

The Australian

Metroløgist

The official journal of the Metrology Society of Australia

Metrology
and the law,
measuring the
boundaries?



Objectivity versus subjectivity;
order versus chaos

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(extracted from TAM No. 41)

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Metrologist

The official journal of the Metrology Society of Australia

The Australian Metrologist is the journal of the Metrology Society of Australia, an association representing the interests of metrologists of all disciplines throughout Australia.

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WALTER GIARDINI

TAM has been published continuously (though at times ad hoc) since 1994 and we are now up to issue number 48. This is my last issue as editor, a job I have found both enjoyable and challenging, and a job which is really the product of a team of committed members in and close to the National Committee.

TAM is the voice of Australian metrology, and it is a great responsibility for the National Committee to publish it. Such a task poses the questions: what is metrology?; who are the members?; what do we want to say?; what do we want to hear? *TAM* exists to support our dialogue as, for example, the current issues of "chartered metrologist", or recent developments in "legal metrology", which form the main topic of this particular edition of *TAM*.

In this issue, two of our most respected and well known members argue about what the purpose and meaning of the *National Measurement Act* is or should be, and where its limits may or may not lie. Ron Cook (ex-OIC of NMI Melbourne Laboratory, now a consultant) wrote a short and relatively informal article which was published in *TAM* No. 41 (April 2007) as "Riverbank Reflections No. 8", most of which is reprinted in this issue in extract form. In that article, Ron had some criticism of the scope of the *National Measurement Act*. With the second anniversary of the introduction of the new National Measurement System

coming up on 1 July 2012, and with some further evolution in the field, Richard Brittain (Manager, Legal Metrology Authority Appointments, NMI) has submitted a long and carefully argued article, refuting some of Ron's assertions, and in the process also giving us a highly detailed and rigorous explanation of many of the core concepts of legal metrology. The scope (and length) of these articles (particularly Richard's article), have essentially made this a single-issue edition of *TAM* – but an important issue.

The two articles are very different in scope, style and intent, and were written with an interval of five years between them, and yet they are linked by a fundamental concern of metrology; how do we manage and control our measurements, for what purpose, at what cost, and with what consequences? *TAM* takes no sides in this dialogue in which Ron and Richard have eloquently presented their views. It is a responsibility of all metrologists to engage with those views and, in the process, to deepen our understanding and appreciation of the significance and scope of the work which defines us.

Electronic submission of manuscripts to the journal

The Australian Metrologist welcomes authors to submit all articles, whether a letter to the editor, conference report or an original article to be peer reviewed, via our web-based Manuscript Management System.

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Once submitted, the manuscript is reviewed by the editor and, if applicable, sent for peer review.

Peer review

Peer reviewers will be asked to review manuscripts using the online Manuscript Management System.

New Appointments

Dr Peter Fisk has been appointed new CEO and Chief Metrologist of the National Measurement Laboratory. Dr Fisk was previously General Manager of the Physical Metrology Branch at NMI and before that led the RF, Microwave, Time and Frequency section.



MSL to host next APMP meeting

New Zealand's MSL to host next APMP meeting

The 2012 Asia Pacific Metrology Programme (APMP) General Assembly and related meetings will be held in Wellington. Dates are not yet finalised, but will be over up to 10 days in November/December 2012. The event is expected to attract up to 300 participants, with most coming from the Asia Pacific region but also including representatives of other regional and international scientific organisations.

The APMP is a regional scientific organisation with 43 member laboratories, including MSL (see <http://www.apmpweb.org/>), and is committed to improving measurement capability within the region and gaining international recognition of its members' capabilities. It achieves this through activities such as inter-laboratory measurement comparisons, science workshops and being one of the APEC specialist regional bodies.

WANTED: EDITOR for TAM

Wanted: new editor for TAM journal

The Australian Metrologist requires a new editor. Providing a voice for our members and for the industry, a way for our wide, scattered membership to communicate, and keeping MSA members informed about what is happening is a vital task of the Society and *The Australian Metrologist*. If you have the interest, some basic skills and want to be part of a great and supportive team working for Australian metrology and metrologists, please contact the president Daniel Burke, the secretary Paul Pokorny, or any member of the National Committee and help us drive the Society into the future.

President's column



DANIEL BURKE

I continue to be impressed by the way in which the National Team donates their time and energy to our professional society. We are all volunteers and all of the achievements of the MSA rest on your efforts. I am sure that the standing of metrology in the scientific and wider communities will be raised by all that we are doing and this will benefit all of us and those fortunate folk who come after us. At this point, I again thank Walter and his editorial team for the work that goes into every edition of *The Australian Metrologist*.

The 2011 conference in Geelong was a great success and the Sydney metrology community has taken on the challenge of hosting the 2013 Conference. Our conference committee is off to a great start with 10 members volunteering to help with its organisation. One of our first tasks is to find a suitable venue that is easy to get to, especially for interstaters, but is still interesting.

My other pet project is a proposal for MSA recognition of expert metrologists by awarding a professional title such as "Chartered Metrologist" or "MSA Fellow". Although my preference in the past has been for the title "Chartered Metrologist" there now seems to be a compelling reason to abandon that option. The compelling reason being the apparent difficulty in arrangements for using the word "Chartered" in any meaningful way. Dr. John Miles, our consultant on this project, has to date not been able to get a clear resolution on this from Engineers Australia,

possibly the only organisation in Australia with whom we could readily collaborate. Unfortunately, I feel that I must work through my frustration with Engineers Australia and try to find the right person to make a decision for us.

There is a new CEO at the National Measurement Institute. Dr. Peter Fisk was appointed earlier this year and he generously met with me to discuss the relationship between MSA and NMI. Dr Fisk is strongly supportive of the MSA having attended every MSA conference since NMI was founded. He is interested in our current projects (MSA2013 Conference, *The Australian Metrologist*, "Chartered Metrologist") and keen to continue his support. To that end he has offered me an opportunity to make a short presentation to the NMI executive about MSA projects.

Finally, may I remind all members that we are seeking nominations for two positions in the National team. The current Vice President, Walter Giardini, and Treasurer, Randall Anderson, are due to retire from the Team soon after many years of excellent service and we need volunteers to familiarise with the duties of the National Team. If you are interested, please contact myself or any member of the Team.

Daniel

Pressed for time? Read the short synopsis below and make a time to read the full article later



DR RICHARD BRITTAIN LLB

Objectivity versus subjectivity; order versus chaos

Why does a strong legal framework of theory and practice make the policing of things such as parking and driving behaviour of motorists better and more effective than a less formal system?

Objectivity

A strong legal framework of theory and practice minimises subjectivity and provides a fair and correct determination by independent means binding on both the measurement making and the person subject to it. It provides the impartial umpire determining where the balance between the interests of two parties lies by facilitating a level playing field.

Consistency

All measurements of the same quantity should agree within the uncertainties. A strong legal framework of theory and practice enables consistency by requiring a transparent process based on clearly identified standards.

Veracity

In addition to being objective and consistent, good measurements are also correct, by ensuring that the measurements used are derived by clear, sound processes derived from agreed standards recognised for the purposes of both metrology and law.

Transparency

Transparency engenders confidence in the soundness of the measurements and equity amongst consumers and is supported by making measurements within a strong legal framework of theory and practice where both the basis of the measurement and process by which it was made are obvious.

