Nuclear Engineering and Science Equipment for Strategic Fuels Analysis Research in the Nuclear and Radiological Engineering Program at the Georgia Institute of Technology

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ABSTRACT:

The Nuclear and Radiological Engineering (NRE) Program at the Georgia Institute of Technology proposes to strategically enhance its academic and research capabilities in the area of nuclear engineering (NE) fuel cycle research. The central focus of these enhancements will be adding key equipment to expand the scope of teaching and research capabilities in our recently constructed Radiological Science\ and Engineering Laboratory (RSEL) facility. The RSEL is a 5000+ ft2 space, constructed with over $5M in investment by the College of Engineering designed to support a variety of nuclear engineering research. In keeping with the Department of Energy's mission and the recent DOE-FOA-0000999 RFP, this proposed expansion of capabilities for teaching and research will target fuel and the fuel cycle, specifically fuel irradiation, isotope research, fuel tomography, and separations chemistry. While also promoting cutting edge research, our approach also seeks to address several critical areas, specifically, the need to 1) enhance student understanding of the nuclear fuel cycle; 2) improve our tools and techniques used in fuel analysis; and 3) expand education and training for students and personnel in the areas of radiochemistry and its links to nuclear detection.

We have identified key equipment and instrumentation to augment our current academic offerings and support development of additional avenues for education, training, R&D, and collaboration with industry and national laboratories. These are 1) installation of a Nuclear Fuel Irradiation Tank for water moderated fuel element subcritical testing, augmenting the existing graphite moderated irradiation capabilities 2) expansion of detection capabilities, to include procurement of a range of gamma-ray and neutron detection equipment, and 3) addition/expansion of radiochemistry capabilities through procurement radiochemistry tools, including a dedicated flow injection analysis (FIA) system with a flow-through beta radiation detector to allow bench-top trace analysis of radionuclides. The proposed equipment and instrumentation will substantially enhance both the academic and research capabilities in the NRE program.

Overall the proposed NFIT, associated support instrumentation, and the renewed emphasis on radiochemical methods will dramatically increase education, training, and research opportunities related to the analysis of nuclear fuel. Academically, approximately 50+ students per year, spanning the chemistry and nuclear engineering programs, will utilize these enhancements. The enhancements will also bring new research capabilities in the areas of nuclear fuels, materials, radiation detector development, health physics, radiochemistry, and support to nuclear safeguards research to support the training of the next generation of nuclear engineers and scientists.