

Technical note

Beryllium-7 in sheep

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Considerable interest in the assessment of radioactivity in sheep has been provoked by the Chernobyl incident, since the levels found have remained higher than was expected. As part of a wider programme of investigations being carried out in N. Wales, a study of the radioactivity of sheep droppings has been undertaken, some preliminary results from which are presented in this note.

Beryllium-7 is formed in the atmosphere by interactions between cosmic radiation and carbon-12. The peak of production occurs at about 15 km altitude with the beryllium being in the oxide or hydroxide form. These molecules diffuse into the atmosphere, where they become attached to dust particles. The majority of such particles will form cloud nuclei, the whole process taking around 30 days [1]. The beryllium will then be deposited in rainfall along with other radionuclides from sources such as atmospheric weapons tests and the reactor accident at Chernobyl.

This deposited beryllium will be taken up into soil and vegetation and can therefore become available for consumption by grazing animals such as sheep. Certain plants, such as *Caldonia alpestris* (reindeer lichen) [2] and *Artemisia principis* and

Artemisia feddici (mugworts) [3] can concentrate high levels of beryllium and the amounts excreted by sheep will be dependent on their consumption of such plants. The fractional absorption of ingested beryllium from the gastrointestinal tract of sheep is likely to be low, of the order of 0.01 [4], and the majority of the remainder will be excreted in faeces. Results of some measurements are shown in table 1.

The activity of beryllium-7 is of lesser consequence than that of caesium-137 since it is less toxic ($ALI\ 2 \times 10^9$ compared with 4×10^6) and little is absorbed from the gut into the flesh of the animal. Problems could occur in the assessment of radioactive content of a sheep by external monitoring using sodium iodide detectors. The gamma energies of caesium-137 and beryllium-7 are 0.662 and 0.478 MeV, respectively, which would therefore require careful setting up of energy channels to differentiate between the two. If counting over a threshold was used to estimate caesium-137, any errors due to the presence of beryllium-7 would be on the safe side.

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Table 1. A comparison of caesium-137 and beryllium-7 activities in sheep droppings collected in N. Wales in February 1988.

Location	Activity (Bq kg ⁻¹)	
	¹³⁷ Cs	⁷ Be
Loggerheads	42.8 ± 18.3	184.0 ± 124.1
Ruthin	51.6 ± 22.1	923.5 ± 150.0
Llyn Celyn	130.5 ± 25.7	3142.1 ± 200.0
Cae'n-y-coed	148.1 ± 33.3	1140.2 ± 216.2
Dolgarrog	52.5 ± 21.1	1889.3 ± 169.2
Cwm Hirnant	37.2 ± 25.4	1918.1 ± 190.9
Mobberly Old Hall (Cheshire)	11.4 ± 12.6	876.9 ± 93.8

The error shown is one standard deviation of a combination of counting errors.

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