

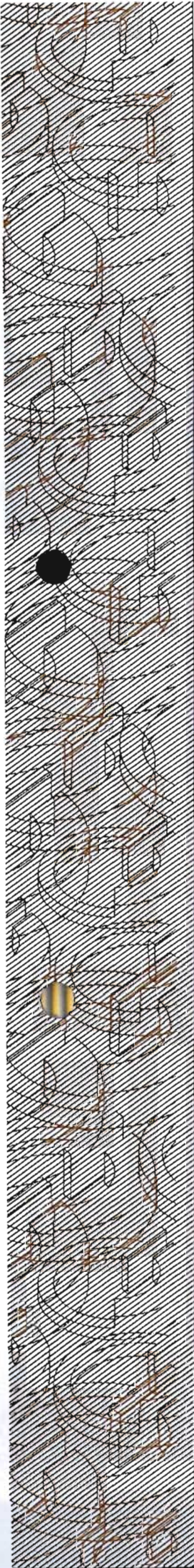
THE AUSTRALIAN METROLOGIST

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Pre-AGM Issue



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.

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All editorial copy should be sent to the editor by the middle of the month prior to publication. Please check with the editor regarding preferred layout (font, size, etc) and any included diagrams or photos.

Further information regarding the Metrology Society of Australia may be found on the Information Page.

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From the Editor

With the Annual general Meeting of the MSA coming up you will find various items relating to that in this issue.

There is also the usual *pot-pourri* of articles covering the activities of a metrologist - I trust you will find some items of interest to you.

You are invited to think about the next biennial conference of the MSA, which will be held not next year but in early 2004. Included in this issue is a discussion by the Victorian group on the focus topic of "Value". Perhaps you would like to be a participant in the next conference.

Your feedback on the TAM content is always appreciated, as it helps us focus on what you the collective membership want.

Letters to the Editor on appropriate subjects are always welcome.

- Maurie Hooper

2001/02 Advertising Rates for The Australian Metrologist

Space	One issue	Two issues	Three/Four
A4 page	issue	issues	issues
Full page	\$400	\$750	\$1050
1/2 page	\$225	\$425	\$600
1/3 page	\$150	\$130	\$400
1/4 page	\$115	\$215	\$290
1/8 page	\$ 60	\$110	\$150
Colour			
Full page	\$800	\$1,500	\$2,100

Closing date for copy to be received for TAM is the 16th of the month preceding publication.

Contact the TAM editor for further details.

Please note: Camera ready artwork is to be supplied. Size and specifications are available from the editor. If extra typesetting etc is required an extra charge will apply. MSA members receive a 10% discount when they place advertisements in TAM.

From the President

Valuing Metrology

"Stop the world I want to get off"

"I never seem to have time for the things that are really important"

"I'm always doing paperwork! There's no time for real work."

"Why are we wasting our time on this political clap-trap when we should be doing ..."

"If only senior management understood the pressure we are under."

"We used to have 5 people doing this work now it's just me and Fred!"

"The accountants seem to run this place and they don't have the vaguest idea what we do."

"I think what you are suggesting is really a good idea and I'd love to help if only I had the time."

Over the past year I have been encountering these same complaints from friends and colleagues about life, whether it is to do with family, work or in our extra curricular activities. There is a level of frustration in the people I encounter that they don't seem to be able to find the energy or time to tackle what is important to them, what they **VALUE**.

Before you leap to the conclusion that either I want more of your time (which, while I do, is not the reason for this monologue) or possibly that I am the source of the frustration (often true but not in this case), I will set your mind at rest. This is an introduction to the topic for the next MSA conference in 2004, will look at the topic of **VALUE** with a focus on metrology.

While we may each personally value what we do and think it is of significant value to others, often the people around us or above don't share our passion. It is obvious that the resources to do the work we do are reducing every day and the focus is shifting to "core business" and away from services. This has led to a marked decrease in the number and in some cases the quality of in-house metrology laboratories, the funds available for research and development, a significant increase in outsourcing, and most importantly a reduction in the time available to add real **VALUE** to the organisations we work in, the science of metrology and the general society.

This topic is intended to broaden the scope of the conference and take a good hard look at ourselves - the way we work, what we do, including the science. We want to look at what and how we do our metrology, including the science, new methods and instruments, uncertainty etc. However, we also want to open the

discussion to the "why", and ask the hard and sometimes controversial questions. What do uncertainty budgets and quality systems add to the value of the work we do? Why is metrology often an afterthought in the operation of an organisation? Should and can we reverse the 'bean counter' trend in minimising the value metrology brings to the economy and society? It is intended that as well as bringing people up to date with the latest technology we can open a debate that will equip us as individuals and a society to take control of the destiny of metrology in the workplace and in society.

We look forward to everyone's involvement in the conference in 2004. (For those who are observant you will note that the date has been shifted. Instead of holding the conference in a wet and windy Melbourne in October 2003 it has been decided to move the conference to March in 2004 when it is fine and dry. It also removes clashes with other events that were occurring in late 2003 around the country.)

Please, start the debate now; I would be very interested in any discussion you as members could add to this topic. For those in Melbourne the debate has already started with a technical meeting held last month and will continue with a panel discussion at the AGM on 23rd October. I encourage all the Victorian members and anyone who is visiting from interstate to attend this night as it should be quite interesting. I also request that as members you think about what value you can add to the Society through your active participation - there are plenty of ways, attend the local meetings that your State Coordinators organise, they are a great way to extend your network. The National Committee is always looking for people who have a keen interest in Metrology to help, so please consider nominating for the 2003 committee. Also the MSA 2004 Conference organising committee are looking for more people to help, the old adage "the more the merrier" applies here. If these two options are daunting, then the State Coordinators are always looking for help organising events and communicating with the membership. If you feel you have something to contribute, or if you don't but would like to sound out what is involved in any of the committees, then please contact any of the National Committee members or State Coordinators. If you want to be involved in the conference organisation (and you don't have to just be in Victoria to do this) then contact either Jane Warne [J.Warne@bom.gov.au], Randall Anderson at Australian Pressure Laboratory [apl@netspace.net.au], Neville Owen [nowen@optus.home.com.au] or Ron McBain [qualcalserv@optus.net.com.au].

I look forward to hearing your thoughts on "value", and seeing you at the various functions that are planned over the next few months.

- Jane Warne

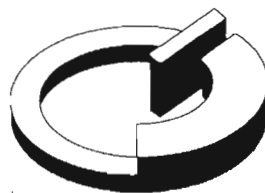


METROLOGY SOCIETY OF AUSTRALIA

Notice of Annual General Meeting

The Annual General Meeting of the Metrology Society of Australia will be held on Wednesday, October 23, 2002, at 6:30 pm at the Monash Science Centre, Monash University, Bldg 74, Normanby Rd. entrance (near Normanby Rd. Roundabout on south side of road).

Following the meeting (see separate call for nominations for National Committee members below), a panel of experts, stakeholders and industry figures will speak to the topic "Can Australia Afford Uncertainty?", and this will be followed by question/answers and discussions with and from the audience, and a light supper.



METROLOGY SOCIETY OF AUSTRALIA

Call for Nominations for Positions on the National Committee

Nominations are called for the following positions on the National Committee of the Metrology Society of Australia.

- (1) Vice President
- (2) Secretary
- (3) Ordinary members (at least 8 to be elected)

The election for these positions will be held at the 2002 Annual General Meeting of the Society, to be held on Wednesday, October 23, 2002, at 6.30 pm at the Monash Science Centre, Monash University, Bldg 74, Normanby Rd. entrance (near Normanby Rd. roundabout on south side of road).

