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A4.05
PR

May 19, 1997

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 (LER) Number 97-015-00 for Waterford Steam Electric Station Unit 3. The Licensee Event Report is submitted in accordance with 10CFR 50.73(a)(2)(v)(D).

Very truly yours,

T R Leonard

T.R. Leonard
General Manager
Plant Operations

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TRL/RJM/ssf
Attachment

cc: E.W. Merschoff (NRC Region IV), C.P. Patel (NRC-NRR),
A.L. Garibaldi, J.T. Wheelock - INPO Records Center,
J. Smith, N.S. Reynolds, NRC Resident Inspectors Office,
Administrator - LRPD

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

LICENSEE EVENT REPORT (LER)

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

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

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TITLE (4)

Ultimate Heat Sink Did Not Incorporate Conservative Assumptions

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
									N/A	05000
04	18	97	97	-- 015 --	00	05	19	97	N/A	05000

OPERATING MODE (9)	5
POWER LEVEL (10)	000

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)	X	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)		OTHER
	20.2203(a)(2)(iii)		50.36(c)(1)	X	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)
T.J. Gaudet, Licensing Manager	(504) 739-6666

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 14[illegible] [illegible]aces, i.e., approximately 15 single-spaced typewritten lines) (16)

Personnel determined the Essential Chillers may not have been able to perform their safety function in the event of a LOCA. As a result of design basis upgrade work, personnel determined additional conservative assumptions should be used in the design basis of the UHS. New analysis established that if the additional conservative assumptions are factored in the analysis of record, the heat input to the UHS is increased by about 21 E06 Btu/hr in the event of a LOCA. This additional heat to the UHS impacts the Component Cooling Water (CCW) temperature to essential equipment, the consumption of water in the Wet Cooling Tower (WCT) basins, and the Essential Chiller cooling capacity. The impact of the additional heat load on the Essential Chiller cooling capacity was determined to be potentially safety significant since there were a number of occurrences during Cycle 6 operation when both the Train A and B Essential Chillers could have tripped due to low flow had a LOCA occurred. This condition did not compromise the health and safety of the public.

REPORTABLE OCCURRENCE

On April 18, 1997 at approximately 1210, Waterford 3 personnel determined that in the past the Ultimate Heat Sink (UHS), (EIIS System Identifier BS), may not have been able to perform its safety function. Subsequent evaluation as part of the root cause analysis established the UHS would have performed its safety function, but the Essential Chillers, (EIIS System Identifier KM), may not have been able to perform their safety function in the event of a LOCA. This event is reportable to the NRC pursuant to 10CFR 50.73(a)(2)(v)(D), as an event or condition that alone could have prevented the fulfillment of the safety function of structures or systems that are needed to mitigate the consequences of an accident.

INITIAL CONDITIONS

Waterford 3, at the time of discovery, was in Mode 5 (Hot Shutdown). The plant was at 0 percent of rated thermal power. There were no structures, systems, or components out of service that contributed to this event.

EVENT DESCRIPTION

In August of 1996, as a result of an ongoing Entergy assessment of the Ultimate Heat Sink (UHS), Waterford 3 personnel questioned whether the impact of a ± 3 °F temperature uncertainty for the logic for UHS valve ACC-126 was considered in the calculations for the design basis of the UHS. In October 1996, personnel were finalizing the evaluation of Information Notice (IN) 96-01. As part of the investigation for IN 96-01, Waterford 3 personnel recognized the heat load rejection of the Containment Fan Coolers (CFCs), (EIIS System Identifier BK), may be higher than the heat load rejection determined for the containment peak pressure analysis. Specifically, the containment peak pressure analysis was performed with a fouling factor of 0.0005 for the CFCs. The assumption of a fouling factor is a conservative analytical approach in modeling the impact of the CFCs in the containment peak pressure analysis since less heat removal is assumed to occur, thus increasing containment peak pressure. On the other hand, the assumption of fouling for the CFCs reduces the heat input to the UHS, and the assumption is not conservative from that perspective. Thus, the new assumption of no fouling is a conservative analytical approach in modeling the impact of the CFCs and the heat input to the UHS. The original calculations for the determination of the maximum heat input to the UHS were based on the assumption of a fouling factor of 0.0005 for the CFCs.

