

Internal Quality Control

Control charts and the Trollbook

Target control limits

Recommendations

Other use of control charts



TROLLBOKEN AB

RECENT DEVELOPMENTS IN QUALITY ASSURANCE
Cyprus 12-13 March 2024
Bertil Magnusson, Trollboken AB

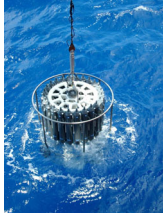
Αναλυτικός χημικός



Welcome
all analytical
chemists



CV Bertil Magnusson



LDPE



AAS - Graphit furnace

XRF



AAS flame ICP



NORDTEST



70'

Water analysis
Heavy metals

80' - 90'

Chemical industry

00' e 10'

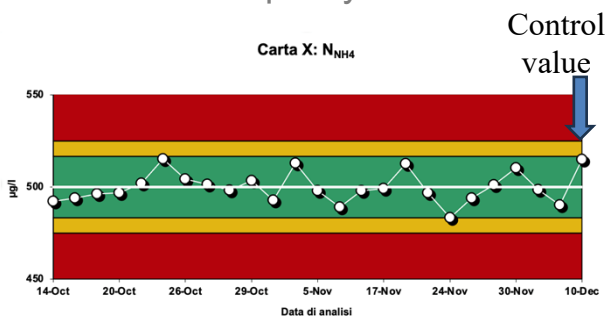
Metrological
Institute

20' Consultant for
laboratories

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Vocabulary for internal quality control



Control chart X,
R and r%

Control limits
Warning % action

Centre line
Average or
nominal value?

Planning quality control is not easy ... Perhaps the Trollbook will help you



S_{Rw}

within-lab
reproducibility

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Important for internal quality control

- **Stable** control samples
 - best for years
- Samples similar to test samples
- Control charts
 - Fixed central line
 - **Suitable** and fixed control limits
- Daily interpretation
 - Clear rules – propose only 2
- Annual review



Interpretation of a control value



or



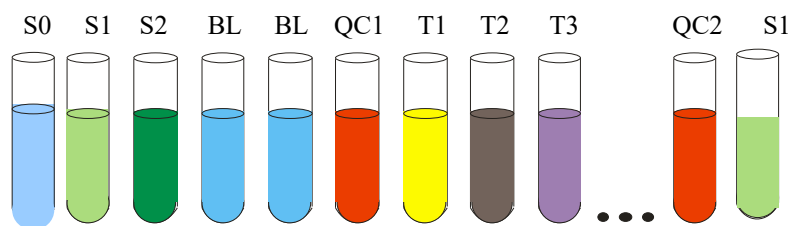
never ever



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Possible quality control setup The analytical run



S0..S2 Standard solutions
BL Blank samples
QC1.. Quality Control Samples
T1...T3 Test samples

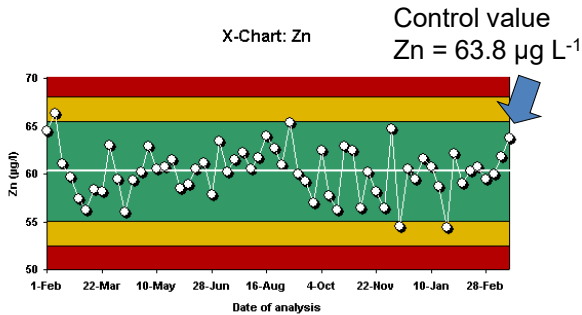
Result Zn
= 85 $\mu\text{g L}^{-1}$

Result Zn
= 63.8 $\mu\text{g L}^{-1}$

Slide 6

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Principles of internal QC - plotting the data in QC chart



Report ALL control values

- at least one more significant digit
- values below LOD
- values even if negative



This chart uses statistical control limits

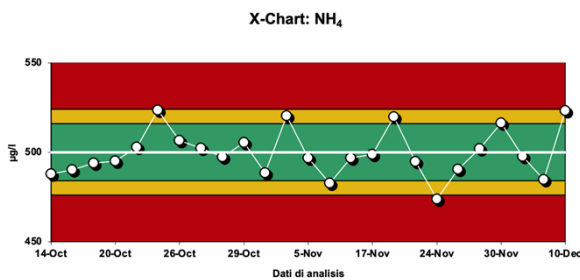
A control sample should be treated in the same way as test sample

but reported differently

Slide 7

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Example with too narrow limits



ISO/IEC 17025 7.7.1

Quality control of results is needed
You can use control chart ...



