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Development of a Simple Nondestructive Assay Technique for Verification of Nuclear Materials in Cylinders

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The present work is a case study that describes a laboratory experimental method for estimating the U-235 mass content and/or enrichment in nuclear material bearing samples. A nondestructive assay technique has been developed for the verification of nuclear materials in cylinders. The technique is based on measuring the Gamma-rays counting rate emitted from a sample and calculating the absolute efficiency of a Gamma-ray detector system at a specific full energy peak for samples of nuclear material in cylinders with specific configuration and source-detector distance. Calculations are performed using a Monte Carlo Simulation Code [MC-4B] to achieve optimal agreement between experimental detector system efficiency and calculation values. The estimated value of U-235 mass content and/or enrichment in Uranium-bearing materials in cylinders with similar configuration and source-detector distance could be obtained for the assayed samples with accuracy in the range 7.1 - 10.8 %. The present method may be considered simple and rapid for the verification of nuclear materials in cylindrical form. Also, it may be implemented in real field cases and for the purposes of nuclear material safeguards.

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