CENTERIOR ENERGY

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September 30, 1994
PY-CEI/NRR-1867L

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D. C. 20555

Perry Nuclear Power Plant
Docket No. 50-440
LER 94-015-01

Gentlemen:

Enclosed is Licensee Event Report 94-015-01 concerning Potential Loss of Emergency Service Water System Due to Loss of Keepfill.

If you have questions or require additional information, please contact Mr. James D. Kloosterman, Manager - Regulatory Affairs at (216) 280-5833.

Very truly yours,

RAS:DHL:sc

Enclosure: LER 94-015-01

cc: NRC Project Manager
NRC Resident Inspector Office
NRC Region III

040033

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NRC FORM 356 (5-92) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 5/31/95

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Perry Nuclear Power Plant, Unit 1	05000 440	1 OF 10

TITLE (4)
Potential Loss of Emergency Service Water System Due to Loss of Keepfill

EVENT DATE (5)			LER NUMBER (6)			REPORT NUMBER (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
										05000
06	09	94	94	-- 015 --	01	09	30	94	FACILITY NAME	DOCKET NUMBER 05000

OPERATING MODE (9)	5	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)							
POWER LEVEL (10)	000		20.402(b)		20.405(c)		50.73(a)(2)(iv)		73.71(b)
			20.405(a)(1)(i)		50.36(c)(1)	X	50.73(a)(2)(v)		73.71(c)
			20.405(a)(1)(ii)		50.36(c)(2)		50.73(a)(2)(vii)		OTHER
			20.405(a)(1)(iii)		50.73(a)(2)(i)		50.73(a)(2)(viii)(A)		(Specify in Abstract below and in Text, NRC Form 366A)
			20.405(a)(1)(iv)		50.73(a)(2)(ii)		50.73(a)(2)(viii)(B)		
			20.405(a)(1)(v)		50.73(a)(2)(iii)		50.73(a)(2)(x)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
David H. Lockwood, Compliance Engineer	(216) 280-7539

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS

SUPPLEMENTAL REPORT EXPECTED (14)				EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
	YES (If yes, complete EXPECTED SUBMISSION DATE)	X	NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

At 1102 on June 2, 1994 Emergency Service Water (ESW) system keepfill supply was transferred to the normal supply, the Service Water (SW) system, from alternate keepfill supply after completion of a design change to the SW system. At 0001 on June 9, 1994 a plant operator reported that ESW loop A keepfill pressure was 10.5 psig; required pressure is greater than or equal to 13.5 psig. At 1030 keepfill pressure for ESW loops B and C was reported as out of specification low. An engineering review of system line-up and parameters determined that ESW A, B, and C loops were operable during the June 2 to June 9 time period. The engineering review also identified that during periods of low Lake Erie water temperature operability of the ESW system could be affected. Immediate corrective actions were to verify system valve line-up, start additional SW system pumps and finally to return ESW system keepfill to the alternate supply.

The cause of the reduced keepfill system pressure was identified as a deficiency in a SW system design change. The ESW keepfill system has been aligned to the alternate supply pending final determination of long term corrective actions.

This supplement revises the design change corrective action completion date, and acknowledges multiple ESW alternate supply sources.

I. Introduction

At 1102 on June 2, 1994 Emergency Service Water (ESW) [BI] system keepfill supply was transferred to the normal supply, the Service Water (SW) [KG] system, from alternate keepfill supply after completion of a design change to the SW system. At 0001 on June 9, 1994 a plant operator reported that ESW system A keepfill pressure was 10.5 psig; required pressure is greater than or equal to 13.5 psig. At 1030 keepfill pressure for ESW loops B and C was reported as out of specification low. Review of the keepfill system identified a deficiency in the SW system design change, which reduced keepfill pressure under certain operating conditions. Immediate corrective actions were to verify system valve line-up, start additional SW system pumps and finally to return ESW system keepfill to the alternate supply.

An engineering review of system line-up and parameters determined that ESW A, B, and C loops were operable during the June 2 to June 9 time period, but that during periods of low Lake Erie water temperature ESW system operability could be affected.

