

Research Report LTKK / Nuclear Safety Research Unit

Condensation Pool Experiments with Non- Condensable Gas TOKE-2/2002

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Abstract

In this research report the formation, size and distribution of the non-condensable gas bubbles in the condensation pools of Olkiluoto 1 and 2 nuclear power plants in a possible LOCA situation has been studied experimentally with the condensation pool test facility. The test facility simulated blow-down pipes, a condensation pool, an ECCS strainer and a pump. Also the effect of the non-condensable gas on the performance of the ECCS pumps has been examined. The tests were carried out so that compressed air was blown to the test pool through blow-down pipes or alternatively compressed air was injected directly to the pump intake pipe.

The tests were performed because in a possible LOCA situation there might be a risk that the gas discharging through the blow-down pipes to the condensation pool could push to the ECC systems and undermine their performance.

When air was blown to the pool the first airflow hit to the bottom of the pool (when pipes filled with water) and it had contact with the ECCS strainer. Next couple of the forming large air bubbles touched the ECCS strainer, too. The level of the strainer was full of air bubbles during the first 30 s because water backflow close to the wall of the pool carried a lot of small air bubbles from the upper part of the pool to the lower part.

In the integral tests the pump was sucking water through the strainer with constant flow rate when air was blown to the pool. At volumetric flow rate 5.5 l/s air bubbles weren't detected inside the transparent intake pipe. At volume flow rate 11 l/s (scaled to the plant conditions) air bubbles were visible approx. 20 s when air was blown to the pool through two blow-down pipes. During the tests the head and water flow didn't decline when air was blown to the pool.

A rough estimation for maximum volume void fraction was made from video frame; 5%. In the pump tests the pump was working at nominal speed 2970 rpm with four different volumetric flow rates when pressurized air was blown directly to the intake pipe. With volume flow rates 57 and 75 l/s air was injected 3- 4% before the head and flow declined considerably. With smaller flows 12.5 and 25 l/s the head and flow started to decline after injection was started and they collapsed totally when air was more than 7% in the intake pipe.

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