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METROLOGIST
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AGM

Quantification 6

Riverbank Reflections 3

Breath Testing in SA

THE AUSTRALIAN METROLOGIST

From the Editor

The conference in Canberra is almost upon - *Smart measurements: Metrologists Advancing Industry* is getting close now. The AGM of the MSA is held during this period and this issue has some of the required paperwork for you - notice of meeting, motions, nomination form and proxy voting form - to allow you to be involved in your society.

In this issue we continue our popular series - Jeff Tapping's *Quantification* and Ron Cook's - *Riverbank Reflections*. Both are entertaining and thought provoking.

Bob Frenkel has submitted a short and thoughtful piece on metrology, meteorology and global warming!

Rick Laslett has provided his two-part paper on new legislation for breath analysis in South Australia - worth keeping in mind if you have more than "one for the road".

Please keep the articles rolling in - as I do not have anything in reserve for the next issue!

- Maurie Hooper

Cover: Drager Alcotest 7110 Mk V (Photo - Glenn Bowkett, Victoria Police)

The Australian Metrologist

The Australian Metrologist is published four times per year by the Metrology Society of Australia Inc., an Association representing the interests of metrologists of all disciplines throughout Australia. Membership is available to all appropriately qualified and experienced individuals. Associate membership is also available.

Contributions

Articles, news, papers and letters, either via e-mail, disk or hard copy, should be sent to:

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The deadline for the next issue is 31st October 2005.

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Write or e-mail the Editor with your details including years of experience and qualifications. This service is offered free of charge.

Need a Metrologist?

If you have a position vacant, write or e-mail the Editor with the details. A charge of $20 for up to 10 lines applies. (The circulation may be small but it is well targeted.)

The deadline for positions wanted/vacant is as above.

Letters to the Editor

Letters should normally be limited to about 300 words. Writers will be contacted if significant editorial changes are considered necessary.

Editorial Policy

The Editor welcomes all material relevant to the practice of Metrology. Non-original material submitted must identify the source and contact details of the author and publisher. The editor reserves the right to refuse material that may compromise the Metrology Society of Australia. Contributors may be contacted regarding verification of material.

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Editor: Maurie Hooper

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Contact either your State Coordinators or the Secretary, Mr Mehrdad Ghaffari (02) 8467 3508, e-mail address mehrdad.ghaffari@measurement.gov.au or write to:

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The **MSA website** address is www.metrology.asn.au

Webmaster: Mark Thomas (03) 9244 4042 (wk)

MSA Membership Fees (under review)

Fellows	$45 Joining Fee
	$45 Annual Subscription
Members	$40 Joining Fee
	$40 Annual Subscription
Associates	$35 Joining Fee
	$35 Annual Subscription

President's Report - September 2005

We Amazing Inventors

I was listening to Bill Bryson's audio book "A Short History of Nearly Everything" when I was struck by the diversity of interests of 16th and 17th century scientists. Newton with his contribution to mathematics in the form of calculus, the laws of motion express in the Principia and alchemy; Halley with his various contributions to astronomy, meteorology (the first weather chart), and oceanography; Lavoisier with economics, physiology and of cause chemistry; and Wren who was an mathematician of note as well as great architect. Their intellect and skills were not limited to one field or one idea. Their ingenuity at solving problems and building instruments to measure the mass of the earth or to see bacteria for the first time was amazing.

It reminded me of an interesting toy I came across last year when we were clearing out a cupboard at work. We found this curious box with even more curious content. While I suspect there are missing pieces (Possibly a mirror), assembled it made no more sense. The rod has measures of cc's on the side. There are valves on either side of the main chamber, which can seal it. As the picture below shows, the flock-lined chamber has a mysterious whipper and graticule glass in the bottom, while the lid of the chamber has an adjustable focus lens that focuses approximately on the graticule.

A number of my colleagues have examined it and come up with a variety of guesses as to it is use, from a device to examine the sun to a particle counter. The question I pose to you is - what is it? What is it used for? How does it work?

All this may seem a strange topic for discussion. But I will now link it back to this society, the here and the now. How diverse is your thinking? When you come to the conference next month I challenge you to step outside your comfort zone. Go to some of the talks outside your field. Science grew in leaps and bounds from the 1700s when men applied their diverse minds to various problems. I think metrology today could benefit from a bit more cross fertilisation.

Regardless, I can recommend Bill Bryson's book - it is a fascinating journey through science and humanity. A good read for the plane trip or listen in the car.

See you in Canberra!

- Dr Jane Warne

Contents

Announcement and Invitation to the Annual General Meeting for the MSA 2005

TO BE HELD AT

University House, ANU, Canberra

Thursday 20th October 2005 at 4.30 pm

The agenda for the meeting will be as follows

- Apologies
- Minutes of the previous AGM
- President's and Treasurers Reports
- Recommendation of fees
- Election of Office bearers
- Discussion and vote on tabled motions
- Close of meeting

Nominations for the National Committee of Management are sought and should be with the Secretary Mehrdad Ghaffari no later than close of business on the 6th October, 2005.

Motions

1. **That the Joining fee for new members or those rejoining the society be abolished.**

2. **That the Membership fees for all levels of Membership be set at $45.**

The membership database is currently looked after by administrative at NMI. This is a generous and valuable contribution to the society by the NMI and was taking a disproportionate amount of time. The National Committee had also received a number of reports of members receiving reminders to pay for memberships fees that had already been paid. As a consequence the National Committee asked Randall Anderson (Honorary Treasurer), Mehrdad Ghaffari (Secretary) and Walter Giardini (Vice President) to investigate the situation and propose a solution. It quickly became apparent that the existing database built ten years ago was no longer adequate and required redesign to make it both more efficient and straightforward to use. Randall Anderson, has kindly volunteered and built a new simpler database. He also after visiting NMI in Sydney and talking to the staff there identified a number of process issues. This has lead to the following motions for consideration by the membership.

The first process change is to do with the tracking and chasing of joining fees, this is taking an inordinate amount of time considering the amount of money involved. When the society started this was an important income stream and helped establish the financial security the Society now enjoys. We are now in a more stable phase with considerably fewer new members per year. The committee also recognises that the joining fee can be an impediment to past members rejoining. Therefore it proposes waiving of this fee.

Secondly, the management of fees on basis of whether the person is an Associate or Member is causing some complications and considerable effort chasing people. It is

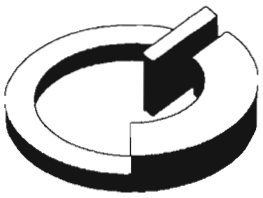
proposed that the fees for all levels be made consistent at $45. This is an increase of $5 per year for Members and $10 per year for Associates. The Society has not raised its fees for a number of years and the increase will help cover the cost associated with the production of TAM and other activities of the Society. There is no proposal to change the status of privileges of the various membership grades as a part of this motion. However it is seen as an encouragement for Associate Members to become Members.

