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High performance gamma ray spectroscopy as a precision tool for nuclear forensics

For many decades, gamma ray spectrometry has been a key technology employed by laboratories for the identification of radioactive materials. Through this method, the detection of specific radioactivity can be indicative of nuclear events (ranging from nearby nuclear incidents to distant nuclear tests detected in global monitoring networks) or the process history and origin of nuclear materials and by-products. Over the past decade, there have been dramatic advancements in this method, where state-of-the art laboratory systems are now combining multiple detectors and exploiting various technologies to be able to detect the smallest amounts of radioactivity. Additionally, this evolution allows for the unambiguous identification of the nature of the nuclear event or origin of nuclear materials and by-products, providing crucial information in support of nuclear security.

This work presents an international effort to evaluate the performance of gamma ray spectrometers for the support of these nuclear forensic applications. Carefully selected environmental samples, measured by various radiation laboratories across a multitude of detector technologies, serve as a benchmarking exercise to illustrate the radiation detection capabilities of these systems. Participants include Canadian laboratories at Health Canada and SNOLAB, international partners such as the Atomic Weapons Establishment in the United Kingdom, among others. At the forefront of this field, the multi-detector systems along with those located in deep-underground laboratories are pushing the limits of this method and advancing multiple domains, including: inspections for illicit nuclear materials, nuclear explosion monitoring, nuclear safeguards, and nuclear non-proliferation monitoring.

State

Canada

Gender

Primary authors: Dr MEKARSKI, Pawel (Radiation Protection Bureau, Health Canada);   Dr UNGAR, Kurt (Radiation Protection Bureau, Health Canada);   HOFFMAN, Ian (Health Canada)

Presenter: Dr MEKARSKI, Pawel (Radiation Protection Bureau, Health Canada)

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