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Waterford 3

W3F1-95-0188
A4.05
PR

January 16, 1996

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

Subject: Waterford 3 SES
Docket No. 50-382
License No. NPF-38
Reporting of Licensee Event Report

Gentlemen:

Attached is Licensee Event Report Number LER-95-007-00 for Waterford Steam Electric Station Unit 3. This report is submitted as a voluntary Licensee Event Report.

Very truly yours.

D.R. Keuter
General Manager
Plant Operations

DRK/WHP/tjs
Attachment

cc: L.J. Callan, NRC Region IV
C.P. Patel, NRC-NRR
J.T. Wheelock - INPO Records Center
R.B. McGehee
N.S. Reynolds
NRC Resident Inspectors Office
Administrator - LRPD

IE22
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NRC FORM 366 (4-95) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 04/30/98

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), 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)
WATERFORD STEAM ELECTRIC STATION UNIT 3	05000 382	1 OF 11

TITLE (4)

ESSENTIAL CHILLED WATER SYSTEM FLOW DEGRADATION

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
05	25	95	95	-- 007 --	00	01	16	96	N/A	05000
									FACILITY NAME: N/A	DOCKET NUMBER: 05000

OPERATING MODE (9)	1
POWER LEVEL (10)	100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)

20.2201(b)	20.2203(a)(2)(v)	50.73(a)(2)(i)	50.73(a)(2)(viii)
20.2203(a)(1)	20.2203(a)(3)(i)	50.73(a)(2)(ii)	50.73(a)(2)(x)
20.2203(a)(2)(i)	20.2203(a)(3)(ii)	50.73(a)(2)(iii)	73.71
20.2203(a)(2)(ii)	20.2203(a)(4)	50.73(a)(2)(iv)	X OTHER
20.2203(a)(2)(iii)	50.36(c)(1)	50.73(a)(2)(v)	Specify in Abstract below or in NRC Form 366A
20.2203(a)(2)(iv)	50.36(c)(2)	50.73(a)(2)(vii)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
J.M. LAQUE, SUPT., SYSTEM ENGINEERING	(504) 739-6630

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)

Through special testing on Essential Chilled Water system train 'B', it was discovered that essential chilled water flow to one of the two 50% capacity room coolers for the 'B' safeguards pump room had significantly degraded flow. Additionally, it was discovered that the as found flow rates for chilled water loop 'B', with its 'B' pump aligned was below the total established design and accident flow rates. Although some individual room coolers had degraded flow conditions, subsequent evaluations determined that adequate cooling was available to support continuous operation of the train 'B' safeguards pumps during the performance of their safety function. Additionally, the remainder of the chilled water system continued to remain operable and capable of fulfilling its intended safety function as a support system to other safety systems. The root cause for this condition is attributed to specific system operating conditions. Immediate corrective actions included restoring the "B' train flow to within its normal parameters and verifying adequate flow on other chilled water sub-loops. This event did not compromise the health and safety of the public. This event is being voluntarily reported because it could be of generic interest to the industry and had the potential for safety significance.

REQUIRED NUMBER OF DIGITS/CHARACTERS FOR EACH BLOCK

BLOCK NUMBER	NUMBER OF DIGITS/CHARACTERS	TITLE
1	UP TO 46	FACILITY NAME
2	8 TOTAL 3 IN ADDITION TO 05000	DOCKET NUMBER
3	VARIES	PAGE NUMBER
4	UP TO 76	TITLE
5	6 TOTAL 2 PER BLOCK	EVENT DATE
6	7 TOTAL 2 FOR YEAR 3 FOR SEQUENTIAL NUMBER 2 FOR REVISION NUMBER	LER NUMBER
7	6 TOTAL 2 PER BLOCK	REPORT DATE
8	UP TO 18 -- FACILITY NAME 8 TOTAL -- DOCKET NUMBER 3 IN ADDITION TO 05000	OTHER FACILITIES INVOLVED
9	1	OPERATING MODE
10	3	POWER LEVEL
11	1 CHECK BOX THAT APPLIES	REQUIREMENTS OF 10 CFR
12	UP TO 50 FOR NAME 14 FOR TELEPHONE	LICENSEE CONTACT
13	CAUSE VARIES 2 FOR SYSTEM 4 FOR COMPONENT 4 FOR MANUFACTURER NPRDS VARIES	EACH COMPONENT FAILURE
14	1 CHECK BOX THAT APPLIES	SUPPLEMENTAL REPORT EXPECTED
15	6 TOTAL 2 PER BLOCK	EXPECTED SUBMISSION DATE

