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March 8, 1985
ST-HL-AE-1202
File No.: G9.17/G9.10

Mr. George W. Knighton, Chief
Licensing Branch No. 3
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr. Knighton:

South Texas Project
Units 1 & 2
Docket Nos. STN 50-498, STN 50-499
NRC Request for Additional Information

REFERENCE: NRC letter to HL&P, G. W. Knighton to J. H. Goldberg, January 29, 1985, ST-AE-HL-90534

Attached is the additional information (attachments 1 through 4) requested by the referenced letter and described in the enclosure to that letter. This information should conclude our input and support our request for eliminating arbitrary intermediate pipe breaks (excluding the Reactor Coolant System Primary Loop).

For convenience we are repeating the request for additional information here:

> Provide detailed justification/documentation to show that eliminating arbitrary intermediate pipe breaks in the main feedwater system will not impact the safety of the plants because of special design features and operating procedures adopted by the South Texas Project to preclude or minimize the effects of water-hammer in that system. An acceptable level of detail on this issue is contained in Attachments F and G to a letter from D. E. Swartz, Commonwealth Edison to H. R. Denton, NRC, "Byron Station, Units 1 & 2 - Elimination of Arbitrary Intermediate Pipe Breaks", dated November 15, 1984.

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W2/NRC2/p

The submittal of this additional information will allow the staff to finalize its input for the supplement to the Safety Evaluation Report (SER).

Should you have any questions please call M. E. Powell at (713) 993-1328.

Very truly yours,

M. R. Wisenburg
Manager, Nuclear Licensing

AND/yd

Attachments:
(1) Main Feedwater Anti-Water Hammer Provisions
(2) Anticipated Feedwater Startup Procedure
(3) Auxiliary Feedwater Anti-Water Hammer Provisions
(4) STP Main/Auxiliary Feedwater

Houston Lighting & Power Company

cc:

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MAIN FEEDWATER ANTI-WATER HAMMER PROVISIONS

The STP Feedwater (FW) system design includes provisions to prevent the condensation-induced water hammer in both the feedwater piping and Steam Generators (S/Gs). Westinghouse (W) concurs that the STP design is in general compliance with the W proposed Main Feedwater Temperature Pegging System. The specific STP anti-water hammer design considerations are described below. (See the STP Main/Auxiliary Feedwater Interface diagram attachment 4).

The STP FW piping employs FW injection into the feed preheater section of each of four Westinghouse Model E2 S/G's rather than employing a feedring type design. Loop seals and the shortest possible horizontal length of piping immediately upstream of the S/G's are in compliance with the W criteria for layout to minimize or eliminate water hammer.

To minimize pressure transient potential (water hammer), it is necessary to prevent the introduction of cold water to the S/Gs through the main FW nozzle at any time when significant voids may be present. Therefore, in the STP design, FW flow is not introduced to the S/G feedwater nozzle during these conditions. The STP control logic for the FW isolation valve does not allow the valve to open until the FW line temperature and water level are above the set limits. An FW temperature pegging system has been incorporated to keep the feedwater above the minimum required temperature and thus minimize the possibility of pressure transients in the S/G preheater and feedwater piping.

Westinghouse studies have shown that pressure transients due to steam void collapse can occur in the S/Gs if feedwater below 250°F is supplied through the main feedwater nozzle concurrent with low S/G water level or low S/G pressure. By use of the W "Main Feedwater Temperature Pegging System" (deaerator pegging) the FW system is designed and operated to ensure the feedwater temperature is always above 250°F.

The FW temperature pegging system uses steam from the auxiliary boiler or from the main steam header (as available) to heat the feedwater in the deaerator to approximately 250°F prior to feedwater system operation. During normal operation, the deaerator is supplied with extraction steam from the turbine second point extraction. If the extraction is lost during normal operation (i.e., extraction valve closure, or turbine trip), the deaerator pegging system is provided with load following logic that pegs the deaerator with main steam within 10 psi of the pre-upset deaeration pressure. This same load following logic has a preset minimum deaerator pressure (35 psg) corresponding to a saturation temperature of approximately 275°F. (This low load preset is also used during startup to approximately 20% turbine load when the turbine extraction steam takes over.) (See our anticipated plant Startup procedure, attachment 2.) It should also be noted here that the STP full flow deaerator storage tanks are sized for 5 minutes storage at the 100% load FW flowrate, which represents longer storage in the event of Main Steam isolation.

The temperature permissives provided to the main feedwater isolation valve (FIV) are a 3 out of 3 logic that verifies that the three temperature elements, one upstream and two downstream of the FIV, located in the feedwater piping each measure greater than 250°F. It should be noted that after the FIVs are opened, the FW temperature elements will have no effect on the FIVs. This is reasonable, since our FW temperature pegging system will assure heated feedwater, above the minimum required FW temperature, over all plant load ranges.