3. That Barry Inglis be elected as an Honorary Fellow of the MSA in recognition of his significant contribution to Metrology in general and the Society in particular.
(Nominated Steve Grady, Seconded Jane Warne)

In support of this I am aware of no one who has done more to raise the profile of metrology in Australia. It is my belief that without the driving force of Barry the NMI would not have come into being. Through the NMI metrology is starting to have some presence in the political landscape of Canberra. - Steve Grady

Barry Inglis is a founding member of the Metrology Society of Australia and its first Vice President. He is CEO of the newly formed NMI and Chief Metrologist, was Regional Coordinator / Chairman of the Asia Pacific Metrology Programme from 1994 to 1999 and in 2003 he was elected President of the CIPM Consultative Committee for Electricity and Magnetism (CCEM).

He has long been a champion for metrology in Australia and the Pacific Region, he is also a great patron to the MSA. His drive and passion for metrology are I believe key in both the establishment of the MSA and the NMI and the profile of metrology in this country. - Dr Jane Warne, President MSA.



METROLOGY SOCIETY OF AUSTRALIA

NOMINATION FORM

To the Secretary
Metrology Society of Australia

We,

_____, Member No _____

and

_____, Member No _____

hereby nominate

_____, Member No _____

for election to the position of (circle one) President
Vice-President
Secretary
Treasurer
Ordinary committee member

of the Society at the MSA's Annual General Meeting of 2005.

Signatures Nominator _____

Seconder _____

I affirm that I am willing to stand as a candidate

Nominee _____

Date _____

METROLOGY SOCIETY OF AUSTRALIA

APPOINTMENT OF PROXY

To the Secretary
Metrology Society of Australia

I, _____, Member No _____

Hereby appoint

_____,

being a member of the Metrology Society of Australia, as my proxy to vote for me on my behalf at the 2005 AGM of the Society and at any adjournment of that meeting.

Signed:_____

Date: _____

Note: This Proxy form must reach the Secretary 24 hours before the AGM.

Metrology, Meteorology and Global Warming

Bob Frenkel

National Measurement Institute

Some people confuse "metrology" and "meteorology". They are of course very different things. Metrology focuses on the detection, analysis and minimisation of errors in any branch of science. Meteorology is the science of climate and weather – a very complicated scientific arena with high uncertainties.

Recently, metrology and meteorology briefly met. (Yes, that's an intended pun!) The general issue was global warming, which may or may not be a real effect: it has both supporters and sceptics. However, three papers in "Science" as published online

(www.sciencexpress.org) have given some fresh support to global warming. The papers are all dated 11 August 2005 and have as respective authors B.D.Santer et al, C. Mears et al, and S.Sherwood et al. Their findings have been described, in simplified terms (which made them easier for me to understand), in The Economist

(13 August 2005), Nature (18 August 2005) and New Scientist (20 August 2005). The paper by S.Sherwood et al, in particular, points out a possible error in previous measurements of atmospheric temperature trends (which had appeared to throw doubt on global warming), and this error seems to me to have a character that is familiar to us as metrologists and that might have been avoided if a proper *metrological* approach had been taken by earlier meteorologists.

The measurements referred to were made using radiosondes (weather balloons). These are released from various stations on the Earth's surface at midnight and at noon UTC. The packages carried by the balloons up to about 30 km contain, among other instruments, a temperature sensor (a thermistor) that has to be exposed to the thin atmosphere but also, for daytime measurements, shielded from direct sunlight – otherwise its reading will be too high. The shielding cannot be perfect, and so a correction to the indicated daytime reading is applied. The correction, naturally, is negative. It appears that, over the last twenty-five or so years, insufficient attention was paid to the fact that shielding techniques gradually improved and that, consequently, a smaller negative (that is, more positive) correction would have been appropriate. The actual correction, however, remained at the value pertinent to poorer shielding and was therefore too negative. Hence it appeared that the external temperature was cooling, when in fact – as suggested by the paper by S. Sherwood et al – this was simply an artefact of the wrong correction being applied.

For us as metrologists, it is second nature, when using an instrument, to ask: "What is its correction? Is it still valid? What environmental conditions would reduce its validity, and by how much?" Perhaps our attitude should be more broadly disseminated throughout the scientific community, and one reason for this (but of course not the only reason) is that – as in the example of global warming – there may be political implications to any claimed scientific finding. The paper by S.Sherwood et al made no mention of metrology, yet from its context the two sciences did meet briefly and perhaps should meet more often.

The MSA is surely just the body for disseminating metrological awareness – sophistication might be a better word. We could release a rhyming slogan, such as: "Never mind the indication – check the latest calibration!"

■

Quantification - Number 6

Jeffrey Tapping

A text-eating bug made its way into the last episode, digesting Question 1 and a line or two above it. The bit of missing text was the concluding remarks on how the U.S. ended up using an obsolete gallon, and read "The metric system was then being adopted in France and there were strong advocates of using it in the U.S. (Thomas Jefferson for one), but the inertia of the populace prevailed."

And the missing question was: "You know what an *odometer* is, don't you? You have one in your car to measure the distance travelled. Well what is a *hodometer*?". So this time you do not have to suffer the pangs of anticipation before getting the answer, which is as follows.

Answer: An *odometer* and a *hodometer* are in fact the same thing. Both are names for a device that measures distances from the number of rotations of a wheel moving along a road, and both names derive from the Greek words *hodo* meaning road, and *metron* meaning measure. The French are to blame for the confusion, because the words come to us via French, and in French the letter *h* is silent at the beginning of a word.

Question 2: It has been pointed out previously that SI units are (with one exception), designated by two letters, the first a multiplier which is a power of ten, the second indicating a unique measurement unit. What are the longest designations for *non*-SI quantities?

Answer: There are heaps with four letters, for example *CGSe* for cgs electrostatic unit, *inHg* for pressure in inches of mercury, *tonf* for ton force, *mbar* for pressures in millibars. The next step is a couple with five characters: *ftH_2O* for pressures in feet of water, *USgal* for US gallon. The longest I have of those used in recent times is *oz apoth* for ounces apothecary. Does anyone have anything to beat this?

Question 3 was: In spite of SI units the calorie is still used very widely to refer to food energy intake, and often as a loose term for the equivalent body fat or weight. But if you do lose a calorie of energy from your body or elsewhere, exactly how much would you lose?

Answer: There are actually many different *calories*, but three main ones; the *international table (I.T.) calorie*, the *15°C calorie*, and the *thermochemical calorie*. These are respectively 4.1868 joules, 4.1855 joules, and 4.184 joules. The *IT calorie* was defined as 1/860 of a Watt-hour, and is used in engineering steam tables. The *15°C calorie*, also known as the *gram calorie*, was defined as the heat required to raise one gram of water from 14.5°C to 15.5°C . The *thermochemical calorie* was simply defined to be 4.184 joules, and was used in chemistry to quantify heats of reaction and so on. Some other units used have been: the *20°C calorie* (heat to raise 1 gram of water from 19.5°C to 20.5°C), and the *100°C calorie* (one hundredth of the heat required to raise 1 gram of water from 0°C to 100°C). All of these have been officially replaced by measurements in joules.

Now let's look at Question 4, the list of units I asked you to ponder on.