At the time of this event the plant was in Operational Condition 5, Refueling, with reactor temperature at 89 degrees F. Notification was made in accordance with 10CFR50.72(b)(2)(iii) on June 9, 1994. This event is being reported under the requirements of 10CFR50.73(a)(2)(v).

II. Description of Event

ESW system keepfill is normally provided by the SW system through a cross-tie connection from the line downstream of the Turbine Building Closed Cooling (TBCC) [KB] system heat exchangers [HX] to a standpipe for each ESW system. The levels in the ESW system standpipes are maintained by a continuous supply of keepfill water to makeup for system loop leakage when the system is in standby readiness. An allowable drain level (ADL) has been established to prevent siphon voids from forming in the high points of each system. An alert level was established in each loop standpipe at a pressure equal to the height of water at the loop high point. Water level in the standpipe between the alert level and the ADL will not create a siphon void, but can create an air pocket if the system is not leak tight. Pump starts with water level below the ADL could cause water hammer due to siphon voids. Pump starts with level between the the alert level and the ADL could cause a water hammer due to air pockets caused by system inleakage.

An allowable leak down rate has been established for each loop based on the volume of water available between the alert and the ADL to provide 20 minutes for operator action. Plant operators monitor ESW keepfill pressure and thus level on a weekly basis.

Following fiberglass pipe repairs and system modifications performed in the current refueling outage the SW system was placed in service under a special test instruction. The test instruction performed flow testing of the newly rerouted SW system pipe downstream of the Turbine Lube Oil Coolers [TD] and TBCC system heat exchangers. These lines were rerouted to the former Unit 2 ESW system discharge line that is routed to the discharge tunnel entrance structure. Pages 7 and 8 of 10 show the previous and new configurations. This altered configuration eliminated the backpressure provided by the weir structure (see page 9 of 10) since it was bypassed. To replace the needed backpressure, a throttle valve [V] was installed downstream of the Lube Oil Coolers and a restricting orifice [OR] was installed downstream of the TBCC heat exchangers. Flow testing under the special test instruction demonstrated that maximum design flows could be obtained with the new pipe routing. Pressure gauge readings were not recorded for the rerouted lines during the special test instruction.

Alternate ESW keepfill was provided by the Fire Protection system [KP] while the SW system was out of service. At 1102 on June 2, 1994 keepfill supply was transferred back to the SW system to re-establish normal supply. Two of four SW system pumps were running with the keepfill line in service supplying makeup water to the three ESW system loops. The TBCC heat exchanger flow was routed through the temperature control valve [TCV] (P41-F003) bypass line (see page 10 of 10). Subsequently the temperature control valve bypass valve (P41-F0390) was throttled to approximately 30 to 35% open by plant operators. TCV P41-F003 was available in parallel and capable of contributing/passing additional flow through the SW system return line, although its initial position on June 2, 1994 was not confirmed. On June 9, 1994 low ESW system keepfill pressures were noted by plant operators. The third SW system pump was started in an attempt to increase downstream pressure, but was unsuccessful. Flow was increased through valve P41-F0390 and the keepfill gauge pressure readings increased to above the alert level. Opening valve P41-F0390 to 70% increased the downstream pressure providing sufficient pressure at the keepfill cross-tie to increase keepfill water pressure above the required level.

For the period June 2 through June 9, 1994 that SW was in service and supplying keepfill to ESW the potential existed for air inleakage to the ESW system. Engineering evaluation has determined that ESW operability was not compromised. On June 2, 1994 valve P41-F0390 was passing flow at 30 to 35% open. On June 9, 1994 standpipe water level was observed at levels well above the ADL, but below the alert level. There is no evidence that valve P41-F0390 position was altered during this time frame.

Lake temperature data records indicate that a Lake Erie temperature inversion occurred overnight between June 8 and June 9, 1994 which reduced lake temperature from 62 degrees F to 54 degrees F. This condition would result in a closing of the valve P41-F003 thereby decreasing keepfill supply pressure.