The S/G low pressure and low level interlocks provided to the FIV represent a Westinghouse provided 2 out of 3 low condition in an affected S/G. On any low condition the affected S/Gs FIV will close to prevent the potential for water hammer.

With the STP design, the FIV will be the only valve in the main FW system which receives the feedwater anti-water hammer S/G level and pressure isolation signals. Likewise, the FIV will be the only valve tied into the FW temperature permissives. This has been reviewed and accepted by Westinghouse for the following reasons:

> The Feed Preheater Bypass Valve (FPBV), used during low load and hot standby operations to connect the main feedwater system to the upper nozzle, is not provided with anti-water hammer logic as this nozzle is not as susceptible to water hammer as the feed preheater nozzle (main FW nozzle). Likewise the Feedwater Isolation Bypass Valves (FIBVs) are not provided with S/G low level or low pressure isolation since this valve has a limited flowrate (with redundancy assuring the low flowrate) which would not expose the S/G feed preheater to the potential for water hammer. The FIBVs are used during the forward flushing process which assures that any water less than 250°F is purged downstream of the FIVs prior to getting an FIV open permissive. Note that while only the FIV receives the extensive anti-water hammer logic, all of the feedwater isolation valves (FIVs, FIBVs, and FPBVs) as well as the feedwater flow control valves (FCVs) and the feedwater bypass control valves (FBCVs) receive a safety system generated feedwater isolation signal.

Considering the above anti-water hammer provisions and the FW temperature pegging system, the potential for S/G feedwater preheater and upstream piping water hammer is minimized.

ANTICIPATED FEEDWATER STARTUP PROCESS

Cold Startup

A. Prior to startup, corrosive products and/or contaminants are removed from the FW system before delivery of water to the SGs. Water for cleanup is supplied from the condenser hotwell via the condensate pumps.

B. Condenser vacuum is established using steam from the auxiliary boiler for the gland seal steam supply.

C. During the initial phase of startup, feedwater equipment is in wet layup. The main steam isolation valves (MSIVs), FIVs, and the FCVs are all in the closed position.

D. The deaerator is pegged using steam from the auxiliary boiler. The condensate is heated in the deaerator and drains to the storage tanks. This heated water is used to purge cold water from the feedwater booster pump (FWBP) suction to the discharge header of feedwater heaters No. 11 A and B. The warmed water is recycled through this portion of the system until the water temperature is greater than or equal to 275°F in both storage tanks and all feedwater temperature elements in this portion of the system.

E. The S/U Steam Generator Feedwater Pump (S/U SGFP) is started and allowed to run at minimum flow, recirculating back to the deaerator until FW is required.

F. The SGs are drained to within the normal operating band.

G. No load temperatures are established, in the primary side, using the reactor coolant pump heat and the pressurizer heaters. During this period, feedwater requirements to the system are supplied from the FW system through the feed preheater bypass line to the auxiliary feedwater nozzles on the SGs.

H. As the reactor is taken critical, the main turbine and SGFPs are warmed up and the gland seal steam supply is transferred to main steam.

I. The SGFPs are started as the reactor is brought to 3 percent power with the turbine bypass, using the Automatic Low Power Feedwater Control system to maintain the required SG level.

J. The portion of the FW system from the feedwater heater's discharge header up to the feedwater isolation valve (FIV) is now purged of cold water. The water is circulated through this portion of the system until the water temperature is greater than or equal to 250°F.

K. The last portion of the FW system upstream of the isolation valve to the SGs, is purged of cold water. The water is circulated through this portion of the system until:

1. The temperatures upstream of the SGs, downstream of the FIV and upstream of the feedwater control valve (FCV) are greater than or equal to 250°F and have been for the required purge times.

2. The bypass flowrate has been between upper and lower limits for the required purge time.

3. The SG pressure is above the setpoint.

4. The SG level is above the setpoint.

When the above permissives are met, the FIVS are remote manually opened and the feedwater isolation bypass control valves (FIBVs) are manually closed.

L. SG level control is transferred from the low power feedwater control system to the FCV as the NSSS load reaches approximately 20 percent.

M. The turbine is warmed up, brought to speed, and the generator is synchronized with the system. As the turbine load increases above approximately 20 percent, deaerator heating steam is supplied by extraction steam.

Startup From Hot Shutdown

Startup from a hot shutdown is essentially the same operation as a startup from a cold shutdown except steam supply is initially available from the main steam system.

AUXILIARY FEEDWATER ANTI-WATER HAMMER PROVISIONS

The STP Auxiliary Feedwater (AFW) system design features that reduce the potential for condensation-induced water hammer are described below. (See the STP Main/Auxiliary Feedwater Interface diagram attachment 4).

1) The STP AFW system consists of four independent trains that are normally not cross-connected. This eliminates the potential for steam binding or water hammer affecting more than one train from a single event.