REPORTABLE OCCURRENCE

On May 25,1995, while performing a special test on Essential Chilled Water system train 'B'(EIIS, KM), it was discovered that essential chilled water flow to one of the two 50% capacity room coolers for the 'B' Safeguards Pump room had significantly degraded flow. This condition was discovered while the A/B Essential Chiller and pump was aligned to supply the 'B' train of Essential Chilled Water. Although not specifically called out in the Technical Specifications, these room coolers are considered to be support equipment for the train 'B' Safeguards pumps. (EIIS, BE/BQ/BP)

Special test data indicated that the "as found" sub-loop flow conditions for 3 of 4 chilled water sub-loops was adequate. Normal flow for the sub-loop which supplies the Safeguards room 'B' room coolers is approximately 94 gpm. The "as found" conditions indicated that this loop had approximately 54 gpm chilled water flow. Subsequent investigation revealed that one of the 'B' Safeguards room coolers, (AH-2(B)), had approximately 8 gpm flow and the other, (AH-2(D)), had approximately 46 gpm flow. The total flow for the essential chilled water train 'B', with the 'A/B' chiller and pump aligned, was initially measured to be approximately 480 gpm, which was greater than the accident flow of approx. 424 gpm. This specific flow configuration was evaluated to be adequate to provide sufficient cooling to support continuous operation of the Safeguards pumps during the performance of their safety function.

On June 1, 1995, during flow balance testing, the "as found" flow rates for Chilled Water loop 'B' with 'B' Essential Chiller and pump aligned was 320 gpm. This was 63 percent of the design flow of 510 gpm and less than the accident flow of approx. 424 gpm. This flow was measured with CHW-115B, "Chilled Water Pump 'B' Discharge Valve" in a ONE NOTCH OPEN position.

During investigation of the event, it was found that with valve CHW-115B fully open, the flow rates for the "B" loop were acceptable (580 gpm).

The "as found" flow conditions of the Essential Chilled Water system(EIIS, KM) was determined to be adequate for the system to perform its intended safety function. A subsequent evaluation determined that the discovered lower flows of the 'B' train Essential Chilled Water system remained adequate such that its support function of providing adequate cooling to the 'B' train safety components could be performed. This condition has been determined to be not reportable for the specific conditions described in this LER. However, this event is being reported as a voluntary LER because it could be of generic interest to the industry and had the potential for safety significance.

INITIAL CONDITIONS

At the time this condition was identified, Waterford 3 was operating at approximately 100 percent power in Operational Mode 1 (Power Operation). Special Test procedure 01135688, Essential Chilled Water Train B Minimum Recirculation Flow Test, was being performed at the time of this event. There was no major equipment out of service specific to this event and no Technical Specification Limiting Conditions for Operation (LCO's) were in effect specific to this event at the time the condition was discovered.

EVENT DESCRIPTION

(Refer to Attachment A) The Essential Chilled Water system consists of three 100 percent capacity subsystems. Each consisting of: one water chiller compressor unit (EIIS, KM-CMP), one chilled water pump (EIIS, KM-P), and associated piping, valves, instrumentation and controls.

