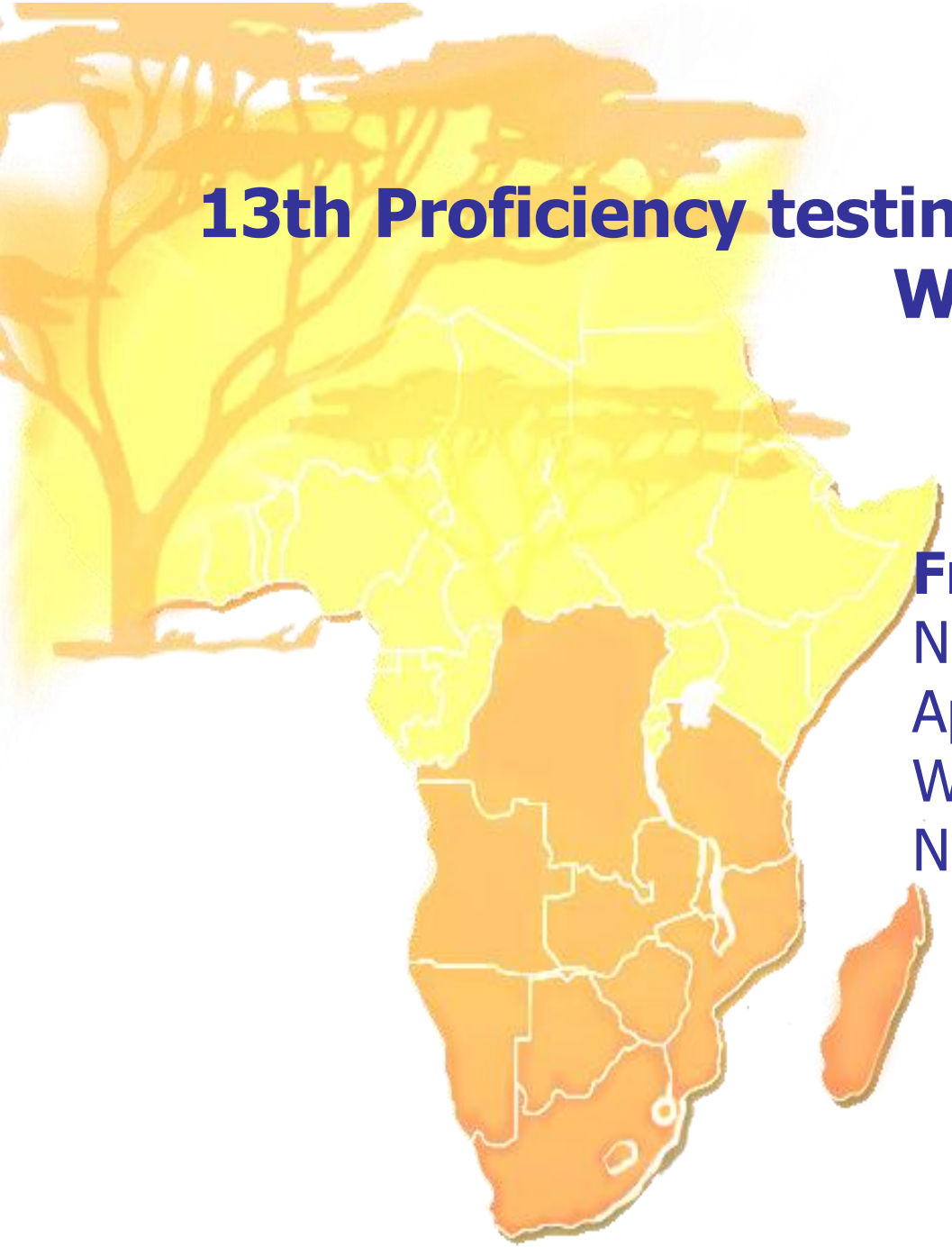

13th Proficiency testing scheme for chemical analysis of Water in Africa

Frieda Nambahu
NamWater
Applied Scientific Services
Windhoek
Namibia

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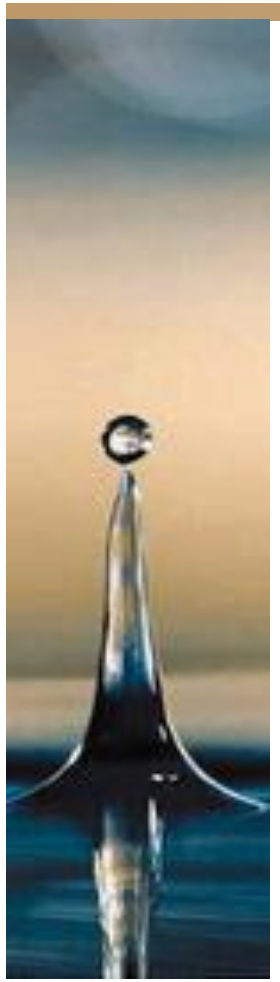

- The bulk water supplier for Namibia
- Established in 1997 from MAWF
- 100% GRN owned
- +/- 80 million m3 potable water per annum
- 28 000 customers
- Asset base N$4 billion
- 670 employees
- Supplies all towns except 5
- Operating on cost recovery basis since establishment

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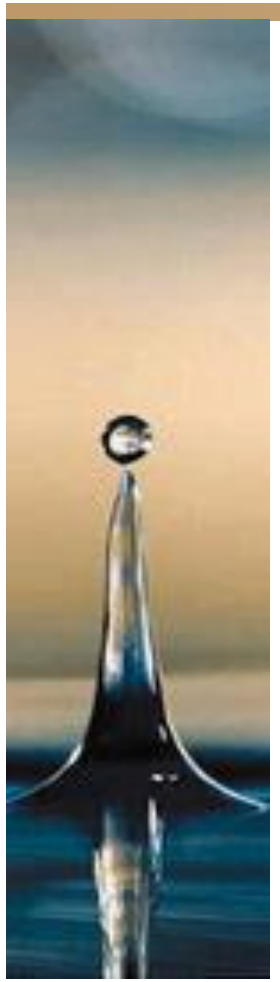
OUTLINE



- ✓Background of the SADCMET PT scheme
- ✓Participation
- ✓Growth of the SADCMET PT Scheme
- ✓Overview of a PT round
- ✓Details of the PT process
- ✓Evaluation & Assessment
- ✓Performance scoring
- ✓Changes and Progress of Parameters
- ✓Summary of the Parameters
- ✓Overall Success
- ✓Challenges 2017
- ✓Conclusion – M Conradie

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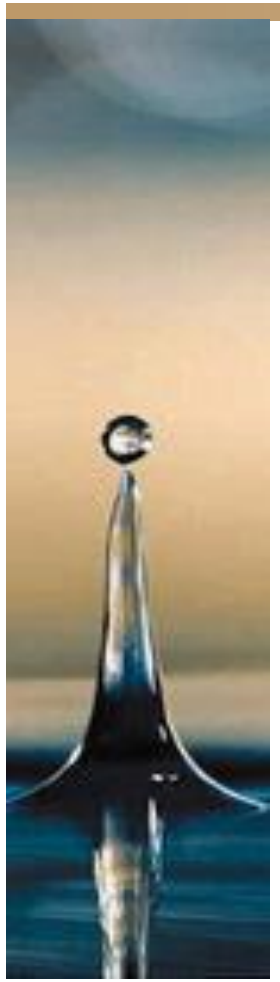
BACKGROUND OF THE SADMET PT SCHEME



2004	The first workshop was held in February in Windhoek, Namibia, with participants from 16 countries where the need for a PT scheme was identified. Training on basic issues of quality in analytical laboratories was also addressed at this workshop.
2004	1st PT round; Evaluation workshop in Pretoria, South Africa
2005	2nd PT round; Evaluation workshop in Dar es Salaam, Tanzania Training session on measurement uncertainty
2006	3rd PT round; Evaluation workshop in Gaborone, Botswana Training session on method validation and control charts
2007	4th PT round; Evaluation workshop in Dar es Salaam, Tanzania Training session on validation and measurement uncertainty October: Poster presentation at the Eurachem workshop in Proficiency testing in analytical chemistry, microbiology and medicine in Rome, Italy

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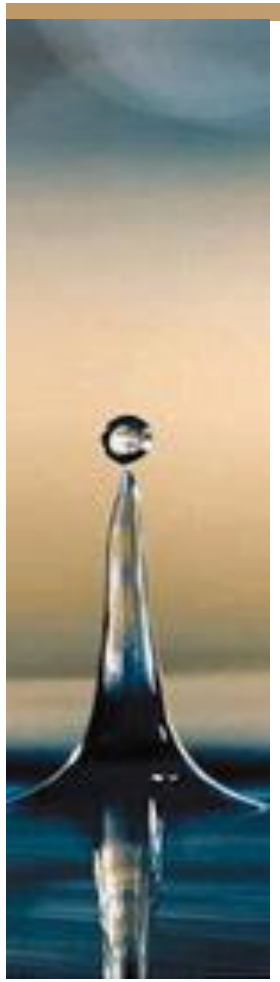
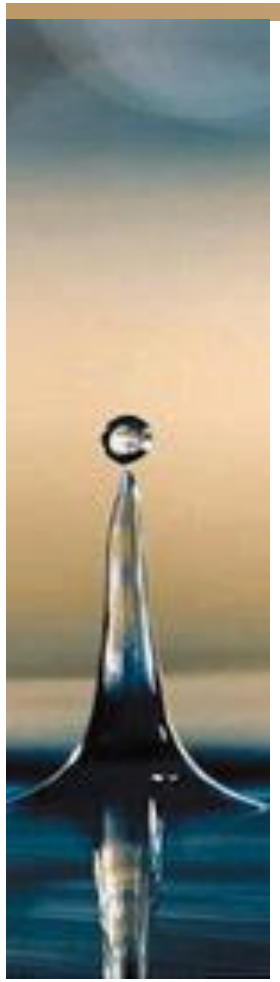
BACKGROUND OF THE SADCMET PT SCHEME cont..



2008	**5th PT round; Evaluation workshop in Kampala, Uganda** **Training session on the Management requirements of the ISO17025**
2009	**6th PT round; Evaluation workshop in Mahé, Seychelles** **Test & Measurement conference: Presentation of Chemical analyses of water in Africa, South Africa**
2010	**7th PT round; Evaluation workshop in Windhoek, Namibia** **Training session on estimation of measurement uncertainty using validation and quality control** **October: Poster presentation at the Eurachem Workshop in Proficiency testing in analytical chemistry, microbiology and laboratory medicine in Istanbul, Turkey**

BACKGROUND OF THE SADCMET PT SCHEME cont..



2011	8th PT round; Evaluation workshop in Port Louise, Mauritius Training session on ensuring the quality of analytical results – Trueness and Precision
2013	10th PT round; Evaluation workshop in Nairobi, Kenya Training session on control charts
2014	11th PT round; Evaluation workshop in Lusaka, Zambia Training session on measurement uncertainty October: Poster presentation at the Eurachem workshop in Proficiency testing in analytical chemistry, microbiology and laboratory medicine in Berlin, Germany
2015	12th PT round; Evaluation workshop in Gaborone, Botswana Training session on Inter-laboratory tests, basic statistics and control charts

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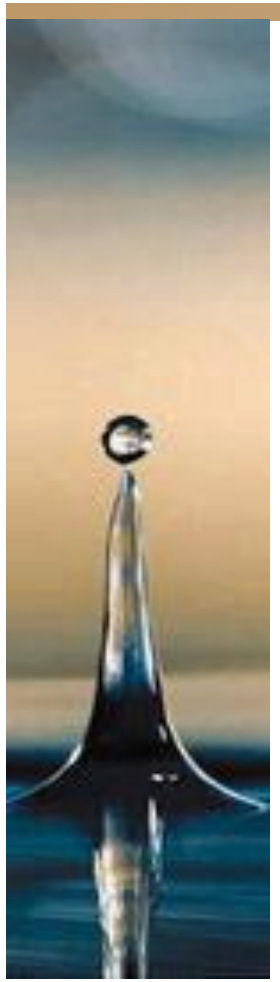
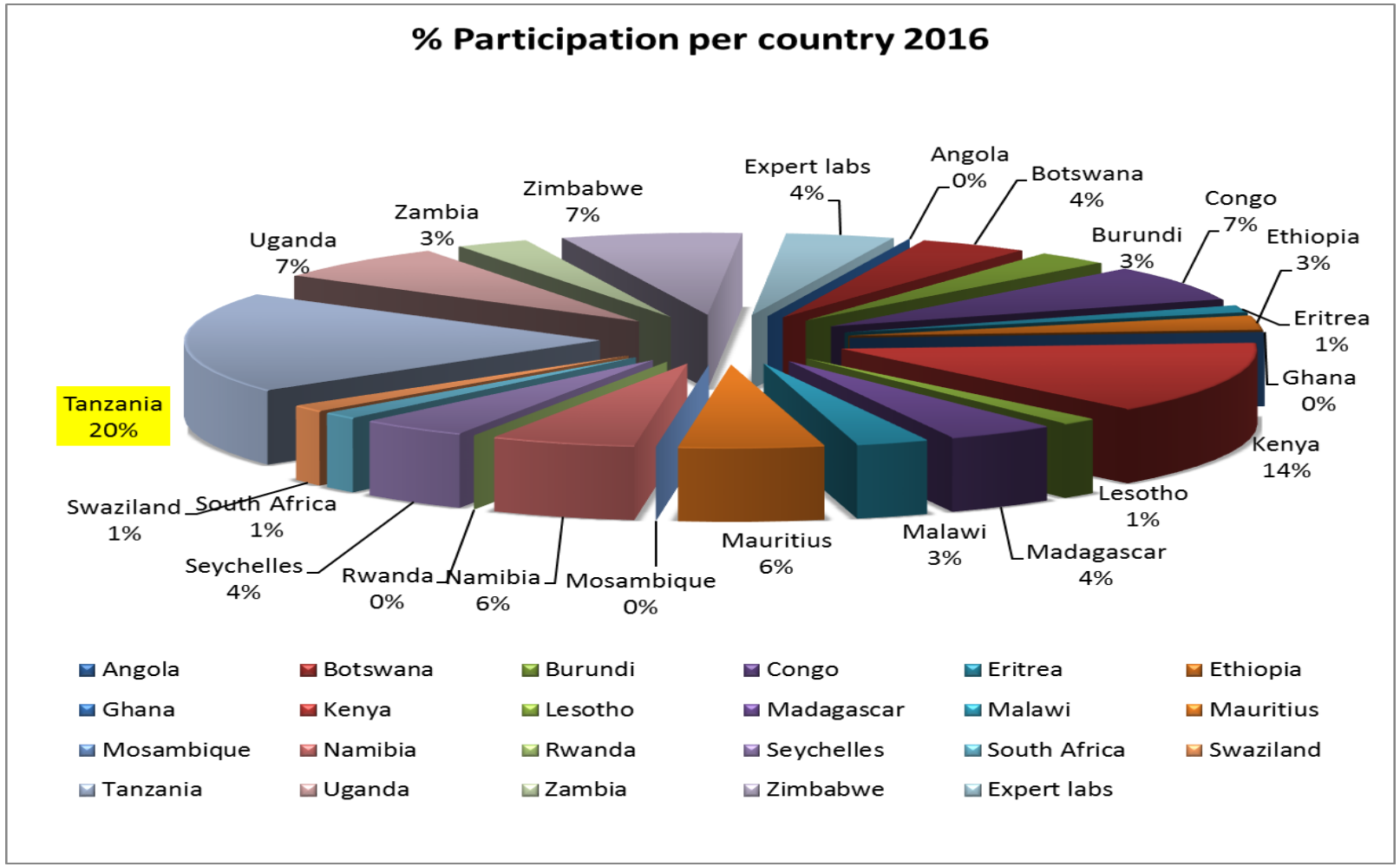
% PARTICIPATION PER COUNTRY





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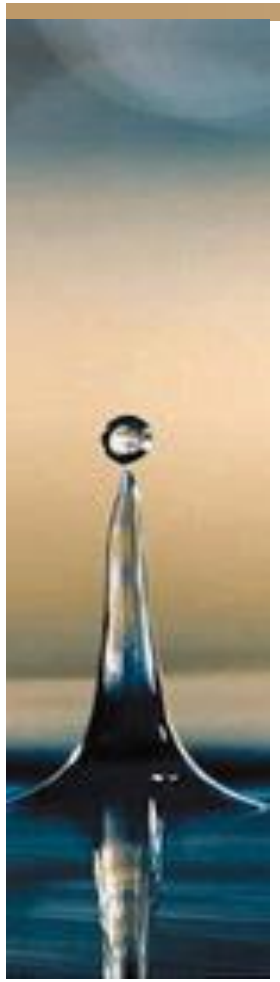
LABORATORIES PER COUNTRY



	2006	2007	2008	2009	2010	2011	2013	2014	2015	2016
Angola	0	0	1	0	0	0	0	0	0	0
Botswana	2	4	2	3	3	3	3	3	3	3
Burundi					1	1	1	2	2	2
Congo					4	5	3	8	7	5
Eritrea	0	0	1	0	0	0	0	0	0	1
Ethiopia	1	0	0	0	0	1	1	2	1	2
Ghana						1	0	0	0	0
Kenya	5	3	3	7	9	7	12	13	8	10
Lesotho	1	1	1	1	1	1	1	1	1	1
Madagascar	2	2	3	3	2	2	2	3	3	3
Malawi	2	3	1	1	2	2	1	1	1	2
Mauritius	4	3	5	6	6	5	4	5	5	4
Mosambique	2	0	0	0	0	0	0	0	0	0
Namibia	3	3	3	3	3	3	3	3	3	4
Rwanda					1	1	1	1	0	0
Seychelles	2	1	1	1	1	1	1	3	3	3
South Africa	0	1	1	1	1	1	1	1	1	1
Swaziland	0	1	2	3	0	0	0	0	1	1
Tanzania	6	12	11	12	13	10	12	15	18	14
Uganda	5	5	5	5	4	5	4	2	3	5
Zambia	2	3	1	3	3	1	1	2	2	2
Zimbabwe	2	5	5	5	4	4	6	7	5	5
Expert labs										3
TOTAL	39	47	46	54	58	54	57	72	67	71

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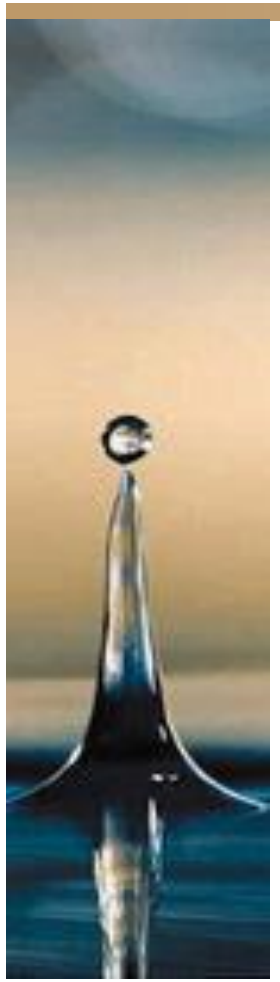
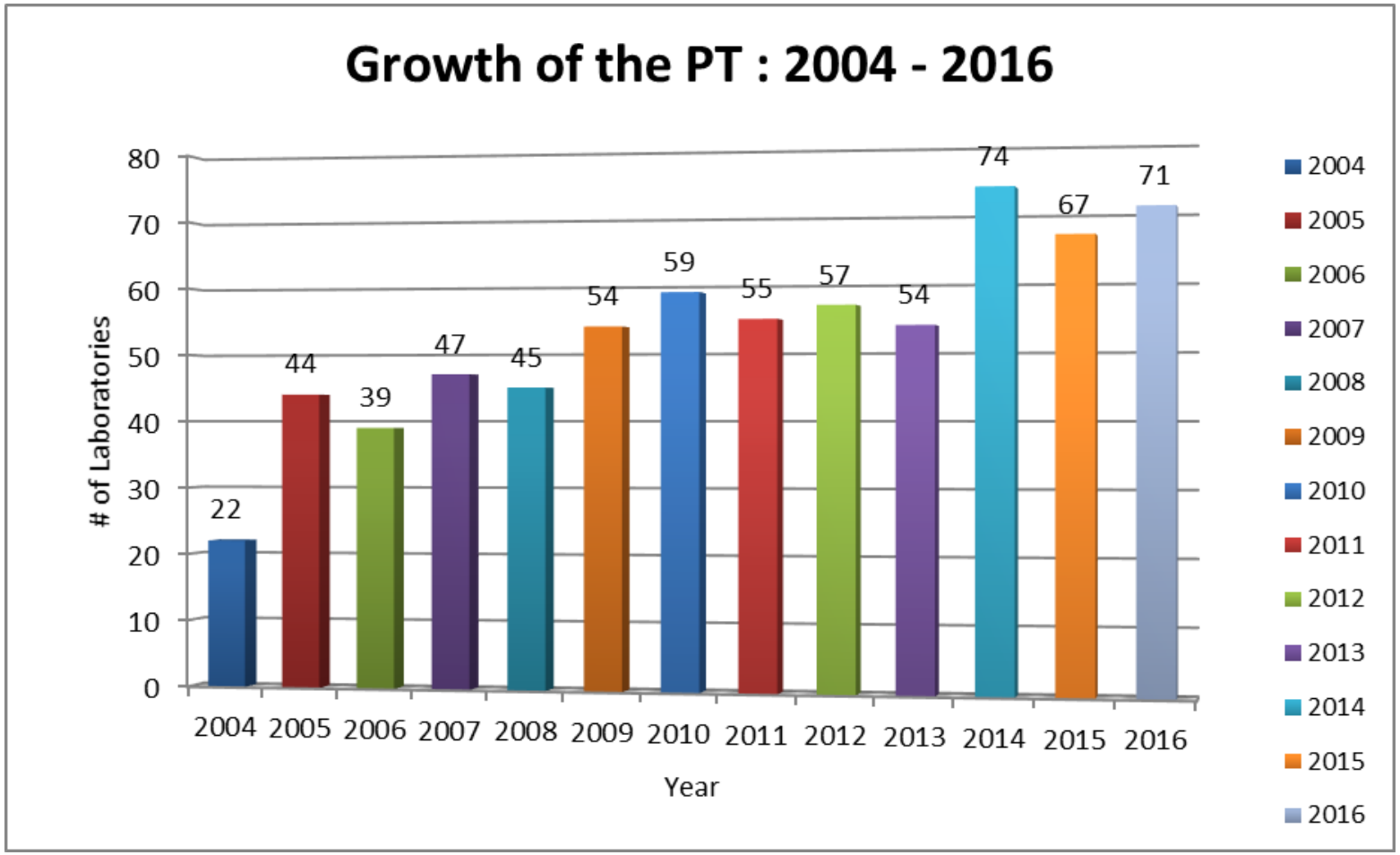
GROWTH OF THE SADCMET PT SCHEME





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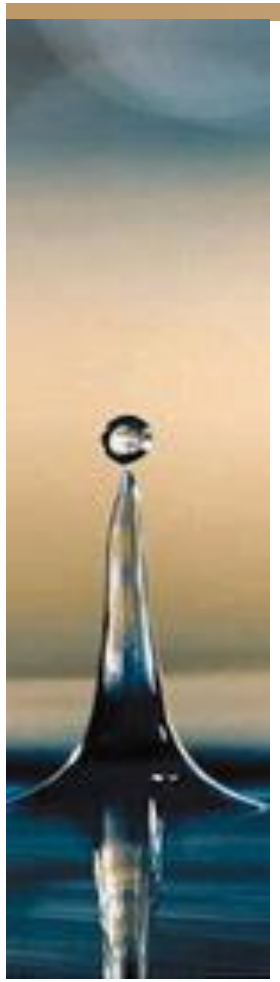
OVERVIEW OF A PT ROUND



Phase 1

- The annual notification is send out by the end of February with the schedule of activities for the year.
- Registration usually close by the end of April

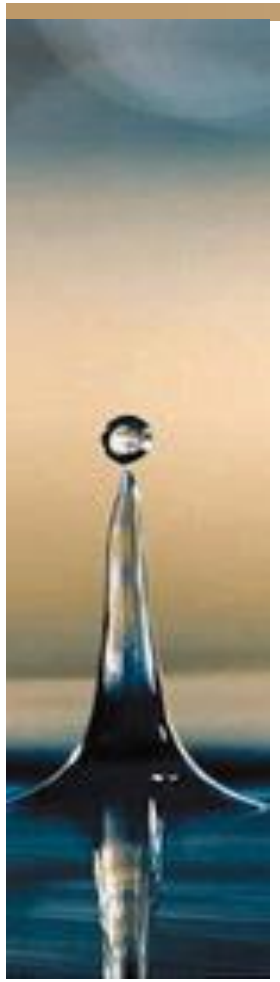
Phase 2

- Identification & calculation of target values
- Ordering of Chemicals & Consumables
- Download certificates of analyses (COA)

Phase 3

- Preparation of the stock solutions and bulk samples
- Packing and distribution of the parcels

OVERVIEW OF A PT ROUND cont..



Phase 4

- Calculations of reference values and measurement uncertainties
- Results submission by participants

Phase 5

- Evaluation of the Results
- Generation of reports

Phase 6

- Deal with enquires
- Preparation for evaluation workshop

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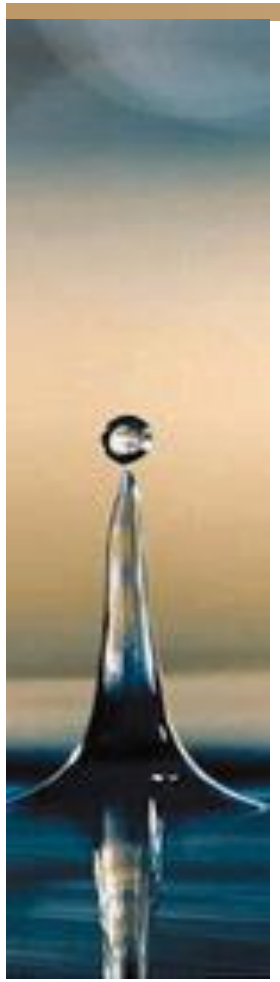
DETAILS OF THE PT PROCESS



Preparation phase

Sample bottles:

- ✓Wash all 480 bottles twice with deionized water
- ✓Bottles & caps were put in the oven @ 60 °C overnight
- ✓Check dryness
- ✓ Cap bottles to prevent them from dust
- ✓Prepare the exact amount of labels for the number of bottles (480 for 80 laboratories)
- ✓Stick labels on the bottles
- ✓Complete for all the sample bottles and store the bottles in numbered crates

Balances:

- ✓Calibration of the balances is done by an external body (Namibian Standards Institution)
- ✓Calibration certificates are obtained for the 3 balances
- ✓Verification with certified internal mass pieces

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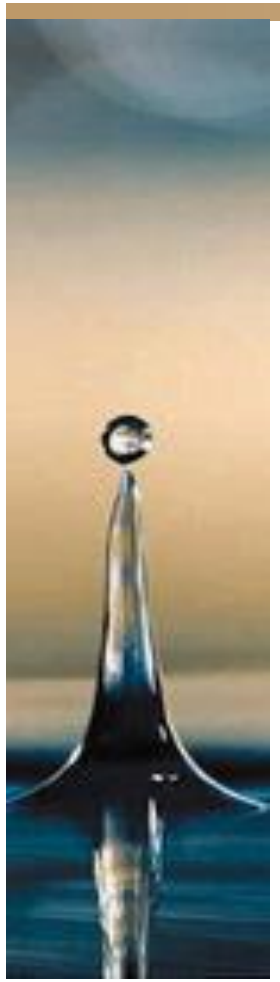
DETAILS OF THE PT PROCESS cont..



Purity:

- ✓The certificates of all the salts and wires are obtained
- ✓The purity for all substances and wires is used to calculate the reference values

Glassware:

- ✓Label the glassware appropriately
- ✓Arrange the glassware accordingly to create a systematic flow

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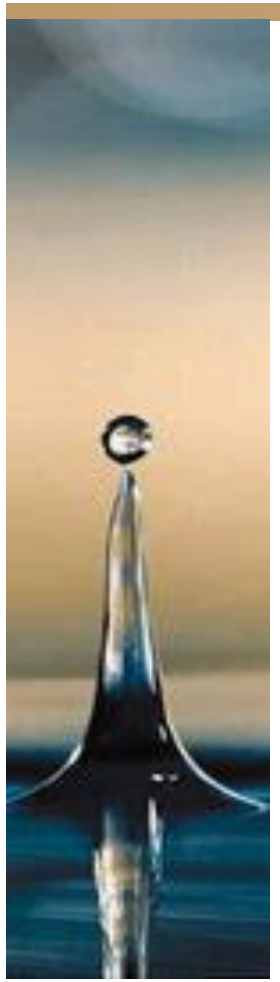
DETAILS OF THE PT PROCESS cont..



Sample preparation phase

Weighing of the stock solution

- ✓ **Weigh the different target masses for the 3 levels of each parameter in a beaker by difference on balance**
- ✓ **Start with the wires since the wires needs to digest for the substance to dissolve completely**
- ✓ **Continue with the salts**

Preparation of stock solutions

- ✓ **Weigh empty flask, transfer the substance into the volumetric flask**
- ✓ **Fill up the flask and weigh the final mass**
- ✓ **Dilutions, especially for the heavy metals, Weigh 100g of stock solution in a beaker by difference weighing**
- ✓ **Follow the same procedure for all the 20 parameters(3 levels)**

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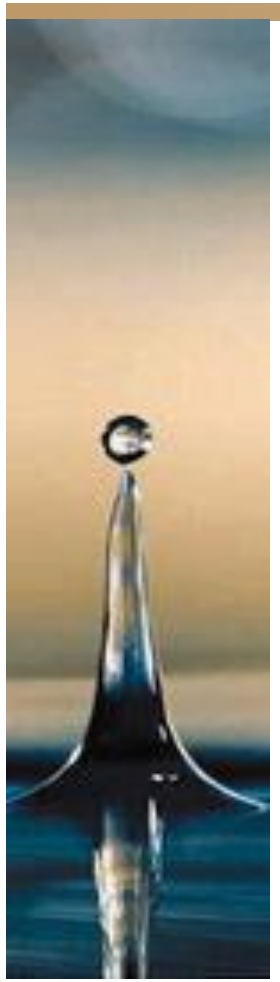
DETAILS OF THE PT PROCESS



Washing of sample bottles

Weighing of the stock solutions

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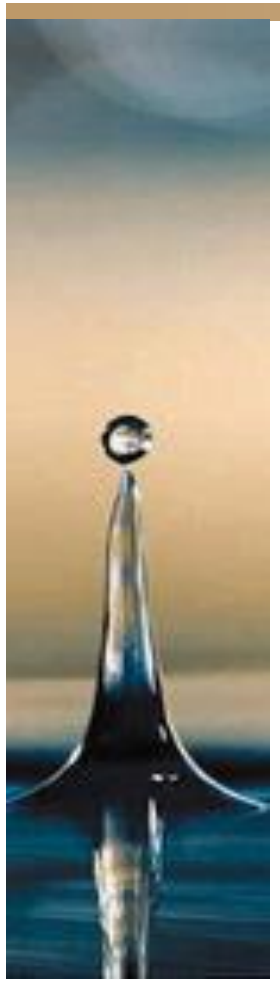
DETAILS OF THE PT PROCESS



Digestion of the wires

Weighing of the stock solutions

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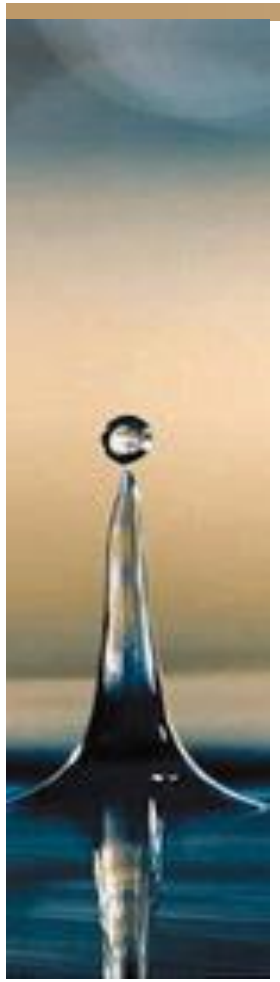
DETAILS OF THE PT PROCESS cont..



Preparation of bulk samples

- ✓Initial weighing of the empty containers
- ✓Fill the containers with deionized
- ✓Calculate target weight from density
- ✓Rinse stock solutions into the 100L container
- ✓Fill to target weight
- ✓Stir combined solution for 20 minutes

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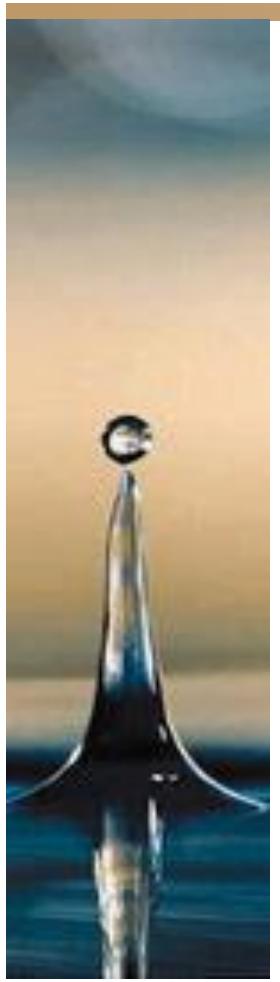
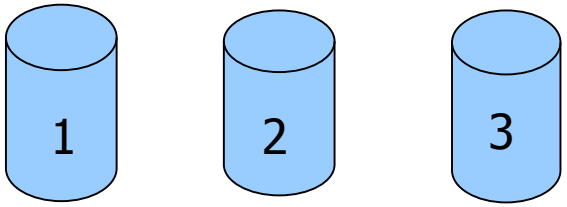
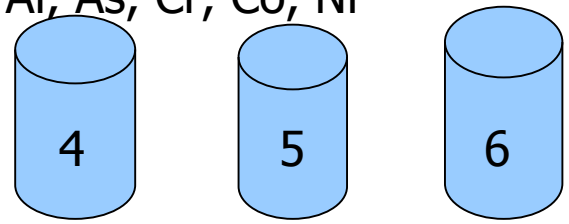
DETAILS OF THE PT PROCESS cont..



Anions : SO_4, Cl, NO_3, F, PO_4,
TDS, Conductivity



Cations : Na, K, Ca, Mg, Fe,
Mn, Cd, Cu, Pb, Zn,
Al, As, Cr, Co, Ni



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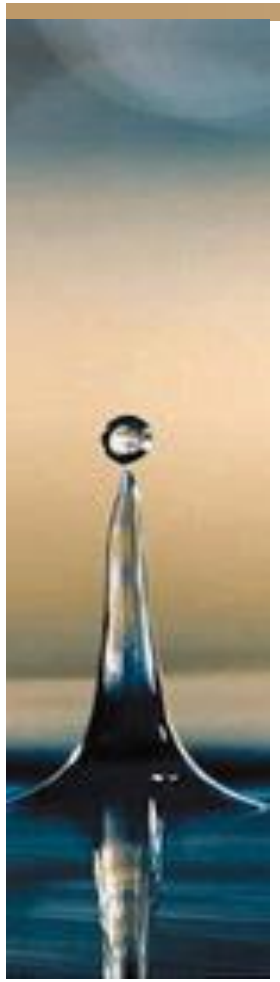
DETAILS OF THE PT PROCESS cont..



