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Radioactivity in coal used in the Lak Vijaya coal power plant - Norochcholai

D R Abeydeera^{1*} and R Hewamanna²

¹*Department of Physics, The Open University of Sri Lanka, Nawala, Nugegoda*

²*Department of Nuclear Science, University of Colombo, Colombo 3*

Coal is used as a fuel in coal-fired power plants to generate electricity. It contains the naturally occurring radionuclides ^{40}K , ^{238}U , ^{232}Th and their decay products. Fly ash and bottom ash are produced from combustion of coal. The effect of emission of radionuclides from a coal power plant would depend on the activities present in the coal. This study reports the radioactivity present in coal, bottom ash and fly ash from the Lak Vijaya coal power plant. Samples were collected from the power plant and analyzed using gamma ray spectrometry with a HPGe detector to measure the activity concentrations of ^{40}K , ^{238}U and ^{232}Th . Coal used in the plant has been imported to Sri Lanka from South Africa and Indonesia. The average activity concentration and range for ^{238}U , ^{232}Th and ^{40}K in Indonesian coal was 9.68 ± 1.04 ; (7 – 16), 7.68 ± 2.03 ; (5 – 12) and 38.63 ± 7.33 ; (17 – 67) Bq kg⁻¹ respectively. The same for South-African coal was 30.65 ± 1.73 ; (29 – 33), 33.70 ± 2.46 ; (30 – 36) and 16.61 ± 8.99 Bq kg⁻¹.

From the total fly ash produced, only 1% is released into the atmosphere and 99% is collected from electrostatic precipitators. About 80% of the total collected fly ash is used to manufacture cement. The average activity concentration and range for ^{238}U , ^{232}Th and ^{40}K for fly ash from Indonesian coal was 78.38 ± 2.31 ; (60 – 100), 80.6 ± 2.80 ; (58 – 84) and 357.44 ± 10.43 ; (138 – 609) Bq kg⁻¹ respectively. Measured activity in bottom ash generated from Indonesian coal, collected from the dumping sites inside the power plant premises were 48.98 ± 1.16 with a range of 37 – 57 Bq kg⁻¹ for ^{238}U . For ^{232}Th and ^{40}K it was 63.06 ± 1.8 ; (34 – 70) and 144.87 ± 6.81 (50 – 272) Bq kg⁻¹ respectively. While the activity concentration of all three radionuclides in Indonesian coal was lower than the world average, South-African coal had relatively higher values other than for ^{40}K . The world average for ^{238}U , ^{232}Th and ^{40}K of are 20, 20 and 50 Bq kg⁻¹ respectively. The activity concentrations of the radionuclides in fly ash and bottom ash are within the ranges recorded in United Nations Scientific Committee on the Effects of Atomic Radiation, 1982.

Keywords: bottom ash, coal, fly ash, radioactivity, radionuclides