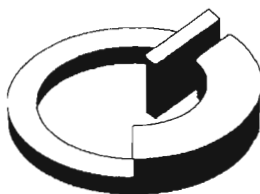
Members are referred to the following section of the Constitution of the Society:

Nominations of candidates for election as officers of the Association or as ordinary members of the Committee: —

- (a) *shall be made in writing, signed by two members of the Association and accompanied by the written consent of the candidate (which may be endorsed on the form of nomination); and*
- (b) *shall be delivered to the Secretary of the Association not less than 7 days before the date fixed for the holding of the annual general meeting.*

Nominations are therefore due to be lodged by 6.30 pm on Wednesday, October 16, 2002 with the Secretary at:

The Secretary, I Budovsky
Metrology Society of Australia
CSIRO National Measurement Laboratory
PO Box 218
Lindfield NSW 2070



METROLOGY SOCIETY OF AUSTRALIA

Nomination Form

To the Secretary
Metrology Society of Australia

We,

_____, Member No _____

and

_____, Member No _____

wish to 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 2002.

Signatures Nominator _____

Seconder _____

I affirm that I am willing to stand as a candidate

Nominee _____

Date _____

You may photocopy this page

AGM MOTIONS

The Treasurer has recommended the following motions be dealt with at the AGM:

1. Fees for 2002/2003 remain as they are:

Associate member	\$35
Full member	\$40
Fellow	\$45
Joining fee is equal to one year's subscription	

2. That Bryce Thornton be elected as Auditor for the Financial Year July 2002 to June 2003.

METROLOGY SOCIETY OF AUSTRALIA

2001 ANNUAL GENERAL MEETING

October 3, 2001

MINUTES

Venue

The meeting was held at the Grand Mercure Hotel at Broadbeach, Queensland as part of the MSA'01 conference. The meeting opened at 6.00 pm.

The following 43 members were present, with Jim Gardner in the chair.

Maurie Hooper, Kim Irving, Horst Sieker, Mary Ryan, Laurie Besley, Glenda Sandars, Carol Sieker, Ian Bentley, Jim Gardner, Tony Collings, David Martin, Noel Bignell, Ron Cook, Xihu Jiang, Gerard de Groot, Randall Anderson, Kim Nguyen, Kitty Fen, Adrian Caster, Alex Smart, Ilya Budovsky, Terry Albury, Geoff Barnier, Marian Haire, Bob Kelly, John Browne, Shane Brann, Grahame Harvey, Brian Pritchard, Ian Kendall, Barry Neville, Tony Jackson, Jana Zeleny, Ruimin Yin, Walter Giardini, Rai Pippia, Barry Inglis, Mark Ballico, Denis Sexton, Brian Phillips, Milutin Arnautovich, Lee Macer-Wright, John Farrar (observer).

Apologies

John Miles, Jim Miles, Jeff Tapping, Jane Warne.

Minutes of the Previous Meeting

The minutes of the 2000 annual general meeting were circulated prior at the meeting. The meeting accepted the minutes as a true record of that meeting on a motion proposed by R Cook and seconded by I Budovsky.

Business Arising From The Minutes

None.

President's Report

Jim Gardner's report was distributed in printed form prior to the meeting. He highlighted a number of developments within the Society during 2001. He then

thanked the 2001 committee for their hard work, particularly those members who were retiring at the election, namely Mary Ryan, Pat McErlain, Barry Deeth and Laurie Besley.

A particular vote of thanks was passed to the MSA'01 organising committee and the three main members – Tony Collings, Shane Brann and Marian Haire for the wonderful way in which the conference was organised.

Treasurer's Report

Marian Haire tabled a written financial report, also distributed to the meeting in advance. It showed the Society to be in a sound financial state. It was moved by Tony Jackson and seconded by Noel Bignell that the Treasurer's report be accepted by the meeting. The motion was carried.

A feature of the report was a recommendation that subscription and nomination fees for 2002 remain at the same level for each membership grade. This was put as a motion by Marian Haire, seconded by Noel Bignell. The motion was passed. It was also moved by Marian Haire, seconded Laurie Besley, that Mr Bryce Thornton be appointed as the Honorary Auditor for the MSA for 2002. The motion was also passed.

Election of Committee for 2002

The President declared that according to the MSA Constitution, all positions on the committee were declared vacant. The nominations received for these positions were equal to the number of positions available and therefore an election was unnecessary. However, no nomination had been received for the position of Secretary and the new committee was asked to fill this position from within their ranks. The following were declared elected:

President	Jane Warne
Vice-President	Walter Giardini
Treasurer	Marian Haire
Committee members: (1 to be secretary)	Carol Sieker Dennis Sexton Neville Owen Steve Jenkins Jim Miles Jeffrey Tapping Brian Phillips Tony Jackson Ilya Budovsky

It was pointed out to the meeting that the new 2002 committee included members from four states, further implementing the trend begun in 2001. It was intended, however, that the new executive would be centred in Victoria.

The MSA Award for 2001

Jim Gardner announced that the MSA Award for 2001 had been made to the MSA/IRIS Education Committee

for their efforts in helping to design and initiate the IRIS graduate diploma course in metrology currently being offered at Swinburne University, Melbourne. The MSA members involved in the work included John Miles, Jane Warne, Walter Giardini, Denis Sexton, Stuart McDonald, Marian Haire and Laurie Besley, though a number of other members had played a part. Special recognition was made to two people:

- a former member of the MSA, Helmi Salem whose ideas and hard work several years ago had laid the groundwork for the success of the course, and
- the Swinburne University staff member, Brian Costello, who though not an MSA member, had laboured long and hard to implement the course concept and to cause it to run successfully.

Recognition was also given to two other non-MSA-members, Kishor Dabke and Bill Swinson who had contributed significantly.

Other Business

In a period of general discussion from the floor, members were first addressed by the TAM Editor, Maurie Hooper, and then asked for their views on how TAM might be developed. A number of views were aired. They included:

- The need for good photographs for the TAM cover.
- The publishing of papers from conferences.
- Republishing of papers from other journals
- Need for articles of a general, policy, nature, eg interviews with influential people
- Need to identify one person on the MSA committee to take responsibility for TAM copy

- Possibility of having a chat type column, eg "60 seconds with Sterlo" style
- Need to appeal to new membership areas - biology, biotechnology, medicine

Members were then invited to air their views on more general issues. Responses included:

- The trend in membership numbers - some retirees not remaining members, 50% subscription reduction approved
- No clear geographical trend in membership increases or decreases
- Specialist groups amalgamating with the MSA, eg Trade Measurement Institute (likely), Coordinate Measuring machine Group (achieved), and Weighing Industry of Australia (possible).
- Level of nomination fee too high? - not much support
- Non-awareness of the MSA in the commercial measurement area
- Ease of joining an issue - need to streamline procedures
- Cross-syndication of TAM articles with other journals

The Chairperson promised that these issues would be considered by the new committee and thanked attendees for their inputs and support.

Meeting Close

The retiring president thanked members for their support and attendance and closed the meeting at 6.45 pm, members retiring to prepare for the conference dinner, togas unfurled.

Letter to the Editor

Dear Sir,

I recently attended Interact 2002, a conference arranged by the Analytical Division of the Royal Australian Chemical Institute (RACI) in conjunction with the RACI Environmental Division, Pharmaceutical Group of NSW, The Australasian Society of Ecotoxicology, the International Chemometrics Society and Chemistry Week. The conference provided plenary speakers covering all of these groups.

You can see how the conference title came about.

Metrology was one of the streams within the conference. Topics including reference materials, traceability, measurement uncertainty, calibration, laboratory accreditation and legal metrology were covered by the

lectures. These topics were discussed within the context of fields such as chemistry, biology, pathology, forensic science and pharmaceuticals.

I was surprised and pleased to see full rooms of ~80 people to some of these presentations. The topic of estimation of measurement uncertainty was especially popular.

As this conference was successful, there was conjecture that the next such conference in 2004 be set up in the same way, with input from other Societies. The MSA could be involved in such a conference. Even if this was not possible, a close association with the RACI Analytical Division may be of benefit to the MSA with regard to the development of chemical metrologists.

