Integrated Multi-Scale Design and Laboratory Curriculum for Nuclear Thermal-Hydraulics Engineering

Executive Summary

In this proposal, the University of Cincinnati seeks to develop and introduce course materials and their implementation tools for incorporating the new pedagogical paradigm of problem-based learning (PBL) with web-based and applications-driven content for multi-scale design analysis in nuclear reactor engineering, which will be coupled with an integrated laboratory experience in the Mechanical Engineering/Nuclear Engineering curricula. This effort includes creating new learning materials and specialized PBL case studies for thermal-hydraulics analysis and fluid-flow transport, developing concurrently relevant bench-top hands-on laboratory experiments and demonstrators, and introducing an elective course sequence (*Boiling,Thermal-Hydraulics, and Fluid Transport*) focused on *advanced thermal-hydraulics, two-phase flow, boiling heat transfer, and fluid-flow transport* in nuclear reactors (current PWR and BWR, as well as future Gen IV and experimental reactors).

The emphasis will be on multi-scale learning (conceptual and mechanistic linkages between nuclear reactor systems → components → processes; and vice versa), targeted towards nuclear thermal-hydraulics and fluid flow, and would help inculcate critical design thinking, inquiry-innovation inventiveness, and life-long learning practices. The developed curriculum will address the urgent and critical needs of strengthening nuclear engineering education infrastructure so as to meet the forecasted resurgent demand for engineers trained in energy production and nuclear safety.

This project, besides employing novel pedagogy to enhance and stimulate student learning, would facilitate the training of engineers who are critically informed, technically competent, and ready for a leadership and decision-making role in nuclear energy, its safety, security, and environmental impact.

Principal Investigator: R.M. Manglik, Raj.Manglik@uc.edu