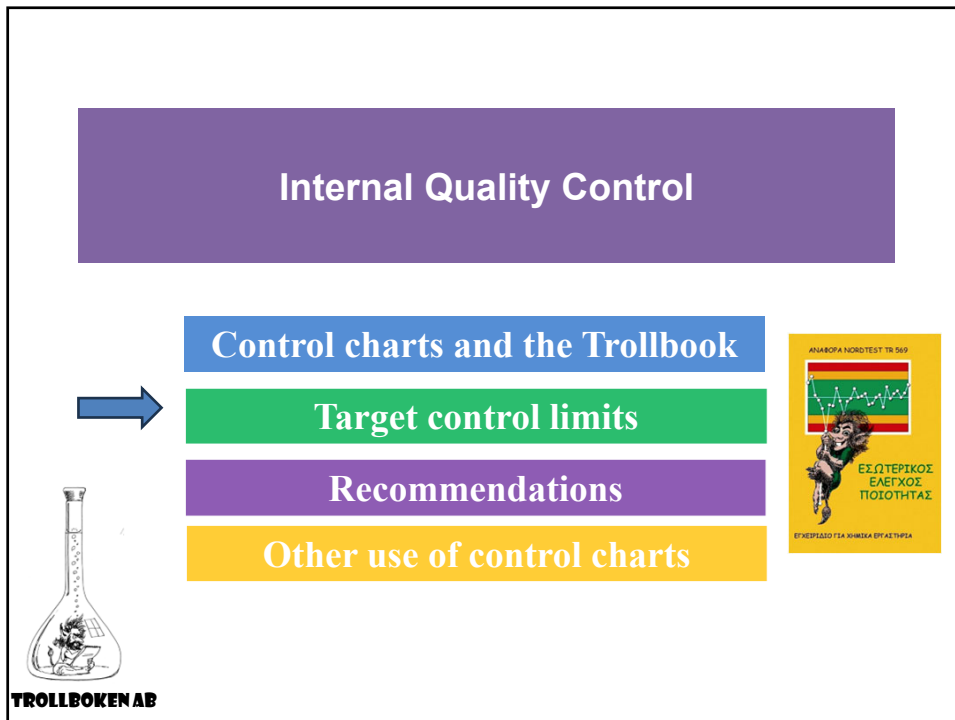
Example with statistical limits

S_{Rw} ?

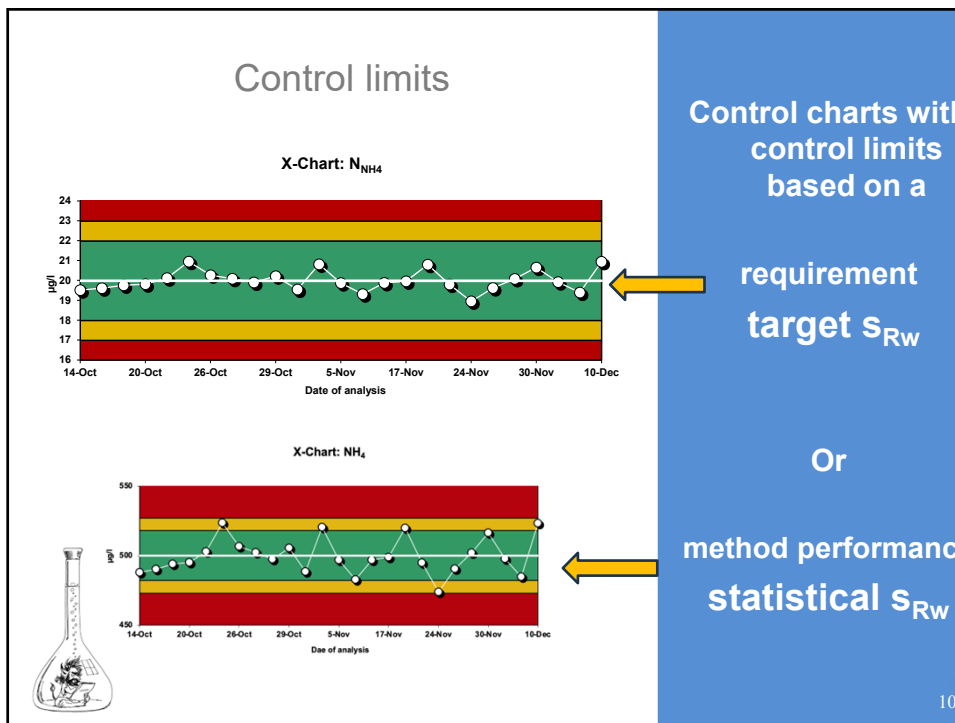
- 1 Many results
- 2 Long time

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We can have different control limits

