UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D. C. 20555-0001

February 11, 2000

NRC INFORMATION NOTICE 2000-01: OPERATIONAL ISSUES IDENTIFIED IN BOILING WATER REACTOR TRIP AND TRANSIENT

Addressees

All holders of licenses for nuclear power reactors.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert addressees to equipment and procedural issues experienced in a recent transient at the Hatch nuclear power plant. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid problems. However, suggestions contained in this information notice are not NRC requirements; therefore, no specific actions or written response is required.

Description of Circumstances

On January 26, 2000, at Hatch Unit 1, the reactor automatically scrammed on low reactor water level after a partial loss of feedwater occurred. One of two main feedwater lines was isolated when a valve unexpectedly closed in the feedwater flow path to the reactor. The licensee later determined that the valve closed because of a problem with the valve control switch. As a result of the valve closure, feedwater flow was significantly decreased; therefore, reactor water level decreased, and the reactor automatically scrammed as expected.

The high-pressure coolant injection (HPCI) system and the reactor core isolation cooling (RCIC) system automatically actuated and injected water into the reactor as designed. These systems, along with the feedwater system, increased reactor water level rapidly. The feedwater and RCIC systems tripped on high level as expected. However, the HPCI system did not immediately trip as designed on high level and continued to inject water into the reactor for about 1 minute before tripping. Reactor water level increased to the point that water entered the main steam lines. The licensee closed the main steam isolation valves (MSIVs) in accordance with the emergency operating procedure.

Pressure in the shutdown reactor began to slowly increase because of decay heat. A licensee operator attempted to open a safety relief valve to control reactor pressure but did not receive the expected indications on the control panel. The operator then actuated the control switches for other safety relief valves until he received the expected open indication on one valve. Subsequently, several safety relief valves were operated satisfactorily to control reactor pressure. Later, the licensee determined that the safety relief valves had opened properly when actuated. Safety relief valve tailpipe temperature indications, available on a control room

back panel recorder, clearly indicated the valves had operated. Reactor pressure reached a maximum value slightly above normal operating pressure and did not approach an operational safety limit.

The licensee controlled the reactor water level using HPCI and RCIC. Although initial attempts to restart RCIC were unsuccessful, the licensee was able to use the system later in the event. HPCI was manually operated several times for water level control and the licensee observed that it tripped properly at the high-level setpoint twice during the recovery.

On January 30-February 5, 2000, the NRC conducted an augmented team inspection (AIT) of the circumstances of this event. The objectives of this inspection were to (1) determine the facts of the event, (2) assess the licensee's response to the event, (3) assess the licensee's event review and recovery actions, and (4) assess any generic aspects of the event.

Discussion

In this event, several systems did not perform as expected.

Safety Relief Valves

The licensee's investigation into the response of the safety relief valves focused on the valve's position indication, the effect water has on the operation of the safety relief valve, and the effect that water passing through the safety relief valve has on the tailpipes, tailpipe vacuum breakers, and tailpipe pressure switches. The licensee was assisted by the nuclear steam supply system vendor, General Electric (GE), and the safety relief valve vendor, Target-Rock, in conducting this investigation and assessment. The licensee concluded that the safety relief valves operated each time the control switches were actuated in the control room. However, the operators were unaware that the safety relief valves were open because they did not receive the expected indicating light on the control panel. A pressure switch located in each safety relief valve tailpipe actuates due to increased tailpipe pressure when the safety relief valve is opened and, in turn, actuates an indicating light on the control panel. During this event, pressure in the tailpipes did not increase sufficiently to actuate the pressure switches while the safety relief valve was passing water. The licensee sent several of the safety relief valve control assemblies (topworks) to a valve test facility for testing and inspection. No abnormalities as a result of this event were identified. The licensee conducted inspections of the safety relief valve tailpipes and other plant components that may have been subjected to the water in the steam lines and did not identify any adverse conditions that resulted from this event.

Reactor Core Isolation Cooling

During the event, the RCIC system automatically initiated on low reactor water level and continued to inject until the RCIC turbine steam admission valve closed on high reactor water level as designed. Initial attempts to restart RCIC were unsuccessful. Water from the main steam lines had entered the line supplying steam to the RCIC turbine, which affected the turbine control system and resulted in closing the trip and throttle valve. The licensee concluded that the closure of the trip and throttle valve was due to an electrical overspeed

condition caused by water carryover into the turbine governor valve. In addition, the licensee's procedural guidance and training for restarting the tripped system with water in the steam supply line was inadequate. The licensee successfully manually started the system later in the event and identified no further problems with its operation.

The licensee concluded that, in accordance with its procedures and training, operators attempted to restart the turbine by resetting and opening the trip and throttle valve with (1) the steam admission valve full open and (2) the turbine control system demanding maximum speed. This method results in rapid admission of steam into the turbine, which increases the possibility of tripping the turbine on electrical overspeed. Additionally, it was determined that the trip and throttle valve response on the simulator did not accurately model the actual valve response in the plant.

