

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, D.C. 20555

January 30, 1987

IE INFORMATION NOTICE NO. 87-06: LOSS OF SUCTION TO LOW-PRESSURE SERVICE
WATER SYSTEM PUMPS RESULTING FROM LOSS OF
SIPHON

Addressees:

All nuclear power reactor facilities holding an operating license or a construction permit.

Purpose:

This notice is to alert recipients of a potentially significant problem involving the loss of suction to the low-pressure service water (LPSW) system pumps resulting from loss of siphon. It is expected that recipients will review this information for applicability to their facilities and consider actions, if appropriate, to preclude a similar problem occurring at their facilities. However, suggestions contained in this notice do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances: (Refer to attached Figure)

On October 2, 1986, Oconee Unit 1 was shut down because of a loss of LPSW system pump suction for Units 1 and 2. Unit 2 was already shut down for refueling. Unit 3 was also shut down because it was susceptible to a loss of LPSW pump suction. LPSW supplies cooling water for the decay heat removal system and other safety-related equipment. The loss of LPSW pump suction for Units 1 and 2 occurred during an electrical load shed surveillance test conducted on Unit 2. The load shed test involved shedding the Unit 2 condenser circulating water (CCW) pump motors. The CCW system takes suction from Lake Keowee and supplies cooling water to the main condensers. In addition, Unit 2 CCW pumps normally provide suction to Units 1 and 2 LPSW pumps and this was the mode at the time of the load shed test. These LPSW system pumps take suction on the upstream side of the main condenser from a LPSW crossover line between Units 1 and 2 CCW.

Each of the four CCW pump motors for each unit is capable of being powered from either of two emergency hydro-generators. However, the Oconee plant is designed to accommodate a loss (shedding) of the CCW pumps and still provide LPSW pump suction through a siphon arrangement. The siphon is necessary because of a high point in the CCW piping just downstream of the CCW pumps and upstream of the LPSW pump suction. This high point may be as much as 25 feet above the level of Lake Keowee (depending upon lake level). The loss of suction to the

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LPSW pumps was caused by a loss of this siphon. The CCW pump discharge flange is normally 9 feet below the surface of Lake Keowee when the lake is at full level. However, because of drought conditions, Lake Keowee level was about 6 feet below the flange at the time of the load shed test. (Technical Specifications permit plant operation with lake levels as low as 16 feet below this flange.) During operation at these reduced lake levels, water leakage at the flange had been observed. This flange was not originally designed to be leak-tight. The amount of water leakage was insignificant during plant operation. However, with the CCW pumps off (shedded), air inleakage caused the high point in the CCW piping to drain and caused a loss of siphon flow in about 1 hour.

Siphon flow, if initiated, could not be sustained in the system, as originally designed and built, during low lake level conditions because of air inleakage at the CCW pump discharge flange. It appears that previous surveillance tests were not of sufficient duration to determine that siphon flow was sustained. Since the large volume of water contained in the CCW lines provided LPSW flow for about an hour before the loss of LPSW suction, it appears that load shed testing personnel, in the past, may have been misled into thinking siphon flow had been sustained.

The Oconee CCW system is designed to also provide suction and discharge (heat sink) for the cooling water pump for an emergency diesel generator (EDG) used in the standby shutdown facility (SSF). The SSF was designed to be an independent decay heat removal system. Analyses performed subsequent to the above load shed test showed that if siphon flow was lost in the CCW pipe, the CCW system could not provide an adequate heat sink for SSF operation to meet its design basis of 72 hours of operation. In addition, when the CCW pumps are not operating, the CCW system should provide emergency gravity-siphon CCW flow to the main condensers to recover condensate for decay heat removal following certain postulated events until the decay heat removal system is in operation. The gravity flow is possible because the CCW discharge from the main condenser is shifted to an alternate pipe that discharges downstream of Lake Keowee dam at an elevation well below the CCW intake. The siphon is required for the same reason as required by the LPSW. This feature of the CCW system also was disabled by the loss of siphon.

The discharge flange on all CCW pumps has been modified to prevent air inleakage when the lake level is below the discharge flange. The LPSW pumps have been successfully tested for several hours with the CCW pumps off and the lake level below the discharge flange. The emergency CCW gravity-siphon flow to the main condensers and the EDG cooling water pump also have been successfully tested under the above conditions. In addition, the SSF cooling water pump has been modified to take a separate and independent suction from Lake Keowee.

No specific action or written response is required by this information notice. If you have any questions about this matter, please contact the Regional Administrator of the appropriate regional office or this office.

