UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555

June 14, 1988

NRC INFORMATION NOTICE NO. 88-37: FLOW BLOCKAGE OF COOLING WATER TO SAFETY SYSTEM COMPONENTS

Addressees:

All holders of operating licenses or construction permits for nuclear power reactors.

Purpose:

This information notice is being provided to alert addressees to a potentially generic problem involving flow blockage in safety-related piping interconnections due to biofouling. This condition may occur and not be detected due to stagnant water in system interconnecting piping which is not routinely flushed or flow tested. The event described highlights the importance of maintaining these lines free of clams, corrosion, and other foreign material. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this information notice do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

On March 9, 1988, Catawba Unit 2 tripped from 20 percent power as the unit was returning to full-power operation following the first refueling outage. As the feedwater regulating valves were being placed in automatic, the B steam generator (SG) feedwater regulating valve failed open. This caused a feedwater swing, and, after the operator assumed manual control of the B steam generator feedwater regulating valve, a high-high level in the D SG, which resulted in a main turbine trip, a main feedwater isolation, and a main feedwater pump trip.

The Catawba auxiliary feedwater (AFW) system is safety grade, designed to start automatically in the event of loss-of-offsite power, trip of main feedwater pumps, a safety injection signal, or low-low SG level. Three AFW pumps are provided, powered from separate and diverse power sources. Two motor-driven pumps are powered from two separate trains of emergency onsite electrical power, each normally supplying two SGs. A turbine driven AFW pump is driven by steam generated from either of two SGs. The condensate storage system is utilized for normal AFW supply and includes the main condenser hotwell, two upper surge tanks per unit, and a shared AFW condensate storage tank (CACST). However, the condensate storage system is not safety grade. Therefore, the safety grade nuclear service water (NSW) system provides an assured backup

water supply. The NSW system is supplied from either Lake Wylie or the standby nuclear service water pond (SNSWP). In the event of partial or complete loss of the condensate storage supply, as sensed by two out of three indications of low suction pressure from any train, automatic swapover to the NSW system is provided. The NSW system also provides assured makeup to several other systems, including the fuel pool cooling and component cooling systems.

Both motor-driven auxiliary feedwater (AFW) pumps automatically started upon loss of the main feedwater pumps. An A train AFW pump low suction pressure resulted in the automatic swapover of train A AFW pump suction from condensate grade water to nuclear service water (NSW) causing valves RN 250A and CA 15A to open. The attached Figure 1 provides a schematic of the AFW flow paths prior to suction flow swapover, while Figure 2 provides the flow paths after swapover. The A train AFW pump normally supplies AFW to SGs A and B. Meanwhile, levels in SGs A and B were dropping. The low-low level set point was reached in SG A and a reactor trip occurred. Approximately 13 minutes into the event, the operator noted that the NSW valve to the AFW system (RN 250A) had opened. The valve was closed immediately. However, at that time it was not noted that the A train AFW pump suction line valve from the NSW system (CA 15A) also had opened and that NSW had therefore been pumped into SGs A and B.

Approximately 20 minutes into the event, it was noted that the SG B level was decreasing. Initial AFW flow had been normal (300 gpm per SG), but had degraded to approximately 200 gpm to SG A and 100 gpm to SG B. The flow control valve to SG A was fully open at this time. During shift turnover, approximately 35 minutes into the event, the oncoming shift found that valve CA 15A had also opened. The main feedwater pumps were then restarted and the AFW system placed on standby. Actions were initiated to disassemble and inspect the AFW flow control valves. When the A and B SG AFW flow control valves were disassembled, it was determined that the valves were clogged with Asiatic clam shells.