Sample dispensing

- ✓After 20 minutes of stirring, 1 L is flushed out
- ✓The conductivity of the sample is checked before dispensing into the sample bottles and after every 20 samples
- ✓Tank is washed properly (4-5times) with deionized water between the batches
- ✓Before starting with the next batch, check the conductivity of the wash water until it reads the same as the deionized water
- ✓Pack the samples in the appropriate crates and pack the crates into the walk in fridge
- ✓Samples kept at 4°C in the Fridge

Preparation of the documentation

- ✓Prepare hard copy of results sheets and the method information
- ✓Prepare all the labels and documentation for transportation for all the countries and participants

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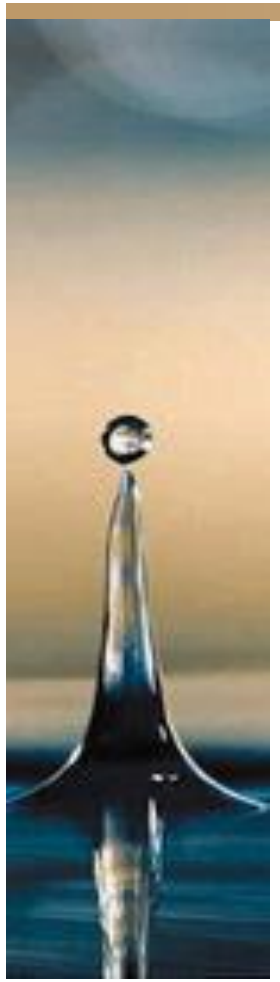
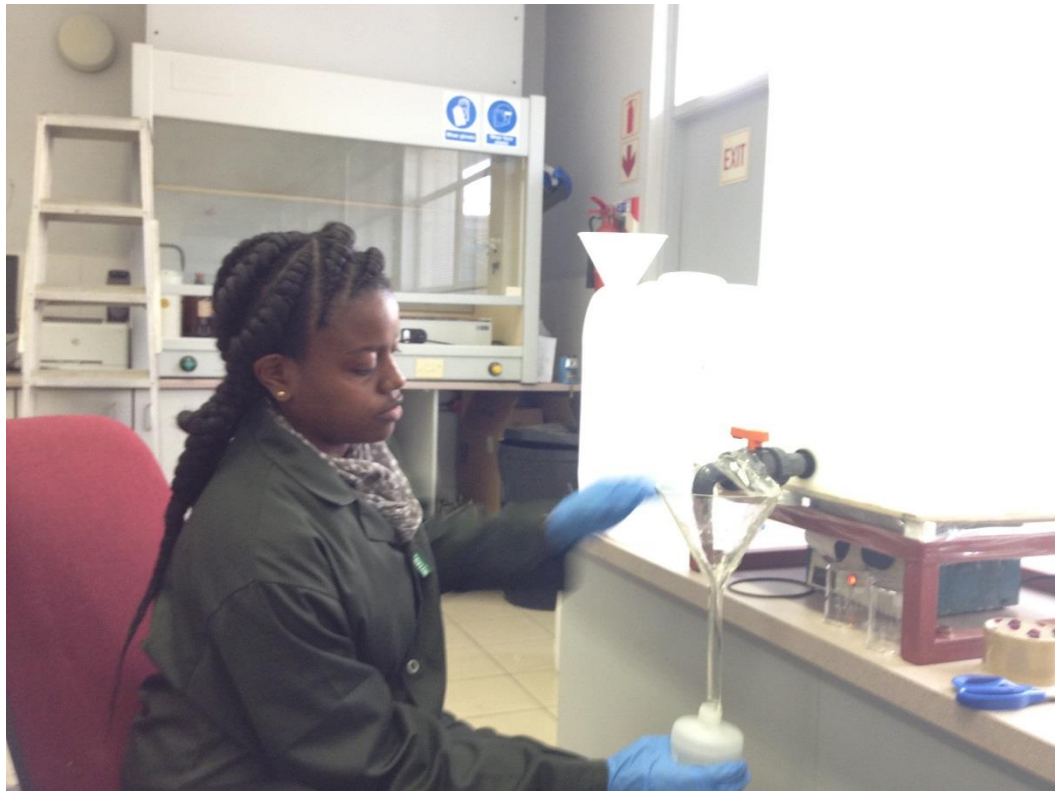
DETAILS OF THE PT PROCESS



Preparation of bulk samples

Dispensing of samples



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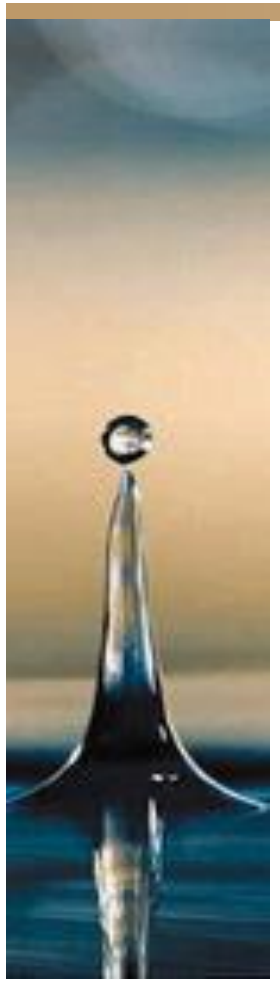
DETAILS OF THE PT PROCESS cont..



Packaging of the samples

- ✓Request quotes from the courier
- ✓Pack the samples (one at a time) into the boxes
- ✓Add documentation and addresses of all the participants
- ✓Confirm the cost with the PTB to proceed

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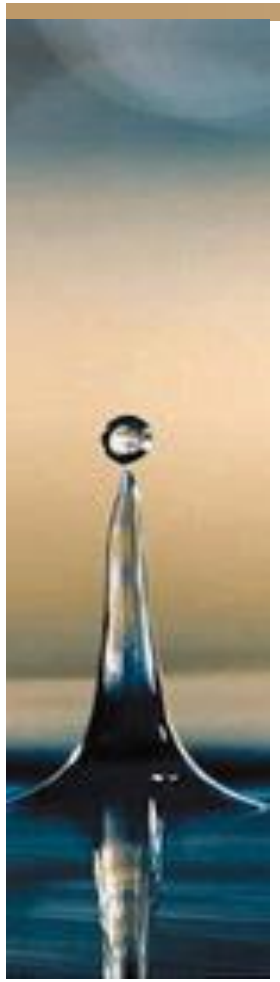
DETAILS OF THE PT PROCESS cont..



Packing

Pick up of the parcels

Parcels were pick up on the 07 July 2016 at NamWater

- ✓ **Delays:**
- ✓ **Some parcels were left behind by the courier and were picked up later**

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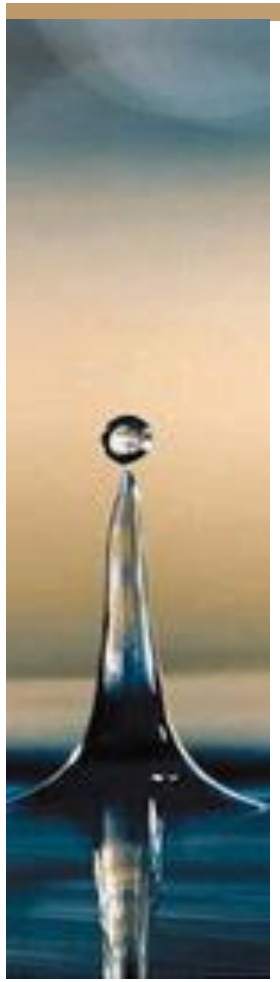
DETAILS OF THE PT PROCESS



Left NamWater on 07 July 2016

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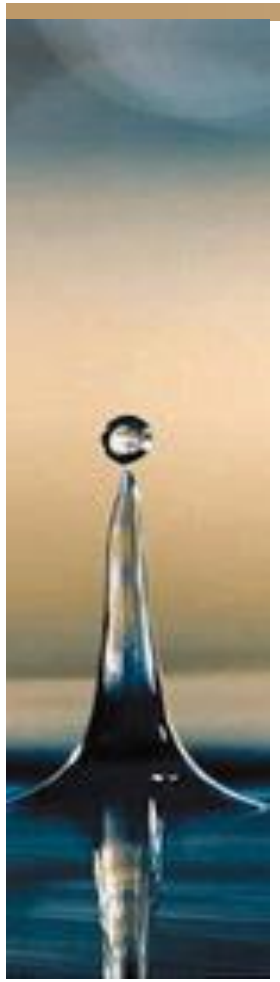
DETAILS OF THE PT PROCESS cont..

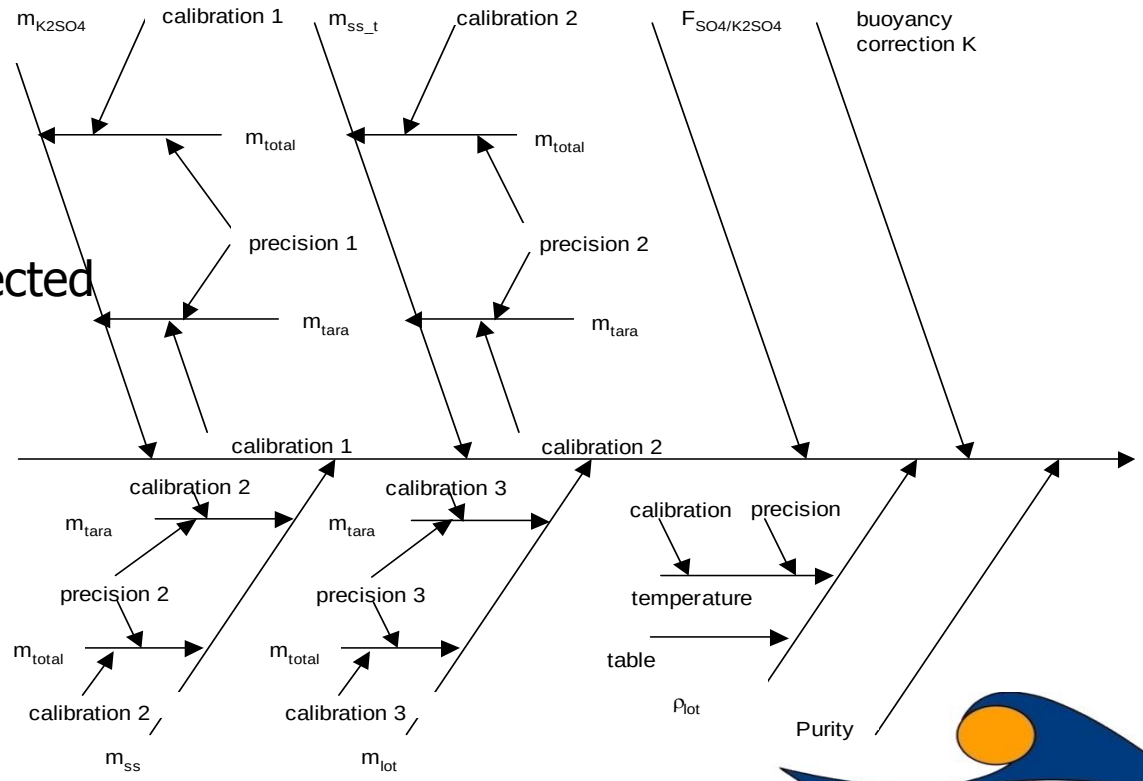


Testing phase

Calculation of reference values

- ✓**Identity all sources of uncertainty in the analytical measurements and list them with the use of a fish bone diagram**
- ✓**The identified sources were:**
  - Purities of the substances used
  - Uncertainty of the three balances used
  - Uncertainty of molecular mass were neglected
  - Density of final samples
  - Buoyancy

$$c_{lot} = \frac{m_{K_2SO_4} \cdot F_{SO_4/K_2SO_4} \cdot P \cdot m_{ss} \cdot \rho_{lot}}{m_{ss\_t} \cdot m_{lot} \cdot K}$$



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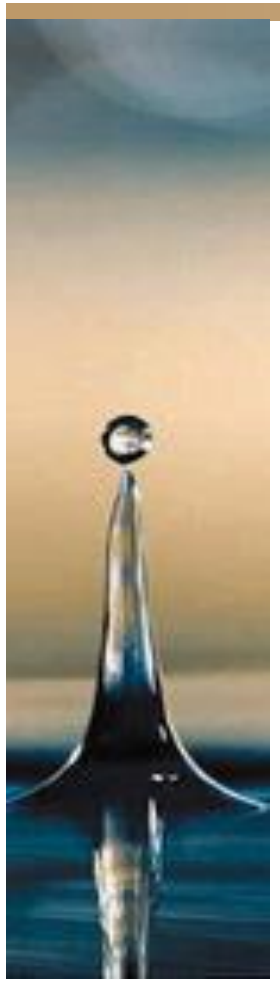
DETAILS OF THE PT PROCESS cont..



Density

- ✓Samples and a bottle with pure water were kept in the balance room
- ✓Temperature of the water and the samples were measured with a calibrated thermometer
- ✓A 100mL pycnometer was used to determine the density of the 6 Samples
- ✓The pycnometer was filled with water and weighed 10 times
- ✓Between each measurement the pycnometer was opened and filled repeatedly to determine the uncertainty of the filling process
- ✓The pycnometer was filled and weighed with the 6 samples 3 times repeatedly
- ✓The densities and uncertainty of the measurements were calculated

Pycnometer

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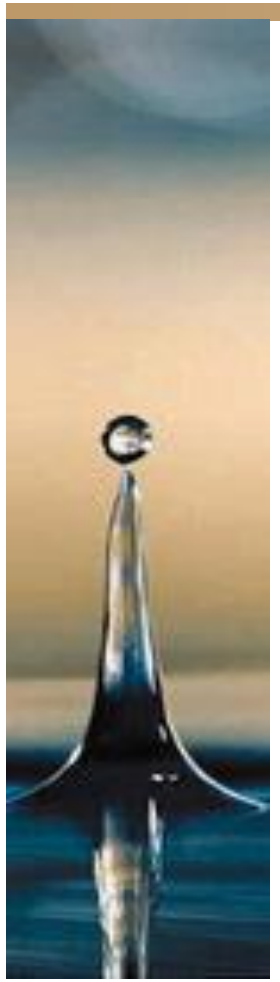
DETAILS OF THE PT PROCESS cont..



Measurement uncertainty of reference values

- ✓ The combined standard uncertainties (mg/l), the combined relative uncertainty(%), the combined expanded uncertainties (mg/l) and the combined relative standard uncertainty (%) were calculated and reported
- ✓ The size of the different contributions was compared using a histogram showing all the standard uncertainties
- ✓ The reference values were calculated with the combined expanded standard uncertainty taken into consideration for all the parameters for the different levels

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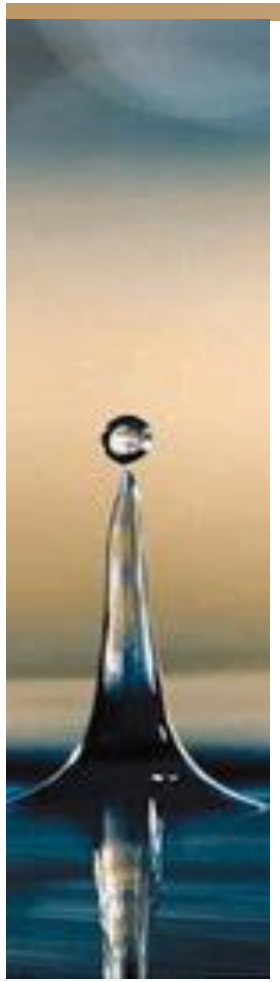
DETAILS OF THE PT PROCESS cont..



The biggest uncertainty components from histograms that was identified were:

Mass of the stock solution

- Fe, Mn (Level 1 & 3), Al, Cu, Zn, Ni, As, Cd, Co

Purity of salts

- SO, Cl, F, NO_3, PO_4, Ca, Mg, Na, K, Mn (Level 2), Pb, Cr ,

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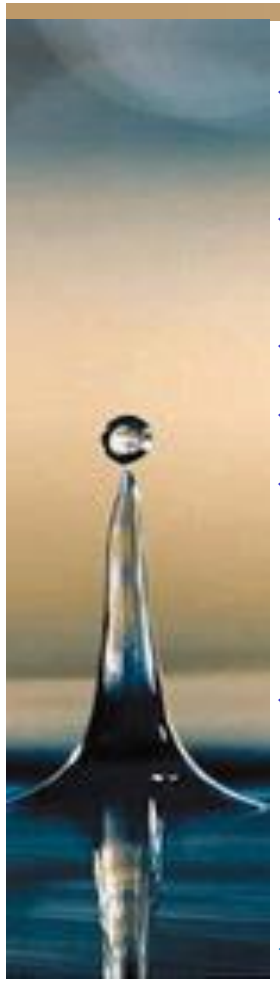
EVALUATION & ASSESSMENT



- **Reference values are calculated from the synthetic, gravimetrical samples with an uncertainty budget**
- **Calculation of standard deviation is done by using the Algorithm A method from ISO 13528 provided it is lower than the calculated value**
- **Where the calculated value is higher, the fitness-for-purpose value is used**
- **The fitness-for-purpose [limit] value was agreed on between participants**
- **The process that applied for the elimination of gross outliers is:**
  - All values < ref.-value/8 and all values > ref.-value * 8 were excluded before applying statistical procedures
- **The report contains:**
  - a graphical display of lab results vs the assigned value to assist with corrective actions
  - A method specific evaluation to assist the laboratories in methods choices
- **Assistance is provided for laboratories that need corrective actions**

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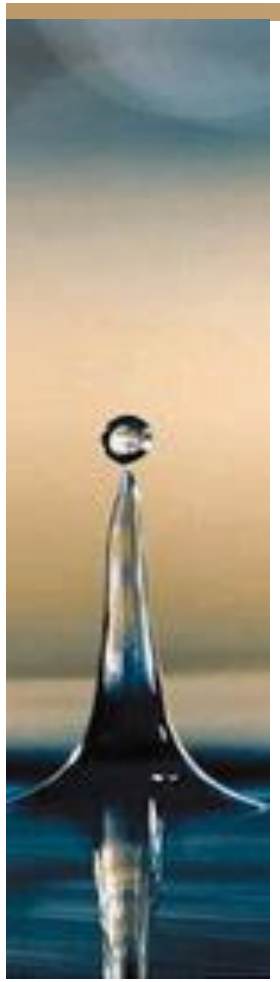
PERFORMANCE SCORING



- The assessment of performance is based on Z-scores
- Use of Z-scores are a common practice in the assessment of laboratory results
- Z-scores reflects the actual accuracy achieved – the difference between the participant's result and the reference value
- A score of zero implies a perfect result
- Z-scores are rounded to one digit after decimal point as requested by ISO17043 and ISO13528
- Usually laboratories produce scores between -2 and 2
- The sign(i.e., + or -) of the score indicates a negative or positive error respectively.
  - $|z\text{-score}| \leq 2.0$ - satisfactory
  - $2.0 < |z\text{-score}| < 3.0$ - questionable
  - $|z\text{-score}| \geq 3.0$ - non satisfactory

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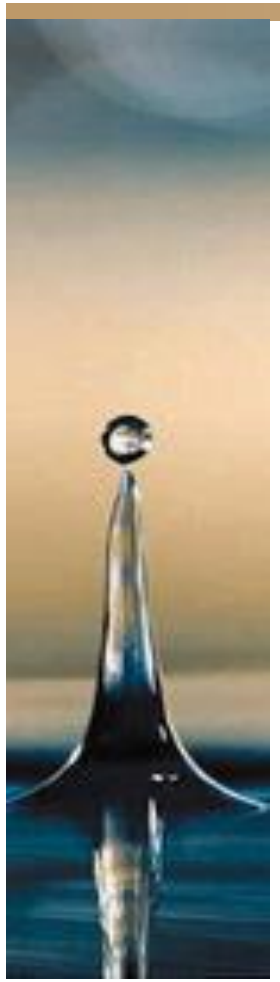
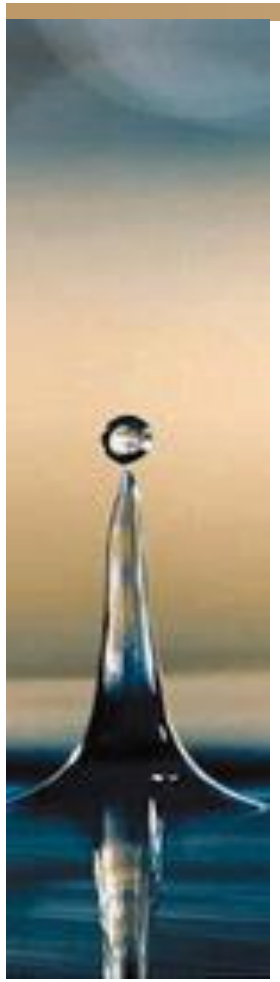
CHANGES AND PROGRESS OF PARAMETERS



PARAMETER	Std Limit (%)
Sulphate	10
Chloride	10
Fluoride	10
Nitrate	10
Phosphate	10
TDS	10
Conductivity	10
Calcium	10
Magnesium	10
Sodium	10
Potassium	10

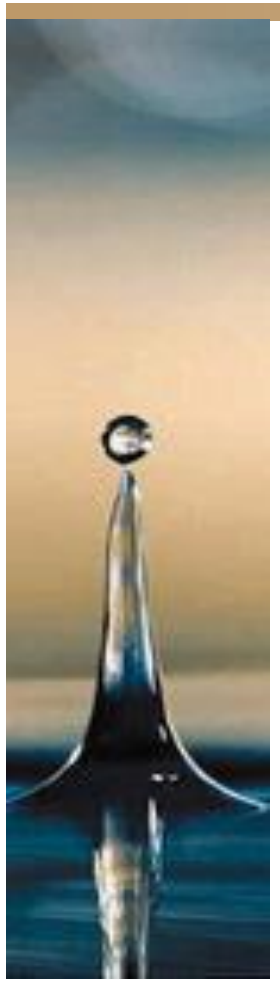
PARAMETERS	Std Limit (%)
Iron	20
Manganese	20
Aluminium	20
Lead	20
Copper	20
Zinc	20
Chromium	20
Nickel	20
Cadmium	20
Arsenic	20
Cobalt	20

RANGES FOR PARAMETERS

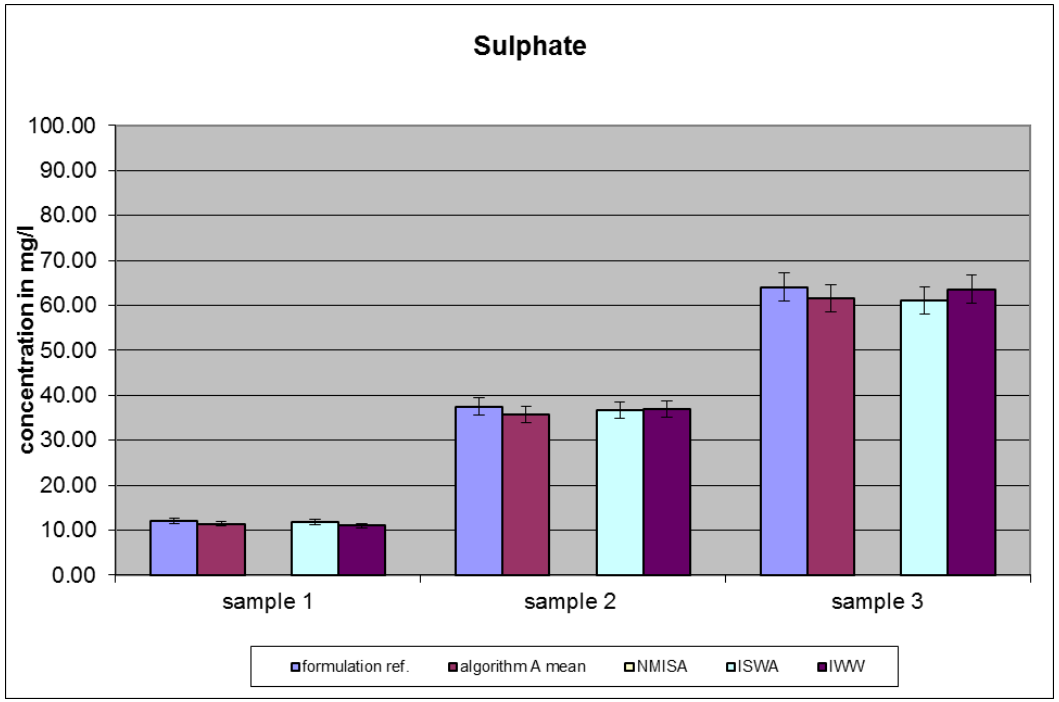


PARAMETER	RANGES	PARAMETER	RANGES
Sulphate in mg/l	9.50 – 80.00	Iron in mg/l	0.09 – 4.61
Chloride in mg/l	10.00-73.40	Manganese in mg/l	0.03 – 5.10
Fluoride in mg/l	0.20 - 2.54	Aluminium in mg/l	0.05 – 4.41
Nitrate in mg/l	9.10 - 88.00	Lead in mg/l	0.05 – 3.33
Phosphate in mg/l	3.20 -30.50	Copper in mg/l	0.05 – 4.05
TDS in mg/l	0-1000 mg/l	Zinc in mg/l	0.45 – 5.89
Conductivity in mg/l	0-400 mS/m	Chromium in mg/l	0.05 – 2.90
Calcium in mg/l	8.40 – 90.0	Nickel in mg/l	0.06 – 3.55
Magnesium in mg/l	7.45 – 55.3	Cadmium in mg/l	0.02 – 1.10
Sodium in mg/l	8.50 – 90.0	Arsenic in mg/l	0.04 - 1.20
Potassium in mg/l	5.00 – 50.0	Cobalt in mg/l	0.05 – 2.68

SULPHATE



Mean vs. Reference value



Summary Sulphate

- ✓ **Average recovery was higher than in the previous round with 95.9 %**
- ✓ **STD are still > 10 %, especially for low conc.**
- ✓ **47 data points outside the limits**
- ✓ **28.6 % of methods still classified as "other"**

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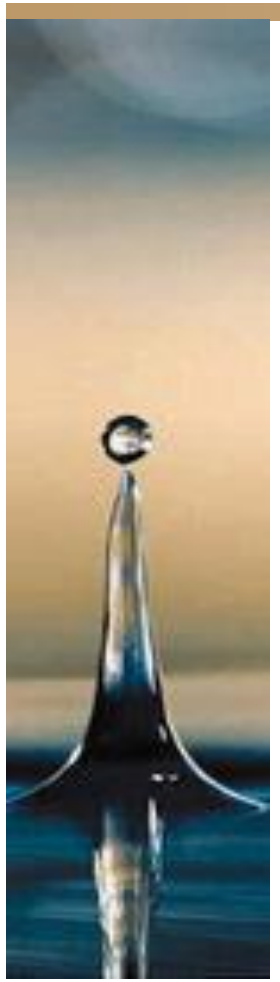
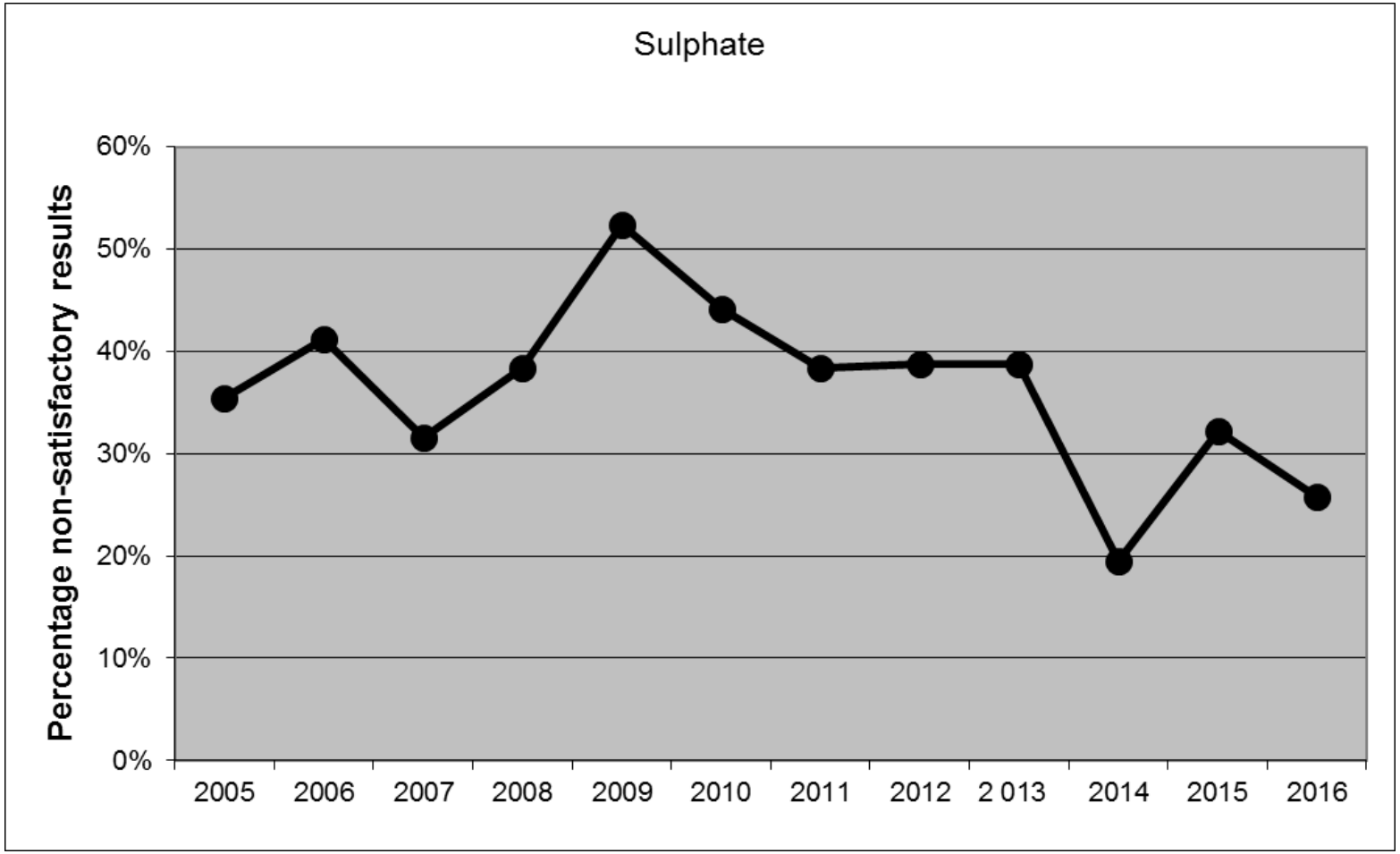
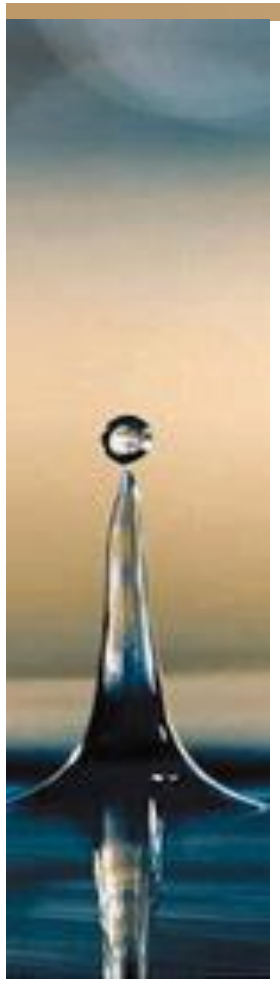
SULPHATE



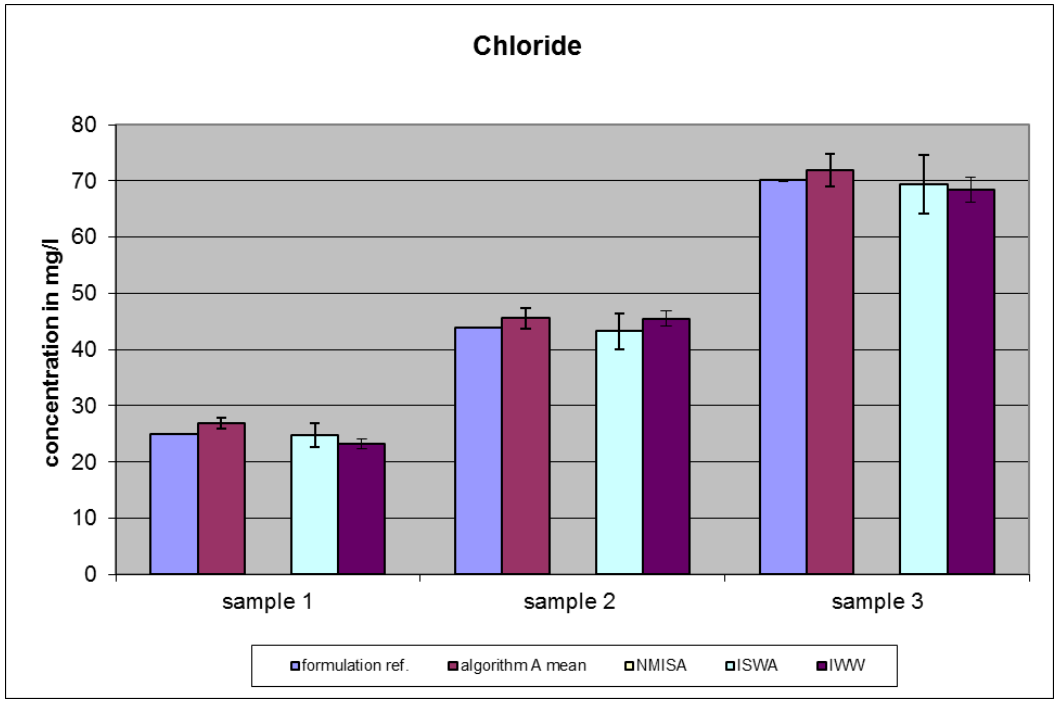


25.8% of the data is outliers (32.1% in 2015)

CHLORIDE



Mean vs. Reference value



Summary Chloride

- ✓ **Average recovery was higher than in the previous round with 103.3 %**
- ✓ **STD are still > 10 %, especially for low conc. (13.79%)**
- ✓ **31 data points outside the limits**
- ✓ **16.2 % of methods still classified as "other"**