Edward L. Jordan, Director
Division of Emergency Preparedness
and Engineering Response
Office of Inspection and Enforcement

Technical Contact: H. Bailey, IE
(301) 492-9006

T. Peebles, RII
(404) 331-4196

Attachment:

1. Oconee Plant, Partial Schematic of LPSW and CCW Systems
2. List of Recently Issued IE Information Notices

*SEE PREVIOUS CONCURRENCES

*DEPER: IE
HBailey:md
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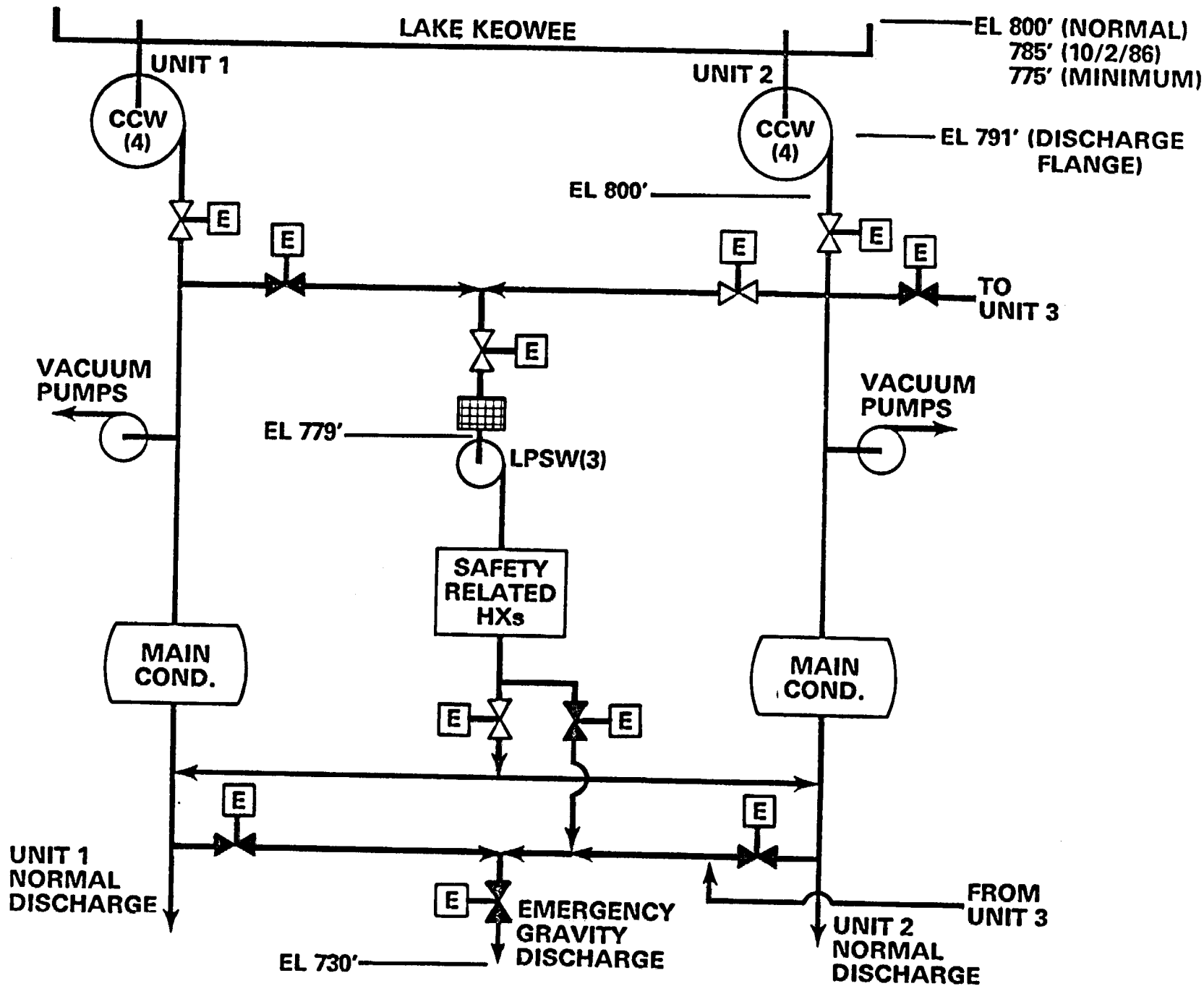
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OCONEE PLANT

PARTIAL SCHEMATIC OF LPSW AND CCW SYSTEMS



LIST OF RECENTLY ISSUED
IE INFORMATION NOTICES

Information Notice No.	Subject	Date of Issue	Issued to
87-05	Miswiring in a Westinghouse Rod Control System	2/2/87	All Westinghouse power reactor facilities holding an OL or CP
87-04	Diesel Generator Fails Test Because of Degraded Fuel	1/16/87	All power reactor facilities holding an OL or CP
87-03	Segregation of Hazardous	1/15/87	All NRC licensees
87-02	Inadequate Seismic Qualification of Diaphragm Valves by Mathematical Modeling and Analysis	1/15/87	All power reactor facilities holding an OL or CP
87-01	RHR Valve Misalignment Causes Degradation of ECCS in PWRs	1/6/87	All PWR facilities holding an OL or CP
86-110	Anomalous Behavior of Recirculation Loop Flow in Jet Pump BWR Plants	12/31/86	All BWR facilities holding an OL or CP
86-109	Diaphragm Failure In Scram Outlet Valve Causing Rod Insertion	12/29/86	All BWR facilities holding an OL or CP
86-108	Degradation Of Reactor Coolant System Pressure Boundary Resulting From Boric Acid Corrosion	12/29/86	All PWR facilities holding an OL or CP
86-107	Entry Into PWR Cavity With Retractable Incore Detector Thimbles Withdrawn	12/29/86	All power reactor facilities holding an OL or CP
86-106	Feedwater Line Break	12/16/86	All power reactor facilities holding an OL or CP

OL = Operating License
CP = Construction Permit

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12/16/86

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