General Scientific Infrastructure Support for Innovative Nuclear Research at the University of Idaho

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Program: General Scientific Infrastructure

ABSTRACT: The graduate Nuclear Engineering Program at the University of Idaho (UI) features a unique collaboration among faculty from diverse disciplines including Chemical and Mechanical Engineering, Material Science and Engineering, and Computer Science. The program, with four focus areas of Thermal Hydraulics, Materials, Fuel Cycle and Nuclear Criticality Safety, serves continuing and emerging educational, and research and development needs in the nuclear field in close collaboration with DOE's Idaho National Laboratory (INL). The overall objective of this project is to enhance the viability and competitiveness of the Nuclear Program through the acquisition and upgrade of scientific infrastructure to strengthen UI capabilities in three different aspects of the program: Thermal Hydraulics, Materials and Chemical Engineering. The infrastructure acquisition and upgrade features three components: 1. Installation of a thermal hydraulic test loop: It is proposed develop and build a test facility to investigate the effects of pressure and thermal cycling of printed circuit heat exchangers (PCHEs) or other heat exchangers in their appropriate temperature and pressure ranges, simulating the increase and decrease of temperature as systems come up to operating conditions and then shut down. The systems will be used to test steels and Ni-based alloys in simulated water reactor environments. 2. Dynamic materials testing loop: An existing static autoclave testing system will be modified with a high pressure re-circulation flow loop, loading train, and required instrumentation for fatigue crack growth and stress corrosion cracking of structural materials used in nuclear reactors. The system will be used to test steels and Ni-based alloys in simulated boiling water reactor conditions without contaminating the high temperature water with corrosion products. 3. Thermal analysis system: A modified thermogravimetric analysis (TGA) system will be acquired for the measurement of adsorption isotherms for various systems including non-radioactive isotopes of fission products on graphite and graphitic materials. These capabilities will enable the university to contribute to DOE-NE research and development efforts to develop innovative technologies that can improve the performance of advanced reactors and fuel cycle concepts. Significant challenges to be addressed towards this goal include development of advanced materials and understanding their behavior under reactor conditions, developing understanding of the performance of advanced reactors including thermal hydraulic characteristics and fission product behavior. Proposed infrastructure enhancement at UI will enable researchers to conduct investigations and advance the state of knowledge in these three critical areas. The infrastructure will also foster collaborations with researchers from other institutions including national laboratories and universities. Proposed infrastructure addition to existing capabilities will also enable UI to educate and train students more effectively, thus fulfilling its core mission of transformative education. The enhanced learning experience gained by the students will prepare them better and potentially attract them to a career in the nuclear energy field. The proposed project will thus also serve to address a critical need for an educated and well-trained workforce for the nuclear industry of the future.


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