PRELIMINARY RESULTS FROM AN OIL SHALE DEPOSIT IN SWEDEN REMAINS FROM 2ND WORLD WAR

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Abstract

During 2nd world war there was shortage of oil in Sweden and one of the assets available were oil shales which could be used to extract oil through pyrolysis. In 1942 the annual production of oil shale reached 100,000 cubic meters and production continued until 1966. The remaining shales were deposited outside the city of Kumla reaching approximately 100m in height and still to this day some parts in the pile is undergoing pyrolysis causing temperature inside the deposit to reach more than hundreds of degrees Celsius. The oil shale contained elevated concentrations of uranium making it a NORM (Naturally Occurring Radioactive Materials) waste.

Samples taken for this study included soil cores of 45 cm depth, moss growing on the top of the deposit, hare droppings found in the area, surface water from a nearby lake and hair samples taken from a nearby barber shop. The samples were analyzed by gamma and alpha spectroscopy.

Analyzed cores showed ^{238}U ranging from 0.44 to 1.62 Bq/g with an average of 1.26 Bq/g. For comparison, the average ^{238}U activity concentration in Swedish soil is 0.07 Bq/g for 0-50 cm depth. It was found that the average ratio of $^{234}U/\ ^{238}U$ in the cores were 0.95 with a max value of 1 and average ratio of $^{210}Po/\ ^{238}U$ were 1.13 and max value was 1.34. The results from the external dose survey showed that the dose above the ground ranged from 0.112 to 1.200 μSv/h.

The results obtained from this preliminary study shows that the uranium concentration in the remaining oil shale are about twenty times the average concentration found in Swedish soil. It is also seen that the concentration is increasing with depth and that a more severe disequilibrium in the ^{238}U decay chain exists along the depth.

Keywords: Shales, NORM, Waste, Alpha, Gamma spectroscopy

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