Equity

It is only possible to achieve and demonstrate equity when these activities are conducted within a strong legal framework of theory and practice which enable the empirical objectivity of science to support the fundamental principle of equality before the law to deliver equity.

The alternative to a strong legal framework of theory and practice is fundamentally an informal system unsupported by the above advantages. Two choices emerge: (1) objectivity or subjectivity, (2) order or chaos.



Riverbank Reflections No. 8

(extracted from *TAM* No. 41)



RON COOK

A short time ago, the local Branch of the MSA advertised a talk by Dr Richard Brittain of the NMI with the title "Caught in the Act". [It] ... was an excellent introduction to the National Measurement Act (known as "the Act") and its purposes. [...]

The National Measurement Act provides an umbrella under which trade and commercial measurements can be fairly made. It arises out of the fundamental and ancient need for a community to have some fair trading rules and regulations, and the units to be used for legal measurements are named and defined in the Act, but the details are mainly in the associated Regulations.

Among other things, these Regulations address certification of reference standards, standard instruments and measuring devices for trade and commerce. Type approval is one of the activities that arise out of the need to ensure fair trade.

There is a lot to commend in the Act, but nevertheless one aspect is, I think, controversial. It is the extension of the regulations to require type approval of devices that on the surface are not related to trade. Yes, there is some possibility of litigation over the measurements, but perhaps there are other ways of dealing with this. I refer to parking meters and in the near future, RADAR speed "guns".

Now I don't have a problem with ensuring that the measuring parts of these devices are sufficiently accurate for their purpose to have their indications accepted, but to have them under the "Fair Trading" umbrella requires a bit of hand waving.

If I buy 250 grams of cheese I expect it to be accurately weighed. If I buy 30 litres of petrol I expect it to have been accurately dispensed. If I buy a metre of cloth I expect the rule used to measure it to be accurate. These are the classical "fair trade" scenarios for which the National Standards Act was originally devised. The Act itself

and the Regulations under the Act were also intended to cover other aspects of trade and measurements and over time its scope has extended.

But how can it apply to parking meters and RADAR "guns"? What are you buying from the parking meter, or its owner, the Local Council? Not principally time which the meter measures. I think you are hiring a space in a public area for a set period of time. So if the "time" dispensed is to be regulated under the National Measurement Act, why not also the amenity you are hiring, namely the parking space? Should I expect to pay more if the space is shaded or less if prone to the droppings of various birds? Should parking places have a written formal standard that they must comply with?

There are other things we hire for time but they do not require the NMI to be looking at applying the National Measurement Act to the time measurement. For example, baggage facilities at bus terminals and airports [...] or a locker at the local swimming pool. You can hire an animal or an aircraft, a bicycle, a book, a car, a companion, a dredge, an electric drill, furniture, a generator, a hotel room, and so on, on a time basis. Will the NMI insist that the clocks used to determine these rental periods are to be traceable and type approved? May I be so bold as to suggest it's not likely?

So why parking meters?

Does having the meter's clock covered by the National Measurement Act make sense? Except for having it measure legal units (SI seconds, with an uncertainty of say 1 in 1000), I'm doubtful that there needs to be any more. Type approval can provide a degree of certainty that the instrument is suitable for purpose. Integrity of the time measurement could be assured by other means such as regular calibrations in a NATA-accredited laboratory.

Then there is the parking fine. While it might be right and proper to fine a "customer" overstaying his rental period, is it right to see it as part of the "fair trade" responsibility of the NMI? The parking space is the object of the transaction and the accuracy of the time measurement, the uncertainty to which the SI second is measured, is perhaps a secondary matter. A sensible magistrate would throw out any case mounted on the possibility of a few seconds per hour error in a clock in a parking meter.

I'd like to now turn to RADAR-based speed measuring instruments. Why have these covered by the National Standards Act?

What do you trade with the traffic policeman? Hopefully nothing. Indeed giving him money or goods might have dire consequences. If he believes he has evidence that you have broken a law, that is,



you have been travelling above the speed limit, then he may use the RADAR instrument reading as evidence to prosecute you with, unless you fess up and pay the fine when it comes. Indeed, in spite of some claims to the contrary, the RADAR reading is the primary evidence of a misdemeanour. This is particularly so in the case of unmanned speed cameras.

In these cases the measurement is made with a view to deciding whether you are to be punished or not. You haven't engaged in trade so why apply the National Measurement Act? Surely it is a matter for the regional Department of Justice, not the NMI?

Some in the community have argued that speeding fines are more of a tax than a punishment. Given the large numbers of motorists who are fined, there has to be an element of truth in that argument. Should the calibration of RADAR "guns" therefore be a matter for the Taxation Department? OK, OK, that's not a good idea.

Obviously there is also a need for some degree of deterrent to maintain a modicum of good behaviour on the roads and a fine is an acceptable way of doing this.

It seems to me that when I exchange money, goods or services for other goods or services then I have engaged in trading. If a physical measurement is required of the goods or services then the National Measurement Act becomes relevant. If I exceed the speed limit I have not been trading but I've possibly been derelict in my civic duty. So why have the National Measurement Act involved?

Is this a case of creeping bureaucracy?

Most motorists would want both their in-car speedometers and the RADAR gun to have errors that did not exceed say 1 km/hr. The use of type-approved equipment and control of the calibration of these under an ISO 17025 regime might be a very good idea. But that isn't about fair trade. It's about "a fair cop". That is, we need to be confident the RADAR at least is sufficiently accurate for its purpose, even if our speedometer is a little in error. Regular calibration of the radar by a laboratory accredited with NATA to do this work should suffice.

It seems to me that it is a combination of lawyers being too smart for our good and a benevolent attitude in the NMI. By trying to argue that RADAR measurements weren't in conformance with the National Measurement Act, the lawyers forced policing organisations to ensure that they were to the extent that a traceable calibration chain has been set up for radars controlled by the police.

Also the NMI, I suggest, saw no reasons why the principles of fair trade shouldn't be extended to the fairness and correctness in all measurements in modern life. (Remember, however, that Big Brother in Orwell's book *1984* started out being benevolent.) I do not want to suggest that the NMI has plans to "take over the country"; merely to point out that the journey to a nasty place can start out with a sheaf of good intentions. I also want to question where we are right now, where are we going and is this where we should go?

For the motorist, it's not a matter of "Are we there yet?" but more a matter of "Where the hell are we?" followed by "Is this the best place to be?"

So should all RADAR "guns" including those in unmanned installations be calibrated? Clearly the answer is "Yes". How

should their measurement and calibration integrity be assured? Well maybe it doesn't have to involve Australian type approval. By selecting instruments that have passed comprehensive environmental tests performed by the manufacturer and having the operating instruments regularly calibrated in a NATA-accredited laboratory? Yes, that is certainly a practical approach.

Apart from the philosophical question of the appropriateness of the application of the National Measurement Act, there is another reason why I question the need for type approval for speed limit enforcement instruments. The technology is not static. Speed measurement technology has changed at a far greater rate than the changes of technology applying to pan balances and load cell balances and volumetric containers. If the technology is changing rapidly then by the time an instrument is type approved, it may well be obsolete and the exercise pointless.

From a philosophical point of view I don't see the connection between a punishment and fair trade so I'm cynical about the "value added" by having RADARs (and their relatives) type approved under the Act.

As a parting thought, I ask whether the whole legal measurement system could be replaced by an accredited measurement system. What do the readers think?

