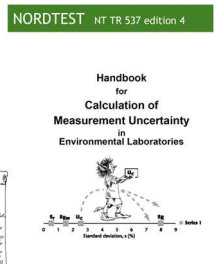
Updates of Handbooks from Nordtest

Uncertainty Quality control Sampling *U* Pipette calibration/control



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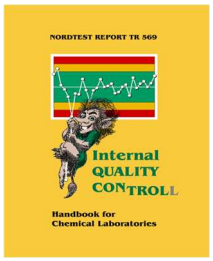

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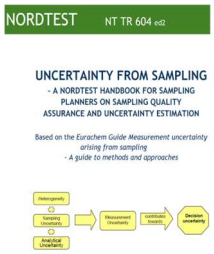

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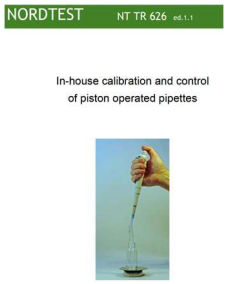

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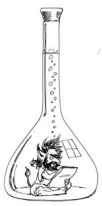
Nordtest handbooks are widely accepted

- Accreditation
  - ILAG G17 **Measurement Uncertainty in Testing** refers to Nordtest 537 (MU) and 604 (Sampling MU)
- Translated to many languages thanks to many devoted colleagues
- Widely used by many laboratories



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Explanations

s = standard deviation

s_{Rw} = within-lab reproducibility

QC = Quality Control

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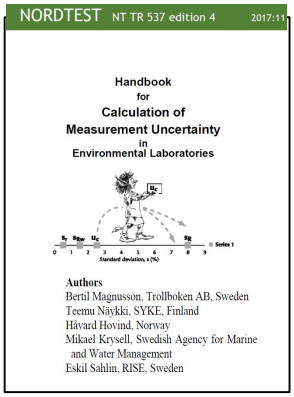
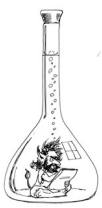
History of Nordtest TR537

- **Edition 1.0 2003**
- **Edition 1.2 2003**
- **Edition 1.3 2003**
- **Edition 2 2004**
- **Edition 3 2008**
- **Edition 3.1 2012**
- **Edition 4 2017**
- **Edition 5 2026**
- **Available in…**
  - English, Danish, Greek, Serbian, Turkish, Finnish, Russian…





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Nordtest 537 updates 2017

- Uncertainty over the measurement range
  - Section of uncertainty over the measurement range,
    - either absolute units or relative units
- Estimating standard deviation from range
  - Pooled standard deviation is used instead of a factor applied to the mean range.
- Stresses the use of control **chart limits** for the within-lab reproducibility component *u*(Rw) when estimating *U*
- Harmonisation with ISO 11352
  - Water quality — Estimation of measurement uncertainty based on validation and quality control data

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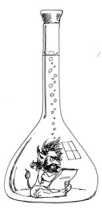
Nordtest 537 updates 2026 – planned not decided

- New title … **evaluation** of MU in **testing laboratories**
- Evaluation of bias from PT
  - Propose using a mean bias for PT results for similar matrix and concentration levels
- Harmonisation of with ISO 11352 2025
  - Water quality — Estimation of measurement uncertainty based on validation and quality control data
  - Calculation of s_{Rw} from control charts with only action limits
- New important references
  - ISO 33403 (2024) Reference materials – Requirements and recommendations for use – discuss uncorrected bias
- Introducing equation for uncertainty over concentration range
  - If only relative uncertainty – propose calculate LOQ from *U*.



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Nordtest TR537 uncertainty estimation

- Basic principle

Within-laboratory reproducibility

Long-term random effects

$$u_c = \sqrt{u(R_w)^2 + u(bias)^2}$$

Bias from CRM/PT/Spiking

Long-term systematic effects

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Uncertainty Quality control Sampling *U* Pipette calibration/control

New edition planned 2026

New edition march 2026

2nd edition 2020

1st version 2025

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Nordtest 569

- 1th edition 2005
- 6th edition 2026
- Translated language in green

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Summary

- Always communicate to client the control chart
- Use target control limits for setting up QC
- Use simple rules for evaluating the QC
- Uncertainty estimation - precision

