

Integrative analytical facility in nuclear nonproliferation, nuclear safeguards, and isotope geosciences research

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Anticipated Request Amount: \$198,718

Executive Summary: We propose an inter-college research infrastructure centered on a shared analytical facility that will stimulate collaboration across a broad spectrum of applications in isotope geoscience, nuclear nonproliferation, and nuclear safeguards research. The proposed research infrastructure merges existing TAMU radioisotope mass spectrometry expertise and analytical instruments with the growing need of nuclear materials researchers for the types of data produced by these instruments. Most of the key components for the collaborative research infrastructure are already in place, we lack only: 1) a quadrupole mass spectrometer to enable new analytical methods and capacity, 2) minor components for our two existing mass spectrometers to allow safe handling of more highly radioactive sample materials, and 3) a shared facility usage agreement.

Isotopic “fingerprinting” of uranium ores and related rocks and minerals can constrain the geological setting of uranium mines and help to identify new undocumented mines or reveal covert uranium mining activity. Isotopic and elemental analyses of nuclear fuel and by-product materials can constrain the type of reactor used in its production, can establish the nuclear history of materials of unknown origin, and can help verify the enrichment capabilities of known facilities. These avenues of research require analysis of the mass spectrum of radioactive elements and their decay products, which is possible only by isotope separation and measurement in a mass spectrometer. Two modern mass spectrometers for high precision elemental and isotopic analysis currently reside in the College of Geosciences’ *R. Ken Williams ’45 Isotope Geosciences Laboratory*, but no similar analytical facilities are planned for the new Zachry Engineering Education Center. The Geosciences instruments, however, already see heavy usage, they are not currently configured to routinely handle refined nuclear materials, and their design limitations constrain their usefulness to a relatively narrow range of applications. Acquisition of a quadrupole mass spectrometer and new components for our existing mass spectrometers will eliminate these technical barriers to a fully integrative research infrastructure. Due to the infrastructural nature of the proposed facility, acquisition of this equipment through federal funding agencies would be unlikely. Technical expertise and suitable laboratory space for the quadrupole mass spectrometer already exist in the *Isotope Geosciences Laboratory* and service-center recharge fees will cover the consumables and service contract after expiration of the extended warrantee.

The creation of this shared facility will have an immediate direct 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. It will also attract researchers from collaborating institutions worldwide. Finally, the proposed facility will sponsor a joint seminar series to serve as a common meeting point for researchers from multiple departments and colleges who would not otherwise normally interact, leading to new interdisciplinary collaborations, funding opportunities, novel ideas, and discoveries.