# TRACEABILITY FOR CANADIAN ACOUSTICAL STANDARDS

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## ABSTRACT

Acoustical measurements in Canada are traceable to the primary acoustical standards maintained at INMS, NRC. In reality this may not be true since most of the users of acoustical measuring instruments in Canada may not realise the importance and understand the process of establishing traceability of a laboratory. There are two paths to establish traceability. A direct path, that is, a national metrology institute (NMI), calibrates an artefact that is used as a reference for measurement. The NMI may be a laboratory that has mutual recognition agreement with NRC. An indirect path may be traceable via laboratories that are accredited under the Calibration Laboratory Assessment Service (CLAS) program jointly administered by the Standards Council of Canada (SCC) and INMS. The latter provides technical support for the program.

## SOMMAIRE

Les mesures acoustiques faites au Canada sont traçables aux étalons acoustiques primaires maintenus par l'IÉNM du CNRC. En réalité, il se peut que cela ne soit pas toujours le cas, parce qu'il est possible que la plupart des utilisateurs d'instruments de mesure acoustiques ne se rendent pas compte de l'importance d'établir la traçabilité des mesures et ne comprennent pas les méthodes utilisées pour l'établir. Il y a deux façons d'établir la traçabilité. Dans la méthode directe, un institut national de métrologie (INM) étalonne un objet qui sert de référence pour la mesure. L'INM peut être un laboratoire ayant conclu une entente de reconnaissance mutuelle avec le CNRC. Dans la méthode indirecte, on établit la traçabilité des mesures par l'entremise de laboratoires accrédités par le Service d'évaluation des laboratoires d'étalonnage (CLAS), un programme administré conjointement par le Conseil canadien des normes (CCN) et l'IÉNM. Ce dernier établissement assure le soutien technique du programme.

## INTRODUCTION

When an acoustical measurement is made, it is reasonable to assume that the information obtained is reliable. Even with the purchase of a new instrument, during the transit of the instrument from its manufacturer, there may be unexpected vibration that can affect the performance of the instrument. In the case of a sound level meter (SLM), the usual quick check is to use a sound calibrator that generates a known sound pressure level to verify the reading provided by the SLM. However, other instrument functions, such as, the A-weighting circuits, microphone performance etc. may have been affected. Traceability of a measurement is usually related to the uncertainty of the sound pressure level measured. When an instrument is certified to be traceable to a National Metrology Institute (NMI), that means the instrument has been calibrated by that institute or certified by a laboratory that has been accredited under the Calibration Laboratory Assessment Service (CLAS) program jointly administered by the Standards Council of Canada (SCC) and INMS.

## TRACEABILITY

There are two paths to establish traceability. A direct path, that is, a NMI, calibrates an artefact that is used as a reference for measurement. The NMI may be a laboratory that has mutual recognition agreement with NRC. An indirect path may be traceable via laboratories that are accredited under the Calibration Laboratory Assessment Service (CLAS) program jointly administered by the Standards Council of Canada (SCC) and INMS. The latter provides technical support for the program. It is a misconception to assume that after the calibration of an artefact, such as a pistonphone sound source, the certified artefact can then be used to "certify" another pistonphone, and then the latter is used to further "certify" others etc. One can see that as the chain of calibration is elongated, the uncertainty of the calibration increases.

## INTERNATIONAL TRACEABILITY

For international trade, it is necessary to have mutual recognition agreements on physical measurements between countries. Currently, INMS (Canada) has mutual recognition of the equivalence of national standards with the National Institute of Standards and Technology (NIST, USA), the National Physical Laboratory (NPL, UK), and the Commonwealth Scientific and Industrial Research Organisation (CSIRO, Australia). Under the umbrella of the Bureau International des Poids et Mesures (BIPM), the Consultative Committee on Acoustics, Ultrasound and Vibration (CCAUV) has arranged international calibration

comparisons, involving over 15 countries. INMS currently participates in the above calibration comparisons on microphones, ultrasound power measurements and accelerometers. In the American states, INMS has completed microphone and accelerometer calibration comparisons with five countries under SIM (Sistema Interamericano de Metrologia): Canada, United States, Mexico, Brazil and Argentina.

## BENEFICIARY OF TRACEABILITY

The above comparisons require a lot of effort from each participating country. One may ask the question: Who is the beneficiary of international comparisons? The answer is rather complex. The results of International Comparisons will provide confidence on the measurement capabilities of the participants. With mutual recognition, the need to have the manufacturer of a product to duplicate acoustical measurements in different countries vanishes. For example: It is mandatory for machinery sold in the EC countries to have a declared noise label (sound power or sound pressure level generated by the machine at a certain distance). With mutual recognition, if the measurements were to be conducted in Canada based on an approved method and with certified acoustical instruments, it is unnecessary to duplicate the measurements in the United Kingdom. This helps to eliminate the possibility of any country from using standardisation as a barrier to trade. In short, the consumer is the ultimate beneficiary.

There are other benefits such as research and development by each country to improve their primary standards. As an example, in a recent International Inter-comparison on microphone calibration, and base on precise measurements in an environmental control chamber, INMS developed an empirical equation[1] that enables other laboratory that do not have environmental controls to arrive at calibration of laboratory standard microphones with less uncertainty. The above equation makes it possible to correct for microphone sensitivity changes with barometric pressure at various frequencies. This information is important in precision free-field measurements.

## CONCLUSIONS

It is important to consider traceability when a measurement is made. Legal consideration is usually the main incentive to seek traceability to ensure reliable acoustical measurements. The ability to demonstrate that the instruments are traceable is as important as the measurement made.

## REFERENCE

[1] G. S. K. Wong and L. Wu, "Controlled environment for reciprocity calibration of laboratory standard microphone and measurement of sensitivity pressure correction, *Metrologia*, **36**(4), 275-280, (1999).