

Study of Performance of a Lanthanum Bromide Detector for Uranium Enrichment Determination in UF₆ Cylinders

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ABSTRACT

Lanthanum Bromide (LaBr₃) is a type of scintillation detector that has become commercially available recently. According to the manufacturer and studies conducted at a laboratory level, this new gamma-ray detector presents improved characteristics in comparison with traditional sodium iodine (NaI) detectors. Better energy resolution, relative efficiency and stability with temperature are some of the features that may impact positively the performance of the measurements made with this detector. Uranium enrichment measurements performed in the field is of special interest for several applications, as nuclear safeguards. This paper presents the results of a study to evaluate the performance of a Lanthanum Bromide probe model BrillLanceCe 380 (B380) to determine the uranium enrichment in 30B UF₆ cylinders containing low enriched uranium. This activity is routinely performed by national and international safeguards inspectors in Brazilian fuel fabrication and enrichment plants. The high-purity germanium detector (HPGe) is usually selected as the standard spectroscopic system in this case. However, with the use of advanced gamma-ray analysis codes, such as NaIGEM®, the performance of NaI for this application has significantly improved. In this study, a new LaBr₃ detector and a version of the NaIGEM code specially developed to analyze the collected gamma-ray spectra constitute the measurement system under evaluation. The possibility to have a technique that is compliant with international standards and meets the needs of national and international safeguards organizations is discussed.