I could go on about other instances where charges are made on both measured quantities and deemed quantities which are, I suggest, in a grey area when it comes to fair trade, but the sun is getting low and if I want some fish to eat for the evening meal then I'd better find a fish pronto.



The scope of the national measurement legislation for the metrological control of measuring instruments for legal purposes or ...

“Riverbank Reflections No. 8” revisited



DR RICHARD BRITTAIN LLB

Senior Legal Metrology Policy Officer
Legal Metrology Branch
National Measurement Institute



Dr Richard Brittain, Who is to manage our national metrology infrastructure ... scientists? ... lawyers? ... or both?

Introduction

The purpose of this paper is to respond to some of Ron Cook's contentions concerning legal metrology in *The Australian Metrologist* – “Riverbank Reflections No. 8”¹ by clarifying the relevant legal metrology concepts, their scope and the principles that underpin them. It is also hoped that the information provided will help to bring metrologists up to date with the significant developments in legal metrology which have occurred since “Riverbank Reflections No. 8”.

Background

In April 2007, after attending a presentation by me at the MSA Victorian Branch, “Riverbank Reflections No. 8” made some interesting, original and unconventional observations on legal metrology and its scope and relationship to both metrology in general, and life and society at large. These observations were allegedly designed to stimulate debate on this relationship, the basis for it and how it might develop and serve us in the future and whether the increasing scope of legal metrology was desirable and planned or insidious and pernicious.

Reactions to “Riverbank Reflections No. 8” in the legal metrology community varied considerably. Some thought it an attack on legal metrology, others considered it to be the result of a fundamental and profound lack of understanding of the subject and still others thought of it as merely a huge NATA promotion – accreditation the solution for just about everything – the snake oil of metrology. I have taken it as an opportunity to set the record straight, if you like, on some fundamental principles of legal metrology.

With acknowledgement to the late Samuel Goldwyn², let me opine that *we have all passed a lot of riverbanks [and a lot of water] since April 2007*. Further, the national measurement and legal metrology infrastructure in Australia has changed significantly over that time. Therefore, April 2011, when this article was first drafted, seemed an apt time to revisit the issues raised to see how they have developed and to provide a legal metrologist's perspective on them.

Before embarking on this analysis, I believe that it is useful to provide some background as an aid to understanding the analysis of the key issues. This will consist of two parts. Firstly, a brief overview of the national measurement legislation. Secondly, a brief overview of the legal system.

The national measurement legislation – an overview

The national measurement legislation is a comprehensive suite of Commonwealth legislation that facilitates the national measurement and legal metrology system or systems in Australia. I say *system or systems* deliberately as in practice these are not separate, distinct, discrete systems. Both are inextricably linked but tend to be bifurcated in the minds of both metrologists and legal metrologists alike for convenience. The national measurement legislation currently consists of the following legislation:

1. *National Measurement Act 1960* (Cth);
2. *National Measurement Regulations 1999* (Cth);
3. *National Trade Measurement Regulations 2009* (Cth); and
4. *National Measurement Guidelines 1999* (Cth).

The references to the “National Standards Act” in “Riverbank Reflections No. 8” are simply a misnomer.

The fundamental purpose of the national measurement legislation is to provide metrological infrastructure, that is, the national measurement and legal metrology system(s). I do not propose to detail all the provisions of the legislation that facilitate these system(s). However, I will describe the key elements of the legal metrology infrastructure that it facilitates, the principles that underpin them and their role in legal metrology, that is:

- Australian legal units of measurement (ALUMs);
- standards;
- metrological control; and
- legal traceability.

As detailed below, this legislation generally does not mandate the use of the metrological control facilities that it provides. It merely provides metrological control infrastructure that stakeholders may elect to engage with when making measurements for legal purposes. The legislation also provides for significant exceptions from its metrological control imperatives. These also are detailed below and are relevant to many of the contentions made in “Riverbank Reflections No. 8”.

Australian legal units of measurement (ALUMs)

ALUMs are units of measurements that are recognised at law in Australia as the sole legal units for the measurement of physical quantities³. They also give effect to Australia’s obligations under the *Treaty of the Metre*⁴ to adopt and use SI metric units of measurement⁵.

Standards

The national measurement legislation provides for the recognition at law, of a suite of standards by which measurements of physical quantities, for which there are ALUMs, may be made in terms of those ALUMs⁶. The documentation associated with the “calibration” of these standards is *prima facie* evidence of their “calibration”. The term used for the “calibration” of these standards in the sphere of legal metrology is either certification or verification. Metrological control and legal traceability are further discussed below.

In view of the breadth of the facilities in the national measurement and legal metrology system(s) for both metrology and legal metrology delivered by national measurement legislation I would submit that the contention in “Riverbank Reflections No. 8” that the “National Measurement Act provides an umbrella under which trade and commercial measurements can be fairly made” is a gross understatement of the contribution that this legislation makes to Australia’s technical infrastructure.

The legal system – an overview

It is not possible to understand legal metrology without remaining cognisant of the fact that in developed societies decisions about all matters in dispute are ultimately decided on the basis of legal principles. These matters may include marriage, money and mental health as well as metrology. Lawyers such as judges rather than scientists make the final decision and in legal rather than scientific *fora* such as courts. It is also necessary to understand, at least in general, how the legal system operates. Legal metrology is about the science-law interface and how to adduce what scientists call data into what lawyers call evidence as it is the latter that will found the basis of any legal decision on the matter in contention.

Australia has a common law system underpinned by the fundamental common law principles, that is:

- the presumption of innocence;
- the burden of proof rests with the regulator;
- a high standard of proof is required for conviction under the criminal law (beyond a reasonable doubt);
- legal decisions are made on the basis of evidence of the facts in issue;

- rules of evidence test the reliability of evidence and filter out unreliable evidence from the decision making process; and
- the doctrine of precedence applies – similar matters are decided in similar ways based on previous litigation, that is, previous decisions tend to create binding precedents.

It is also necessary to remain cognisant of the fact that the system is adversarial and lawyers are active in the legal process. Conversely, judicial officers are passive adjudicators akin in many ways to umpires as well as being the ultimate decision makers. Lawyers representing each side of the argument try to use the rules of evidence to adduce in to evidence facts supportive of their case and to object to evidence from their opponent that is inimical to their case. It is the role of the judicial officer to decide what goes into evidence and what does not and then to decide, on the basis of the evidence that has been admitted, whether an action or a defence has been made out, and to rule accordingly. The common law tradition is based primarily on evidence in the form of personal oral testimony. This originated from the time when most people were illiterate. The tradition still continues as it is regarded as a tried and tested way of testing the reliability of witnesses and of their evidence. It gives the court the opportunity to form an opinion about how reliable a witness is and what weight (if any), to give their evidence based on their performance under examination and cross-examination, in particular⁷.

Legal metrology

Key to legal metrology is the ability to demonstrate the veracity of a measurement at law by means which are recognised at law. This is achieved through the use of standards recognised at law as appropriate references against which to compare and verify measurements made for legal purposes⁸. The method of comparison must also be recognised at law as appropriate for that purpose. The legal metrology infrastructure satisfies that requirement by providing for legal metrology authorities. These are technical facilities or laboratories that can calibrate standards and measuring instruments and issue reports in the form of evidential certificates that are *prima facie* evidence of the certification or verification performed by that authority.

