Radiometrics and mass spectrometry synergy in ultra-sensitive radionuclide analysis

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Recent developments in radiometrics and mass spectrometry techniques for ultra-sensitive analysis of radionuclides in the environment are reviewed. In the mass spectrometry sector, applications of Inductively Coupled Plasma Mass Spectrometry (ICPMS) and Accelerator Mass Spectrometry (AMS) for the analysis of long-lived radionuclides in the environment are the most important recent achievements. In the radiometrics sector the dominant development has been the utilisation of large HPGe detectors in underground laboratories with anti-cosmic or anti-Compton shielding for the analysis of short and medium-lived radionuclides in the environment. In radiometrics techniques they include applications of high efficiency HPGe detectors (up to 200% relative efficiency to a 75 mm diameter, 75 mm long NaI(Tl) detector) with anti-cosmic or anti-Compton shielding very often operating at least a few tens of metres underground where the nucleonic component of cosmic rays is reduced by several orders of magnitude. The recent developments do not only considerably decrease the detection limits for several radionuclides (up to several orders of magnitude), but they also enable to decrease sample volumes so that sampling e.g. of the water column or sediments can be much easier and more effective. A comparison of radiometrics and mass spectrometry results for the analysis of radionuclides in the environment shows a reasonable

agreement – within quoted uncertainties, for wide range of activities and different sample matrices analysed. These new techniques have considerably decreased the detection limits for several long-lived radionuclides.