

Investigation of limit of detection using standard radioactive sources with a LaBr₃(Ce) detector

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Abstract

Ambient background radiation has been measured using a LaBr₃(Ce) detector. This background gamma-radiation is mainly a result of construction materials (such as concrete) and air. Radionuclides that form part of the background have been identified after an energy calibration of the detector was performed using ²²Na, ⁶⁰Co and ¹⁵²Eu radiation sources. These same sources have been measured at increasing distances from the detector. The study focussed mainly on the determination of the detection limits of each radiation source taking into account the presence of background radiation. Therefore, the change in the intensity measured for each source as a function of increasing distance from the detector has been emphasised. This application is in relation to the solid angle between the points of the radiation source and the active detector volume. Further studies and application of all data available will focus on the relevant factors in order to calculate the limit of detection for a specific activity for each radiation source.

This study forms part of a broader research project that entails the design, building and commissioning of a prototype mobile gamma-ray detection system equipped with a LaBr₃(Ce) detector. The successful development of such a detector system will enable in situ measurements of radiation in various robust terrestrial environments with improved sensitivity and spectral resolution.

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