Contribution ID: **57** Type: **Poster**

Use of radiation detection instruments in laboratory practice for nuclear security education

In practice, it is important to know technical challenges of qualification and calibration of radiation detection instruments for the identification of radioactive and nuclear materials. In this context, the selection, procurement and use of suitable radiation measuring devices for the safe handling, storage and transportation of nuclear and radioactive materials has great importance in a facility. Because there are a variety of radiation detection and measuring equipment in the market. It is a very vital matter to know which of these devices to use for which purpose and to determine the measurement capabilities.

The purpose of this paper is to describe a perspective on the gained experience radiation detection instruments for the identification and characterization of nuclear and radioactive materials. This perspective may give some insights to overcome the challenges and benefit from the opportunities of the state-of the art of the technology related to radiation instruments.

For use of the available radiation detection instrument in nuclear security education, an academic nuclear security course for BSc students was conducted in three Academic Semester between 2017 and 2019 in Institute of Nuclear Sciences of Ankara University. In this course, practical exercises were carried out in the laboratory. One key parameter is the uranium enrichment of the uranium material for the characterization. For instance, for determination of the isotopic uranium abundance, gamma-ray spectrometry is a fast and cheaper one than other analytical tools due to its ease of use, portability, non-destructive nature in such applications in the nuclear security activities. This technique also allows analysts or first responders/front of lines on-site to measure and identify the radiation sources and materials. However, the uranium enrichment necessitates the use of specifically designed instrumentation and methods. To perform this in Nuclear Security Education activity in Ankara University, experimental setups were devised to use a gamma-ray spectrometer with Low resolution detector(NaI:Tl), intermediate resolution (LaBr3:Ce and CdZnTe) and high resolution (HPGe). The students were performed the regular experiments to determine 235U enrichment degree according to the Enrichment Meter Principle and Multigroup Analysis(MGA) methods. As a material, low enriched uranium(U3O8 in Certified EC-NRM171) certified reference materials (CRM) were used. In these experiments, uranium enrichment meter principle is based on use of 185.7 keV peak of 235U and MGA method uses 80-130 keV region of uranium spectrum. In each semester, about 20 students have already gained an experience on the calibration of a gamma-spectrometer with use of different types of detectors, obtained a perspective on the importance of knowledge of energy resolution, efficiency, experimental setup parameters such as geometrical factors, collimators and interleaved absorbers between sample and detector, and thus determining accurately 235U isotopic abundance in uranium samples.

In such a nuclear security education course, the encountered challenges, the gained experience on the use of radiation detection instruments, the pros and cons of gamma-ray spectrometry for nuclear security of nuclear and radioactive materials will be presented in detail.

State

Turkey

Gender

Male

Primary author: Prof. YÜCEL, HALUK (Ankara University, Institute of Nuclear Sciences)

Co-authors: Mr NARTTÜRK, RECEP BORA (Ankara University, Institute of Nuclear Sciences); Mr BALCI, SEFER (Ankara University, Institute of Nuclear Sciences); Ms SAATCI, SELIN (Ankara University, Institute of Nuclear Sciences); Ms KAPLAN, NESLİHAN CEREN (Ankara University, Institute of Nuclear Sciences); Ms BARUT, AYŞEN (Ankara University, Institute of Nuclear Sciences, Tandogan Campus, 06100 Ankara, Turkey)

Presenter: Prof. YÜCEL, HALUK (Ankara University, Institute of Nuclear Sciences)

Track Classification: MORC: Detection technology development and performance testing