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How good are my stable isotope data? Implications on using an in-house Quality Control system for stable isotope measurements

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Stable isotopes are widely used with applications in forensics, ecology, biogeochemistry, atmospheric sciences, and hydrology. Isotope data are frequently compared and combined, which requires data of high quality. This brings to the attention how comparable the data is and the need for an internal Quality System in research and service laboratories to support data quality. Since the amount of isotope data produced in the recent years has increased considerably, a plea for high-quality isotope data is required. Estimations of data quality including uncertainty calculations may be complicated by various and not well-controlled factors, including sample matrix effects, incomplete reactions and byproducts formed etc. The use of data scatter (e.g. Standard deviation of certified reference materials and in-house working standards) as a measure of uncertainty is obviously insufficient. Instead, one may consider other or combined data quality indexes. The use of a simplified uncertainty estimation together with z-scores calculation enhances the assessment of lab performance and quality and increases the likelihood to accept the target performance chosen by any isotope laboratory. However, uncertainties associated to unknown samples also reduces the probability of obtaining significant differences between sample groups, which the purpose of the analysis could not fit. Here we discuss the criteria to revise limits of QC materials (e.g. lab standards) in an objective manner including the removal of outliers. Warning and action limits depend on the stable isotopic composition of the material (enriched vs. natural abundance), the homogeneity of the material, and the statistical approach utilized. We will report data of 1-2 years of QC tools of a soil standard material obtained at the laboratory in UKCEH-Lancaster and we will discuss how to deal with internal QC system including outlier removal, sample preparation issues, etc. Implementation of these or similar QC protocols are of great relevance for a well-based decision making when using isotope results.