Using the knowledge from ongoing design basis upgrade work and the UHS self assessment, personnel recognized the need to ensure a conservative analytical approach in the design basis of the UHS. In March 1997, an analysis was performed using the computer code CONTEMPT to determine the maximum heat input to the UHS. The CONTEMPT analysis was performed using the assumption of no fouling for the CFCs and an uncertainty of -3 °F for the temperature logic associated with maintaining Component Cooling Water (CCW), (EIIS System Identifier CC), temperature concurrent with the data and assumptions used in original design basis analysis. The result of the CONTEMPT analysis was that the heat input to the UHS was 195.4 E06 Btu/hr, which exceeded the design basis heat input of 178.35 E06 Btu/hr.

On April 4, 1997, while operating in Mode 1 at approximately 100% power, the operability evaluation was completed and approved. The operability evaluation concluded the UHS was operable, provided all Dry Cooling Tower (DCT) and Wet Cooling Tower (WCT) fans remained operable. the peak dry bulb temperature does not exceed 95 °F, and the 3 day average dry bulb does not exceed 84 °F. On April 4, 1997, administrative controls were put in place to monitor meteorological conditions and to implement the appropriate Technical Specification requirements if certain meteorological conditions were not met.

The determination of whether this condition affected the past operability of the UHS is a complex function of the performance of several sub-systems and components as well as the assumptions made in the design bases analyses. These sub-systems, components, and assumptions include, for example, CCW system, Auxiliary Component Cooling Water (ACCW) system, Essential Chillers, CCW heat exchanger, DCT and WCT fans, ACCW and CCW flow rates, fouling factors assumed for CCW heat exchanger, number of DCT and WCT fans operable, and ambient meteorological conditions. The operability evaluation established that the UHS was operable provided all DCT and WCT fans were operable, the dry bulb temperature does not exceed 95 °F, and the 3 day average dry bulb does not exceed 84 °F. After reviewing from a qualitative standpoint the operating history of Waterford 3 and the factors and conditions which could affect and define the operability of the UHS, a judgment was reached that, for brief periods of time, the UHS may not have been operable. On April 18, 1997, a four hour report was made to the NRC pursuant to 10CFR 50.72(b)(2)(iii)(D).

A root cause analysis was initiated to determine the root cause, safety significance, generic implications, and corrective actions.

CAUSAL FACTORS

The root cause was the result of design errors associated with the original design of the Ultimate Heat Sink.

In the late 1970 time period, the method used to determine the heat load for the UHS was to use the maximum heat load based on the FSAR Chapter 6 LOCA containment peak pressure analysis. An analysis was then performed to demonstrate the UHS could dissipate the maximum heat load while also demonstrating sufficient margin in the system. Sufficient margin in the design was demonstrated by assuming certain conservative assumptions in the analysis, specifically a clean shutdown heat exchanger and the assumption in the analysis that CCW temperature could rise to 120 °F. Therefore, a worst case maximum Ultimate Heat Sink heat load was not calculated. This approach was consistent with the regulatory requirements in place at the time, which did not delineate specific assumptions to be assumed in the design of the Ultimate Heat Sink, and Regulatory Guide 1.27, which specifically stated that sufficient conservatism should be provided to ensure the design basis temperature of safety related equipment was not exceeded.

However, the original design assessment did not consider the response of the UHS to the additional heat load beyond the analyzed heat load of 178.35 E06 Btu/hr. The system response to additional heat load would be the ACCW system would pass more flow through the CCW heat exchanger in order to maintain CCW temperature at 115 °F, and thus lessen the flow through the Essential Chillers. The system would not respond by allowing CCW temperature to rise to 120 °F. There were no design features in place to prevent ACCW flow from exceeding 5000 gpm. Thus, the design flow of 850 gpm to the Essential Chiller could not be assured.