The NRC has issued several information notices (listed below) on experiences at other nuclear power plants with water in the steam supply to turbine-driven pumps.

High Pressure Coolant Injection

Early in the transient, the system initiated, as designed, upon reaching its reactor water low-level setpoint and injected to assist the RCIC and feedwater systems in recovering the reactor water level. The system did not immediately trip upon reaching the high reactor water level but tripped after about 1 minute of continued operation. Later in the transient, the licensee manually restarted HPCI several times for reactor water level and pressure control. The system promptly tripped, as designed, at the high-level setpoint on two occasions.

The licensee conducted a detailed investigation regarding HPCI operation and did not conclusively determine why the system did not immediately trip during its initial operation. Testing of the associated components failed to identify the cause of the event but supported operability of the system.

Feedwater Valve Handswitches

The partial loss of feedwater occurred when a valve in the main feedwater flow path to the reactor closed unexpectedly. Later, the licensee determined that the valve closed because of a malfunction of a GE Type CR 2940 control switch. In 1977, GE issued Service Information Letter No. 217, which indicated that this model control switch was overly sensitive during positioning and that the switch contacts may close prematurely from the slightest movement of the selector switch.

Performance of Licensed Operators:

Several operational performance issues complicated the transient and recovery. For example, after the initial injection, several efforts to restart RCIC were unsuccessful because the procedural guidance and simulator training were not adequate for the existing conditions. The event occurred during shift turnover when a large number of operators were in the control room and resulted in unclear lines of responsibility and communication difficulties during some phases of the event. For example, there was a slight delay by the operators in shutting the

MSIVs. Additionally, the operators did not identify that HPCI did not immediately trip at the high-level setpoint.

Health and Safety Assessment

The AIT concluded that the event did not adversely affect the health and safety of the public. The event did not result in a radiological release, and no operational safety limits were approached. Safety-related systems remained capable of accomplishing their required safety functions, although some problems occurred with important plant equipment. No need existed to declare an unusual or emergency condition.

Generic Implications

The AIT concluded that several issues identified during the inspection potentially have generic implications. They are:

1. Safety relief valve operation and indication is affected when the valve is passing water instead of steam. Opening times may be slower, on the order of several seconds versus milliseconds. Tailpipe pressure experienced when passing water may not be sufficient to actuate pressure switches used for position indication.

2. Procedural guidance for closing the main steam isolation valves and setpoints for the high-level trips of the injections systems may not prevent complications due to water collecting in the main steam lines.

3. RCIC performance is affected by resetting the turbine trip and throttle valve with the steam admission valve open and a flow demand present, especially if excessive moisture is present in the steam supply to the turbine.

Related Generic Communications

- Information Notice 85-50, “Complete Loss of Main and Auxiliary Feedwater at a PWR Designed by Babcock & Wilcox,” July 8, 1985

- Information Notice 85-76, “Recent Water Hammer Events,” September 19, 1985

- Information Notice 86-14, “PWR Auxiliary Feedwater Pump Turbine Control Problems,” March 10, 1986

- Information Notice 86-14, Supplement 1, “Overspeed Trips of AFW, HPCI, and RCIC Turbines,” December 17, 1986

- Information Notice 86-14, Supplement 2, “Overspeed Trips of AFW, HPCI, and RCIC Turbines,” August 26, 1991

- Information Notice 88-77, “Inadvertent Reactor Vessel Overfill,” December 17, 1986

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact one of the technical contacts listed below or the appropriate Office of Nuclear Reactor Regulation (NRR) project manager.

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LIST OF RECENTLY ISSUED
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Information Notice No.	Subject	Date of Issuance	Issued to
99-34	Potential Fire Hazard in the use of Polyalphaolefin in Testing of Air Filters	12/28/99	All holders of licenses for nuclear reactors and fuel cycle facilities
99-33	Management of Wastes Contaminated With Radioactive Materials	12/28/99	All medical licensees
99-32	The Effect of the Year 2000 Issues on Medical Licensees	12/17	All NRC medical licensees
99-31	Operational Controls to Guard Against Inadvertent Nuclear Criticality	11/17/99	All NRC licensed fuel cycle conversion, enrichment and fabrication facilities
99-30	Failure of Double Contingency Based on Administrative Controls Involving Laboratory Sampling and Spectroscopic Analysis of Wet Uranium Waste	11/8/99	All fuel cycle licensees and certificates performing laboratory analysis to determine uranium content, in support of administrative criticality safety controls
99-29	Authorized Contents of Spent Fuel Casks	10/28/99	All power reactor licensees and spent fuel storage licensees and applicants
99-01, Rev. 1	Degradation of Prestressing Tendon Systems in Prestressed Concrete Constrainments	10/7/99	All holders of operating licensees for nuclear power reactors
99-28	Recall of Star Brand Fire Protection Sprinkler Heads	9/30/99	All holders of licenses for nuclear power, research and test reactors, and fuel cycle facilities
99-27	Malfunction of Source Retraction Mechanism in Cobalt-60 Teletherapy Treatment Units	9/2/99	All medical licensees authorized to conduct teletherapy treatments

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