Predictive Tools to Assess Safety Margins for Heat Pipe-cooled Reactors

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Objective: Development of predictive tools to assess accident scenarios and claimed margins for heat pipe-cooled reactors

Federal Stakeholders: Natural Resources Canada, Canadian Nuclear Safety Commission

Results

1. State-of-the art literature review on:
    i. Heat pipe-cooled reactor design concepts including the AECL/CNL Nuclear Battery, Los Alamos National Laboratory Special Purpose Nuclear Reactor (SPNR), modified SPNR core designs and the Westinghouse e-Vinci micro reactor
    ii. The Idaho National Laboratory (INL) report on SPNR assessment using Phenomena Identification and Ranking Table
    iii. Previous experiments
    iv. Heat pipe technology
    v. Failure mechanisms
2. Initiated a collaboration basis with Carleton University (Dr. Tarik Kaya)
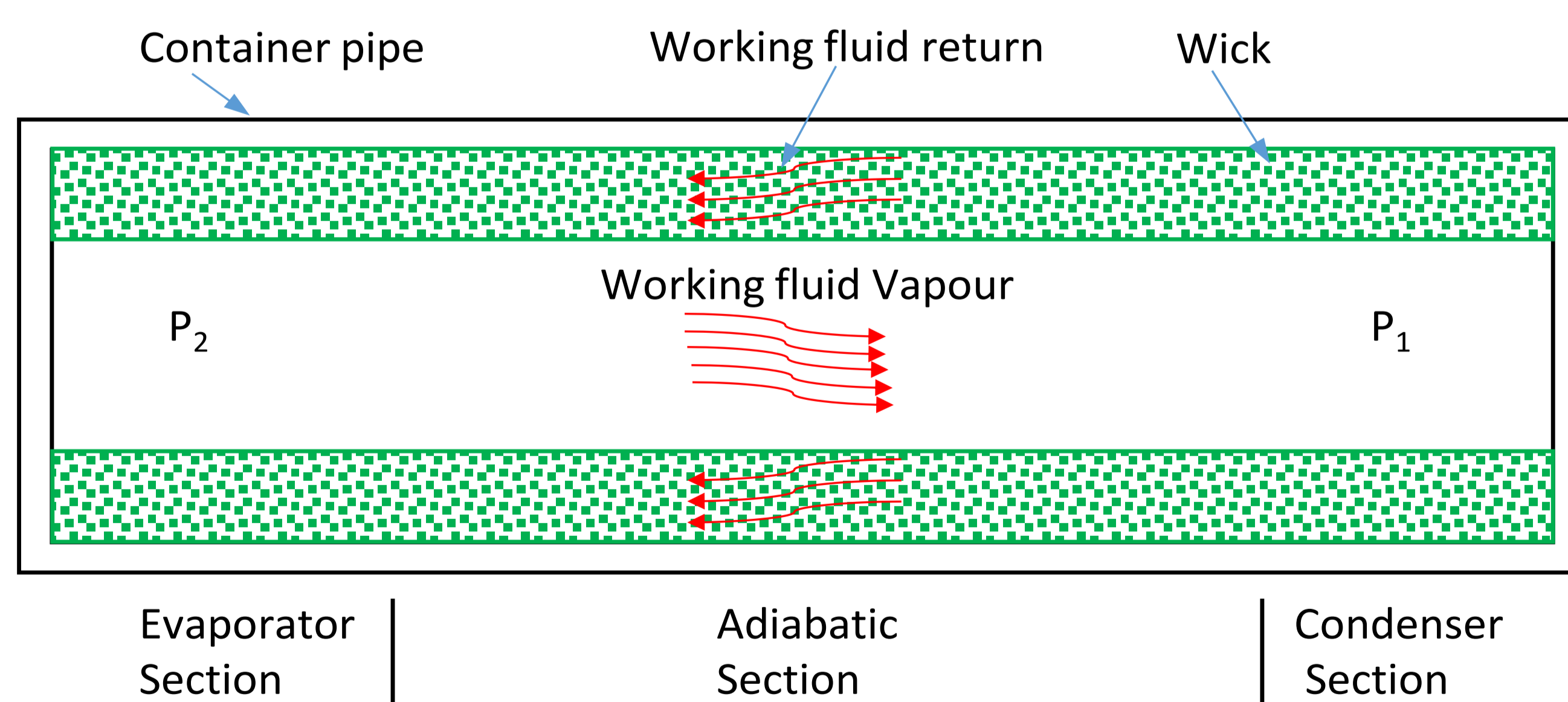
Expected Outcomes