Of critical importance is the fact that a majority of the documents used by metrologists including NATA reports and other measurement reports have no standing as evidence unless the person who prepared and signed the report is present in court to be examined and cross-examined as a witness. They also need to survive the process of cross-examination with their integrity, alleged competence and nerves intact.

Metrological control

Metrological control of measuring instruments ensures that they are fit for purpose and are calibrated in a manner that enables them to make legally traceable measurements. It ensures that measuring instruments are:

- capable of making measurements of appropriate accuracy;
- capable of working in the field, that is, under the conditions that they will experience in their deployment such as temperature, humidity, vibration, the normal vicissitudes of the mains power supply such as interferences and disturbances and the presence of EM radiation including from mobile phones;

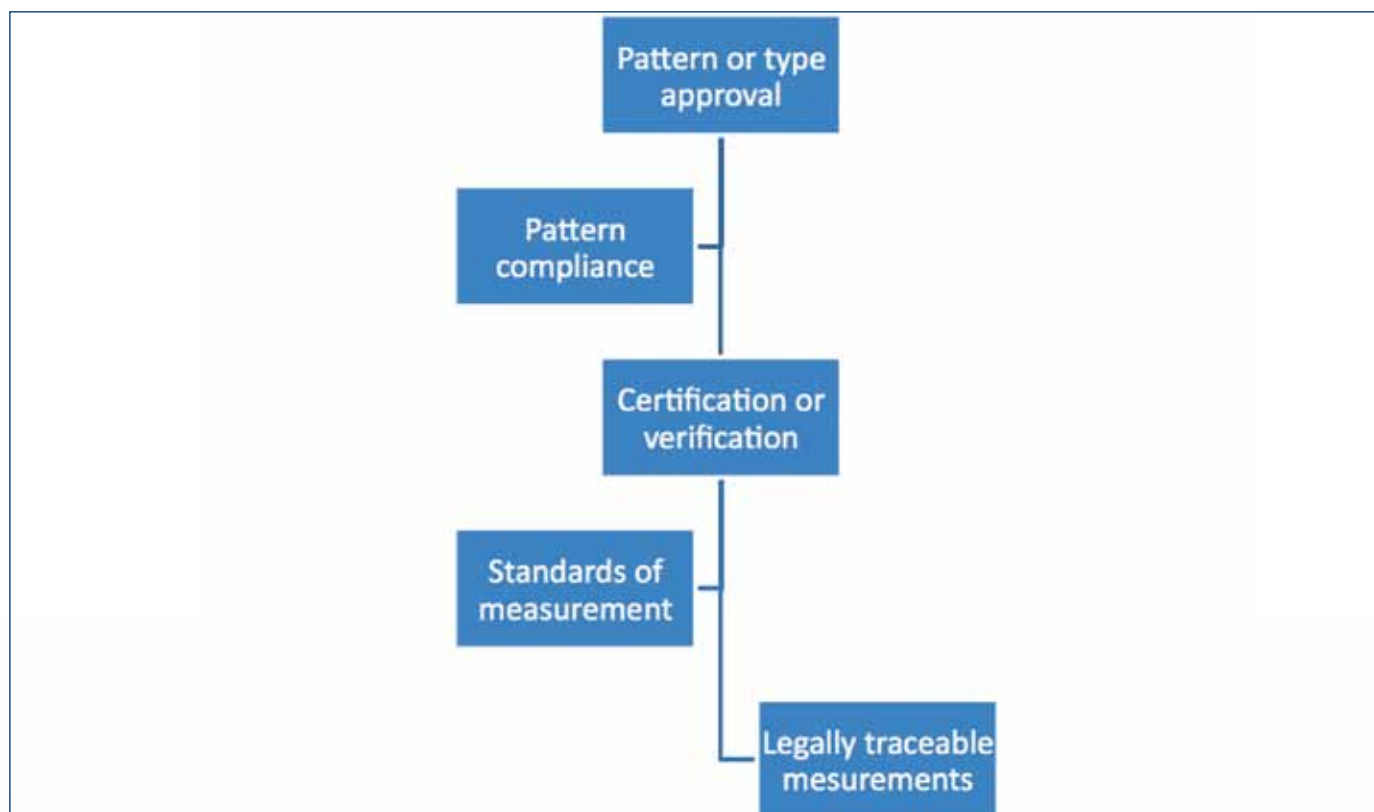


Figure 1. The essential components of a metrological control system.

- capable of retaining a calibration;
- as resistant to accidental or fraudulent adjustment as is practicable; and
- calibrated so that they can make legally traceable measurements.

The primary purpose of metrological control is to ensure the integrity of measurements made for legal purposes through legally traceability.

Metrological control systems

Metrological control is achieved by the deployment of the metrological control system(s) made possible by the facilities provided by national measurement legislation. The essential components of a metrological control system are pattern or type approval, pattern compliance and certification or verification. Figure 1 shows the structure of a metrological control system and its components are further described below.

Pattern (or type) approval

Pattern approval (also known as type approval) is a check of the design or pattern of a measuring instrument to ensure that it is metrologically sound and that measuring instruments manufactured to the pattern are fit for purpose, that is, are capable of making legally traceable measurements of appropriate accuracy in the field.

Pattern approval occurs only once for the design of each model of a measuring instrument. Once a pattern has been approved, any number of measuring instruments may be manufactured in compliance with the approved pattern. The cost of pattern approval is, therefore, amortised across the entire population of instruments manufactured to an approved pattern. It is submitted

that this is a small price to pay for the benefits that it provides and a very modest price in comparison with some of the alternatives suggested by “Riverbank Reflections No. 8” (see below).

The National Measurement Institute’s (NMI’s) Chief Metrologist is responsible for both the majority of pattern-approval testing and for the granting of approvals of patterns of measuring instruments in Australia. The criteria against which the patterns of measuring instruments are checked are determined by the NMI’s Chief Metrologist. However, the national measurement legislation gives effect to Australia’s obligations under the international legal metrology convention⁹ by requiring that the pattern-approval criteria contained in the recommendations of the International Organization of Legal Metrology (OIML) established by the convention be adopted unless it is not practicable to comply with their specifications because of particular circumstances applying in Australia, or the inconsistency is in the national interest¹⁰.

Pattern approval is a general means of determining whether a measuring instrument is fit for purpose. Whether that purpose is for trade measurement, or for other legal measurements, or indeed for non-legal purposes such as conventional metrology, the process still provides vital information about the metrological performance of measuring instruments. Ultimately, there is no point in calibrating a measuring instrument that is incapable of retaining a calibration or incapable of working in the field condition in which it will be deployed. Therefore I would submit that the contention in “Riverbank Reflections No. 8” that “type approval is one of the activities that arise out of the need to ensure fair trade” seriously understates the role and value of pattern approval to metrology in general as well as perhaps fundamentally misinterpreting its main purpose.

Pattern compliance

Pattern compliance is an auditing function that ensures that instruments purporting to be manufactured in accordance with an approved pattern do in fact comply with that pattern. The NMI's Chief Metrologist is responsible for performing, or arranging for, pattern compliance auditing in Australia.