These subsystems are piped such that chilled water is circulated, from any two of the subsystems, through three loops (Safety Train 'A', Safety Train 'B' and Non-Nuclear Safety) which serve equipment in various parts of the Reactor Auxiliary Building (EIIS, NF). Two of the three loops serve safety-related air handling units. The third loop serves non-safety air handling units. During a design basis accident, the non-safety loop is isolated from the remainder of the system and the two safety-related loops are isolated from each other so that each operating subsystem serves a safety-related loop while the non-safety loop receives no chilled water.

The chilled water trains 'A' and 'B' are further sub-divided into four sub-loops. Each sub-loop provides chilled water to a group of safety related air handling units. One of these sub-loops, on the 'B' safety train, provide chilled water to the Safeguards pump room 'B' room coolers and the Shutdown Heat Exchanger room 'B' room cooler (AH-2(B), AH-2(D) and AH-3). Chilled water to each room cooler in the system is controlled by a flow control valve (EIIS, KM-FCV) which modulates flow according to area temperature.

On May 25, 1995, a Special Test Procedure(STP) 01135688, Essential Chilled Water Train 'B' Minimum Recirc. Flow Test, was being performed on the essential chilled water system train 'B'. This test, although not required, was initiated at the General Manager, Plant Operation's request, to determine the correct fail safe position for the "Essential Chiller Recirculation Flow Control Valve", CHW-129B (CHW-129 A/B), and to determine existing system flow characteristics by performing a flow balance test of Essential Chilled Water Train 'B' using testing methodologies similar to that described in original startup test procedure SPO-46E. Additionally, this test was to determine an acceptable throttle position for the "Essential Chiller Recirculation Flow Control Inlet and Outlet Isolation Valves", CHW-127B and CHW-131B, and the "Chilled Water Pump Discharge

Valve", CHW-115B. System alignment for this test required chiller 'A/B' and chilled water pump 'A/B' to be aligned to the chilled water train 'B' safety loop.

During the performance of the test, it was discovered that the Essential Chilled water sub-loop which supplies chilled water to the room coolers for the 'B' Safeguards pump room and the Shutdown Heat Exchanger Room 'B' (AH-2(B), AH-2(D) and AH-3) was lower than required. The required sub-loop flow was approximately 94 gpm. The flow measured in the sub-loop was approximately 54 gpm. Sub-loop flows to the other three sub-loops remained adequate throughout this test. The total flow for the Essential Chilled Water train 'B' during this test (STP 01135688) was measured to be approximately 480 gpm. This was greater than the accident minimum required flow rate of approximately 424 gpm, but was less than the design flow rate of 510 gpm.

When this information was provided to the Shift Supervisor the Technical Specifications, 3.5.3 and 3.6.2.1 for High Pressure Safety Injection(HPSI) 'B' (EIIS, BQ), Low Pressure Safety Injection(LPSI) 'B' (EIIS,BP), and Containment Spray(CS) 'B' (EIIS, BE) were entered.

Action was immediately taken to restore the chilled water flow to established conditions. Four valves were adjusted by the Special Test procedure: "Chilled Water Pump Discharge Valve", CHW-115 A/B, "Safeguards Room 'B' Room Cooler Outlet Isolation Valve", CHW-840A(B) and the "Charging Pump & Emergency Feedwater Systems Chilled Water Return Header 'B' Isolation", CHW-823. Adjusting these valves established chilled water flow to 565 gpm total loop flow and 95 gpm for the Safeguards room 'B' sub-loop flow. These flows were above acceptable limits.

On June 1, 1995, the chilled water loop 'B' was again subjected to a flow balance test via Special Test Procedure 01136204. This test, however, had the 'B' chilled water pump and chiller aligned to the 'A/B'train. During the performance of this test the "as found" flow rates for Chilled Water loop 'B' with the Chilled Water pump 'B' aligned was 320 gpm, which was less than the accident flow. This was with CHW-115B in a ONE NOTCH OPEN position. During investigation of the event, it was found that with CHW-115 B fully open, the flow rates for the 'B' loop were acceptable (580 gpm).