Therblig

This is a very interesting unit, because it was coined by a man for a unique purpose and in a unique way, and is the only unit I know of which used the name of the inventor. It is the reverse spelling (almost), of the surname of Frank B. Gilbreth. He had to keep the 'th' to avoid having it come out as Hterblig which would have been a bit difficult to get your tongue around. Frank, together with his wife Lillian, developed the system of time-and-motion study to investigate efficiency in processes. Frank was a consulting engineer in New York U.S.A., and Lillian began studying literature but switched to psychology after marrying Frank and being caught up in his enthusiasm for efficiency. The *therblig* was coined as a unit of physical activity of an operator in a process. I have been unable to find what the unit represented precisely. The enthusiasm for

efficiency and order seems to have even extended to how they ran their own family, because two of their children satirised their life in a very successful movie *Cheaper by the Dozen* in 1950 which will be remembered by our older readers.

Kati

European colonial rulers in east Asia invented a local system of weights and measures that were used in trade, which included the *kati*, a unit of weight also called the *catty*, *chin*, *kon*, *kan*, *kin* and *gin* in different places in the region. Different references assign different values to it:

1) The Dent Dictionary of Measurement gives 1 1/3 pounds, 604.8 g,

2) The Macquarie Dictionary gives it as approximately 670 g,

3) An Indonesian-English dictionary gives 626 g,

4) A Malaysian dictionary gives 600g.

And for some reason in Thailand the *catty* was twice the amount that it was elsewhere (1209.6 g). Given this range of values, it seems to me that the weight actually varied from place to place, according to which colonial rulers were in power. The unit was used in weighing tea, and is the origin of the word *caddy* as a container for tea. The question that comes to my mind is, why would the colonists bother to invent a system different to what they used in their homelands? My guess is that it was an adaption of a local system, and so one that the indigenous traders could easily accept and understand. But there is one other possible variant to this explanation. The kati was equal to 16 tahils (or taels), and the coincidence with there being 16 ounces in a pound suggests that the tahil was the local measure and the kati was just a familiar multiple of it. You can take your pick of explanation, or even come up with your own. As always, I would be pleased to hear from anyone who has their own ideas.

Fanega

We in English-speaking countries tend to think that prior to the metric system, the world used the Imperial units. In fact colonial powers other than Britain had their own systems that they also transported to their colonies. The *Fanega* is a volumetric measure originally used in Spain and Portugal, and adopted by some of their colonies in South America. In Spain it was principally a dry measure (such for corn), but was also used for liquid measures elsewhere. The name derives from an Arabic word for a large sack, so it probably was initially used only for dry goods. As we have noted with other quantities of bygone eras, the exact values could vary from country to country:

1 Spanish fanega = 12 Spanish almudes = 48 cuartillos = 55.5 L

1 Portugese fanega = 3.315 Portugese almudes = 16 quartos = 55.364 L

1 Argentinian fanega = 137 L

But this story is not yet complete. The name *fanega* was also used for a unit of land area on the Iberian Peninsular, and again this unit diverged in value at different locations.

1 Spanish fanega = 6,400 m^2

1 Peruvian fanega = 6,536 m^2

1 Mexican fanega = 35,600 m^2

You have to wonder how a unit progresses from a value of 6,400 to 35,600 don't you?

Amagat

All old measurement units seem to have been developed either for trading, or agriculture or for building. This unit is perhaps a sign of the new era in civilisation, because it was invented by scientists for scientific work, and was named in honour of Dutch physicist E.H. Amagat (1841-1915). Principally it was used to specify the density of a gas in moles per litre at standard conditions of 0°C and 760 mm of mercury pressure. But it was also as a unit of volume of a gas, with 1 amagat equal to the volume occupied by 1 mole of the gas at the above standard conditions of temperature and pressure. If your mind can stretch back to your high-school chemistry you will recall that for that non-existent ideal gas, this would be 22.4 litres. To me this use of two different definitions is shamefully messy for scientists, and I trust that the unit has met the oblivion it deserves.

Erlang

Here we have another unit invented for non-traditional applications, and a very up-to-date activity, namely telecommunications. It is equal to the number of telephone calls that pass through an exchange per hour, multiplied by the average duration of the calls. A little thought will show that the number of erlangs over a given period is the total call-time for that period., and was (or is), probably used to used to indicate the volume of call traffic relative to the maximum capacity of the facility.

Eotvos unit

This is yet another unit invented by science. It expresses the gradient of the gravitational field across the surface of the earth, that is, it is used to give the rate of change of gravity with distance. The magnitude is:

1 eotvos unit = 10^{-9} galileo per cm

One galileo (abbreviated as gal) is an acceleration of 1 cm per second per second (1 cm s^{-2}). The unit was named in honour of Baron Roland Eotvos, the Hungarian physicist who invented the torsion balance, a device that enabled the measurement of the miniscule forces detected by a gravity meter. Many years ago in my early career I worked briefly for an oil exploration company processing gravity survey results, and I do not remember this unit being used. Maps I recall were hand-drawn in contours of milligals by a gum-chewing Canadian called Andy.

Fahrenheit scale

This scale was invented by Daniel Fahrenheit, a physicist who was born in Poland, worked in Holland and Germany and died in Holland. He invented the sealed glass thermometer, initially containing alcohol (1709), then mercury (1714), instruments that became universally used for 300 years. The scale took as zero the temperature of an equal mixture of salt and water, assigned 32°F to the freezing point of pure water and 96°F to body temperature. But how did he choose these numbers? And how is it that body temperature is actually about 98°F? We will have a look at this in the next issue.

And finally the Trick question: *Who invented the Celsius temperature scale that we use today?* The trick is in the phrase, "that we use today".

In 1742 Swedish astronomer Anders Celsius described a thermometer in a paper read before the Swedish Academy of Sciences, in which the freezing point of water was 100 degrees, and the boiling point zero degrees. Two scientists are credited with inverting the scale: first Christin of Lyon, then later but independently Märten Strömer of Upsala. So it was in a sense a shared development. But while Celsius deserves the credit for suggesting the vital property of the reliable fixed-points of ice and steam to anchor the scale to and the decimal interval between them, it is Christin and Strömer who invented the scale we have now.

In the next issue we will look at the following units.

tonelada

picul

ephah

oitavo

bath

tog

tex

And some questions to ponder on.

Why is that as the diameter of a wire becomes smaller, the wire gauge goes up, not down?

What is the origin of the DL envelope size?

In the last issue the symbol °R was used for the Rankine scale of temperature. What other unit has also used the same symbol?

What is epagomenal time?

If you were looking at a shock of objects, what would you be looking at?

And finally, what quantity is represented by the unit, the *pond*?

■

Riverbank Reflections 3

Ron Cook

It's pelting down - beautiful rain. Of course getting out the rod and casting a line is out of the question so I'll just take in the spectacle for a few minutes. The water's muddy and rising after a long dry spell covering the sandy banks and a few surviving stalky tussocks. The muddy water reminds me of an email I received recently quoting a management "guru". In a nutshell the message was that today's managers must stop managing things and instead manage relationships because today organizations are so flat. It took about 300 words to say this and I had to read it several times to see if I'd missed anything or even if it really was serious. The waters were certainly muddied by rhetoric, but there was a message in there. Is it a reasonable message?