Discussion:

Fouling of service water systems has been recognized for some time as having the potential for compromising system operability. Information Notice 81-21, "Potential Loss of Direct Access to Ultimate Heat Sink," and Bulletin 81-03, "Flow Blockage of Cooling Water to Safety System Components by Corbicula Sp. (Asiatic Clam) and Mytilus Sp. (Mussel)," issued by the NRC Office of Inspection and Enforcement (IE) addressed the potential for fouling of safety-related heat exchangers by Asiatic clams, mussels, and debris from other shell fish. Information Notice 86-96, "Heat Exchanger Fouling Can Cause Inadequate Operability of Service Water Systems," addressed similar fouling problems from buildup of mud, silt, and corrosion in NSW piping. The AFW flow control valves at Catawba have an anti-cavitation trim that can collect particles of clam shells and may thus exacerbate flow degradation from fouling.

Duke Power Company has in place several programs and practices designed to verify NSW flow to various systems and components. These include (1) periodic flow balancing of the NSW system, (2) testing to verify heat transfer capability of essential heat exchangers served by the NSW system, (3) periodic cleaning of

heat exchangers based on differential pressure indications and, 4) visual examination of heat exchangers and related piping during cleaning for the presence of clams and unusual fouling conditions. Previous inspection of the NSW system dead leg piping for clams consisted of spot radiographic (RT) inspection of low spots in the piping between the NSW and AFW systems. None of the RT inspections revealed any clams. The valves in the NSW/AFW suction swapover lines had been periodically stroke tested, but no flow through the lines was established.

As a result of the Catawba Unit 2 AFW swapover from condensate to NSW and the introduction of raw NSW containing clams into the AFW system, Duke Power Company initiated a program of flushes and inspections of dead legs between the NSW system and various safety-related systems. The NSW system flushes and inspections performed included the NSW backup supply to AFW system piping, NSW emergency makeup to component cooling system piping, and NSW backup to penetration valve injection piping. Flushing also was planned on the NSW emergency makeup to spent fuel pool cooling piping. Spot radiographic inspection indicated the presence of clams in the piping to the component cooling and spent fuel pool cooling piping prior to flushing. These locations were not previously radiographed.

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

Charles E. Rossi, Director
Division of Operational Events Assessment
Office of Nuclear Reactor Regulation

