



# UKIAFT Guidelines for Performing Alcohol Technical Defence Calculations

## Table of Contents

<b>Introduction .....</b>	<b>2</b>
<b>The Law .....</b>	<b>2</b>
Post-incident drinking ( the “hip flask” defence) .....	2
Laced drinks defence (“special reason” for not disqualifying).....	2
Back-calculation .....	3
Time to driving.....	3
<b>Recommendations for Practitioners.....</b>	<b>3</b>
<b>(a) Information Required.....</b>	<b>3</b>
Tests & Circumstances.....	3
Subject Details .....	3
Food & Drink Consumption .....	3
Volumes & Strengths .....	4
Drinks measures in Licensed Premises.....	4
Drink strengths .....	5
<b>(b) Calculations.....</b>	<b>6</b>
Alcohol Distribution.....	6
Alcohol Consumption .....	6
Validity of Back Calculation .....	7
Alcohol Elimination.....	8
Blood to Breath Ratios .....	8
<b>(c) Reports.....</b>	<b>8</b>
Report content.....	9
Statement/report format.....	9
<b>Selected references.....</b>	<b>11</b>



## **Introduction**

Alcohol Technical Defence (ATD) calculations may be required in a number of casework situations involving drinking and driving.

These guidelines are designed to ensure, where possible, a consistent approach to such casework within the United Kingdom and Republic of Ireland. There are potentially many parameters that could be used for such calculations which could produce a different evidential outcome given the same information. These guidelines are designed to minimise such potential problems but are not a guide on 'how to perform' the calculations.

## **The Law**

In England, Wales and Scotland the relevant legislation is contained within the Road Traffic Offenders Act 1988, Section 15.2 and in Northern Ireland in Article 18(2) of the Road Traffic Offenders (Northern Ireland) Order 1996:-

Evidence of the proportion of alcohol or any drug in a specimen of breath, blood or urine provided by or taken from the accused shall, in all cases be taken into account and, subject to subsection (3) below, it shall be assumed that the proportion of alcohol in the accused's breath, blood or urine at the time of the alleged offence was not less than in the specimen.

That assumption shall not be made if the accused proves:-

- (a) that he consumed alcohol before he provided the specimen and
  - (i) in relation to an offence under section 3A, after the time of the alleged offence, and
  - (ii) otherwise, after he had ceased to drive, attempt to drive or be in charge of a vehicle on a road or other public place, and
- (b) that had he not done so the proportion of alcohol in his breath, blood or urine would not have exceeded the prescribed limit and, if it is alleged that he was unfit to drive through drink, would not have been such as to impair his ability to drive properly.

There is no such provision within the Republic of Ireland Road Traffic Act 2011.

Situations where a forensic scientist can be requested to perform calculations include:-

### **Post-incident drinking ( the "hip flask" defence)**

Where a motorist claims to have consumed alcohol after driving but before their evidential sample has been supplied and it is therefore necessary to calculate the contribution from this additional alcohol consumed.

### **Laced drinks defence ("special reason" for not disqualifying)**

Where a motorist claims to have unknowingly consumed alcohol e.g. where extra alcohol has been added to a drink, and calculations are required to allow for this extra alcohol.



### **Back-calculation**

A calculation to extrapolate the measured alcohol level to a previous time. This may be required when a motorist has absconded from the scene of a collision or driving incident and thereby delayed sampling or been injured and taken to hospital, again delaying sampling. It is also a requirement of Section 3A of the Road Traffic Act 1988 Amended 2006 (e.g. causing death by dangerous driving); regional variations may apply. Ultimately it is for lawyers to decide whether or not such a calculation can be used at court.

### **Time to driving**

A calculation to determine at what time the motorist's blood or breath alcohol level would have fallen below the prescribed limit where they have been arrested under an "in charge" offence.