If you have ever been to a management training course you will be told about the importance of managing relationships, so it's a rework of an old message. You will also be told that your level of management has the toughest job, but this course will offer you a great array of tools to cope. (Part of a confidence building process. And all managers need a regular boost of confidence in order to keep getting out of bed each day). You will also be told that managing a budget is easier than managing a team of people. Unlike the guru's message you won't be told to dismiss the importance of the budget and other administrative activities. It should be obvious that you need an administrative structure for any organization to survive. As a manager you will be accountable for some of the income and expenditure and ultimately perhaps the viability of the business. In the old days there were people to carry out most of the support activities and administrative work. But today, in the "flat" organization, technical staff do their own support work such as making their own travel arrangements, typing, mailing and filing their own reports They make out their own promotion cases, look after the reference library, buy their own supplies, answer the front door and so on. If they sign off on any expenditure then they almost certainly have the word "manager" in their job title even if they have no subordinates. Any competent technical person can master all these activities and there are countless courses to learn about things such as accrual accounting. In addition to the system tasks already mentioned the manager also has to maintain a quality system, an OH&S system, plus carry out complex technical work that he or she might have thought was the core activity. No time to do anything else? They need all the help they can get.

All managers have to manage relationships, and if a middle level manager he or she has to manage other staff and look after customer relationships.

While the management of things has changed remarkably as we moved on from clay tablets to quills to Microsoft Office, the management of people hasn't changed much and we can all learn to be competent people managers. That's the good news. There have been kilotons of texts written on "new" management methods and techniques, but the ancient Babylonians, Egyptians and Romans knew them all. Rumor has it there is a papyrus describing with the Seven Habits of Effective Pharos and a set of clay tablets described how the aspiring Babylonian astronomer should apply for grants from the king. The US Cavalry of 200 years ago were famous for their execution of the "Just in Time" technique. If you were going to encapsulate all the golden rules of management into one sentence then it would be this. Treat others as you would like them to treat you. Following on from that the next important activity of a manager is to communicate clearly to his management and his clients and if he has any, his support staff.

Fair dealing and clearly stating what you need doing will carry you a long way. Management by objectives, empowerment of staff, inclusivism, all these are in essence the same old principle in different clothes.

The most popular management courses are probably the ones with a title like "Dealing with Difficult People". The premise is that you can always convert into productive co-operative people all those of the ilk of the recalcitrant, the disruptive, the work-shy, the chatterbox, the inventive genius, the my way's the only way and other difficult or dysfunctional persons. As far as I can tell none of the famous leaders, rulers and managers were totally successful in that. Even the prospect of facing the Inquisition or the firing squad (the stick) or being offered the position of Governor (the carrot) won't change the nature or behavior of everyone. Appeasement at best buys some time but doesn't solve the problem, as Mr. Chamberlain (one time Prime Minister of England) could attest. So what are the options? How do you get some clarity in the muddied waters? Communicating what you as see as appropriate actions and behavior and listening to the response has to be a very good start.

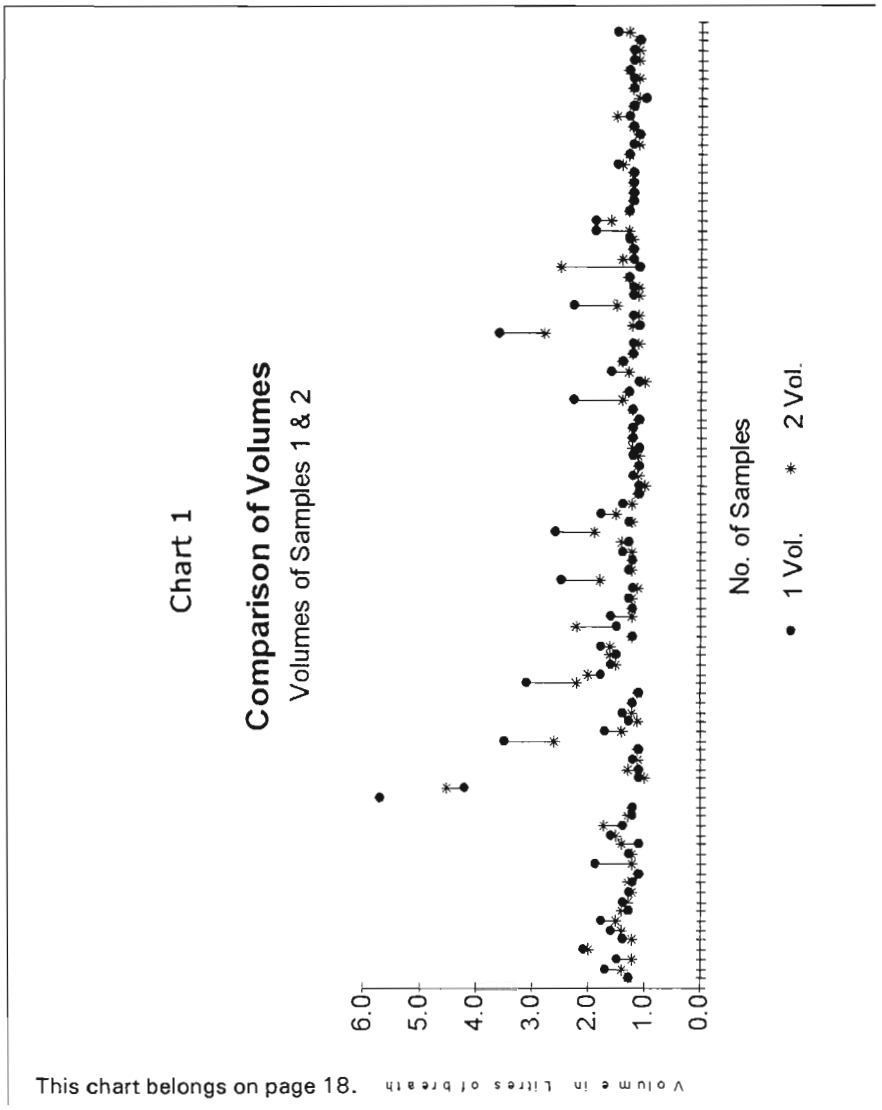
If a person has become "difficult" the interpersonal relationships may have already been damaged. That is a recoverable situation if acted upon quickly and is one instance where the "do nothing" rule will lead to bigger problems. If the wrong person was selected for the job then action is again called for. Of course the person might be suited for their role but lack some specific knowledge or guidance. Eliciting this information can be difficult if you have been preaching self reliance and high levels of achievement as your expectations. In larger organizations a more appropriate job may exist but if after say three attempts by both parties to reach an acceptable outcome then you should "present the person with the opportunity to move on". Not to do so would be non- productive for both parties.

Simple principles, but people with a technical background will always want some rules to guide them. Well that's just why people are out there offering courses. They will make even the muddiest of waters crystal clear. Or so they say. Can you learn for free without taking 40 years to discover the answers? Maybe. I was told in my youth that all young engineers should select a role model and emulate them. Initially I could find no one I could say was a person that I wanted to be like. I did find lots of managers I didn't want to be like and unfortunately added some of their behavior to mine. Things that seemed smart or gave a short term payoff had bad long term effects. Nevertheless, knowing what not to do is a help. The best model of bad office and management behavior around today is the Dilbert comic strip. Of course it's written to amuse and is exaggerated, however, the behavior of the characters is a reflection of the actual behavior of many managers and amply illustrates what not to do.