Certification and verification

Certification or verification is the process of calibrating a pattern-approved measuring instrument that is recognised at law. Legal metrology authorities are appointed by the NMI for this purpose under the national measurement legislation. These authorities are called certifying or verifying authorities and the certification or verification documentation that they generate must be in the form prescribed in the legislation. It is *prima facie* evidence of certification or verification throughout the Australian legal system, that is, in all Commonwealth and state courts and tribunals. In order to be appointed as a certifying or verifying authority, the national measurement legislation requires that applicants hold accreditation by NATA against the competence criteria of AS ISO/IEC 17025 (2005) *General Requirements for the Competence of Calibration and Testing Laboratories*, which the NMI's Chief Metrologist regards as appropriate. Certifying and verifying authorities are also required to possess and use legally traceable standards when performing their functions so that the calibration of measuring instruments used for legal metrology is legally traceable. This, of course, in turn enables legally traceable measurements to be made by these instruments.

Legal traceability

Traceability is a familiar concept to metrologists and defined in the *International Vocabulary of Metrology – Basic and General Concepts and Associated Terms* (VIM)¹¹ as the:

property of a measurement result whereby the result can be related to a reference through a documented unbroken chain of calibrations, each contributing to the measurement uncertainty.

Legal traceability is a fundamental requirement of measurements made for legal purposes and requires that two additional conditions over and above the requirements of metrological traceability be met. Firstly, that the "reference" be a reference recognised at law in the jurisdiction where the measurement is made. Secondly, that the "documented unbroken chain of calibrations" consist of documentation of evidential standing in that jurisdiction. Section 10 of the *National Measurement Act 1960* (Cth) provides for the legal traceability of measurements in Australia by requiring that measurements made for legal purposes shall be made in terms of ALUMs and, when necessary, that be demonstrated by means of, by reference to, by comparison with, or by derivation from standards recognised at law in Australia. The legislation also provides that the certification or verification of these standards have associated with it measurement reports known as certificates which are *prima facie* evidence of the certification or verification of these standards throughout the Australian legal system, that is, in all Commonwealth and state courts and tribunals.

Ultimately, legal metrology is designed to enable the veracity of measurements made for legal purposes to be demonstrated at law

rather than their "integrity" which "Riverbank Reflections No. 8" contends could be assured by means such as "regular calibrations in a NATA accredited laboratory". This, with all due respect, appears to completely miss the point by confusing integrity, a fundamentally scientific concept, with veracity, a legal concept.

So in answer to the question in "Riverbank Reflections No. 8", "how should calibration integrity be assured", I would answer that the veracity of measurements made for legal purposes should be assured and demonstrated when necessary by the metrological control of measuring instruments used for legal purposes, using the provisions of the national measurement legislation.

Scope of legal metrology

Many of the more abstract postulations and conjectures in "Riverbank Reflections No. 8" related to the scope of legal metrology and its limits. These were, in my opinion, based on significant misinterpretation(s) of what the scope of legal metrology is and how it is circumscribed. The scope of legal metrology is not readily circumscribed by its definition as seen below. However, a general definition with a scope circumscribed by the legislation does, in my opinion, provide the best indicia of its scope.

Definition of legal metrology

Both the *International Vocabulary of Terms in Legal Metrology* (VIML)¹² and the *OIML Document D1 Elements for a Law on Metrology*¹³ provide definitions of legal metrology.

The VIML definition is:

legal metrology part of metrology relating to activities which result from statutory requirements and concern measurement, units of measurement, measuring instruments and methods of measurement and which are performed by competent bodies.

The definition further notes that "the scope of legal metrology may be different from country to country".

The OIML D1 definition, which is also found on the OIML website¹⁴, is:

Legal metrology comprises all activities for which legal requirements are prescribed on measurement, units of measurement, measuring instruments and methods of measurement, these activities being performed by or on behalf of governmental authorities, in order to ensure an appropriate level of credibility of measurement results in the national regulatory environment.

It applies not only to trading parties, but also to the protection of individuals and society as a whole (e.g. law enforcement, health and safety measurements).

Legal metrology generally includes provisions related to units of measurement, to measurement results (e.g. prepackages) and to measuring instruments. These provisions cover the legal obligations related to the measurement results and the measuring instruments, as well as the legal control which is performed by or on behalf of the government.

As a legal metrologist, I believe that a very general definition is a more appropriate starting point and the definition that I prefer is:

Legal metrology consists of all measurements required or permitted by law.



The latter readily and logically encompasses both trade measurement and other legal measurements. It also allows for the scope of legal metrology to be effectively circumscribed by the national measurement legislation, which in my submission is the case and I will be advocating this interpretation in this article.

The scope of legal metrology in legislation

In my submission both the fundamental scope of legal metrology and its delineation from other metrology are in fact found in the proper interpretation of section 10 of the *National Measurement Act 1960* (Cth). This section stipulates the legal traceability imperative, provides means for satisfying it, as well as specifying the four conditions to be met before it applies and there is a requirement for a measurement to be legally traceable. These are:

- the measurement must be being made for a legal purpose;
- the measurement must be of a physical quantity;
- there must be ALUMs for the physical quantity being measured; and
- there must be necessity to show that the measurement is being made in terms of ALUMs.

The last condition is, in my submission, the critical trigger that enlivens the provision and limits its scope. I submit that necessity arises when there are two or more sets of measurement of a disputed quantity. It is in that situation when a court is likely to find in favour of a submission based on the measurements that can demonstrate their legal traceability. Under this interpretation, it is clear that legal metrology is not an all-pervasive evil that will inevitably result in lawyers wresting control of metrology from metrologists using the might of the state and its legal system.

The scope of both trade measurement and other legal measurements are further circumscribed by the national measurement legislation¹⁵. The *National Measurement Act 1960* (Cth) circumscribes the scope of trade measurement defining when measuring instruments are considered at law to be in 'use for trade'¹⁶, that is:

"use for trade: a person uses a measuring instrument for trade if:

- (a) the person is actually or apparently in control of the measuring instrument; and
- (b) the person uses it, or makes it available for another person to use, for either or both of the following purposes:
 - (i) determining the consideration in respect of a transaction;
 - (ii) determining the amount of a tax".

The *National Measurement Regulations 1999* (Cth) circumscribe the scope of measurement made for legal purposes other than trade by defining "*legal measuring instruments*" thus:

"legal measuring instrument means a measuring instrument used, or intended for use, in the determination of a physical quantity:

- (a) for:
 - (i) law enforcement; or
 - (ii) demonstrating compliance, or lack of compliance, with a law of the Commonwealth or of a State or Territory; or

(b) that is, or may be, relevant to a proceeding in which the quantity is an issue".

Thus I submit that *legal metrology consists of all measurements required or permitted by law* is the appropriate way to define the scope of legal metrology, and that the scope thus defined rightly includes both trade and other legal measurements contrary to the contention in "Riverbank Reflections No. 8".

I would also submit that the implication in "Riverbank Reflections No. 8" that the increase in the scope of legal metrology over the years has been insidious and based on "a combination of lawyers being too smart for our good and a benevolent attitude by the NMI" was in fact specious and without legitimate basis or real merit. The scope of legal metrology has increased with the efflux of time for legitimate scientific, legal and social reasons. Science and technology are increasingly used in more aspects of modern life as they develop and they are able to provide objective assistance with additional aspects of modern life. Similarly the law is also called upon to regulate an increasing range of aspects of modern life in order to protect the population from the increasing and expanding range of challenges in modern life.

Surely objective regulation based on demonstrably good metrology is an ally of society rather than being inimical to its interests as implied in by the reference to that George Orwell's *1984*¹⁷ in "Riverbank Reflections No. 8"? I submit that it was the ascension of subjectivity over objectivity that was the real foe in Orwell's *1984* and that the road to hell paved with good intentions does not originate or emanate from legal metrology.

