NEUP Nuclear Energy University Program
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Research, Education and Training Center of Excellence on Nuclear Fuel Cycle and Waste Management Towards Advanced Reactor Technology

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Program: IRP 2-Grand Challenge Research and Development at Minority Serving Institutions

ABSTRACT:

Three institutions will establish a research, education, and training Center of Excellence to bring together in-depth expertise on nuclear fuel cycle and waste management to support our future advanced reactor designs. Directly related to the center are experts in nuclear chemical science and engineering, radiation and health physics, isotope separations and detections, neutron transports, industrial and manufacturing processes, mechanical engineering and economics & finance. The proposal team will bring a fully diversified group of students from a commonwealth public research university (VCU) and historically black universities (VUU and VSU) – creating a one-of-a-kind education and research training program that has never existed in the state of Virginia. Our future workforce and graduate school potentials will fulfill their training missions at the forefront of national laboratories (e.g., Idaho National Laboratory, Oak Ridge National Laboratory, Pacific Northwest National Laboratory, etc.) and nuclear industries (e.g., Dominion Energy, Seaborg Technologies, NuVision Engineering, etc.). To achieve our goal and unite our efforts, we will work in a broad collaborative environment for nuclear fuel cycle and waste management (NFCWM) towards the advanced reactor technology, called Innovation Environment, through a combination of Department of Mechanical and Nuclear Engineering (VCU), Department of Economics (VCU), Department of Physics (VUU), and Department of Engineering and Manufacturing Engineering Program (VSU).

This learning environment is designed to support deeper collaboration and cross-pollination of ideas across our team and community. We will have an integration of research & education, as well as university, national laboratory and nuclear industry, to bridge gaps and build partnerships. We will build the next generation of scientists and leaders with the requisite skill sets, flexibility of thinking, diversity, and collaborative mindset to solve future DOE-NE needs.

The research that supports this pipeline of educated, collaborative thinkers is focused on improving our ability to characterize and advance processes within the NFCWM of interest. To achieve this goal, the team will pursue the following overarching research objectives:

1. Identify the most important features of nuclear fuel cycle economics;
2. Improve our ability to describe the important fuel cycle operations with uranium from exploration through enrichment;
3. Identify the basic and advanced concepts of design, fabrication, use, storage, and transportation of reactor fuels;

4. Describe the fundamental aspects of used fuel separation and fuel cycle waste management;
5. Better understand the fundamental principles of nuclear material detection and accountancy.

These five objectives are within the research activities on five topic areas (TAs): (TA1) materials science & chemistry, (TA2) neutron transport, (TA3) heat transfer and systems, (TA4) nuclear material quantification, and (TA5) engineering economics & finance. We are planning to provide a successful pipeline within Innovation Environment meeting our proposed overarching objectives, linking to the research and development TAs, and courses satisfying the cross-cutting technology areas—modeling and simulation, education, and disruptive technology.