

Assessment of Heavy Metals and Radionuclide Concentrations in Mafikeng Waste Water Treatment Plant

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Abstract : A study was carried out to assess the heavy metal and radionuclide concentrations of water from the waste water treatment plant in Mafikeng Local Municipality to evaluate treatment efficiency. Ten water samples were collected from various stages of water treatment which included sewage delivered to the plant, the two treatment stages and the effluent and also the community. The samples were analyzed for heavy metal content using Inductive Coupled Plasma Mass Spectrometer. Gross α/β activity concentration in water samples was evaluated by Liquid Scintillation Counting whereas the concentration of individual radionuclides was measured by gamma spectroscopy. The results showed marked reduction in the levels of heavy metal concentration from 3 $\mu\text{g/L}$ (As)–670 $\mu\text{g/L}$ (Na) in sewage into the plant to 2 $\mu\text{g/L}$ (As)–170 $\mu\text{g/L}$ (Fe) in the effluent. Beta activity was not detected in water samples except in the in-coming sewage, the concentration of which was within reference limits. However, the gross α activity in all the water samples (7.7-8.02 Bq/L) exceeded the 0.1 Bq/L limit set by World Health Organization (WHO). Gamma spectroscopy analysis revealed very high concentrations of ^{235}U and ^{226}Ra in water samples, with the lowest concentrations (9.35 and 5.44 Bq/L respectively) in the in-coming sewage and highest concentrations (73.8 and 47 Bq/L respectively) in the community water suggesting contamination along water processing line. All the values were considerably higher than the limits of South Africa Target Water Quality Range and WHO. However, the estimated total doses of the two radionuclides for the analyzed water samples (10.62 - 45.40 $\mu\text{Sv yr}^{-1}$) were all well below the reference level of the committed effective dose of 100 $\mu\text{Sv yr}^{-1}$ recommended by WHO.

Keywords : gross α/β activity, heavy metals, radionuclides, ^{235}U , ^{226}Ra , water sample

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