Why is the flatness of an organization relevant? Simply that without the support staff we are all very reliant on each other and without high levels of co-operation we won't be able to adequately do our jobs. You get the best co-operation if have good relationships. So management of relationships is really important, but the management of "things" is also indispensable. It's similar to standing up in a small boat, balance is important.

It's time to get out of here before the road becomes impassable. Talk to you again later.

■

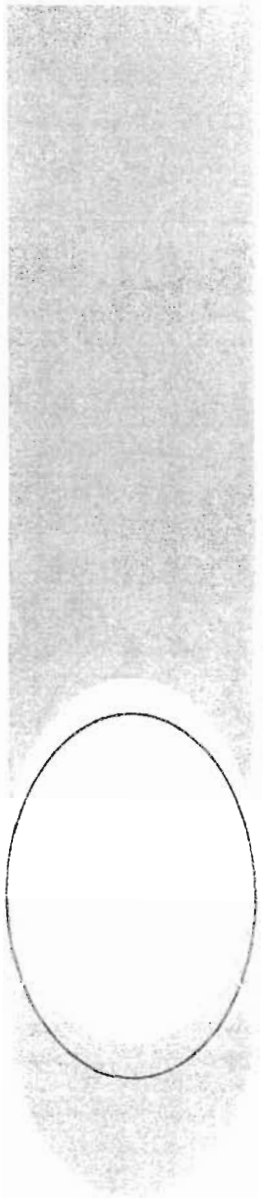


This chart belongs on page 18.

New Legislation for Breath Analysis in South Australia Part 1

Richard Laslett APM

The two articles were previously published in the Newsletter of the International Association of Chemical Testing, Vol 15 No 3 December 2004 and Vol 16 No 1 March 2005.



Key Words: Breath Analysis; Breath Samples; Drager Alcotest 7110 Mk V; BrAC; Duplicate breath samples

Part 1 of this study describes the instrument used in South Australia as the Drager Alcotest 7110, MkV. Strict procedures were used in the calibration of the instrument to comply with the requirements of the National Association Testing Authorities (NATA). A certified dry gas standard was used to verify the calibration of the instrument. All calibrations are carried out using a Drager "fish tank" calibrator. All calibrations must be the actual SAS value ±0.001%. The new legislation requires two breath samples to be taken from subjects using an evidential breath analyzing instrument approved pursuant to the Road Traffic Act, 1961. The legislation requires the second result must be within the criteria of ± 15% of the first result. The second sample must be taken between two and ten minutes after the first sample has been provided. The legislation came into affect May 2002. All evidential breath testing is conducted by trained breath analysis operators who are authorised by the Commissioner of Police in accordance with the Road Traffic Act. Testing can be undertaken either at the scene or at a police station. Once a person is required to undergo a breath analysis, a waiting period of at least 15 minutes is required before a breath sample can be taken. The breath analysis must be started within 2 hours of the occurrence of the event.

Introduction

Breath testing of drivers of motor vehicles is carried out in South Australia by South Australia Police (SAPOL). The testing can be as a result of the driver committing a driving offence of which the driving of the motor vehicle is an element of the offence, having been involved in a crash or where random breath testing (RBT) is in process.

South Australia covers an area of 984,381 km^2, with a population of about 1.7 million people, the majority of which reside within the Adelaide metropolitan area. At the time of writing there were 92 Drager Alcotest 7110 instruments. Adelaide and the metropolitan area have the most instruments, with the remainder being in the country. The most distant police stations with an instrument are Marla (1100 km north of Adelaide) and Penong (1000 km west of Adelaide). Other stations to the northeast, southeast and Riverland are 300 to 600 km away.

Prior to 1995, SAPOL had a Breath Analysis Section, but since that date SAPOL does not have a dedicated group to conduct evidential breath tests. Training is carried out by nationally accredited personnel, experienced in breath analysis.

Drivers who are required to submit to a breath test are firstly required to supply a sample of breath into a screening device. This is a small hand held instrument (Lion Alcolmeter SD400) which uses an electro-chemical cell to determine whether the person has the prescribed concentration of alcohol present in the blood.

Should the driver record a positive result (0.050 or more grams of alcohol in 210 litres of breath) then that person is required to supply a sample of breath for analysis into an evidential breath analysis instrument. The driver has a right to a blood sample and the driver must obtain a blood sample if that person wishes to contest the breath test. The breath analysis operator must give the driver blood rights where the prescribed concentration of alcohol is reached or exceeded.

Prescribed concentration for South Australia is zero grams of alcohol in 210 litres of breath for certain classes of drivers e.g., Learner, Probationary drivers, unlicensed, disqualified, drivers of heavy vehicles and certain specialized drivers.

In May 2002 the Road Traffic Act[1] [2] was amended to allow for the taking of two breath samples from a person in relation to a drink driving offence. The legislation that is set out below requires a person to supply two breath samples for analysis into a breath analysing instrument, with the second sample being provided between two to ten minutes after the first sample was provided. The second breath result must be within ±15% of the first breath result. The lower of the two results is the subject's breath alcohol concentration.

The minimum breath sample provided by the subject must be 1 litre of breath. Prior to the change in the legislation, there was no legislative requirement as to the volume of the breath

sample. Police had the instruments programmed to accept 1.5 litres of breath and if that was not achieved, the operator was able to override the 1.5 litres of breath and the instrument would accept 600ml or more of breath. This method of sampling has been cancelled and all instruments now operate on the sample minimum being 1 litre or more of breath to comply with the legislation and with National Standards Commission standard for Evidential Breath Analysers[3]

Also to comply with National Standards Commission standard for Evidential Breath Analysers[4], the breath analysis result was amended from grams of alcohol in 100 millilitres of blood to grams of alcohol in 210 litres of breath. The minimum breath sample required being one litre.

Instrumentation

Currently SAPOL has 51 Drager Alcotest 7110 Mk V instruments, and 43 Drager Alcotest 7110 Mk II instruments. The Drager Alcotest 7110 Mk V instrument has an electrochemical cell to check the infrared breath analysis result. The result from the infrared analysis is used for evidential result. The instrument is programmed to comply with the legislative requirements.

The data used in this paper refers only to the Drager Alcotest 7110 Mk V instrument.

Calibration

All instruments are re-calibrated after service/repair.

The calibration of instruments is in accordance with NATA requirements set out in the Laboratory Quality Manual and Procedures manuals. The South Australia Police (SAPOL) laboratory is an accredited NATA[5] laboratory for chemical and electrical testing.

The Standard Alcohol Solution (SAS) for the calibrator is obtained from State Forensic Science and is stated to be 0.100% ±ð 0.003%.