The root cause investigation established that the designers which worked on the original design of the UHS intended for CCW temperature to be maintained between 115 °F and 120 °F. The post-accident CCW temperature of 115 °F was considered a minimum design limit, not the setpoint. This intent was not effectively communicated and documented when the setpoints for UHS temperature control valves ACC-126A(B) were established. Further, this intent was also not effectively communicated and documented to other support groups responsible for ensuring a CCW post-accident temperature of 120 °F was used for essential equipment. The uncertainty of -3 °F for the temperature logic associated with UHS temperature control valves ACC-126A(B), given the setpoint of 115 °F, could result in increased ACCW flow. Similarly, given ACCW flow greater than 5000 gpm, the design flow of 850 gpm to the Essential Chiller could not be assured. Further, the consumption of WCT basin water would increase if meteorological conditions are unfavorable since the DCT would be less efficient.

The Waterford 3 current design control program is in accordance with the Waterford 3 Quality Assurance Program Manual which ensures the activities associated with the design or modification to plant safety related systems, components, and structures are planned, controlled, and correct. The program includes procedures which describe the criteria, parameters, bases, and other design requirements of the design process. These procedures describe the process of reviewing, confirming, or substantiating the design by one or more methods to provide assurance the design meets the specified design inputs. These procedures follow the guidelines given in ANSI N45.2.11-74, "Quality Assurance Requirements for the Design of Nuclear Power Plants." The procedures also require a 10CFR50.59 evaluation be performed to ensure calculations do not impact the plant design basis or the facility as described in any licensing basis document.

CORRECTIVE MEASURES

The following immediate corrective measures were taken.

On April 4, 1997, an operability evaluation was completed. The operability evaluation concluded the UHS will remain operable provided all DCT and WCT fans are operable, the dry bulb temperature does not exceed 95 °F, and the 3 day average dry bulb temperature does not exceed 84 °F.

On April 4, 1997, administrative requirements were put in place to require that all DCT and WCT fans be operable, to monitor meteorological conditions to ensure the dry bulb temperature does not exceed 95 °F, and the 3 day average dry bulb temperature does not exceed 84 °F, or if any of these conditions are exceeded, to implement the appropriate requirements of the Technical Specifications.

The following additional actions will be taken.

Waterford 3 will submit a technical specification change request to change the minimum fan requirements based on the revised heat load for the UHS. The FSAR will be changed accordingly.

Calculations will be performed, based on revised heat load, to demonstrate there is sufficient inventory in the WCT basins for the essential loads for the UHS to perform its safety function.

The appropriate throttled positions of ACCW valves ACC-127A(B) will be determined and implemented to ensure design flow is maintained to the Essential Chillers.

Procedure OP-002-001 will be revised to maintain ACCW valves ACC-127A(B) in throttled positions to ensure design flow is maintained to the Essential Chillers.

A calculation will be performed to confirm there is no impact on the minimum containment pressure analysis for performance capability of the Emergency Core

Cooling System (ECCS), (EIIS Identifiers BE, BQ, and BP), based on the assumptions of no fouling for the containment fan coolers and a cooler CCW inlet temperature. The analysis of the FSAR, section 6.2.1.5, will be revised if necessary.

A 10CFR 50.59 evaluation will be performed for certain I&C setpoint and uncertainty calculations to evaluate the issue of uncertainty.

SAFETY SIGNIFICANCE

The UHS heat rejection capability was based on the LOCA containment peak pressure accident heat load of 178.35 E06 Btu/Hr given in FSAR Table 9.2-3. The UHS maximum heat load was calculated to be 195.4 E06 Btu/Hr based on the conservative assumptions of no fouling for the CFCs and a CCW temperature of 112°F, and 199.4 E06 Btu/Hr with the two foregoing assumptions and the assumption of a shutdown heat exchanger heat transfer coefficient of 450 Btu/Hr °F ft^2 in the analysis. The additional heat load of about 21 E06 Btu/Hr has an impact on the CCW water temperature to the essential cooling equipment, the consumption of water of the WCT basins, and the Essential Chiller space cooling capacity.

