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UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, DC 20555

January 31, 1986

IE INFORMATION NOTICE NO. 86-04: TRANSIENT DUE TO LOSS OF POWER TO INTEGRATED CONTROL SYSTEM AT A PRESSURIZED WATER REACTOR DESIGNED BY BABCOCK & WILCOX

Addressees:

All nuclear power facilities holding an operating license (OL) or a construction permit (CP).

Purpose:

This notice is to inform recipients of a recent event at an operating pressurized water reactor resulting from loss of power to the integrated control system. Recipients are expected to review the information in this notice for applicability to their facilities and consider actions, if appropriate, to preclude similar problems from 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:

On December 26, 1985, Rancho Seco was operating on automatic control at a constant power level of 710 MWe (76% of licensed power). At 4:14 a.m., power to the integrated control system (ICS) was lost. The annunciator alarm for "Loss of ICS or Fan Power" sounded. As designed, ICS demand signals went to midscale. The main feedwater valves closed to 50%, and the atmospheric dump valves, turbine bypass valves, and one set of auxiliary feedwater valves opened to 50%. The main feedwater pump speed was reduced to minimum. Low discharge pressure at the main feedwater pump caused the motor-driven auxiliary feedwater pump to start automatically. The net decrease in feedwater flow caused the reactor to trip on high reactor coolant system (RCS) pressure.

After the reactor trip, the above ICS valves remained at 50% (i.e., could not be operated from the control room) causing excessive cooling of the RCS which was exacerbated by autostarting of the dual-drive auxiliary feedwater pump. During the 26 minutes required to restore ICS power, operators acted to minimize the resulting transient. However, difficulties were experienced with manipulation of valves, operation of pumps, and control of various liquid levels, pressures, and temperatures. RCS pressure decreased to a minimum of 1064 psig at 4:21 a.m. At 4:40 a.m., the lowest RCS temperature (386°F) during the cooling transient was reached. RCS pressure at that time was 1413 psig. Eventually, a senior reactor operator discovered that switches which supplied

power to the ICS dc power supplies were in the off position and set them to the on position. Although manual (i.e., hand) operation was now possible in the control room, the valves initially received a 100% demand signal. Operators quickly shut the valves. At 5:00 a.m., RCS pressure and temperature were stabilized at 716 psig and 433°F and maintained there for 3 hours. This unusual event, which was declared at 4:30 a.m., was terminated at 8:41 a.m.

Before the event was terminated, a large number of problems were experienced, including:

- * The RCS was cooled 180°F in 24 minutes violating the technical specifications limit of 100°F in 1 hour.
- * Recommended pressure/temperature limits for pressurized thermal shock were exceeded; however, nil ductility temperature limit in the technical specifications was not violated.
- * Pressurizer level was low and off scale.
- * After loss of ICS power, ICS controlled valves could not be manually operated from the control room.
- * One auxiliary feedwater isolation valve could not be closed.
- * One auxiliary feedwater flow control valve was overtorqued using the manual handwheel, and the manual operator failed.
- * Operators had considerable difficulty determining (locally) the position of the auxiliary feedwater flow control valves.
- * One steam generator was overfilled.
- * A main feedwater flow recorder in the control room failed at midscale because of the loss of ICS power although main feedwater flow was essentially zero.
- * An RCS makeup pump was run without water (i.e., suction valve shut) and severely damaged, specifically, seals for the makeup pump failed and approximately 450 gallons of water were spilled in the auxiliary building.
- * A containment radiation monitor was damaged because it continued to run after the suction valve had been shut by a Safety Features Actuation Signal.


Four senior reactor operators were present during the event. At 5:01 a.m., one of them collapsed from exhaustion in front of a control panel. He was transported by ambulance to a local hospital and subsequently released in satisfactory condition at 7:00 a.m.

Discussion:

The NRC sent an incident investigation team (IIT) to Rancho Seco shortly after the event. The licensee has agreed to hold in abeyance any work in progress or planned (except as required by plant safety considerations) until the licensee and the NRC have had an opportunity to develop detailed troubleshooting plans for failed equipment. Further, the licensee has agreed to maintain the unit in a shutdown mode until NRC concurs with the licensee that the unit can be returned to power safely.

Review by the IIT is continuing. As additional information about the event is obtained, this notice will be supplemented, if appropriate.

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 NRC regional office or this office.


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

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Attachment: List of Recently Issued IE Information Notices

LIST OF RECENTLY ISSUED
IE INFORMATION NOTICES

Information Notice No.	Subject	Date of Issue	Issued to
86-03	Potential Deficiencies In Environmental Qualification Of Limitorque Motor Valve Operator Wiring	1/14/86	All power reactor facilities holding an OL or CP
86-02	Failure Of Valve Operator Motor During Environmental Qualification Testing	1/6/86	All power reactor facilities holding an OL or CP
86-01	Failure Of Main Feedwater Check Valve Causes Loss Of Feedwater System Integrity And Water-Hammer Damage	1/6/86	All power reactor facilities holding an OL or CP
85-101	Applicability of 10 CFR 21 To Consulting Firms Providing Training	12/31/85	All power reactor facilities holding an OL or CP
85-100	Rosemount Differential Pressure Transmitter Zero Point Shift	12/31/85	All power reactor facilities holding an OL or CP
85-99	Cracking In Boiling-Water-Reactor Mark I And Mark II Containments Caused By Failure Of The Inerting System	12/31/85	All BWR facilities having a Mark I or Mark II containment
85-98	Missing Jumpers From Westinghouse Reactor Protection System Cards For The Over-Power Delta Temperature Trip Function	12/26/85	All Westinghouse designed PWR facilities holding an OL or CP
85-97	Jail Term For Former Contractor Employee Who Intentionally Falsified Welding Inspection Records	12/26/85	All power reactor facilities holding an OL or CP

OL = Operating License
CP = Construction Permit