

Contamination of waterways in the Czech Republic with radionuclides from uranium mining and milling

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Data on the contents of uranium, thorium, ^{226}Ra , ^{228}Ra and ^{228}Th in bottom sediments in the catchment of Labe (Elbe) River in the Czech Republic are analyzed. It is shown that some rivers and reservoirs are extensively contaminated with uranium and ^{226}Ra from the past uranium mining and milling, whereas the activities of thorium, ^{228}Ra and ^{228}Th are rather evenly distributed without apparent anthropogenic effects. The background concentrations of all the radionuclides are established and the sources of local contamination are identified. Some of the sources represent old liabilities of the mining and milling whose remediation remains important task for future. Analysis of radioactive equilibria ($^{238}\text{U}/^{226}\text{Ra}$ and $^{232}\text{Th}/^{228}\text{Ra}$) in the sediments have indicated that the uncontaminated river sediments contain ^{226}Ra mainly bound inside mineral particles in equilibrium with ^{238}U , but a large part of ^{226}Ra in the contaminated river sediments is adsorbed on the surface of sediment grains. The fraction adsorbed is large also in all reservoir sediments and particularly in suspended solids of river water. ^{228}Ra is bound by adsorption more than ^{226}Ra in uncontaminated sediments. Comparison of the activities of uranium and ^{226}Ra in the river sediments with similar activities in the adjacent river water revealed rather small variability of the ratio of the sediment/water activities among different sampling sites. The ratio represents a kind of modified “Kd” value. Significance and possible uses of this value are discussed.