Statistical limits

Target limits



Let's talk about requirements for target limits

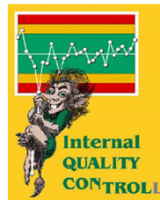
Control limits should be based on requirements

VASTED

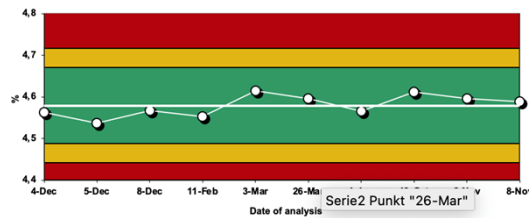
11

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Example 1 in



X-Chart: Ni



Requirement on uncertainty

$$s_{Rw} = \frac{U}{4}$$

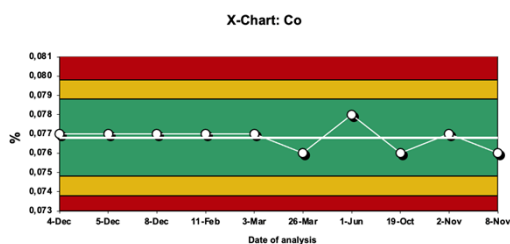
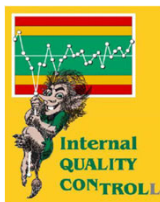


s_{Rw} Target within-lab reproducibility
 U Target uncertainty

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Example 2 in



s_{Rw} Target within-lab reproducibility
 LOQ Required limit of quantification

Requirement on LOQ

$$s_{Rw} = \frac{LOQ}{10}$$

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EU directive UE 2020/2185

concerning the quality of water intended for human consumption

Table 1. Minimum performance characteristic 'Uncertainty of:

Parameters	Uncertainty of measurement (See Note 1) % of the parametric value (except for pH)
Aluminium	25
Ammonium	40

Indicator parameters



Parameter	Parametric value	Unit
Aluminium	200	µg/l
Ammonium	0,50	mg/l

Requirement on uncertainty

Uncertainty $\leq 40\%$

Maximum value for ammonium is 0.50 mg/l

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Ammonium in drinking water

Target uncertainty

$$U \leq 500 * 40/100 \leq 200 \mu\text{g/L}$$

Target standard deviation

$$s_{RW} = \frac{U}{4} = \frac{200}{4} = 50 \mu\text{g/L}$$



Requirement on uncertainty

EU 2020/2185
Drinking water for ...