## **Recommendations for Practitioners**

A number of recommendations on the information required to perform such calculations, what calculations should be performed and what parameters should be used are detailed below:-

### **(a) Information Required**

In order to be able to carry out the calculations that may be required, the following information should be obtained:-

#### **Tests & Circumstances**

- Time of driving incident
- Time of screening breath test and result
- Time of evidential breath analysis and result
- Time and analytical result of other sample e.g. blood

#### **Subject Details**

- Name
- Age
- Gender at birth
- Height
- Weight

If the weight of the subject is not available but the height and build is provided, it may be possible to estimate the motorist's weight from tables

#### **Food & Drink Consumption**

Details of food consumption within previous 24 hours



Details of alcohol consumption over the previous 24 hours. It is important to include as much detail as possible – such as times of drinking (especially the start time), volumes consumed and brands

Details of medication (if any)

Medical conditions

### **Volumes & Strengths**

Bottle and can sizes in United Kingdom and Republic of Ireland:-

A normal bottle of spirit is 70cl (700ml) but 1 litre bottles (1000ml) are readily available. Bottles are also available at half-sizes (350ml) and small (200ml). Miniatures, where available, are generally 50ml in volume

A standard bottle of wine is 750ml; half-bottles are increasingly available (375ml).

Bottles of beer are either 500ml, 330ml or 275ml although occasionally other sizes may be available e.g. 660ml or 1 pint (568ml).

Cans of beer can be sold in many different sizes. Most common will be 500ml, 440ml or 330ml but others are available.

Alcopop bottles are generally 275ml in size although supermarkets often sell these in 700ml bottles.

### **Drinks measures in Licensed Premises**

#### *United Kingdom*

Spirits are sold in measures of either 25ml or 35ml for a single. If information is not known 35ml should be assumed but clearly stated in the report/statement. In the Isle of Man spirits are still served as 1/5 gill (28.4ml).

Wine is sold in various sizes of glass:-

125ml (small); N.B. this is 'standard' for champagne

175ml (small or standard\*)

250ml (standard or large\*)

Some may even sell a 500ml glass as a large glass

\*depending on the establishment's policy

A standard measure for a fortified wine is 50ml



### *Republic of Ireland*

A standard measure of spirit is 35.5ml.

187ml (1/4 bottle) is a standard glass of wine.

### **Drink strengths**

The alcohol content, alcohol by volume (ABV), of stated brands of drinks can be readily found via internet searches or by contacting the manufacturer or distributor. The drink strength may well vary, even within brand, depending on whether it is in a can or is being sold as draught. If the brand and/or can/bottle size is not available the following are suggested as typical values. Whatever value is used should be clearly stated in the report/statement.

Lager	4.2%
Premium/Export lager	5.0%
Strong lager	9.0%
Draught bitter	3.8%
Bottled beer	5.0%
Cider	4.5%
Premium cider	6.0%
Strong cider	8.2%
Red wine	13%
Rose wine	12%
White wine	12%
Champagne	12%
Sherry	17.5%
Port	20%
Vodka	37.5%
Gin	37.5%
White rum	37.5%
Dark rum	40%
Whisky	40%
Brandy	40%
'Alcopops'	4 to 5.5%



## **(b) Calculations**

### **Alcohol Distribution**

Many ATD calculations require the so-called Widmark factor to be determined. This is a measure of the proportion of the person's body weight that is available for alcohol distribution and takes into account weight, height and age.

The factor should be calculated for the motorist by using the methods described by Forrest and/or Watson, Watson and Batt and is actually a "modified Widmark factor". Where both are calculated the lowest of these factors will normally be used in all subsequent calculations as this will usually be in the motorist's favour for most of the calculations performed. If no age is available for a male subject, Forrest's method should be used. An alternative approach has been suggested by Seidl but since this always leads to much higher factors than the other methods, which would not be in the motorist's favour for the majority of calculations, this approach has not been adopted.

The particular method used must be included in the practitioner's statement/report.

If insufficient detailed information has been supplied for calculating an accurate modified Widmark factor (e.g. weight, height) certain assumptions may be made but these must be detailed in the statement so they can be challenged if necessary. Steps should be taken to ascertain the required information or provide a fair estimate. Any estimates made should be clearly stated in the practitioner's statement/report.

It should be noted that caution should be used when applying the factors to older motorists and also those with a very high BMI as the models may not be so accurate.