2) THe STP programmed water level is above the AFW (upper) nozzle internal extension during all NSSS load conditions. The auxiliary feedwater piping will not drain as a consequence of low SG water level because of the internal extension. These provisions assure that the nozzle and upstream piping will not fill with steam.

3) The STP AFW horizontal piping immediately upstream of the SG nozzle is minimized, with a down turned elbow located near the SG consistent with Westinghouse recommendations.

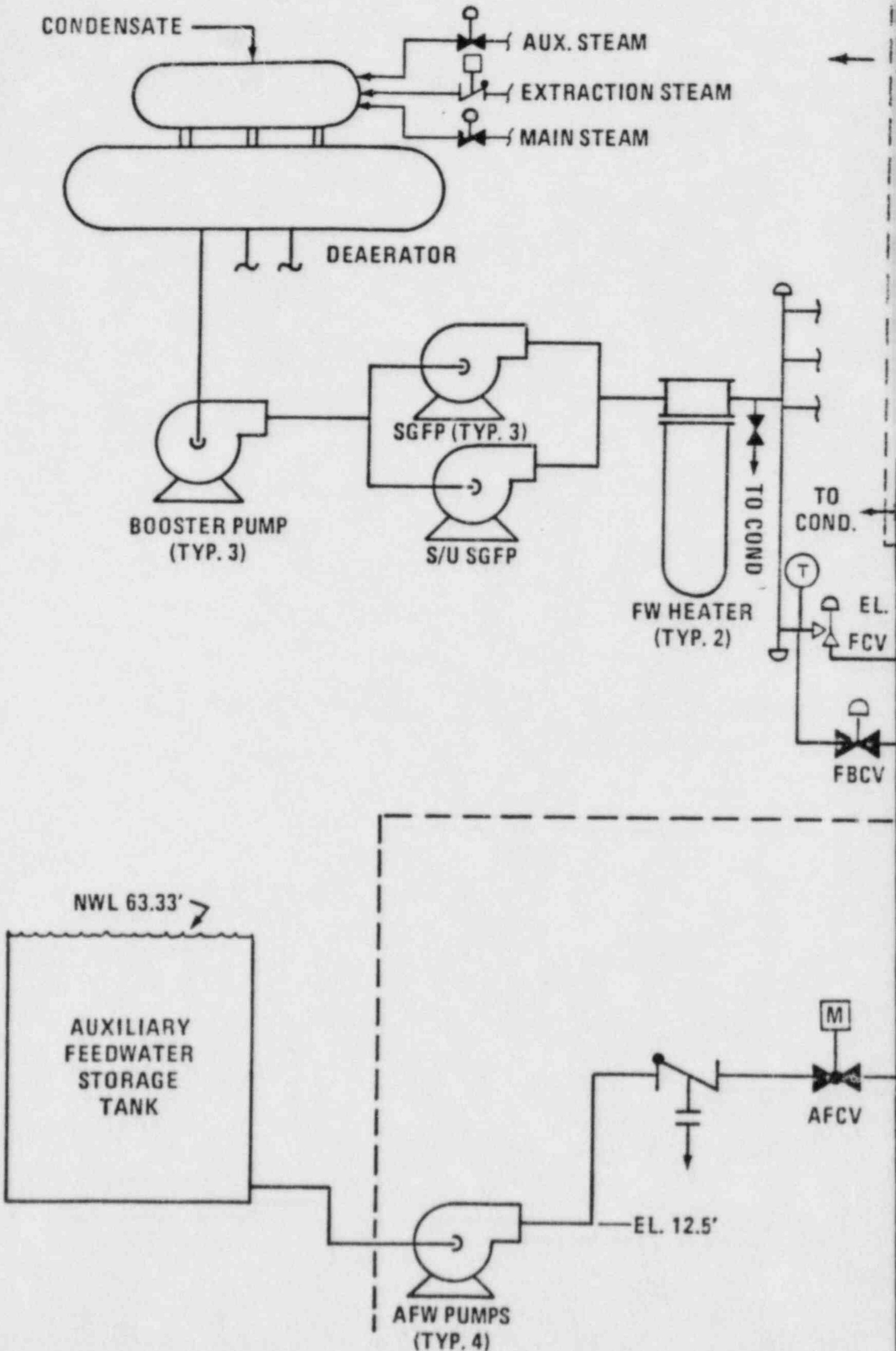
4) The Auxiliary Feedwater isolation valve (AFIV) is a normally closed stop check valve that opens on an AFW actuation signal. This normally closed valve prevents backleakage to the AFW pump train during low load operations when using the FW/AFW crossconnect. Likewise during normal power operation the AFIV in combination with the normally closed FPBV seal the AFW piping upstream of the AFW check valve inside containment, this "bottles" the upstream piping not allowing backflow.