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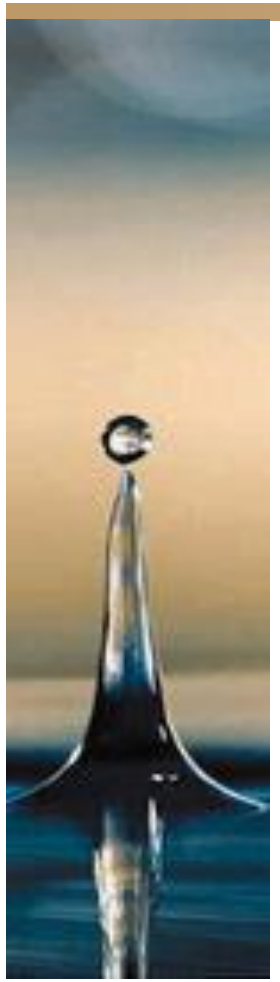
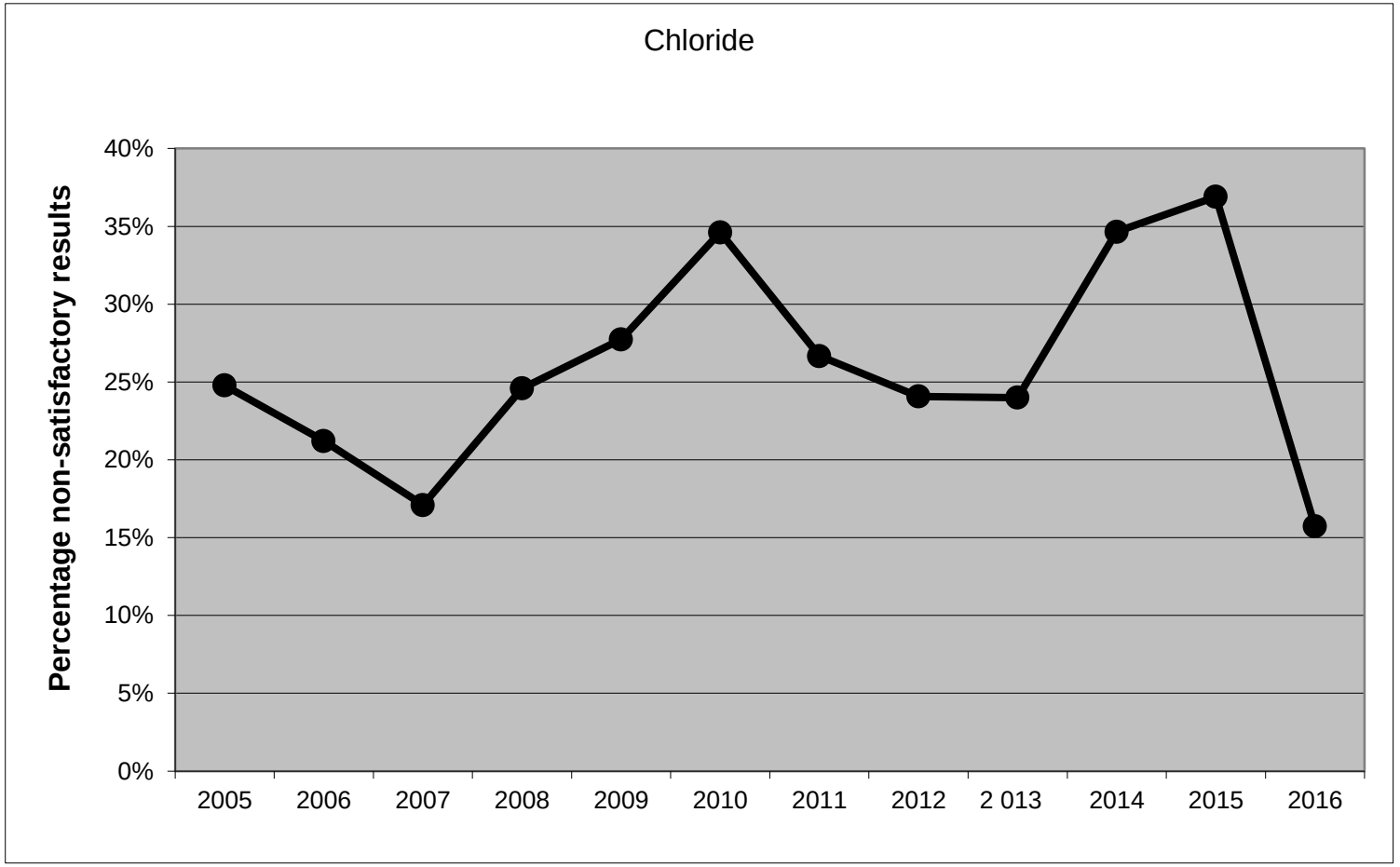
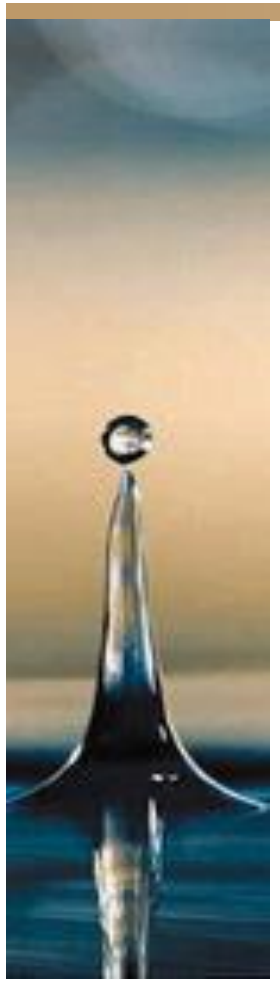
CHLORIDE



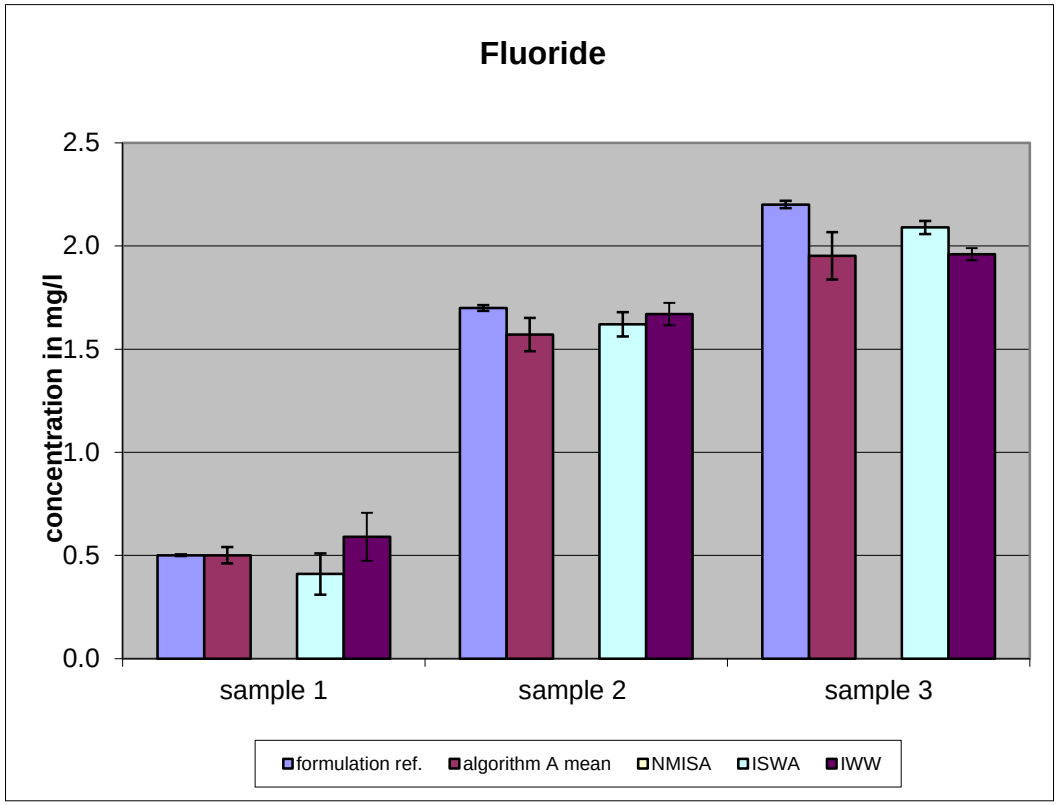


15.7% of the data is outliers (36.9% in 2015)

FLUORIDE



Mean vs. Reference value



Summary Fluoride

- ✓ **Average recovery was 90.4 %**
- ✓ **STD are still > 10 %, especially for low conc. (20.7%)**
- ✓ **30 data points outside the limits**
- ✓ **23.8 % of methods still classified as "other"**

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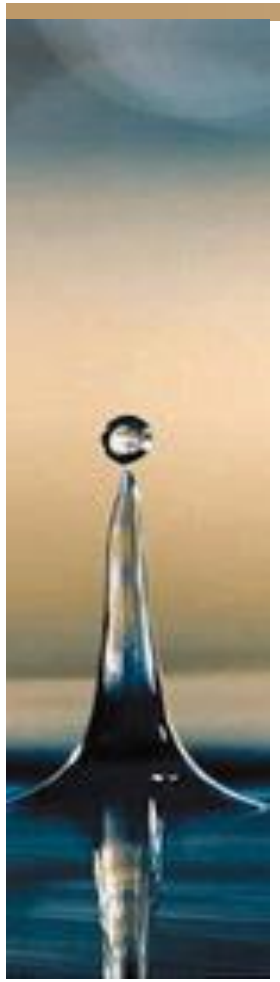
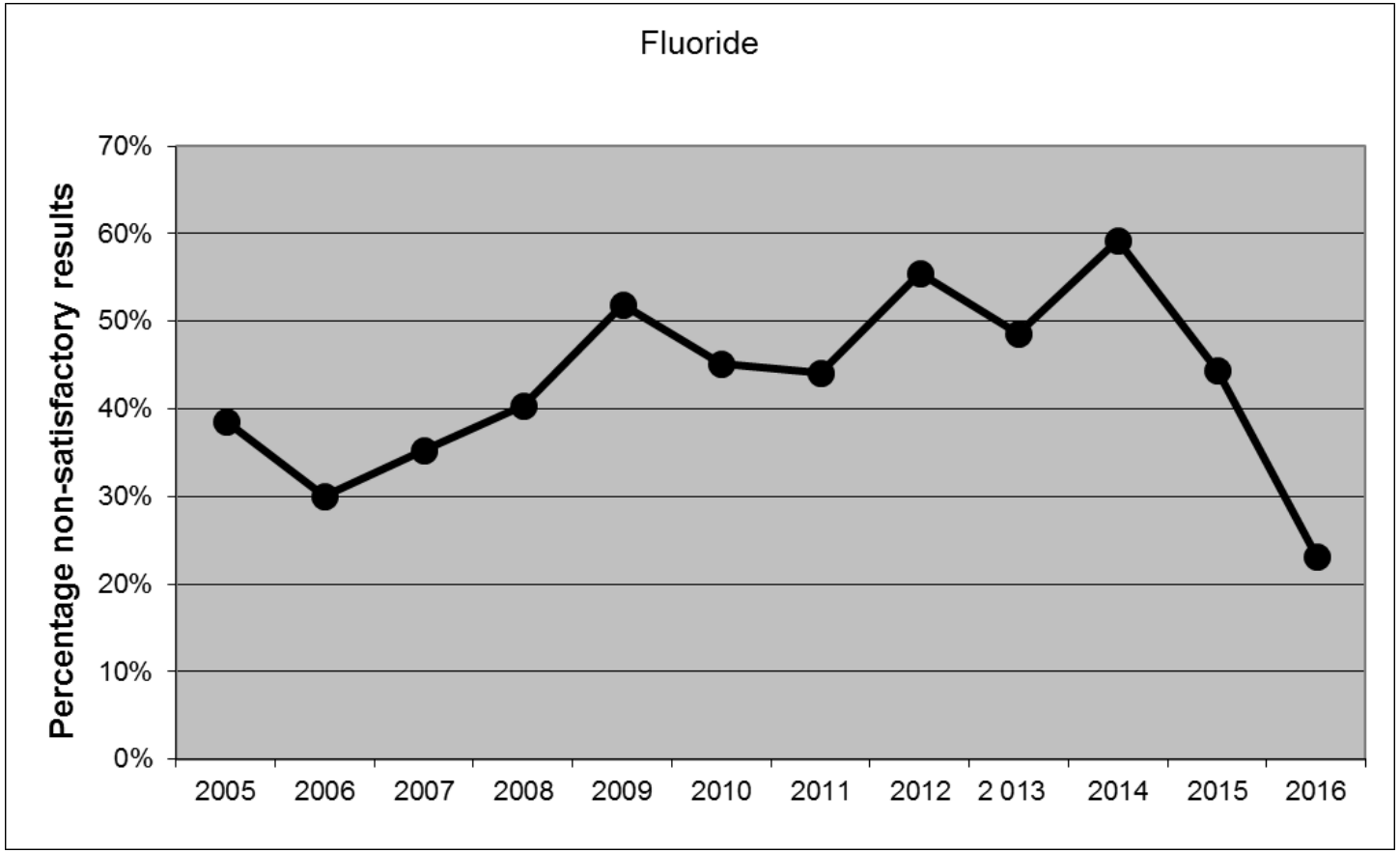
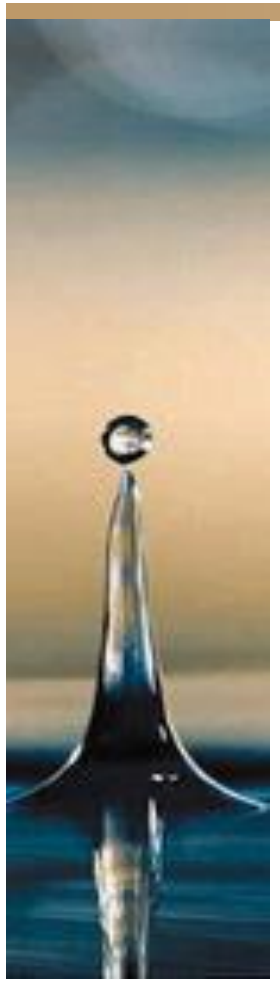
FLUORIDE



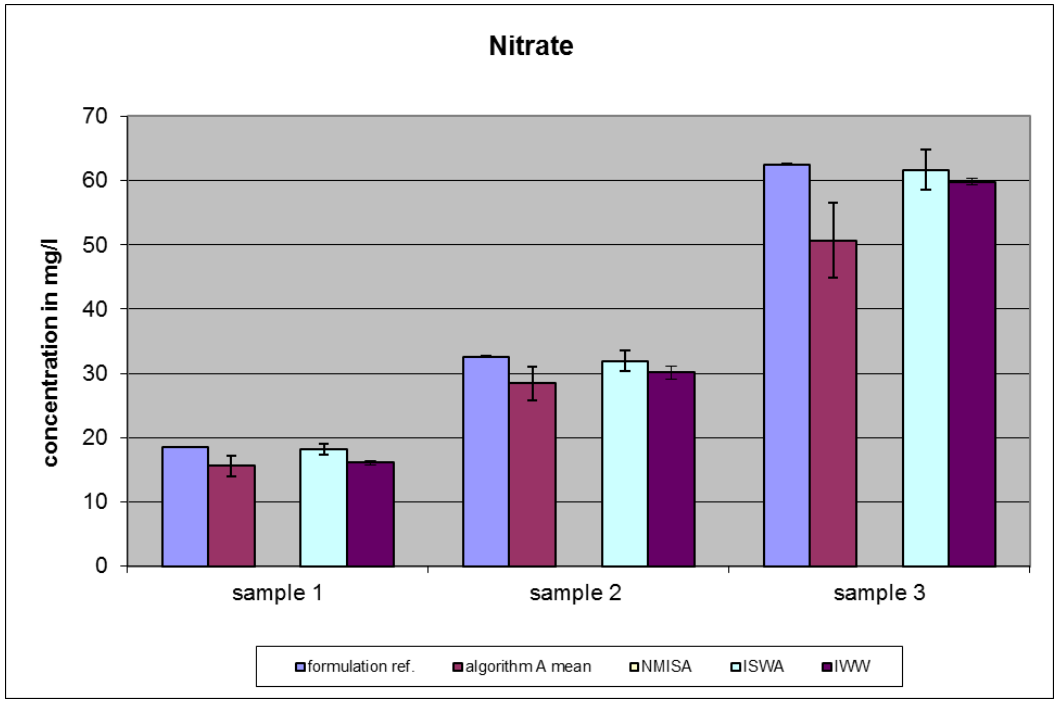


23.1 % of the data is outliers (44.4% in 2015)

NITRATE



Mean vs. Reference value



Summary Nitrate

- ✓ **Average recovery was 82.5 %**
- ✓ **STD are still > 10%, especially for low conc.** (Sample 1 - 26.8%;Sample 2 24.0%,Sample 3 - 27.2%)
- ✓ **69 data points outside the limits**
- ✓ **41.6% methods still classified as "other"**

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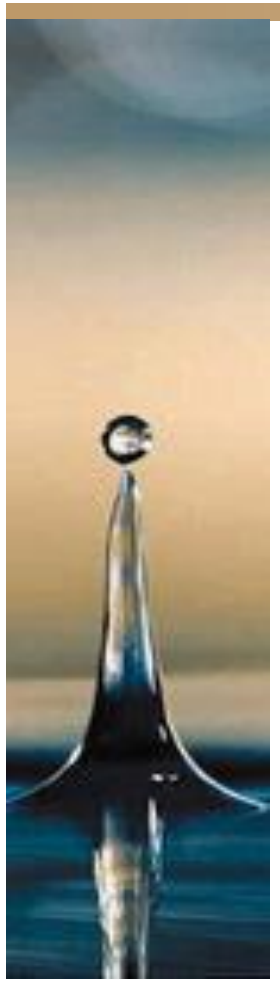
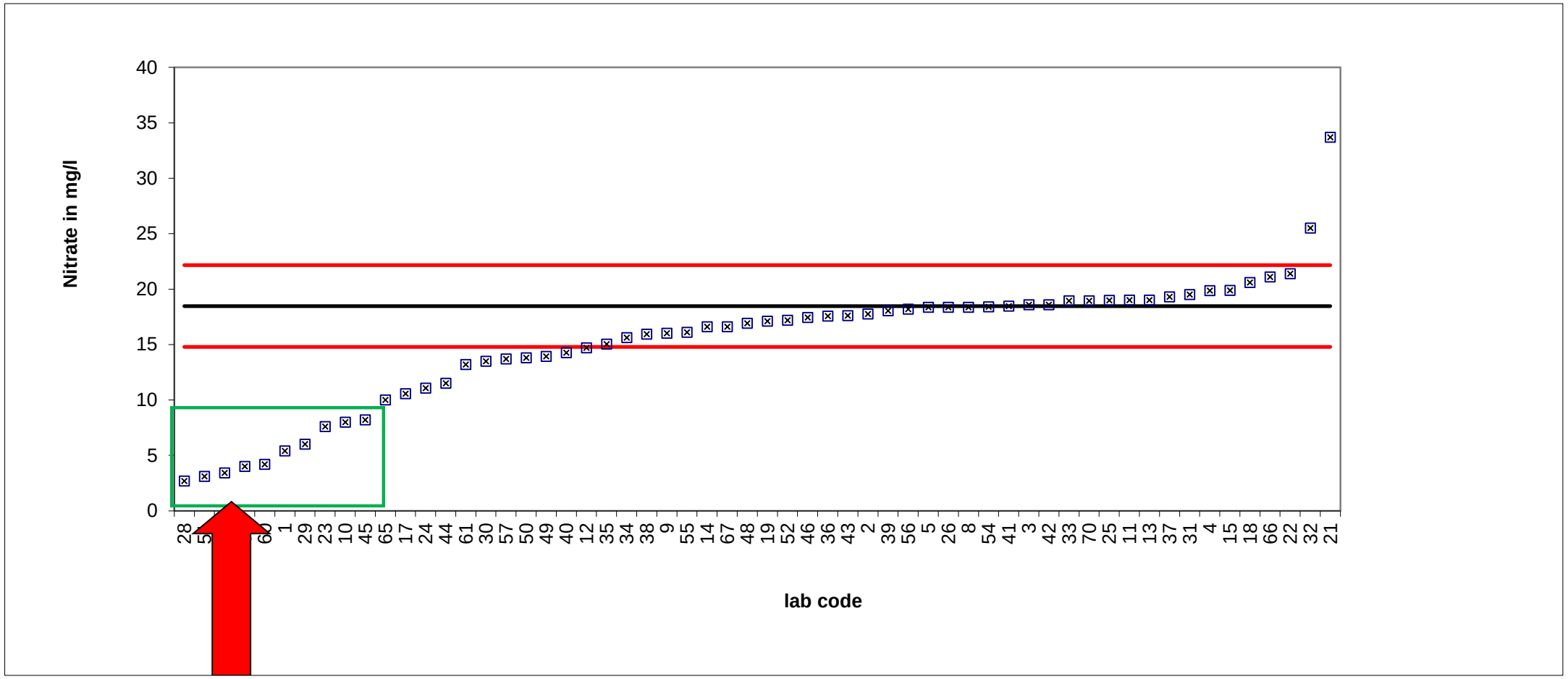
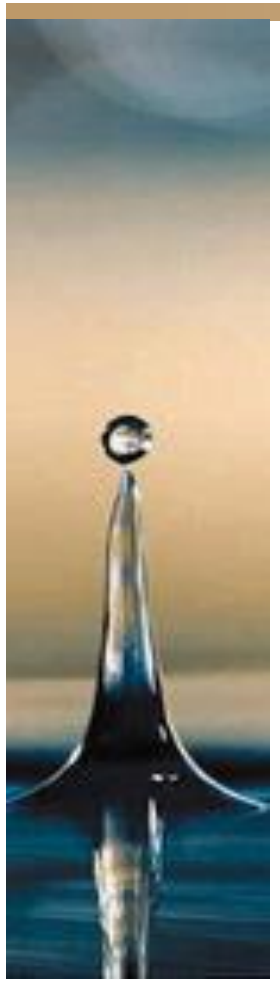
NITRATE 1

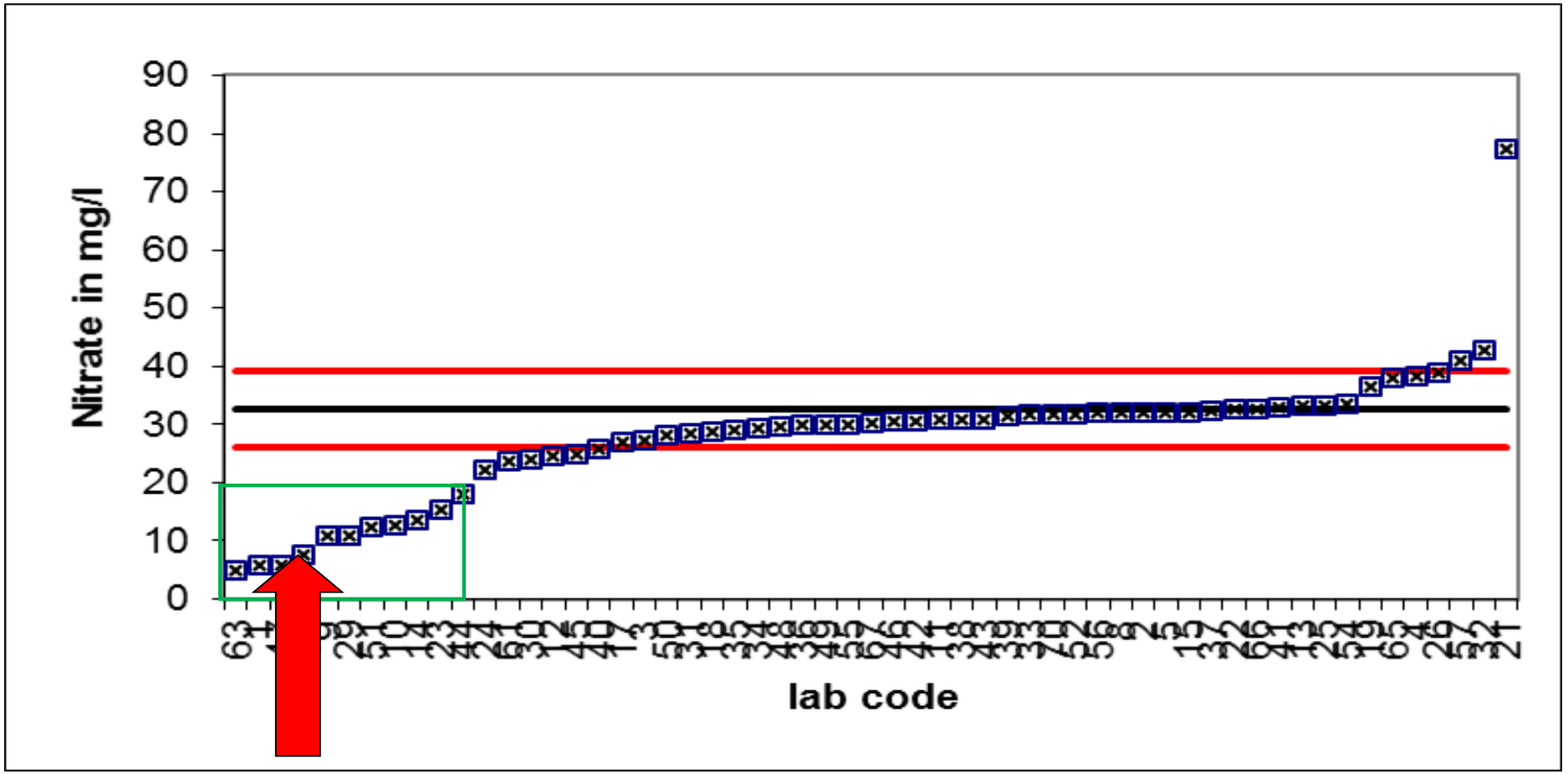




Wrong units again as NO_3^--N instead of NO_3^-

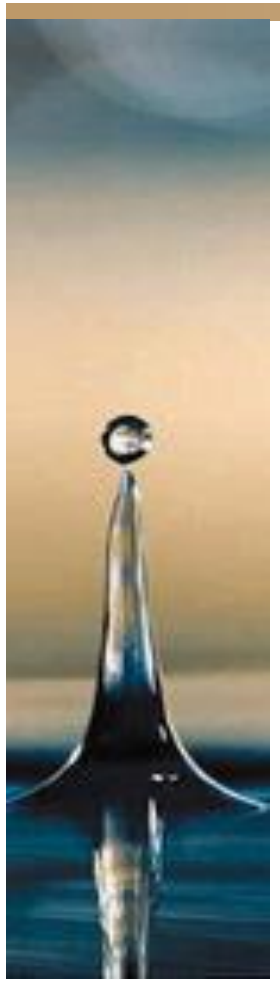
NITRATE 2

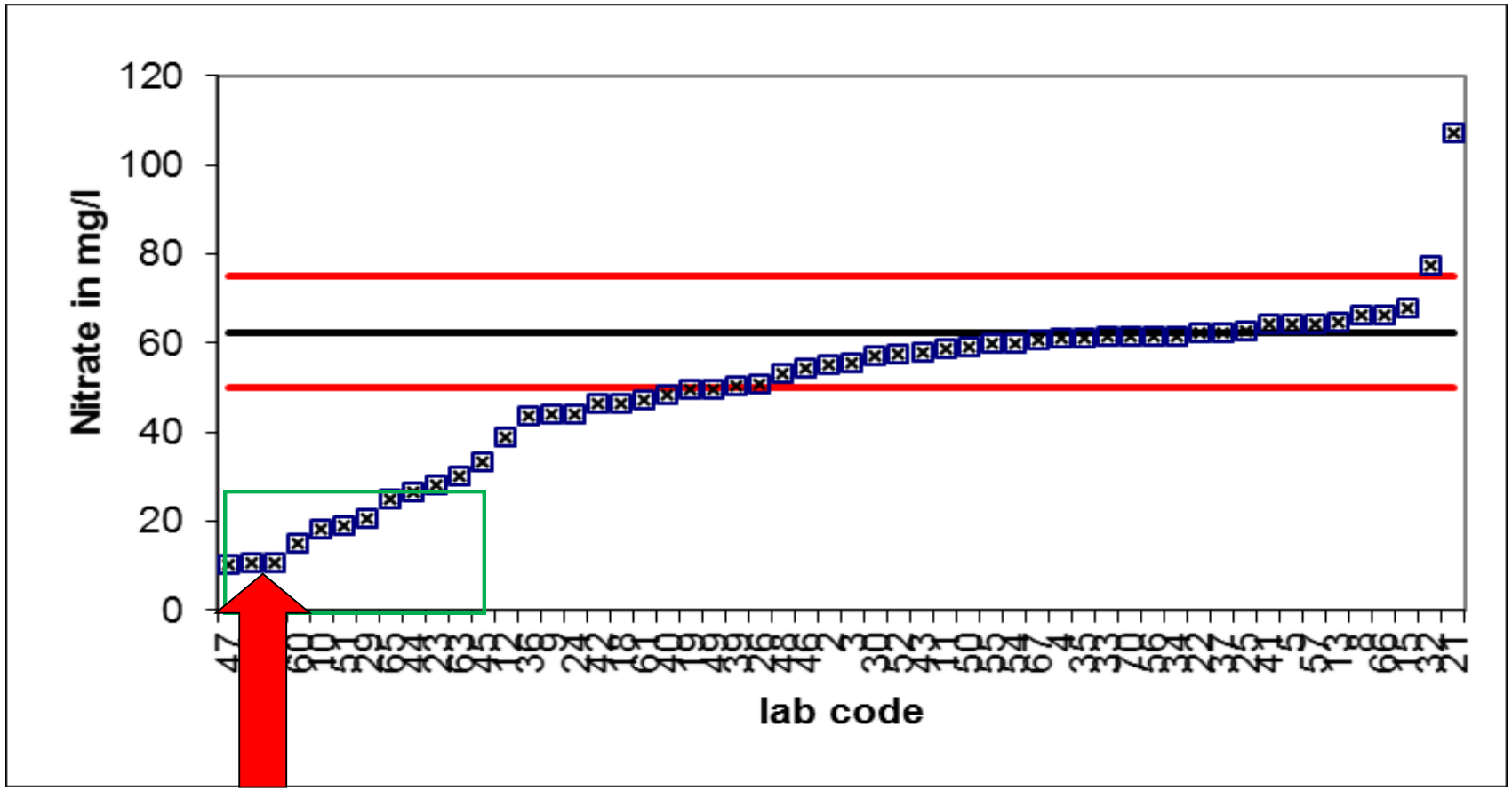




Wrong units again as NO_3^--N instead of NO_3^-

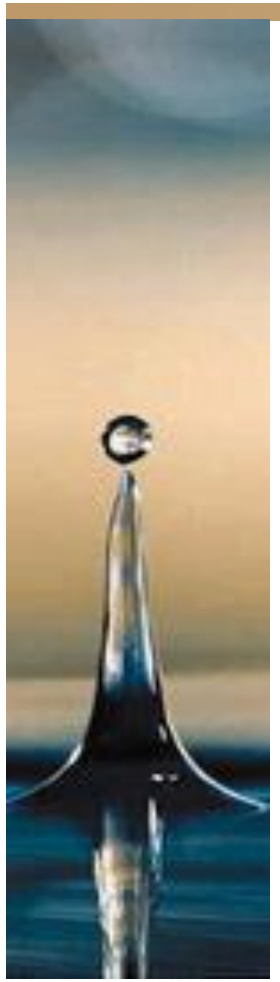
NITRATE 3

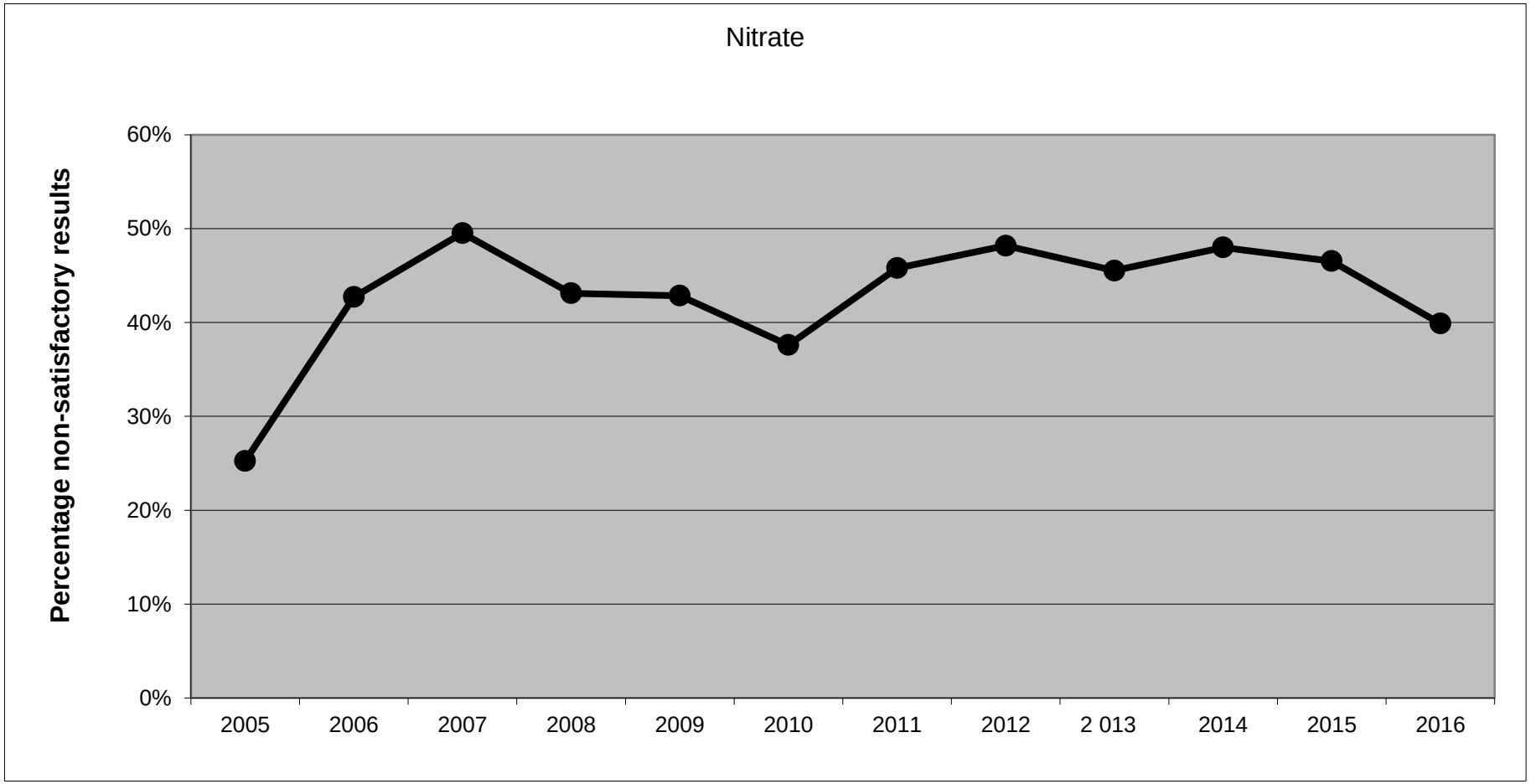




Wrong units again as NO_3^--N instead of NO_3^-

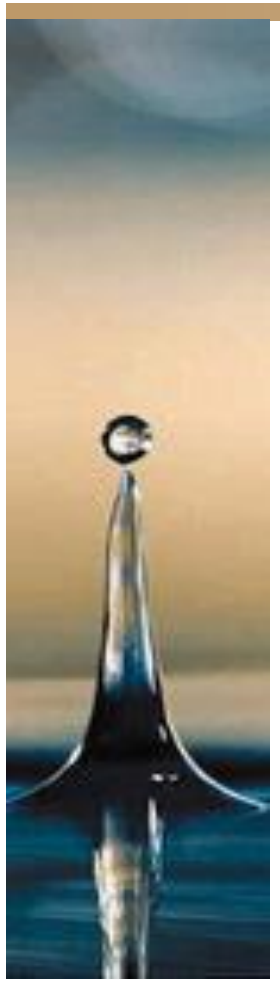
NITRATE



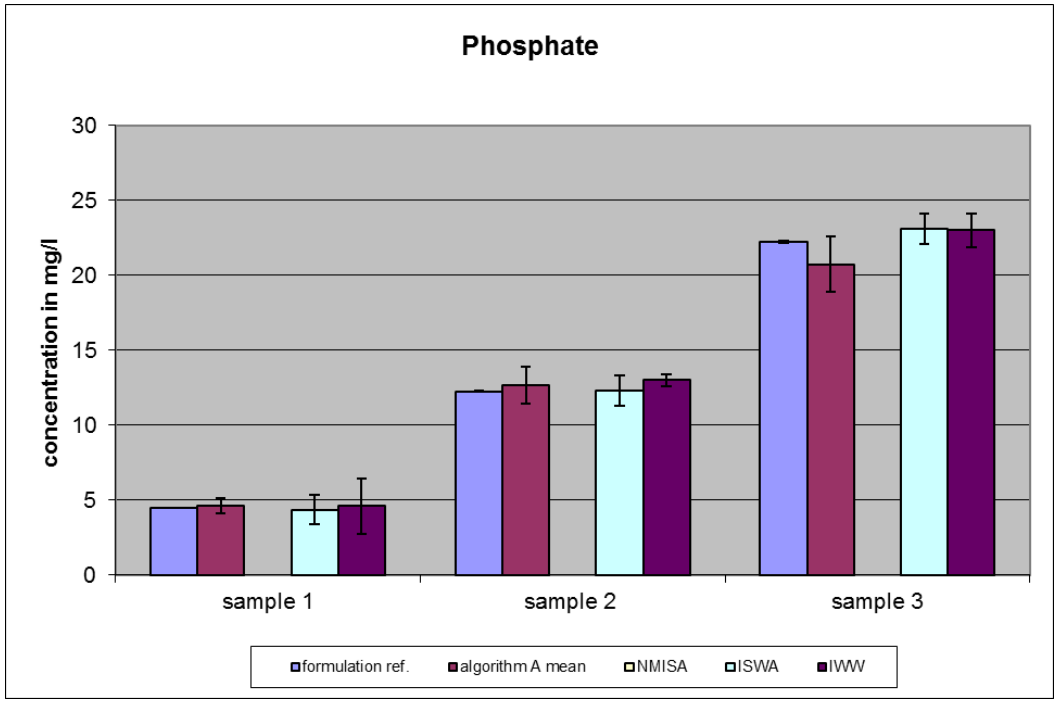


39.9 % of the data is outliers (46.5% in 2015)