- J Widdowson, Parkdale, Vic.

Your Role in the Metrology Society of Australia

National Committee member Neville Owen says the more you put in, the more you get out, and asks MSA members to help the Society be all that it can be.

Where is the MSA Right Now?

The MSA is now 7 years old and, like all societies must do at some time, it has reached a plateau. Membership is stable, but not growing. The impact the MSA has on industry and government is minimal. The international impact of the MSA, despite its respected position is also minimal.

This can be a period of stability upon which a strong future can grow. Or it can be a brief period of detritus after which a rapid downfall follows taking the hard work of a visionary few with it. All clubs, societies, councils and groups of like minded people reach this phase and all will face similar decision making times. Sometimes the outcome will be heavily influenced by external factors in the community that can either help or hinder. At present the industrial community influences may be viewed as detrimental where we find little if any spare time to put back into our careers. The eternal pessimists in society will decry time poor and woe the future and wish for the good old days. The eternal optimists in society will find a variety of opportunities in our present situation and make the best of those opportunities.

Your Role in the MSA

One such opportunity is the chance to bring more people together to move the MSA forward. Members of the MSA have very different reasons for joining and maintaining membership. Like minded people banding together, the kudos of recognition and membership among your peers, the journal which presents a view of the metrology world outside your own sphere and a host of other personal reasons.

What Does the MSA Do?

The MSA brings current issues to members' attention through its magazine, *The Australian Metrologist* (TAM). The editor strives to publish at least two technical articles, member feedback, news from NML and NATA, uncertainty issues, international conference details, IMEKO updates etc.

A technical conference is held roughly every two years to showcase new measurement methods and advances in metrology. Meetings are held in each state to discuss state-based issues, to present training and to provide an opportunity for members to exchange views. Industry tours are arranged in places where otherwise no access is possible.

As a general body the MSA has enough impetus to be heard by government on important issues that affect

metrology and to attract international measurement interest and attention.

The national committee, now located across four states, is here for the members. State coordinators are your first point of call for all issues and are there to help keep members in touch with metrology issues and to arrange activities. State coordinators also provide a local voice to communicate national committee issues to members.

What Can You Do?

The MSA national committee needs to hear from rank and file industrial metrologists about what is affecting them. What barriers are preventing you from working smarter. We all know the purpose of metrology is to make the wheels of industry turn more smoothly, more effectively and in some cases more quickly. If the MSA is to be useful then it should be able to assist you in this endeavour. To achieve this outcome you need to be up to date with what is going on. New standards, new methods, new thinking. The only way to stay involved is to be involved.

Are you less than satisfied with the current material in TAM? Write an article about your latest and greatest methods or developments. You don't need to give away your secrets in order to present your achievements, new ideas and methods and you will gain a bit of that kudos and recognition that you so rightly deserve.

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When is an inch not an inch?

In a previous edition of TAM, we heard about problems with "different" inches and mistakes with units. We delve a little more into these matters with Marian Haire of the National Standards Commission.

Shortly after Federation the Australian government decided to build a small arms factory at Lithgow, NSW. The plan was to have Short Lee-Enfield .303 rifles built there and the ammunition for the rifles produced at a new factory in Maribyrnong, Vic. Tenders for the small arms factory were submitted by one American and three British engineering firms. The American company Pratt and Whitney Co won the tender by putting forward a convincing case for their system of "repetition manufacture" being far superior to the British system.

In July 1909 Pratt and Whitney started supplying equipment for the factory. The plant was to manufacture rifles whose components were to be interchangeable with those made in Australia and those already in existence. The firm experienced great difficulty achieving this outcome. The existing stock of rifles had been manufactured in Great Britain and drawings had been supplied. The first problem they solved was the tolerances specified in the British drawings did not permit interchangeability. The permissible limits for the dimensions of a piston, for example might be 2.746 to 2.742 in and of the cylinder into which it fit 2.744 to 2.748 in. In the case of the rifles the 0.303 in bullet

might not always fit into the rifle bore because the tolerances overlapped. This problem was overcome by readjusting the tolerances but still the parts were not interchangeable with the six prototypes they had been sent from Great Britain. After a great deal of effort it was discovered that two versions of the inch were being used. For dimensions less than 2 in the Enfield inch was used and for those over 2 in dimensions were stated in terms of the Imperial Standard Yard. The Enfield inch was only about 0.000 4 inch in error. It didn't affect the rifles but it did affect the production measurement gauges, which had tolerances of about 0.000 1 inch.

By an oversight Pratt and Whitney had not been told about the Enfield inch. They had set up all their equipment in terms of the Imperial Standard Yard. After a lot of time and money had been spent the desired outcome was achieved and the rifles produced were interchangeable with those already in existence.

This story is a summary of the one related in *The Role of Science and Industry* by D P Mellor and was brought to my attention by Tony Griffiths. Thanks to Tony this article shows just how important good measurement is to getting the desired outcome. Can I challenge you to think of other similar stories that show the importance of measurement to a desired outcome. If you haven't time to write them up send them to mhaire@nsc.gov.au and I will do it for you.

Air Conditioning

Randall Anderson, Australian Pressure Laboratory

I thought our experience with achieving air conditioning control in a small laboratory might be of interest to others. Recent developments in domestic air conditioning equipment offer a great improvement in control and efficiency and whether your lab is small or a small space in a large organisation the improvements are significant.

Our laboratory is around 30 m² and requires control to better than 1°C. Traditionally we have used a reverse cycle air conditioner with a high degree of manual intervention of the set point to cater for changes in the heating load and for switching between cooling and heating.

Several domestic air conditioners are now available using inverter control of the compressor motor. This is a great advance over previous technology because it allows the unit to operate down to around 10% of full output. You might have experienced the cold blast from a standard machine which is then required to cycle on and off frequently to achieve control with an undesirable effect on temperature uniformity.

We bought a Daikin inverter split system unit recommended by the company's preferred installer who

assured us the 5kW model would "eat the task". The unit failed to hold 20°C on the hottest days and the indoor unit was prone to icing. We then purchased the next model up rated at 6kW cooling and 7 kW heating which has been very satisfactory since February. We are used to modifying our airconditioners by pulling out the sensor and extending the wire so we can sense the temperature elsewhere in the room. However, the temperature control was still not able to hold $\pm 1^\circ\text{C}$ with varying loads and still needed frequent manual intervention.

We already had a data-acquisition system monitoring room temperature and it has always been a frustration that we couldn't simply control the airconditioner using the PC.

So we went fishing on the internet and found a home automation product from the US that claimed to be able to learn the IR codes from the hand held remote control and via an RS232 connection, enable the computer to output the control sequences. This sounded great and we put the ~ A\$400 down only to find we could control every other device in the house but not the Daikin unit which has a proprietary IR coding system. Bless them! Anyone want to control their Hi-Fi?

As a final effort, we purchased a second remote control unit and drilled holes in its circuit board and used a conductive glue to connect into the switches which you press for the various functions. We then connected these to a home built array of relays and back to a standard I/O board in our PC, which we had purchased earlier.

One last hitch was that my favourite programming language Visual Basic had grown up to be such a serious language that version 5 could no longer make the machine level calls necessary for our now aging I/O board. We faced having to re-write our monitoring program in C - hell! Back to the internet and a call for help on the VB news site, which I really had no confidence in and to my amazement an Indian professor sent me an email suggesting I download a free DLL from his website which came with better documentation than most commercial products.

That did it!

The computer could make the calls, the I/O board could fire the relays and the airconditioner set point could be changed along with 6 other functions such as on/off and mode changing.

