PURDUE UNIVERSITY | School of Nuclear Engineering

# Nuclear Engineering Seminar

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## Wednesday, October 18, 2023

## 3:30pm | WALC 1018

Addressing Ongoing U.S. DOE Infrastructure-Wide Nuclear Measurement Needs & Challenges


### Abstract

The United States Department of Energy (DOE) infrastructure is vast and comprises numerous nuclear, radiological measurements related to needs and challenges. The Savanna River National Laboratory's Nuclear Measurements Group provides both radiochemical analyses and non-destructive assay of nuclear material to the Savannah River Site, to other DOE facilities, as well as serving a Nuclear Forensic function for the U.S. Department of Homeland Security (DHS). The radioanalytical capability of the group serves to complement the more limited services provided by DOE's production analytical laboratories and offsite commercial laboratories. The amounts of radioactivity in sample matrices vary widely, ranging from ultra-trace environmental levels to those with doses high enough to require remote handling and manipulation.

For items too large or inconvenient to transport to the laboratory for analysis, a nondestructive assay (NDA) can be performed in situ. The NDA team conducts on-site neutron and gamma assays. The NDA team also provides technical support for non-destructive gamma, neutron, and calorimetry assay systems installed in various Site facilities.

The Nuclear Measurements Group supports nuclear measurement technology development to address the Savannah River Site (SRS) needs and address nuclear measurement shortfalls identified in various other US Government Agency Calls. Taking advantage of varied radiological handling expertise, numerous university collaborations are

currently underway researching areas such as detritiation of water and synthesis of exotic radiological waste forms, incorporating radioisotopes into potential radiological waste forms such as metal-organic frameworks and salt inclusion materials. An active collaboration with the Taleyarkian group at Purdue University is also underway, studying the potential for tensioned metastable fluid detector technology to support various DOE needs at SRS and elsewhere in the complex.

An overview of past and present nuclear processes at DOE-site-wide locations will be discussed with a focus on SRS, followed by explanations of how the Nuclear Measurements Group services are currently intertwined with these operations. A summary of current opportunities, research challenges, and development program opportunities, as well as the potential for large NNSA consortium teaming, will be highlighted.


Dr. DiPrete is a Laboratory Fellow at Savannah River National Laboratory which provides technical leadership to the Nuclear Measurements Group, the Environmental Legacy Management Directorate, and SRNL to support arising nuclear measurement challenges at SRS and across the DOE Complex. Under his technical supervision, the radiochemistry laboratory, previously limited in capability to rudimentary analyses on only high-activity samples, currently performs complete radiological characterization on a wide range of matrices spanning from environmental-level samples to high level waste. The laboratory currently analyzes materials from various SRS processes, as well as from other DOE, DOD, and DHS programs, through a strategic combination of radiochemical separations and analyses. The laboratory also supports nuclear measurement technology development to address shortfalls identified in various US Government Agency Calls. The team also conducts neutron activation analyses (NAA) to determine concentrations of a suite of stable elements in materials where conventional chemical analyses are challenged. The team is responsible for in-situ non-destructive analyses (NDA) measurements across SRS processing facilities involving gamma, neutron, and calorimetry measurements. In addition to developing and directing radiochemical analyses and nuclear counting capabilities, Dr. DiPrete has authored or co-authored more than 250 publications and presentations in the public domain. He is a Special Graduate Faculty at Purdue University, and serves in various similarly capacities at Clemson University and Florida International University. Dr. DiPrete has been awarded numerous patents for his innovative nuclear measurement solutions.