

PROJECT TITLE: Sodium heat pipes; design and failure mode assessment for micro-reactor applications

TECHNICAL WORK SCOPE IDENTIFICATION: Topic area 1 – Reactor Development and Plant Optimization

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ABSTRACT:

The present proposal aims to experimentally investigate the thermal-hydraulics performance of liquid sodium heat pipes applied to microreactors, with a focus on exploring different failure modes, evaluating the effect of different design and manufacturing parameters (presence of non-condensable gases and oxygen concentration) on operating performance, studying corrosion of the heat pipe material, and performing a wick/heat pipe optimization study. The scope and tasks of this proposal have been thoroughly discussed with partner Westinghouse and heat pipe experts at LANL and these areas were selected to be the most relevant for the next steps in heat pipe reactor deployment that a University could help support. The following objectives will be realized during the course of the project

1. Build heat pipes instrumented with optical fibers to allow high resolution distributed temperature measurements
2. Characterize failure modes on the heat pipes, study survivability and their effects on heat pipe performance.
3. Experimentally assess the effect of the presence of non-condensable gases in the heat pipe performance.
4. Evaluate the effect of the sodium oxygen concentration on the heat pipe performance and corrosion of stainless-steel 316 and FeCrAl, being considered by Westinghouse.
5. Develop a methodology for wick optimization of liquid sodium heat pipes.
6. Obtain detailed data regarding the behavior and performance of the wick-optimized liquid sodium heat pipes, including limits of operation. Use this data to help in validation of simulation tools like SOCKEY.
7. Train several graduate students who will contribute to the nuclear industry