PHOSPHATE



Mean vs. Reference value



Summary Phosphate

- ✓ **Average recovery was 95.9 %**
- ✓ **STD are still > 10%, especially for low conc.** (Sample 1 – 31.72%;Sample 2 28.81%,Sample 3 – 23.44%)
- ✓ **69 data points outside the limits**
- ✓ **32.9 % of methods still classified as "other"**

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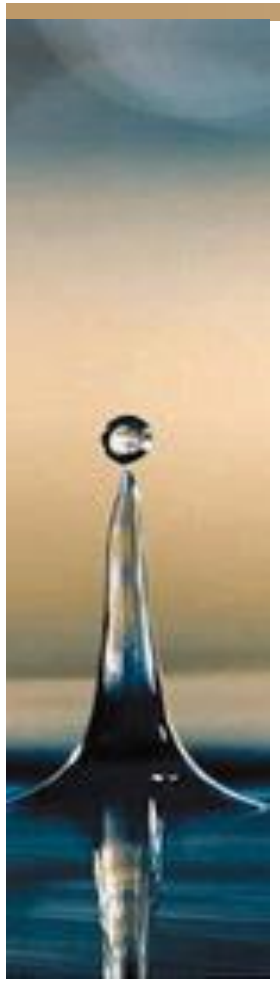
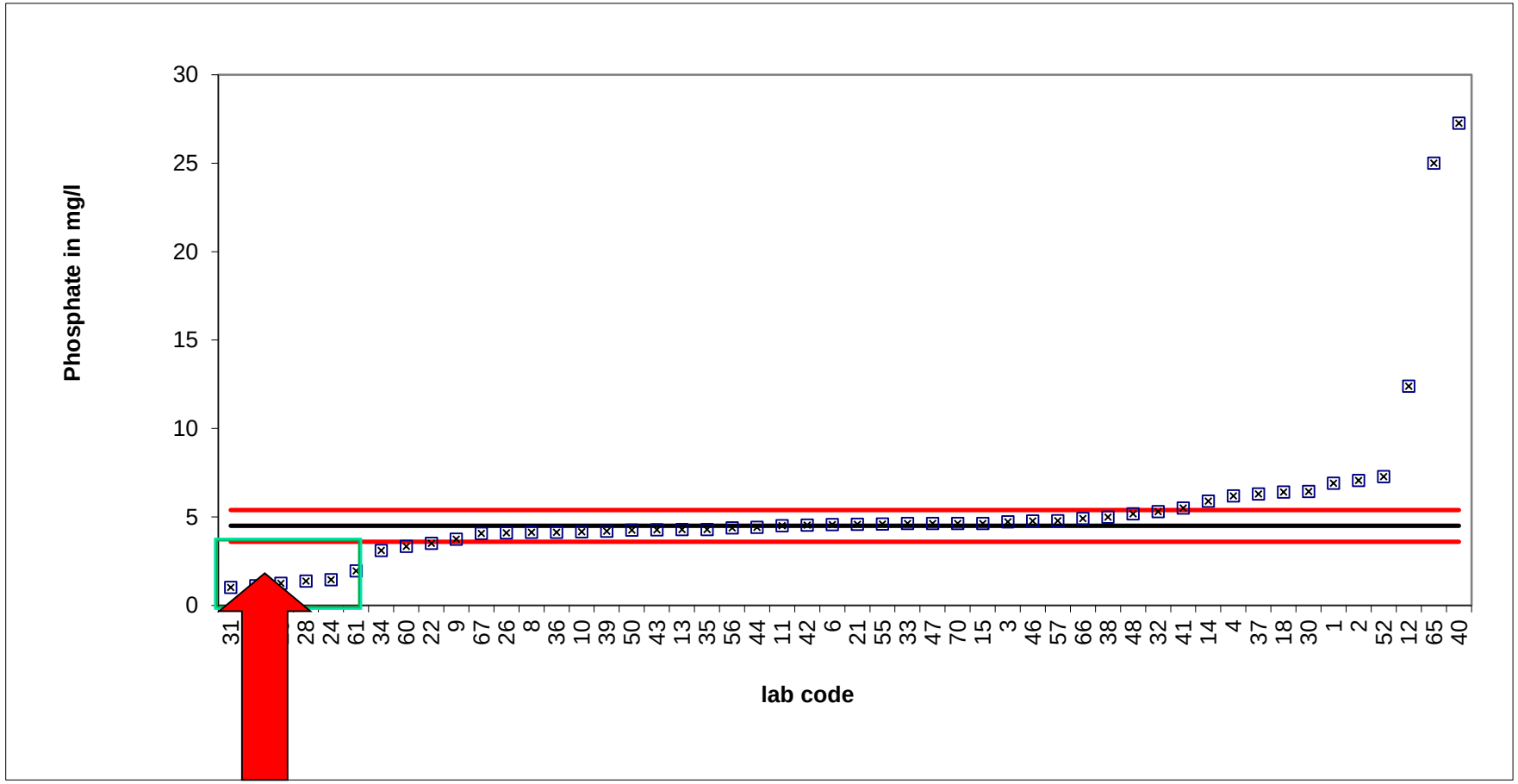
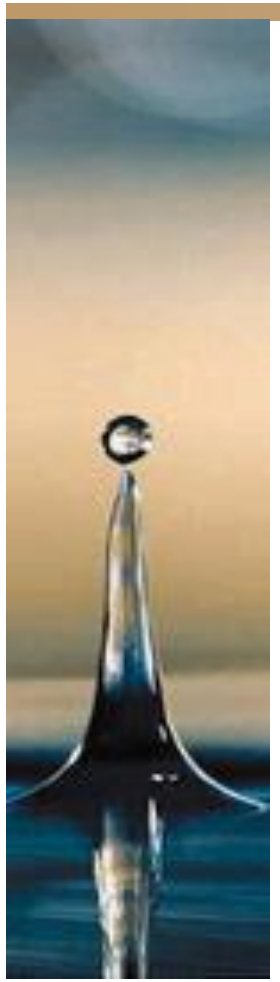
PHOSPHATE

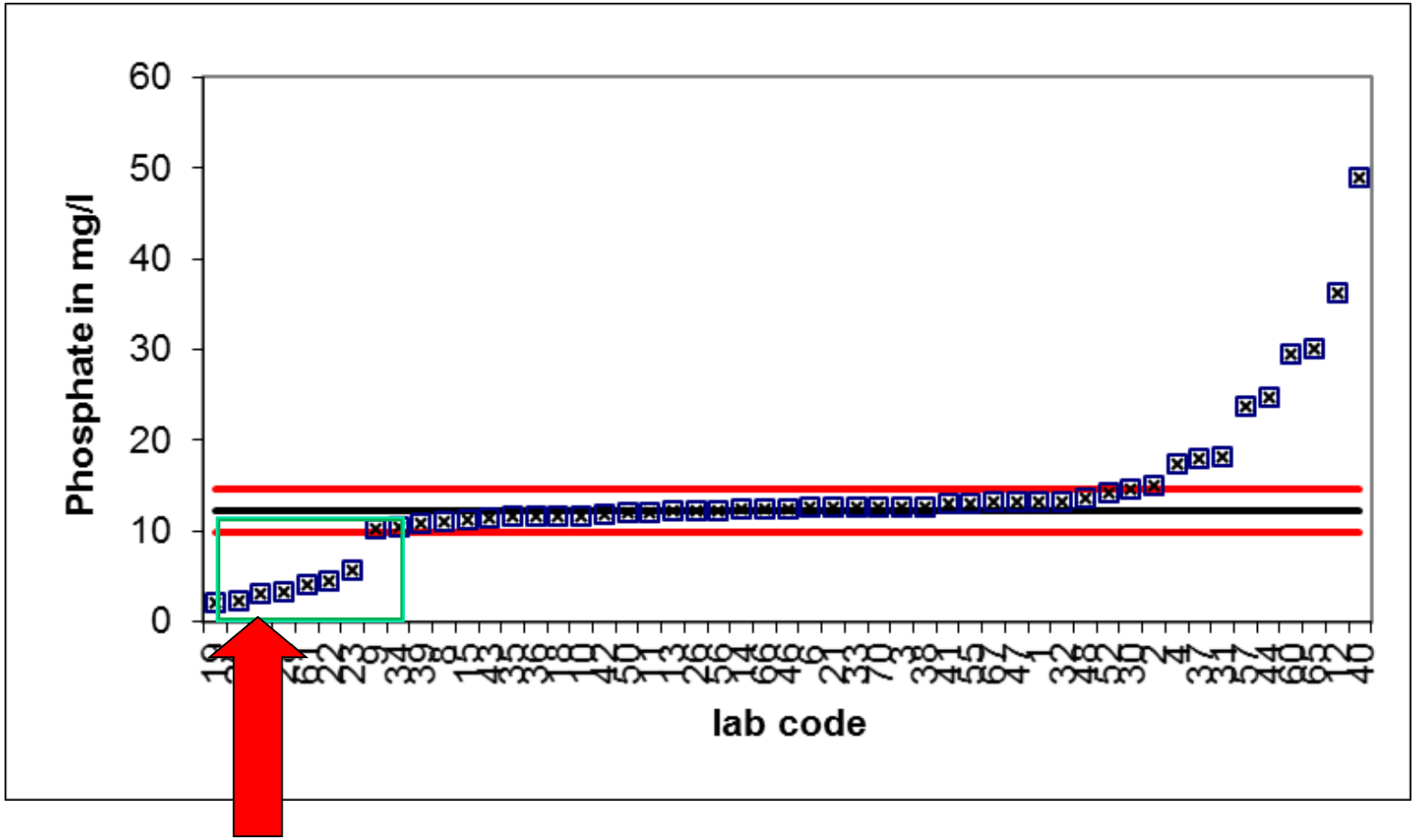




most probably reported in PO_4^{3-}-P instead of PO_4^{3-}

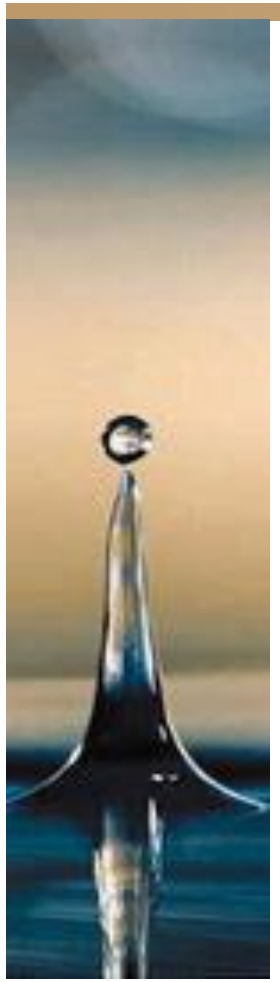
PHOSPHATE

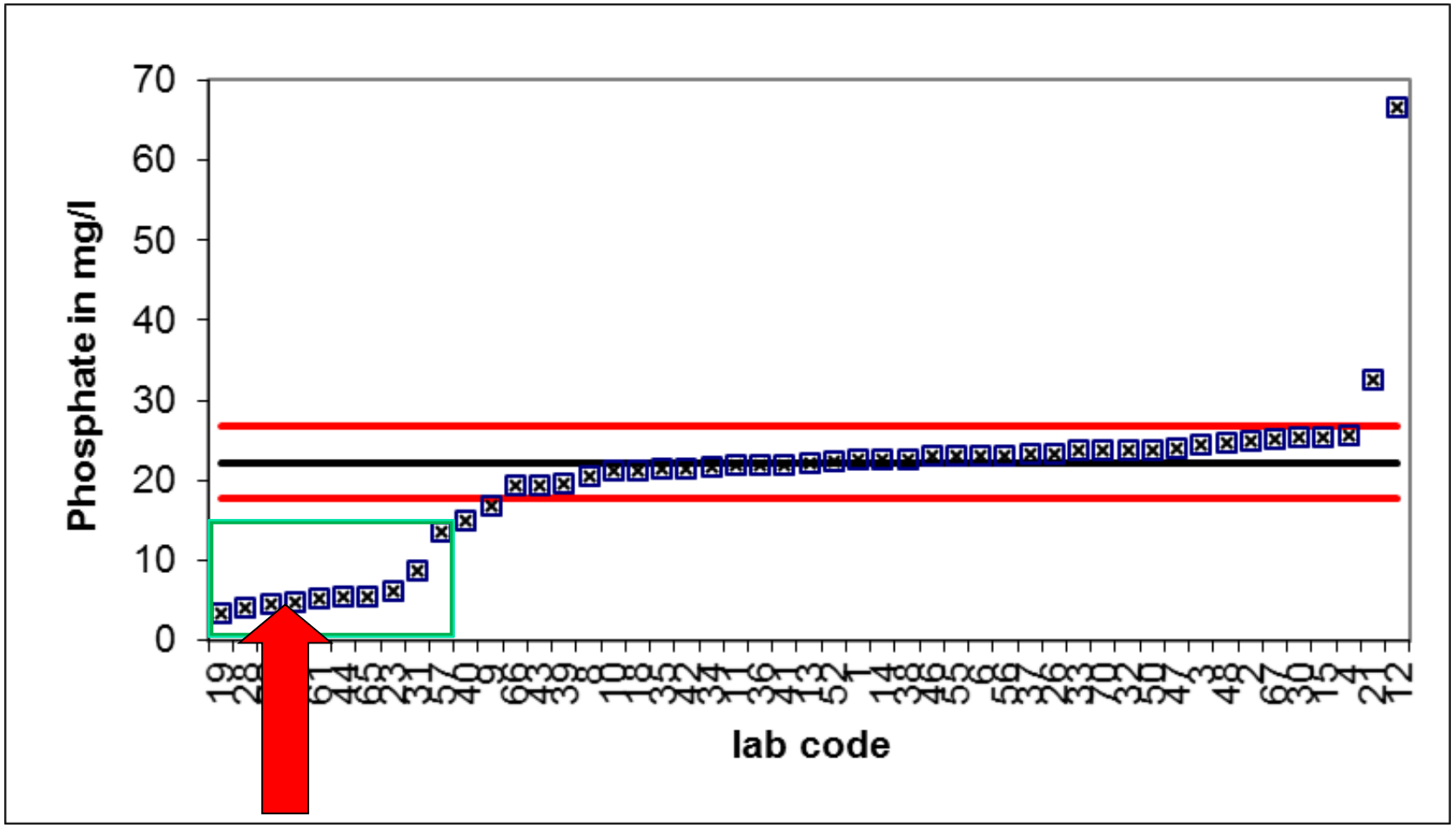




most probably reported in PO_4^{3-}-P instead of PO_4^{3-}

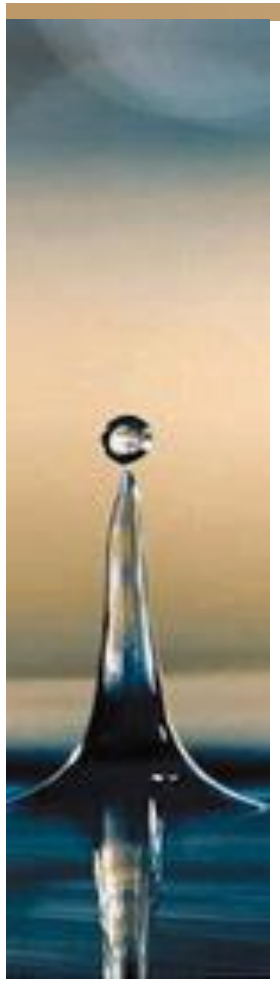
PHOSPHATE

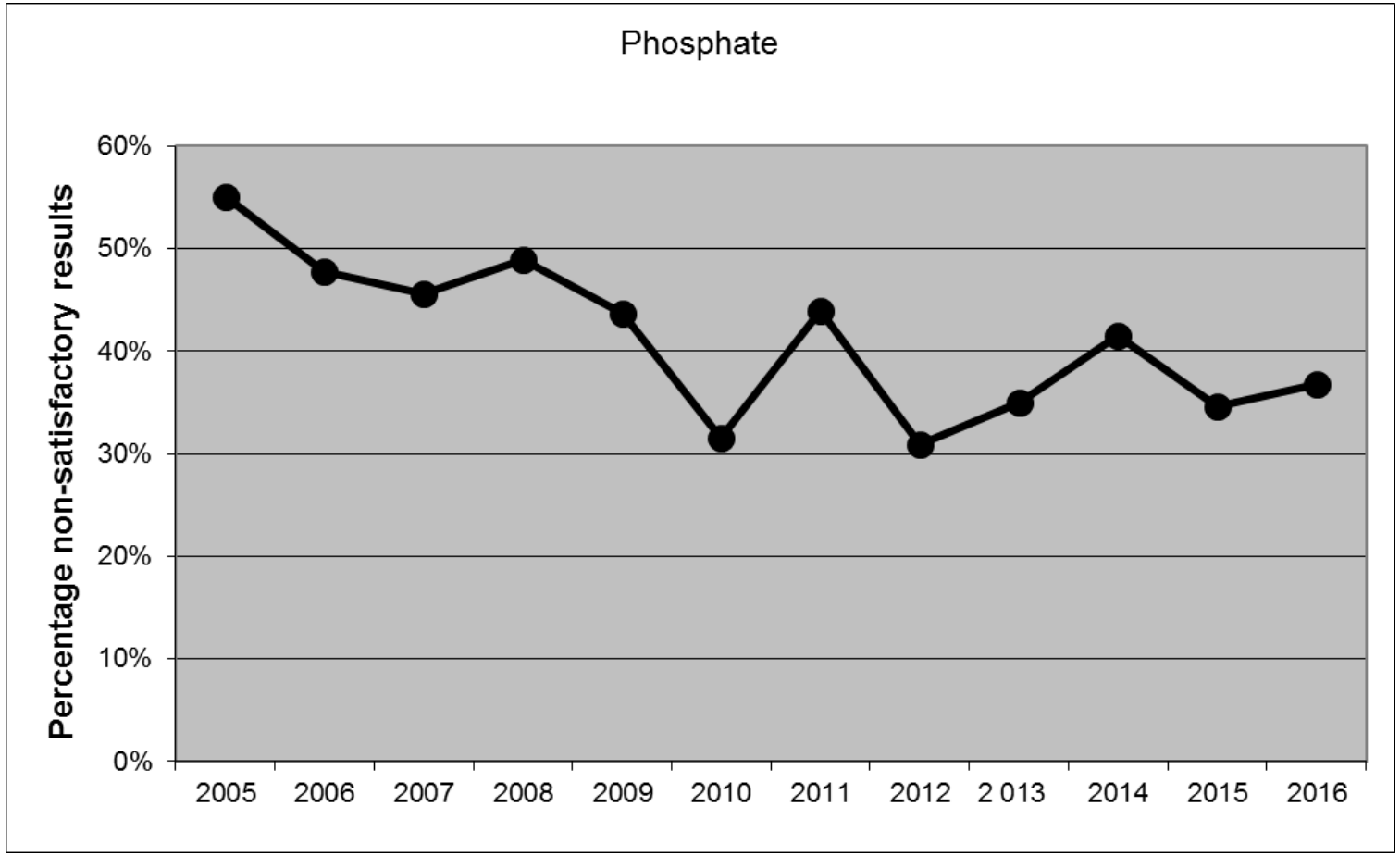




most probably reported in PO_4^{3-}-P instead of PO_4^{3-}

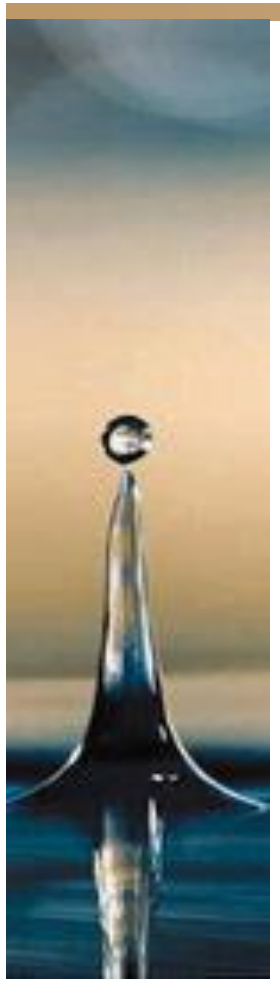
PHOSPHATE



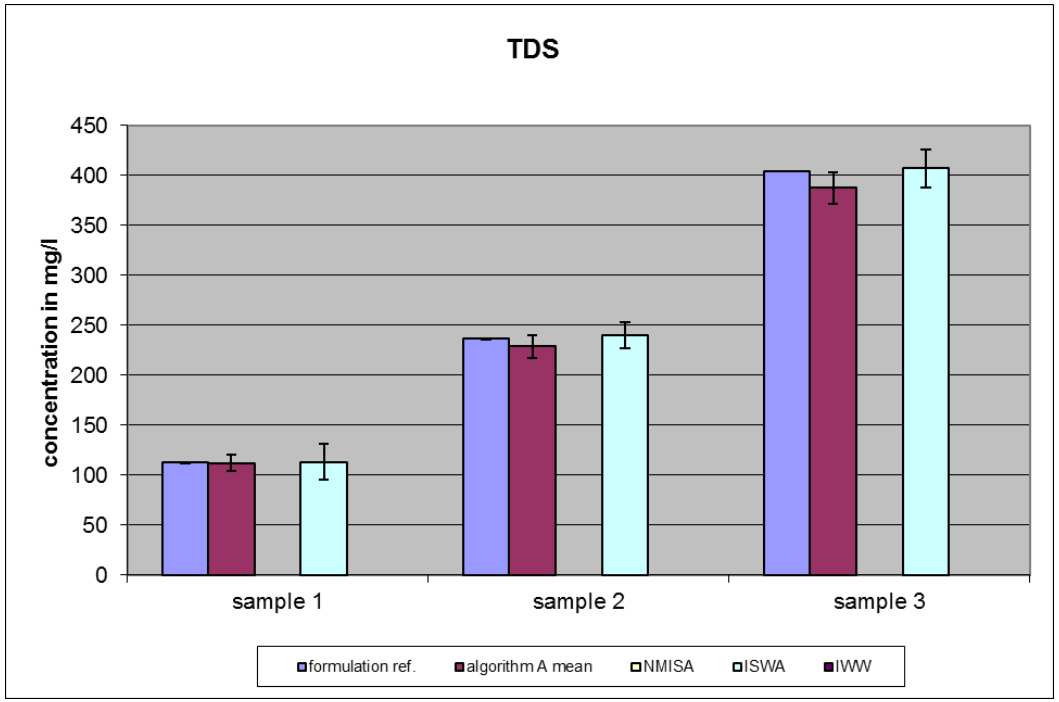


36.8% of the data is outliers (34.6% in 2015)

TOTAL DISSOLVED SOLIDS (TDS)



Mean vs. Reference value



Summary TDS

- ✓ **Average recovery was 96.3 %**
- ✓ **STD are between 12.0-21.2 % - for low conc. (21.2%)**
- ✓ **44 data points outside the limits**
- ✓ **29.3 % of methods still classified as "other"**

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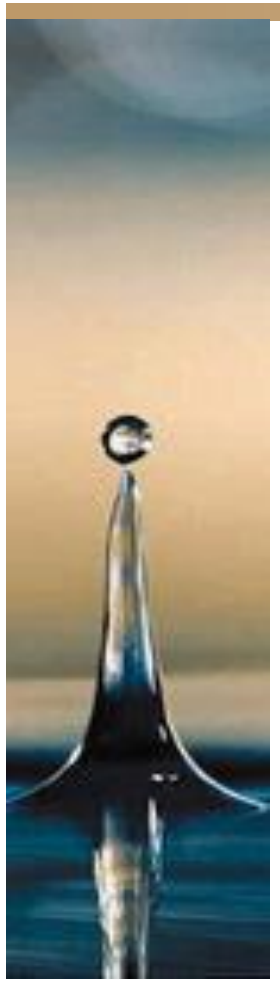
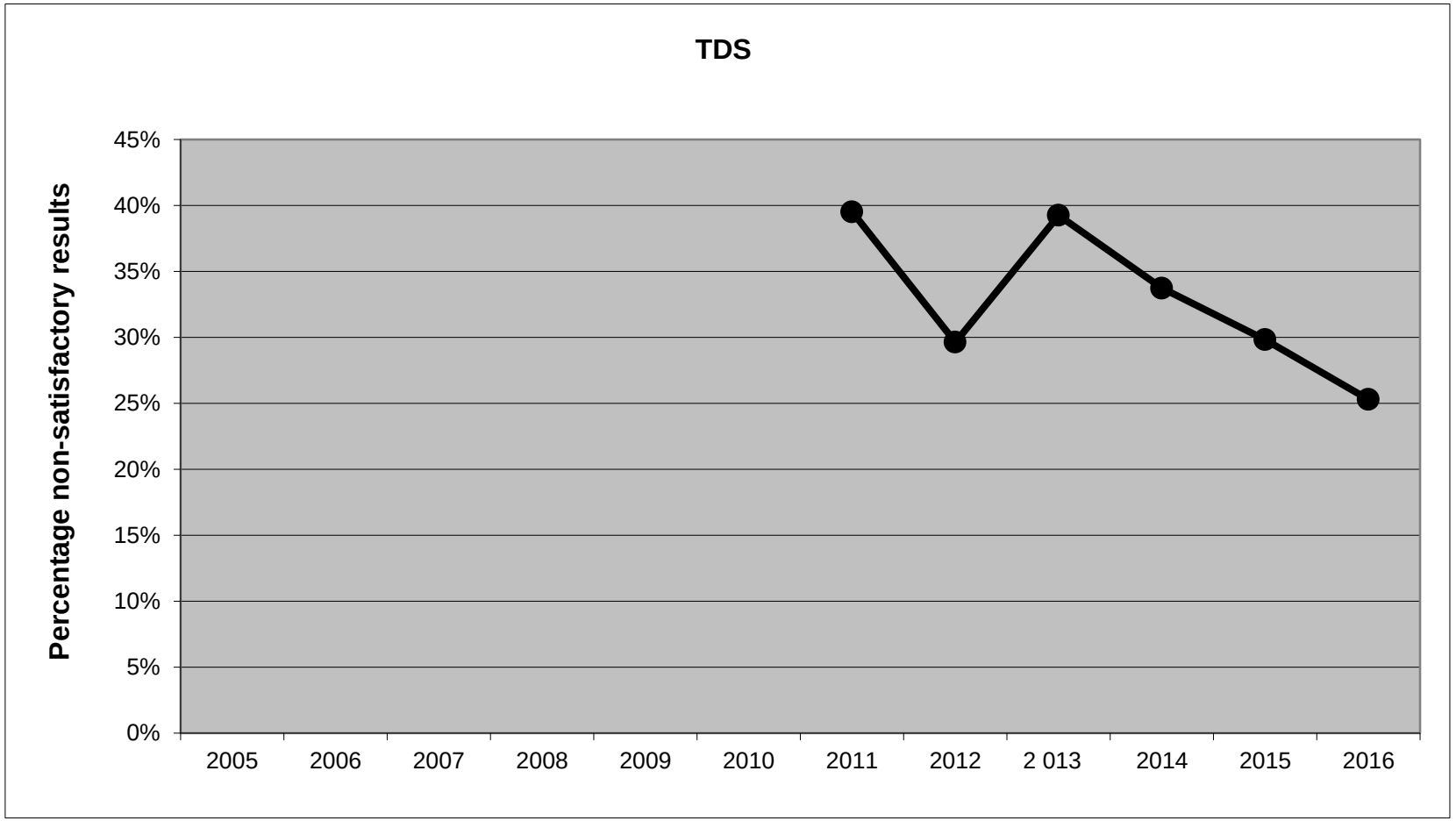
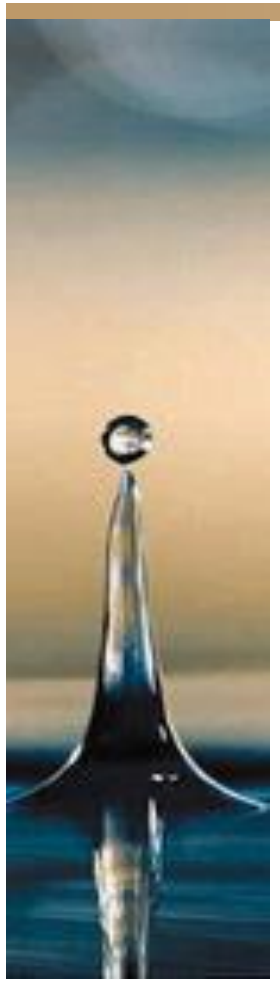
TDS



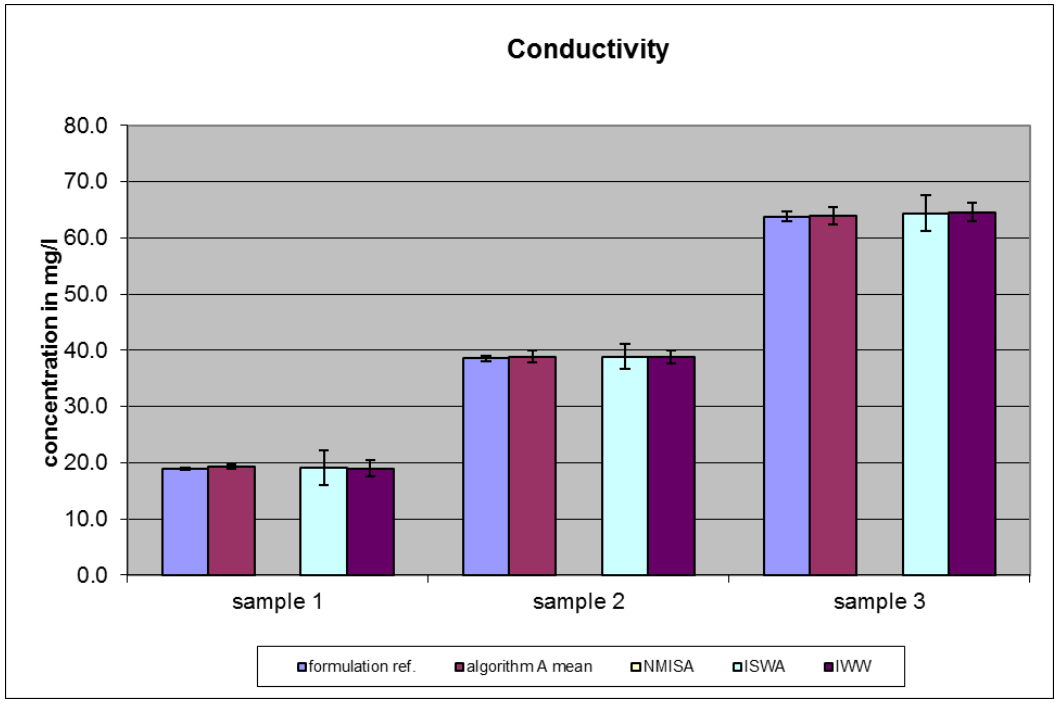


25.3% outliers (29.6.6% in 2015)

CONDUCTIVITY



Mean vs. Reference value



Summary Conductivity

- ✓ **Average recovery was 100.4 %**
- ✓ **STD are all < 10 %,** Sample 1 – 6.7%;Sample 2 – 8.2 %,Sample 3 – 6.9%)
- ✓ **52 data points outside the limits**
- ✓ **29.2% of methods still classified as "other"**

