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June 17, 1991
C321-91-2152

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

Dear Sir:

Subject: Oyster Creek Nuclear Generating Station
Docket No. 50-219
Licensee Event Report Revision

This letter forwards one (1) copy of to Licensee Event Report (LER) No. 88-021, Rev. 1. Vertical lines in the right side margin indicate those sections of the LER that have been revised.

Very truly yours,

J. J. Barton
Director, Oyster Creek

JJB/BDEM:jc
(ler/Covltrs)
Enclosure

cc: Administrator, Region 1
Senior NRC Resident Inspector
Oyster Creek NRC Project Manager

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IE22

NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/85

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Oyster Creek, Unit 1	0 5 0 0 0 2 1 9	1 OF 0

TITLE (4) Plant Shutdown Required due to both Isolation Condensers being in an Unanalyzed Condition due to Thermo-hydraulic Operation Outside Normal System Design

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 NAMES	DOCKET NUMBER(S)
0 9	2 9	8 8	8 8	0 2 1	0 1	0 6	1 7	9 1		0 5 0 0 0
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OPERATING MODE (9)	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
POWER LEVEL (10) 1 0 0	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
	20.405(a)(1)(i)	50.36(a)(1)	50.73(a)(2)(v)	73.71(c)
	20.405(a)(1)(ii)	50.36(a)(2)	50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)
	20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
	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
Brenda DeMerchant, Licensing Engineer	AREA CODE 6 0 9 — 9 7 1 — 4 6 4 3

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 fifteen single-space typewritten lines) (16)

On September 29, 1988, while operating at 100% reactor power, it was determined that both the "A" and "B" isolation condensers were operating in a mode outside of the system design. Temperature data suggested that the steam lines to the isolation condensers were at least partially filled with water, and a thermo-hydraulic mechanism had been established that resulted in both isolation condensers steaming at a combined rate of about 4 MWth. The temperature data also suggested that condensate flow was reversed through one-half of each condenser.

Due to concerns about potential water hammer in the condenser steam lines and the potential system damage which could result in a loss of safety function, a decision was made to isolate the condensers from the reactor. At 1315 on September 29, 1988, all isolation valves to both isolation condensers were closed and the condensers were declared inoperable. Since the Technical Specifications require a reactor shutdown (cold shutdown) in the event both isolation condensers become inoperable, an orderly reactor shutdown was commenced. The plant reached cold shutdown on September 30, 1988.

The safety significance and corrective actions have been evaluated and were provided to you in correspondence dated December 15, 1988 (TDR 950), December 28, 1988 (TR 056), and January 9, 1989 (TDR 950 Revision 1).

DATE OF OCCURRENCE

The event occurred on September 29, 1988 at approximately 1300 hours.

IDENTIFICATION OF OCCURRENCE

During normal plant operation, it was determined that both the "A" and "B" Isolation Condensers (EIIS-BC) were in an unanalyzed condition. The condensers were subsequently isolated from the reactor and declared to be inoperable. Technical Specification 3.8 requires a plant shutdown (cold shutdown) when both isolation condensers become inoperable. Consequently, the reactor plant was placed in a cold shutdown condition.

This event is considered to be reportable as defined in 10CFR50.73(a)(2)(i)(A).

CONDITIONS PRIOR TO OCCURRENCE

The reactor was operating in the RUN mode with a thermal output of 1920 MWth and a generator load of approximately 650 MWe. The "A" isolation condenser was steaming at a rate of approximately 1.5 MWth and the "B" isolation condenser was steaming at a rate of approximately 2.7 MWth. Initially, it was believed that the steaming of the isolation condensers was due to leakage past the condensate return valves.

DESCRIPTION OF OCCURRENCE

On September 29, 1988, analysis of temperature data on the "A" and "B" isolation condensers (IC) suggested the existence of reverse flow through one-half (1/2) of each isolation condenser and the possibility of subcooled condensate buildup in the steam lines to the isolation condensers. This raised concern over the potential effects of increased piping loads, increased thermal stress to the IC steam nozzles at the reactor, and possible water hammer damage to the IC system should the isolation condensers be initiated.

Under normal conditions the isolation condenser steam lines are kept at saturation temperature (550° F) by a small, continuous flow of steam through a vent line on the high point of the IC steam piping. In this situation, temperature data and operator observations showed that the vent lines from both condensers were apparently filled with condensate. Monitored temperatures on the IC steam lines ranged from 250°F to 350°F.

DESCRIPTION OF OCCURRENCE Cont'd

The thermo-hydraulic mechanism that would allow a build up of condensate in the steam lines and set up a reverse flow condition through one-half of the IC could not be fully explained at that time. Normally, any condensate buildup in the IC steam lines will drain, by gravity, to the reactor. However, each IC had been isolated just prior to the point when it began steaming. It is suspected that this may have allowed water to build up in the condensers to the point where the observed thermo-hydraulic effects could be established. Investigations showed no way of draining the IC steam lines was possible without breaching Primary Containment Integrity or actually initiating the Isolation Condenser System.

Because the conditions in the isolation condensers were unanalyzed with regard to system operation, the IC's were isolated from the reactor and declared inoperable. Since both IC's were inoperable, an orderly plant shutdown was commenced in accordance with Technical Specification 3.8. The plant reached the hot shutdown condition on September 30, 1988 at 0306 hours, and was placed in cold shutdown on September 30, 1988 at 0955 hours.