Finally, the national measurement legislation, whilst providing facilities for the metrological control of measuring instruments, does *not* mandate the use of those metrological controls other than for measuring instrument in *use for trade*. This requirement was first introduced on 1 July 2010 when the Commonwealth, acting through the NMI, took up its responsibility for trade measurement under the Constitution¹⁸. Therefore, in 2007 when "Riverbank Reflections No. 8" contended that "*the extension of the regulations to require type approval of devices that on the surface are not related to trade*" was "*controversial*" it appears to have been acting on the basis of a mistake as to the facts.

Exemptions to the scope of legal metrology in legislation

The *National Measurement Act 1960* (Cth) further circumscribes the scope of legal metrology by providing for some key exemptions from its trade measurement provisions¹⁹. These include:

- charges relating to telephone calls or the use of internet services;
- the fare payable for use of a taxi;
- the charge for the hire of a motor vehicle;
- tyre pressures; and
- the expiration of time, or the calculation of time, for parking a vehicle.

Further, as a proposition of law under the *National Measurement Act 1960* (Cth) time interval related to the calendar is not considered to be a physical quantity²⁰. This, of course, renders many of the comments relating to the hire of goods and services in "Riverbank Reflections No. 8" both incorrect as to law and/or otiose.

It also raises the possibility that metrology consultants charging for their services on the basis of time could be using unverified measuring instruments for trade and thereby possibly committing a criminal offence. Further, I would not be as sure as “Riverbank Reflections No. 8” that this is beyond the foreseeable future ...

It is not clear to me whether “Riverbank Reflections No. 8” was unaware of these exemptions or chose to ignore them in the tradition of not letting too many facts get in the way of a good (sic) story. Notwithstanding this possibility, in my submission it is clearly a case of *ignorantia juris neminem excusat*²¹.

Quantity and quality measurements in legal metrology

On the basis that the scope of legal metrology is *all measurements required or permitted by law* and is circumscribed by the national measurement legislation, it is relatively easy to answer the question *does legal metrology include measurements of quality as well as quantity?* by considering whether measurements of quality are required or permitted by law. Measurements of quality generally set the unit price of a good or service. Therefore, they may be considered to “determine the consideration in respect of a transaction”²² and to be for the purposes of trade. The consideration ultimately comprises the product of the quantity of the good or service and its unit price. Both the quantity and the quality are increasingly being determined by objective measurement(s). Examples of quality measurements that determine the unit price of a good are the sugar content of wine grapes, the colour of wine grapes (or their must), the protein and moisture content of grains and seeds and the sugar content of sugar cane.

So in the case of parking, measurements of both quality and quantity are legitimately within the scope of legal metrology, notwithstanding that only the latter occurs in practice and it is currently exempt from the trade measurement provisions of the *National Measurement Act 1960* (Cth). Paying for parking on the basis not only of measurement of the time that the parking space is occupied but also at a rate set by objective measurement of the quality of the parking space, is in my submission akin to determining the cost of purchasing grain based on its unit price and the quantity.

The contention in “Riverbank Reflections No. 8” that “the parking space is the object of the transaction” whilst the accuracy of the time measurement is secondary I submit fails to recognise the true scope of legal metrology. In passing, I would submit that suggestions as to what it is sensible for a magistrate to do are best couched in terms of legal principles by lawyers rather than in terms of science by non-lawyers. Further, the cumulative effect of errors of only a few seconds per hour can become significant in long-term parking in expensive venues such as airport car parks, which is why the fitness for purpose criteria that underpin pattern approval is critical to both legal metrology and good metrology in general. A good defence at law to a charge of overstaying in a parking bay is best based on an alternative measurement of the time that is legally traceable rather than a discussion on metrology, which is unlikely to persuade a court which is thinking in terms of legal principle rather than metrology.

Legal metrology, trade measurement and fair trading

Whilst I have argued that the scope of legal metrology legitimately includes both trade and other legal measurements as circumscribed by the national measurement legislation, I would also submit that a clear distinction needs to be drawn between legal metrology and fair trading. “Riverbank Reflections No. 8” appears to consider legal metrology as a subset of fair trading and to use these terms interchangeably. This, in my submission, fails to appreciate the important difference between legal metrology and fair trading. Legal metrology clearly includes trade measurements and the latter clearly represents the largest subset of the measurements made for legal purposes within the field of legal metrology. However, fair trading is not a part of legal metrology even though it is supported or underpinned in many cases by objective, fit-for-purpose trade measurement.

Leaving aside the definition of fair trade that relates to paying a fair price to producers for their produce and products (particularly in developing countries), fair trading has a specific legal meaning. Legally fair trading is a framework of law designed to eliminate or control unfair business practices such as monopolies, cartels, price collusion, false and misleading representations and to redress, or compensate for, the often large differences in economic power between trading parties. This is designed to ensure that the less powerful are treated fairly in business and not bullied, exploited or cheated. The framework of law for fair trading is currently found in the *Competition and Consumer Act 2010* (Cth) which recently replaced the *Trade Practices Act 1974* (Cth) and much of the state and territory fair trading legislation²³. The fact that this fair trading legislation was made under corporations powers²⁴ in the *Constitution* whilst the national measurement legislation was made under the weights and measures²⁵ powers of the *Constitution* further reinforces my submission that they are designed for fundamentally different, if complementary, purposes, that is, to regulate distinctly separate aspects of society.

The NMI does not have any “fair trade responsibility” under the national measurement legislation as contended in “Riverbank Reflections No. 8” and the allusion to the same is fundamentally incorrect. To borrow the words of the legal scholar Professor Ashburner when discussing another famous legal fallacy, when it comes to fair trading and trade measurement in my submission “the two streams of jurisdiction ... though they run side by side do not mingle their waters”²⁶.

Trade, regulation, penalties and tax

Trade and regulation are two fundamentally disparate functions that were incorrectly conflated throughout “Riverbank Reflections No. 8”. As a matter of legal principle, a penalty imposed as part of the enforcement of a regulation is neither a tax nor the consideration in a transaction. It is particularly important to keep this distinction in mind when the penalty is of monetary form, that is, a fine, if legal metrology is to be properly understood.

In my discussion of the scope of legal metrology I explained that it included the determination of the considerations in transactions based on measurements of both quantity and quality, the amounts of taxes based on measurements of taxable physical quantities and on the measurement of physical quantities to determine whether

regulatory limits have been reached or breached. However, the fact that the scope of legal metrology is broad enough to service all these fields does not imply that they are not discrete separate functions or that the wide scope of legal metrology renders it in any way inconsistent. The recipient of an invoice including *ad valorem* tax or a parking or speeding fine is not a customer of the regulator or the state entity levying the tax and these parties are not engaged in trade – fair or otherwise.

The attempt to divorce the scope of the *National Measurement Act 1960* (Cth) from “civic duty” is also, in my opinion, based on flawed reasoning and the contention made is simply *non sequenter*. The civic duty of every citizen includes obeying the law. Where the *National Measurement Act 1960* (Cth) lawfully determines matters within its scope, one’s civic duty includes obeying that law *per se*.

