The NIST *Simple Guide* for Evaluating and Expressing Measurement Uncertainty

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Abstract. NIST has recently published guidance on the evaluation and expression of the uncertainty of NIST measurement results [1, 2], supplementing but not replacing B. N. Taylor and C. E. Kuyatt's (1994) *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results* (NIST Technical Note 1297) [3], which tracks closely the *Guide to the expression of uncertainty in measurement* (GUM) [4], originally published in 1995 by the Joint Committee for Guides in Metrology of the International Bureau of Weights and Measures (BIPM).

The scope of this *Simple Guide*, however, is much broader than the scope of both NIST Technical Note 1297 and the GUM, because it attempts to address several of the uncertainty evaluation challenges that have arisen at NIST since the 1990s, for example to include molecular biology, greenhouse gases and climate science measurements, and forensic science.

The *Simple Guide* also expands the scope of those two other guidance documents by recognizing observation equations (that is, statistical models) as *bona fide* measurement models. These models are indispensable to reduce data from interlaboratory studies, to combine measurement results for the same measurand obtained by different methods, and to characterize the uncertainty of calibration and analysis functions used in the measurement of force, temperature, or composition of gas mixtures.

This presentation reviews the salient aspects of the *Simple Guide*, illustrates the use of models and methods for uncertainty evaluation not contemplated in the GUM, and also demonstrates the *NIST Uncertainty Machine* [5] and the *NIST Consensus Builder*, which are web-based applications accessible worldwide that facilitate evaluations of measurement uncertainty and the characterization of consensus values in interlaboratory studies.

References

[1] Possolo A 2015 *Simple Guide for Evaluating and Expressing the Uncertainty of NIST Measurement Results* (Gaithersburg, MD: National Institute of Standards and Technology) NIST Technical Note 1900

[2] Possolo A 2016 *Metrologia* **53** S17–S24

[3] Taylor B N and Kuyatt C E 1994 *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results* (Gaithersburg, MD: National Institute of Standards and Technology) NIST Technical Note 1297 URL physics.nist.gov/Pubs/guidelines/TN1297/tn1297s.pdf

[4] Joint Committee for Guides in Metrology 2008 *Evaluation of measurement data — Guide to the expression of uncertainty in measurement* (Sèvres, France: International Bureau of Weights and Measures (BIPM)) BIPM, IEC, IFCC, ILAC, ISO, IUPAC, IUPAP and OIML, JCGM 100:2008, GUM 1995 with minor corrections URL www.bipm.org/en/publications/guides/gum.html

[5] Lafarge T and Possolo A 2015 *NCLSI Measure Journal of Measurement Science* **10** 20–27