A Drager "Fish Tank" calibrator is used for the wet gas calibration. This instrument contains a large water bath of approximately 70 litres of water that is heated to 34°ðC ±ð0.5°ðC. Several layers of copper tubing run around the inside of the tank. Breathing air in a cylinder and regulator is attached to this tubing. The outlet of the copper tubing is attached to three 1L flasks in series that are surrounded by the 34°ðC water. These flasks each contain 500 mL of SAS. A magnetic stirrer is in each flask. Air from the gas bottle is passed through the copper tubing and heated to 34°ðC and from there through each flask. The heating is electronically controlled and a certified mercury in glass thermometer monitors the temperature. (Regulation 13 Certificate, National Measurement Act – Commonwealth of Australia).

The dry ethanol gas standard (260.5ppm ±5ppm of ethanol, remainder nitrogen) is used directly after the instrument has been calibrated in the calibration mode with five samples of 0.100% ethanol gas from the Drager Calibrator.[6]

The dry ethanol gas standard is supplied with a NATA certificate and is stable for a 36 month period.

To verify the Drager 7110 calibration, five samples in the calibration mode of dry ethanol gas samples are passed through the instrument and measured. This is carried out in the calibration mode of the instrument. Barometric pressure is taken prior to the dry gas standard being used.

Quality Assurance ethanol solutions also used prior to the instrument being certified for use in the field.

In the field, the instrument is not checked by an alcohol solution between the 6 monthly service/calibration procedures. This has been the case since the instruments were introduced in 1987, as it was determined that the instrument would make full use of technology. The self-check functions of the instrument are relied upon, and are accepted by the Courts.

Legislation

Concentration of alcohol in breath taken to indicate concentration of alcohol in blood

47EA. Where a person submits to an alcotest or a breath analysis and the alcotest apparatus or the breath analysing instrument produces a reading in terms of a number of grams of alcohol in 210 litres of the person's breath, the reading will, for the purposes of this Act and any other Act, be taken to be that number of grams of alcohol in 100 millilitres of the person's blood.

(2e) The regulations may prescribe the manner in which an alcotest or breath analysis is to be conducted and may, for example, require that more than one sample of breath is to be provided for testing or analysis and, in such a case, specify which reading of the apparatus or instrument will be taken to be the result of the alcotest or breath analysis for the purposes of this and any other Act.

Conduct of breath analysis

8A. (1) Pursuant to section 47E(2e), where a person submits to a breath analysis, the breath analysis must be conducted in the following manner:

(a) the person must provide two separate samples of breath for analysis; and

(b) each sample must be provided in accordance with the directions of the operator of the breath analysing instrument and must consist of not less than one litre of breath; and

(c) there must be an interval of not less than two minutes and not more than 10 minutes between the provision of the samples.

(2) Despite sub-regulation (1)—

(a) if, on analysing a sample of breath, the breath analysing instrument indicates an error in the analysis of the sample—

(i) that sample, or, if that sample was the second sample provided, both samples, must be disregarded; and

(ii) the person may be required to provide two further samples of breath for analysis using a different instrument (and such

samples must be provided in accordance with sub-regulation (1)*(b)* and *(c)*; or

(b) if, on analysing a sample of breath, the breath analysing instrument indicates the presence of alcohol in the mouth of the person—

(i) that sample, or, if that sample was the second sample provided, both samples, must be disregarded; and

(ii) the person may be required to provide two further samples of breath for analysis (and such samples must be provided in accordance with sub-regulation (1)*(b)* and *(c)*); or

(c) if, on analysing two samples of breath, the breath analysing instrument indicates that the reading obtained on analysis of the second sample was more than 15% higher or lower than the reading obtained on analysis of the first sample—

(i) those samples must be disregarded; and

(ii) the person may be required to provide two further samples of breath for analysis (and such samples must be provided in accordance with sub-regulation (1)*(b)* and *(c)*); or

(d) if, for any reason, a second sample of breath is not provided within 10 minutes of the provision of the first sample—

(i) the first sample is to be disregarded; and

(ii) the person may be required to provide two further samples of breath for analysis (and such samples must be provided in accordance with sub-regulation (1)*(b)* and *(c)*).

(3) Where a person submits to a breath analysis, the result of the breath analysis will, for the purposes of the *Road Traffic Act 1961* and any other Act, be taken to be the reading produced by the breath analysing instrument, on analysis of the samples of breath provided by the person in accordance with this regulation, that indicates the lower concentration of alcohol in the person's breath (not taking into account any samples that, in accordance with this regulation, are to be disregarded).

Field Sampling Procedures

All evidential breath testing is conducted by trained breath analysis operators who are authorised by the Commissioner of Police in accordance with the Road Traffic Act.

Operators are trained to take breath samples by requiring the subject to take in as much breath as possible and then to exhale continuously through the mouthpiece attached to the breath analysing instrument. Operators are trained to encourage the subject to keep supplying the sample until told to stop.[7]

Testing can be undertaken either at the scene or at a police station.

Once a person is required to undergo a breath analysis, a waiting period of at least 15 minutes is required before a breath sample can be taken. A second sample must be supplied between 2 to 10 minutes after the first sample has been provided. The Drager Alcotest 7110 MkV is programmed to wait for 2 minutes after the first sample and to time out after the expiration of 10 minutes. Operators are to attempt get sample volumes of similar capacity.

Where a subject does not supply a breath sample of 1 litre or more, or refuses to supply samples for analysis, the operator informs that person of their obligations and rights. On failing to supply or refusing to supply again, then an offence occurs and that person is charged with the appropriate offence.

[1] Road Traffic Act, 1961.

[2] Joint Legal, Policing and Scientific Committee on Drink Driving Legislation Reform Sth Aust 1998

[3] National Standards Commission: NSC R-126 Standard for Evidential Breath Analysers.

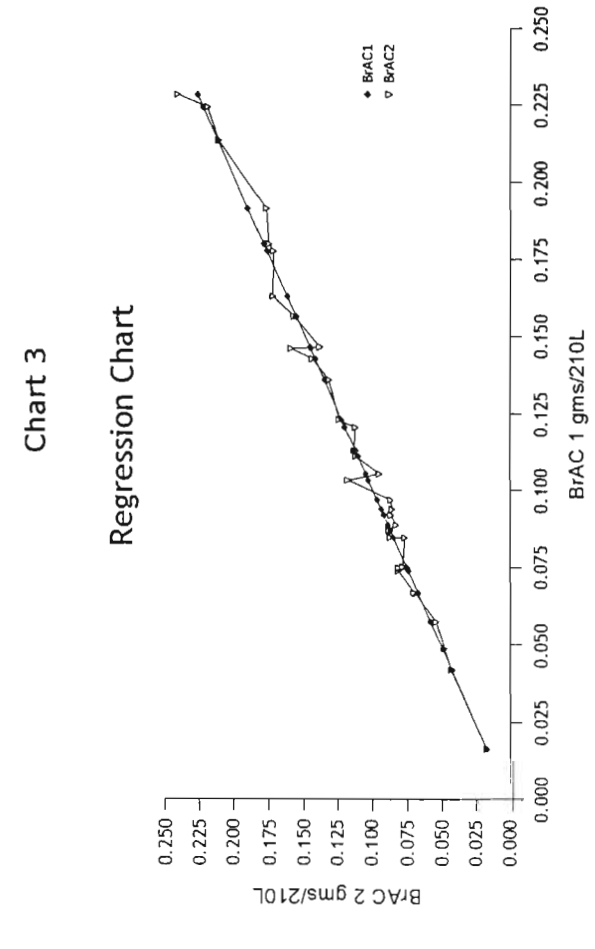
[4] National Standards Commission: NSC R-126 Standard for Evidential Breath Analysers.