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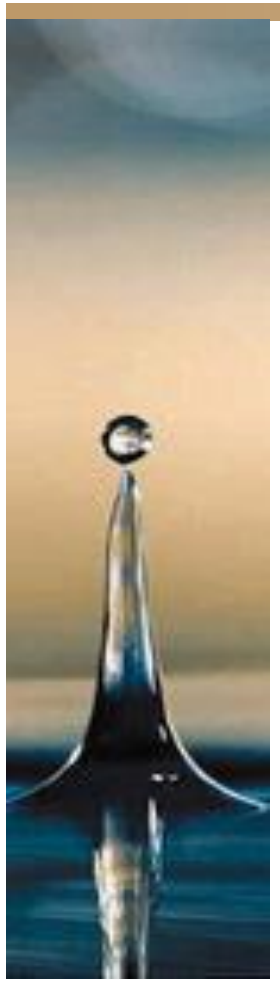
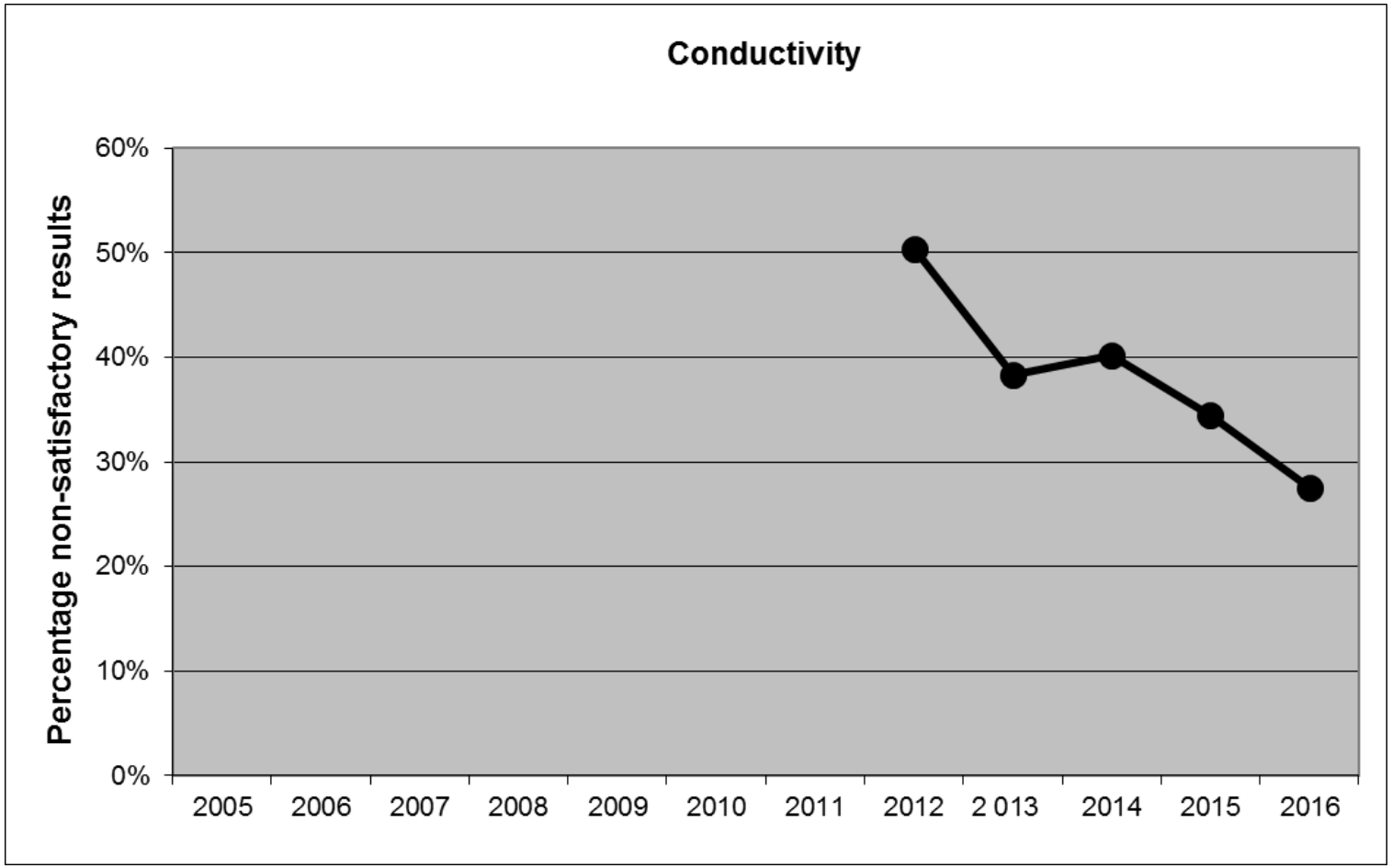
CONDUCTIVITY





27.5 % of the data is outliers (34.5 % in 2015)

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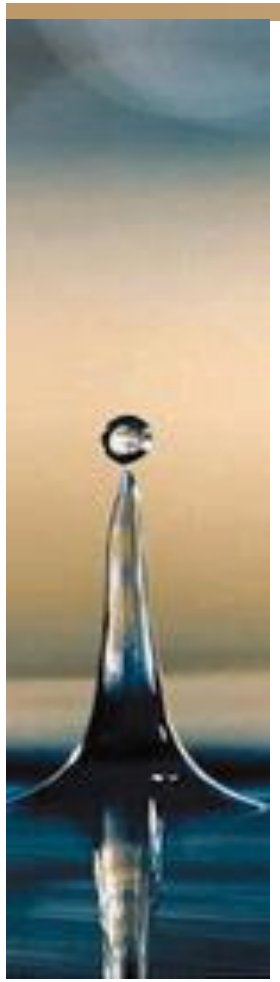
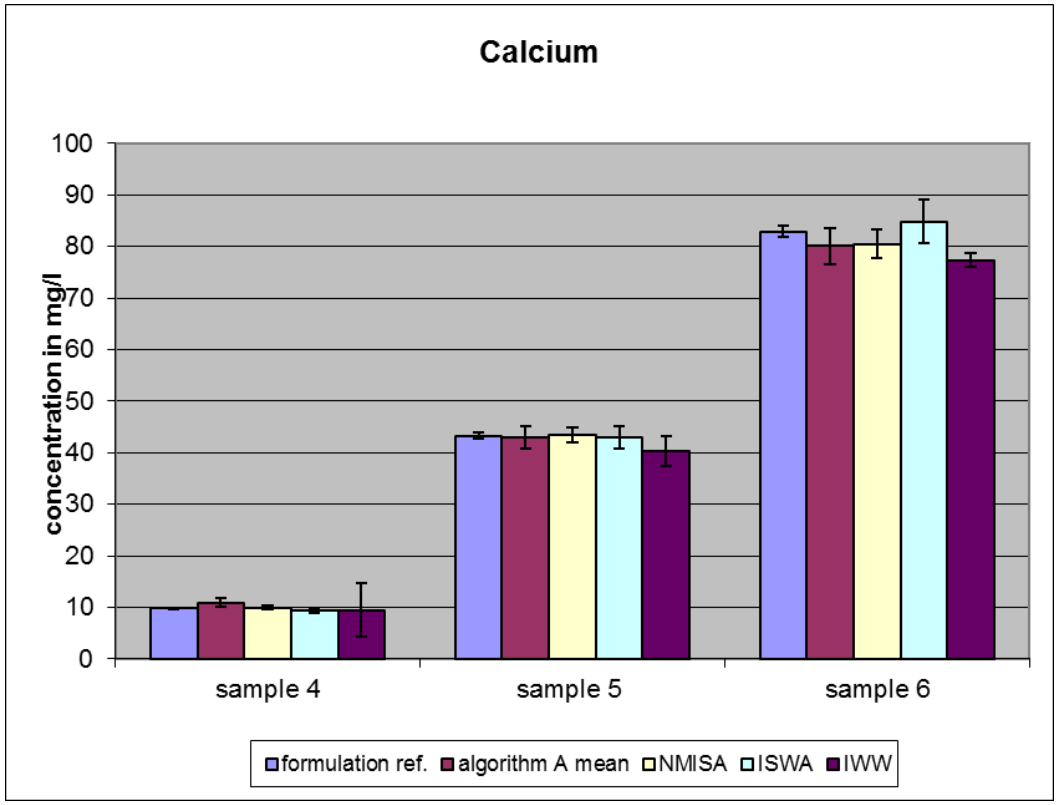
CALCIUM



Mean vs. Reference value



Summary Calcium

- ✓ **Average recovery was 98.2 %**
- ✓ **STD > 10 % for all three levels (lowest level – 23.63 %)**
- ✓ **52 data points outside the limits**
- ✓ **28.1% of methods still classified as "other"**

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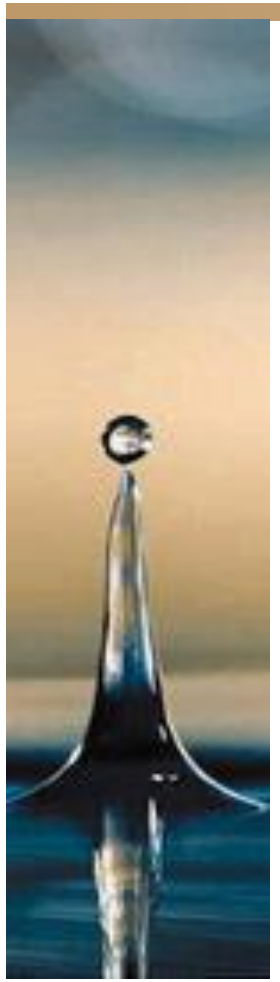
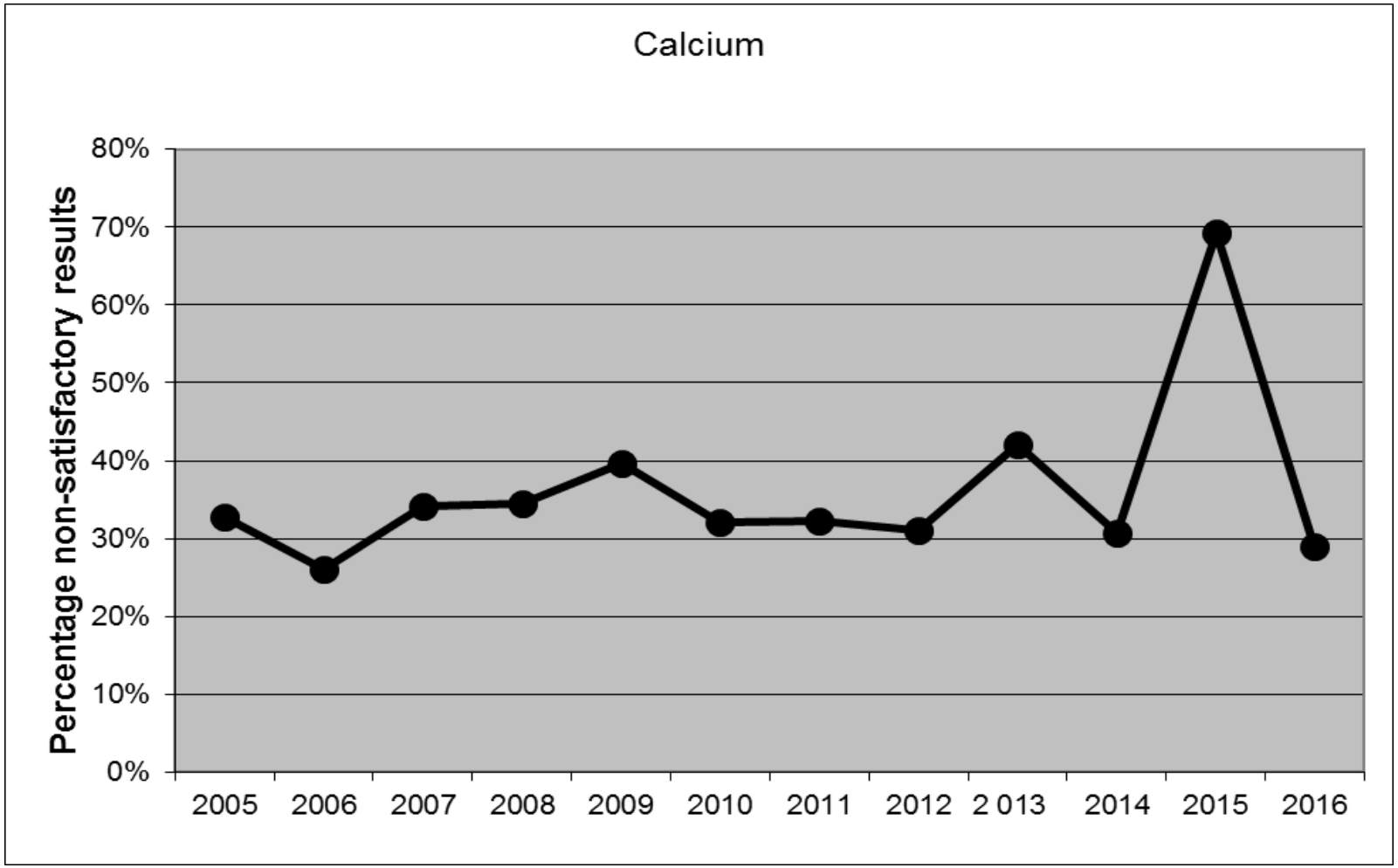
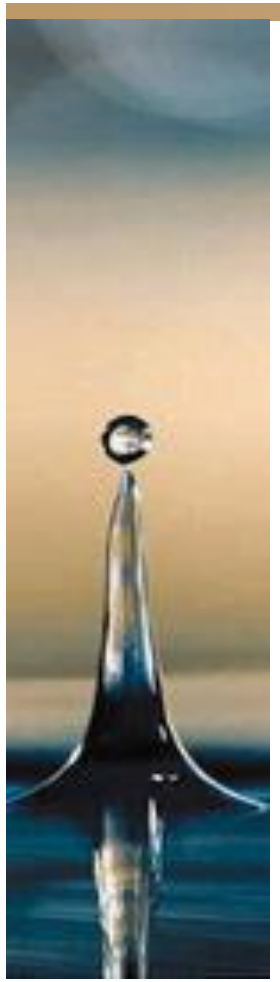
CALSIUM



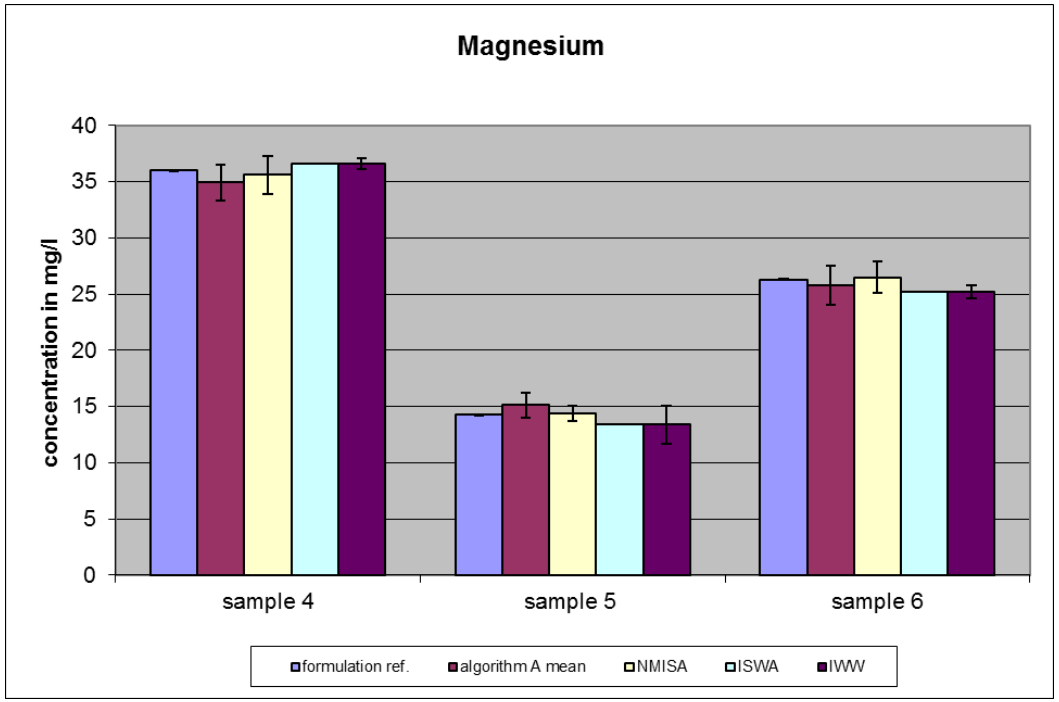


29.9 % of the data is outliers (69.3% in 2015)

MAGNESIUM



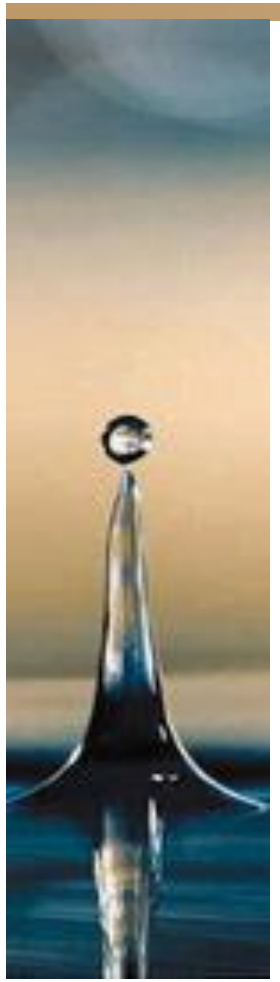
Mean vs. Reference value

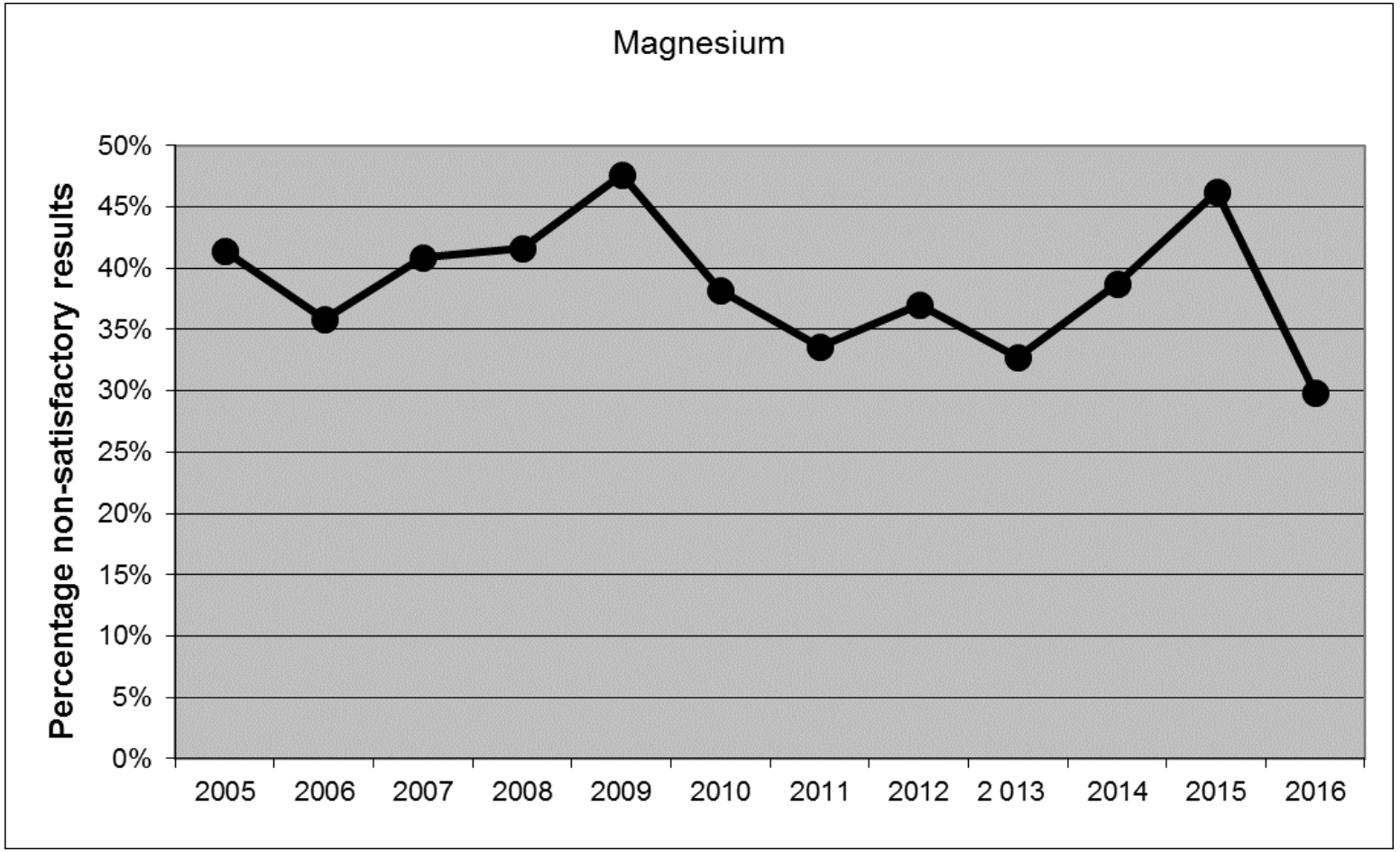


Summary Magnesium

- ✓ Average recovery was 97.3 %
- ✓ STD below 20 % for Sample 5 and 6 Sample 4 (lowest level – 27.42 %)
- ✓ 52 data points outside the limits
- ✓ 28.1% of methods still classified as "other"

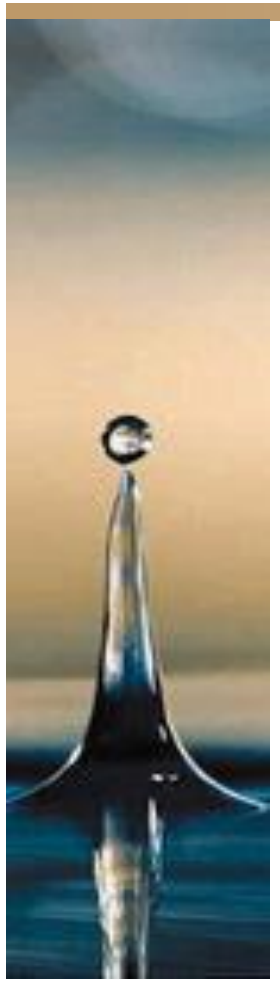
MAGNESIUM



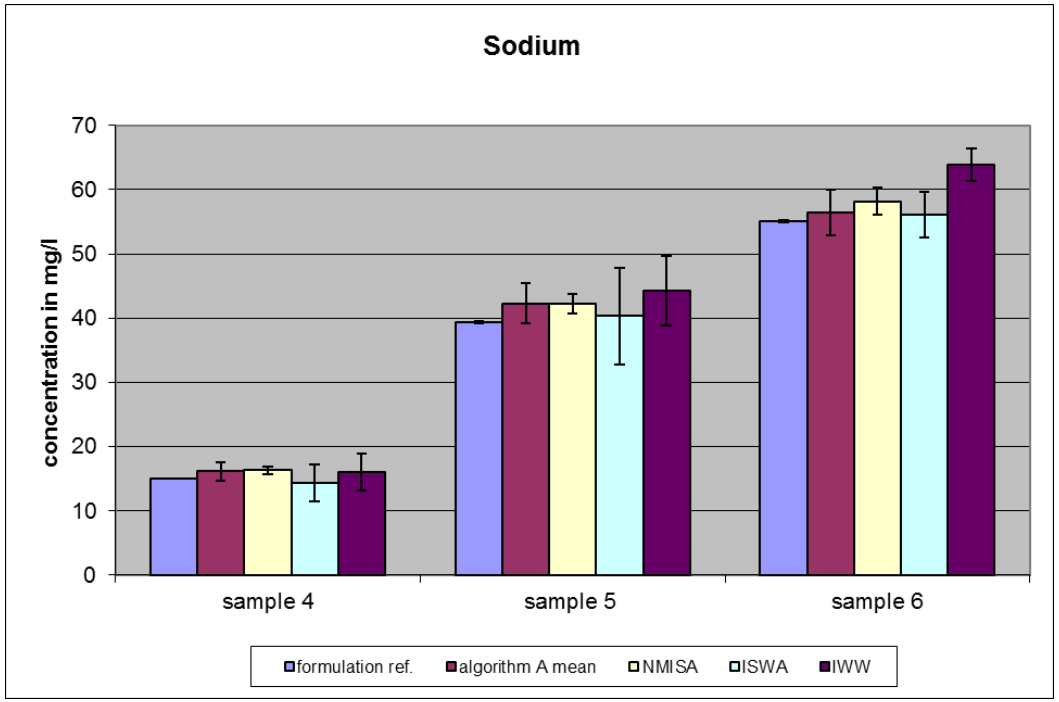


29.1 % of the data is outliers (46.2 % in 2015)

SODIUM



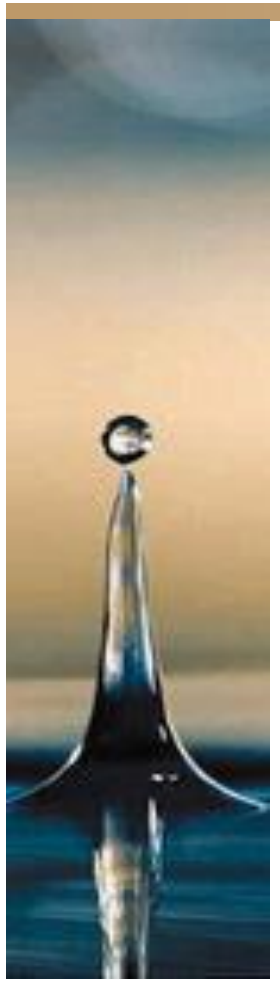
Mean vs. Reference value

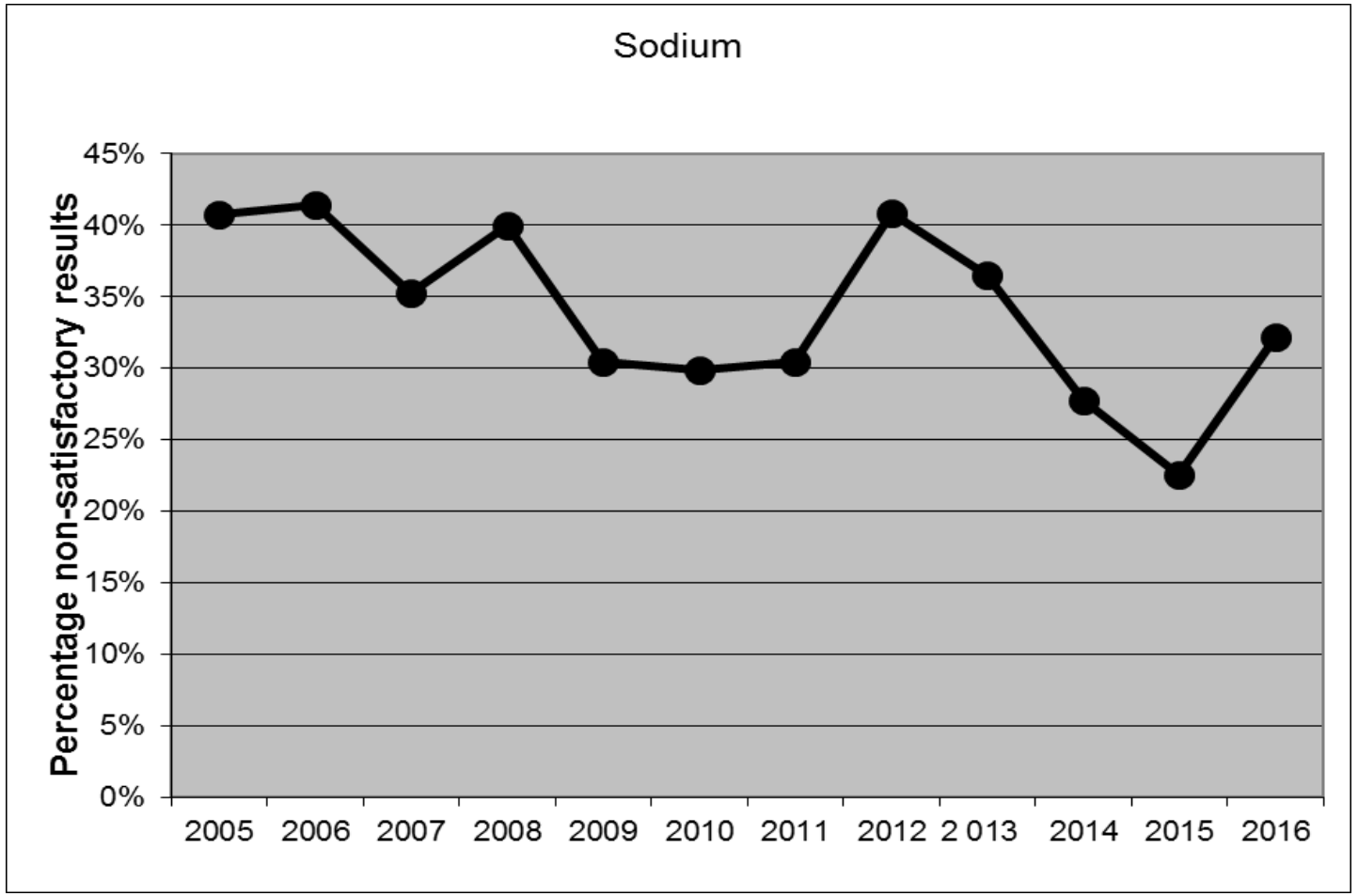


Summary Sodium

- ✓ **Average recovery was 104.2 %**
- ✓ **STD above 10 % for all three samples (lowest level – 26.25 %)**
- ✓ **45 data points outside the limits**
- ✓ **40.7% of methods still classified as "other"**

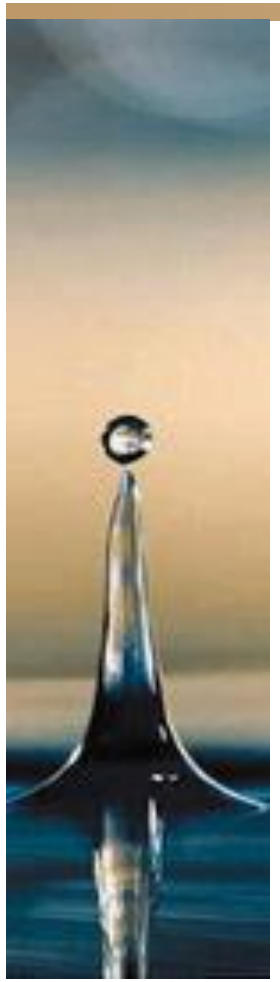
SODIUM



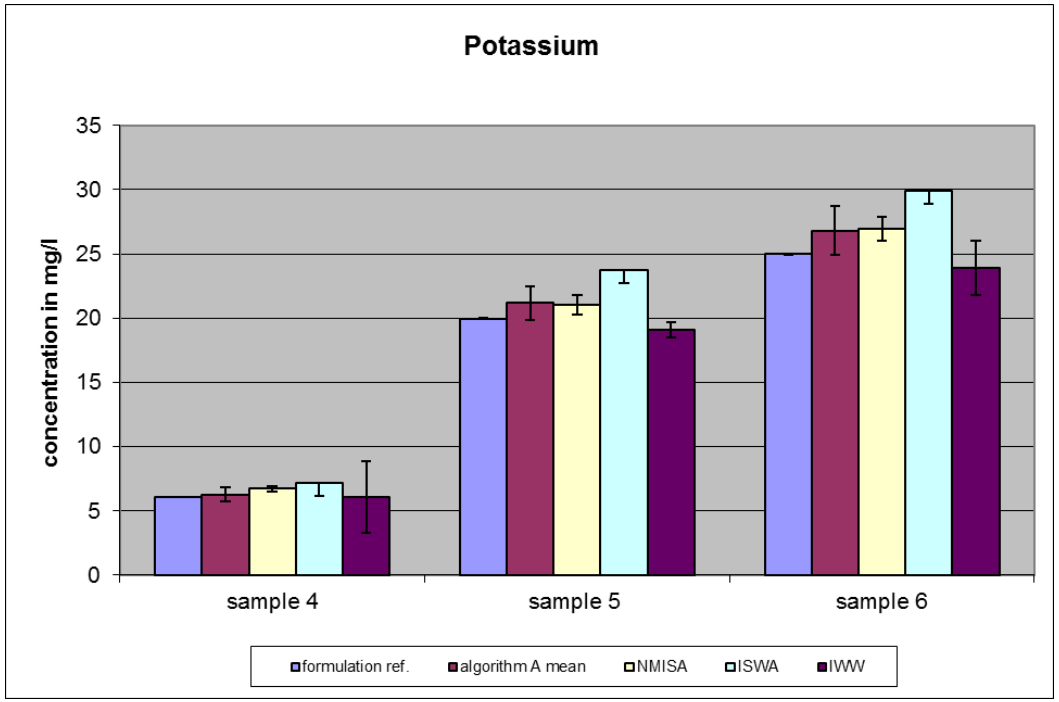


32.1 % of the data is outliers (22.5 % in 2015)