The result is control on the bench to around $\pm 0.2^\circ\text{C}$ regardless of the weather and a great flexibility in shutting down for weekends with the lab warmed up 12 hours before work on Monday. The energy savings will be significant although I don't have the data to quantify the benefit. This system solves the problem of a small lab requiring better control without the buckets of greenhouse gas coming from systems achieving control by running the heating and cooling against each other. One day an air conditioner will come on the market with an RS232 port to make this a whole lot easier.

News from the National Measurement Laboratory (NML)

The CSIRO National Measurement Laboratory continues its involvement in the international arena with participation in comparisons, attendance at high profile conferences and visits made by staff to various laboratories, as visitors, guest workers and assessors.

The Mutual Recognition Arrangement (MRA)

In 1999, under the authority given to the International Committee of Weights and Measures (CIPM) in the Metre Convention, an international agreement titled "Mutual Recognition of national measurement standards and of calibration and measurement certificates issued by national metrology institutes" was drawn up and signed by the directors of 38 national metrology institutes (NMIs) around the world. This agreement, known as the "global MRA", currently covers relationships between 48 NMIs and sets the benchmark for best practice in NMIs.

The objectives of the MRA are to establish the degree of equivalence of national measurement standards maintained by NMIs and to provide for the mutual recognition of calibration and measurement certificates issued by these laboratories. In this way governments and other parties are provided with a sound technical basis for wider agreements related to trade, commerce and regulatory affairs.

As part of the MRA process, the International Bureau of Weights and Measures (BIPM) coordinates international comparisons of national measurement standards (known as key comparisons) by national metrology institutes as well as supplementary international comparisons. The MRA also requires each participating national metrology institute to have in place a quality system meeting the criteria of ISO 17025 or similar, and to demonstrate its technical competence in delivering services. BIPM

maintains a database that is publicly available on the Internet (<http://www.bipm.org>) and lists the results of comparisons as well as the calibration capabilities of national metrology institutes.

One aspect of NML's commitment to this agreement requires officers to visit other national metrology institutes from time to time to undertake peer assessments. Most recently, Bruce Meldrum visited the national metrology institute in Taiwan in late August for an assessment of the acoustics and vibration areas.



Mr Bruce Meldrum enjoying a break after assessment duties

Conference on Precision Electromagnetic Measurements (CPEM02)

The Conference on Precision Electromagnetic Measurements (CPEM) is the foremost International Metrology Conference and embraces a broad range of Metrology including electrical, laser and time and frequency measurement as well as research related to the fundamental constants. The CPEM is held biennially and, this year, the twenty third conference was hosted by

the National Research Council, Canada, in Ottawa on 16 - 21 June.

NML presented seven papers or posters at CPEM02, covering such diverse topics as laser-cooled ions, the Avogadro Constant and several areas of electrical measurement.



Dr Ilya Budovsky engrossed in discussion at CPEM02

The Redefinition of the Kilogram

A number of national laboratories around the world are working on the redefinition of the kilogram in terms of a specific number of ^{12}C atoms to replace its realisation as a material artefact. This international project aims to determine the Avogadro constant - the number of atoms in 0.012 kg of ^{12}C - with a relative uncertainty of 1 part in 10^8 .

In order to coordinate the data produced by the various research groups, NML Fellow Dr Michael Kenny spent three months at the European Union Joint Research Centre Institute for Reference Materials and Measurement in Geel, Belgium, working on a comprehensive web-based database. The database brings together all information obtained by the dozen or so laboratories participating in the X-ray Crystal Diffraction, or silicon, route as it is known. The database is maintained on the web by the BIPM in Paris. Mike presented a paper describing the database at CPEM02 (see above).

NML and the Observation of Time

Contracts for the supply of NML time transfer systems to the Korea Research Institute of Standards and Science (KRISS), Chunghwa Telecom Company Ltd, Taiwan and the Philippines Atmospheric, Geophysical and Astronomical Services Administration are now underway.

Earlier this year, Dr Peter Fisk (NML) installed a new time transfer system at BIPM. It is hoped that this will lead to broader interest within Europe for NML's expertise in this field.

On the home front, NML's director, Dr Barry Inglis, and Dr Peter Fisk attended the first meeting of the reconstituted National Time Committee. The Committee's role includes advising the National

Standards Commission on issues related to the traceability and dissemination of time in Australia and reviewing the performance of NML as the provider of the national time scale, Universal Coordinated Time, Australia [UTC(Aus)].

High Pressure Gas Flow Calibration Facility

It has long been recognised that a high-pressure gas-flow calibration facility should be established in Australia. Initial discussions between the interested parties have canvassed the options and talks are continuing, in order to reach an appropriate solution to the problems associated with bringing this to fruition.

Seminar on Australia's Standards and Conformance Infrastructure

A seminar on Australia's Standards and Conformance Infrastructure was held in Parliament House in late August. The seminar was opened by the Parliamentary Secretary, the Hon Warren Entsch, on behalf of the Minister for Industry, Tourism and Resources, with speakers from industry and a response from the Minister for Science, the Hon Peter McGauran. The seminar arose from one of the regular meetings between the Executives of the Infrastructure bodies, viz. the Australian Government Analytical Laboratories (AGAL), the Joint Accreditation System of Australia and New Zealand (JAS-ANZ), the National Association of Testing Authorities, Australia (NATA), the National Measurement Laboratory, CSIRO (NML), the National Standards Commission (NSC) and Standards Australia International (SAI). The objective of the meeting was to create an awareness among politicians, senior government officials and senior industry representatives of the value and benefit of an effective Standards and Conformance Infrastructure.

Presence on the World Wide Web

NML recently returned to the Web with a much enhanced and informative site at www.nml.csiro.au. You are invited to visit the site to find general information about NML and its staff as well as the various fields of calibration, the services provided and the research being undertaken by NML. Calibration enquiries can now also be initiated via the Web or by contacting Mrs Darien Northcote on 02 9413 7180 or email: Darien.Northcote@csiro.au.

Training Courses Offered by NML

NML offers training courses, on a regular basis, in many fields of metrology, such as the measurement of mass, electrical quantities, pressure, time and frequency as well as calculating uncertainties. Tutorials supplying practical and/or theoretical information can be tailored to suit specific needs of individuals or companies.

The next course on offer covers the theory and practice of temperature measurement, and will be held from 9th to 11th October 2002, at NML's laboratory in the northern Sydney suburb of Lindfield, NSW. The course

provides an opportunity to gain knowledge about general principles of measurement as well as specific techniques in thermometry. It consists of lectures, demonstrations and laboratory tours and is of value to technicians, engineers, scientists and others involved in or responsible for work in which the measurement of temperature is important. Emphasis will be placed on traditional techniques involving thermocouples and resistance & radiation thermometers and, in particular, on an explanation of why all measurements are in error. The *ISO Guide to the Expression of Uncertainty in Measurement* (ISOGUM) will be described. Participants will receive a hardcover three-volume set on temperature

measurement as well as two NML Monographs on uncertainty and traceable measurements.

Further information on this course and the availability of other courses may be obtained by contacting Robin Bentley on 02 9413 7764 or email: Robin.Bentley@csiro.au.

Publications

NML offers a number of publications for sale, covering the topics of uncertainty in measurement, the statistical background to the ISOGUM, traceable measurements and the calibration of weights and balances. Further information on these publications may be obtained from Ms Dianne Douglass on 02 9413 7761, email: Dianne.Douglass@csiro.au.

Training for Chemists in the Estimation of Measurement Uncertainty

Helen Palfreeman,

Team Leader, Policy Development, Education and Training,
National Analytical Reference Laboratory
Australian Government Analytical Laboratories

Introduction of ISO/IEC 17025

In 1999, a new laboratory standard, ISO/IEC 17025 "General requirements for competence of testing and calibration laboratories" replaced the existing standard, ISO Guide 25. A clause by clause comparison of the two standards reveals differences though it was recognised at the time ISO/IEC 17025 was introduced that many accredited laboratories would meet most of the "new" requirements. The term "new" is somewhat misleading – rather ISO/IEC 17025 is more explicit in defining elements of good laboratory practice that have already been implemented to a greater or lesser extent.

