



# Measurement of Uncertainty





# New Concept to Environmental Labs?

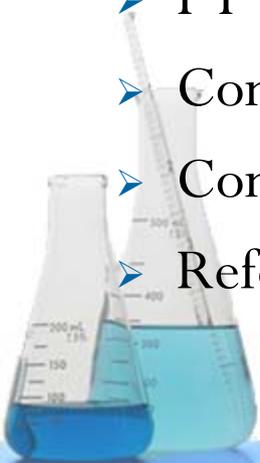
- Although a well established concept in calibration labs where simpler physical measurements are involved, the application of measurement uncertainty is relatively new to testing laboratories where random sources of uncertainty dominate.
- In the Environmental Lab measurement of uncertainty usually pertains to “Analytical Uncertainty”





# Analytical Uncertainty

- A subset of Measurement Uncertainty that includes all laboratory activities performed as part of the analysis
- These laboratory activities consist of estimates uncertainties from data derived from routine laboratory QC samples such as:
  - Duplicates – Precision
  - PT Studies
  - Controls (LCS) – Accuracy
  - Control Limits (95% Confidence)
  - Reference Materials (traceable to NIST) - Accuracy



# REPORTING: UNCERTAINTY

## **nelac** 5.5.10.3.1

- where applicable, a statement on the estimated uncertainty of measurement; information on uncertainty is needed when a client's instruction so requires;

## TNI 5.10.3.1

- where applicable, a statement on the estimated uncertainty of measurement; information on uncertainty is needed in test reports when it is relevant to the validity or application of the test results, when a customer's instruction so requires, or when the uncertainty affects compliance to a specification limit;

ISO 17025 Change



# Do we need to report?

- where applicable, a statement on the estimated uncertainty of measurement;
  - Does not say you have to report uncertainty values
  - Statement can be a narrative qualifying results
    - ✦ Usually included with test reports now
  - Most customers would not want to see results with  $\pm$  factor



# When?

- when it is relevant to the validity or application of the test results,
- when a customer's instruction so requires,
- or when the uncertainty affects compliance to a specification limit;





# MODULE 6: RADIOCHEMICAL





# MEASUREMENT UNCERTAINTY

- Each result shall be reported with its measurement uncertainty.
  - indicate whether the uncertainty is the combined standard uncertainty (“one sigma”) or an expanded uncertainty; and
  - for expanded uncertainties, indicate the coverage factor ( $k$ ) and optionally the approximate level of confidence.
- The procedures shall be documented and shall be consistent with
  - ISO Guide 98: 1995, Guide to the Expression of Uncertainty in Measurement (GUM)
  - Chapter 19 of the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP)



# Toxicity

- 1.7.1.4 Test Sensitivity
- a) The PMSD (percent minimum significant difference) shall be calculated according to the formula specified by the method and reported with the test results.
- b) Point estimates: (LCp, ICp, or ECp) – Confidence intervals shall be reported as a measure of the precision around the point estimate value, when the calculation is possible.
- Toxicity statistics computer programs (including one by EPA) provide these calculations