Inter-Laboratory Comparisons (ILC)

Overview

- Definitions
- Types of ILCs
- Why to participate
- How ILC are organised
- Assignment of values & evaluation
- ILC organisers
- Corrective Action after participation
Inter-Laboratory Comparison - ILC
‘Organisation, performance and evaluation of tests on the same or similar test items by two or more laboratories in accordance with predetermined conditions’

(Laboratory) Proficiency Testing - PT
‘Determination of laboratory testing performance by means of inter-laboratory test comparisons’


Goals of an ILC

- ILC to demonstrate competence and establish degree of equivalence between results of the participating laboratories
- ILC used to assign certified values to RMs
- ILC to standardise/improve a method (determine repeatability, reproducibility, ...)
- ILC as a training exercise to improve skills
ILC for Validation of measurement procedure

- Objective: determine procedure repeatability “s_r” and reproducibility (between lab) “s_R”
- Evaluation using ANOVA (Analysis of Variance)
- Check for Outliers (before averaging/concluding)
  – Cochran test for variance outliers,
  – Grubbs test for average outliers

[ISO5725-2]

ILC for certification of (C)RM

- Objective: determine the certified value and it’s uncertainty for Reference Materials
- Uncertainty estimation, \( u_{char} \) [ISO-GUM]
- Technical Discussion Meeting

[ISO Guide 35]

See Module “CRM”
ILC for performance evaluation of laboratories (PT)

- Objective: determine the performance of laboratories
- Evaluation Parameters:
  - Assigned value
  - Performance indicators
- Evaluation of single performance
- Evaluation of combined performance with composite scores

[ISO Guide 43 & ISO/DIS 13528]

I - Design

- Establish objectives/ purpose
- Selection of organiser
- Selection of sample/matrix & measurand/analyte
- Selection material provider
- Preparation of Test material
- Test of Homogeneity and stability
- Determination of assigned/reference value
- Selection of participants
II - Execution

- **Distribution** of test samples to participants
- **Analysis** by participants *(measurand quantification)*
- **Reporting** by participants to Organiser

III - Evaluation

- **Evaluation** of results
- **Reporting** by Organiser to participants *(feedback)*
- **Draw Conclusions ⇒ corrective action**

Performance Evaluation Criteria are set by the ...

- Organiser of the PT/ILC
- Accreditation body
- Regulator
- Participating laboratories themselves
How to obtain assigned values?

- Nominal value
  - By preparation (gravimetric/volumetric)
- Value derived from
  - all participants results
  - a sub-set (after outlier rejection)
- Reference Value independent from participant results, with demonstrated metrological quality
  - traceability and small uncertainty
  - link to international measurement infrastructure

IMEP-13 (directive 94/62/EC)
Trace Elements in polyethylene

Results from all participants.
Results from all laboratories.

externally set deviation unit: set by legislation 98/83/EC

Performance Indicators

- Percent Difference
  \[ \frac{X_{\text{lab}} - X_{\text{ref}}}{X_{\text{ref}}} \times 100 \]

- Z-scores;
  \[ Z = \frac{X_{\text{lab}} - X_{\text{ref}}}{s} \]

- Zeta score;
  \[ \text{zeta} = \frac{X_{\text{lab}} - X_{\text{ref}}}{\sqrt{u_{\text{lab}}^2 + u_{\text{ref}}^2}} \]

**Evaluation of Performance**

**Common examples of application scores are:**

<table>
<thead>
<tr>
<th>Performance</th>
<th>z score</th>
<th>Zeta score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satisfactory</td>
<td>( \leq 2 )</td>
<td>( \leq 2 )</td>
</tr>
<tr>
<td>Questionable</td>
<td>( \text{&gt; 2 but ( \leq 3 )} )</td>
<td>( \text{&gt; 2 but ( \leq 3 )} )</td>
</tr>
<tr>
<td>Unsatisfactory</td>
<td>&gt; 3</td>
<td>&gt; 3</td>
</tr>
</tbody>
</table>

**Corrective Action after participation:**

1) ‘blunder’
   (measurement system out of control, calculation error)

2) Measurement ‘model’ is not correct: the mathematical description of reality is not complete enough,
   *(e.g. bias not taken into account: digestion? extraction?)*

3) Underestimated uncertainty of an influencing input quantity

4) Combination of 2) and 3)

Unsatisfactory performance? ➔ Spot the mistake & implement Corrective Action
Who organises ILC/PT?

- CCQM (www.bipm.fr)
- IMEP by IRMM (www.imep.ws)
  - external reference value, linked to international measurement capability
  - support to EA (European Cooperation Accreditation)
  - on issues related to EU directives, crossing borders of sectors & geographic regions
- FAPAS (www.fapas.com)
- AFSSA (www.afssa.fr)
- EA (www.european-accreditation.org)
- Community Reference Laboratories (CRLs), for National Reference Laboratories (NRLs)
- Other ➔ check www.eptis.bam.de
  (European Information System on PT Shemes)