- Tell client results is ± 2 s_{Rw}
- Based on client's requirements
- Propose 3s & 2s rules (2 of 3 on same side) and yearly review
- Use the control limits NOT the actual *s* measured

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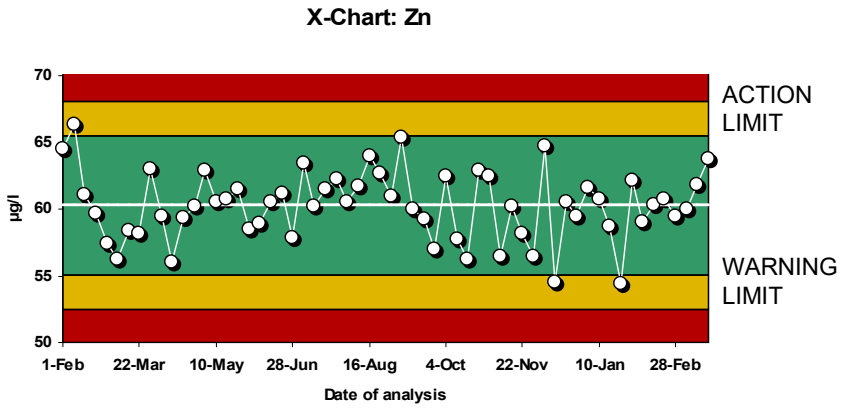
QC chart



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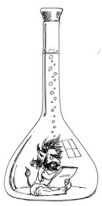
Two scenarios

The QC (internal quality control) is important for a laboratory to know and show the quality of the results.

We will start with common scenarios for a production laboratory

1) the client trusts all the figures reported in the result
2) the client is nearly always questioning the results when a “different” result is repoorted

Let’s start with an example of a client questioning the results



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Once upon a time there was a laboratory who always quarrelled with the catalyst department…

…but one day during coffee break,
one colleague of mine at the lab said

There are no extra samples from the catalyst department any more. They always used to send a second or a third sample because they did not believe the first results

- I was a new analytical chemist at this analytical laboratory of a chemical company, later AKzoNobel
- I wanted to start with QC in the lab
- My colleagues did not like me proposing MORE work

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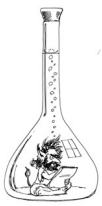
The catalyst department

- Produced fluid cracking catalysts, FCC, to crack crude oil into lighter fractions
- The catalyst is poisoned by metals in the crude oil, e.g. Ni and V – maximum 1000 mg/kg
- Each month the refinery took a sample of the catalyst and send to the laboratory
- The laboratory analyse Ni, V ….



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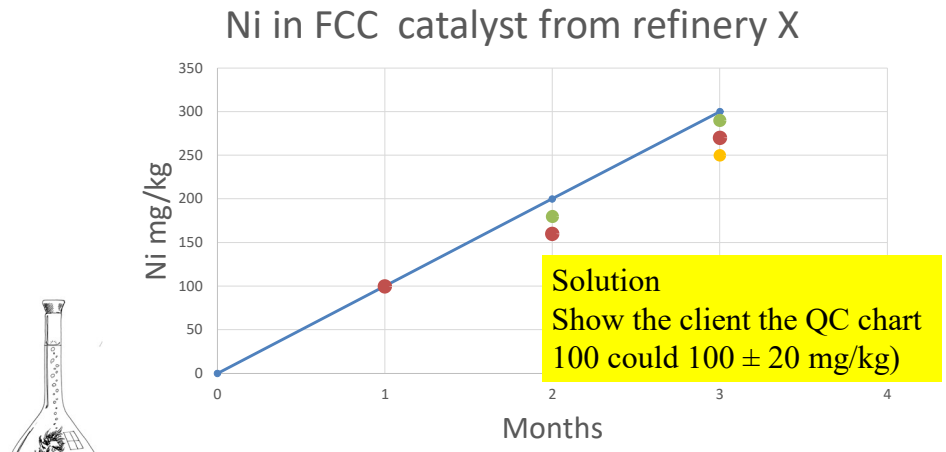
Lab results month 2 and 3 does not fit with predicted – each month extra analysis



Solution
Show the client the QC chart
100 could 100 ± 20 mg/kg)

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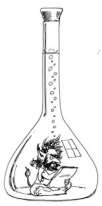
…and they lived happily all after

and no more extra samples from the catalyst department and

my colleagues started to ask me

Could you help me with setting-up this control charts that they use for the FCC catalyst…



