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Competence and reliability to analyze gamma emitting anthropogenic radionuclides in water samples at the Department of Nuclear Science, University of Colombo

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Contamination of water bodies with anthropogenic radionuclides has been of concern with nuclear weapon testing and nuclear power plant disasters. As water plays an important role to sustain life, it may affect life when contaminated even in tracer levels. The Department of Nuclear Science (DNS) has been involved in water analysis for radioisotopes for more than three decades. The need for technical competence by a certified validation method became important for the credibility of testing and results generated. With the International Atomic Energy Agency Analytical Quality Control Service (IAEA-AQCS) providing member states the opportunity to participate in inter laboratory comparisons, the Department became a participant in proficiency tests (PTs) for anthropogenic gamma (γ) emitting radionuclides (^{51}Cr , ^{54}Mn , ^{57}Co , ^{60}Co , ^{65}Zn , ^{85}Sn , ^{133}Ba , ^{134}Cs , ^{137}Cs , ^{152}Eu and ^{241}Am) in water. Gamma spectra of the prepared sample bottles (diameter, 8.5 cm; height, 9.0 cm) were measured using a shielded High Purity Germanium Detector (HPGe, Gem 13200; Ortec). This study reports data for thirteen participated PTs of water during the period 2006 - 2014. PT samples provide results in terms of satisfactory relative bias, precision and z scores at 95% confidence limit. IAEA evaluate reported results against the acceptance criteria for accuracy and precision and assign the status "acceptable" when it passes both criteria. In analyzing similar radionuclides over the years, acceptance of reported results have increased, with less relative bias and higher precision due to the availability of primary and secondary standards and improvement of analytical skill. At present, DNS has gained the competence to determine ^{51}Cr , ^{54}Mn , ^{60}Co , ^{65}Zn , ^{85}Sn , ^{134}Cs , ^{137}Cs and ^{152}Eu in water. Minimum detection limits (MDL) of the above radionuclides were 5.0, 0.8, 0.8, 1.3, 0.7, 0.8, 0.8 and 3.0 Bq kg⁻¹ respectively. Accurate and precise determination of ^{57}Co (MDL = 0.7 Bq kg⁻¹) and ^{133}Ba (MDL = 1.3 Bq kg⁻¹) are critical in the presence of ^{152}Eu and ^{214}Pb due to their less resolved energy peaks. DNS has still been unable to get good agreement with precision for gamma analysis of ^{241}Am .

Keywords: Gamma emitting radionuclides, proficiency test, anthropogenic