1. The final product will be a computational tool capable of analyzing heat pipe reactor safety concerns.
2. In the interim, the literature review summarizes the characteristics, and concerns about the proposed reactor conceptual designs and provides a knowledge base serving the future research.
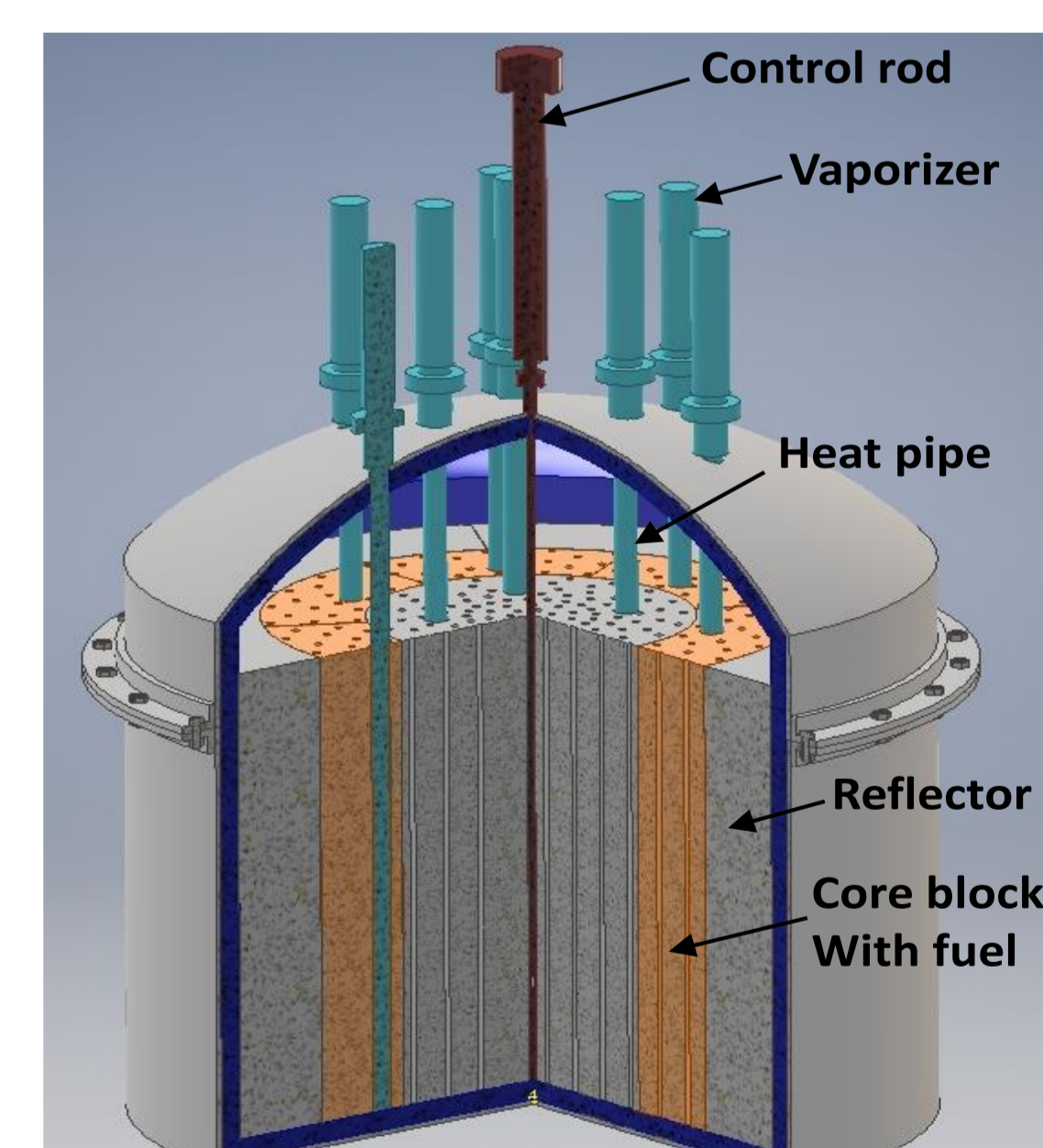
Future Work

- ❑ Design of Test Facilities
- ❑ Work Plan for Next Years
- ❑ Heat Pipe Performance Parameters Study
- ❑ Numerical Code Review
- ❑ Participation in Conferences

- ❑ Neutron Leakage Study
- ❑ Procurement of Equipment & Materials
- ❑ Facility Installation & Commissioning
- ❑ Test Plan, Testing & Test Report
- ❑ Computational Tool Development & Validation

Future Collaborations: Carleton University and INL

Container pipe · Working fluid return · Wick · Working fluid Vapour · P_2 · P_1 · Evaporator Section · Adiabatic Section · Condenser Section

Schematic of a Heat Pipe

Control rod · Vaporizer · Heat pipe · Reflector · Core block With fuel

CNL Nuclear Battery Core, Reproduced from Kozier (1991)

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