of Decay Heat Removal initiation. Therefore, installation of a new check valve in the EFW pump recirculation line is required to prevent the loss of water from CST "B" through the broken line in the event of earthquake.

5. Tornado Missiles or Aircraft Impact on Condensate Storage Tanks

A postulated event of tornado missiles or aircraft impact may cause a loss of water inventory in either of the two condensate storage tanks and a loss of offsite power. Since the motor operated valves (CO-V-111A&B) for the cross-tie between both tanks are normally open and are powered from the non-vital power source, an operator action to manually close either valve CO-V-111A or valve CO-V-111B is required to isolate the damaged CST from the EFW system so that the intact CST would still have sufficient water available for the EFW system function. Assuming 20 minutes for an operator action, a total of approximately 11,000 gallons of water would be drained out from the intact CST to the damaged CST at a rate of 540 GPM, but would still leave sufficient water available for EFW operation for a period of 8 hours. This would still provide sufficient time and water inventory to allow a plant cooldown to the conditions permitting operation of the Decay Heat Removal System to achieve further cooling.

6. Availability of River Water for the EFW System

Once the water inventory from both storage tanks is depleted, a backup supply of river water is available from the Reactor Building (R.B.) Emergency Cooling pumps. This water supply enters the EFW pump common suction header between sectionalizing valves EF-V-1A&1B. The piping from the R.B. Emergency Cooling water pumps to the EFW pump common suction header is designed to Seismic Class I requirements. Manual actions are required to access this backup water supply. Motor operated valves EF-V-4&5, powered from Class 1E source, are normally kept locked closed and the motor control center breakers for these valves are locked open. If a backup supply of river water to the EFW system, is needed these locks will be removed and the breakers closed.

VI. PROPOSED MODIFICATIONS

In view of the above evaluations, modifications to the condensate system are required. The following modifications, which will have the least impact on normal and emergency plant operating functions, procedures and maintenance of CST water chemistry, yet provide an upgrade to plant safety, are proposed.

A. Add a check valve in the EFW pumps recirculation line and change the Seismic Class I boundary as shown on the attached sketch.

This new check valve should be installed as close as possible to the CST "B" so that it will prevent the loss of water from CST "B" in the event of a line break in the non-seismic portion of the recirculation line.

B. Change the power supply to the motor operated valves CO-V-111A&B from the non-vital power sources to vital power sources.

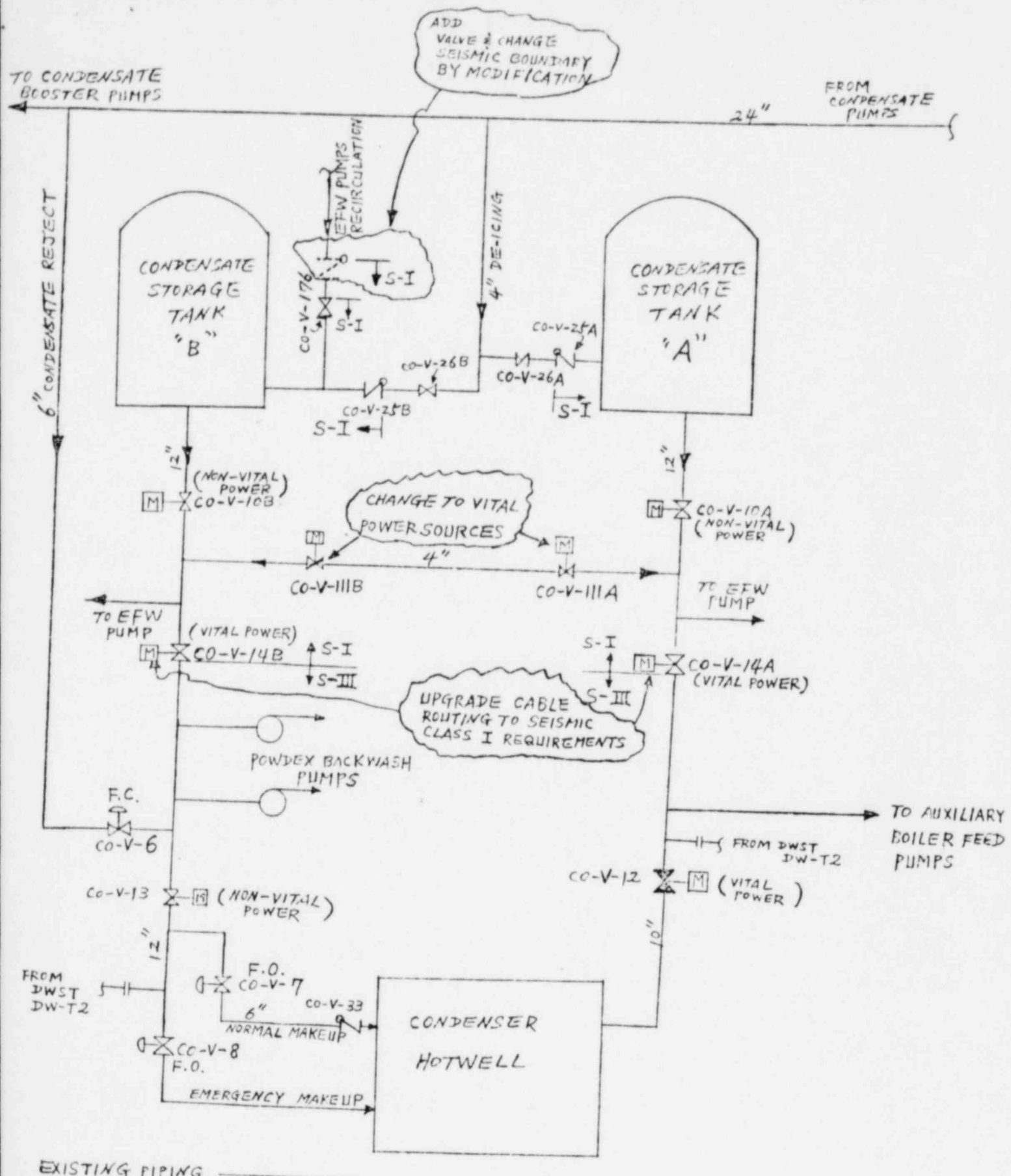
This change will provide the capability to isolate the damaged CST from the EFW system by closing these valves from the control room so that the intact CST would still have sufficient water available for EFW system function in the event of an earthquake coincident with a loss of offsite power since the event could block operator access for manual closure of these valves within an acceptable time period.

C. Upgrade the cable routing for motor operated valves CO-V-14A&B to meet Seismic Class I requirements.

D. Revise plant operating procedures for EFW to close both valves CO-V-111A&B and CO-V-14A&B if there is an EFW initiation and the condensate storage tank has reached the Tech. Spec. limit.

This change in procedures will insure that if there is a break in the condensate supply system, the required quantity of condensate which is required by the EFW system for a plant cooldown will be available. The procedures should also require the operator to insure that there is not a break in the condensate system before these valves are re-opened.

The above modifications will therefore ensure that a sufficient condensate water inventory is available for the EFW system function to cooldown the plant in the event of an earthquake or if there is a missile damage on either of the two CSTs.



SKETCH NO. 1

S.Y.K. 4-20-82