Legal metrology is about both “fair trade” and “fair cop” if fair trade is correctly interpreted to mean quality and quantity measurements made in the course and/or for the purposes of trade. The “philosophical” problem “Riverbank Reflections No. 8” has in making a connection between “punishment” and “fair trade” and the “value added” by having legal measuring instruments pattern approved is in my submission because there is no link of the type sought by “Riverbank Reflections No. 8” between these factors. Unfortunately, numerous misinterpretations and misunderstandings of key concepts in legal metrology appear to have led “Riverbank Reflections No. 8” up the creek without a paddle.

What is the alternative to legal metrology?

In my submission the fact that lawyers, by arguing that “RADAR measurements weren’t in conformance with the *National Measurement Act* ... forced policing organisations to ensure that they were to the extent that a traceable calibrations chain has been set up for radars controlled by the police” is a positive outcome. It is not clear to me how this can be construed as a case of “lawyers being too smart for our good and a benevolent attitude in the NMI”. Inherent in traceability is a hierarchy of accuracy in measurements realised through a hierarchy of standards²⁷. Surely “Riverbank Reflections No. 8” is not arguing that it is inappropriate for the accuracy of measurements made by regulators for legal purposes (such as that of vehicle speed) to be greater than the accuracy of the measurements that they are checking? This would indeed run contrary to the principles of good metrology.

What is the alternative to legal metrology as provided for by the national measurement legislation and the infrastructure (both legal and technical) that it provides? Lawyers’ metrology where disputes involving measurement are decided purely on legal principle? Is “Riverbank Reflections No. 8” seriously advocating the silent and willing acquiescence by metrologists in the handing down of absurd but binding legal precedents by our courts based purely on legal principle with no scientific basis?

Is “Riverbank Reflections No. 8” suggesting that metrologists should simply ignore the fact that all disputes are settled by law in advanced societies? The head-in-the-sand approach. Or perhaps we should go back to duelling with pistols at dawn? Alternatively we could send more metrologists into court, a field

in which they have no formal training or qualifications? A field that is populated and run by professional people whose formal training and qualifications are primarily designed to enable them to engage with the legal process. It is worth remembering that to be a lawyer you need more than academic qualifications. Lawyers like metrologists need appropriate tertiary qualifications. However, lawyers, unlike metrologists, also need to obtain and renew on an annual basis a practising certificate in order to continue working. This requires that they keep up to date with the practice rules and procedures of the legal system and relevant developments in law. Therefore, they are generally much likelier to succeed in any interaction with the legal system than is a metrologist. Especially if, rather than basing their submissions in legal principles, the said metrologist talks about the integrity of the measurements and then cheerfully admits that there is some uncertainty associated with them. Many lawyers regard taking expert witnesses apart on the stand as a bit of a sport – after all pushing an expert until they ‘lose it’ or breakdown is a good way to undermine their credibility.

Further, “Riverbank Reflections No. 8” does appear to acknowledge, or perhaps even be aware of, the fact that what metrologists call data is not necessarily the same as what lawyers and courts consider to be evidence. For example, NATA reports are not evidence; their purpose is to provide data which has metrological traceability²⁸ for metrologists. They are not evidence of the matter stated in them nor of legal traceability as are the evidential certificates that can be issued by legal metrology authorities under the national measurement legislation – they are of standing in science rather than law. Is “Riverbank Reflections No. 8” really suggesting that long and often torturous personal testimony by metrologists in court is preferable to the use of the evidential documentation in litigation provided for by the legal metrology infrastructure? Evidence of the fitness for purpose of measuring instruments and of their legally traceable calibration that is already provided for by the national measurement legislation?

In suggesting that pattern approval or metrological control could be replaced by “regular calibrations in NATA-accredited laboratories” I submit that “Riverbank Reflections No. 8” has failed to appreciate that one of the fundamental purposes of pattern approval is to ascertain whether a measuring instrument is capable of retaining a calibration. If that has not been established, what purpose is there in calibrating it? Further, repeated calibration of an instrument that is not capable of retaining a calibration would clearly serve no useful purpose. The fact that such calibrations were performed by a laboratory that has had its competence assessed and accredited by NATA is irrelevant in the case of an instrument that is not capable of retaining a calibration.

A rose by any other name, reinventing the wheel, or back to the future?

Having argued that pattern approval and metrological control are unnecessary “Riverbank Reflections No. 8” then suggests that: “*measurement and calibration integrity*” may be “assured ... by selecting instruments that have passed comprehensive environmental tests performed by the manufacture and having operating instruments regularly calibrated in a NATA-accredited laboratory”. Is this not merely metrological control by another name? I submit that it is and further that it is better if pattern

approval is not performed by manufactures but by an objective independent third party such as the NMI. It appears to me that “Riverbank Reflections No. 8” is advocating reinvention of the wheel but with all the checks and balances removed and without utilising any of the evidential provisions provided by the national measurement legislation that could support this objective. Back to the future by replacing a sound and objective system by a fundamentally flawed one operated by those with a vested interest? This clearly begs the question is it time for my medication or “Riverbank Reflections No. 8”’s and is it time to review the dose and the accuracy of its measurement?

The term “integrity” is not defined in “Riverbank Reflections No. 8” nor is it generally used in legal metrology. Therefore, I believe that it must be accorded its general dictionary meaning. Legal metrology is about ensuring the veracity of measurements used for legal purposes and being able to demonstrate that veracity at law through legal traceability. The definition of “integrity” in the *Oxford English Dictionary*²⁹ demonstrates why it is not an alternative to legal traceability. It is defined as the:

- quality of having strong moral principles;
- state of being whole;
- condition of being unified or sound in construction; or
- internal consistency or lack of corruption in electronic data.

“Riverbank Reflections No. 8” contended that there is no need for pattern approval as “the technology is not static” but changing. Technology is continuously changing – it has always changed and hopefully always will. One school of thought classifies this as progress. I submit that it is a good thing rather than a valid reason to abandon legal metrology. It is an historical fact that the law is nearly always reactive rather than proactive with respect to changes. However, it is extrapolated by applying the fundamental principles to the situation/circumstances that exist at the time in question and setting the relevant limits at appropriate levels. Taking an example from “Riverbank Reflections No. 8”, if the speed limit on a road is set in order to allow all users of that road to coexist safely, then the quantum of that speed limit is governed by the mix of traffic on the road at the time when the limit is set. The quantum will have been much lower in the days when the fastest thing on the road was a horse and the biggest vehicle on the road was a carriage drawn by horses, than was appropriate when motor bikes and motor cars arrived. Likewise, the appropriate limit changed again with the advent of faster and bigger motor vehicles. However, the principle remains intact, that is, the speed limit is set in order to allow all users of that road to coexist safely. By analogy, pattern approval standards developed by legal metrologists specify the metrological criteria that a measuring instrument must meet to be fit for purpose. These are technology independent. If a measuring instrument for vehicle speed is required to have a particular accuracy to be fit for purpose then that accuracy applies to the measurement of vehicle speed *per se*. It is irrelevant whether the basis of the measurement is RADAR, LIDAR or any other technology.

The “parting thought” in “Riverbank Reflections No. 8” is that perhaps the “whole legal measurement system could be replaced by an accredited measurement system” in my submission simply repeats and reinforces the apparent and profound lack of

knowledge and understanding demonstrated throughout the article.

The scope of legal metrology – where to from here?