Amongst other differences, ISO/IEC 17025 places more emphasis on traceability and measurement uncertainty. Calibration laboratories and laboratories involved in traditional "physical" fields of testing have been well supported by national and international measurement systems in meeting the requirements of these clauses. In comparison, the systems in support of chemical and biological laboratories are much less developed. It should be noted that the terms physical, chemical and biological are convenient terms for laboratories involved in a diverse range of work.

Metrology in the non-physical fields

Previous articles published in *The Australian Metrologist* have included progress reports on the establishment of systems to improve traceability/comparability of results for chemical tests. There is still much debate on the balance between adding value for the customer in the description of the test result and adopting a rigorous metrological approach. The scope of this debate is extending, with the CCQM (Consultative Committee for

Amount of Substance) recently establishing a working group to look at potential issues of traceability and reliability of results in the biological area.

There are ongoing discussions as to what constitutes a biological or chemical test, but the important issue is that at this moment there are laboratories who are grappling with the concepts of measurement uncertainty and traceability and how best to implement the relevant clauses of ISO/IEC 17025. NATA too is facing similar questions in judging the adequacy of action taken by laboratories to meet ISO/IEC 17025 and in providing advice as to how laboratories can meet accreditation requirements.

MU training needs and a new training venture

The National Analytical Reference Laboratory (NARL) was established by the Australian Government Analytical Laboratories (AGAL) in 1997 to lead the development of an Australian chemical measurement system.

In the initial phase of NARL's development, resources were committed largely to participation in international activities and the development of in-house capability with respect to primary methods, reference material and proficiency testing. However, the importance of also promoting an understanding of metrological principles in working laboratories was recognised early on and since 1999, NARL has offered a two-day measurement uncertainty course using chemical examples to illustrate the process.

In early 2001, discussions between AGAL/NARL, NATA and Dr Bernard King (a consultant and former director of NARL), highlighted the immediate need to educate not only large numbers of laboratory staff (including

NATA assessors) but also regulators and customers of laboratories in the concepts of measurement uncertainty and traceability and their place in improving analytical quality.

The web was considered as a suitable training medium for an introductory course for the following reasons:

- Potential to reach large numbers of participants
- Presentation of material can be enhanced through participant interaction
- Learning is self-paced
- Additional reading material can be made available and accessed when and if the participant feels the need
- Administration minimised with on-line payment of participation fee

The limitation of the web to provide the level of interaction that can be delivered by the more conventional face-to-face approach was also considered. Accepting this limitation and the introductory nature of the course, specific and detailed examples of MU calculations were not included.

The role of the web course is simply to introduce the concepts and accreditation issues relevant to measurement uncertainty and traceability and to do this in a way that is comprehensible to people from a variety of backgrounds.

The AGAL/NARL, NATA, and Dr B King web course in Measurement Uncertainty and Accreditation

The course was developed as a collaborative venture between AGAL/NARL, NATA, and Dr King with the software being provided by Catalyst Communications and

Training. The development process was an educational experience for the three key stakeholders. NARL, NATA and Dr King, had to come to grips with the peculiarities of instructional design for the web, and Catalyst Communications, the terms and scientific jargon!

The course has been available on the web since April 2002 and so far 35 people have participated. On the whole, feedback has been positive, with participants being able to make suggestions and observations regarding content and course structure.

More recently, we have asked participants in the NARL two-day course to complete the web course prior to attending the "face-to-face" session. This reduces the lecture component of the latter course and reduces the amount of information people are asked to absorb in a short space of time. It also allows more time to be spent attempting the practical examples with the guidance of the course presenters.

Where to now?

ILAC have set December 2002 as the implementation date for ISO/IEC 17025. There is no doubt that many have not yet fully addressed measurement uncertainty in their laboratories. The larger task of educating the user of laboratory results in an area that many scientists do not find easy to understand or explain themselves is just beginning. It is anticipated that the /NARL/NATA/King web course will provide a useful resource to assist in this education process.

Further details on the course can be obtained via the NATA (www.nata.asn.au) and AGAL (www.agal.gov.au) web sites. The course can be accessed directly at www.mutrain.com.

Queensland Activity

The Association of Geotechnical Testing Authorities (Qld) Inc. invited Queensland member Brian Phillips to present a talk covering the subjects of balance technology, justification of user checks, common sources of errors in balances and how to apply the information supplied in an NATA endorsed calibration report. Brian thought it was too big a topic to fit into the time available, but he gave a brief overview to an audience of about 25 on the 5th August 2002 at the Institute of Engineers Building in Brisbane – Brian reports:

The initial subject matter touched on Mechanical Balance construction with some explanation of physical concepts, then advanced to Electronic Balances. This covered Strain Gauge Technology, including Load Cells, Frequency Modulated Force Measurement and Electromagnetic Force Compensation. In this last category, a description

of the modern mechanical weighing cell was expanded to indicate the difference between the "conventional" cell and the "Monobloc" cell and samples of both cells were presented to give the audience an appreciation of these differences. The "Monobloc" cell has about one third of the individual components found in a "conventional" cell and is considered to be more robust.

An interesting and vexing problem was brought up dealing with user checks on balances in remote locations. Some balance suppliers will sell a balance with an NATA endorsed report included in the purchase price. This is not a problem when the supplier is able to deliver and set the balance up on site, but when a balance is purchased in "Location A" with an endorsed report, then sent by the purchaser to "Location B", the report is no longer valid, user re-location checks not being enough to validate

the issued report. NATA Technical Note 13 instructs that re-location checks are required when a balance with a current NATA endorsed report is moved from one location to another and this requirement is being interpreted to cover a new balance issued with an endorsed report when set up in a remote location. The problem also arises as to what the laboratory is to do if the checks carried out at the new location indicate results that are outside the required parameters.

Another presentation given that evening covered some of the prospects arising from "Public Liability Insurance" as it applies to Geotechnical Engineer. It was a clear that many companies associated with many forms of testing and/or calibrating were in for significant price increases in their policies. Perhaps we may have members who can make further comments on this subject.

Vic Branch on "Value and Metrology"

On a mild Melbourne evening, members gathered at the RAAFA Centre in South Yarra to hear Mark Thomas (Tenix Defence Pty. Ltd.) and Walter Giardini (CSIRO-NML) talk about and to discuss, a simple but apparently elusive concept, the value of metrology. President Jane Warne's introduction included an impassioned plea for members to step forward to join the National Committee at the upcoming AGM and help drive the Society into the next Millenium....

A talk on "Value and Metrology" given by Mark and Walter was attended by about 20 MSA members, and led to some lively discussion on the topic. This talk arose from their discussions on how to most effectively manage a new pressure service area being provided by the Tenix Metrology Lab. It quickly became apparent that the needs of the enterprise (and how to evaluate the effectiveness of different options) go well beyond the \$ cost of calibration. Issues of response time, availability of equipment, timely on-site support for a variety of metrology needs, training, skill development and maintenance of on-site expertise, troubleshooting, repair and maintenance, accuracy required by different parts of the organization, production and systems, all play a vital role. Mark outlined these various roles and the way they worked for the Tenix Metrology Laboratory. Walter then started by saying that metrology, the science of measurement, has not been very good at measuring its own value. He talked about the importance of understanding and making a strong link between the "uncertainty" mindset of metrologists, and the "accuracy" mindset of production people, quite different to each other, and both equally valid in their own contexts. The traditional metrology control pyramid, with the SI unit at the top, followed by NMI's, NATA labs and so on down to "users", was inverted to the metrology support pyramid, with "users" at the top, being the ultimate value-outcome, and all other levels existing to support that function. The value of the metrology infrastructure system was then analysed in terms of the uncertainty/accuracy, risk level, cost level, support level

along one axis, and technological parameters such as (in the case of pressure) different operating regimes and media at different parts of the range. Mark and Walter argued (to the converted!) that we need to argue the case for metrology to enterprise, government and clients (stakeholders) in the context of support, and in the context of hard but not necessarily direct \$ units.