On July 24, 1995, during valve sensitivty testing per STP-01136204 (Rev. 1), the AH-21B (Safeguards A/B) room cooler "as found" condition showed no flow through the room cooler. The discharge throttle valve (CHW-853) was cycled and placed back to its required position and the required flow was achieved. In addition, it was discovered that after cycling CHW-840 A & B, the required flow for AH-2 (B) was achieved after placing the valves in it's original position (1 5/8 turns OPEN) as required by Operations procedures. It was found, through bulk chemistry samples, that rust and sediment had apparently caused the blockages.

On July 25, 1995 during the performance of Special Test Procedure 01136661, the "as found" condition for air handling unit AH-26A (Control Room Mechanical Equipment Room) room cooler showed no flow through the cooler. The discharge throttle valve (CHW-613) was cycled and placed back to it's required position and the required flow was achieved. It was apparent that rust and sediment had also impaired flow through this cooler.

CAUSAL FACTORS

The root cause for the conditions of room coolers with little or no flow is attributed to iron deposits that have settled, over time, on the seats of

the individual room cooler chilled water manual throttle valves. These valves remain in a low flow condition for the majority of the time due to their small throttled position (i.e., only a few turns from closed) and the normally throttled closed position of their associated flow control valves. This allowed iron deposits to settle on the valve seats and block flow through the small opening between the disc and seat. When the valves were cycled, the sediment and rust was flushed and adequate flow was restored. Additionally, chemistry results indicated a large increase in the iron concentration of the Chilled Water System subsequent to these flushing manipulations. It should be noted that although a large increase was seen, the total iron concentration remained below the administrative limits set by Waterford.

A contributing cause for this condition is the lack of Essential Chilled Water System flow testing. The Chilled Water system is not designed for individual room cooler flow verification. There is an insufficient number of flow measuring instruments at the room coolers within the system to adequately monitor changes in local flow conditions. Periodic testing, however, could detect changes in the system resistance and flow characteristics.

In order to establish consistent flows throughout the chilled water system it was determined that the Chilled Water Pump Discharge Valves CHW-115A, B, and A/B should be fully opened. The need to reposition CHW-115A/B and CHW-115 B to the fully open position was due to the inherent characteristics of the butterfly valves. A small amount of movement in the valve disc causes a relatively large change in flow. Presently, all three CHW-115 valves are FULL OPEN. Differential Pressure measured across the Chilled Water pump 'A/B' and Chilled Water pump 'B' indicated that the pumps were operating on their respective pump curves.

IMMEDIATE CORRECTIVE MEASURES

Immediate corrective action was taken to restore the chilled water flow to established design conditions. Four valves were adjusted by the special test procedure: Chilled Water Pump Discharge Valve, CHW-115 A/B, Safeguards Room 'B' Room Cooler Outlet Isolation Valves, CHW-840A and B and Charging Pump & Emergency Feedwater Systems Chilled Water Return Header 'B' Isolation, CHW-823. Adjusting these valves established chilled water flow to 565 gpm total loop flow and 95 gpm for the safeguards room 'B' sub-loop flow. Additionally, Design Engineering evaluated the "as found" flow conditions of the 'B' chilled water train and concluded that the flows were satisfactory for the 'B' Chilled Water train to perform its intended support safety function.

ACTIONS TO PREVENT RECURRENCE

System engineering developed a Special Test Procedure (STP) to align the chilled water pump A/B to the chilled water loop 'A' to determine the flow rates in this configuration. This testing was performed during refuel 7 outage under Work Authorization 01140353.

System engineering has developed procedures, PE-004-022, Flow test of Chilled Water train B, and PE-004-023, Flow test of Chilled water train A, for use as required to periodically test the flows of the chilled water system. Additionally, they have established the routine initiation of a Condition Identification/Work Authorization package to periodically verify that selected room coolers have sufficient flow.

