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Development of a mobile LaBr3:Ce detector unit for in situ radionuclide analysis at TENORM contamination sites

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A mobile radiation detection unit (MRDU) featuring a 2"x2" LaBr3:Ce detector was developed for real-time radiation monitoring in terrestrial environments. The detector underwent calibration for energy, resolution, and efficiency using standard point sources at iThemba LABS and standard calibration pads at NECSA. Subsequent environmental measurements were conducted at two distinct sites: The Kruger National Park (KNP) and Welverdiend AH in the West Rand, Gauteng. An effluent spill from a tailing dam at the Bosveld Phosphate mining site near Phalaborwa in the Limpopo Province resulted in chemical contamination in aquatic ecosystems within the KNP. Despite the site's rehabilitation, no previous radiation contamination studies were conducted, considering uranium is a known by-product of phosphate mining. The West Rand, renowned for gold mining, also yields uranium as a by-product. The region, characterised by numerous tailings dumps, raises concerns about potential radionuclide contamination in nearby terrestrial environments. The MRDU was deployed to conduct measurements in both areas. Results indicated the complete rehabilitation of the KNP site, with uranium activities below the minimum detectable level. However, elevated uranium levels were observed at Welverdiend AH in the West Rand. In conjunction with gamma-ray measurements, soil samples from both sites underwent chemical analyses. The results demonstrated a strong correlation between radiation measurements and chemical analyses, affirming the successful rehabilitation of the KNP site and revealing higher uranium levels at the West Rand site. The study confirmed the MRDU as a practical and effective tool for measuring radiation in terrestrial environments, producing reliable real-time data and providing precise spatial mapping that identifies hotspot sites in the measured areas.

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