POTASSIUM



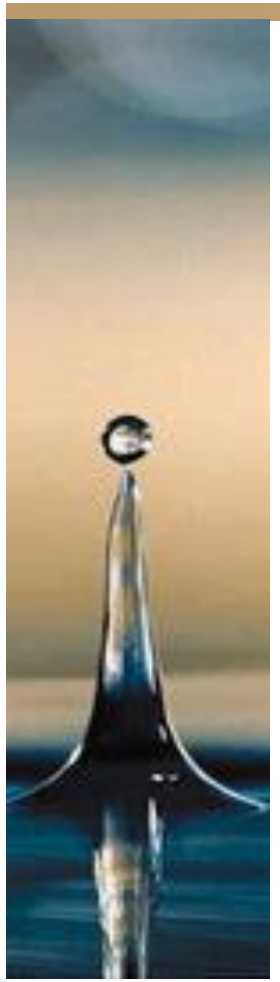
Mean vs. Reference value

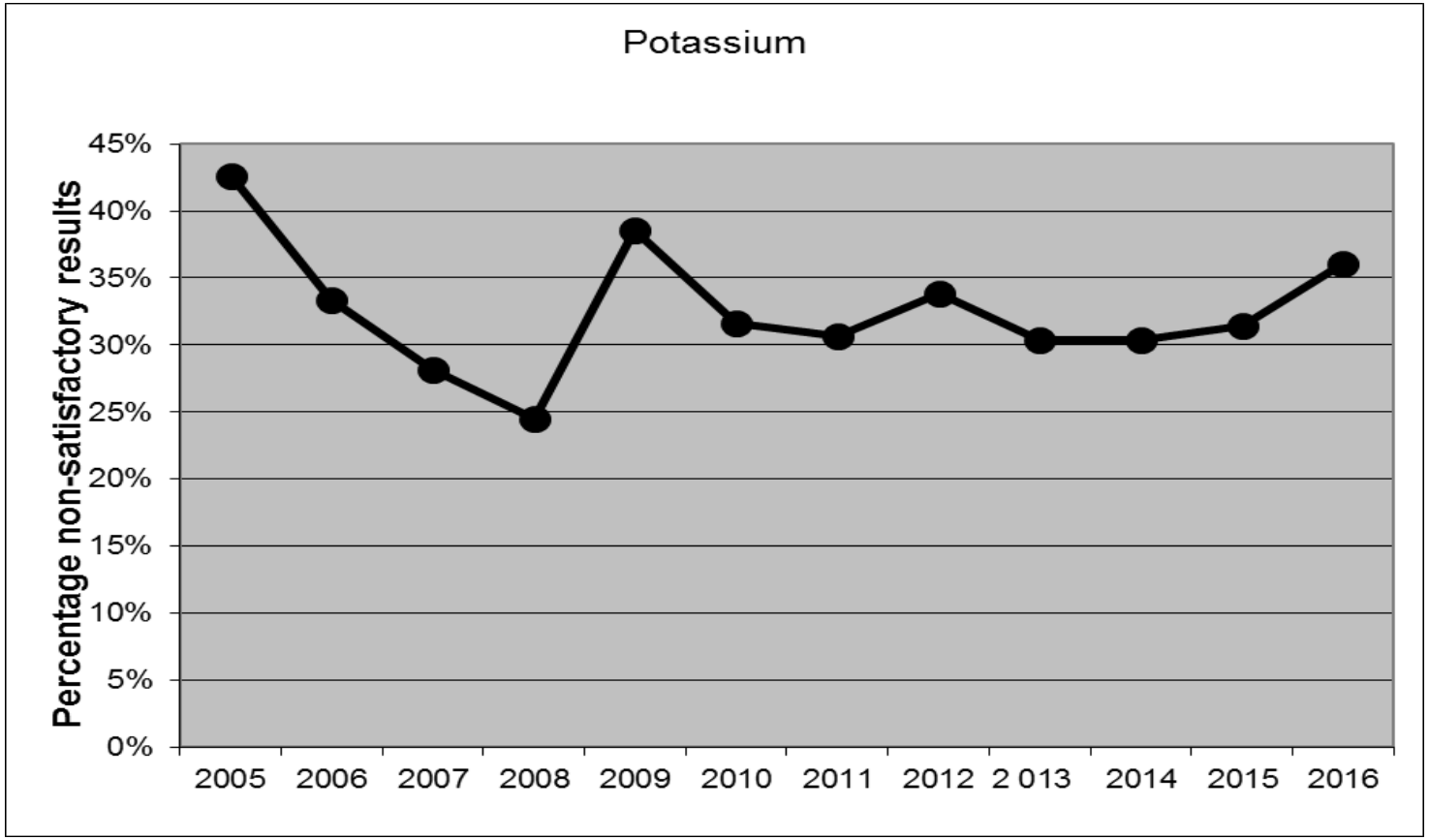


Summary Potassium

- ✓ **Average recovery was 106.7 %**
- ✓ **STD below > 10 % for all three levels**
- ✓ **53 data points outside the limits**
- ✓ **42.2 % of methods still classified as "other"**

POTASSIUM





36.1 % of the data is outliers (31.4 % in 2015)

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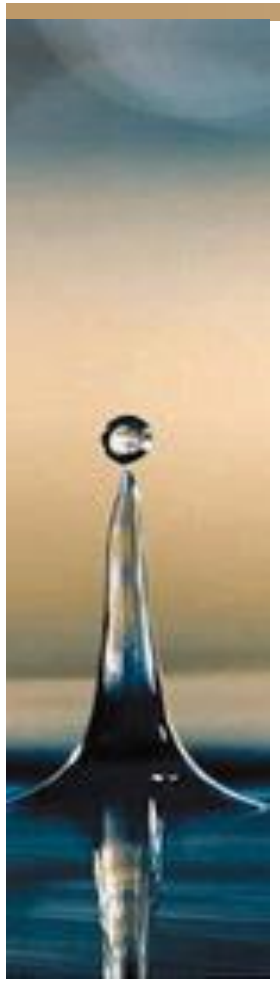
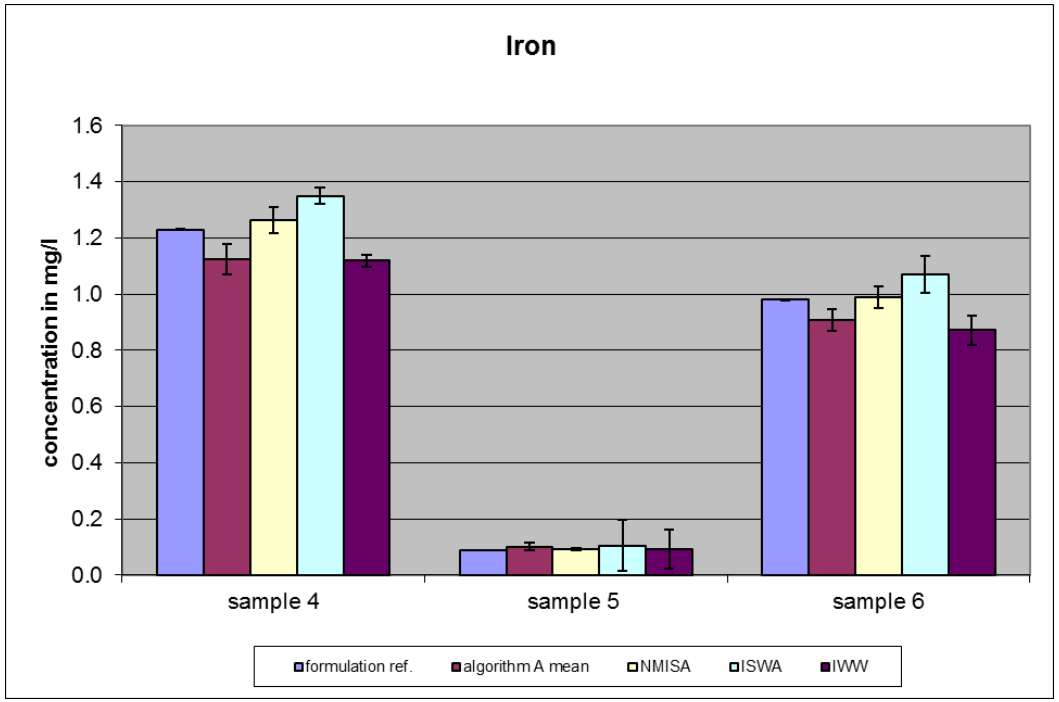
IRON



Mean vs. Reference value



Summary Iron

- ✓ **Average recovery was 92.0 %**
- ✓ **STD below 20 % for Sample 5 and 6 Sample 4 (lowest level – 42.66 %)**
- ✓ **41 data points outside the limits**
- ✓ **44.0% of methods still classified as "other"**

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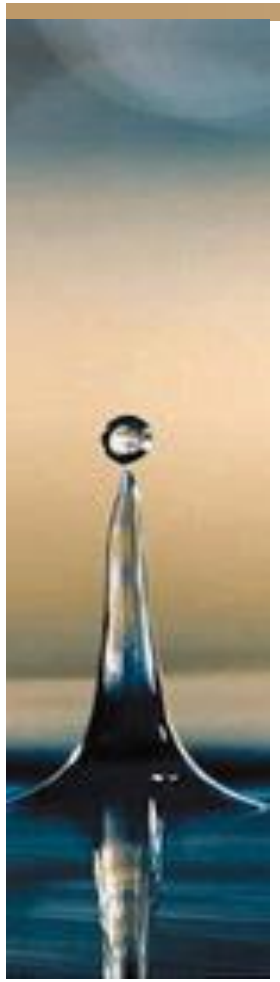
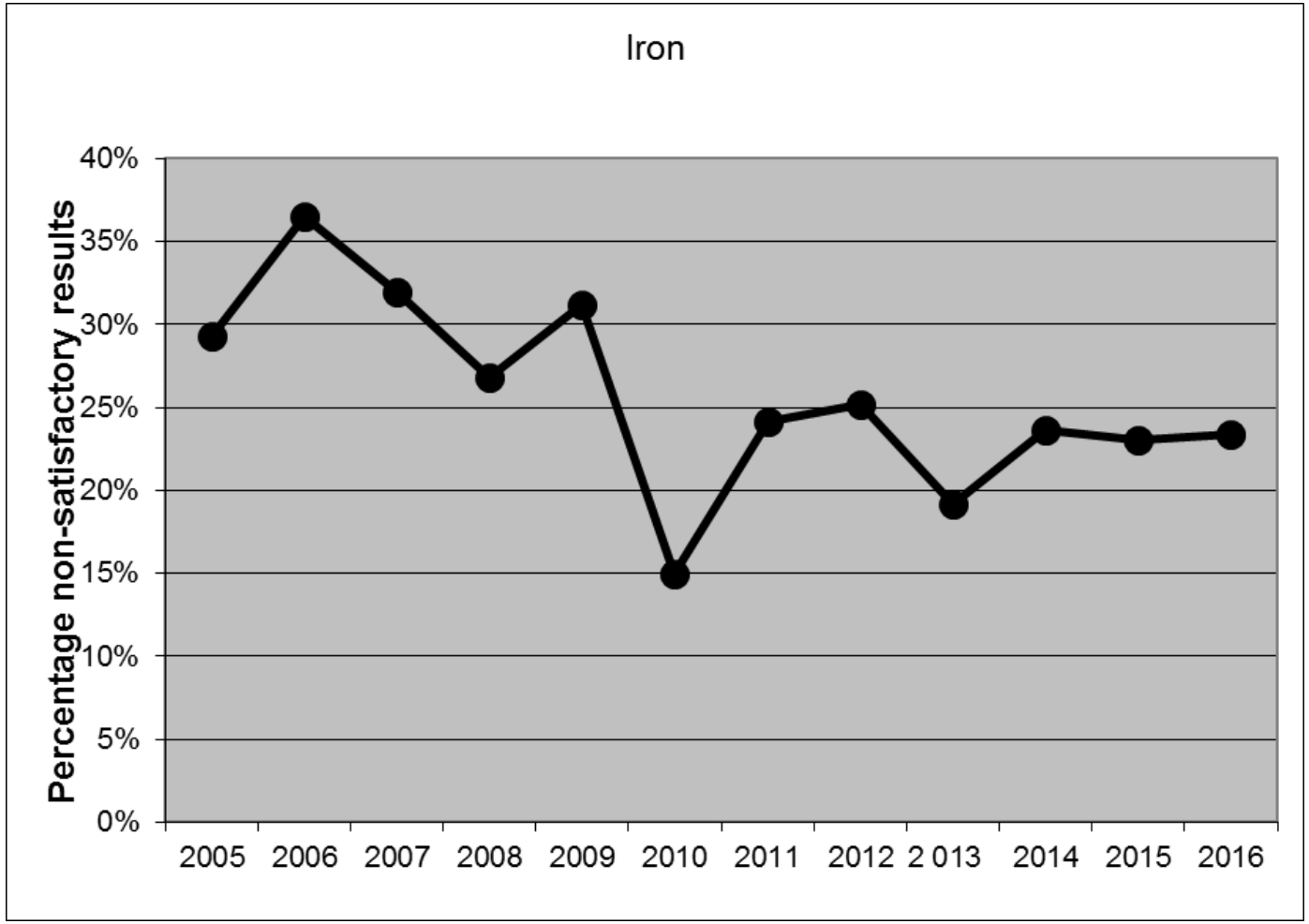
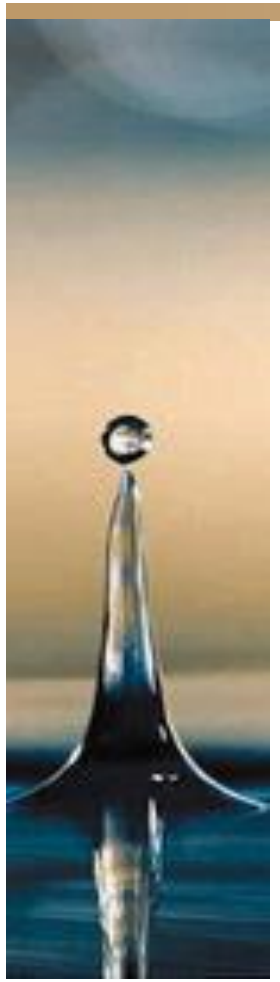
IRON



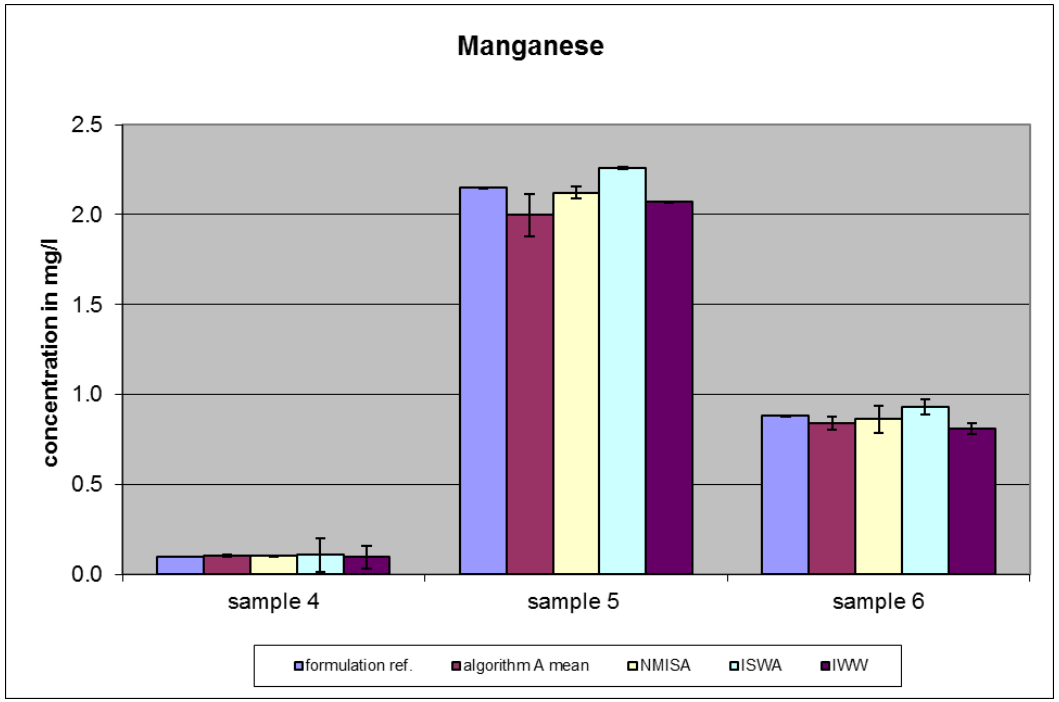


23.4 % of the data is outliers (23.0 % in 2015)

MANGANESE



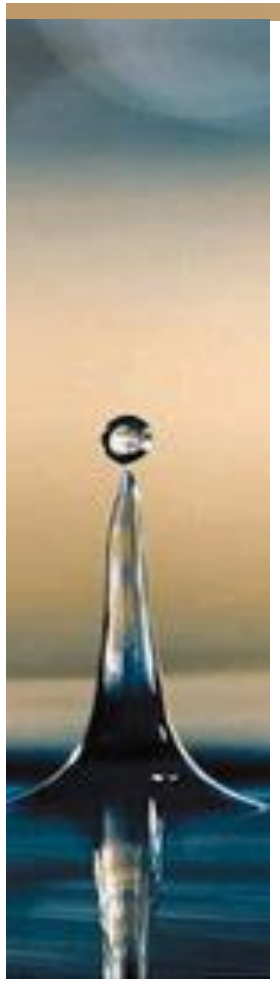
Mean vs. Reference value

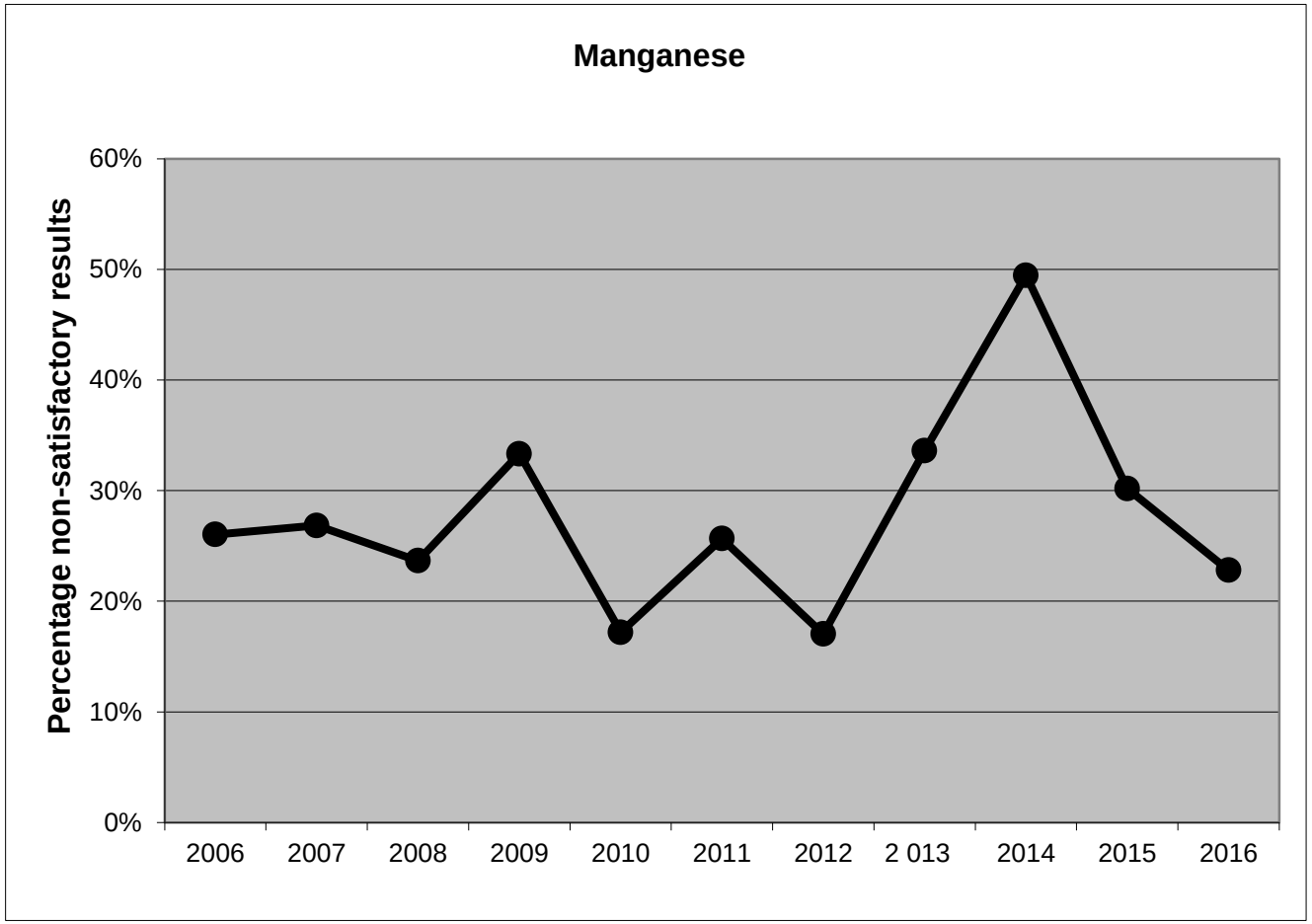


Summary Manganese

- ✓ Average recovery was 93.3 %
- ✓ STD below 20 % for Sample 5 and 6 Sample 4 (lowest level – 20.17 %)
- ✓ 39 data points outside the limits
- ✓ 50.9% of methods still classified as "other"

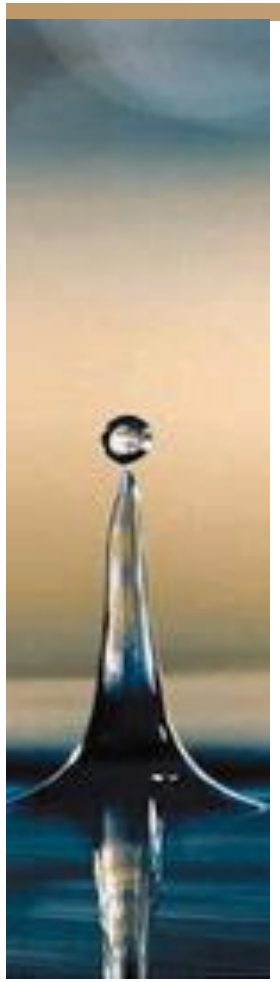
MANGANESE



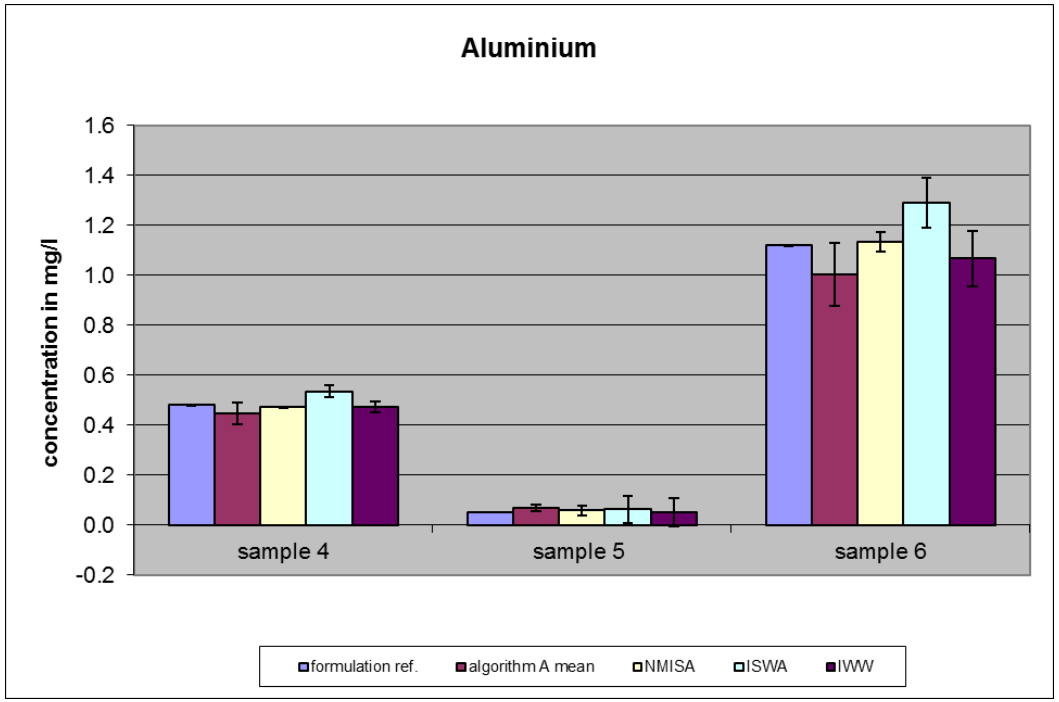


22.8 % of the data is outliers (30.2 % in 2015)

ALUMINIUM



Mean vs. Reference value



Summary Aluminium

- ✓ Average recovery was 90.2 %
- ✓ STD above 20%, 62.2 for lowest level; sample 4 (21.6%) Sample 6 (27.2 %)
- ✓ 32 data points outside the limits
- ✓ 42.2% of methods still classified as "other"

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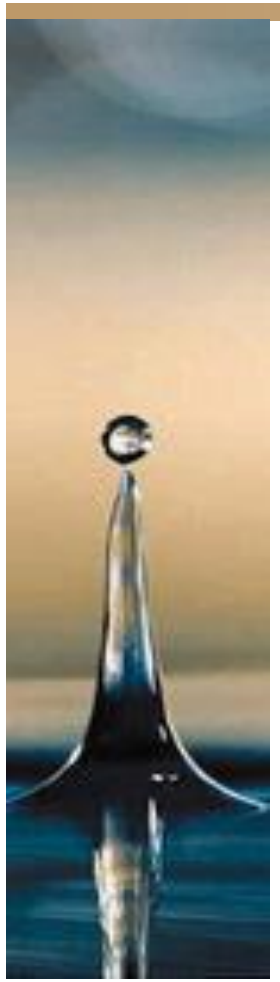
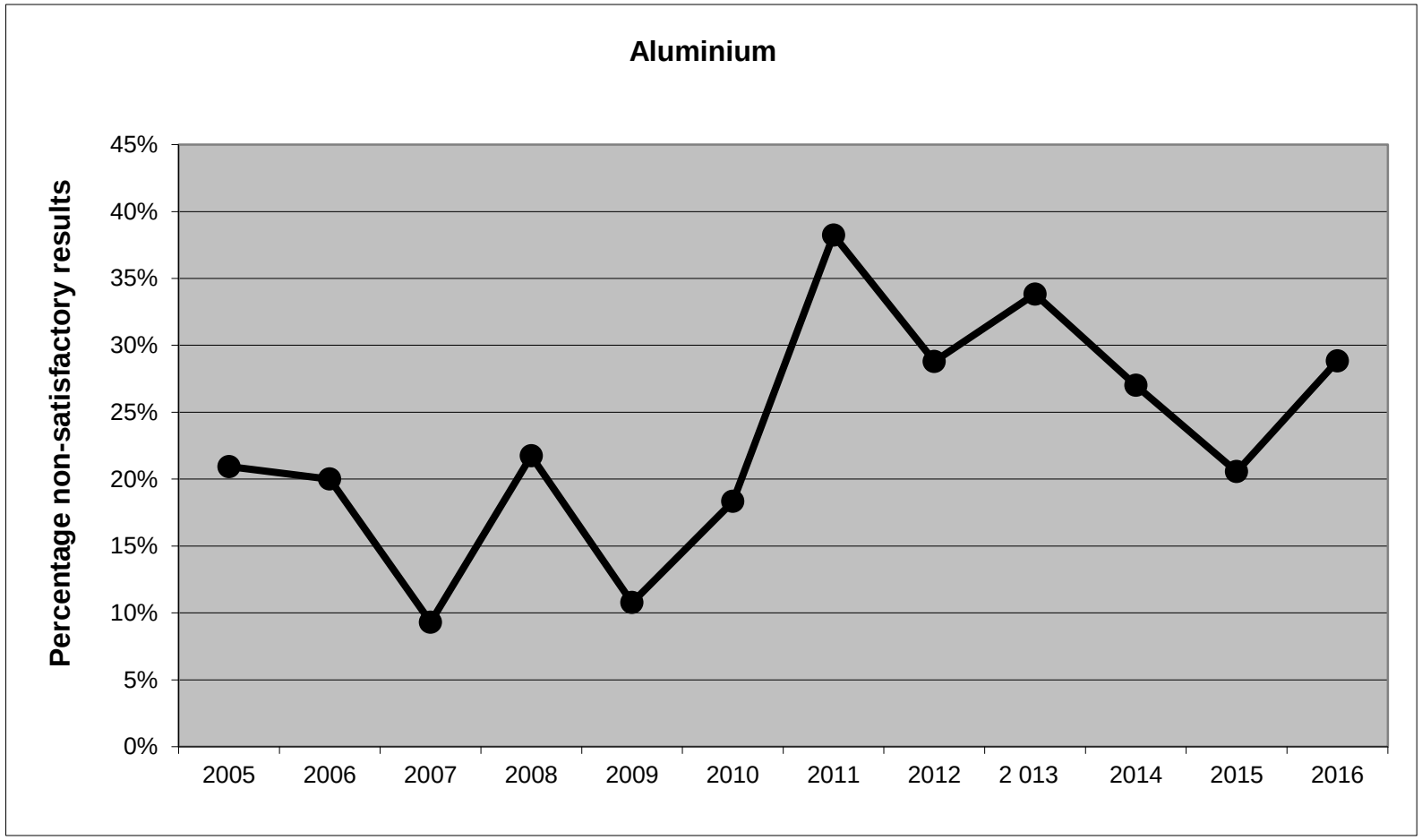
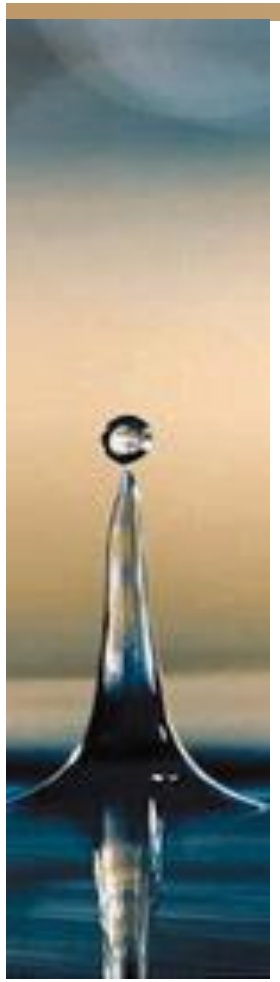
ALUMINIUM



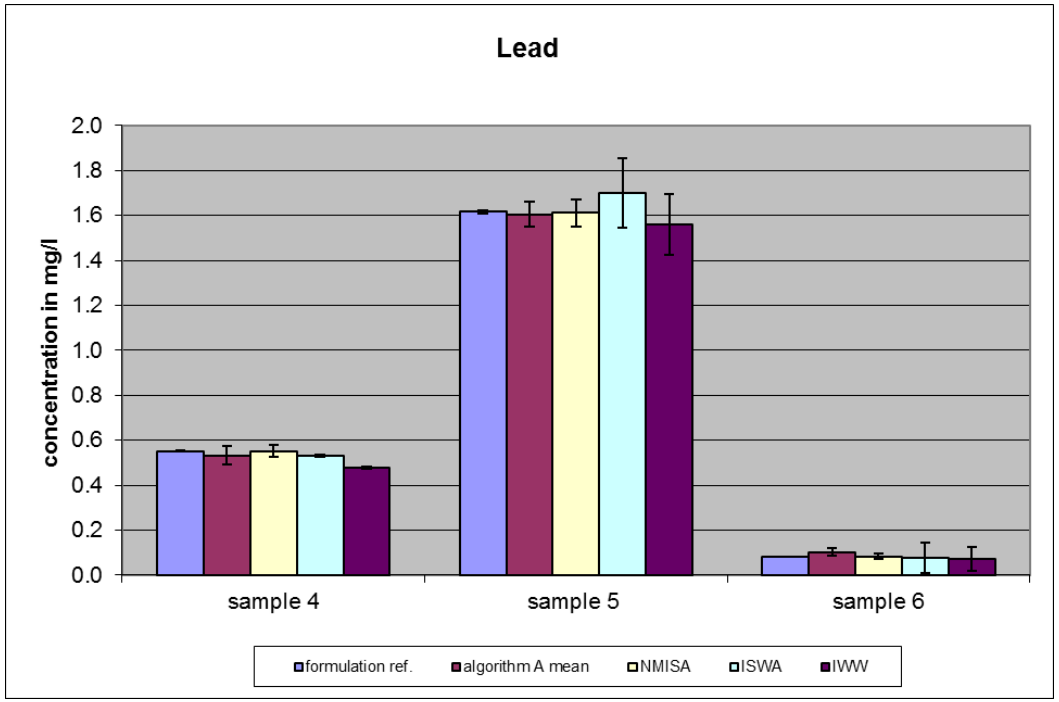


28.8 % of the data is outliers (20.6 % in 2015)

LEAD



Mean vs. Reference value



Summary Lead

- ✓ **Average recovery was 99.1 %**
- ✓ **STD below 20 % for Sample 5 and 6 Sample 4 (lowest level – 50.76 %)**
- ✓ **27 data points outside the limits**
- ✓ **44.5% of methods still classified as "other"**

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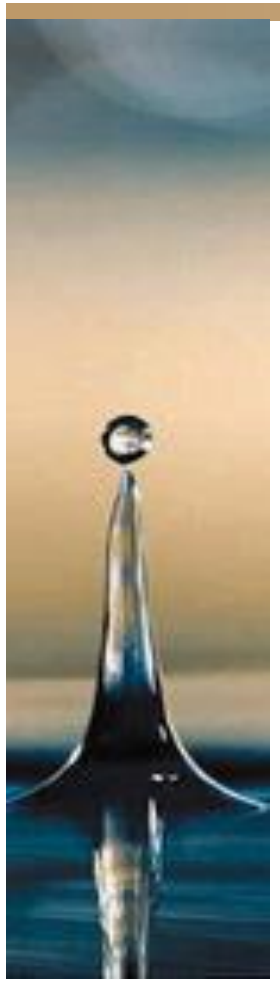
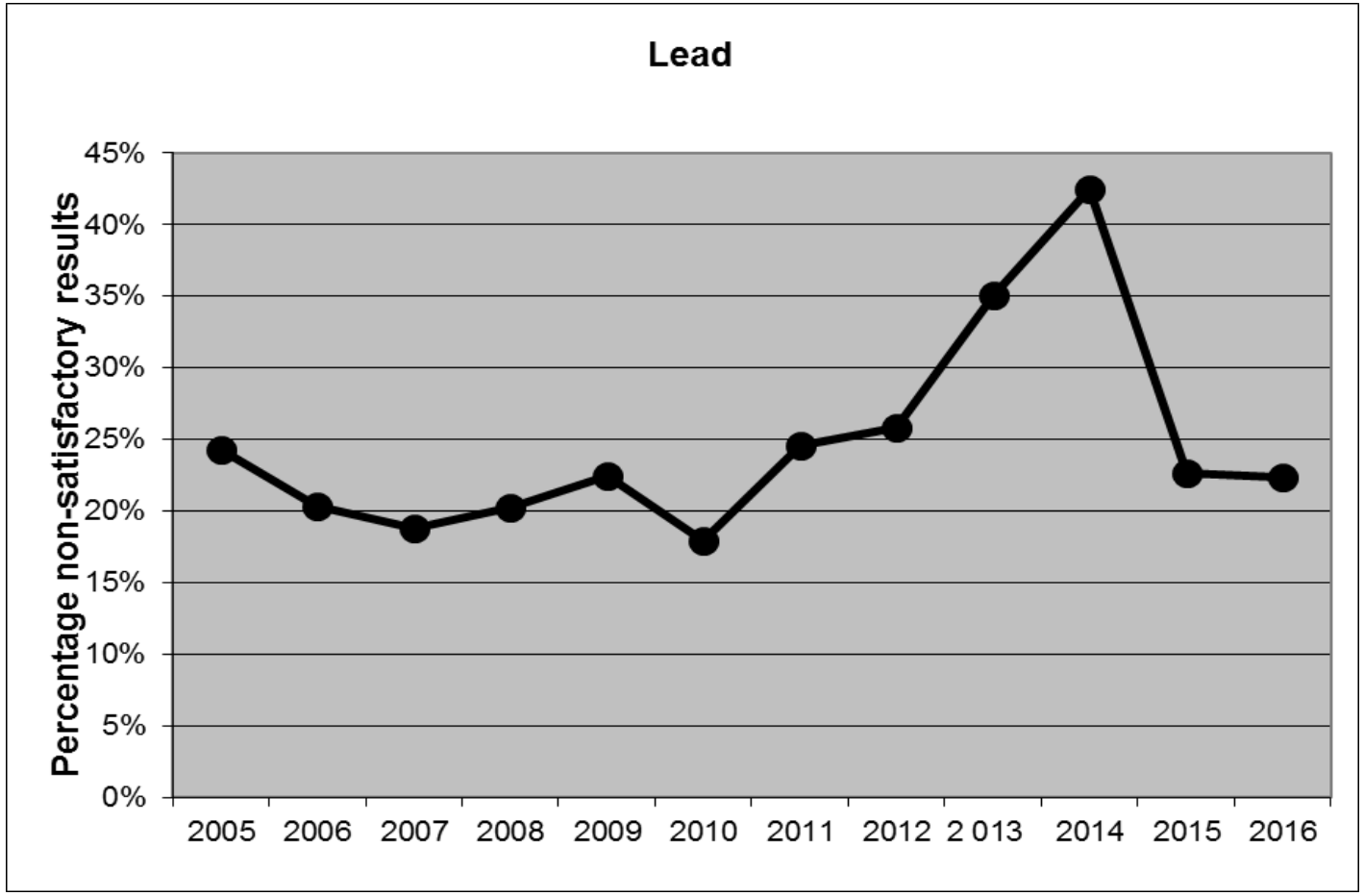
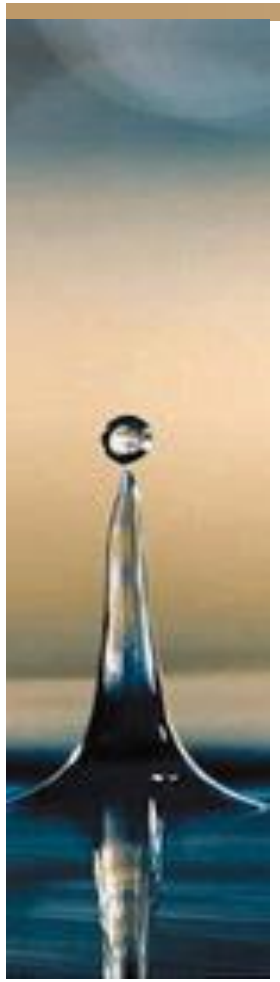
LEAD



