Abstract

The guidelines for evaluating and expressing the uncertainty of NIST measurement results were last updated in the 1994 edition of NIST Technical Note 1297, prepared by Barry Taylor and Chris Kuyatt, more or less contemporaneously with the publication of the "Guide to the expression of uncertainty in measurement" (GUM).

During the almost 20 years that have since elapsed, not only has the circle of metrology widened considerably, now including measurement challenges arising in molecular biology, computational material science, climatology, and medicine, for example, but also the techniques available to represent, evaluate, and express measurement uncertainty have been greatly enriched.

These advances and the challenges that the expanding scope of measurement science have created, demand that those original guidelines be updated. This presentation outlines the path that we are currently following towards this goal, which has involved a NIST workshop and a first round of reviews of a draft proposal, and in which we now we wish to engage the whole NIST scientific community.

General Goals

- *Increase freedom of choice* that scientists, statisticians, and mathematicians need to have to be able to address needs of rapidly evolving and expanding fields of measurement science.
- *Widen class of measurement models* used to assign value to measurands and to evaluate measurement uncertainty.
- *Facilitate critical assessment of models and assumptions* in particular of those that support probabilistic interpretation of uncertainty.

Grandfathering

All published uncertainty evaluations associated with NIST measurement services (SRMs / calibrations) remain valid and will not need not be redone.

Key Facts

- Measurement uncertainty expressed most completely and generally by probability distribution — characterizes knowledge about measurand.
- Experimental data may be used alone or combined with other information to estimate measurand, and to characterize measurement uncertainty.
- Evaluate uncertainty consistently with measurement model
  - *Measurement equation* — Monte Carlo methods / Gauss's formula
  - *Observation equation* — methods of mathematical statistics

NIST Uncertainty Machine

Download software and user's manual from **`www.nist.gov/itl/sed/gsg/uncertainty.cfm`**, for Microsoft Windows, Linux, and Apple's OS X.