The system engineering group has inspected the AH-21 chilled water piping, valves and other components for iron deposits and Microbiological Induced Corrosion (MIC). Additionally, Chemistry and system engineering will

develop a sampling plan for additional sampling of the chilled water safety sub-loops. Chemistry will develop a plan to remove iron from the chilled water system.

A special test (Work Authorization 01140352) was developed and performed during refuel 7 outage to drain and flush the B and A/B (from the B header) Chilled Water headers. Subsequent flow verification testing indicated improved flow performance. The room coolers associated with the A Chilled Water header will be drained and flushed during subsequent component outages this operating cycle (Cycle 8).

For long term correction, system engineering has obtained approval for Station Modification Request (SMR) CHW-006. This will consider the removal of the NNS chilled water loop from the existing loops and placing them on the Non-safety chilled water loops. This would allow for the failing open of most of the flow control valves in the chilled water safety system (except for AH-12, AH-25 and AH-30) to achieve maximum flow at all times. This modification is scheduled to be a cycle 8 modification.

Operations department procedures OP-100-009, "Control of Valves and Breakers", OP-903-062, "Chilled Water System Valve Lineup Check", and OP-903-063, "Chilled Water Pump Operability Verification", will be revised to show the new positions for CHW-115A, B and A/B, and the position for CHW-823.

Other similar safety related cooling systems with manual valves in locked, throttled positions were evaluated and the Component Cooling Water system was identified as a candidate for additional flow testing. The Component Cooling Water System was satisfactorily flow tested in Refueling Outage 7 under Special Test, WA #01140557.

SAFETY SIGNIFICANCE

Special testing results indicated that the 'A' safety train exceeded its minimum design flows and remained operable. Additionally, with the 'A/B' chiller and pump aligned to the 'B' safety train it was found that, although the flows were lower than expected, they were greater than the required accident flow rate. Therefore, with the 'A/B' chiller and pump aligned to the 'B' safety train the 'B' safety train remained operable. The Chilled Water system met its Technical Specification requirement of two operable trains at all times, therefore was able to fulfill its support system safety function.

In addition to special testing an evaluation of this event was performed by Design Engineering. The evaluation analyzed the capabilities of the Essential Chilled Water train 'B' with flow in the degraded as found, 63% of design flow, condition. The evaluation demonstrated that with 63% of design flow through Essential Chiller B, Essential Chilled Water train B was Operable at all times.

This operability confirmation required that an analysis be performed on each room with an affected room cooler to determine the maximum ambient air temperatures during a Design Basis Accident (DBA). The most limiting case for the analysis was with the 'B' chiller operating on the 'B' loop with the safeguard pump room 'B' room coolers in a severely degraded condition (i.e., one room cooler inoperable). These maximum ambient air temperatures were then used to evaluate individual equipment operability. The Safeguards B room and CCW pump B room was evaluated specifically because it was determined that they would experience temperatures greater than their design values. The EQ equipment evaluation determined that equipment in the two subject rooms would remain operable at the maximum calculated

ambient air temperatures. Therefore, the chilled water train 'B' would be able to fulfill its intended support safety function.

