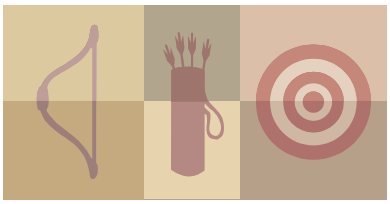
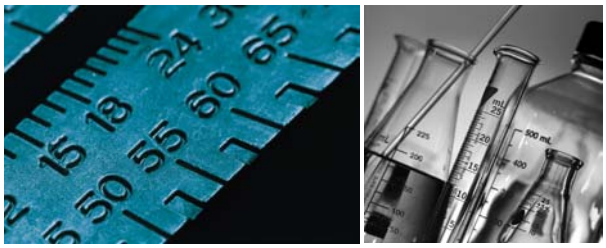
Statistical Issues in Good Laboratory Practices (GLP)



Introduction to the Analysis of Measurement Uncertainty



Introduction to the Analysis of Measurement Uncertainty

Definition of uncertainty

Why is it important to measure uncertainty?

Characteristics of a measurement system

- Types of error and uncertainty: random and systematic errors
- Data quality: reliability, validity, accuracy, precision, bias, stability, etc.
- Impact of error on data quality

Positioning uncertainty analysis in Good Laboratory Practices (GLP)

Two approaches to uncertainty analysis: Type A and Type B Evaluation

Statistical Tools for Uncertainty Analysis

Descriptive statistics

- What are variables and distributions?
- Visualizing distributions: Box-plots and blob plots
- Characterizing distributions: Central tendency and dispersion measures

Statistical inference

- True value vs. population (best estimator of the measurements or determinations)
- Standard-Error (standard deviation of the measurement mean)
- Impact of the number of measurements on the size of the standard error
- Confidence intervals
- Connection to the notions of standard and expanded uncertainty

Some statistical distributions and their properties

- How does the sample measurement mean evolve as the number of repetitions increases? (Central Limit theorem)
- Normal distribution
- Uniform distribution
- Triangular distribution

The Process of Measuring Uncertainty

- Definition of the« measurand »
- Identification of sources of uncertainty
  - Sampling, storage conditions, measurement instruments, purity of components, measurement conditions, improper calibration, use of blanks, operator, etc.
  - Graphical tool: Ishikawa diagram
- Statistical approach for measuring uncertainty: Type A
  - Experimentation
  - Sampling: homogeneous material (random) vs. heterogeneous material (systematic)
  - Sample size determination
  - Statistical tools
  - Advanced methods: ANOVA, least squares
  - Detection of extreme values (Box-plots, statistical tests, etc.)
- Analytical approach for measuring uncertainty: Type B
  - Context of use
  - Interpreting manufacturer's specifications
  - Other application examples
- Combining the two types of uncertainty (combined uncertainty)
  - Budget
  - Propagation of errors method
  - Monte-Carlo simulation methods
- Utilization and reporting results
  - Current standards (norms) in use
  - Differences between standards
- Related methods (an overview)
  - Bias quantification
  - Calibration curves