[5] National Association of Testing Authorities.

[6] R.Laslett: Dry Ethanol Gas Standard to Verify the Wet Ethanol Gas Calibration on the Drager Alcotest 7110, Mk V; The Australian Metrologist, No. 28, September 2002.

[7] Crockett, Schembri, Smith, Laslett, Alpers: Minimum respiratory function for breath alcohol testing in South Australia; Journal of the Forensic Science Society, 1992.

Chart belongs on page 18



New Legislation for Breath Analysis in South Australia
Part 2

Key Words: Breath Analysis; Breath Samples; Drager Alcotest 7110 Mk V; BrAC; Duplicate breath samples

Part 1 of this article described the breath alcohol testing programme in South Australia and the introduction of new legislation requiring duplicate breath samples.

Part 2 of the study relates to the analysis of the data obtained from 1671 persons who had been tested by Police for drink driving offences. The mean difference between duplicate samples was 0.0045 grams of alcohol in 210 litres of breath (g/210L) with of standard deviation of 0.0047. The mean volume of breath for the first sample was 1.5 litres and 1.4 litres for the second sample. The differences between the first sample and the second sample were 0.000 to 0.0308 g/210L. Of the 1671 persons tested, 54 (3.23%) refused to supply any sample. 31 (1.86%) failed to provide a sample of 1litre or more of breath for analysis. 33 second samples did not comply with the ± 15% criteria; however, 8 of those samples were as a result of large differences between the sample volumes. All 33 were retested and subsequently complied with the criteria. The failure rate between 0.020 and 0.049 (n = 161) is nil. The failure rate where the BrAC is > 0.050 (n = 1335) is 1.87% with a standard deviation of 0.007. 90 subjects were less than 0.020 g/210L. The mean time between samples was 3 minutes. Duplicate breath samples can be successfully obtained on a Drager Alcotest 7110 Mk V instrument coupled with strict breath sampling procedures, calibration procedures and a good quality assurance programme.

Introduction

An application was made to the South Australian Commissioner of Police setting out the objectives and a request for data collected in the Drager Alcotest 7110 MkV instruments to be downloaded and analysed.

The analysed data was used to determine the effectiveness of the police breath analysis operators in obtaining duplicate breath samples in accordance with the legislation and also whether or not the instrument's analysis of Sample 2 would be closely correlated to Sample 1. A random number selection was used to obtain data for the linear regression model and once completed the standard error of the estimate was calculated to measure the variability around the line of regression. Finally, a determination was made whether a significant relationship between the variables existed by testing whether β_1 (the true slope) is equal to zero.

Results

Sample of data downloaded from Drager Alcotest 7110 Mk V is given in Table 1.

The data was obtained from six of the fifty one Drager Alcotest 7110 Mk V instruments used in South Australia over a 5 month period. A total of 1671 persons who had been tested by Police for drink driving offences were analysed. The mean difference between duplicate samples was 0.0045 grams of alcohol in 210 litres of breath (g/210L) with of standard deviation of 0.0047. The differences between the first sample and the second sample ranged from 0.000 to 0.0308 g/210L. Of the 1671 persons tested, 54 (3.23 percent) refused to supply any samples for analysis, 31 (1.86 percent) failed to provide a sample of 1 litre or more of breath for analysis. Thirty three second samples did not comply with the ± 15% criteria; however, 8 of those samples were as a result of large differences between the sample volumes. All 33 were retested in accordance with standard Police protocol and subsequently complied with the criteria. The failure rate for providing compliant duplicate samples between 0.020 and 0.049 (n = 161) is nil. The failure rate where the breath alcohol concentration was > 0.050 (n = 1335) was 1.87 percent with a standard deviation of 0.007. 90 subjects were less than 0.020 g/210L. See chart 1.

The mean volume of breath for Sample 1 was 1.5 litres and the mean volume of breath for Sample 2 was 1.4 litres.

In relation to the breath results, on 116 occasions Result 1 and Result 2 were the same, Result 1 were greater than Result 2 on 732 occasions and Result 1 were less than Result 2 on 662 occasions.

Of the 1510 breath samples analysed, 494 samples were of the same volume, 697 first samples were greater than the second sample and 319 second samples were greater than the first sample. See Table 2.

Table 3 breaks the data further into sections showing the various results from the different combinations available.

Chart 2 shows the result that is given to the subject (i.e. the lower of the two analyses) compared to the difference between the first and second breath analysis results.

Chart 3 shows the first breath result plotted against the second breath result.

For the linear regression model, the data in Table 1 were used. In these calculations Y = 2nd BrAC and X = 1st BrAC.

Equations (1) and (2) were used to compute the values of b_o and b_i: where the Y intercept (b_o) and the slope (b_i) can be used as estimates of the respective parameters (β_0 and β_1). β_0 = the true Y intercept of the sample and β_1 = the true slope.

Equation 1

$$b_i = \frac{n\sum_{i=1}^{n} X_i Y_i - \left(\sum_{i=1}^{n} X_i\right)\left(\sum_{i=1}^{n} Y_i\right)}{n\sum_{i=1}^{n} X_i^2 - \left(\sum_{i=1}^{n} X_i\right)^2}$$

Equation 2

$$b_0 = \overline{Y} - b_i \overline{X}$$

Thus the equation for the "best" straight line for these data:

Equation 3

$$\hat{Y}_i = b_o + b_1 X_1$$

As the regression line serves only as an approximate predictor of a Y value for a given value of X the standard error of the estimate was calculated to measure the variability around the line of regression.

Equation 4

$$S_{YX} = \sqrt{\frac{\sum_{i=1}^{n}\left(Y_1 - \hat{Y}\right)^2}{n-2}}$$

$S_{YX} = \pm 0.0069$

The coefficient of determination (r^2) is 0.983. The closeness of the correlation coefficient to + 1.0 implies a strong association between the two samples.

Finally, the Student's t-test was used to determine whether a significant relationship exists between the first and second BrAC's between by testing whether β_1 (the true slope) is equal to zero. The hypothesis test of the slope is at the 0.05 level of significance with 34 degrees of freedom.

H_0: $\beta_1 = 0$ (there is no relationship)

H_1: $\beta_1 \neq 0$ (there is a relationship)

Equation 5

$$t_{n-2} = \frac{b_1 - \beta_1}{S_{b1}} = 44.924$$

S_{b1} = the standard deviation of the sample slope (b_1).

In Equation 5, since 44.924 > 2.0322, H_0 is rejected and there is a significant linear relationship between the two samples.

Conclusion

Duplicate breath samples can be successfully obtained on a Drager Alcotest 7110 Mk V instrument coupled with strict training and breath sampling procedures.

The result of the second sample when compared with the result of the first sample is shown to be significantly the same.

Legislation must be workable and easily understood by police.

