R. Collé
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On the Non-Need for Chapter on Weighing Uncertainty

I cannot recognize a need for a separate chapter on weighing (mass) uncertainty assessment. Firstly, any such report can clearly not be intended to be a definitive document on mass metrology, of which volumes have been written and are available, covering everything from weighing methods, calibration protocols, corrections, and uncertainty treatments. Such things are and should be written by mass metrology experts and are obviously outside the purview of our concerns and discipline. Secondly, the mass uncertainty per se in radionuclidic metrology rarely occurs uncorrelated to the uncertainties in other parts of the measurement methods employed, and the largest component of that mass uncertainty is of necessity largely if not wholly embodied in these other uncertainty assessments. To me, inasmuch as we are normally concerned with determinations of massic activity, it would make as much sense to have a separate chapter on time determinations for rates (independent of the method used) as it would to develop a weighing chapter. I think the result of the intended chapter would be futile and a pointless exercise, having scant merit or utility.

Mass measurements in radionuclide metrology are necessary in at least two very important and distinct operations; viz., source and solution preparations.

The first arises from the need to prepare very quantitative counting sources. Therefore, it seems more logical that weighing and mass considerations should be incorporated in a chapter on source preparation since it is a necessary component of that. I can assure you that Collé is certainly not a very authoritative person to prepare a source-preparation chapter, particularly considering that other laboratories (e.g., IRMM) have much more expertise and experience at source preparation. One must also appreciate the fact that most well-designed experiments would have the major weighing uncertainty embodied within other uncertainty components – such as in averaging massic counting rates over numerous sources having variable masses. The exception, of course, would be if only one counting source is prepared, which is never a good idea! One further appreciation is that no amount of words (insightful, clever, or not) in a document will ever suffice in the training of metrologists without hands-on mentoring by experienced master practitioners. And if this is needed, as I believe it is, then what role does the document serve. The assignment of an uncertainty value to a mass determination is largely irrelevant if the measurement itself is dominated by mistakes, blunders, and uncontrolled experimental errors. For example, a document (and many exist) could spell out in excruciating detail exactly how to correctly perform double- or triple-substitution weighing in the few milligram range. I contend (and I have witnessed it) that any

novice following these instructions is more likely to obtain an incorrect mass than if this untrained person just read the mass from single readings on an electronic single-pan balance and would be much better served. This person could indeed go through all of the substitution steps – in cookbook fashion – and crank out a derived uncertainty from the data and would likely have a very erroneous result. This is the problem with rote formulations. It can bestow confidence and the appearance of rigor when none exists.

The second area of weighing, which has even more possible variations, involves the preparation of solutions and the performance of solution dilutions. Most of the above comments equally apply in these situations. Again, the mere assignment of uncertainty values outside the scope of what was exactly done for the given case is irrelevant. There is not just one way to do things, particularly for complex assays. For example, I suppose I could write a general protocol to cover the most common case of obtaining a dilution factor with confirmation by dispensed and contained mass comparisons, including a prescription for its uncertainty assessment. But then, I can similarly imagine that it might be blindly invoked for something where it doesn't apply. It all comes down to having well-designed experiments and well-executed procedures – performed with understanding. No single chapter could possibly cover all of the conceivable designs that may be encountered and all of the operations that are commonplace in analytical solution chemistry. I contend that if anyone needs to read such a chapter to do these operations and to assign uncertainties on them, without the necessary educational background and requisite training from experienced masters, then they just shouldn't do the work.

Let us try to remember that an uncertainty number is not just picked out of the sky for a given component and it cannot be generalized as one oft sees done in ICRM papers without any evident analyses. It starts with the underlying experimental design and measurement model and then depends on what was actually done and what the data show. How do you generalize all this when I know for a fact that the uncertainty in mass determinations that I make can be quite different from that of my closest colleagues doing the same procedures on the same balances?

I (Collé) am not a suitable candidate to prepare the proposed weighing uncertainty chapter.