

**Table 3**  
**Sampling Uncertainties\*\* for U and Pu element Mass Fraction and U and Pu Isotope Ratio Measurements**

| Material                                           | Uncertainty Component<br>(% rel., k=1)         |                   |                                     |                 | Recommended<br>Sample Size <sup>1/</sup> |
|----------------------------------------------------|------------------------------------------------|-------------------|-------------------------------------|-----------------|------------------------------------------|
|                                                    | U and Pu element mass fraction<br>measurements |                   | U and Pu isotope ratio measurements |                 |                                          |
|                                                    | u(r)                                           | u(s)              | u(r)                                | u(s)            |                                          |
| DUF <sub>6</sub>                                   | 0.1                                            | *                 | 1 <sup>2/</sup>                     | 1 <sup>2/</sup> | 5 to 10 g                                |
| NUF <sub>6</sub> , LEUF <sub>6</sub> <sup>6/</sup> | 0.05                                           | *                 | 0.1 <sup>6/</sup>                   | *               | 5 to 10 g                                |
| U-oxide Powder                                     | 0.2                                            | *                 | 0.05                                | *               | 10 to 20 g                               |
| U-oxide Pellets                                    | 0.05                                           | 0.05              | 0.05                                | 0.05            | 1 pellet                                 |
| U-oxides (with Gd)                                 | 0.2                                            | *                 | 0.05                                | *               | 1 pellet                                 |
| U Scrap (clean) <sup>3/</sup>                      | 1                                              | *                 | 1                                   | *               | 30 g                                     |
| U Scrap (dirty) <sup>4/</sup>                      | 10                                             | *                 | 10                                  | *               | 2 x 30 g                                 |
| Reprocessing Input<br>Solution                     | 0.3                                            | 0.2 <sup>5/</sup> | 0.05                                | *               | 2 x 1 mL                                 |
| High Active Liquid Waste                           | 5                                              | 5                 | *                                   | *               | 2 x 1 mL                                 |
| U Nitrate Solution                                 | 0.1                                            | *                 | 0.05                                | *               | 10 mL                                    |
| Pu, U and Pu Nitrate<br>Solution                   | 0.2                                            | *                 | 0.05                                | *               | 10 mL                                    |
| Pu-oxide                                           | 0.1                                            | *                 |                                     |                 | 2 x 1 g                                  |
| FBR MOX                                            | 0.2 (Pu)                                       | *                 | 0.1                                 | *               | 2 x 1 pellet,<br>or 2 x 2 pellet         |
|                                                    | 0.1 (U)                                        | *                 |                                     |                 |                                          |
| LWR MOX                                            | 0.7 (Pu)                                       | *                 | 0.1                                 | *               | 2 x 1 pellet,<br>or 2 x 5 g              |
|                                                    | 0.1 (U)                                        | *                 |                                     |                 |                                          |
| MOX Scrap (clean)                                  | 1                                              | *                 | 1                                   | *               | 2 x 5 g                                  |
| MOX Scrap (dirty)                                  | 10                                             | *                 | 10                                  | *               | 2 x 10 g                                 |
| HEU Metal and Alloys                               | 0.2                                            | *                 | 0.05                                | *               | 1 - 5 g                                  |

\* Values have not yet been defined.

\*\*Values listed in this table are indicative of the sampling uncertainties that are dependent on the homogeneity of samples.

<sup>1/</sup> According to STR-69 (Destructive Analysis and Evaluation Services for Nuclear Material Accountancy Verification, STR-69, Rev. 5, IAEA, Vienna, 2004).

<sup>2/</sup> Additional sampling uncertainties are expected for DUF<sub>6</sub> when samples are taken from the gas phase of a non-homogenized cylinder.

<sup>3/</sup> Scrap with low impurity content and suitable for recycling.

<sup>4/</sup> Sampling uncertainties can vary widely depending on material heterogeneity and sample size.

<sup>5/</sup> Sampling uncertainties of systematic nature, resulting from airlift effects (evaporation).

<sup>6/</sup> Proposed Prospective Cristallini ITV: Root mean square error =  $[u(r)^2 + u(s)^2]^{1/2} = 0.038\%$  (based on limited data i.e. 16 pairs LEU samples, and subject to change as more samples are collected and analysed).