Flow Verification and Flow/Power Characterization of a Commissioning Reactor Using Site Data and NUCIRC Code

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Abstract

Before a Reactor can complete the commissioning phase and go on to commercial operation it must perform flow verification activities. The key objectives of the commissioning flow verification is:

1. Ensure that there are no flow blockages
2. Show that the design is meet, helps validate the safety cases done
3. Verify instrumentation readings

These flow verification activities are the first step to characterising the primary heat transport system (PHTS) system that can then be use to track plant PHTS throughout its life.

The procedure involves measuring flow in the core so that the reactor flow/power characteristics can be verified. The flow measurements along with other system parameters, are very useful in the development and verification of thermalhydraulic models used in analysis codes.

Design simulations are performed to give a solid foundation in which the flow and process measurements can be checked against to help highlight any instrumentation calibrations or installation issues.

The flow and process measurement data is collected in Phases. In Phase A, the first stage the measurements are taken with and without fuel in the core. Phase C the reactor is tracked from zero power hot to 100% full power. A NUCIRC slave channel is used along with ultrasonic flow measurements to help verify that there is sufficient flow in each channel. It should be noted that Phase B is low power testing and not a part of flow verification.

Phase A of the flow and measurement verification is done with and without fuel load into the core and ultrasonic flow measurements are taken on all channels. Again a NUCIRC slave channel model is used to show that the addition of fuel has not introduced any blockage to the channels.

Phase C the reactor is brought from zero power hot to 100% full power stopping at 0, 25, 50, 75, and 100% full power. At each power level the flow in the core is measured via inverse heat balance method. NUCIRC is used to with process measurements to show that sufficient flow is maintained through out the flow/power curve.

This paper presents the final result of this analysis and the integration of the site data and plant models in NUCIRC.