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Efficiency Calibration and Characterization of the Radioxenon Gamma Spectroscopy Counting System of a Very Low Background HPGe Detector Using Monte Carlo Simulation

Measurement of noble gases started in 2011 at the ENEA Italian Laboratory for Environmental and Anthropic Monitoring Measurements and within the framework of the CTBT and the NDC related activities carried out at the laboratory. The present status of the noble gases gamma spectroscopy analysis system will be presented. A completely dedicated HPGe detector has been used: it is a p-type extended range detector (CANBERRA, model GX6020), 60% efficiency. The germanium crystal is contained in a very low background endcap made of carbon fiber that allows an energy range 3 keV - 10 MeV. The crystal is isolated from the background using a U-type ultralow background cryostat (model 7915-30ULB), and all the materials of the detector and shielding are selected with the requirement of Ultra Low Background. Based on the Monte Carlo simulation software VGSL, we have developed both the calibration efficiency procedure for the detection of xenon radioisotopes and the characterization of calibrated containers made of different materials such as aluminium and carbon fiber. Moreover, using VGSL, the efficiency distortion due to the self absorption of the source emissions, at different concentration of xenon and helium in the counting cell, is also modelled and discussed.

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