Therefore, the condition on June 9, 1994 represents the worst case scenario for this time frame. The SW system flow at this condition continued to provided adequate pressure to maintain a water column above the allowable drain down level to prevent siphon voids from forming.

Although air inleakage is possible with standpipe level below the alert level the formation of an air pocket is considered unlikely. Engineering calculation has determined that significant differential pressure was not available at the known standpipe water level to allow for air inleakage. Further, the potential leak sources at loop high points and other locations are limited. However, no means exists within the system configuration to determine if air inleakage has occurred or at what level below the alert level the ESW loops would become inoperable.

The ESW pumps were run intermittently during the time period. There were no reported problems that would indicate that water hammer had occurred. Placing a ESW pump in service would result in filling its associated standpipe.

An engineering evaluation was performed for the impact of the new configuration on ESW keepfill with lower Lake Erie water temperature. The evaluation considered the winter season, Lake Erie water temperature approximately 33 degrees F, as the worst case. With the plant in normal winter operation, the potential of inadequate keepfill pressures exists. If a plant shutdown were to occur during the winter season with minimal heat loads on the TBCC system and valve P41-F0390 closed, SW system operational flow rates would be lower than the minimum required for normal operation in the winter. Valve P41-F003 would therefore close even further, diminishing downstream SW pressure required to maintain ESW keepfill.

The available SW system makeup may be less than the allowable leak rate that has been established thus decreasing standpipe level to below the ADL. Further, available SW system makeup may decrease to a value below the standpipe inlet check valve lifting pressure contributing to a decrease in water level. Plant operators verify standpipe level on a weekly basis. During the time period between level verifications, standpipe level could decrease below the ADL and cause siphon voids.

With water level below the alert level, air inleakage is possible. During the time period between level verifications inleakage could cause an air pocket of sufficient size to cause a water hammer on pump start.

Therefore, the ESW keepfill system could have reached the ADL prior to being monitored by the plant operators.

III. Cause of Event

The cause of this event was inadequate design. The design of the restricting orifice installed downstream of the TBCC heat exchangers was based on maximum system operational flow and did not consider minimum flow conditions or the ESW keepfill line located upstream.

IV. Safety Analysis

The primary function of the ESW keepfill system is to prevent water hammer during ESW system startup from standby or secured status. The ESW system is comprised of three independent loops. The system is designed such that the occurrence of any single active or passive failure will not reduce the safety related functional performance of the Emergency Core Cooling system (ECCS). The ESW system is capable of supplying cooling water to the equipment on two of the three ESW loops following a single failure. However, this event resulted in a potential loss of all loops of the ESW system.

This event is not considered safety significant as the ESW system was determined to be operable during the period June 2 through June 9, 1994 and potential inoperability was identified prior to the adverse conditions being achieved.

V. Similar Events

Loss of ESW A loop keepfill due to a mispositioned valve was documented on LERs 91-024 and 91-024-01. LER 94-005 identified a loss of all trains of a safety system, Control Room Emergency Recirculation system, due to inadequate design. None of these events resulted in a loss of all trains of the ESW system. Corrective actions from these previous similar events would not have prevented this event.

VI. Corrective Actions

Immediate corrective actions were to verify system valve line-up, start additional SW system pumps and finally to return ESW system keepfill to the alternate supply, Fire Protection system water.

Engineering has conducted SW system testing to determine ESW keepfill pressures. System operating parameters were recorded at various TBCC temperature control valve and bypass valve positions to evaluate SW system performance and provide data for determination of permanent corrective actions. A design change is being developed to provide a new keepfill supply from the SW system and will be completed prior to startup from the fifth refuel outage.

ESW keepfill will remain aligned to an alternate supply until final corrective actions are completed.

Engineering will determine the time period that level can be below the standpipe alert level without affecting ESW system operability. Engineering will also review the monitoring frequency of standpipe level to determine if a greater frequency is required. At this time standpipe level is being monitored once per shift. This action will be completed by October 31, 1994.

