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Title: Biosensors for Detecting Nuclear Fuel Cycle Activities in the Environment

Abstract
Environmental sensors that can detect and monitor fuel cycle activities are critical for use in verifying nuclear arms nonproliferation and supporting the safe development of global nuclear energy resources. The detection of undeclared nuclear fuel cycle activities currently presents a significant challenge for nonproliferation technology, with wide-area environmental sampling (WAES) considered to be one of the most promising approaches for identifying clandestine materials/operations. As part of the Monitoring Technology and Verification (MTV) Consortium, the Savannah River Site (SRS), Oak Ridge National Laboratory, and Y-12 have been selected as field sites of interest to collect environmental samples in areas with legacy nuclear site contamination and to obtain data that reflect a timeline of contamination. The general goal of sample collection and analysis is to investigate the potential for deconvolution of nuclear fuel cycle activities from contamination signatures preserved in microbial communities and plants. This presentation will describe the results of field collection and preliminary analysis of biochemical, microbial, and geochemical samples for biosensor characterization. This will include characterization of plant tissue, surface water and sediment samples collected from known and suspected contaminant pathways and analyzed to determine if plant and microbial biosensors can predict the presence of radionuclide contaminants from specific fuel cycle activities, their source locations, and migration paths. Results of this work will be integrated with historical records and prior biogeochemical analyses to establish temporal constraints, correlations, and proxy models to predict contaminant presence, timing and level(s) of exposure, and contaminant evolution. Interpretations from the results of this work will help develop a comprehensive framework for application of natural, in-situ biosensors to detect undeclared nuclear activities.