SSINS No.: 6835
IN 86-63

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

August 6, 1986

IE INFORMATION NOTICE NO. 86-63: LOSS OF SAFETY INJECTION CAPABILITY

Addressees:

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

Purpose:

This notice is to alert recipients to a potentially significant problem pertaining to the loss of safety injection (SI) capability as a result of common-mode failure of SI pumps from crystallization of boric acid. The NRC expects that recipients will review this notice 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.

Related Documents:

AEOD Engineering Evaluation Report E606: "Loss of Safety Injection Capability at Indian Point Unit 2," May 1986.

NRR Generic Letter 85-16: "High Boron Concentrations," August 23, 1985.

NRC "Report to Congress on Abnormal Occurrences," NUREG-0090, Vol. 8, No. 2, November 1985.

Description of Circumstances:

On December 28, 1984, during operations to top off the ECCS accumulators, the licensee at Indian Point Unit 2 observed discharge pressure to two SI pumps to drop from 1100 psig and 1500 psig, respectively, to about 700 psig corresponding to accumulator pressure. These pumps were secured from operation. The third SI pump could not be manually started. The licensee declared all the safety injection (SI) pumps inoperable and manually tripped the reactor. The malfunction of the pumps was apparently caused by boric acid crystallization blocking pump suction and by possible gas binding of the pumps.

Two parallel, leaky valves in the discharge line of the boron injection tank (BIT) enabled highly concentrated boric acid to flow through the low pressure

Copies to: Withers, Yundt, Lentsch, Orser, Steele, E. Burton, E. Jordan, A. Holm, LIS, C. A. Olmstead, S. Hoag, S. Sautter, R. Johnson, TNP:GOV REL F:NRC CHRONO, TNP:GOV REL F:NRC IE Information Notice 86-63

PGE Action - None Required "Completed - BIT Removed See License Amendment 103"

8-13-86

discharge line (SI pump suction) and to precipitate in the pumps, which were not heat traced. Degassing of the nitrogen cover gas dissolved in the boric acid solution is believed to be one of the likely sources of gas found in the pumps.

On May 10, 1974, a precursor to this event took place at Indian Point 2. In that event, two of the three SI pumps were rendered inoperable as a result of boric acid crystallization. No gas was noted in the pumps at that time.

On June 1, 1984, while in cold shutdown, the licensee at San Onofre Unit 1 found the two boric acid flow paths required by the plant's Technical Specifications to be blocked. The blockage was caused by crystallization of boric acid between the boric acid storage tank (BAST) and the charging pumps. There are two parallel lines, one having a transfer pump and the other a boric acid injection pump. Both were blocked. The operators were using highly concentrated boric acid from the BAST to rapidly make up to the refueling water storage tank (RWST) but failed to monitor concentration and solubility. Viable alternate flow paths were established by shifting the charging pump suction to the RWST and by using a manual bypass valve for the transfer pump.

Discussion:

These events demonstrate the potential for losing emergency safety injection capability by common-mode failure resulting from either boric acid crystallization or gas binding of the pumps. As to the gas binding possibility in the December 1984 event at Indian Point 2, the licensee studied the possible sources of gas and concluded that the probable effect of gas evolution on pump performance would be minor.

Originally in Westinghouse (W) plants, the addition of highly concentrated boric acid solution (20,000 ppm) to the reactor coolant system (RCS) following a design-basis main steam line break (MSLB) was intended to compensate for the addition of positive reactivity to the core by the sudden cooling of the RCS. In most W plants, the BIT (or equivalent) is located downstream of the SI pumps. On an SI signal, the pumps inject the BIT contents into the RCS, provided the RCS pressure is less than the SI system shutoff pressure. Indian Point Unit 2 is among the few W PWRs that has the BIT upstream of the SI pumps. Other plants with a source of boric acid similarly located include San Onofre 1, Haddam Neck, Yankee Rowe, Point Beach 1 and 2, Prairie Island 1 and 2, Kewaunee, and Ginna. Of these plants, San Onofre 1, Haddam Neck, and Yankee Rowe use typically 2,000 ppm boric acid from the RWST for SI. Indian Point 2 uses a 20,000 ppm solution from the BIT, while Point Beach 1 and 2, Prairie Island 1 and 2, Kewaunee, and Ginna use a 20,000 ppm solution from the BAST for SI.

Recent evaluations of the design-basis MSLB accidents in some W PWRs have revealed excessive conservatism regarding boric acid requirements. In some cases, it was shown that the requirements of 10 CFR 100 would not be exceeded if the BIT were eliminated or if the boric acid concentration were reduced. Following the Indian Point 2 event on December 28, 1984, NRR sent Generic

Letter 85-16 to all licensees of W plants to encourage them to reevaluate their MSLB analysis and the need for the BIT. So far, in addition to Indian Point 2, at least the following plants have received NRR approval for removal of their BIT and/or for modifying technical specification requirements that would allow operation with reduced boric acid concentrations:

Turkey Point 3 and 4
Harris 1
Surry 1 and 2
Beaver Valley 1
South Texas
McGuire 1 (McGuire 2 was licensed without a BIT)
Catawba 1 and 2
Callaway
Farley 1 and 2
Trojan

For those plants that are still required to provide high boric acid concentrations for SI, plant-specific procedures normally provide for flushing the SI system after every SI actuation to prevent boric acid precipitation in the piping and for periodic sampling of the SI system.

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 Contacts: Vern Hodge, IE
301-492-7275

Raji Tripathi, AEOD
301-492-4435

Attachment: List of Recently Issued IE Information Notices

Attachment 1
IN 86-63
August 5, 1986

LIST OF RECENTLY ISSUED
IE INFORMATION NOTICES

Information Notice No.	Subject	Date of Issue	Issued to
86-62	Potential Problems In Westinghouse Molded Case Circuit Breakers Equipped With A Shunt Trip	7/31/86	All power reactor facilities holding an OL or CP
86-61	Failure Of Auxiliary Feedwater Manual Isolated Valve	7/28/86	All power reactor facilities holding a CP
86-60	Unanalyzed Post-LOCA Release Paths	7/28/86	All power reactor facilities holding an OL or CP
86-31 Sup. 1	Unauthorized Transfer And Loss Of Control Of Industrial Nuclear Gauges	7/14/86	All NRC general licensees that possess and use industrial nuclear gauges
86-59	Increased Monitoring Of Certain Patients With Implanted Coratomic, Inc. Model C-100 and C-101 Nuclear-Powered Cardiac Pacemakers	7/14/86	All NRC licensees authorized to use nuclear-powered cardiac pacemakers
86-58	Dropped Fuel Assembly	7/11/86	All power reactor facilities holding an OL or CP
86-57	Operating Problems With Solenoid Operated Valves At Nuclear Power Plants	7/11/86	All power reactor facilities holding an OL or CP
86-56	Reliability Of Main Steam Safety Valves	7/10/86	All PWR facilities holding an OL or CP
86-55	Delayed Access To Safety-Related Areas And Equipment During Plant Emergencies	7/10/86	All power reactor facilities holding an OL or CP

OL = Operating License
CP = Construction Permit