Plant modifications installed during the current refuel outage will be reviewed. Details and the extent of this review are being addressed by separate correspondence with the NRC.

Energy Industry Identification System (EIIS) codes are identified in the text as [XX].

NRC FORM 366A (5-92) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 5/31/95

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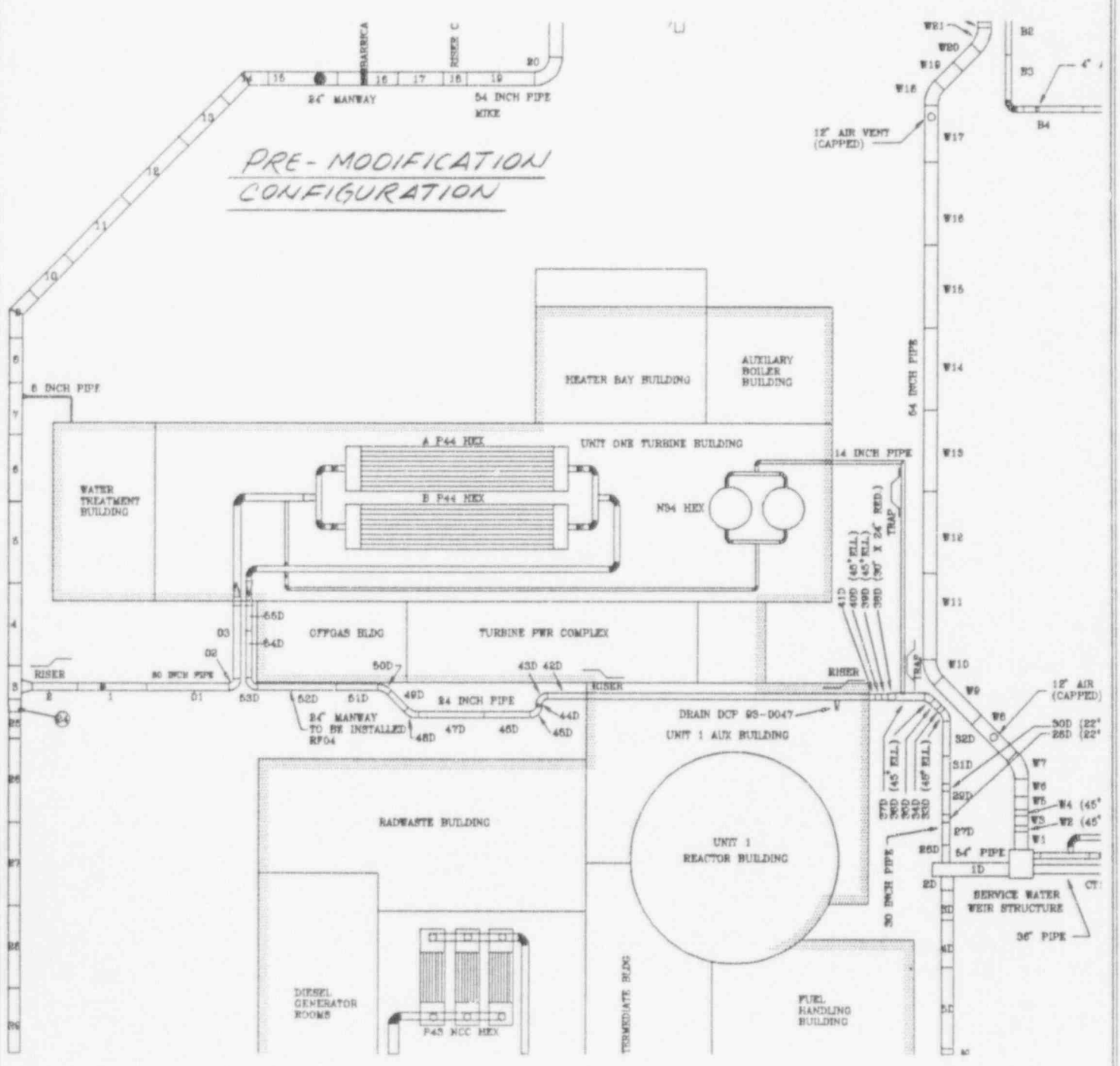
LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Perry Nuclear Power Plant, Unit 1	05000 440	94	- 015 -	01	7 OF 10