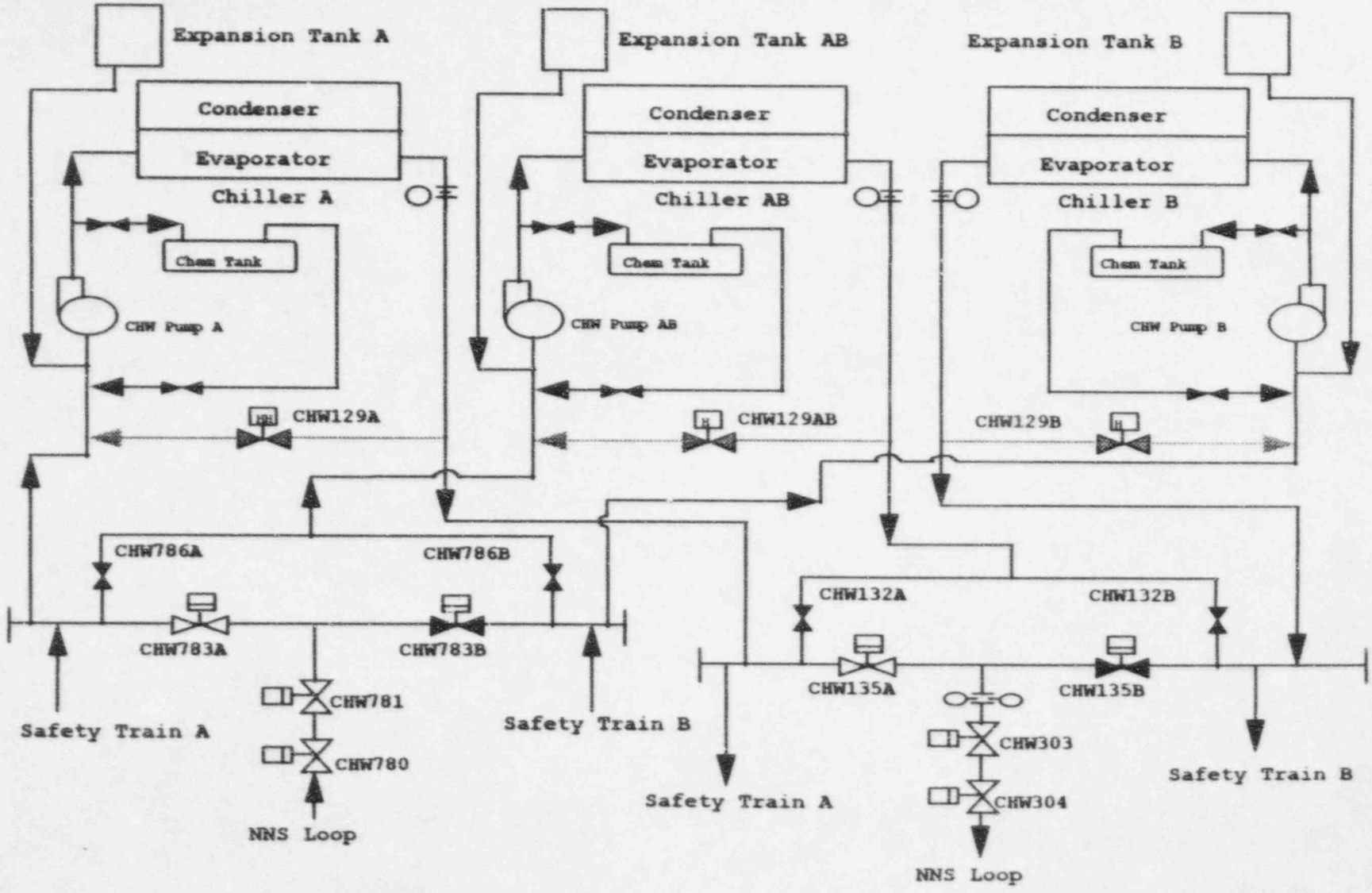
This condition did not prevent the fulfillment of the Essential Chilled Water system's support safety function therefore this condition did not prevent the fulfillment of the safety function of a system needed to mitigate the consequences of an accident, remove residual heat, shutdown the reactor and maintain it in a safe shutdown condition, or control the release of radioactive material. This event did not compromise the health and safety of the public.

SIMILAR EVENTS

There have been no similar events at Waterford 3.

