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

December 20, 1988

NRC INFORMATION NOTICE NO. 88-99: DETECTION AND MONITORING OF SUDDEN AND/OR RAPIDLY INCREASING PRIMARY-TO-SECONDARY LEAKAGE

Addressees:

All holders of operating licenses or construction permits for pressurized-water reactors (PWRs).

Purpose:

This information notice is being provided to alert addressees to potential problems in detecting and monitoring sudden and/or rapidly increasing leakage through the steam generator tubes from the primary system to the secondary system. 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 October 19, 1988, Indian Point Unit 3 was operating at full power with no indication of significant primary-to-secondary leakage. The strip chart recording for the condenser air ejector monitor (R15) indicates that the count rate began to increase above background at 2000 hours. At 2026 hours, the R15 monitor alarmed at 300 counts per minute (cpm). The licensee estimates the corresponding primary-to-secondary leak rate to have been quite low, approximately 0.02 gallons per minute (gpm).

Subsequent to alarm of the R15 monitor, the air ejector effluent was automatically diverted to containment. This diversion caused the effluent to bypass the R15 monitor and the normal collection point for taking air ejector grab samples.

At 2030 hours, the operators isolated the steam generator blowdown. A liquid blowdown sample taken at 2100 hours showed no significant change in activity relative to a previous sample taken earlier that day at 0832 hours.

At 2100 hours, a grab sample was taken from an alternate collection point located on the air ejector effluent diversion path to confirm and trend the

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leakage. However, air in-leakage from a vacuum breaker upstream of the alternate collection point invalidated the sample.

At 2219 hours, the air ejector flow path was rediverted to its normal flow path (to the turbine building vent) to facilitate taking a grab sample from the normal collection point. Grab samples taken at 2235 hours and 2303 hours revealed that the leakage rate had reached 2 gpm and was holding steady. This leak rate exceeded the plant Technical Specification limit of 0.3 gpm. The licensee immediately began a plant load reduction (to shutdown) at 2322 hours upon analysis of the initial grab sample, and the air ejector exhaust was again diverted to containment at 2327 hours.

Subsequent investigation revealed the leak to be associated with a circumferential crack extending approximately 250° around the tube circumference. The crack was located in a tube at the periphery of the tube bundle. The elevation of the crack was just above the top tube support plate where the tube had some minor denting. The cause of the crack (e.g., fatigue, stress corrosion cracking) has not been clearly established.

The licensee implemented a number of improvements to enhance its ability to detect, trend, and respond to sudden and/or rapidly increasing primary-to-secondary leakage. Equipment modifications were implemented to ensure continuous R15 monitor surveillance and to provide for continuous grab sample collection capability during periods when the air ejector effluent is diverted to containment. A computer display of the R15 count rate and of the alarm setpoint was installed in the control room to further enhance monitoring capabilities. A micro-R-meter was installed on the air ejector piping to confirm the R15 readings. Leak rate monitoring procedures were extensively upgraded to make optimal use of the available data to permit timely detection, trending, and response to rapidly increasing leak rates.

Discussion:

Although the Indian Point 3 occurrence did not lead to a tube rupture event, the occurrence does highlight the importance of leak rate monitoring methods and procedures that are effective in ensuring the timely detection and response to rapidly increasing primary-to-secondary leakage that may otherwise lead to a tube rupture event such as occurred at North Anna 1 in July 1987.

There is a wide diversity of methods among licensees to monitor primary-to-secondary leakage. Primary and secondary system mass balancing, isotopic sampling of the steam generator blowdown, and isotopic sampling of the air ejector effluent are among the methods typically in use. However, these methods are employed at discrete time intervals (e.g., three times weekly, daily) and these methods may not provide a timely indication of sudden and/or rapidly increasing leakage. Furthermore, leak rate estimates based on liquid samples from steam generator blowdown may significantly lag behind actual leak rates at the time the sample was taken in cases of rapidly increasing leak rates. This latter point is exemplified by the fact that the blowdown sample taken at Indian Point 3 approximately 34 minutes after annunciation of the R15 alarm showed no significant increase in activity even though the leakage rate at this time had probably already reached the Technical Specification limit.

Optimal use of data from the air ejector monitor is one method by which operators can be quickly alerted to sudden and/or rapidly increasing leakage. This data is monitored continuously and exhibits a relatively good time response to sudden and/or rapidly increasing leak rates. Radiation monitor alarm setpoints corresponding to very low levels of primary-to-secondary leakage, such as existed at Indian Point 3, can alert the operators to the need for quickly confirming, quantifying, and trending leakage through appropriate methods such as sampling of the air ejector effluent. Specific procedures to accomplish these goals are important to ensure a timely response to rapidly increasing leaks.

Although the R15 alarm provided an early indication to the Indian Point 3 operators of possible primary-to-secondary leakage, the design of the air ejector effluent containment diversion feature contributed to difficulties in monitoring the leakage for almost 2 hours immediately following the alarm. Actions such as those taken by the licensee for Indian Point 3 to ensure the ability to monitor leakage while the air ejector effluent is diverted to containment can substantially enhance the ability of operators to monitor and respond to sudden and/or rapidly increasing leakage.

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

Charles E. Rossi

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

Technical Contact: E. Murphy, NRR
(301) 492-0945

Attachment: List of Recently Issued NRC Information Notices

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EMurphy	KWichman	JWermeil	CYCheng	JRichardson
12/02/88	12/02/88	12/02/88	12/02/88	12/06/88

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JRichardson	LCShao	CBerlinger	CRossi
12/06/88	12/07/88	12/13/88 with minor change	12/ /88

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