TEXT (If more space is required, use additional copies of NRC Form 366A) (17)



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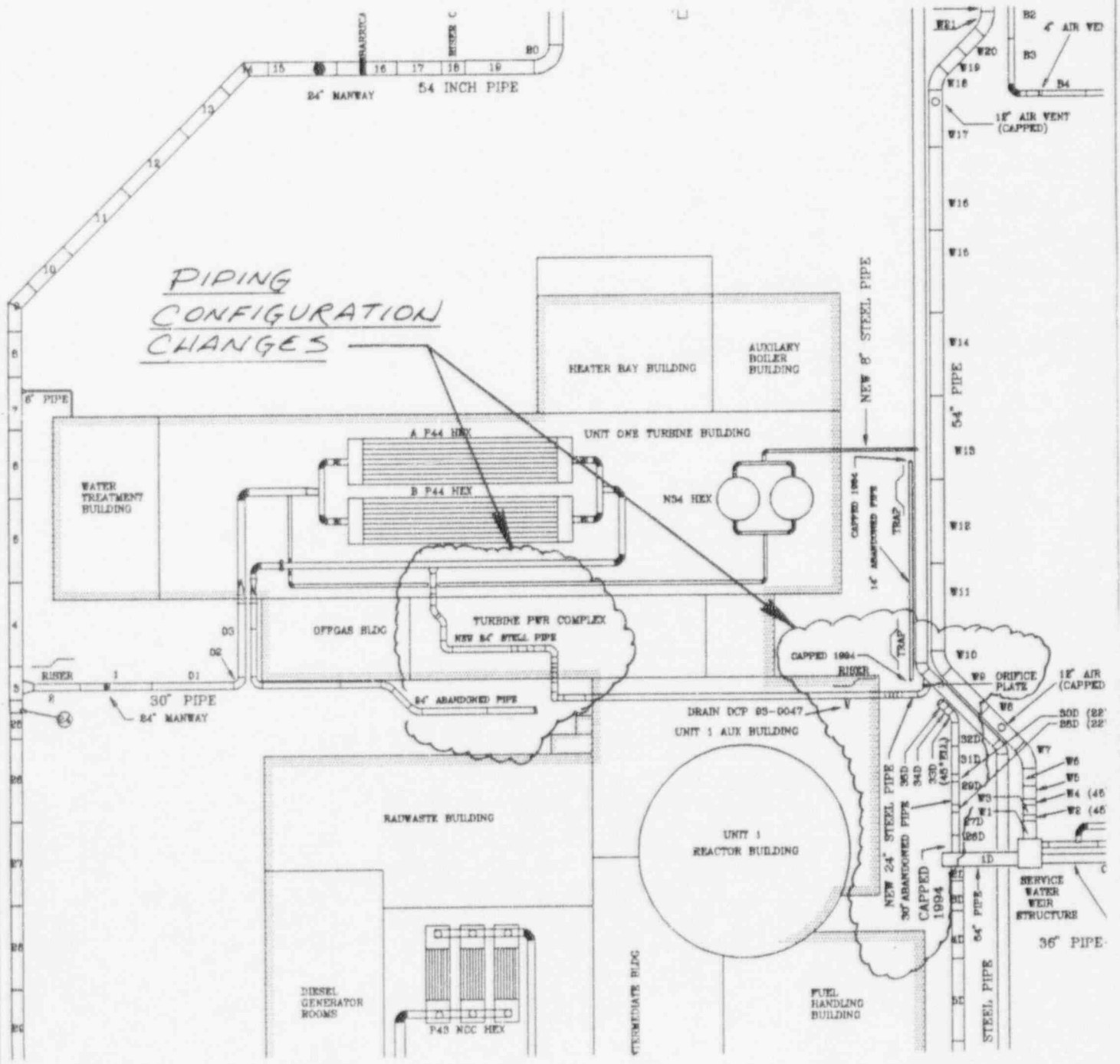
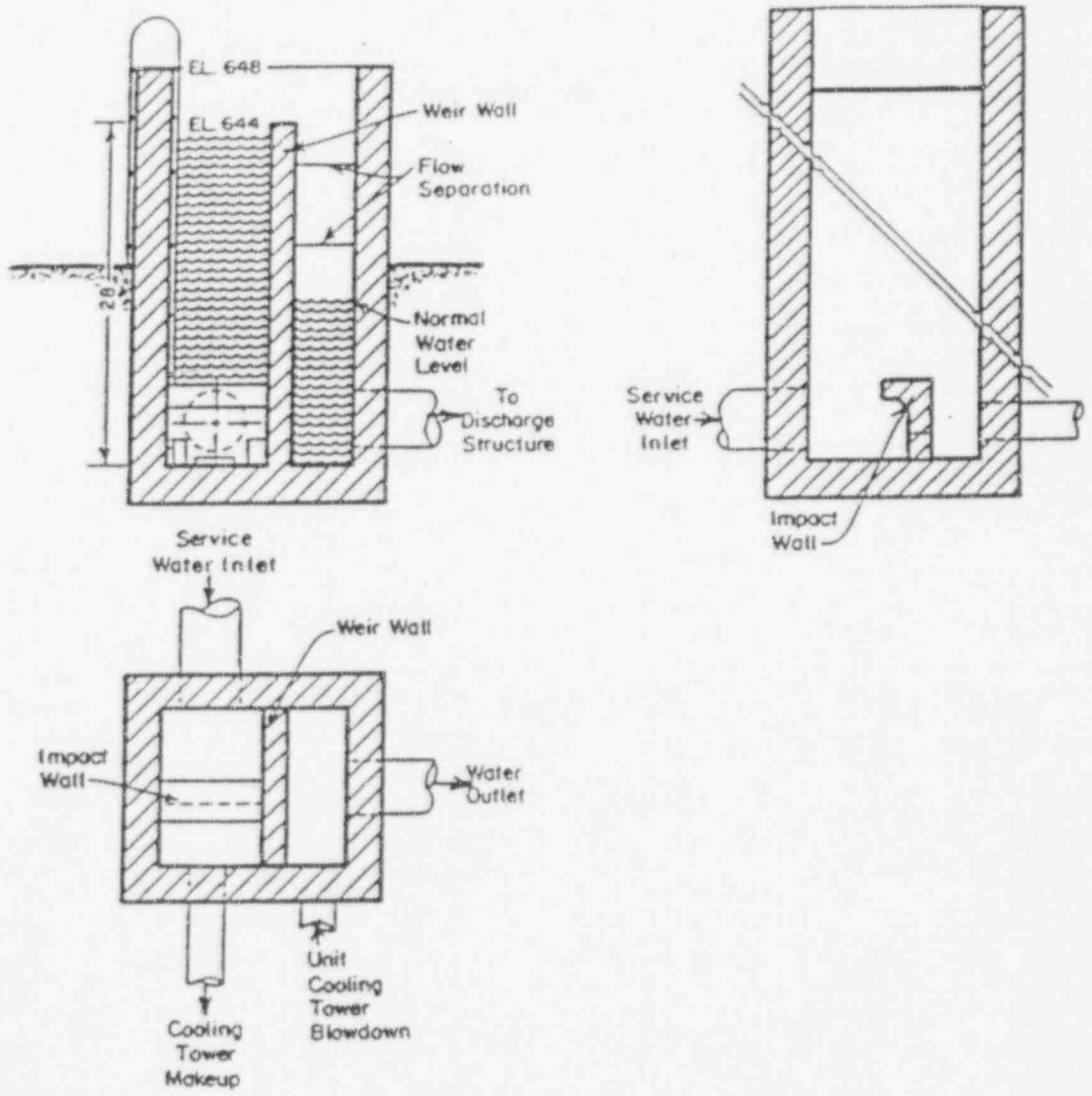
