

Application Title: Actinide Science and Analysis Laboratory

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Key Participating Units: Nuclear Security Science & Policy Institute; Department of Nuclear Engineering, College of Engineering; and Department of Geology and Geophysics, College of Geosciences

Key Team Members: Dr. Sunil Chirayath (NUEN) and Dr. Brent Miller (GEPL)

Anticipated Request Amount (\$): 241,000

Executive summary: We propose standing up an actinide science and radiochemistry research infrastructure capability centered on safe handling and analysis of samples containing radioactive materials, which will be integral in writing and winning competitive proposals and recruitment of top-tier PhD seeking graduate students in the area of geosciences, actinide and radiochemistry sciences. The proposed research infrastructure is designed to meet the growing need for well-trained actinide scientists, particularly those with experience in handling and analyzing transuranic elements, within the federal agencies, such as U.S. Department of Energy, the U.S. Department of Defense, U.S. Department of Homeland Security U.S. Nuclear Regulatory Commission, as well as the National Laboratory complex to support ongoing mission on critical efforts such as forensics and nuclear waste management.

Actinide science plays an integral role in many fields from nuclear power to national security to space exploration to geosciences to medicine. Some obvious examples include the development of nuclear fuel type and composition; reprocessing and disposition of used nuclear fuel; both pre- and post-detonation nuclear forensics methodologies; development of radioisotope thermoelectric generator used as power sources for satellites, Mars rovers, and other space probes; understanding actinide speciation and migration in the environment; recovering uranium from sea water and sediments; as well as, various application in nuclear medicine including the emerging field of targeted alpha therapy.

Despite the national need for actinide scientists, there is very little research with the transuranic actinides being conducted here at Texas A&M. Several of the pieces needed to perform research with the transuranic actinide elements are already in place, 1) a PI with expertise and publication track record in this area (Dr. Burns), 2) a funded project to investigate aspects of actinide science (Nuclear Energy University Partnership, Group Actinide Separation by Crystallization: A Single-Technology Approach to Used Nuclear Fuel Recycle), and 3) trace analysis mass spectrometry laboratory which can handle radioactive samples (R. Ken Williams '45 Isotope Geosciences Laboratory). One reason for minimal activity in this area, is the necessity for safe handling which is essential when performing research, as many of these species are highly radioactive. Currently, there is only meager facilities to actually perform the research and generate samples for analysis, which includes a single radiological glovebox shared between three projects. We propose an upgrade of the current infrastructure with the addition of a second radiological glove box designed specifically for handling and analysis of actinide samples, equipped with atmospheric control for samples that need inert environments, temperature control with a closed loop circulating bath investigate non-ambient systems, and high-resolution spectroscopic analysis in the range of UV-Vis-NIR (350–1,300 nm) for in situ investigation. Other equipment will include a low mechanically cool high-purity germanium detector for low-background gamma ray analysis, as well as, radiation monitoring equipment to ensure the safety of the researchers in the lab. Due to the infrastructural nature of the proposed facility, acquisition of this equipment through federal funding agencies would be unlikely.

The creation of this facility will have an immediate impact, giving TAMU researchers a competitive advantage in seeking research funding through the National Science Foundation, the Department of Homeland Security, Department of Defense, Department of Energy, and other federal agencies. Recent collaborations between members of the participating units have led to three \$1M+ research proposals in the last two years. The proposed research infrastructure will provide the analytical capacity to support larger-scale initiatives in Texas, including the interim nuclear storage facility options being considered.