APPARENT CAUSE OF OCCURRENCE

The cause of this event was determined to be a direct result of operation with water filling the normally steam-filled portion of the isolation condenser system. It was hypothesized from the sequence of events, data and hand calculations of mass and energy balances that the isolation condenser steaming initiated upon restoring the condensers to their normal system configuration with both the condensate return and steam inlet sides flooded. The test cases to demonstrate this hypothesis were provided in our correspondence dated January 9, 1989 (TDR 950, Revision 1). Under certain conditions in the current design, a steam flow loop can be set up in which steam flows up one of the vertical legs of the wye, through one of the tube bundles where it is condensed (and transfers heat to the shellside water) into the condensate return header and then back through the other tube bundle. From there, the condensed steam flows down the other vertical leg of the wye and mixes with the incoming steam at the wye. This flow regime led to the steady state steaming of the isolation condensers which caused the forced plant shutdown.

ANALYSIS OF OCCURRENCE AND SAFETY SIGNIFICANCE

The purpose of the isolation condensers is to remove decay heat following a reactor trip in the event the main condenser is unavailable as a heat sink. Using the isolation condensers in this condition will conserve inventory in the reactor vessel preventing a possible decrease in water level below the limits specified in Technical Specifications. During a high pressure condition in the reactor vessel, the isolation condensers, together with the turbine bypass system, electromatic relief valves, and safety valves, also act to ensure that reactor pressure never reaches the reactor coolant system pressure safety limit of 1375 psig.

Since the actual condition of the isolation condensers could not be determined at the time (ie: steam-water mixture or all water in the steam lines), initiation of one or both IC's could have some safety significance. With water in the steam lines, initiation of an IC could cause a water hammer, which could result in system damage and/or a loss of safety function.

Since the isolation condensers operated in the steaming mode for a significant period without any water hammers, the consideration of water hammer can be limited to transients. Two possible transient conditions are identified: (1) initiation of the isolation condenser operation from the steaming mode, and (2) placement of the system in the standby mode with some water in the steam line. A review of the various mechanisms for water hammer was conducted. Most of the known mechanisms require specific geometrics which do not exist in the isolation condenser system. Two mechanisms can not be ruled out on this basis, however: (1) pressure or momentum induced water hammer, and (2) condensation induced water hammer (CIWH). These two mechanisms have been reviewed by GPUN. The services of an outside consultant were also used for an independent assessment.

Evaluation of the RELAP5/MOD2 pressure and velocity profiles do not suggest the occurrence of pressure or momentum induced water hammer for either placing the isolation condenser in the standby mode or for initiating operation from the steaming mode. This is the expected result since there are no large pressure differences associated with either of these operations. Further supporting this result is the fact that the valve opening times for either the condensate return valves or the steam isolation valves are slow (about 18 seconds) which avoids rapid changes in system conditions. Therefore, it is concluded that momentum and pressure induced water hammers will not occur.

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

ANALYSIS OF OCCURRENCE AND SAFETY SIGNIFICANCE (Cont'd)

The potential for condensation induced water hammer upon placing the isolation condenser in standby is more difficult to evaluate. There is some empirical data, however, which suggest that these hammers do not exist. The steam isolation valves were opened with water in the steam line during the original initiation of the steaming mode without water hammer. Further, placing the isolation condenser into the standby mode has occurred many times during past plant operation, without any reported occurrence of water hammers. On at least some of these occasions, it is reasonable to believe that there was some level of water in the steam line (due to condensate that accumulates with the steam inlet valves closed), although not sufficient to initiate the steaming mode. While this does not necessarily bracket all possible conditions in the isolation condenser, it does give assurance that water hammers are not a likely result of placing ar isolation condenser into standby.

Other than the short unintentional initiation of isolation condenser B on 8/28/88 there is no empirical data that CIWH would not have occurred following initiation from natural circulation steaming. However, a number of factors acting together would probably have minimized the chances of having had CIWH. These include the slow condensate return valve opening time and the small driving pressure differentials which would minimize hydrodynamic instabilities and warm temperatures of the water in the steam lines (200 to 300°F) steam pockets.

Our latest evaluation (TDR 950, Revision 1) concludes that 1) no damage has been done to the isolation condenser system, 2) the isolation condensers would have performed at their normal capacity if actuated, 3) the steaming experienced can be avoided in the future, and 4) methods for diagnosing the occurrence of and recovery from this phenomena are available should it recur.

CORRECTIVE ACTION

All of the isolation condenser piping located outside the drywell was replaced during the current 13R outage. As part of this modification, the location of the "wye" was raised by about 20 feet to avoid creating a thermal driving head which now makes it as high as the top of the tube bundle. Under these conditions, no steady state thermal driving head can be generated since the heat addition and heat removal points for the loop are effectively at the same elevation.

Increased resistance to flow will occur with the modifications, since replacement piping procured to date has a slightly smaller inside diameter and the new valves may have higher flow resistance. Also, relocating the wyes will reduce the flow area (from two 12" pipes to one 16" pipe) for approximately 20 linear feet in each steam line. An analysis has been performed which verifies that these modifications will have no adverse effects with respect to the isolation condenser system heat removal capability.

SIMILAR EVENTS

LER 88-019: "Technical Specification violation due to "A" and "B" Isolation Condensers being Inoperable due to Mechanical Problems and Procedural Inadequacies."