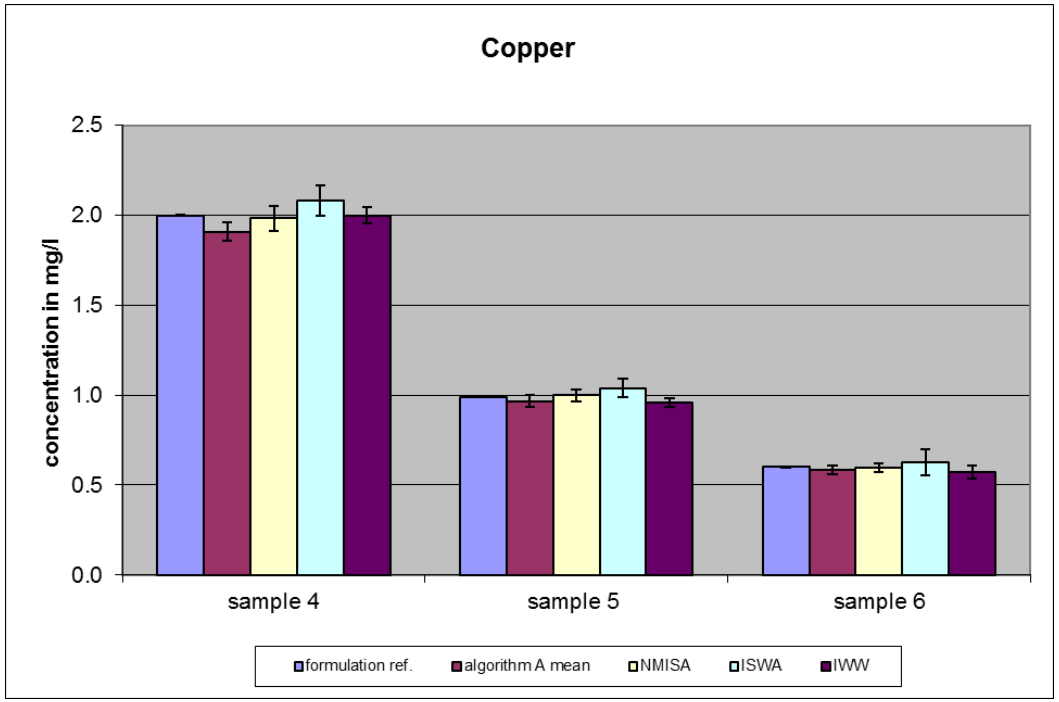


22.3 % of the data is outliers (22.7 % in 2015)

COPPER



Mean vs. Reference value



Summary Iron

- ✓ **Average recovery was 96.0 %**
- ✓ **STD below 20 % for all three samples (lowest level – 11.32 %)**
- ✓ **21 data points outside the limits**
- ✓ **45.1% of methods still classified as "other"**

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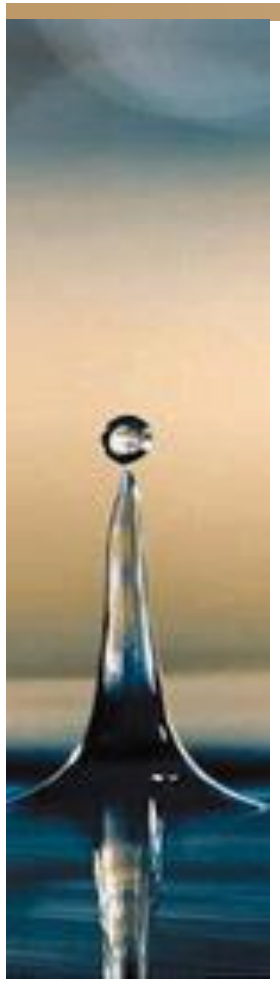
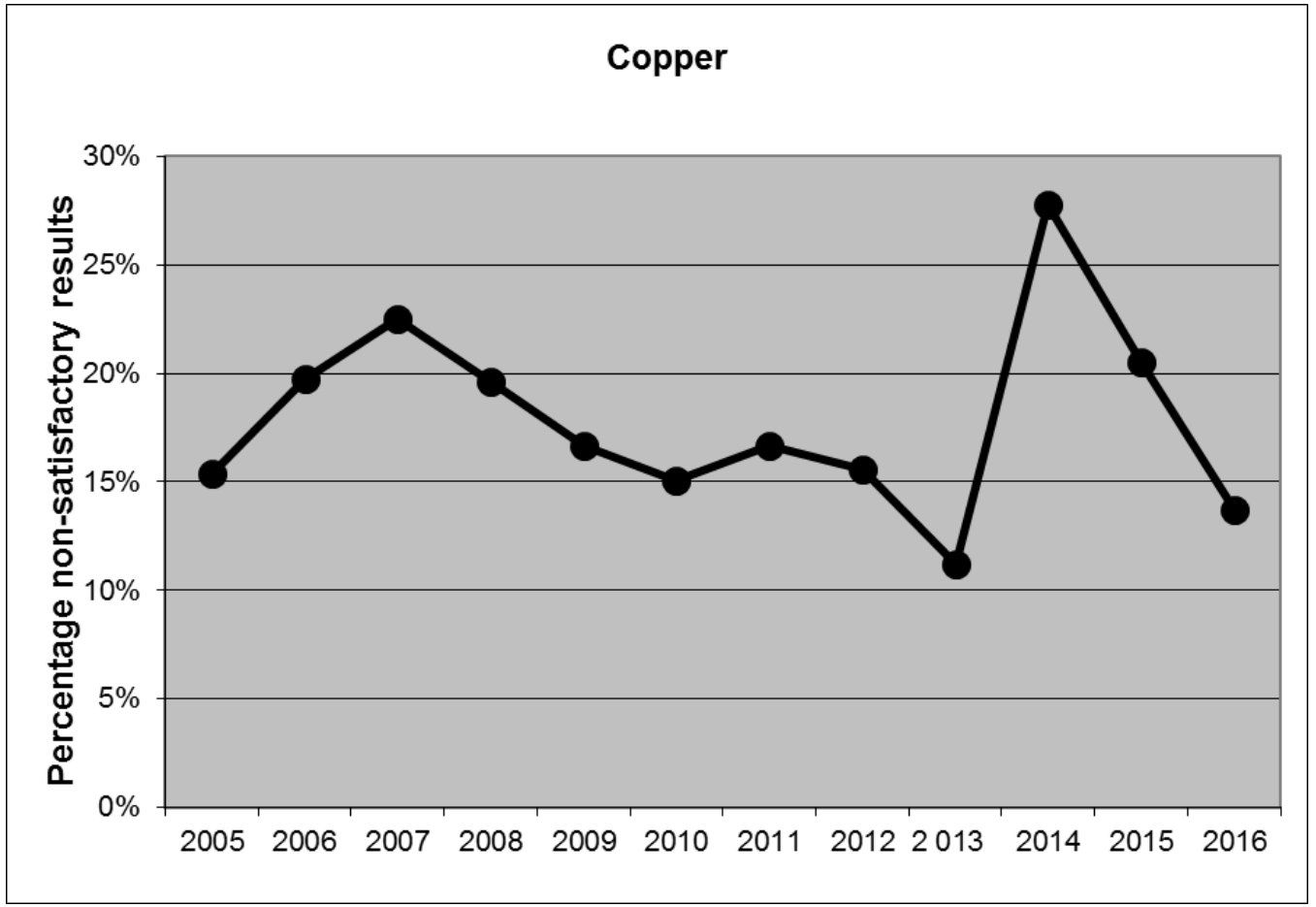
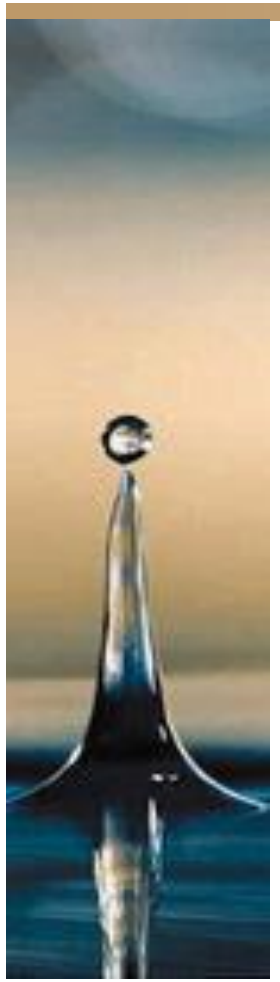
COPPER



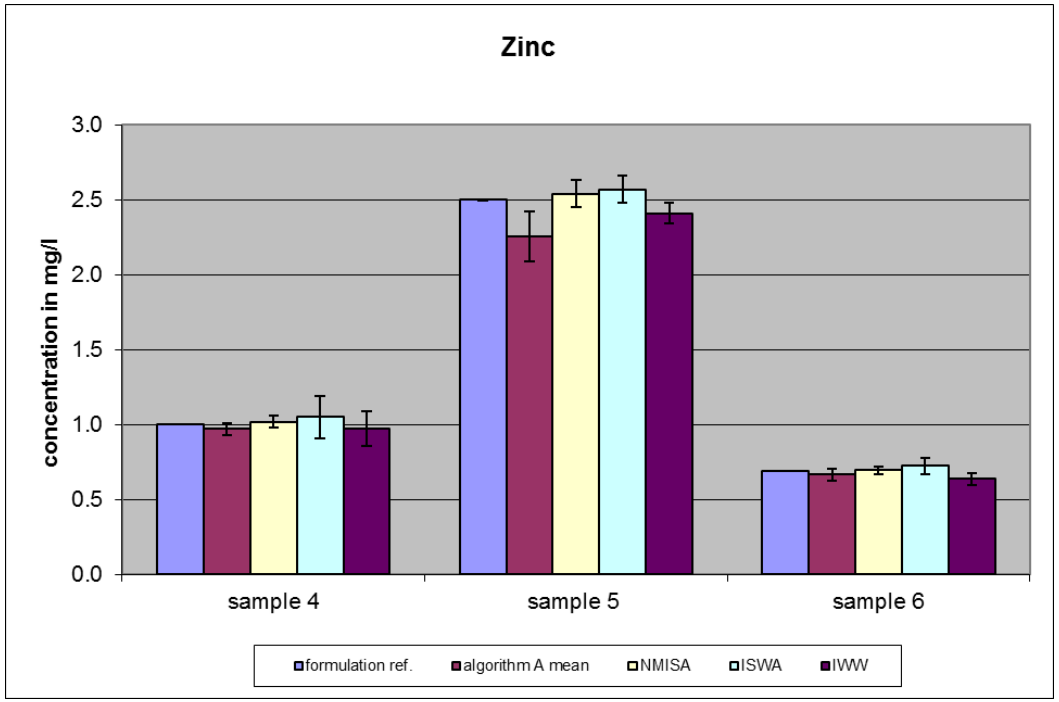


13.7 % of the data is outliers (20.5 % in 2015)

ZINC



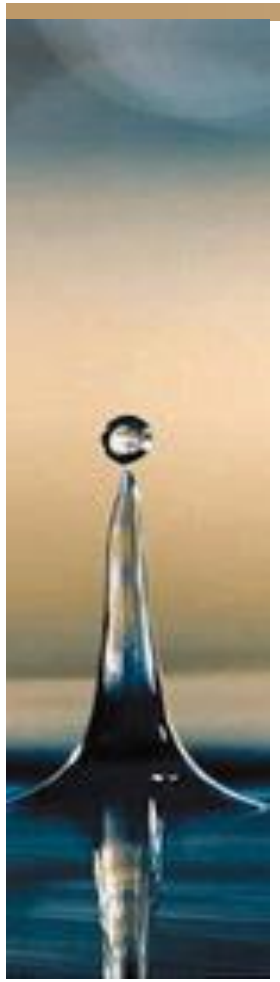
Mean vs. Reference value

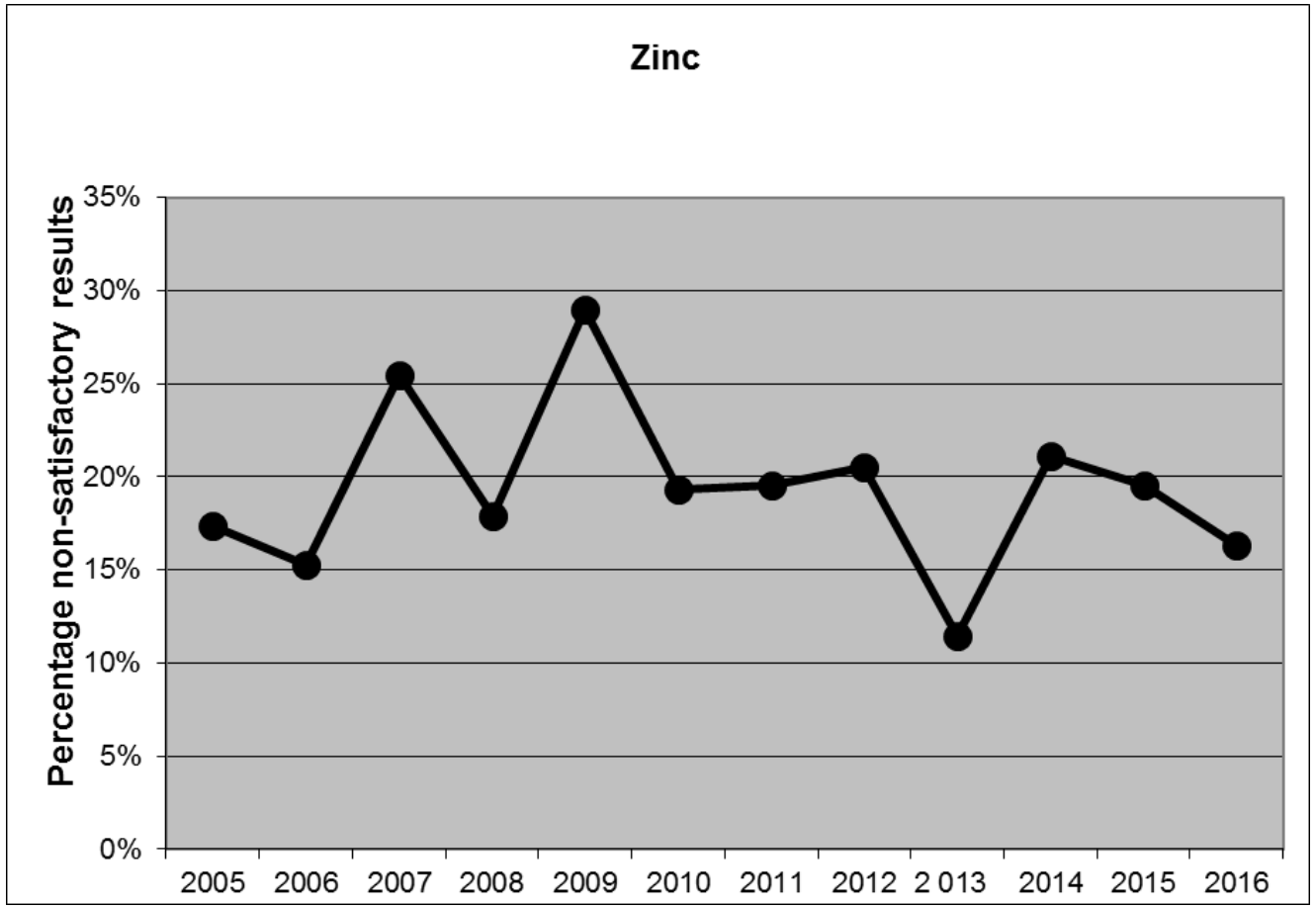


Summary Zinc

- ✓ Average recovery was 91.6 %
- ✓ STD below 20 % for all three samples (lowest level – 15.1 %)
- ✓ 22 data points outside the limits
- ✓ 42.2% of methods still classified as "other"

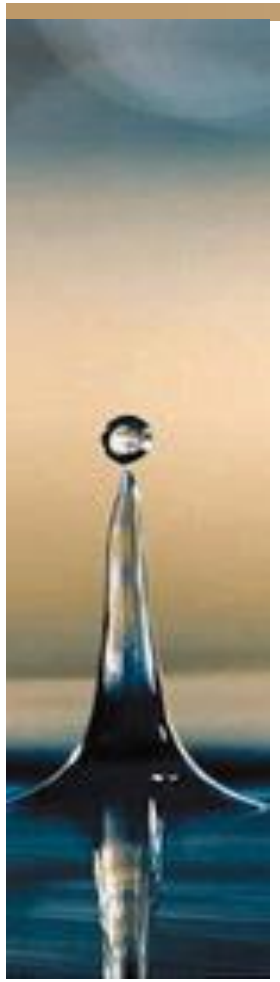
ZINC



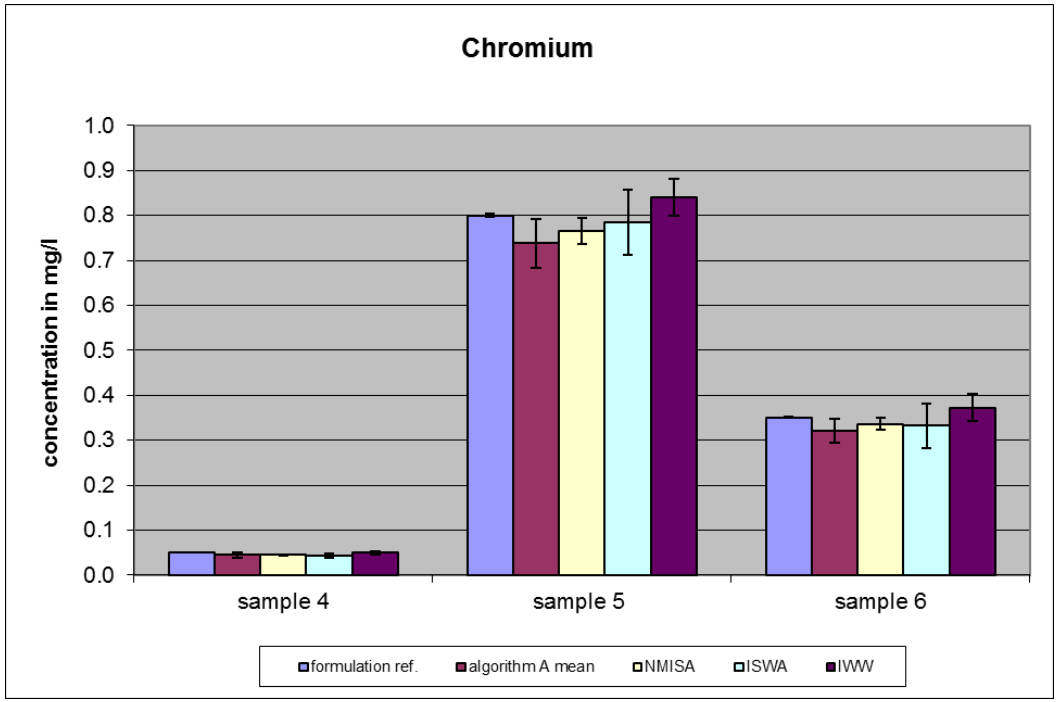


16.3 % of the data is outliers (19.5 % in 2015)

CHROMIUM



Mean vs. Reference value



Summary Chromium

- ✓ Average recovery was 95.6 %
- ✓ STD below 20 % for all three samples
- ✓ (lowest level – 16.5 %)
- ✓ 29 data points outside the limits
- ✓ 40.0% of methods still classified as "other"

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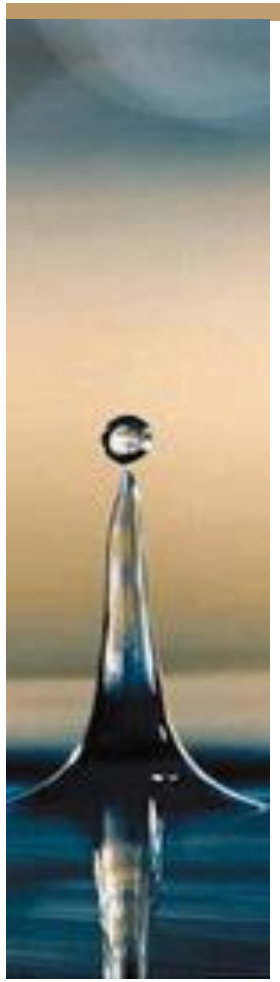
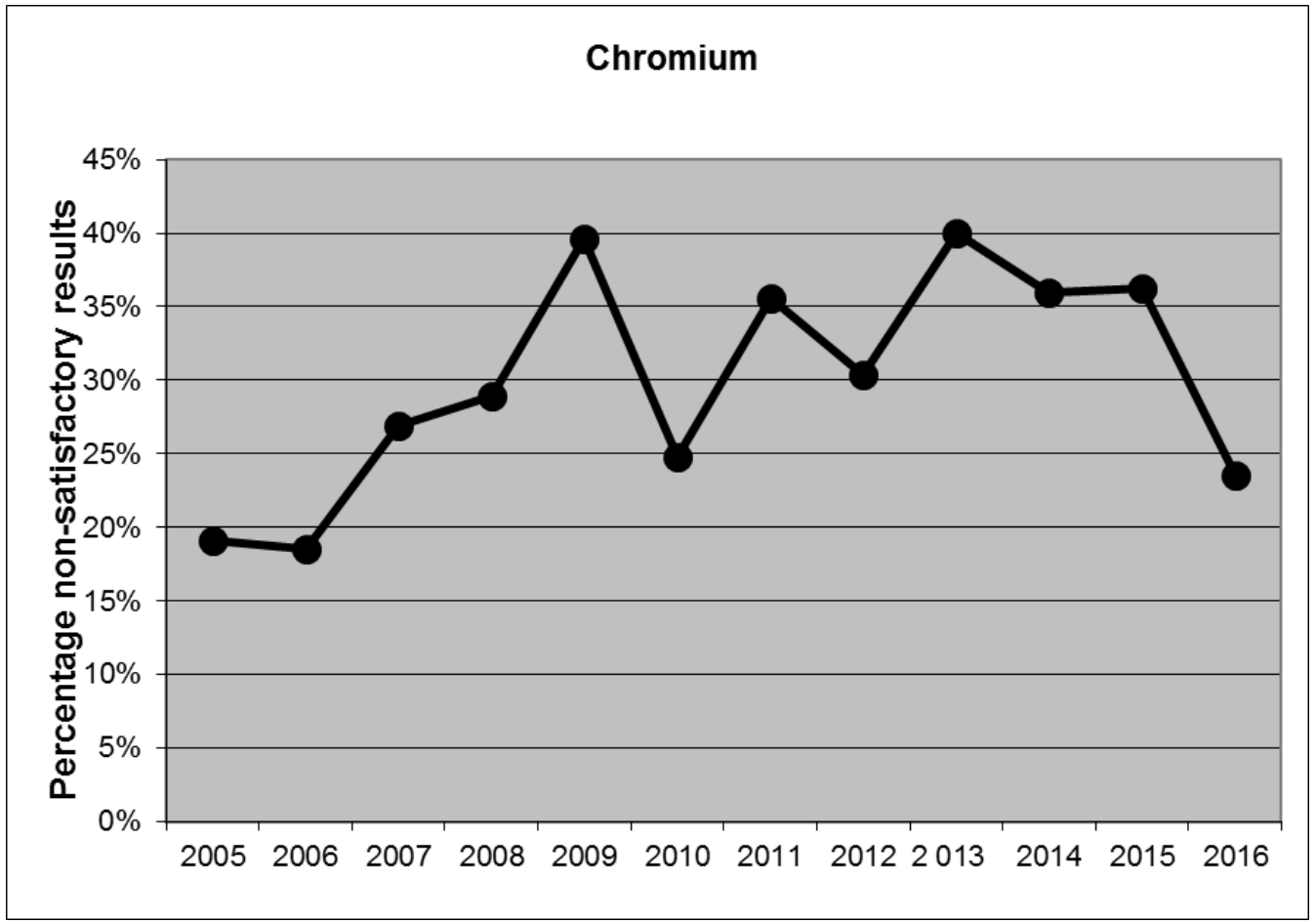
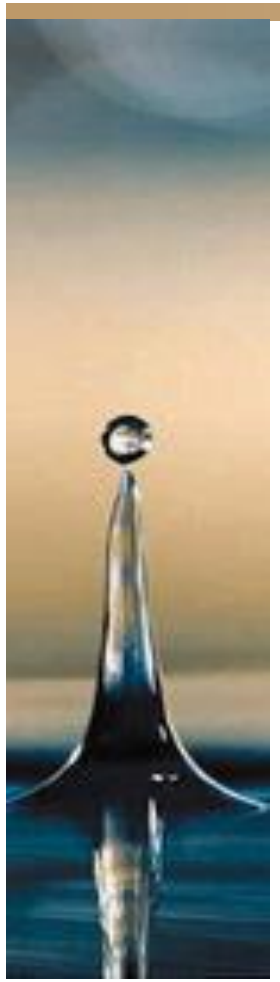
CHROMIUM



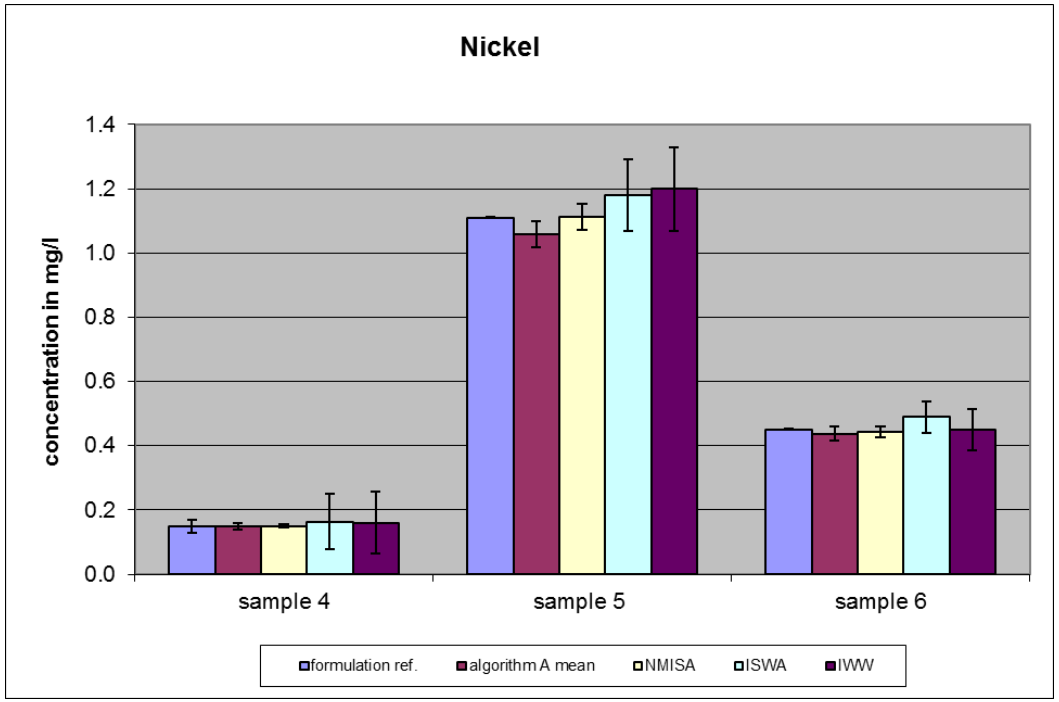


23.6 % of the data is outliers (36.3 % in 2015)

NICKEL



Mean vs. Reference value



Summary Nickel

- ✓ **Average recovery was 95.6 %**
- ✓ **STD below 20 % for all three samples (lowest level – 16.6 %)**
- ✓ **25 data points outside the limits**
- ✓ **40.0% of methods still classified as "other"**

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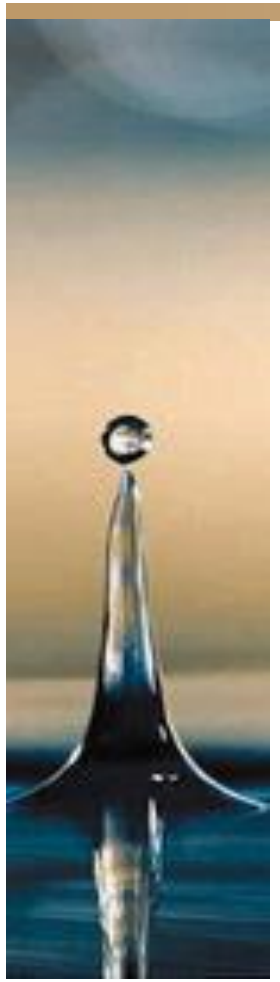
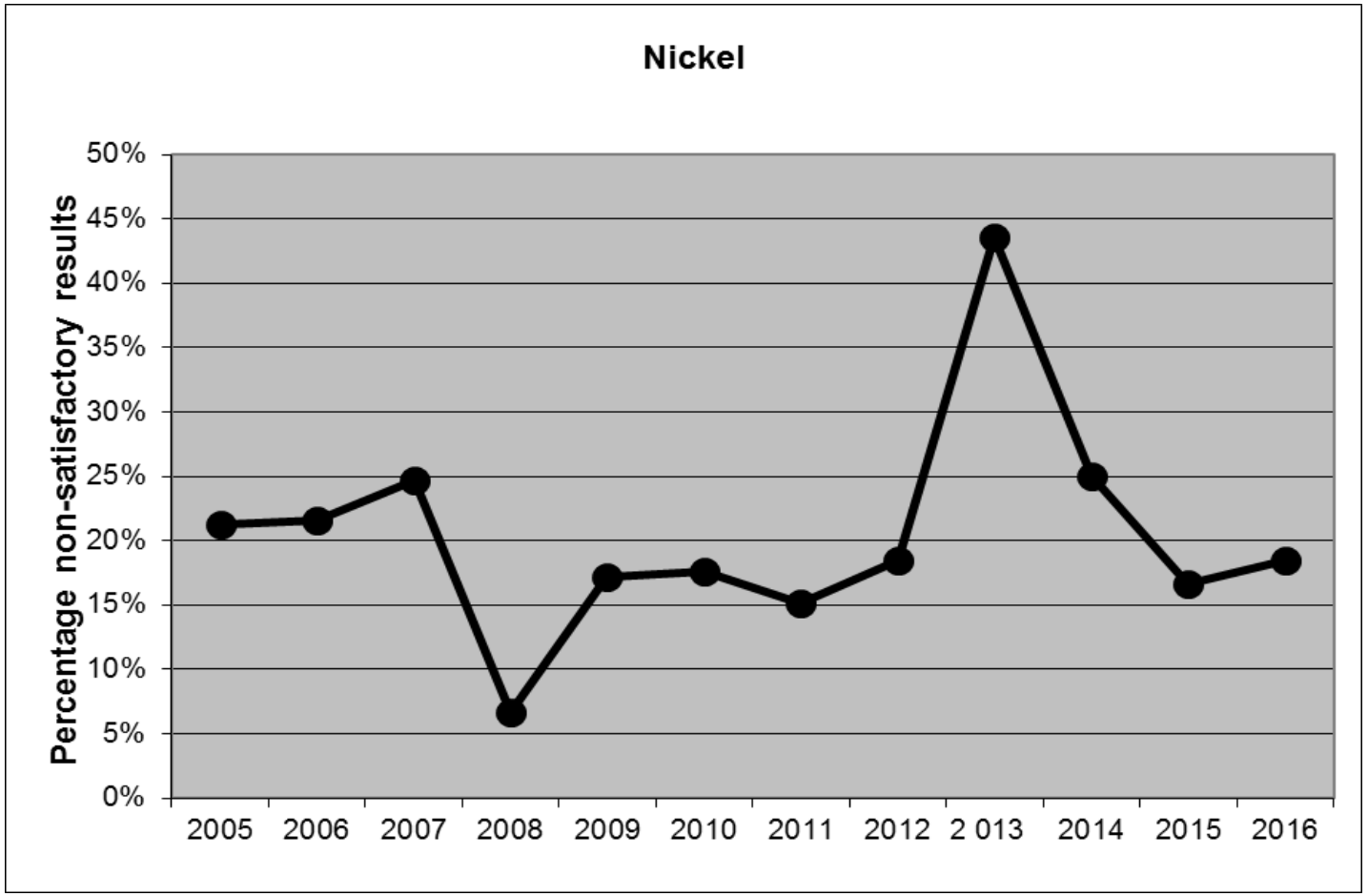
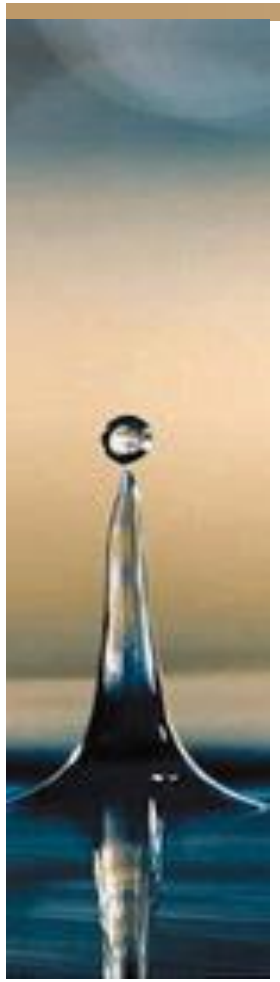
NICKEL