5) The AFIV and the FPBV being containment isolation valves will be on a scheduled maintenance and leak testing program. The other FW and AFW check valves will be maintained to minimize backleakage.

6) Consistent with Westinghouse recommendations, there are at least two check valves in each flow path by which backleakage could occur into the Auxiliary feedwater or Main Feedwater System.

Considering the above, the potential for condensation induced water hammer in the AFW piping is unlikely.

STP MAIN/AU



CONDENSATE
AUX. STEAM
EXTRACTION STEAM
MAIN STEAM
DEAERATOR
BOOSTER PUMP
(TYP. 3)
SGFP (TYP. 3)
S/U SGFP
FW HEATER
(TYP. 2)
TO COND
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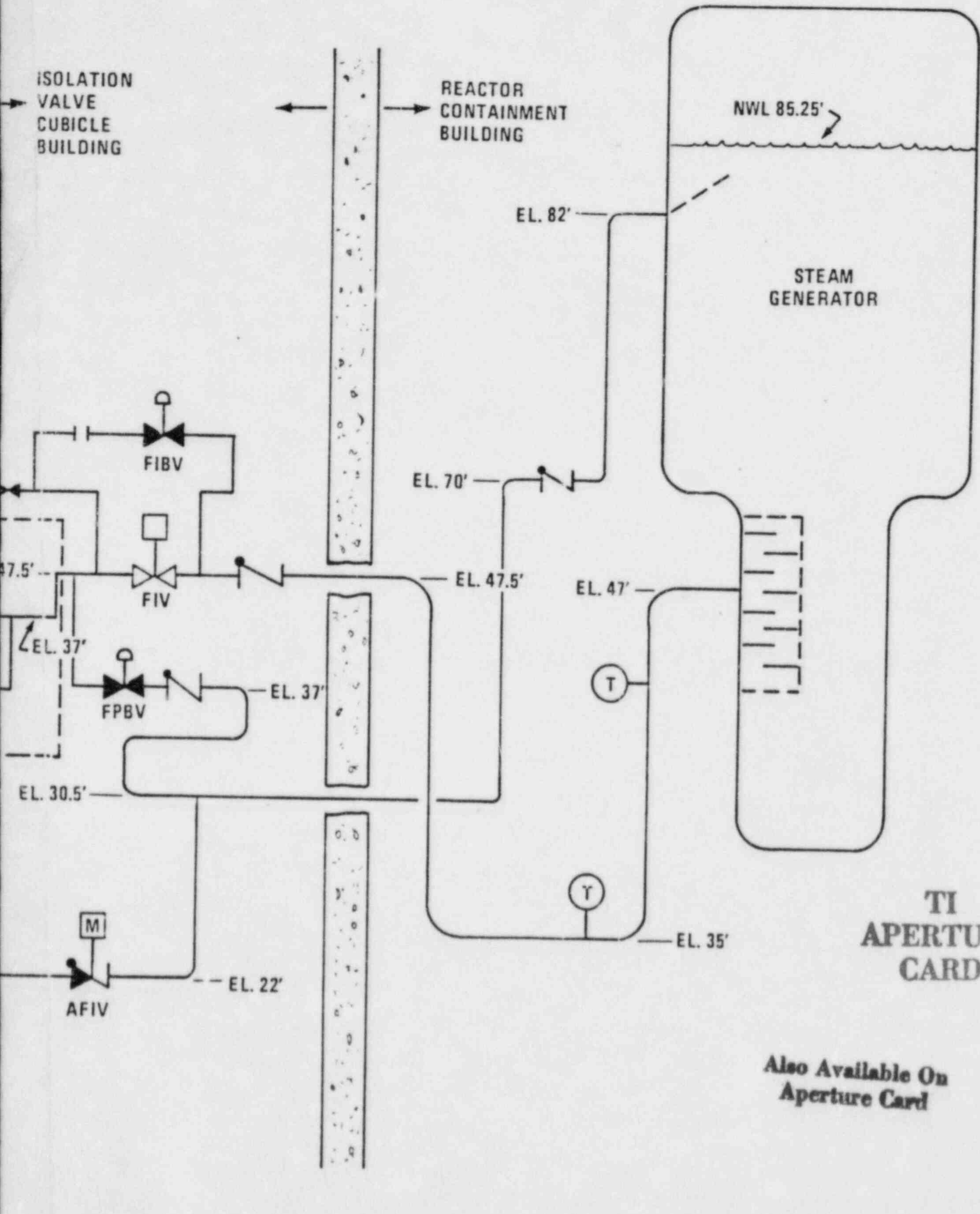
EL.
FCV
FBCV
NWL 63.33'
AUXILIARY
FEEDWATER
STORAGE
TANK
M
AFCV
EL. 12.5'
AFW PUMPS
(TYP. 4)

XILIARY FEEDWATER INTERFACE



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