Technical Contacts: Thomas Peebles, RII
(404) 331-4196

Brian Bonser, RII
(404) 331-4198

W. Lefave, NRR
(301) 492-0862

Attachment: List of Recently Issued NRC Information Notices

FIGURE 1

CATAWBA NUCLEAR STATION AUXILIARY FEEDWATER SYSTEM

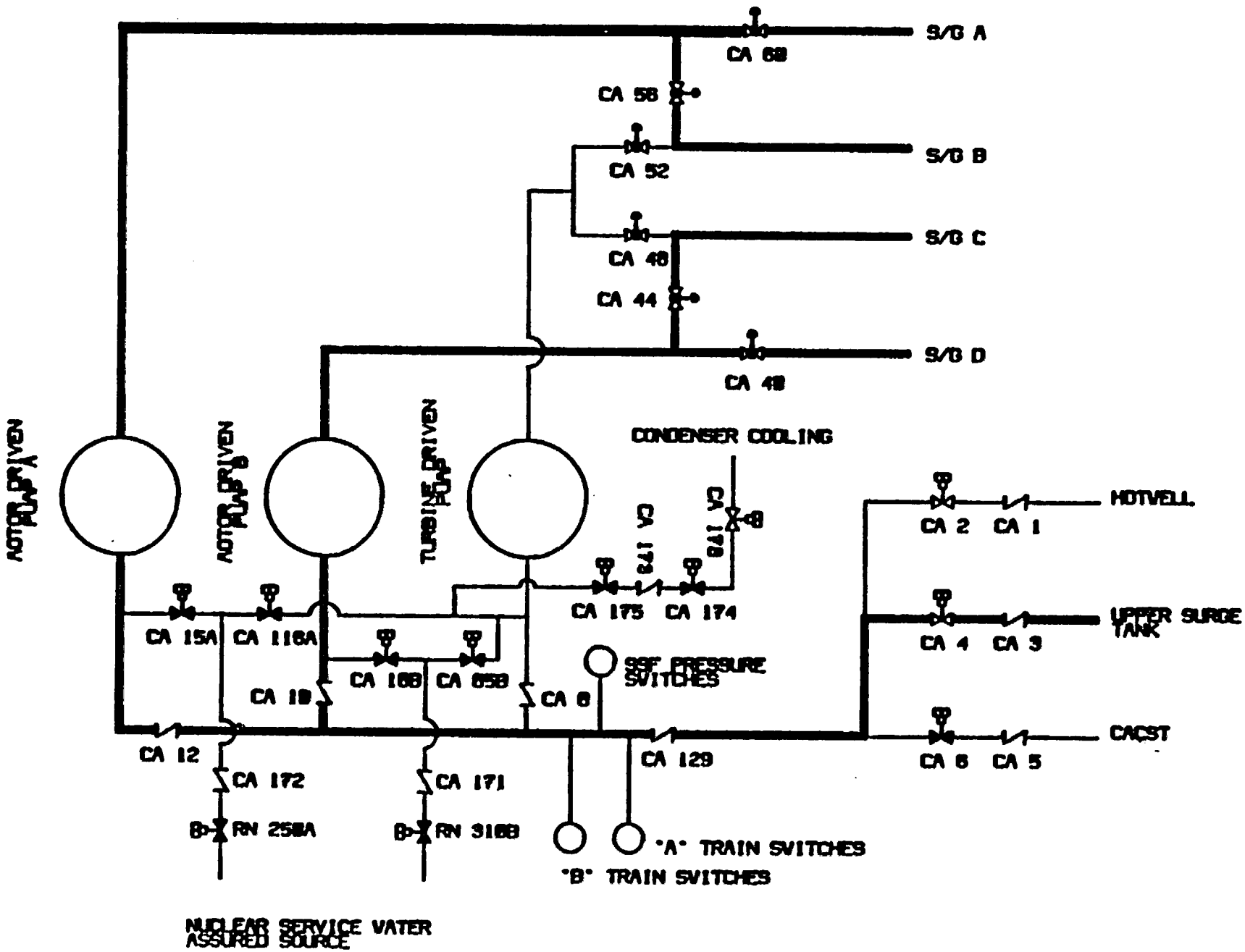

FIGURE 2

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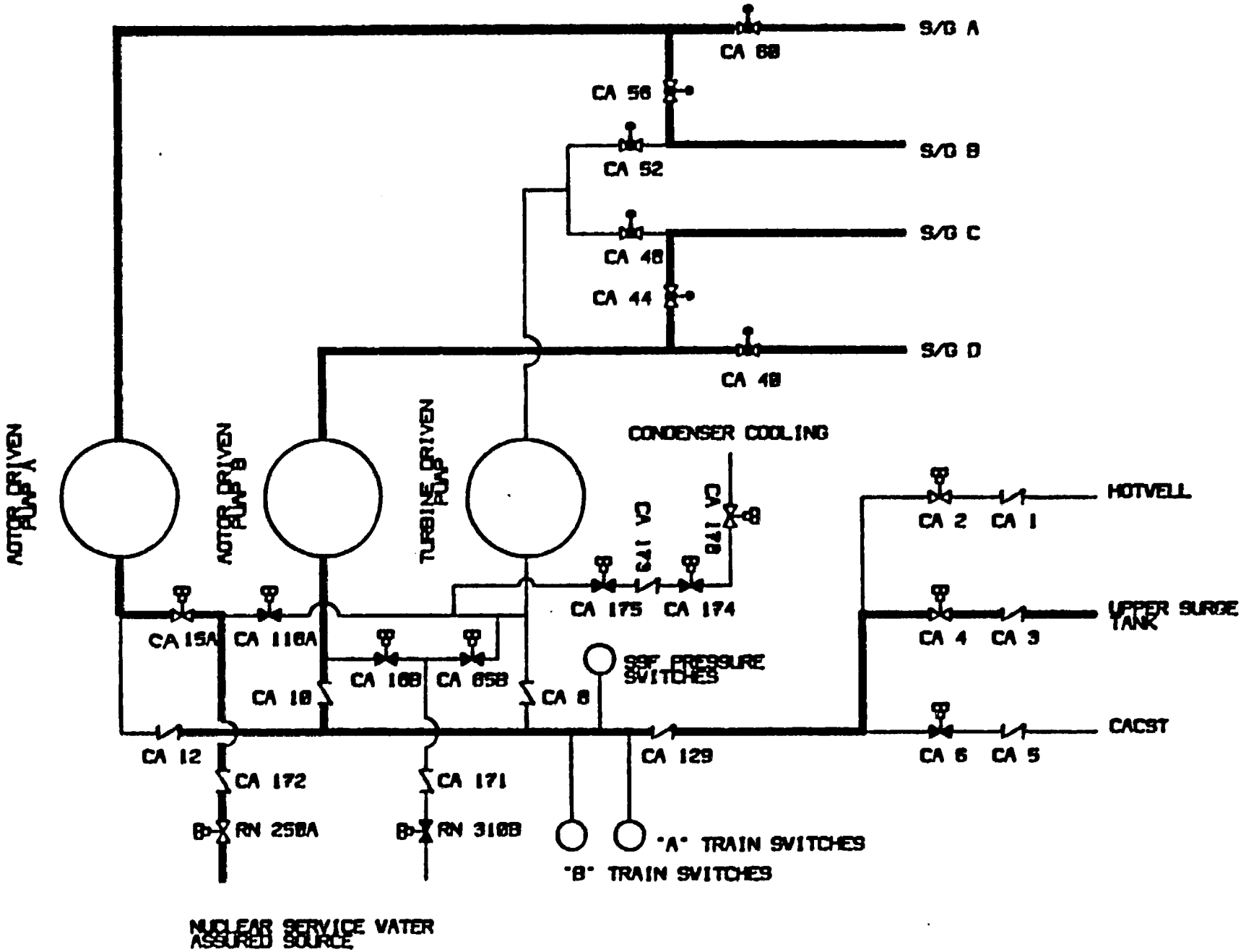

LIST OF RECENTLY ISSUED NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
88-36	Possible Sudden Loss of RCS Inventory During Low Coolant Level Operation	6/8/88	All holders of OLs or CPs for PWRs.
88-35	Inadequate Licensee Performed Vendor Audits	6/3/88	All holders of OLs or CPs for nuclear power reactors.
88-34	Nuclear Material Control and Accountability of Non-Fuel Special Nuclear Material at Power Reactors	5/31/88	All holders of OLs or CPs for nuclear power reactors.
87-61, Supplement 1	Failure of Westinghouse W-2-Type Circuit Breaker Cell Switches	5/31/88	All holders of OLs or CPs for nuclear power reactors.