The talk quickly went into "discussion" mode, as views and experiences from the audience were shared. Amongst others, Brendon Dickins, Neville Owen and Randall Anderson noted that the terms accuracy and uncertainty are not the same though they tend to be treated as the same outside the measurement industry, that companys (ie metrology customers) need to look at what needs to be calibrated and that appropriate calibration intervals are assigned. Len Kerwood made the interesting point that metrologists with an understanding of uncertainty and how that would apply to a car speedometer would have trouble accepting the new 'zero tolerance' rule that applies to traffic speeding offences. Effectively the government is reducing the speed limit, and this shows a very poor understanding and appreciation of uncertainty in the community. John Widdowson made the point that perception of a metrologist to the general public is that a metrologist tends to turn the simple into the complex, a view with which there was some agreement, and Andrew Spurling felt that customers can base a lot on their perception of the calibration laboratory rather than the reality.

There was much more of course, and members are invited to the follow up talk (Part 2) being organized by the Victorian Branch Committee on the value of Metrology, tentatively entitled, "Can Australia afford uncertainty?" (see separate notice of this year's AGM in this issue), certain to elicit a broad range of views.

The evening concluded with coffee and snacks, and many members staying on to catch up with colleagues, find out the latest industry news, and expand on many of the issues raised during the formal part of the evening.



NLA TEST AND MEASUREMENT CONFERENCE 2002

Ron Cook

What's the nearest thing to an MSA Conference? An NLA Conference. I was fortunate to be able to attend the South African National Laboratory Association (NLA) annual Test and Measurement Conference held from 18th August to 21st August 2002. This conference is run in conjunction with the South African CSIR National Metrology Laboratory (NML) and the Metrology Instrumentation Group (MIG).

There were some 70 technical papers presented in four parallel streams, covering all fields of testing and measurement, from Josephson voltage standards to substance abuse, thermometry to photography, compliance testing and measurement uncertainty, an enormous range of topics. The conference theme was "Good Measurements take time and money, but poor measurements take more".

The venue, Roode Vallei Country Lodge, was a converted farm some 40 minutes drive from Pretoria in the high veldt – a most picturesque setting with comfortable motel-like accommodation and a range of well-equipped lecture rooms. About 250 delegates attended. Each day commenced with plenary sessions and keynote papers. Dr Sandra Hart, General Manager of AGAL, Australia, presented one of these papers (Drugs in Sport Testing, voted one of the best papers of the conference). I chaired a session on measurement uncertainty on the Tuesday morning in which on behalf on the NLA I attempted to break the bad news to testing laboratories – they would have to calculate uncertainties both for the calibrations they did and also for the non-standard tests they were doing. Some thought this would be impossible, absolutely impossible (where have I heard that before?). Later that day I participated in an international panel discussion on uncertainty of measurement in temperature and heat, something I enjoyed as the chairman, Dr Neville Robinson, had prepared a couple of tricky and controversial questions. I gave a couple of tricky and controversial answers. On the Wednesday I chaired an excellent tutorial session on measurement uncertainty presented by Angelique Botha (an NML chemical metrologists).

On the Tuesday night the NML launched their Measurement Practice Improvement Guide, complete with Minister for Trade and Industry, flashing lights,

thumping music, reporters, photographers and a lake of some sweet alcoholic fluid that the South Africans think is sherry. An American I was with at the time seemed to think it was pretty good stuff, although the next morning he wasn't so sure. They are serious about raising the standards of testing and measurement in SA, and my small sample of laboratories visited indicates they already have many very competent laboratories.

I was particularly impressed by the efficiency and discipline of the session chairmen. Presenters had 20 minute to make their pitch, 5 minutes for questions and 5 minutes to allow attendees to move to another lecture room. Although some presenters used up much of their question time, none ventured, or were allowed to venture into the change-over time.

There was a very good trade display with the usual international big boys, Fluke, Hart, National Instruments, Isotech and Guildline plus some locals such as Rand Water.

The atmospherics were good, delegates from all over Africa plus a few Europeans and two Australians mingling in a most affable manner. One evening I had the pleasure of discussing Jonty Rhodes fielding abilities with a past classmate of his (and international hockey player in his own right). And yes, there were some discussions over Type B estimation techniques. The food and beverage was there in copious quantities and of a high standard. I can recommend the Windhoek beer from Namibia. Pinotage is a popular red wine that I enjoyed but did not rate as highly as the locals do. Possibly the Cape Town folks keep the good stuff for themselves, although like Australia the SA wine export industry is growing rapidly and there is a large range of inexpensive varietal and blended wines available in the stores.

Apart from the usual dark blue conference bag and a set of proceedings, there was a CD with the proceedings on it, definitely a much more compact arrangement. A copy has been deposited with the NML Lindfield library.

Security is something always on the minds of any South African, crime rates are significantly higher than here, but when attending conferences such as this it is easy to make sure you are at least as safe as you would be in any

you fly South African and with 5.6 Rand to the \$A, land costs are usually very economical.

If you enjoy the MSA Conferences and want an excuse to go visit the big game parks, etc., why not consider next years NLA conference. Its very professionally run, the standard is quite high and it is a lot of fun. (Oops, probably shouldn't say that as I was supposed to be working....). Details will appear on their web site soon.

Ron provides the following information about the NLA.

What is the NLA?

The NLA is the South African National Laboratory Association. The following information was extracted from an associated web page.

The NLA once operated much like our NATA. During 1998 the South African National Accreditation Service (SANAS) officially assumed responsibility for all accreditation functions (laboratories and certification bodies) in South Africa and the NLA ceased to operate as an accreditation body. The NLA board at that time decided that the NLA would continue to exist in the form of a voluntary association of laboratories and the name National Laboratory Association (NLA) was adopted.

The NLA continues to play a vital role in the laboratory community and a number of significant milestones have been reached in the past 3 to 4 years.

NLA Highlights

- formation of CMeTSA, the training arm of the NLA and the co-ordination of metrology and measurement training
- development of new courses
- active participation on both local and international bodies
- successful take-over of the annual workshop activity
- financial stability
- expansion of members
- formation and participation in the education arena via the Unit Standards and Professional recognition

The above list is underpinned by the functions and goals of the association, which are as follows:

- to nominate members for SANAS Standards Technical Committees (STC's) when requested
- provide recommendations to SANAS on the need for new STC's

- identify specialists as lecturers for CMeTSA courses
- develop courses geared towards supporting metrology and test laboratories
- in conjunction with the MIG run the Excellence Award program
- manage the intellectual property of the NLA through the transfer of knowledge and encouragement of questions on the NLA web site <http://www.nla.org.za> and the media
- organise a register of courses and co-ordinate the presentation of them through Centre for Skills Co-ordination, CMeTSA <http://www.nla.org.za/cmetsa>
- help source and provide suitable speakers for metrology and testing workshops
- represent the local laboratory community nationally (through SANAS, SABS and other bodies) and internationally (through ILAC, Laboratory Committee, Eurolab etc)
- manage the financial resources available and where possible sponsor bursaries and study grants for testing/metrology students with special attention being given to those from previously disadvantaged backgrounds
- promote the benefit of an impartial laboratory association to both existing and new members as well as the community at large
- continue to review the existing constitution and make changes where necessary to accommodate wider representation (e.g. legal metrology)
- create and support special interest groups

"The NLA will address generic issues concerning accreditation, such as interpretation of accreditation requirements, identifying generic national accreditation needs and resolving issues that are not covered by SANAS STCs, with the objective of making representation to SANAS on behalf of the association of laboratories"

It can be seen that there is a significant overlap of NLA activities and those for which the MSA was formed.

