Uncertainties in assessments of doses from intakes of radionuclides

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Abstract

The evaluation of uncertainties in doses from intakes of radionuclides is widely acknowledged to be one of the most difficult problems in internal dosimetry. The reasons are two-fold; information on uncertainties in quantities and model parameters used in internal dose calculations is often sparse, and a methodology for estimating uncertainties in doses assessed from monitoring measurements has been lacking. As a result, internal doses are generally reported without confidence intervals.

Two recently-developed methods are described that approach the problem in somewhat different ways. In the first method, developed at IRSN in collaboration with IBPh, it is assumed that that the main sources of uncertainty for routine measurements are in time of intake and in the bioassay monitoring data. Random (Type A) sources of uncertainty in measurements are quantified using normal probability distribution functions, while systematic (Type B) sources of uncertainty are quantified as log-normal distributions. These uncertainties are propagated through to assessed dose using standard biokinetic/dosimetric models and default parameter values. Results are presented for the example of iodine-in-thyroid monitoring.

In the second method, developed at HPA, probability distribution functions are defined for both the monitoring measurements and the important biokinetic model parameters such as those describing inhaled particle size distribution and respiratory tract absorption. Monte Carlo simulations are carried out to propagate these uncertainties through to assessed dose. Results are presented for the examples of tritium-in-urine monitoring and bioassay monitoring for ^{60}Co exposures.

Work is continuing at HPA on the development of calculational methods and software for assessment of uncertainties in internal doses. Recent developments are described and results presented. Recent work on the assessment of uncertainties in dose coefficients is also briefly reviewed.