88-33	Recent Problems Involving the Model Spec 2-T Radiographic Exposure Device	5/27/88	All Agreement States and NRC licensees authorized to manufacture, distribute or operate radiographic exposure devices and source changers.
88-32	Promptly Reporting to NRC of Significant Incidents Involving Radioactive Material	5/25/88	All NRC material licensees.
88-31	Steam Generator Tube Rupture Analysis Deficiency	5/25/88	All holders of OLs or CPs for Westinghouse and Combustion Engineering-designed nuclear power plants.
88-30	Target Rock Two-Stage SRV Setpoint Drift Update	5/25/88	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License
CP = Construction Permit

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*SEE PREVIOUS CONCURRENCES

	D/DOEA:NRR	*C/OGCB:DOEA:NRR	*PPMB:ARM	*D/DEST:NRR
	CERossi	CHBerlinger	TechEd	LCShao
	06/9/88	05/31/88	05/05/88	05/25/88
*OGCB:DOEA:NRR	*RII	*RII	*AC/SPLB:DEST:NRR	*SAD/DEST:NRR
BMann	TPeebles	BBonser	JCraig	AThadani
05/05/88	05/05/88	05/05/88	05/19/88	05/24/88

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	CERossi	CHBerlinger	TechEd	LCShao
	05/ /88	05/3//88	05/05/88	05/25/88
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	concurred by telephone	concurred by telephone		