Forensic Toxicology Subcommittee Response to STRP Final Report for 2020-S-0003 Guidelines for Performing Alcohol Calculations in Forensic Toxicology

Organization of Scientific Area Committees (OSAC) for Forensic Science

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STRP Final Report
2020-S-0003
Guidelines for Performing Alcohol Calculations in Forensic Toxicology

Organization of Scientific Area Committees (OSAC) for Forensics Science
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The OSAC Forensic Toxicology Subcommittee and the document Task Group wish to express their appreciation to the members of the STRP for their review and constructive feedback. We are also grateful to the Forensic Science Standards Board (FSSB) Legal Task Group and Statistics Group for providing valuable insight during drafting of the guideline.

This report addresses the feedback from the STRP Report. The Subcommittee looks forward to further considering this feedback in context with input from the broader community as the document continues through the OSAC 2.0 process and eventually proceeds to the AAFS Standards Board (ASB) to go through the accredited standards development process, including public review.

Report Components:

I. **Scientific and Technical Merit:**

Consensus Views – While this standard is correct to point out that it is inappropriate to provide point estimates alone, the proposed standard does not propagate various sources of error in a statistically meaningful way. As a result, the ranges obtained from the proposed method do not have a probabilistic meaning. There are several sources of uncertainty that may affect the calculations considered in this report: sampling bias, instrumental measurement error, and variation within the population. An approach grounded in statistical methods, such as measurement error research, could address these sources of error in a scientifically valid way.

The Foreword explains that the guideline does not apply a statistical approach to the work. The peer reviewed scientific literature regarding statistical treatments for this type of calculation is still evolving. NIST is currently funding a research project titled "Propagation of uncertainty in blood alcohol concentration calculations for forensic purposes." The Subcommittee believes that a fully statistical approach will be possible in the future, but in the meantime, conservative estimations can still be provided in a meaningful and unbiased manner using the guideline in its current draft form.

Consensus View – The ranges given for each of the pharmacokinetic parameters could suggest a rectangular distribution. And the references that establish these ranges are based on limited sample types and sizes. These limitations need to be mentioned for each parameter in sections 4.1.1 – 4.1.3, and Section 4.4 should include more cautionary language.

Since the calculations are currently only meant to offer a range of possible values without formal propagation of uncertainty, the reader should not be assigning nor assuming any type of distribution for the ranges suggested in the guideline. Even if confidence intervals were calculated using appropriate propagation of uncertainty, it would be incorrect to give them a probabilistic interpretation.

The Subcommittee feels that the limitations are sufficiently addressed in the Foreword and Sections 4.1.1 through 4.1.3. In particular, Sections 4.1.1-4.1.3 are not intended to train or fully educate the reader on the pharmacokinetics of ethanol. They are basic background information, to be used in conjunction with the references, to support the approaches recommended in Section 5.

II. **Human Factors:**

III. **Quality Assurance:**

Consensus View – Section 6.5 on postmortem samples would be clearer if combined with section 4.3 on specimen considerations.

This suggestion will be considered along with public comments as the draft goes through the standards development process.

Consensus View – Section 4.3.2 on urine could be strengthened as "not amenable" could be interpreted as "not ideal but still usable." Similarly, section 5.1.1 could include a "but not urine" clause.

This suggestion will be considered along with public comments as the draft goes through the standards development process.

Consensus View – The measurement error for alcohol concentration will depend on the method of measurement. This standard assumes that alcohol concentration measured by either blood or breath will both have equivalently trivial degrees of measurement error. The standard should require the reporting of which method was used and the associated measurement error, if known. If the associated measurement error is not known, the standard should require this to be stated as well. Throughout the standard, alcohol concentrations are treated essentially as an exact number. This assumption needs justification. Requirements for alcohol concentration measurements need to be briefly listed or cited to ensure the results of the subsequent calculations are as precise as hoped.

The guideline does address measurement uncertainty associated with the measured alcohol result when known. The guideline is providing a framework for making estimations that are conservative and unbiased. Testing for ethanol is beyond the scope of this guideline. In many instances, the expert performing the calculations is not involved in the testing method. The guideline intentionally does not try to define an appropriate alcohol result. The expert is directed to discuss any assumptions related to the type of testing.

Minority View – Experts are advised by this document to include the measurement uncertainty in their calculations when provided, but measurement uncertainty is not currently available for all test results, especially regarding breath testing programs. Requirements for alcohol concentration measurement testing to ensure acceptable levels of precision is well outside the scope of this guideline and should be addressed separately in documents focused on analytical guidelines, some of which are currently in process with ASB.

The Subcommittee concurs with the Minority View.

IV. **Scope and Purpose:**

V. **Terminology:**

Consensus View – Section 4.4 is titled "Uncertainty of Measurement" which suggests the precision of results of a single measurand. The content in this section, however, seems to have more to do with the variability of these parameters in a population. While both effects can propagate through subsequent calculations, they are not quite the same thing.

The Subcommittee previously accepted this suggestion to revise the title of Section 4.4.

VI. **Method Description:**

Consensus View – Sections 4.1.2.1, 4.1.2.2, and 5.2.3 refer to an "anthropometric approach" that can be used to calculate V_d in lieu of the provided range. More information about this approach, ideally the actual equations, needs to be provided. Maskell seems partial to two equations, "The results from the present study seem to favour the anthropometric equations published by Forrest [9] and Watson et al. [6]." These equations are simple and straightforward; including them in the standard would not be too onerous. Further, perhaps this standard, should recommend only these two favored methods. At a minimum, some discussion is needed about the effect of the anthropometric approach on V_d values (i.e., could they fall outside of the prescribed V_d range?). Perhaps, an example could be added to the appendix where this anthropometric approach is used.

The reference is listed as a normative reference because it is indispensable for the application of the standard. The Subcommittee wants to prevent the calculations from being oversimplified. If an expert intends to apply an anthropometric approach, they need to fully understand the parameters, and evaluate if the assumptions necessary for that approach are valid. Due to this complexity, the Subcommittee does not believe that paraphrasing or summarizing the approach could be improved beyond citing the original reference. The Subcommittee does not believe that the standard should cite only the two methods suggested above (Forrest [9] and Watson et al. [6]) because the scientific literature may evolve further.

VII. **Reporting Results:**

Consensus View – The ranges for the pharmacokinetic parameters, previously discussed, could lead to reports with results that could be misinterpreted that extreme values are as probable as more central values.

As stated above, the ranges proposed in this guideline do not have a probabilistic interpretation at this time. Furthermore, even properly calculated confidence intervals do not provide an adequate basis for a probabilistic interpretation within the boundaries of the intervals. As discussed with regard to Sections 4.1. through 4.3 above, the draft guideline cautions experts that they should not make assumptions about the distribution of probabilities within the confidence interval.

- Minority View – The probability of where an individual subject would likely fall within the calculated range is dependent on a number of factors and would be open to interpretation by the expert. Interpretation of results is outside the scope of this document and is addressed, to some extent, in ANSI/ASB 037 'Guidelines for Opinions and Testimony in Forensic Toxicology'. Applying a full range as stated in this document reduces the possibility that an expert will inadvertently exclude possible concentrations by applying a certainty to the midpoint that does not exist.

  The Subcommittee concurs with the Minority View.