



## EDITORIAL

# Use of Measurement Uncertainty in Compliance Assessment with Regulatory Limits

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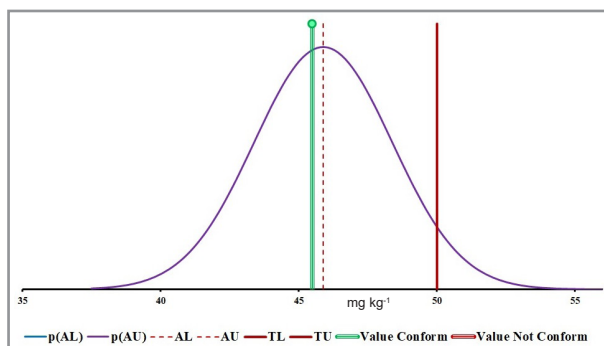
Measurement results, especially in Analytical Chemistry, must be presented in order to guarantee reliability, so that the information can be evaluated and compared with values provided in standards or regulatory limits. These measurement processes must be unambiguous so that, when reproduced anywhere in the world, metrologically compatible results are achieved.

To use a result and decide whether it indicates conformity or non-conformity with a specification, the recent literature recommends considering measurement uncertainty as the main indicator of the quality of any experimental result [1].

I highlight the importance of conformity assessment vis-à-vis the concepts of decision rules. Such rules are based on the level of acceptable probability for a wrong decision on the acceptance or rejection of a product, based on the measurement result accompanied by its uncertainty, reference risk (consumer, producer or shared), specification limits and guard band for conformity assessment against regulatory limits.

The greater the value of measurement uncertainty (sampling uncertainty plus analytical uncertainty) [2], the greater the proportion of samples that will be judged incorrectly. However, the lower the value of this variability, the greater the cost of the analysis. Thus, ideally, the quality of the measurement process should have an uncertainty value in order to balance the costs of analysis and incorrect decisions.

For instance, in the area of oil and gas, Brazil's National Agency of Petroleum, Natural Gas and Biofuels (ANP) regulates the quality of fuels. In the case of commercial gasoline, the upper limit for the specification of the sulfur mass fraction is  $50 \text{ mg kg}^{-1}$ . Considering a typical result of this critical parameter analyzed by ultraviolet fluorescence as  $45.5 \text{ mg kg}^{-1}$ , for a measurement uncertainty of  $5 \text{ mg kg}^{-1}$  ( $k = 2$ ; 95.45%) and a risk of 5% for the consumer, is this item considered to conform or not?



Conformity assessment

$p(AL)$  - probability density at the lower acceptance limit  
 $p(AU)$  - probability density at the upper acceptance limit  
 AL - Lower acceptance limit  
 AU - Upper acceptance limit  
 TL - Lower tolerance limit  
 TU - Upper tolerance limit

*Final conformity assessment: This item is conform to an effective Consumer's Risk of 5%.*

Finally, in order to leave no doubt concerning the decision rules, a clear and unequivocal method of decision-making should be stated, including the parameters mentioned above in detail. For advanced approaches, I recommend including repeated measurements, the detection and treatment of outliers and multivariate acceptance limits [3].

I am completely confident that BrJAC is in the correct way in order to become a renowned journal, since our publications are shedding light on the importance of Analytical Chemistry related to industrial activities, which can no longer be pushed aside. This issue highlights quality control and the optimization of industrial processes; I invite you to send us manuscripts correlating analytical data to regulatory limits and specifications. Let's think outside the box and understand that this approach continues be Analytical Chemistry!

## REFERENCES

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2. Ramsey, M. H.; Ellison, S. L. R.; Rostron, P. (Eds.) Eurachem/EUROLAB/ CITAC/Nordtest/AMC Guide: *Measurement uncertainty arising from sampling: a guide to methods and approaches*. Second Edition, Eurachem, **2019**.
3. de Oliveira, E. C.; Lourenço, F. R. *Chemosphere*, **2021**, 263, 128265 (<https://doi.org/10.1016/j.chemosphere.2020.128265>).



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