



^{238}U , and its decay products, in grasses from an abandoned uranium mine

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Bioaccumulation of radioactive contaminants by plants is of concern particularly where the sward is an essential part of the diet of ruminants. The abandoned South Terras uranium mine, south west England, had primary deposits of uraninite (UO_2) and pitchblende (U_3O_8), which contained up to 30% uranium. When the mine was active uranium and radium were extracted but following closure it was abandoned without remediation. Waste rock and gangue, consisting of inefficiently processed minerals, were spread around the site, including a field where ruminants are grazed. Here we report the activity concentrations of ^{238}U , ^{235}U , ^{214}Pb , ^{210}Pb , and the concentrations of selected metals in the soils, roots and leaves of grasses taken from the contaminated field.

Soil samples were collected at the surface, and at 30 cm depth, using an auger along a 10-point transect in the field from the foot of a waste heap. Whole, individual grass plants were removed with a spade, ensuring that their roots were intact. The soils and roots and grass leaves were freeze-dried. Activity concentrations of the radionuclides were determined by gamma spectroscopy, following 30 days incubation for development of secular equilibrium. Dried soils, roots and grasses were also digested in aqua regia and the concentrations of elements determined by ICP techniques.

Maximum activity concentrations of ^{238}U , ^{235}U , ^{214}Pb and ^{210}Pb surface soils were 63,300, 4,510, 23,300 and 49,400 Bq kg^{-1} , respectively. The mean $^{238}\text{U}:^{235}\text{U}$ ratio was 11.8 ± 1.8 , an order of magnitude lower than the natural value of 138, indicating disequilibrium within the decay chain due to mineral processing. Radionuclides in the roots had 5 times lower concentration and only grass leaves in the vicinity of the waste heap had measureable values. The mean soil to root transfer factor for ^{238}U was 36%, the mean root to leaf was 3% and overall only 0.7% of ^{238}U was transferred from the soil to the leaves. The roots contained 0.8% iron, possibly as iron plaque acting to mediate ^{238}U transfer within the plants. The results are discussed in the context of remediation of grazing land contaminated with radionuclides.