Members of the Metrology Society of Australia

Overseas

Noel Cayron
Lawrence Christian
Geoffrey Clark
Tjhang Hendri
Brenton Hodgson
Lyndon Kapoor
Alexander Katkov
Arsemar Poblete
David Soucy

ACT

Barry Stokker

NSW

David Adkins
Jeffrey Andrews
Mile Arnautovich
Errol Atkinson
Vasukan Balakrishnan
Mark Ballico
Trevor Bell
Judith Bennett
Ian Bentley
Laurie Besley
Raj Bhat
Noel Bignell
Stephen Boronkay
Lyndon Branscomb
Richard Brittain
Graham Brown
Nicholas Brown
Stan Brulinski
Ilya Budovsky
Douglas Burgess
Bruce Cameron
Adrian Caster
Khaled Chahine
Henry Chen
Jung Chen
Neil Ciclovan
Philip Ciddor
Anthony Collings
John Connolly
Peter Coogan
Michael Cook
Judith Cuthbertson
Maxwell Cuthbertson
Michael Daly
Florian de Celis
Gerard de Groot
Barry Deeth
William Deusien
Laurence Dickinson
Gary Dykes

John Ebsary
Frederick Emms
Kitty Fen
Stuart Findley
Robert Frenkel
James Gardner
Michael Gibbes
David Gowdie
Stephen Grady
Donald Groeneveld
Marian Haire
Grahame Harvey
Philip Heskett
Brynn Hibbert
Patrick Hogbin
John Hunter
Barry Inglis
Anthony Jackson
Ferdouse Jahan
Xihu Jiang
Leigh Johnson
Mario Jueco
Robert Kelly
Franz Kocijan
Doan Lam
Peter Langley
Victor Lawrence
Yi Li
Hongwei Lu
Lee Macer-Wright
Noel MacGregor
Lindsey Mackay
John Man
Antal Mark
Peter Mayo
Patrick McErlain
Bruce Meldrum
Jim Miles
Ian Monro
Edwin Morris
Bruce Morrison
Ben Mosman
Richard Myers
Kim Nguyen
Helen Palfreeman
John Peters
Ronald Petto
Paul Pokorny
Ian Pope
Gary Price
Brian Pritchard
Hong Qin
Brian Ricketts
Regina Robertson

Juris Rungis
Mary Ryan
Glenda Sandars
Greig Small
Mark Spillane
Alan Squirrell
Kip Stavrou
Malcolm Stephen
Maree-Ann Stuart
Barry Sutcliffe
C Peter Taylor
Eric Thwaite
Cesar Torres
Kostas Tsampazis
Peter Underwood
Christopher Walsh
John Walsh
Allan White
Julian Wilson
Robert Woo
William Wright
Ruimin Yin
Jana Zeleny

NT

Leslie Anderson
Francis Osborne

QLD

Terrence Albury
Geoffrey Barnier
Shane Brann
Brian Brannelly
John Browne
Steve Chakalakias
John Darling
Peter Gardener
John Gilluley
Glen Hay
Robert Irwin
David Johnston
Ian Kendall
Karl Kozehuba
Nigel Lane
John Leinster
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DRY ETHANOL GAS STANDARD TO VERIFY THE WET ETHANOL GAS CALIBRATION ON THE DRAGER ALCOTEST 7110, Mk V

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Key Words: Ethanol; Dry Gas; Wet Gas; Drager Alcotest 7110 Mk V; SAS; BrAC.

The aim of this study is to determine the viability of using a dry ethanol gas standard to verify the wet ethanol gas calibration of the Drager Alcotest 7110, Mk V. A method is described to relate the results obtained from the two types of gases to give a high level of accuracy for those results. A formula has been derived to allow the dry gas result to be converted to the wet gas result that then allowed the results to be compared. The results show that the mean difference between the wet gas samples and the dry gas samples was 0.000 4 g/210 L.

Introduction

The legal system and courts in Australia demand high standards to be maintained for equipment used by Police in the detection of drink-driving offenders. This requirement has led to extensive validation studies being taken up, firstly in Victoria and more recently by South Australia.

South Australia Police (SAPOL) has used the Drager Alcotest 7110 for evidential breath testing since 1987. The instrument uses infrared absorption as a means for determining the alcohol concentration (BrAC) of a driver's breath. The BrAC is obtained by measuring the change of infrared transmission at a wavelength of 9.5 mm through a sample chamber when breath containing ethyl alcohol is passed through it. This wavelength is a characteristic absorption band of alcohol vapour. New Drager Alcotest 7110 Mk V units recently purchased also test the vapour in an electro-chemical fuel cell, and the instrument only accepts a reading if the two results agree within the set tolerances.

The legislation for breath analysis is contained in Section 47 of the Road Traffic Act, 1961, and similar legislation is also contained in the Harbours and Navigation Act. When a driver is stopped either for a traffic offence, having been involved in a crash or at an RBT site, the driver is required to submit to a screening test. Should a positive result be recorded, an evidentiary breath test is carried out. Two samples of breath are taken for analysis and the lower of the two readings is accepted as the driver's BrAC. The result of the second sample must be within $\pm 15\%$ of the first sample result. The second sample must be taken within 2 to 10 minutes after the first sample was received. These are legal requirements.

The result of the breath analysis in the past has been expressed in grams of alcohol in 100 millilitres of blood, so the familiar "0.05" figure represents 0.05 grams of alcohol in 100 mL of blood. Legislation has been amended for the breath analysis result to be expressed in grams of alcohol in 210 litres of breath (g/210 L). The two expressions are equivalent, but the new specification provides a more direct link between the legislation and the measurements actually made. The expression of the BrAC result in g/210 L was determined from Henry's Law, which states: "When an aqueous solution of a volatile compound comes to equilibrium with air, there is a fixed ratio between the concentration of the compound in the air and the concentration of the compound in the solution and this is constant at a given temperature." The ratio, known either as the distribution ratio or the partition ratio between blood and breath in the body is 1:2100 at 34°C.

Alcohol testing units have traditionally been calibrated using a vapour taken from above a solution of alcohol in water (wet gas), a simulation of the process which takes place in the lungs. The objective of this study was to determine if a dry ethanol gas standard could be used to verify the wet gas results of the calibration of the Drager Alcotest 7110, using the methods of Dubowski[1] and Silverman[2]. Dubowski used a Drager Alcotest 7110 Mk III as well as an Intoxilyzer 1400 evidential breath analysing instrument. These investigators used a dry ethanol gas to ascertain the viability of using dry gas as a calibration standard. Silverman *et al* analysed effluent gas from a wet simulator standard to show its equivalence with compressed gas ethanol breath standards.

Wet Gas Calibration Procedure

The Drager instruments have two modes of operation: the first is a calibration mode and the other is the normal measurement mode. In the calibration mode a gas of known alcohol content is passed through the Drager to set the reading at 0.100 g/210 L. Breath testing instruments are currently calibrated in South Australia using a Drager 3-bowl "fish tank" calibrator. This consists of a water bath holding 80 litres of water that is electrically controlled at a temperature of 34°C. The three bowls are immersed in the bath, and each contains 500 mL of a standard alcohol solution (SAS), with a space above the liquid for an alcohol vapour-air mixture. The bowls are connected in series by copper tubing, and

air is forced into the first bowl so that alcohol-air vapour passes from the first bowl then through the other two bowls in turn. This arrangement ensures that the final vapour is at an equilibrium proportion. The gas outlet from the final flask is connected to the sample tube of the breath analysis instrument. The temperature of the water is monitored using a certified mercury-in-glass thermometer that has a Regulation 13 calibration certificate pursuant to the Commonwealth National Measurement Act. The temperature of 34°C is a standard used world wide and is specified by the International Organisation for Legal Metrology (OIML) for Evidential Breath Analysers. It is also contained in the National Standards Commission standard for Evidential Breath Analysers.