Target s_{RW}
for the
control chart is

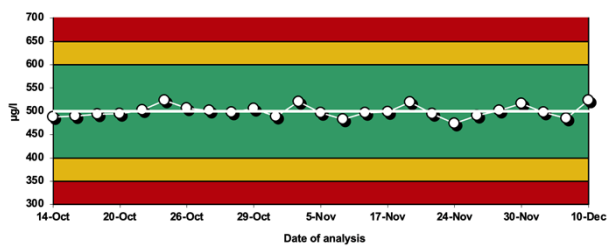
50 $\mu\text{g/L}$

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Ammonium in drinking water

X-Chart: NH_4



s_{RW} Target within-lab reproducibility
 U Target Uncertainty

Requirement on uncertainty

EU 2020/2185

Target s_{RW}

$$s_{RW} = \frac{U}{4} = \frac{200}{4}$$

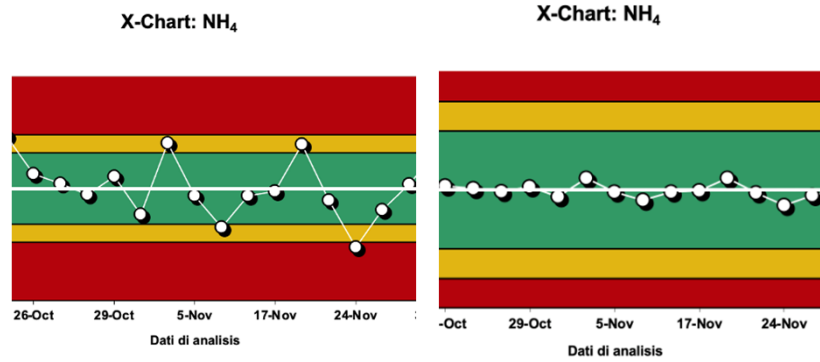
= 50 $\mu\text{g/L}$

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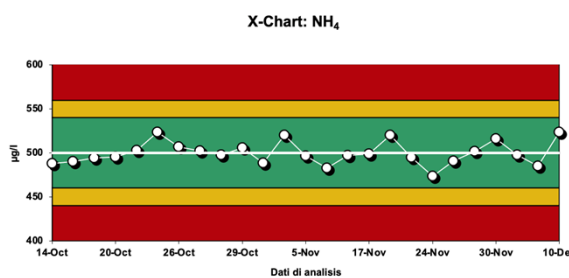
Comparing the control charts – same data

- Target control limits



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Ammonium in drinking water



Target s_{RW}

$$s_{RW} = 20 \mu\text{g/L}$$

Method

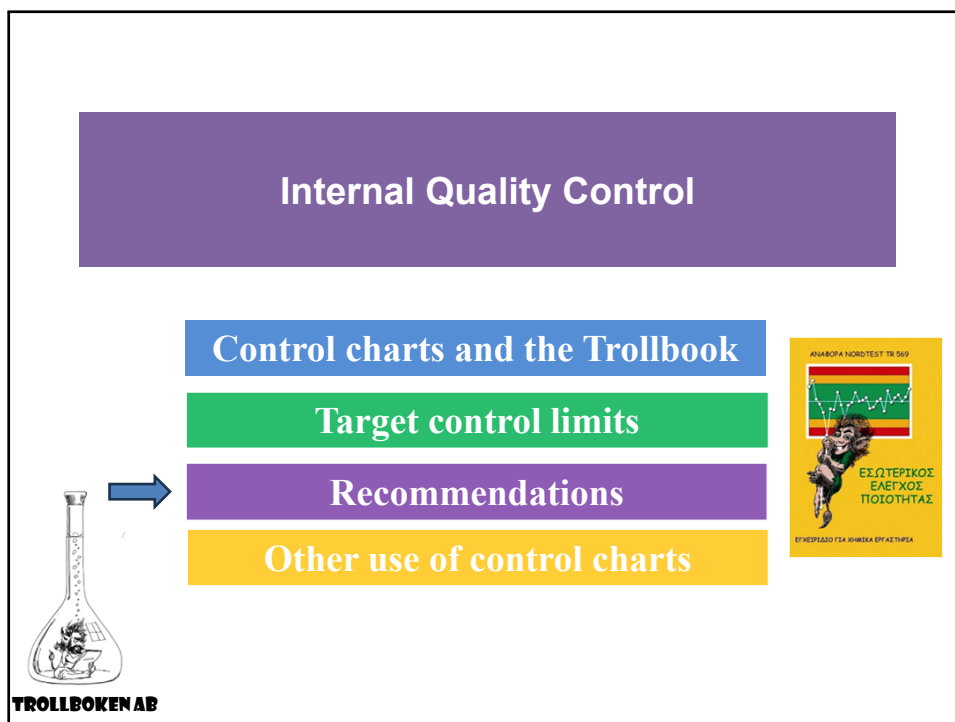
$$s_{RW} = 9 \mu\text{g/L}$$

It is not necessary to set limits that are more than two times the method performance







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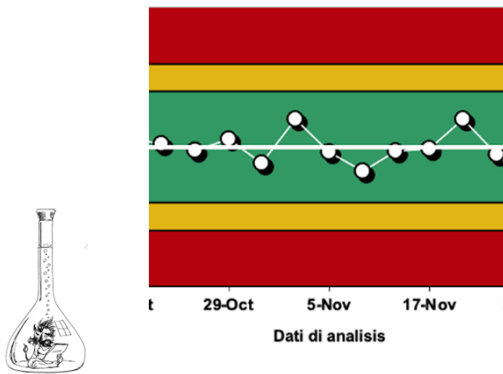
19