ATTACHMENT A (1 of 4)

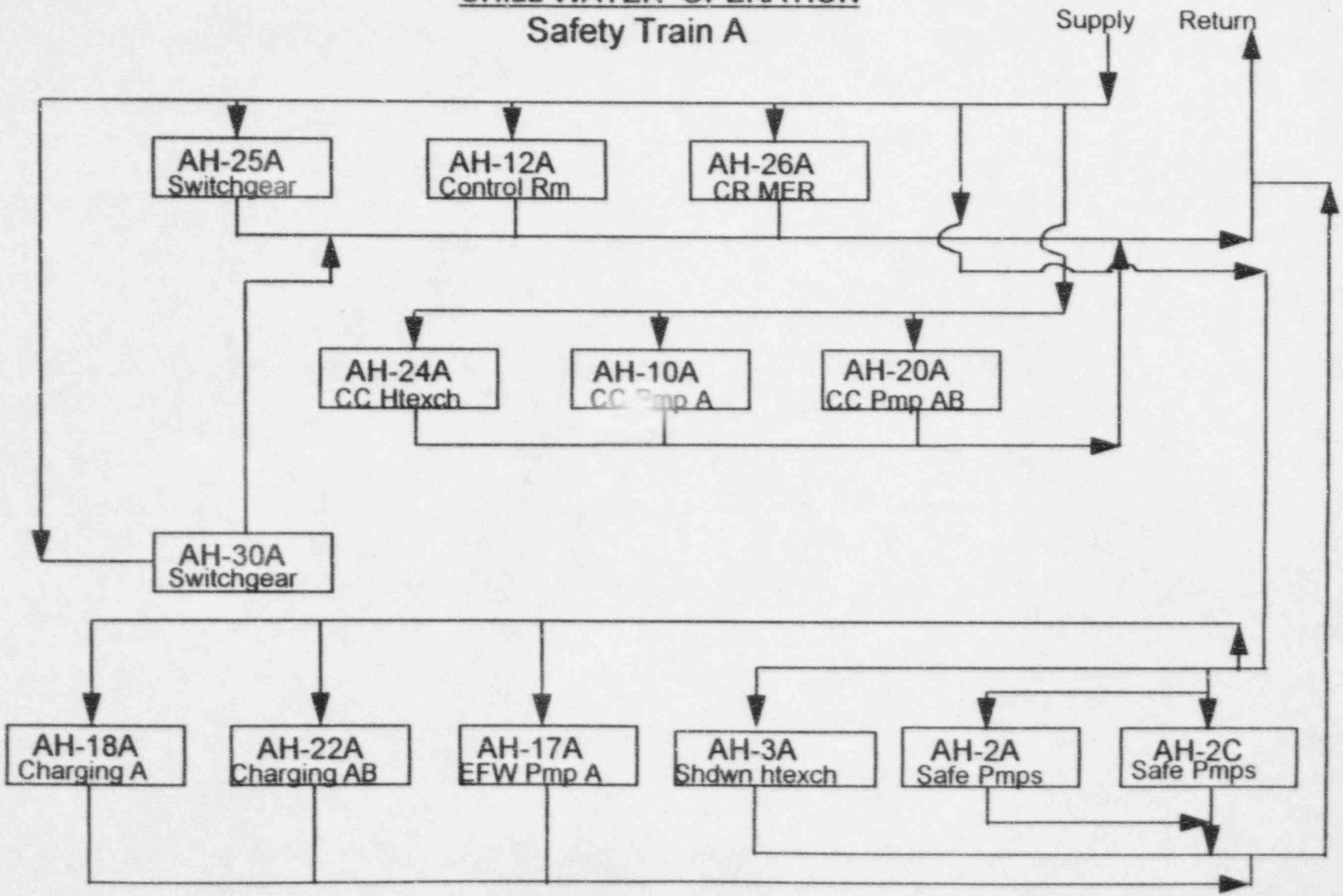
CHILL WATER OPERATION



ATTACHMENT A (2 OF 4)

