

CONTINUOUS MONITORING OF STEAM GENERATOR PERFORMANCE USING NON-INTRUSIVE DOWNCOMER FLOW MEASUREMENTS

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Nuclear plant reliability depends directly on steam generator performance. Downcomer flow is a good monitor of steam generator performance. It provides information critical to the efficient and safe operation of steam generators as determined by the recirculation ratio and water inventory. In addition, reduced downcomer flow may indicate steam generator crudging or inadequate chemical cleaning.

This paper describes the recent advances in the application of ultrasonic technology to measure flow velocity in the downcomer annulus during operation. This technique is non-intrusive since the measurements are taken with ultrasonic transducers mounted on the outer shell of the steam generator. New transducers and improved installation techniques have resulted in increased transducer reliability. Whereas previous installations provided data for two to three months, a current installation has been operating for over a year.

Through on-site testing, it was determined that some CANDU steam generators are experiencing carry-under (steam from the separators is carried into the downcomer). To measure the downcomer flow under these conditions, a different ultrasonic technique was required. A new technique became available in 1995 and was successfully adapted for high-temperature application. This Transflection method was attached to a Bruce A steam generator in January of 1996. This installation is still operating as this paper is being written.

Options for movable measuring systems and simpler surface preparation have also been examined. This research has determined the several obstacles and some possibilities for the use of magnets in temporarily holding the transducers at a given location. This would allow for measurements to be taken in a larger number of locations. In addition, the need for minor welding on the surface of the steam generator shell would be eliminated.