Depleted uranium (DU) normative value pilot study: levels of uranium in samples from the general population

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A normative study of the levels of urinary uranium in the general population was planned to provide a basis for comparison with levels measured in UK military and ex-military personnel who served where armour piercing munitions containing depleted uranium (DU) were used. As preparation, this pilot study trialled the process of collecting 24-hour samples from adult male civilians, and compared the measurements from 24-hour samples with those from spot samples taken over the subsequent 24 hours. Twenty five convalescent hospital in-patients were recruited as participants.

Uranium was detected in all the 24-hour samples, with concentrations ranging from 1 to 10.6 ng.litre⁻¹; the spots ranged from not detectable to 38.1 ng.litre⁻¹. Normalised to creatinine, concentrations in the 24 hour samples ranged from approximately 100 to 800 ng per mol creatinine; those in the spot samples ranged from not detectable to approximately 4000 ng per mol creatinine. The ranges appear similar to those reported for residents of the US.

The distribution of spot sample results indicated that 95% of a participant’s creatinine-adjusted concentrations from spot samples would be within the range 40% to 250% of his mean. Adjusting for creatinine almost entirely eliminated a slight indication of diurnal variation in urinary uranium concentration in spot samples.

All the 24-hour samples and 137 out of the 139 spot samples showed ratios of isotopes \(^{238}U\) to \(^{235}U\) consistent with natural uranium (i.e. neither enriched nor depleted). The two spot samples with slightly elevated ratios were not supported by other samples from the same participants and they indicate that slightly elevated ratios may be recorded on very low concentration (<1 ng.litre⁻¹) samples. In the main, quantification of this isotope ratio from spot samples was hardly more variable than from 24-hour samples.

Complete 24-hour urine samples gave better precision than spot samples in estimating uranium concentrations at these low levels, but presented more logistic difficulties in the collection of the samples.

These findings, and the practical lessons learnt from the pilot study, would inform the design of a full normative study.