*Water Distribution Constant:* The calculations should be modified to reflect the proportion of water in whole blood, by substituting the water distribution constant for plasma (0.80) with the constant for whole blood (0.84) when appropriate (Trudnowski and Rico, Snyder et al., Lentner).

### **Alcohol Consumption**

A standardised approach is suggested for performing calculations as follows:-

1. Calculate the contribution of the alleged post-incident alcohol consumption or the alcohol contained in a laced drink.
2. Calculate the estimated blood or breath concentration in the absence of the post-incident, or laced drink, at the time of the evidential analysis
3. Calculate the estimated blood or breath concentration in the absence of the post-incident or laced drink contribution at the time of the incident. This should be extrapolated ("back-calculated") from the test after allowance for the post incident consumption has been



deducted but must only be performed where this calculation is scientifically viable (see below).

N.B. In certain situations it may be necessary to change the order and back-calculate from the test and then subtract the post-incident consumption unless the calculation programme, if used, can deal with negative numbers.

4. Calculate the expected blood or breath alcohol concentration at the time of the evidential sample using the total alcohol consumption claimed by the motorist. The concentration is derived by calculation of the maximum contribution from all of the drinks consumed and then allowing for alcohol elimination between the start of drinking and the time of the evidential test.

5. An optional additional calculation is to estimate the motorist's blood or breath concentration at the time of the incident, from the claimed pre-incident consumption. This involves the calculation of the maximum contribution that the claimed pre-incident drinking could have produced, but also allowing for the possibility that this may not have been completely absorbed (depending on the times involved).

### **Validity of Back Calculation**

(a) The stated drinking scenario should be thoroughly examined to ensure that the motorist's alcohol level would not have fallen to zero at any point in the time period under investigation (e.g. between drinks). If this could have occurred the calculation must be modified accordingly. It may be that a concentration could have fallen to zero at a fast elimination rate but not a slow one and this should be considered carefully.

(b) Some, simple, cases may require only a back calculation, which involves adjustment for alcohol elimination between the time of an incident and the evidential analysis (which may be below the limit). This can include situations for example where a motorist has left the scene or been hospitalised leading to a significant delay in testing.

(c) Back-calculations should not normally be performed where the motorist has consumed alcohol within 60 minutes of the incident/sampling. If the last drink was more than 2 hours previously a back-calculation is considered to be safe. If a meal has been consumed then caution should be applied if a back-calculation is required to between 1 and 2 hours after last drinking and a caveat should be stated.

(d) Back-calculations should only be undertaken when a measured blood alcohol concentration is greater than 20mg%. Below this Michaelis-Menten kinetics should be used. The practitioner must be familiar with this method of calculation.

(e) If the post-incident alcohol consumption accounts for the measured alcohol concentration a back-calculation may not be valid or required.



N.B. When calculations from urine alcohol concentrations are attempted they should be converted to blood equivalents, using a ratio of 1.33 : 1 urine : blood for the purpose of the calculation. Consideration of the time of the urination and that of the previous (discarded) specimen should be taken into account, when the information is available, as the blood equivalent concentration relates to the mid-point between the times of supplying the discarded and evidential specimens, assuming the bladder was emptied. Following calculations the concentration should be converted back to urine for the purposes of reporting.

### **Alcohol Elimination**

A recent paper by Jones suggests a range of 10 to 35mg%/hr with a “most likely” of 15mg%/hr for social drinkers and 19mg%/hr for likely heavy drinkers. Following discussions as to the most appropriate studies for elimination rates in the drinking and driving scenario it was agreed to adopt those suggested by Jones and Andersson which showed a range from 9 to 29mg%/hr with a most likely rate of 19mg%/hr. The quoted range is a 95% confidence interval. Therefore 1 in 20 motorists are still likely to fall outside of this range.

Any calculations from low levels must take Michaelis-Menten kinetics into consideration (see Lewis).