The impact on CCW water temperature to the essential cooling equipment is not considered safety significant. The UHS, by design, is self adjusting should it be subjected to additional heat load. The UHS is designed to dissipate the maximum post-accident heat load with an ACCW flow of less than 5000 gpm through the CCW heat exchanger. The UHS would respond to the additional heat load by increasing ACCW

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flow through the CCW heat exchanger to maintain CCW temperature at 115 °F. The CCW water temperature would rise slightly should the ACCW flow required be more than the ACCW pump capability. However, the heat input into the UHS would then decrease because of slightly higher CCW water temperature to the essential equipment. The CCW temperature to the essential equipment would not exceed the design temperature of 120°F based on an increased heat load of about 21 E06 Btu/Hr to the UHS.

The impact of the additional heat load on the water consumption of the WCT basins is not considered safety significant since makeup to the WCT basin, via the WCT basin cross-connect and the Circulating Water system, has been demonstrated by a special test performed in accordance with special test procedure STP 01156126. The water inventory contained in the redundant WCT basin or the Circulating Water system would provide enough water to meet the additional heat load.

The impact of the additional heat load on the Essential Chiller cooling capacity had potential safety significance. The UHS temperature control valves ACC-126A(B), by design, will provide adequate head through the parallel Essential Chiller loop to ensure a design flow of at least 850 gpm if ACCW flow does not exceed 5000 gpm for train A and 4500 gpm for Train B through the CCW heat exchanger. The UHS temperature control valves ACC-126A(B) may throttle, given the additional heat load, to allow more flow than 5000 gpm or 4500 gpm through ACCW thus lessening the flow to the Essential Chillers so the design flow of 850 gpm to the Essential Chillers is not assured. This condition would reduce the space cooling capacity of the Essential Chillers. The

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Essential Chillers would trip on low flow if ACCW flow to the Essential Chiller reduces to below 510 gpm. The impact on a degraded flow condition to the Essential Chiller, less than 850 gpm but greater than 510 gpm, is not considered safety significant. In the flow range of 510 gpm to 850 gpm, room cooling may have been degraded for a few hours, but room cooling would have returned to design cooling when ambient conditions became more favorable or when the accident heat load reduced. Also, ACCW will supply cooling water to the Essential Chiller at or below 90°F. The design capacity of the Essential Chiller is based on an inlet cooling water supply of 850 gpm at 105°F. Therefore, it is expected the design space cooling would be maintained, for the short periods during which unfavorable ambient conditions existed, since ACCW supplies cooling water at least 15°F below the Essential Chiller design requirement.

There were a number of occurrences during Cycle 6 operation that ACCW flow through the CCW heat exchanger could have increased resulting in tripping the Essential Chillers on low flow. There were 78 instances during Cycle 6 operation, most for a period of a few hours, that both the Train A and the Train B Essential Chillers could have tripped due to low flow. There were no instances, during Cycle 7 and 8 operation, that both the Train A and the Train B Essential Chillers could have tripped since the CCW heat exchangers were in a clean condition and meteorological conditions were favorable.

This condition did not compromise the health and safety of the public.

SIMILAR EVENTS

A similar event was documented and reported to the NRC in Licensee Event Report (LER) LER-96-005. As part of a self-initiated flow balance test on the ACCW system, it was discovered the design basis flow rates could not be achieved on ACCW Train B. In evaluating past operability of Train B, it was conservatively determined that for several brief periods of time both trains of ACCW may have been inoperable from an Essential Chiller supply function. This condition did not compromise the health and safety of the public or plant personnel.