<p>Important for internal quality control</p> <ul style="list-style-type: none"> • Stable control samples <ul style="list-style-type: none"> – best for years • Samples similar to test samples • Control charts <ul style="list-style-type: none"> – Fixed central line – Suitable and fixed control limits • Daily interpretation <ul style="list-style-type: none"> – Clear rules – propose only 2 • Annual review <div style="text-align: center; margin-top: 20px;">  </div>	<p>Interpretation of a control value</p> <div style="text-align: center; margin-top: 20px;">  <p>or</p>  <p>never ever</p>  </div>
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Important for internal quality control

- Fixed central line
- Fixed control limits



Recommendation

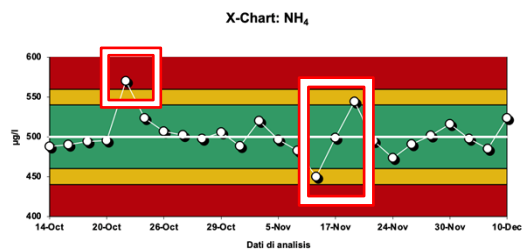
For statistical limits
> 60 results and
one year
for fixed limits

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Important for internal quality control

- Daily interpretation
 - Simple and clear rules



Interpretation of a control value



The analyst can NOT report analytical results if the control value ...

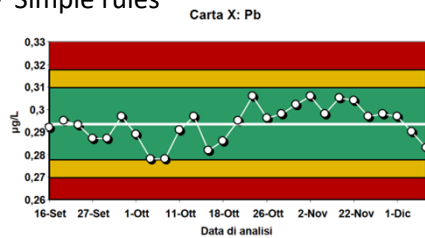


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Important for the internal quality control

- Daily interpretation
 - Simple rules



Analyst can report analytical results when the control value is in the green area



Long-term review of control chart

Interpretation of a control value



Recommendation
Annual review

Capitolo 10



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Other use of control charts



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Other use of control charts

- Balance



- Pipette



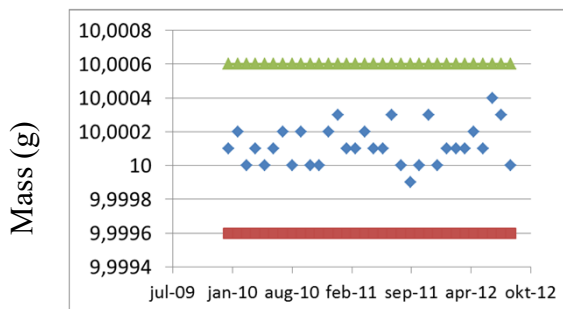
You can use just
action limits

«Acceptance charts»

25

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Control of an analytical balance – 3 years



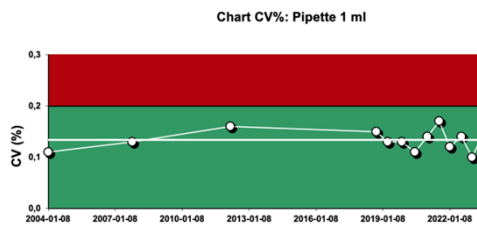
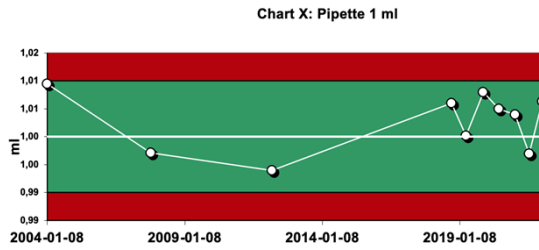
Target control
limits

Use
 ± 5
of last digit

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15 years control of a pipette 1 ml



Action limits
from specification

Chart X
0,01 ml

Chart CV%
0,2 %



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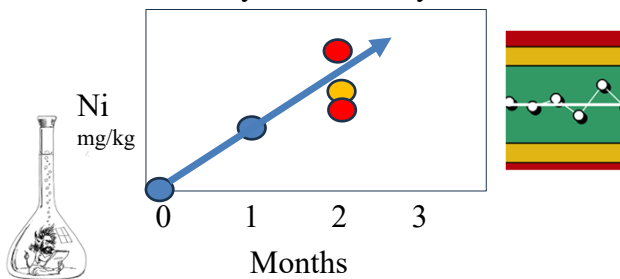
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How to introduce QC charts

Coffee break 1985 in my lab



Analysis of a catalyst



Control charts
are for:

You
Your client
&

Technical assessors

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Annual review

Interpretation of a control value

or

never ever

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for listening - looking forward to comments & ?

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