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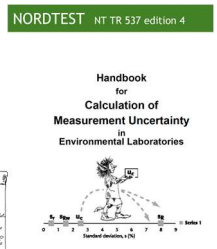
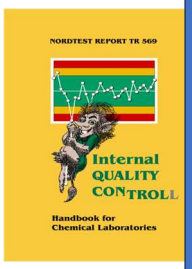
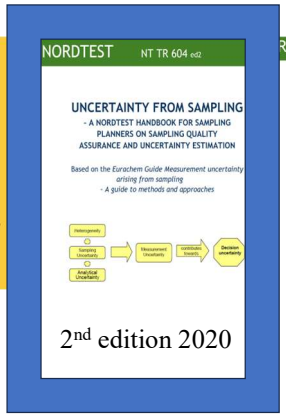


New edition planned 2026



New edition march 2026



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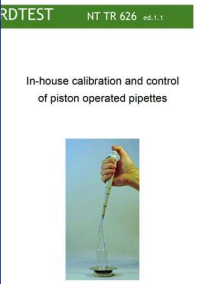

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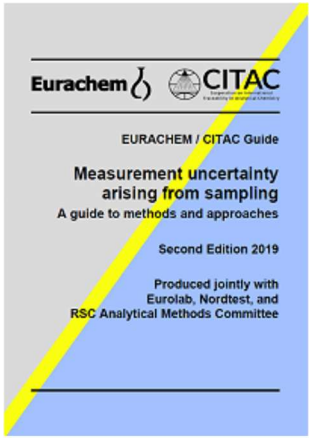
Uncertainty from sampling Nordtest 604

- Developed in a working group together with Eurachem
- The handbook is an extract of the *Eurachem Guide Estimation of measurementuncertainty arising from sampling*.
- Why this copy?
  Nordtest has worked a lot with environmental sampling and wanted to alsopublish a shorter guidance



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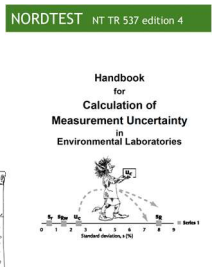

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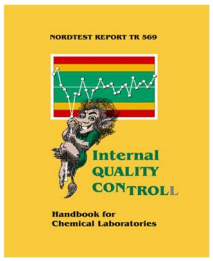

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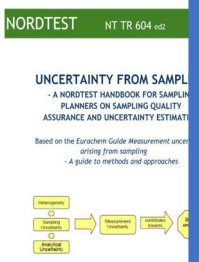

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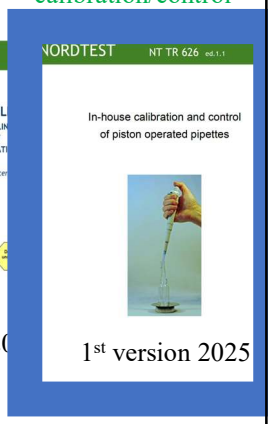

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Nordtest TR 626

Nordtest TR 626
In-house calibration and control of piston operated pipettes

Edition 1.1 (2025)

Martin Jönsson and Bertil Magnusson
Eurolab Eurachem Sweden

eurolab Eurachem

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Instruction for calibration of automatic pipette

Calibration, verification and control of automatic pipettes

Based on following standards for volumetric apparatus:

- ISO/TR 20461:2023 Uncertainty for volume measurements of a piston-operated …
- ISO 8655-1 giving general requirements and terms for volumetric measuring apparatus;
- ISO 8655-2 and ISO 8655-6 describes gravimetric methods for determining the volume delivered from piston operated volumetric apparatus; and
- ISO 8655-10 [6] giving user guidance.

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a. Note the temperature in the laboratory
b. Put the weighing vessel on the analytical balance
c. Attach the pipette tip and wet the tip by rinsing at least three times with the pure water
d. Press down on the plunger
e. Hold the pipette vertically (0°) and immerse the tip to a depth of about 3 - 5 mm below the surface
f. Release the plunger slowly
g. Hold for 1-2 seconds then raise the pipette from the liquid
h. Zero set the balance
i. Hold the pipette tip against the inside of the vessel with the pipette at a 30 - 45° angle* – Figure 1
j. Depress the plunger smoothly to the first stop to transfer the liquid. Where applicable, wait 1 second then use the 'blow out' or 'purge' function to transfer the last drop by pushing the plunger all the way down. Finish by pulling the tip towards the inside of the weighing vessel and removing the pipette
k. Note the mass m_i

If required repeat the cycle from c to j until all measurements are completed.

