

Table 4a
Uranium Element Mass Fraction Measurements (DA)

Method	Material	Uncertainty Component (% rel., k=1)		ITV (% rel. , k=1)	Notes
		u(r)	u(s)		
GRAV	U (pure compounds)	0.05	0.05	0.07	<u>1/</u>
	U (with Gd)	0.1	0.1	0.14	<u>10/</u>
TITR ^{2/}	U (pure compounds)	0.1	0.1	0.14	<u>11/</u>
	U Alloys	0.2	0.2	0.28	
	Mixed U/Pu	0.1	0.1	0.14	
POLA	U (with Gd)	0.1	0.1	0.14	
IDMS ^{8/}	Hot Cell Conditions	0.2	0.2	0.28	<u>3/ 4/</u>
		0.3	0.3	0.42	<u>3/ 5/</u>
	Glove Box Conditions	0.15	0.1	0.18	<u>3/ 4/</u>
		0.2	0.2	0.28	<u>3/ 5/</u>
KEDG	U and U/Pu Solution	0.2	0.2	0.28	<u>6/</u>
HKED	Spent Fuel Solution	0.2	0.2	0.28	<u>6/</u>
XRF	U Solution (low conc.)	2	2	2.8	<u>7/</u>
USP	U Solution (low conc.)	2	2	2.8	<u>7/ 9/</u>

1/ Materials containing non-volatile impurities at less than 1000 µg/g; ITVs could be higher for powder samples depending on additional sources of uncertainties (oxidation during storage, balance resolution).

2/ Davies & Gray Method.

3/ For all materials typically encountered in the nuclear fuel cycle.

4/ Using gravimetrically prepared and/or using commercially available non-diluted spikes (such as Large Size Dried Spikes), spiking non-diluted samples.

5/ Using samples and/or spikes after dilution, using artificial spikes or high abundant spikes with variable spike to sample amount ratios.

6/ U concentration above 150 g/L with a U/Pu mass ratio above 80 and measurement times in the range of 3 x (1000-3000) s. The uncertainty for dissolved mixed-oxide (MOX) fuel pellets and powder is higher than these ITVs, because of lower U concentration and lower U/Pu ratio.

7/ Uncertainties related to XRF performance and for samples in solution in the range of U concentrations from 1 g to 50 g/L (HKED system).

8/ Refers to ID-TIMS and ID-MC ICPMS.

9/ For process analysis under hot cell conditions.

10/ The range of Gd content is less than 10 %.

11/ Including U with Gd.