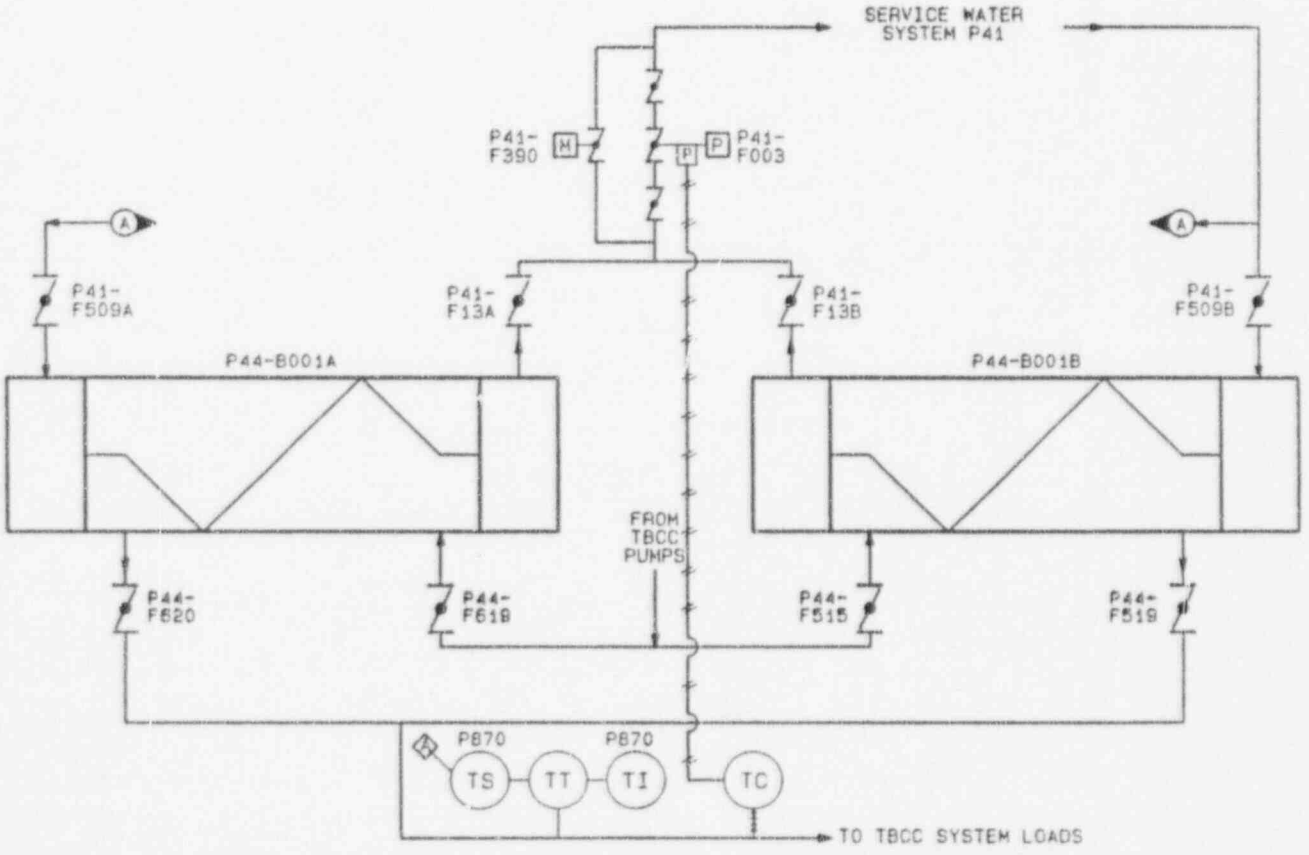




SERVICE WATER WEIR STRUCTURE



TBCC SYSTEM HEAT EXCHANGER SERVICE WATER FLOW CONTROL