Instruction for calibration of automatic pipette

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Nordtest 626 - Scope

- One detailed pipetting procedure used for

1) in-house calibration (n =10)
2) verification of specification (n =10)
3) routine check. (n =1)

- NOTE: In-house calibration: Calibration of equipment that is n
the instrument that produces the result being reported.

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In-house calibration
Measurement uncertainty for a **single** delivery

- Two components
- Repeatability - % RSD
- Bias $b = \frac{\bar{V} - V_{ref}}{V_{ref}} \times 100$

Uncertainty for a single delivery of volume using the pipette

$$U = |b| + 2 \times \%RSD$$

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In-house calibration
Measurement uncertainty for a single delivery

- For a laboratory performing in-house calibrations the important outcome is the uncertainty *of a single delivered volume*
- Here is used the simplified approach proposed in ISO/TR 20461 Annex A

1. Only a single delivered volume is considered.
2. The max random error is the repeatability at 95% confidence, 2 × %RSD.
3. The max systematic error expressed as percent bias is added to the uncertainty, taking into account that no bias corrections is applied.

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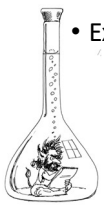
Verification

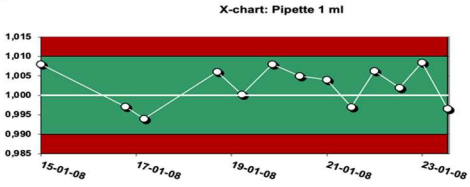
•Verification of internal specifications. Limits can be set according to

1) manufacturer's specifications, I
2) SO 8655-2 or
3) according to the laboratory's own requirements.

• Proposed maximum permissible systematic and random errors.

• Examples of how errors can be monitored





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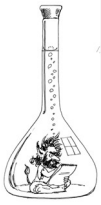
Routine check

The action limits are set according to the requirements.
The table shows examples from one laboratory with action limits set based on acceptable measurement uncertainty.

Volume mL	*U* %	Lower AL mL	Upper AL mL
1	**2**	0.98	1.02
2	**2**	1.96	2.04
5	**2**	4.90	5.10
10	**2**	9.80	10.20



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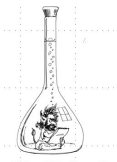

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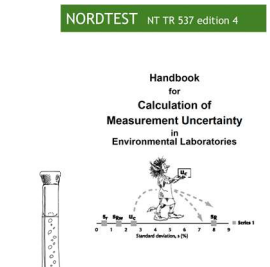

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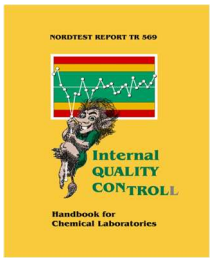

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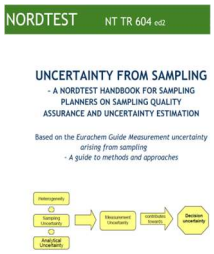

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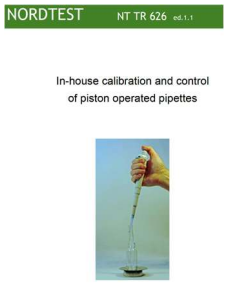

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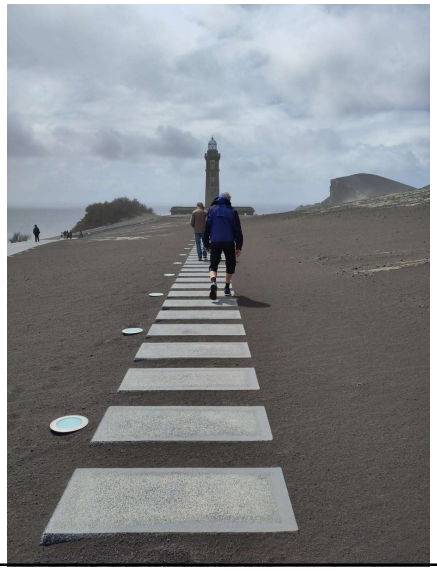
Thanks for listening – looking forward to ?



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