



Metrological Traceability - fundamentals



Summary of Issues

- Connection to ISO 17025 and the Big Three
- Traceability definition and elements
- Overlap with measurement uncertainty
- Calibration programs for measurement devices
- Metrology Institutes around the world – NMIs / DIs
- Gray area traceability
- OEMs and CRMs
- Recommendations





ANSI-ASQ National Accreditation Board



Location of ANAB Offices

- **Lab-related Group** (formerly ACLASS)
 - 500 Montgomery St., Suite 625
Alexandria, VA 22314
 - 11617 Coldwater Road Suite 101
Ft. Wayne, IN 46845 (L-A-B legacy)
- **Forensics-related Group** (FQS + ASCLD-Lab)
 - ASCLD/LAB, 139 J Technology Drive
Garner, NC 27529 • Phone 919-773-2600
- **Management Systems Group**
 - 600 N. Plankinton Ave., Suite 300
Milwaukee, WI 53203





ANSI-ASQ National Accreditation Board

- Laboratories – ISO/IEC 17025
- Inspection Bodies – ISO/IEC 17020
- RMPs – ISO 17034 /Guide 34
(Reference Material Producers)
- PT Providers – ISO 17043
- Medical Labs – ISO 15189
- Product Certifiers – ISO 17065 with ANSI
- Government Programs: DoD ELAP, EPA
Energy Star, CPSC Toy Safety, NRC, NIST
IPV6, TNI, NLLAP, NEFAP
- TRAINING Programs
- Certification Bodies -
ISO/IEC 17021
- *Accreditation for
Management System
Certification Bodies that
certify to :*
 - *ISO 9001 (QMS),*
 - *ISO 14001 (EMS),*
 - *TS 16949 (US
Automotive) etc.*
 - *ISO 13485 / 22001*
- Forensic agencies – 17025
and 17020



Connection to ISO 17025 and the Big 3

- Testing and calibration labs either take measurements or determine properties
- The “Big 3” is understood as :
 - Measurement uncertainty
 - Metrological traceability
 - Proficiency testing
- Overlapping elements are key to assure conformity



Traceability definition and elements

- 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 (VIM 2.41)**
- “reference” can be a ref std, measurement unit, or a measurement procedure
- Elements include :



Traceability elements

- Reference standard or material (CRM / RM)
- Calibration procedure
- Chain of comparisons – thru NMI to SI units or consensus standards, when possible
- Calibration environmental management
- Measurement uncertainty assured
- PT participation by cal lab



Calibration

- Definition -- operation that, under specified conditions, in a first step, establishes a relation between the **quantity values** with **measurement uncertainties** provided by **measurement standards** and corresponding **indications** with associated measurement uncertainties and, in a second step, uses this information to establish a relation for obtaining a **measurement result** from an indication (VIM 2.39)



Overlap with measurement uncertainty

- Traceability includes **two levels of confidence**
 - **First**, confidence that the chain of calibrations was done diligently, with good technique and reference standards
 - **Second**, confidence that the measurement error with your calibrated device are known
 - Lastly, calibration presumes determination or consideration of MU



Calibration programs for measurement devices

- Calibration intervals are often annual but can be variable – your lab metrologist can decide
- Daily verification checks are independent of cal interval
- Critical that devices display labels with due date
- Other factors may affect cal interval
 - Dropped / damaged / removed from lab / failed verification check



Metrology Institutes around the world

– NMIs / DIs

- Related to BIPM / CIPM
- Roughly 60 countries have participating members
- Internationally acceptable for traceability, BUT... not exclusively ... more automatically accepted



Gray area traceability

- Many measuring devices can only be calibrated by their OEM (manufacturer) or limited people
- Many of them are not accredited
- Some, not all, AB's may accept non-accredited calibration sources, if . . .
- Elements of metrological traceability needed
- Some tests or cal's may not be accredited
- Huge area if not SI unit measurands – bio / chem



Non-SI unit Traceability Issues

- Biological – and microbial extra element to check
- Chemical
- Consensus standards
- Traceability to a method



Recommendations

- Prepare a list of measuring devices
- List of key reference standards, RMs, CRMs
- Schedule for calibrations
- Schedule for verifications
- Assurance of metrological traceability elements for key equipment and standards
- Ask your AB for advice and clarifications in advance of accreditation visits

