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PMW

A Digital Display on a Quick-Blow Tester: Just a Sales Gimmick!

I have been asked by Lion to comment, based on my forty-seven years of experience in the breath alcohol business, as to whether there is any merit in incorporating a digital readout display into a breath alcohol testing instrument that does not use a mouthpiece for breath sampling. In my expert opinion there is no merit at all in such a feature - and in fact there is a potential danger - all of which I explain below.

Dr Paul M Williams: My Background and Experience in Breath Alcohol

Please see the end section of this paper for details of my forty-seven years of experience in breath alcohol.

The Starting Point: What is the Purpose of the Test that We Are Conducting?

Now before addressing the specific issue of a digital display, I need to consider some basic concepts of an analysis procedure, for whatever purpose. The first question is, *"What is the purpose of this breath test?"*. The answer to this may at first seem rather obvious, but it is not always necessarily so.

Analysis: The Basic Scientific Concepts

Whenever we carry out an analysis, of anything, the overriding concept is [or should be] that of ***integrity***. In other words, how reliable is the result that is finally produced, for the purpose we want it? In determining that reliability or integrity factor in the context of our defined test purpose we must consider two aspects:

- ***Sample Integrity*** - how good is the sample that we have obtained, and how representative is it of the main source?
- ***Analysis Integrity*** - in common language, how accurately did we analyse whatever we were measuring in the particular sample?

So, firstly, we need to take a sample that properly represents what we are trying to determine; and then, secondly, we need to make a proper analysis of whatever we are trying to determine in that sample.

Breath Testing: What is the Purpose of the Test and What Are the Integrity Issues?

In the context of breath testing, do we wish to measure the subject's actual alcohol level, or simply determine whether or not they have alcohol in their body? The answer to this question will be important in the context of how we take the sample to test, and how we then display the alcohol reading of that test.

In the context of ***Sample Integrity***, only ***deep lung breath*** can provide a quantitative measurement of how much alcohol is in the person's body, since only this has been in contact with their blood. But even top-lung/mouth air will contain at least ***some*** alcohol if the subject has it in their blood. So mouth air will enable us to determine if the person has alcohol in their body, but that is as far as such a sample can take us.

In the context of ***Analysis Integrity***, the fuel cell is quite capable of providing an accurate measurement of how much alcohol is in the sample. This means that it is not ***this*** aspect of the process that is in question.

Breath Sampling for Alcohol Testing

There are three ways in which a breath sample may be taken from a subject for alcohol testing purposes:

- ***Active, with a Mouthpiece:*** the subject blows directly into the instrument, through a disposable mouthpiece, generally until a sample of their ***deep lung air*** is taken for analysis. It is only such breath that can be used for a fully quantitative measurement of the subject's body alcohol loading. This is because, firstly, it is only such breath that will have been in contact with their blood; and secondly, it is only sampling in this way that protects the breath sample during its delivery from alcohol loss resulting from direct exposure to the colder ambient air and from the effects of crosswinds. In other words, it is only this type of sampling that enables breath with a high ***Sample Integrity*** to be taken for analysis. This is why most breath analysis devices operate in this way, particularly those that are designed to give a fully quantitative alcohol reading. ***ALL*** evidential analysis instruments use this breath sampling system.
- ***Active, with No Mouthpiece:*** here the subject blows into the instrument either directly or through a cup, but making no physical contact with it. Although it may be possible in theory to take a deep lung breath sample this way, in practice this rarely happens: this is because the required blowing time is generally very short. But even if deep lung air is taken for analysis, there is then the issue of alcohol loss during sampling by exposure of the breath to ambient air, as well as by the effect of crosswinds. This is why this method of breath sampling can only be used for a ***semi-quantitative*** measurement, giving a reading [at best] in the format of **LOW-MEDIUM-HIGH**. This method of sampling is ***never*** used in ***evidential*** analysis. This is because, although the ***Analytical Integrity*** is still high, the ***Sample Integrity*** is not: an accurate measurement is being made on a poor sample.
- ***Passive:*** here, as the name implies, the subject does not participate in the test at all. The instrument is held in front of his or her mouth or nose, and a sample of their breath is taken [hopefully] while they are speaking or exhaling. This means that the breath so sampled has never originated from deep in the lungs, and there are also the same questions of alcohol loss through the ambient factors as defined above - but on a potentially much greater scale. So again, although the analysis itself may well be accurate, the sample is not one that can be relied on for even semi-quantitative purposes. This is why it is only possible in this way to determine whether the person has alcohol in their body at all, and no more - so the result should only ever be in the format **PASS-FAIL**.

Breath Alcohol Testing Instruments: Display Systems

In the above section I have hopefully explained the display format that is justified for use in breath testing instruments, depending on which type of sampling they employ. It is bad science to express the result of an analysis to a level of accuracy that is greater than the least accurate element. As an example, if you measure a distance of say 100 meters with a ruler that is marked only in meters, then you can only express the result in meters, and not centimeters as well. So in the case of breath testing, although the analysis in itself may well be accurate, we should never give a reading that purports to state how much alcohol the subject has in their body, if the sample that we analysed does not and in fact simply ***cannot*** reflect that.