Calibration procedures must be strictly adhered to and incorporate checks developed to ensure that the wet ethanol gas calibration is traceable to a certified ethanol gas standard (i.e. a NATA certified dry ethanol gas standard). Procedures set out in the NATA Laboratory Quality Control and Calibration Manuals to be strictly adhered to. Quality control records and charts must be maintained so that trends can be identified and corrected. Without these procedures in place the integrity of the calibration laboratory becomes questionable and court proceedings jeopardized. Public faith in breath testing is also put at risk.

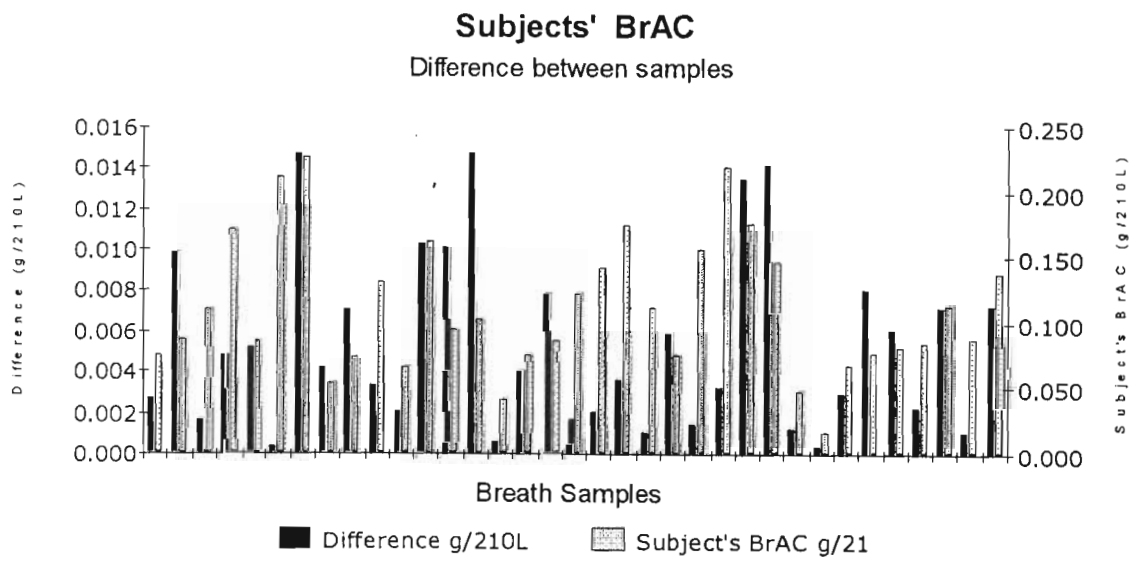
Acknowledgement

The author thanks the Commissioner of South Australia Police, Mr. M.A. Hyde APM for kindly giving permission to use data from instruments.

Line to follow Equation 2:

$$\sum X_i = 4.83, \sum Y_i = 4.0797, \sum X_i^2 = 0.5573, \sum X_i Y_i = 0.094216, n = 36, b_i = 1.0081$$
$$b_0 = -0.001013$$

Chart 2



Sample of data downloaded from Drager Alcotest 7110 Mk V

Table 1

Vol 1[1]	IR 1[2]	EC 1[3]	Vol 2[4]	IR 2[5]	EC 2[6]	Reported Result[7]
1.7L.	0.0756	0.0747	1.4L.	0.0783	0.0787	0.075
1.5L.	0.0970	0.0989	1.2L.	0.0871	0.0886	0.087
2.1L.	0.1110	0.1136	2.0L.	0.1127	0.1142	0.111
1.4L.	0.1770	0.1785	1.2L.	0.1722	0.1747	0.172
1.6L.	0.0921	0.0942	1.4L.	0.0869	0.0888	0.086
1.8L.	0.2127	0.2135	1.5L.	0.2123	0.2146	0.212
1.3L.	0.2274	0.2299	1.4L.	0.2421	0.2452	0.227
1.4L.	0.0579	0.0571	1.3L.	0.0537	0.0539	0.053
1.3L.	0.0743	0.0726	1.2L.	0.0814	0.0798	0.074
1.2L.	0.1356	0.1369	1.3L.	0.1323	0.1350	0.132
1.1L.	0.0669	0.0674	1.1L.	0.0690	0.0684	0.066
1.9L.	0.1625	0.1629	1.2L.	0.1728	0.1768	0.162
1.3L.	0.1054	0.1075	1.2L.	0.0953	0.0963	0.095
1.1L.	0.1033	0.1045	1.4L.	0.1180	0.1192	0.103
1.6L.	0.0424	0.0422	1.5L.	0.0430	0.0426	0.042
1.4L.	0.0751	0.0774	1.7L.	0.0791	0.0806	0.075
1.2L.	0.0940	0.0949	1.3L.	0.0861	0.0869	0.086
1.2L.	0.1228	0.1245	1.2L.	0.1245	0.1266	0.122
5.7L.	0.1423	0.1449	5.7L.	0.1444	0.1484	0.142
4.2L.	0.1793	0.1841	4.5L.	0.1757	0.1812	0.175
1.1L.	0.1129	0.1136	1.0L.	0.1140	0.1159	0.112
1.1L.	0.0753	0.0753	1.3L.	0.0812	0.0793	0.075
1.2L.	0.1560	0.1570	1.1L.	0.1575	0.1585	0.156
1.1L.	0.2234	0.2234	1.1L.	0.2202	0.2211	0.220
3.5L.	0.1908	0.1948	2.6L.	0.1774	0.1810	0.177
1.7L.	0.1457	0.1465	1.4L.	0.1598	0.1606	0.145
1.3L.	0.0493	0.0483	1.1L.	0.0480	0.0485	0.048
1.4L.	0.0172	0.0172	1.5L.	0.0176	0.0172	0.017
1.2L.	0.0672	0.0669	1.2L.	0.0701	0.0703	0.067
1.1L.	0.0850	0.0850	1.1L.	0.0770	0.0762	0.077
3.1L.	0.0890	0.0909	2.2L.	0.0829	0.0848	0.082
1.8L.	0.0850	0.0863	2.0L.	0.0873	0.0890	0.085
1.6L.	0.1203	0.1215	1.5L.	0.1131	0.1150	0.113
1.5L.	0.0873	0.0877	1.6L.	0.0884	0.0890	0.087
1.8L.	0.1461	0.1470	1.6L.	0.1388	0.1383	0.138

[1] Volume of first breath sample.
[2] First infrared analysis.
[3] First EC cell analysis.
[4] Volume of second breath sample.
[5] Second infrared analysis.
[6] Second EC cell analysis.
[7] Result given to subject.

Table 2

BrAC1=BrAC2	BrAC1>BrAC2	BrAC1<BrAC2	Vol 1=Vol 2	Vol 1>Vol 2	Vol 1<Vol 2
116	732	662	495	695	320

Table 3

	Breath 1 = Breath 2	Breath 1 > Breath 2	Breath 1 < Breath 2
Volume 1 = Volume 2	51	216	228
Volume 1 > Volume 2	33	383	279
Volume 1 < Volume 2	32	133	155