Conference or Workshop Item

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Measuring doses to small mammals in the Chernobyl Zone

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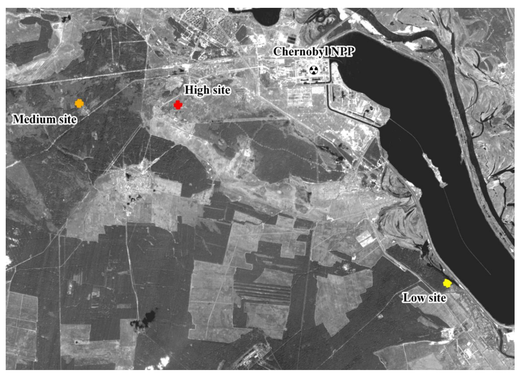
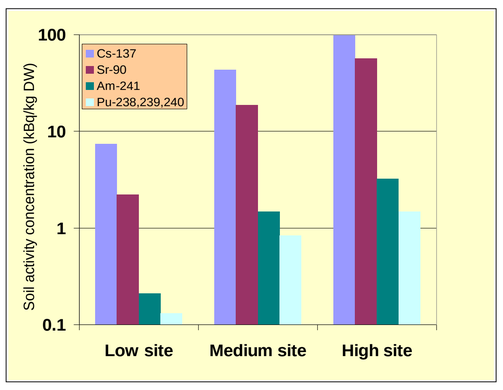
Introduction

In previous testing of approaches to estimate the exposure of biota to ionising radiation an inability to compare predicted absorbed doses with measured data was highlighted. To provide such data for small mammals a study was conducted in the Chernobyl exclusion zone between early July and mid-August 2005.

Three forest sites with differing soil radionuclide activity concentrations were selected:

- *Low* - located approximately 8.5 km south-east of Chernobyl power plant
- *Medium* - approximately 8 km to the west of the Chernobyl power plant.
- *High* - approximately 5 km to the west of the Chernobyl power plant.



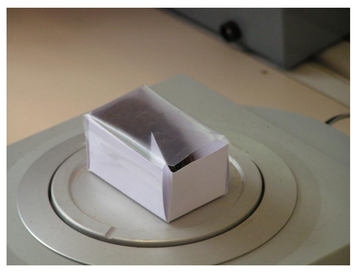


Whole-body counting

To determine their whole-body ^{137}Cs and ^{90}Sr activity concentration the animals were placed in a small cardboard box prior to whole-body counting. The box was then placed inside a lead shielded counting container. They were analysed using a hyper-pure germanium detector and thin-film (1 mm) NaI scintillation detector to measure ^{137}Cs and ^{90}Sr respectively. The duration of count times varied from 150 to 1200 seconds depending upon the activity concentration of the animal.

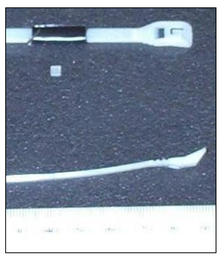
For animals from which TLDs were recovered whole-body activity concentrations (Bq kg^{-1} FW) were:

Site	n	Range in whole-body activity concentrations (Bq kg^{-1} FW)	
		^{137}Cs	^{90}Sr
Low	21	3140-9750	1390-21100
Medium	48	17000-252000	4290-36000
High	15	108000-3180000	38100-167000



Trapping and TLDs

Over each study area, a grid of 100 m x 100 m was marked out using posts at 10 m intervals. 100 ‘Sherman’ humane traps were placed at these marker posts and baited with rolled oats overnight.



- Trapping occurred on 14 occasions.
- On the first occasion an animal was caught it was fitted with a numbered collar with attached LiF-100 TLD (thermoluminescent dosimeter).
- Study species were: Yellow-necked mice (*Apodemus flavicollis*), Bank voles (*Clethrionomys glareolus*) and a vole species (*Microtus spp*).
- The animals live-weight and trapping location was recorded together with its whole-body ^{90}Sr and ^{137}Cs activity concentration.
- The animals were then returned to the individual trapping location from which they were caught, and released.
- If an animal was recaptured more than 14 d after being fitted with a collar it was removed and replaced. The animal was also re-weighed and its whole-body ^{90}Sr and ^{137}Cs activity concentration determined again.
- 230 collars were fitted of which 84 were recovered, these having been on the animals for between 6 and 36 days.

Trapping success and species captured varied across the three sites – including vandalism by wild boar!

Dose rate estimates

Absorbed dose rates from the TLDs were adjusted for beta dose rates using the results from TLDs encased in perspex placed at various locations at each sampling site. Estimated absorbed (external) dose rates were:

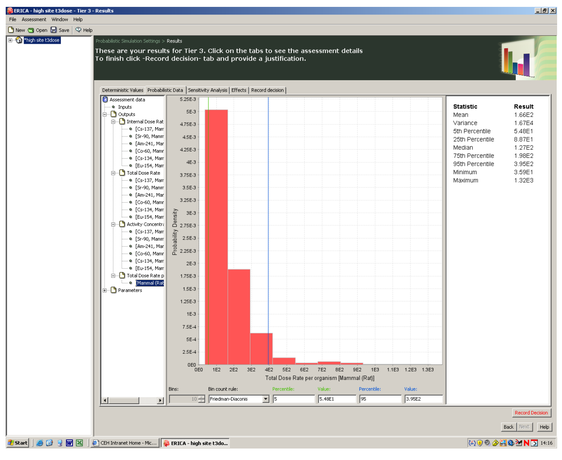
Site	TLD external dose rate (μGy h^{-1})			
	Mean	SD	Min.	Max.
Low	1.58	0.63	0.46	2.64
Medium	13.9	7.9	4.7	51.4
High	46.6	18.7	23.9	96.4

Total absorbed dose rates (i.e. internal + external) were estimated to be 13, 57 and 304 μGy h^{-1} for the *Low*, *Medium* and *High* sites respectively.

Gamma-kerma rates were determined at 5 cm above ground surface at each trapping site: these results were comparable to the estimated absorbed (external) dose rates from the TLDs (i.e. gamma-kerma rates are a good estimate of external dose rates).

Area of ‘Red Forest’ in which coniferous trees were killed in 1986 – adjacent to the *High* sampling site. (Photo: summer 2005).

The data have subsequently been used to (successfully) test the predictions of the ERICA-Tool (software for estimating exposure of natural biota).



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