This means that it is totally unjustified, scientifically, to incorporate a digital display into a breath instrument unless that instrument uses active sampling via a mouthpiece. To do otherwise infers a degree of accuracy that is simply not there - simply as a result of low ***Sample Integrity***. It is somewhat like a Police Officer smelling a person's breath and then telling them that they have some particular blood alcohol level. You just cant't do that, anymore than it would be justified to fit a digital display to a sundial to read the time!

A Potential Legal Hazard …

It is unlikely that anyone is ever going to be prosecuted for driving with excess alcohol, or disciplined for being drunk at work, simply on the basis of a reading given by any type of breath instrument other than one using a mouthpiece and sampling deep lung air. This means that if the result given by the initial tester was inaccurate [for the reasons given above], it is very likely to be quite different to the far more accurate reading subsequently given by the evidential analyser, and on which any subsequent proceedings would inevitably be based. Such discrepancies in readings between instruments are commonly exploited by the defence fraternity when trying to cast doubt on the accuracy of the evidential result. But if the initial test reading was non-numeric, then such a possibility of a defence attack in this way simply does not arise.

The Two Instruments in Question

The video for the **Sentech iblow 10** clearly shows it taking a sample after a very short blow, and when the subject is blowing directly into the instrument, but with no contact with it. The brochure for the **FiT031** states that the blowing time requirement is just 0.5 seconds.

Neither instrument samples deep lung air, and so each operates on the basis of a very low ***sample integrity***. This means, for all the reasons given, it is totally unjustified [at best] to include a digital display into these instruments to give what purports to be an accurate, quantitative reading of the subject's alcohol level.

Dr Paul M Williams, BSc, MSc, PhD, C Chem, FRSC, FCSFS 23 August 2018

About the Writer: Dr Paul M Williams: My Background and Experience in Breath Alcohol

Paul was born in Portsmouth, England, in February 1950 and graduated from the University of Wales Institute of Science and Technology, Cardiff in 1971 with an Upper Second Class joint BSc [Honours] degree in applied chemistry and applied biology.

From then, in late 1971, still at the University of Wales Institute of Science and Technology, Cardiff, he commenced a four and a half year research program on alcohol, under the direction of Dr TP Jones; and, initially, alongside [the now] Professor AW Jones. This full-time research work was heavily focused towards the development of alcohol sensing technology for breath analysis. However, it also involved many practical and detailed studies on the fundamental principles of alcohol physiology in the body; and its analysis in breath, blood and urine. During this research period Paul personally carried out many hundreds of experiments on human subjects. In so doing he administered known amounts of alcohol to them, and then measured their breath and blood alcohol levels. This alcohol research work resulted in Paul receiving the degrees of MSc and then PhD in chemistry, plus of course the development of the fuel cell alcohol sensor that is now used by Lion Laboratories Limited at the heart of their range of **lion alcolmeter®** breath alcohol analysers as used by the Police in the UK and worldwide for traffic law enforcement. He has continued his work on alcohol to the present day, full time, during his employment with Lion - as Head of Forensic Support - from where he retired in February 2015, and since then on a part-time basis in his role as a self-employed forensic science consultant.

As a result of his University research work Paul became skilled in calculating breath and blood alcohol levels from stated intake, and, conversely, the minimum intake of alcohol required to account for a measured breath or blood level. He now uses these skills and this knowledge in cases of back-calculation, forward-calculation, accounting for alleged post-driving alcohol intake and in cases involving alleged laced drinks - mainly in drink-drive investigations. He is also periodically consulted by the Crown Prosecution Service or Police to conduct alcohol calculations in investigations of murder, manslaughter and rape.

Paul has worked closely with the British Home Office, Crown Prosecution Service, Forensic Science Service and Police Forces on various aspects of alcohol analysis in traffic law enforcement. In addition to those said organisations in the United Kingdom, he has also worked closely with their equivalents in Australia, New Zealand, Korea, Singapore, Malaysia, Botswana, South Africa, Cyprus, Malta, the USA and Ireland.

Paul regularly gives expert, forensic advice to prosecution and [sometimes] defence lawyers and to the Police in drink-drive matters, and has given expert evidence in Court on now around 2,400 occasions - mainly in the United Kingdom, but in also in several other countries [including Australia, South Africa, Ireland, the USA, Singapore and St Helena]. Additionally, Paul has carried out training for Police, lawyers [solicitors, barristers, Magistrates and Judges], as well as the medical profession. He also serves on the Training Committee of the International Association of Chemical Testing in the USA, in respect of which he regularly delivers training presentations to forensic scientists there.

He has written many articles and has given lectures and papers at many international conferences on matters relating to alcohol analysis in the human body. He has often been quoted in the press and has appeared on many television and radio programmes concerned with this subject.

More recently Paul has been consulted by Her Majesty's Government [Great Britain] to advise them on certain issues in respect of alcohol levels and drink-drive law enforcement.

He is a Fellow of the Royal Society of Chemistry and the United Kingdom Chartered Society of Forensic Sciences, both of which fellowships were gained for his alcohol work. He is a member of the British Academy of Forensic Sciences; the International Association of Chemical Testing; the International Council on Alcohol, Drugs and Traffic Safety; and the United Kingdom and Ireland Association of Forensic Toxicologists.

In summary, Paul has worked in the alcohol field for some forty-seven years. Having retired from Lion [in 2015] he now operates his own consultancy, specialising in the forensic aspects of alcohol.