

Experimental study of two-phase natural circulation circuit

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This paper reports an experimental study on the behavior of fluid flow in natural circulation under single-and two-phase flow conditions. The natural circulation circuit was designed based on concepts of similarity and scale in proportion to the actual operating conditions of a nuclear reactor [1]. The behavior of the phenomenon of natural circulation was monitored by a software with graphical interface, showing the evolution of temperature measurement points and the results stored in digital format spreadsheets. Besides, the natural circulation flow rate was measured by a flowmeter installed on the cold leg.

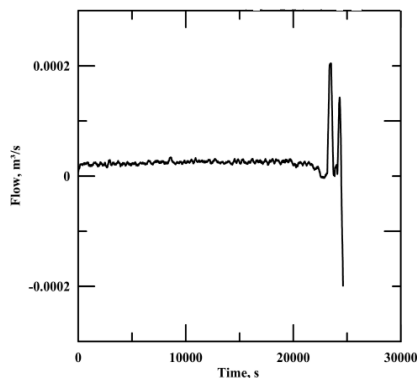


Figure 1. Natural circulation flow.

A flow visualization technique was used in order to identify vertical flow regimes of two-phase natural circulation.

The experiments contributed for the study of the behavior of the natural circulation phenomenon by using a low-cost small-sized thermal-hydraulic circuit based on the philosophy of height and volume proportionality and scaled similar circuit.

The Reynolds number allows the conclusion: the natural circulation flow has a transitory behavior between the laminar and turbulent regimes.

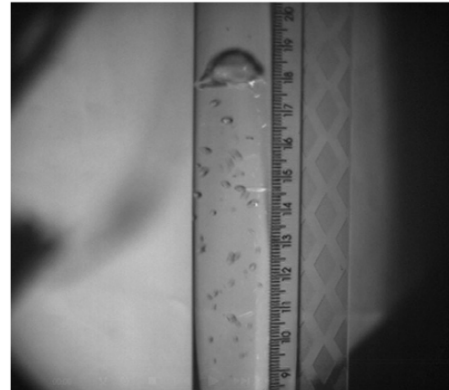


Figure 2. Image of the bubbles.

The images allowed to identify the behavior of flow natural circulation compared with two-phase natural circulation along the hot leg (riser).

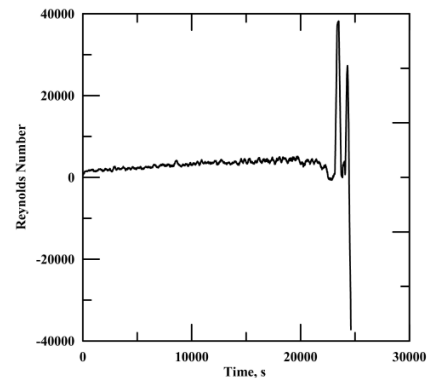


Figure 3. Reynolds number.

The experiment had a positive contribution for the acquisition of important information on the phenomenon of natural circulation, as well as for the acquisition of important information on the phenomenon of natural circulation. Likewise, it played an important role for the identification of real conditions of functioning in shut down or emergency of nuclear power plants from the performed experiments in similar conditions [2].

References

- [1] Zvirim, Y. (1981). A Review of Natural Circulation Loops in Pressurized Water Reactors and Other Systems. *Nuclear Engineering and Design*, Vol. 67, pp.203-225.
- [2] Lemos, W.F., Su, J., Faccini, J.L.H. (2012), Experimental Study of Two-Phase Natural Circulation Circuit, Proceedings of ENCIT2012, Rio de Janeiro, RJ, Brazil.