CCN 91-14083

PEACH BOTTOM—THE POWER OF EXCELLENCE

PHILADELPHIA ELECTRIC COMPANY
PEACH BOTTOM ATOMIC POWER STATION
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June 13, 1991
Docket No. 50-277

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

SUBJECT: Licensee Event Report
Peach Bottom Atomic Power Station - Unit 2

This revised LER is being submitted following a completed root cause analysis concerning the Emergency Service Water (ESW) system inoperability. This LER concerns potentially inoperable safety systems due to inadequate ESW cooling flow through the room coolers.

Reference:	Docket No. 50-277
Report Number:	2-90-004
Revision Number:	01
Event Date:	03/20/90
Report Date:	06/13/91
Facility:	Peach Bottom Atomic Power Station RD 1, Box 208, Delta, PA 17314

This LER is being submitted pursuant to the requirements of 10 CFR 50.73(a)(2)(v).

Sincerely,

cc: J. J. Lyash, USNRC Senior Resident Inspector
T. T. Martin, USNRC, Region I

IE22
1/1

NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/88

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
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TITLE (4) Potentially Inoperable Safety Systems Due to Inadequate Emergency Service Water Cooling Flow through Safety System Compartment Room Coolers

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 3	2 1	9 0	9 0	0 0 4	0 1	0 6	1 3	9 1	PBAPS -- Unit 3	0 5 0 0 0 2 7 8
										0 5 0 0 0

OPERATING MODE (9)	N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
POWER LEVEL (10)	0 9 0	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 (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
	AREA CODE
A. A. Fulvio , Regulatory Engineer	7 1 7 4 5 6 - 7 0 1 4

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 March 21, 1990 during a review of a completed Special Procedure it was calculated that under design basis accident conditions some of the Unit 2 Emergency Core Cooling Systems (ECCS) and Reactor Core Isolation Cooling (RCIC) System room coolers would not receive minimum acceptable Emergency Service Water (ESW) flow. This resulted in the potential of ECCS, and RCIC pumps being inoperable under certain plant environmental and climatic conditions. The cause of this event was the gradual buildup of corrosion products and silt on the interior wall of the ESW piping. A root cause analysis revealed numerous contributing causes including less than adequate (LTA) chemical treatment of the ESW system, lack of understanding of the ESW design basis, LTA administrative controls involving modifications and testing and LTA original design. As corrective actions, one ECCS and RCIC System pump room cooler inlet hand valve in each Unit 2 pump room was closed to provide satisfactory flow to the alternate room cooler. Sections of the Unit 2 ESW System were cleaned, and a modification was completed on Unit 2 which replaced major portions of the ESW System piping. A similar modification was also completed on Unit 3. Chemical treatment and Design Basis Documentation programs have been initiated. Programmatic enhancements have been made to the modifications and testing programs.

Requirements for the Report

This LER is being submitted pursuant to 10 CFR 50.73(a)(2)(v) to report a condition which alone could have prevented the fulfillment of a safety function.

Unit Status at Time of Discovery of the Condition

Unit 2 was in cold shutdown with the Reactor Mode Switch (EIIS:HS) in the shutdown position.

There were no structures, systems, or components that were inoperable at the start of the event that contributed to the event.

Description of the Event

On March 21, 1990, during a review of data from a completed Special Procedure it was calculated that under design basis accident conditions the room coolers in the following Unit 2 pump rooms would not receive minimum acceptable Emergency Service Water (ESW) (EIIS:CC) flow: the High Pressure Coolant Injection (HPCI) (EIIS:BJ) pump room, the Reactor Core Isolation Cooling (RCIC) (EIIS:BN) pump room, the "C" Residual Heat Removal (RHR) (EIIS:BO), pump room, and the "A" and "C" Core Spray (CS) (EIIS:BM) pump rooms. The ESW System supplies cooling water to both Unit 2 and Unit 3 components. For each Unit there are twenty pump room coolers (EIIS:CLR), two coolers in each pump room (i.e., 4 RHR rooms, 4 CS rooms, 1 HPCI room and 1 RCIC room, referred to as the Emergency Core Cooling System (ECCS) and RCIC System pump rooms). From March 11, 1990 to March 16, 1990 testing was performed on the Unit 2 ESW System to determine the effect an event such as a loss of instrument air (EIIS:LD) would have on flow to the above room coolers.

