Reporting uncertainty

Dr. C. H. Meyers, reporting on his measurements of the heat capacity of ammonia:

We think our reported value is good to 1 part in 10000:

we are willing to bet our own money at even odds that it is correct to 2 parts in 10000.

Furthermore, if by any chance our value is shown to be in error by more than 1 part in 1000, we are prepared to eat the apparatus and drink the ammonia

Err on the side of providing more information

- Describe methods used to calculate result and uncertainty
- List all uncertainty components and how they were evaluated
- Present data analysis so that independent calculation can be repeated
- give all corrections and constants used and their sources

When using $u_c(y)$...

- In one of the 4 following ways
- "m_s=100.02147g with (a combined standard uncertainty) u_c=0.35mg"
- "m_s=100.02147(35)g, where the number in parentheses is the numerical value of (the combined standard uncertainty) u_c referred to the corresponding last digits of the quoted result."

When using $u_c(y)$...

- "m_s=100.02147(0.00035)g, where the number in parentheses is the numerical value of (the combined standard uncertainty) u_c expressed in the unit of the quoted result."
- "m_s=(100.02147±0.00035)g, where the number following the symbol ± is the numerical value of (the combined standard uncertainty) u_c and not a confidence interval"

When using U

- "m_s=(100.02147±0.00079)g, where the number following the symbol ± is the numerical value of (an expanded uncertainty) u_c=0.35mg and (a coverage factor) k=2.26 based on the t distribution for ν=9 degrees of freedom, and defines an interval estimated to have a level of confidence of 95 percent."

Number of digits...

- Do not give excessive number of digits
- At most two digits, but sometimes more may be required to avoid round off errors in subsequent calculations
- Round up, in general
- $u_c(y)=10.47m\Omega$ might be rounded to $11m\Omega$
- But use common sense
- $u_c(y)=28.05kHz$ maybe rounded to $28kHz$

Number of digits...

- Round off measurement result to be consistent with their uncertainties
- If $y=10.05762\Omega$ with $u_c(y)=27m\Omega$,
- y should be rounded to 10.058Ω
- Correlation coefficients should be given with three digit accuracy if their absolute values are near unity

Detailed report...

- Give each input estimate and its standard uncertainty
- Give estimated covariances or correlation coefficients associated with correlated input estimates
- Give degrees of freedom for the standard uncertainty of each input
- Give the functional relationship, sensitivity coefficients