CHILL WATER OPERATION

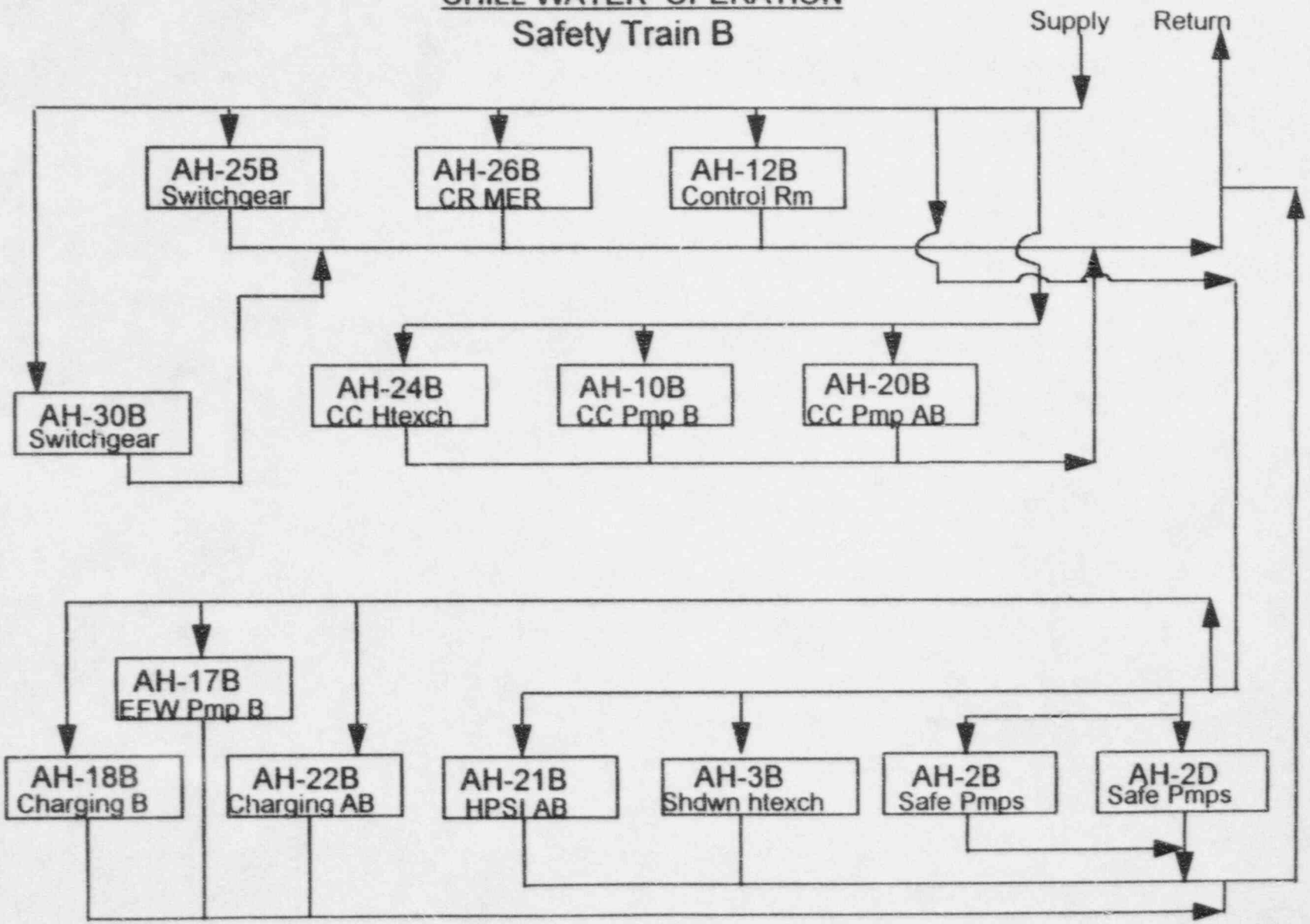
Safety Train A



ATTACHMENT A (3 OF 4)

CHILL WATER OPERATION

Safety Train B



ATTACHMENT A (4 OF 4)

CHILL WATER OPERATION

Non Nuclear Safety