The ESW System is common to both Units 2 and 3, and is a safety system to provide a reliable supply of cooling water to the Emergency Diesel Generator (EDG) (EIIS:EK) heat exchangers (EIIS:HX), RHR pump seal coolers, CS motor oil coolers, and the ECCS and RCIC System pump room coolers, as required, during a design basis event involving loss of offsite power.

Each pump room contains two 100% capacity unit room coolers. On an ECCS or RCIC pump initiation, without a loss of instrument air, the primary unit room cooler fan automatically starts and the associated air operated valve opens to allow flow through the cooler. The standby unit cooler comes into operation only if the fan on the primary unit fails (low differential pressure). A loss of air will result in flow to the standby room cooler as well as the primary room cooler, which results in a decrease in flow to the primary cooler. Room cooling is diminished, unless the fan on the standby cooler is switched on. The effect of the reduced flows is to increase the operating temperature of the equipment or room being cooled.

Surveillance Testing performed prior to March 16, 1990 and conducted in accordance with Surveillance Test (ST) 21.5-2 "ESW Flow Test Through ECCS Room Coolers and RHR pump Seal Cooler - Unit 2", verified ESW component flows with the ESW System aligned with both room coolers in the room being tested and one room cooler in each of the other ECCS and RCIC System pump rooms receiving ESW System flow. In this configuration, the ESW flow through each aligned room cooler was greater than the minimum acceptable ESW flow.

The Special Procedure conducted on Unit 2 was performed with ESW flow to both room coolers in each ECCS and RCIC System pump room (20 room coolers). The data recorded indicated that the following eleven Unit 2 room coolers were not receiving required flows under design basis accident conditions: both HPCI pump room coolers; both RCIC pump room coolers; both "A" CS pump room coolers; both "C" CS pump room coolers; both "A" RHR pump room coolers; and one of the two "B" RHR Pump room coolers. Therefore, two CS pumps ("A" & "C"), one RHR pump ("A"), the HPCI System, and the RCIC System could be rendered inoperable due to less than required ESW component cooling flow.

On March 6, 1990, Unit 3 ESW testing was completed. With ESW flow to Unit 2 isolated, ESW flow through Unit 3 components was verified to be greater than that required.

Cause of the Condition

The proximate cause of this event was the gradual buildup of corrosion products and silt on the interior wall of the ESW piping resulting in higher resistance to flow.

Unit 3 ESW System piping was replaced during its last outage. This pipe replacement of the Unit 3 portion of the ESW System may have contributed to the reduced Unit 2 ESW System flow. This is because less pipe restrictions with the new pipe on Unit 3 would cause higher ESW flow to Unit 3 diverting flow from Unit 2. Pre-modification dual unit testing was not performed, however, Unit 3 testing completed on March 6, 1990 and subsequent dual unit testing demonstrated satisfactory flows of the Unit 3 ESW System. This indicates that satisfactory flows have probably existed in Unit 3 since its ESW pipe replacement. The condition of Unit 3 ESW flow prior to the modification is indeterminate.

A root cause analysis revealed contributing causes including less than adequate (LTA) chemical treatment of the ESW system, lack of understanding of the ESW design basis, LTA administrative controls involving modifications (mods) and testing and LTA original design.

The chemical treatment of the ESW System was LTA because of a high rate of unavailability and low priority placed on repairs of the chemical treatment system since installed in 1985.