By adopting the definition that *legal metrology consists of all measurements required or permitted by law*, it follows that its scope is circumscribed by the national measurement legislation. Its future scope and limits are also set by that legislation which is managed by the NMI. The NMI has a staff with the necessary legal and metrological knowledge and skills to ensure that the scope of legal metrology set by legislation is based on sound metrology and good law. As a metrologist with decades of professional experience, and a member of the NMI staff with responsibility for setting the scope of legal metrology in Australia, I firmly believe that it can be demonstrated that legal metrology serves the needs and best interest of society and does not impose pointless legal overheads on general metrology. In short, it is a carefully planned regime with clearly defined purpose, based on sound public policy goals and not a “creeping bureaucracy” as contended by “Riverbank Reflections No. 8”. Therefore, I submit that it is, borrowing the words of the late President JF Kennedy, really a case of “ask not where legal metrology is taking you but where are you taking legal metrology or asking legal metrology to go”³⁰.

Conclusions

“Riverbank Reflections No. 8” conflated many issues under the banner of legal metrology and the jury is still out on whether this was done wilfully in order to play the devil’s advocate and stimulate debate, or out of genuine indigence. The approach taken in this response has been to try and tease out the key legal metrology issues raised, and then to attempt to clarify them by explaining them in terms of both the scientific and legal principles on which they are based and their societal context.

The key legal metrology issues clarified are:

- Both trade measurement and regulatory measurements legitimately fall within the scope of legal metrology.
- Both quality and quantity measurement legitimately come within the scope of legal metrology.
- Fair trading is often underpinned by good legal metrology but is not part of legal metrology and is regulated under a different legal framework based on different Commonwealth powers under the *Constitution*.
- The scope of legal metrology *is all measurements required or permitted by law* and it is circumscribed by the national measurement legislation which is managed by professional staff within the NMI skilled in both law and metrology.
- The scope of legal metrology is based on sound metrology and good law with the goal of ensuring that measurements are what they purport to be, that is, ensuring the veracity of measurements made for legal purposes, and providing appropriate means of demonstrating that veracity at law when necessary.
- The scope of legal metrology rightly changes with the advent of new technologies and the changing needs and values of society and this change is a planned and controlled rather than *ad hoc*.

- The legal traceability provisions of legal metrology do not apply to all measurements, only measurements made for legal purposes when there is a necessity to demonstrate their veracity.
- Pattern or type approval is a vital tool for establishing the fitness for purpose of measuring instruments – both those used for legal purposes and those deployed in conventional metrology.
- Changing technology does not render pattern approval otiose – fit-for-purpose measurements are technology independent and the criteria of fitness for purpose develop with technological advances and changing societal needs.
- Metrological control of measuring instruments using the facilities provided by the national measurement legislation is the most effective means of ensuring and demonstrating the veracity of measurements made for legal purposes.
- Objective regulation based on good metrology is an ally of society rather than being inimical to its interests.
- It is appropriate that measurements made by regulators for legal purposes are more accurate than the measurement made by those being regulated.
- Legal metrology is not “a combination of lawyers being too smart for our good and a benevolent attitude by the NMI”.
- Legal metrology is not a “creeping bureaucracy”.

“Riverbank Reflections No. 8” did not develop its suggestion that the deeming provisions of legal metrology may be in a “grey area when it comes to fair trade”; however, I would suggest that on the basis of the submissions made above this suggestion is likelier to be based on fallacy than fact.

Whilst it may be contended that the study of metrology sharpens the mind, unfortunately, on the basis of some of the arguments put forward by “Riverbank Reflections No. 8” it appears that it may achieve that end by narrowing it.

Finally, with respect to idly hanging around on river banks I would suggest that it is a case of *fac et aliquid operis, ut semper te diabolus inveniatur occupatum*³¹ and needs to be treated with appropriate caution.

References

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2. Samuel Goldwyn – a famous and outspoken American film producer and co-founder of MGM studios, 1879–1974.
3. *National Measurement Act 1960* (Cth) sections 7, 7A and 7B.
4. The *Treaty of the Metre or Convention of the Metre (Convention du Mètre)* founded the International Bureau of Weights and Measures (BIPM) in 1875. The Treaty is the basis of international agreement on units of measurement. Australia became a signatory in 1947.
5. The *Système International d’Unités* or SI units – endorsed by the 11th General Conference on Weights and Measures in 1960 and adopted by the International Bureau of Weights and Measures (BIPM) as the practical system of metric units of measurement.
6. *National Measurement Act 1960* (Cth) sections 8 and 8A.
7. “Confrontation and the opportunity for cross-examination is of central significance to the common law adversarial system of trial” Gleeson CJ, Kirby, Hayne and Callinan JJ. *Lee v The Queen* (1998) 72 ALJR 1484, 1489.
8. *National Measurement Act 1960* (Cth) sections 8, 8AA, 8A and 10.
9. The *Convention Establishing an International Organisation of Legal Metrology* (OIML) was made in 1955 and Australia became a signatory to the convention in 1959.
10. *National Measurement Act 1960* (Cth) subparagraphs 19A(7)(b) (i) and (ii).
11. *International Vocabulary of Metrology – Basic and General Concepts and Associated Terms*, (3rd edn JCGM 200: 2008) clause 2.41 metrological traceability.
12. OIML *International Vocabulary of Term in Legal Metrology* (2000).
13. OIML Document D1: *Elements for a Law on Metrology* (2004).
14. <http://www.oiml.org>.
15. *National Measurement Act 1960* (Cth); *National Measurement Regulations 1999* (Cth); *National Trade Measurement Regulations 2009* (Cth); and *National Measurement Guidelines 1999* (Cth).
16. *National Measurement Act 1960* (Cth) subsection 3(1).
17. George Orwell, 1984, novel first published in 1954.
18. The *Australian Constitution* section 51, placitum xv.
19. *National Measurement Act 1960* (Cth) section 4B.
20. *National Measurement Act 1960* (Cth) subsection 3(2).
21. Latin – translates to: *ignorance of the law excuses nobody*.
22. *National Measurement Act 1960* (Cth) subsection 3(1).
23. *Fair Trading Act 1992* (ACT); *Fair Trading Act 1987* (NSW); *Consumer Affairs and Fair Trading Act* (NT); *Fair Trading Act 1989* (Qld); *Fair Trading Act 1987* (SA); *Australian Consumer Law (Tasmania) Act 2010* (Tas); *Fair Trading Act 1999* (Vic); and *Fair Trading Act 2010* (WA).
24. The *Australian Constitution* section 51, placitum xx.
25. The *Australian Constitution* section 51, placitum xv.
26. Brown D, *Ashburner’s Principles of Equity* (2nd edn 1933).
27. *International Vocabulary of Metrology – Basic and General Concepts and Associated Terms*, (3rd edn, JCGM 200:2008) clause 2.41 metrological traceability.
28. *International Vocabulary of Metrology – Basic and General Concepts and Associated Terms*, (3rd edn JCGM 200: 2008) clause 2.41 metrological traceability.
29. Judy Pearsall (ed), *The Concise Oxford English Dictionary* (10th edn, 2002). 30.
30. President John F Kennedy’s inaugural address, 20 January 1961, Washington DC USA “Ask not what your country can do for you – ask what you can do for your country ...”.
31. Latin – translates to: *do something, so that the devil may always find you busy, or more commonly: the devil finds work for idle hands*.

The Australian Metrologist welcomes
contributions to the letters page, comments,
opinions, questions and so on.

