

A model for the calculation of individual dose from exposure to radionuclides in contaminated soil.

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The acceptable level of residual radioactivity in the ground at sites where radioactive materials have been handled is an important question for decommissioning. In order to answer this question, it is necessary to be able to estimate individual doses from exposure to radionuclides in the soil, taking the future use of the site into account.

This presentation describes a model which has been developed for the Swedish Radiation Safety Authority for the estimation of individual doses from exposure to radionuclides in contaminated soil. The model is generic, and calculates conservative estimates of individual doses. The results of the model, individual unit doses, are intended for screening as a basis for decisions about remediation and clearance of smaller areas of ground.

The calculated individual doses are based on assumptions about the exposure of people to soil which are, as far as possible, consistent with the assumptions used in the Swedish Environmental Protection Agency (SEPA) model for the calculation of generic guideline values for contaminated land. As in the SEPA model, two exposure scenarios have been considered; sensitive land use (e.g. housing, nurseries, schools, and parks) and less-sensitive land use (e.g. industrial and commercial areas, roads and car parks). However, an important difference between the two models is that individual doses from radionuclides are calculated for six age-groups, using the available dose conversion factors for radionuclides (Sv/Bq), whereas SEPA's model considers only two age-groups, adults and children (up to the age of 6 years).

The model estimates the partitioning of radionuclides in the environment between soil-solids and pore-water, the transport of radionuclides to other media, and the exposure of people to radionuclides. The exposure pathways considered are external dose, direct oral ingestion of soils, inhalation of dust, consumption of drinking water from a nearby well, consumption of plants grown on the contaminated area, and the consumption of meat and milk produced on the area.

Dose calculations have been carried out for the radionuclides: H-3, Cl-36, Co-60, Ni-63, Sr-90, Tc-99, Cs-137, Np-237, Am-241, Pu-241, Pu-239, U-232 series, U-235 series and U-238 series, for times of up to 1000 years.

A selection of results for sensitive and less-sensitive land use will be presented, together with the results of a sensitivity analysis on the effects of various parameters on the estimated individual dose.