### **Blood to Breath Ratios**

In a large survey in the 1980s written up in the Paton Report (Cobb and Dabbs), only 0.5% of subjects were found to have a blood to breath ratio <2000:1 and 3.4% had a value >3000:1. Therefore it is suggested that calculations involving conversion from breath alcohol concentrations to blood alcohol concentration equivalents take into account a range of blood to breath concentration ratios from 2000:1 to 3000:1 (as well as the stated blood alcohol elimination rate range). The most-likely blood to breath ratio should be taken as 2300:1.

When calculating the likely breath alcohol concentration from a stated alcohol intake the blood to breath partition ratio is relevant and should be taken as 2300 to 1. No ranges should be applied since this calculation will specifically address the situation where the blood supply, carrying the alcohol, is in contact with the alveoli in the lungs. This ratio varies little between individuals and depends on the partition ratio of alcohol between blood and air at 34°C (expired air temperature) but with allowance for alcohol lost and gained on inspiration and expiration.

### **(c) Reports**

*Report content and format will vary depending on the case circumstances, and the customer requirement but the following components are suggested as a minimum for the content.*





The format varies widely currently but a suggestion is made to provide clarity and consistency between practitioners.

Streamlined/abbreviated statements/reports should be used with caution for ATD casework and must contain sufficient information for decisions to be made by the Prosecution.

### **Report content**

The following information must be included in all statements and reports:-

Practitioner's qualifications and experience

Purpose of statement/report

Information received

Receipt and results of examination of any items submitted

The scientific basis of the calculation (this can be included as a standardised appendix)

The information/assumptions on which the calculations are based

Comments including calculations

Conclusions

A comment that the report/statement has been compiled in accordance with published UKIAFT ATD Guidelines, including version number, could also be included.

### **Statement/report format**

In post-incident drinking and laced drink cases, the following calculations should be included. In order to maximise the clarity of the report/statement it is suggested that each calculation has a separate heading. A logical order has been suggested:-

1. The contribution due to the additional alcohol, using the widest range of values.
2. The estimated result in the absence of the post-incident, or laced drink, at the time of the test using the widest range of values.
3. The estimated concentration in the absence of the post-incident or laced drink contribution at the time of the incident.
4. The expected blood or breath alcohol concentration at the time of the evidential test based upon the total intake of alcohol as claimed by the motorist and a comparison between this and the actual measured value with a comment stating whether or not the alleged total alcohol consumption is consistent with the results obtained, using the widest range of values.

[N.B. If the result is only consistent with the claimed pattern if extreme factors are used this should be stated and may be important to the court when assessing the likelihood or otherwise of evidence presented. If the calculations are not compatible with the results and



claimed drinking pattern, a warning should be included that caution is required when considering the remainder of the practitioner's statement. This would normally only apply if the motorist's account details insufficient alcohol; an adverse comment should only be used in situations where extra alcohol is detailed in exceptional circumstances e.g. where an unrealistically large amount of additional alcohol has been claimed]

If the lower end of the range in a breath calculation falls between the prescribed limit and charging threshold (i.e. prosecution limit) this must be clearly stated.

The Practitioner should proceed with caution if detailing the amount of alcohol "missing" from a motorist's account (i.e. where a deficit in the total alcohol calculation exists) as this would enable a motorist to change their drinking history and approach another Practitioner (see Forrest and Williams). Prior involvement of another Practitioner does not have to be disclosed by the Defence.

As it is not known which alcohol concentration will be used at court calculations to the time of the incident, as well as to the time of the evidential test, are recommended to be included in a report/statement. All information is then available for the Prosecution to proceed as they wish.

The practitioner should always carefully consider the assumptions made in their calculations, particularly when they are aware of uncertainties surrounding case information such as the nature and volume of the alcohol consumed and possible inaccuracies in weight, height etc.

When a calculated range is close to the prescribed limit or the charging threshold (prosecution limit) extra care should be taken in wording statements and any uncertainties clearly expressed to avoid possible miscarriages of justice.

In a situation where clearly more alcohol has been consumed than stated, as we cannot say when this extra alcohol had been consumed, the statement must clearly reflect that it is not possible to specify whether this additional alcohol consumption occurred before or after the incident, or both.



## Selected references

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