The instruments are calibrated using a solution of a nominal composition of 0.100 g in 210L (which gives a reading of twice the legal limit), in the calibration mode. On completing the calibration, the instrument is then tested using the ethyl alcohol solution in the User operating mode as a cross-check on the calibration. To verify that the calibration line is linear, a quality control solution is then used. These are ethyl alcohol solutions with values between 0.020g/210L and 0.150g/210L. All calibration results are recorded and entered onto a Control Chart spreadsheet. Trends of instruments or calibrations can then be seen and appropriate action taken. The level of uncertainty of the measurement is ± 0.006 g/210 L.

Dry Gas Calibration

The dry gas is supplied with a composition of 260 ppm ethanol in dry nitrogen (volume-to-volume ratio). At a temperature of 34°C and a pressure of 1013.3 hPa, an alcohol-in-water solution of 0.1 g in 100 mL produces a vapour with 260.5 ppm alcohol. This is equivalent to a vapour content of 0.1 g in 210L of air. So the dry gas reading is equivalent to

$$260/2605 = 0.0998 \text{ g in 100 mL}$$

And to convert from a dry gas measurement to the equivalent wet gas measurement:

$$W = D \frac{0.1}{0.0998 \frac{P_B}{1013.3}}$$

Where W is the equivalent wet gas reading

D is the dry gas reading

P_B is ambient atmospheric pressure

Materials and Methods

The ethanol solution for the calibrator is obtained from SA State Forensic Science Laboratories and is nominally 0.100 g/100 mL, with an uncertainty of ± 0.003 g/100 mL. Documentation of the actual composition of the

solution is supplied. All solution containers are sealed, and any container with the seal broken is rejected.

For security reasons an electronic key (dongle) must be used to access the calibration menus of the Drager Alcotest 7110, Mk V. One part of the calibration menu allows a choice of wet or dry gas. Depending on which gas is to be used the appropriate choice is made.

Instruments are calibrated against the actual ethanol solution concentration to an uncertainty of ± 0.001 g/210 L. For example if the standard alcohol solution has a concentration of 0.1019 g in 100 mL (giving a vapour of 0.1019 g/210 L), then the instrument is calibrated at 0.1019 ± 0.001 g/210 L. The result at 0.100g/210L is then:

$$\text{Measured Result} \times 0.1 / \text{Actual value of SAS}$$

The ethanol dry gas standard was obtained from Linde Gas Pty Ltd. The gas contains 260 ppm ethanol and the balance nitrogen. A NATA certificate verifying the concentration is supplied with the gas. The gas was stated to remain stable for 36 months.

Because the unit notation parts per million is a simple proportion, the parts per million value is independent of pressure or temperature in compressed or decompressed gases or vapours, whereas restatement in mass in unit volume concentration units requires a conversion factor.[1]

Barometric pressure was measured using a Davis Inception II electronic barometer. The barometric pressure was verified against the Bureau of Meteorology via the Internet. The Bureau updates the data every 10 minutes. The barometer was checked to ascertain how much variation would occur between readings inside and outside the laboratory, comparing with the Bureau of Meteorology value. The differences were so minimal as to have no effect on the gas standard. The barometric pressure was measured and recorded at the time of the sampling.

Eleven instruments were chosen to be subjected to dry gas testing as they came in for routine maintenance after the completion of their normal service. The dry gas standard was used directly after the instrument had been tested in the Calibration mode with five samples of 0.100 g/210 L wet ethanol gas from the Drager Calibrator. Five samples of the dry gas were then analysed by each instrument using the Calibration mode. All testing carried out was part of normal service and calibration procedures by Traffic Technical Support of equipment that was used in the field by trained police breath analysis operators.

Results

The results of the testing are given in the table, expressed as grams of alcohol in 210 litres of breath. (g/210 L).

The results contained in the Adjusted column are a comparison of the wet calibration against the dry gas standard. In both cases the averaged results have been

Results of Tests

Instrument Serial No.	Gas	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Mean	Standard deviation	Adjusted	Difference wet - dry	Pressure
MRREA032	Wet	0.1010	0.1012	0.1005	0.1005	0.1012	0.1009	0.0005	0.1001		
	Dry	0.0993	0.0999	0.0995	0.1001	0.1001	0.0998	0.0005	0.0999	0.0002	1014
MRREA043	Wet	0.1008	0.1010	0.1003	0.1003	0.1005	0.1006	0.0004	0.0998		
	Dry	0.0984	0.0991	0.0995	0.0993	0.0993	0.0991	0.0004	0.0989	0.0009	1017
MRREA015	Wet	0.1005	0.0995	0.0991	0.0987	0.1001	0.0996	0.0008	0.0988		
	Dry	0.0989	0.0989	0.0987	0.0989	0.0995	0.0990	0.0004	0.0996	0.0005	1009
MRREA021	Wet	0.0999	0.1001	0.1001	0.1001	0.0991	0.0999	0.0005	0.0991		
	Dry	0.0989	0.0993	0.0999	0.0997	0.0989	0.0993	0.0005	0.0995	0.0004	1014
MRREA038	Wet	0.0999	0.1010	0.0999	0.0997	0.0991	0.0999	0.0009	0.0991		
	Dry	0.0997	0.0984	0.0982	0.0997	0.0995	0.0991	0.0005	0.0997	-0.0006	1009
MRREA048	Wet	0.1012	0.1003	0.1001	0.0997	0.0995	0.1002	0.0008	0.0994		
	Dry	0.1001	0.0991	0.0991	0.0993	0.0995	0.0994	0.0004	0.1000	-0.0006	1009
MRREA016	Wet	0.1018	0.1012	0.1005	0.1018	0.1005	0.1012	0.0005	0.1004		
	Dry	0.0993	0.1001	0.1005	0.1003	0.1012	0.1003	0.0007	0.1004	0.0000	1014
MRREA024	Wet	0.0993	0.0991	0.0993	0.0993	0.0980	0.0990	0.0004	0.0982		
	Dry	0.0987	0.0987	0.0987	0.0993	0.0984	0.0988	0.0004	0.0989	-0.0007	1014
MRREA023	Wet	0.0997	0.1003	0.0997	0.1005	0.0999	0.1000	0.0005	0.0992		
	Dry	0.0989	0.0984	0.0980	0.0991	0.0991	0.0987	0.0005	0.0992	0.0000	1010
MRREA017	Wet	0.0997	0.1003	0.1001	0.0993	0.0999	0.0999	0.0005	0.0991		
	Dry	0.0987	0.1001	0.099	0.0997	0.0999	0.0995	0.0007	0.0992	-0.0001	1018
MRREA018	Wet	0.1005	0.1003	0.1003	0.0993	0.0997	0.1000	0.0005	0.0992		
	Dry	0.0993	0.0997	0.0993	0.1003	0.1001	0.0997	0.0005	0.0996	-0.0004	1017
Means								0.0005		-0.0004	

normalised from the calibration value of the reference standard used, to 0.100 g/210 L. The Difference column shows the differences between the two methods after adjustment.

Discussion

In this study the mean of the differences between the adjusted results of wet gas and dry gas is 0.000 4 g/210 L. This is well within the estimated uncertainty of individual wet gas measurements of 0.006 g/210 L and the standard deviations of the sets of readings.

The results clearly show that it is quite practical to use a dry ethanol gas standard to verify the wet gas calibration standard and obtain a meaningful comparison. Perhaps most importantly they show that an independent technique can be used as a check on the wet gas calibration, greatly increasing confidence in the measurement. This becomes quite a strong point in contested Court matters where the operation, maintenance and calibration of the instrument is often put to the test.

The methods described have now been incorporated in the calibration procedures for all Drager Alcotest 7110 Mk V instruments in South Australia.

Acknowledgements:

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