The lack of understanding of the ESW design basis involved:

- not having a full appreciation of the importance of chlorination of the ESW system

- not fully understanding the significance of a loss of instrument air on ESW

- lack of ESW design information availability on the site

The LTA administrative controls involving mods and testing involved the following factors:

- baseline date taken for ESW during initial startup in 1974 did not include heat transfer data that would have been helpful in the design of later modifications

- LTA mod acceptance criteria and testing methodologies supplied by engineering on ESW mod performed in the mid-1980's

- Network Analysis performed in 1985 not formally followed up by a safety evaluation

- ESW testing was LTA due to lack of complete ESW design information at the station

The LTA original design involved the following factors:

- not fully considering the effects of low river water flow on carbon steel pipe and changing river water chemistry over time

- no cleanouts for maintenance or provisions for monitoring flow

- there were low points where crud could collect

- loss of instrument air effects were not fully considered

Analysis of the Event

No actual safety consequence occurred as a result of this event.

With offsite power available and no seismic event, cooling water for ECCS and RCIC System pump rooms and other equipment would be supplied by the non-safety related Service Water System if required. The Service Water System operates at a higher pressure with greater capacity than the ESW System and would provide greater than minimum acceptable cooling water flow to the pump room coolers even during a loss of air event.

If the facility experiences a design bases event including a loss of offsite power, the Service Water System and Instrument Air System are assumed to be unavailable. Upon loss of air, the air operated ECCS and RCIC System pump room cooler isolation valves would fail open. In this configuration some heat removal would still occur for these rooms using ESW. Depending on the heat loads within the plant and the temperature of the incoming ESW water (seasonally dependent), ESW may have performed its intended function under certain environmental and climatic conditions. Under worse case environmental and climatic conditions, ESW would not have performed its safety function for design bases events involving loss of offsite power which would cause the HPCI System, two CS pumps, one RHR pump, and the RCIC System to be inoperable.

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

Corrective Actions

Unit 2, which was shutdown at the time of the discovery of the event, remained shutdown until satisfactory ESW System flows were established.

Prior to the confirmation of the condition, ESW was isolated from Unit 2 and Unit 3 was tested to ensure operability.

Sections of the Unit 2 ESW System piping were inspected and cleaned to improve ESW System flows.

One ECCS and RCIC System pump room cooler inlet hand valve in each Unit 2 pump room was closed to provide satisfactory flow to the alternate room cooler.

ESW flow to the EDG was throttled to divert more ESW flow to the ECCS and RCIC System pump room coolers.

Applicable ESW procedures were revised to ensure ESW System testing verifies adequate flow to the ESW System components with the system in a configuration that supports the design bases.

A modification was completed during Unit 2's eighth refueling outage which will replace major portions of Unit 2's ESW System piping. A similar modification was completed on Unit 3 during the last cycle outage.

In addition to the corrective actions identified above, a root cause analysis and other reviews by management have resulted in numerous corrective actions being initiated that resolve issues related to the inoperability of Unit 2 ESW and the NRC HPCI/ESW Safety System Functional Inspection (SSFI).

A Design Basis Documentation (DBD) program is in progress to enhance the design basis descriptions of plant systems.

The availability of the Chemical Injection System has been reviewed and will be enhanced as appropriate.

Numerous programmatic enhancements have been implemented concerning the modification, 10CFR50.59, corrective action and testing programs.

Previous Similar Events

There was one previous similar event identified involving inoperability of the ESW system. LER 2-86-014 identified a shutdown of Unit 2 due to a leak in the ESW system. The leak was caused by localized pit corrosion. Besides repairing the leaks, corrective actions consisted of installing an ESW chemical treatment system and increasing surveillance testing of ESW flow rates. The installation of the ESW chemical treatment system did not prevent recurrence because of a high unavailability rate of the system. The increased surveillance of flow rate testing did not prevent recurrence because of inappropriate acceptance criteria due to a lack of understanding of the ESW design basis.