

Dosimetry of uranium exposure by integrating alimentary uranium contribution to bioassay measurements

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1. Context and objectives

Risk of inhalation of uranium aerosols monitored by measurement of urinary and/or faecal samples

Uranium naturally present in food and drinking water

⇒ Amounts of natural uranium detectable even in the absence of occupational exposure.

How to decide whether contamination took place? How to calculate the corresponding dose?

2. Methods

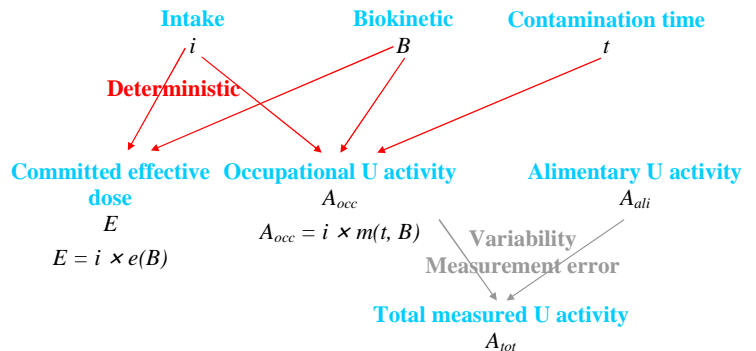
Data: Urinary and faecal measurements results from 2002 for a control population with no occupational contamination and from the studied population from 2004 for ²³⁴U, ²³⁸U and ²³⁵U

Comparison of the populations by non parametric Wilcoxon test on bioassay measurements for each isotopes

Empirical distributions of the control measurement data built through Kaplan-Meier approach to determine the 95th percentiles = threshold to test for occupational intake

Variability of the control population measurements modelled by lognormal distribution which parameters are adjusted to the data by using a maximum likelihood method integrating positive and negative measurements. The distributions are used for the uncertainty propagation.

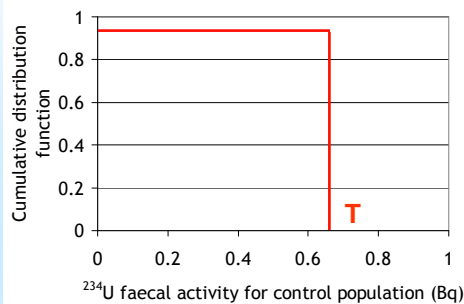
Calculation of the intake and dose probability for the studied population using a Bayesian network¹



3. Results

Comparison: highly likely that the studied population has a contamination

Empirical distributions and determination of the thresholds

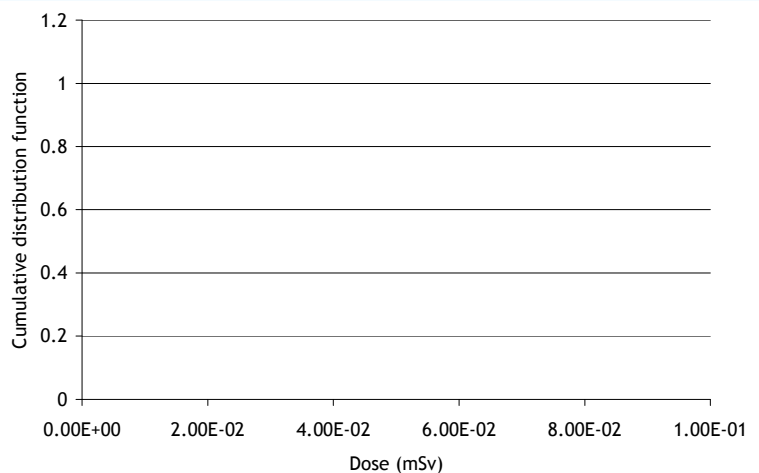


Variability of the control population measurements:

	μ	σ
Urines	²³⁴ U	
	²³⁸ U	
	²³⁵ U	
Faeces	²³⁴ U	
	²³⁸ U	
	²³⁵ U	

Calculation of the intake and dose probability

	5 th percentile	median	95 th percentile
Intake (Bq)			
Dose (mSv)			



4. Conclusion

Following a control population allows to derive collective dose by accounting for variability of the alimentary uranium excretion

This could be a general approach for dealing with alimentary intake.

¹Davesne et al, RPD, 144, 2011



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