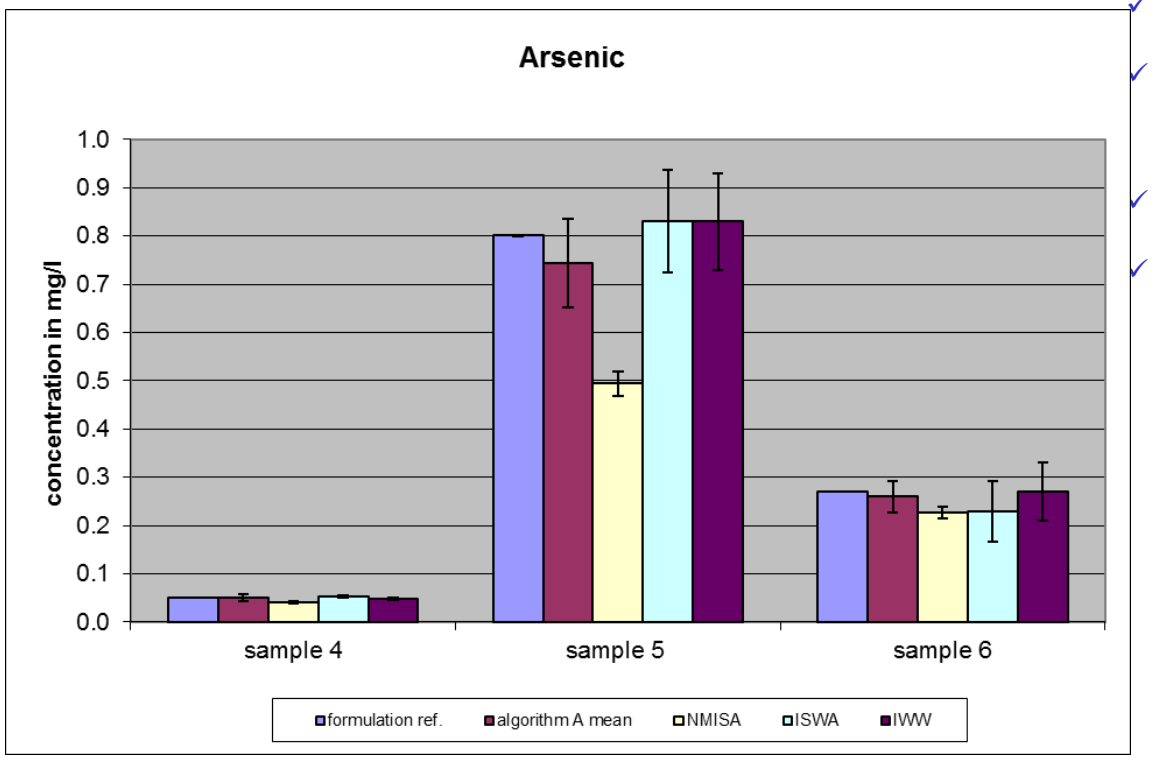


18.5 % of the data is outliers (16.7 % in 2015)

ARSENIC



Mean vs. Reference value



Summary Arsenic

- ✓ Average recovery was 93.2 %
- ✓ STD above 20 % for all three samples (lowest level – 27.3 %)
- ✓ 20 data points outside the limits
- ✓ 39.0% of methods still classified as "other"

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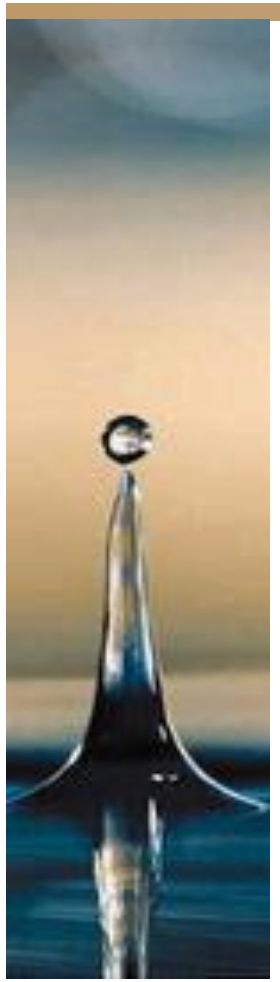
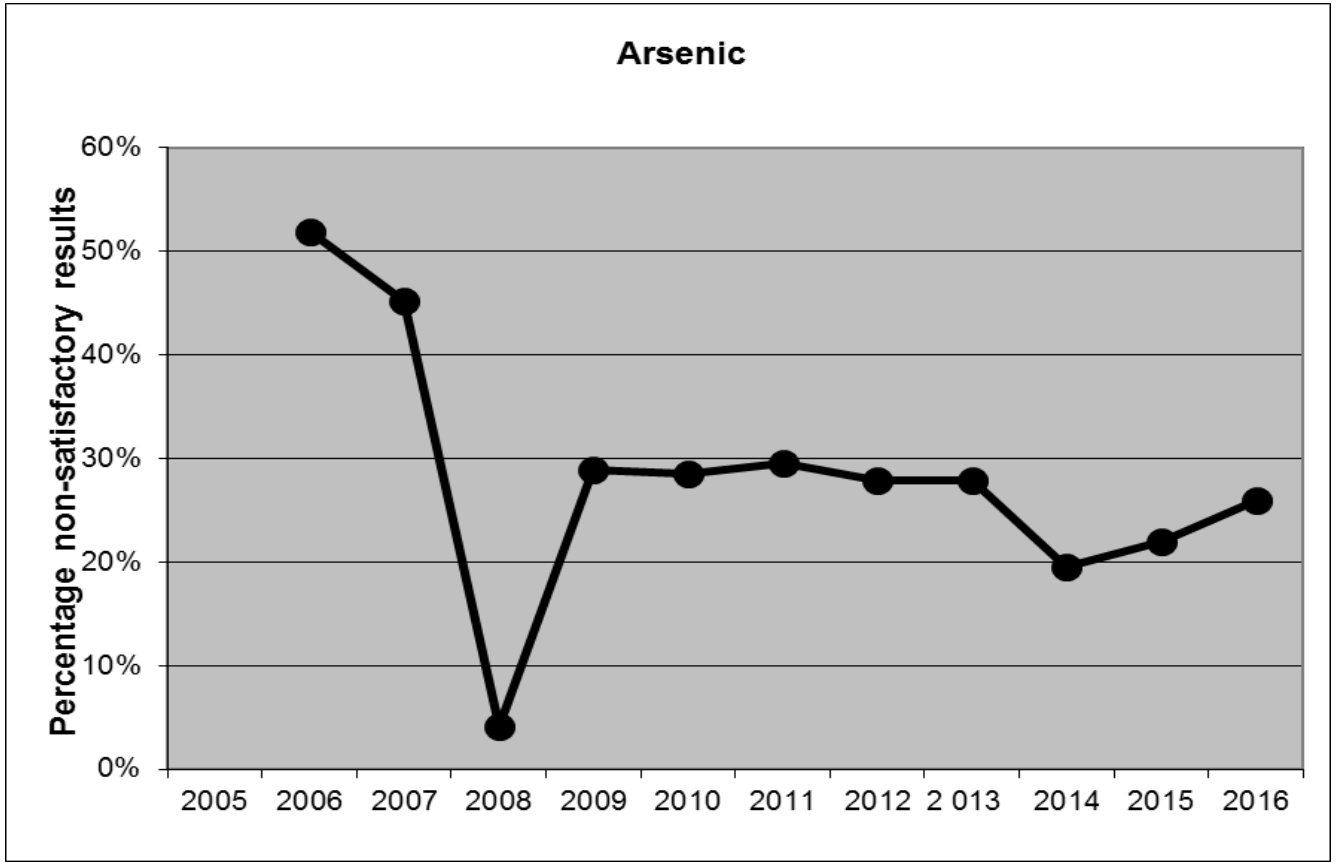
ARSENIC





26.0 % of the data is outliers (22.0 % in 2015)

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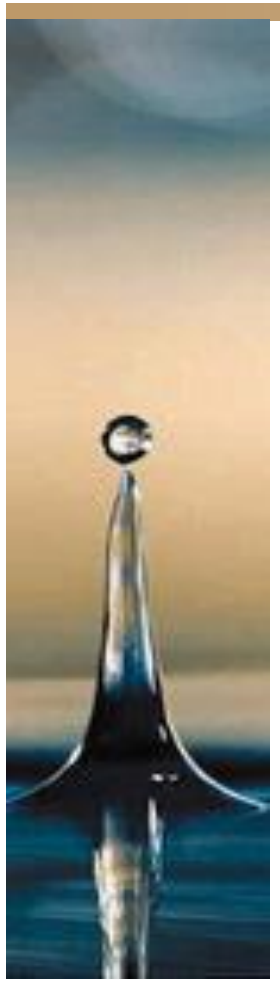
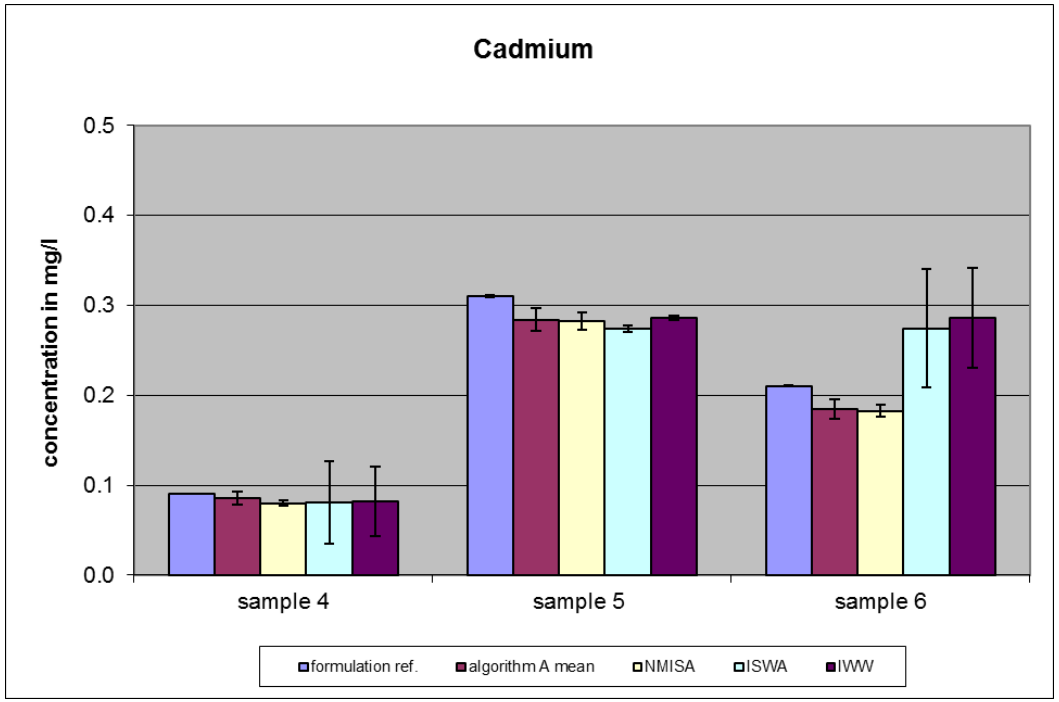
CADMIUM



Mean vs. Reference value



Summary Cadmium

- ✓ Average recovery was 90.5 %
- ✓ STD below 20 % for all three samples (lowest level – 19.6 %)
- ✓ 30 data points outside the limits
- ✓ 35.5% of methods still classified as "other"

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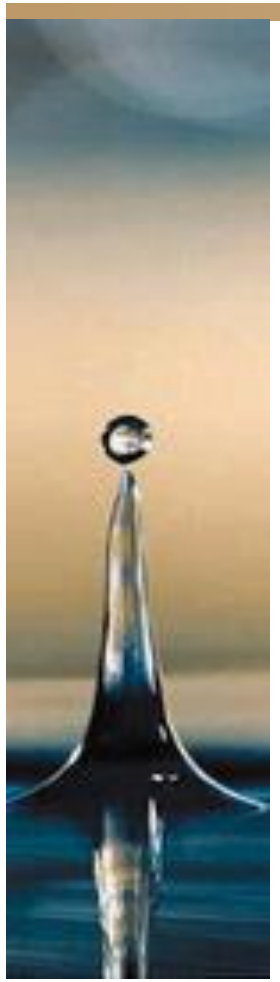
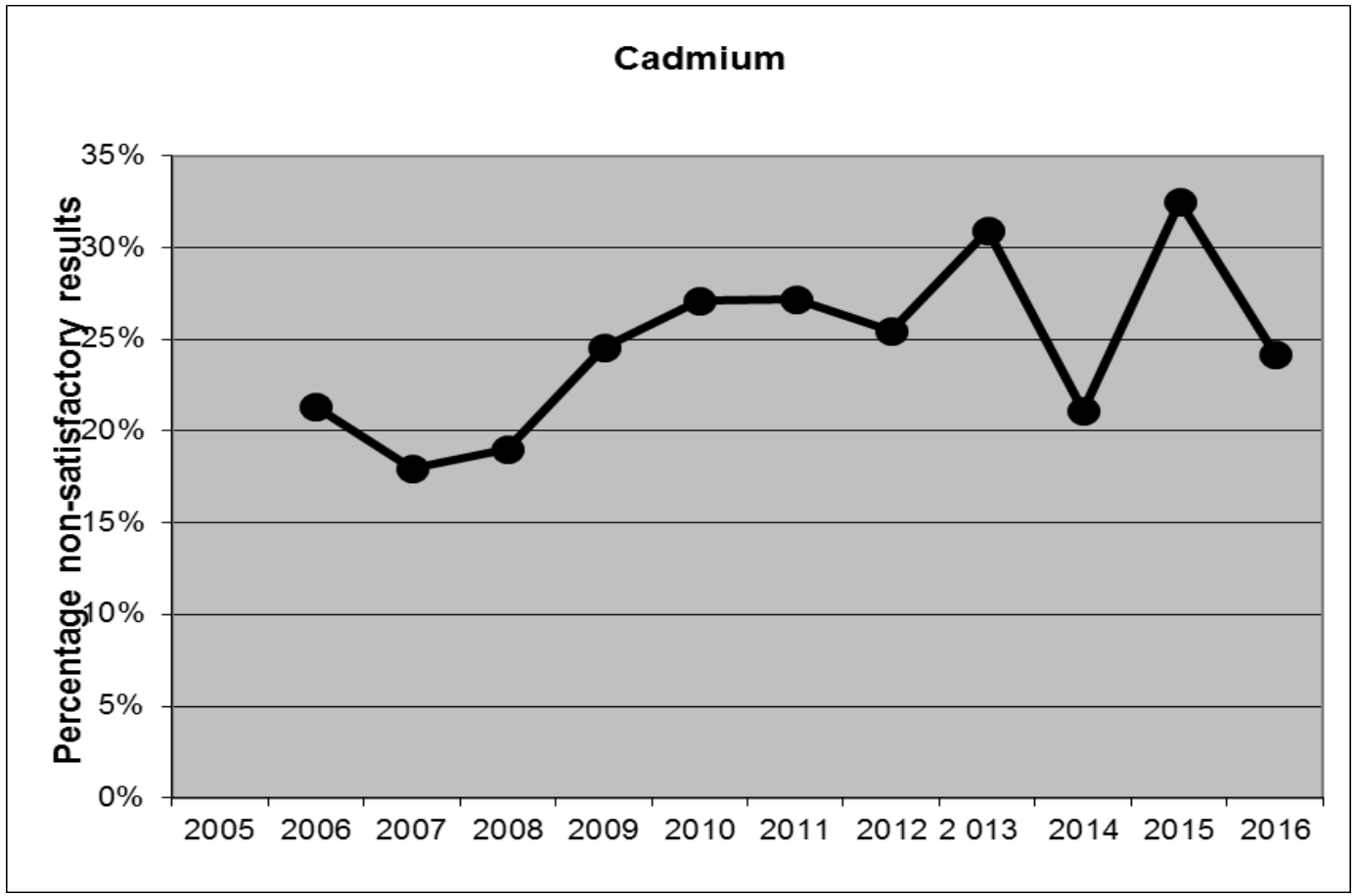
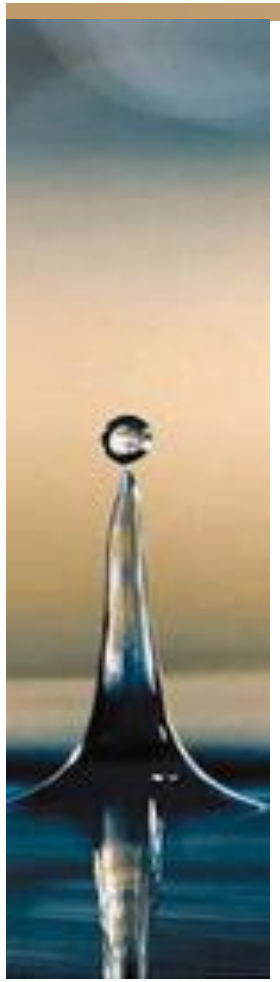
CADMIUM



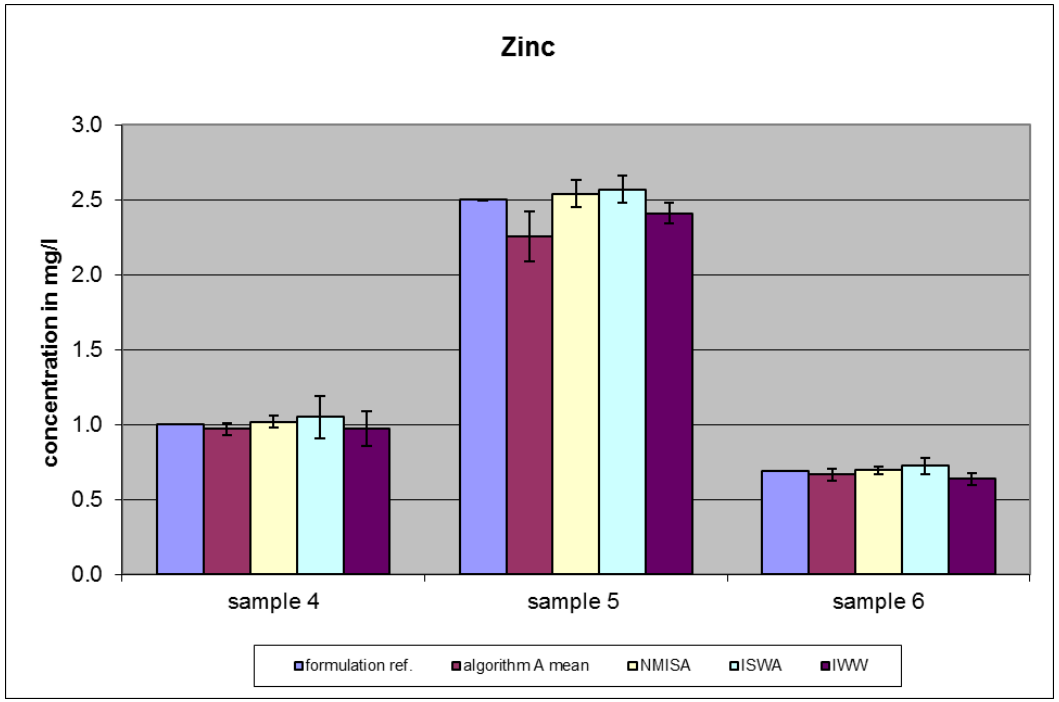


24.2 % of the data is outliers (32.5 % in 2015)

COBALT



Mean vs. Reference value



Summary Cobalt

- ✓ Average recovery was 96.5 %
- ✓ STD below 20 % for all three samples (lowest level – 12.29 %)
- ✓ 22 data points outside the limits
- ✓ 13.3% of methods still classified as "other"

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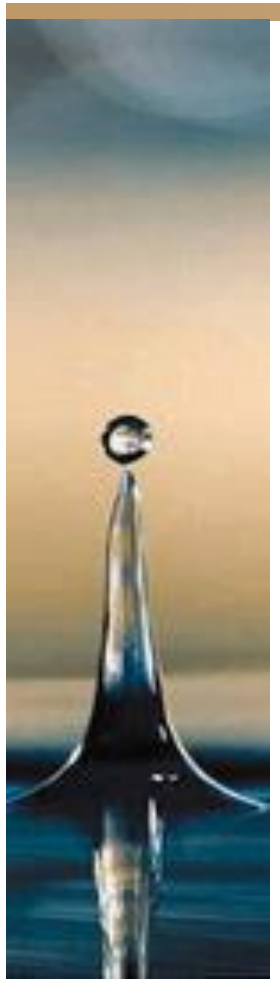
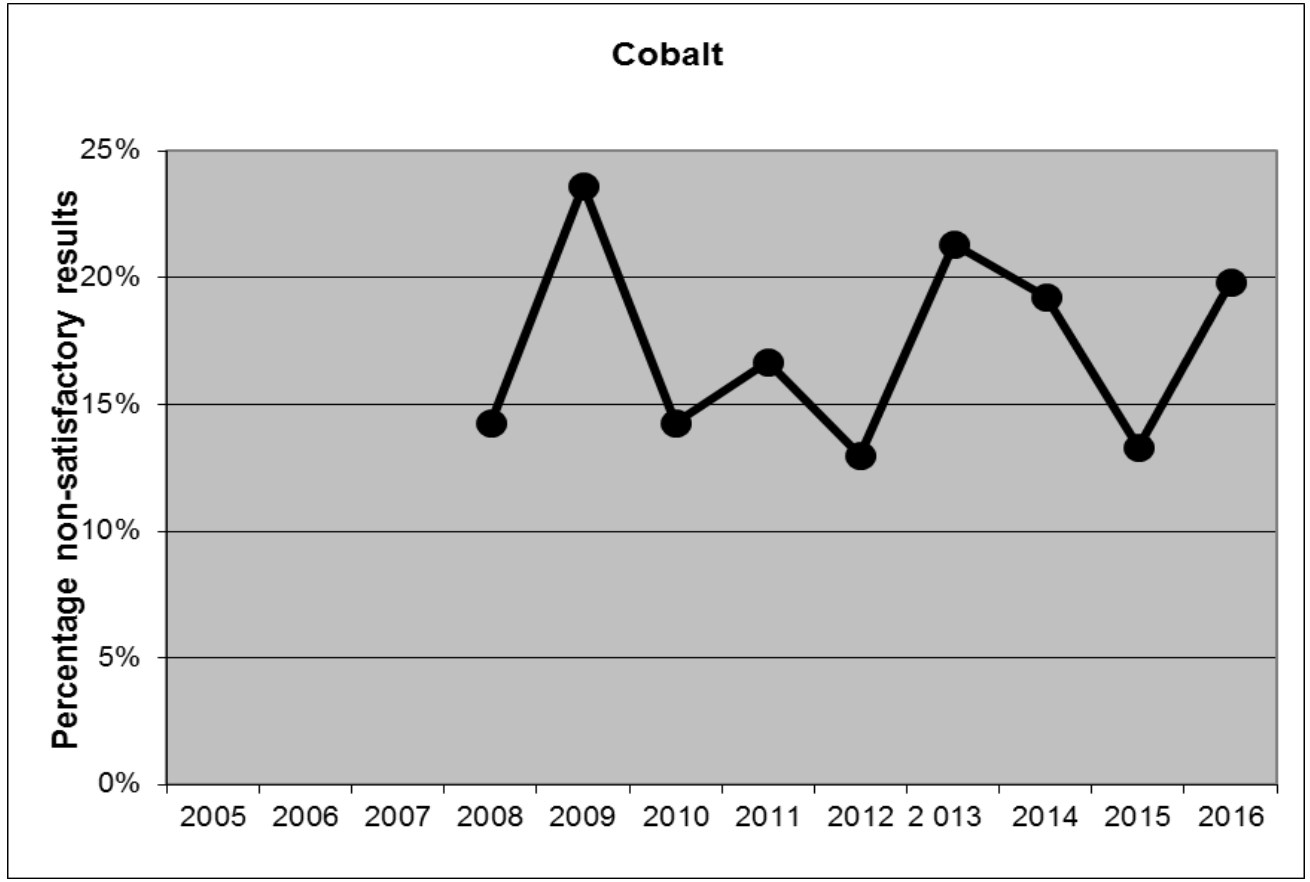
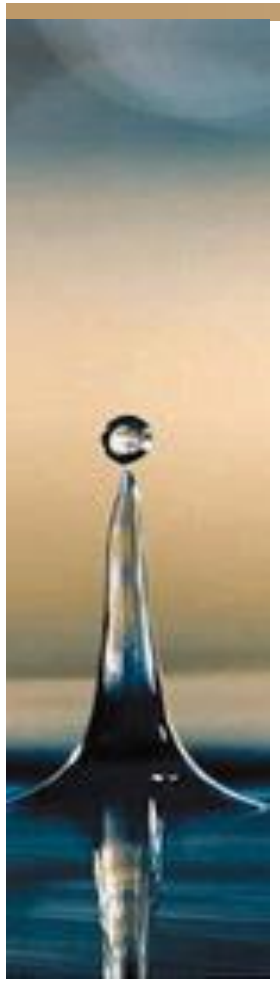
COBALT

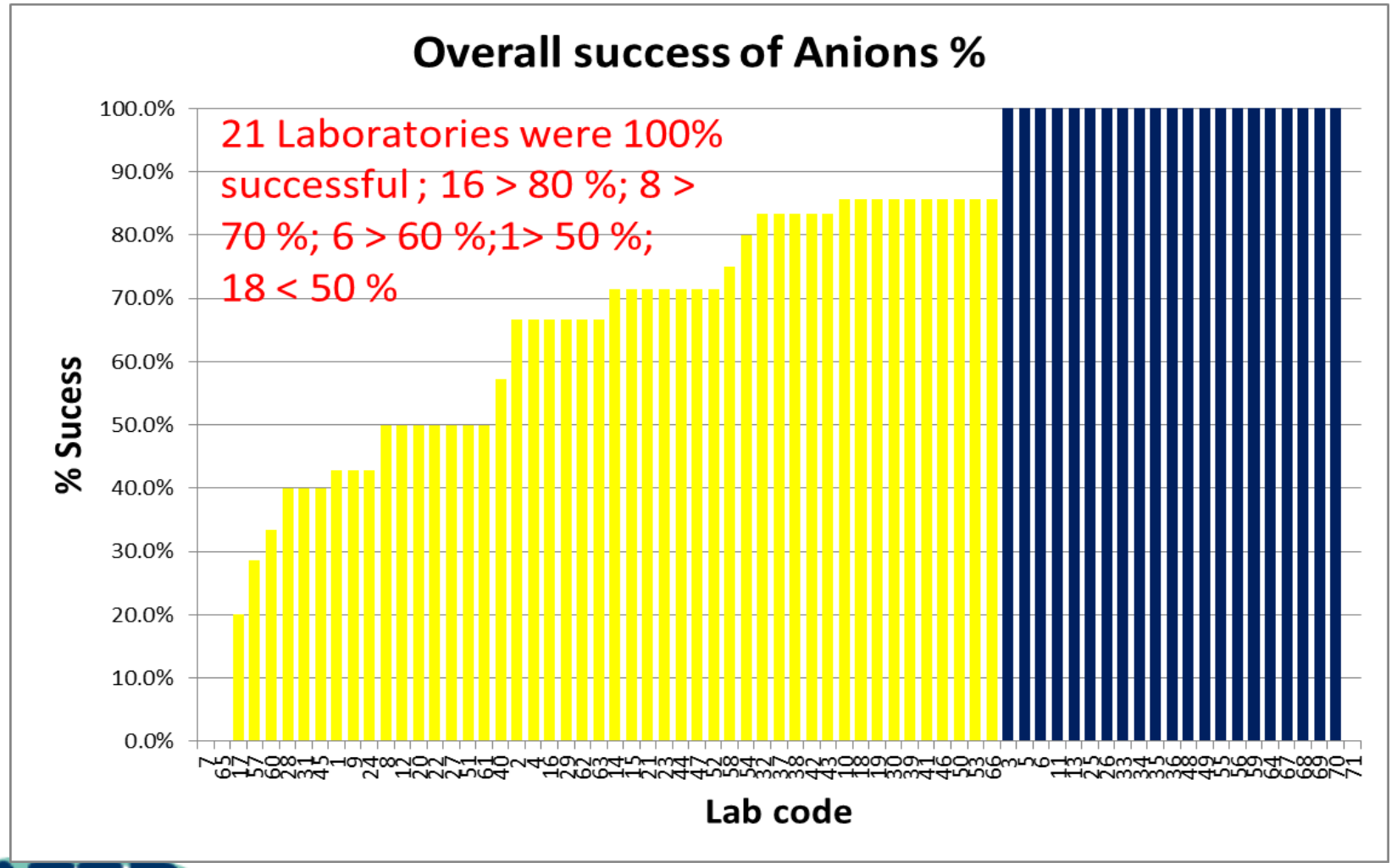




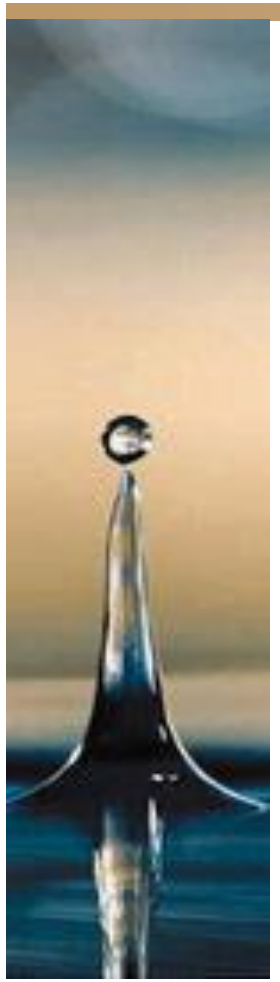
19.8 % of the data is outliers (13.3 % in 2015)

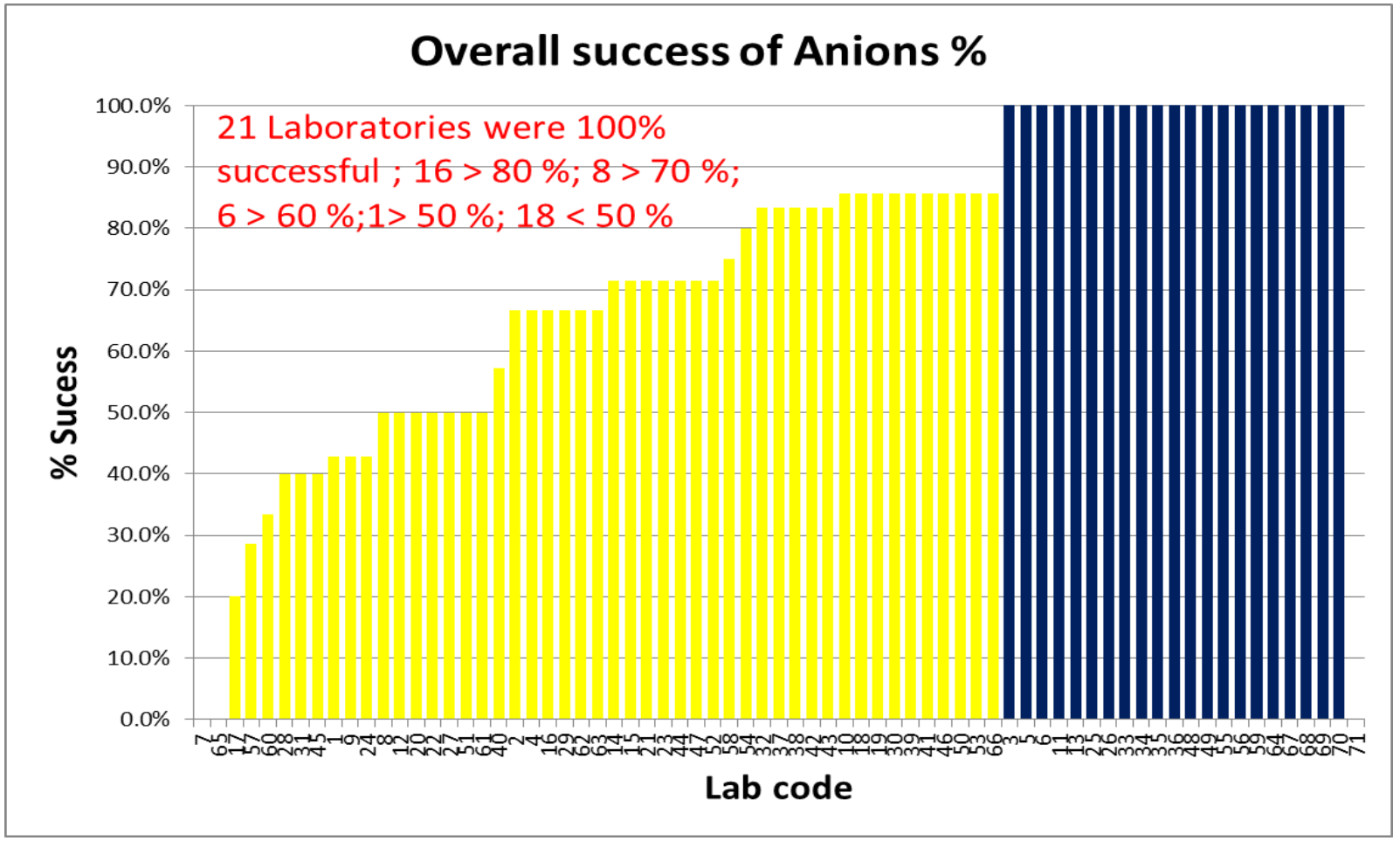
PARAMETERS ANALYSED



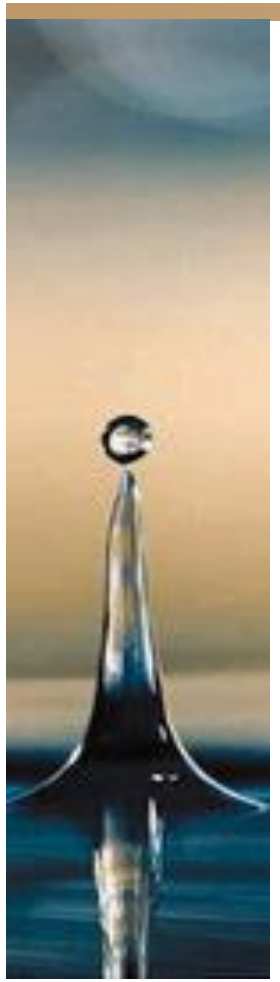


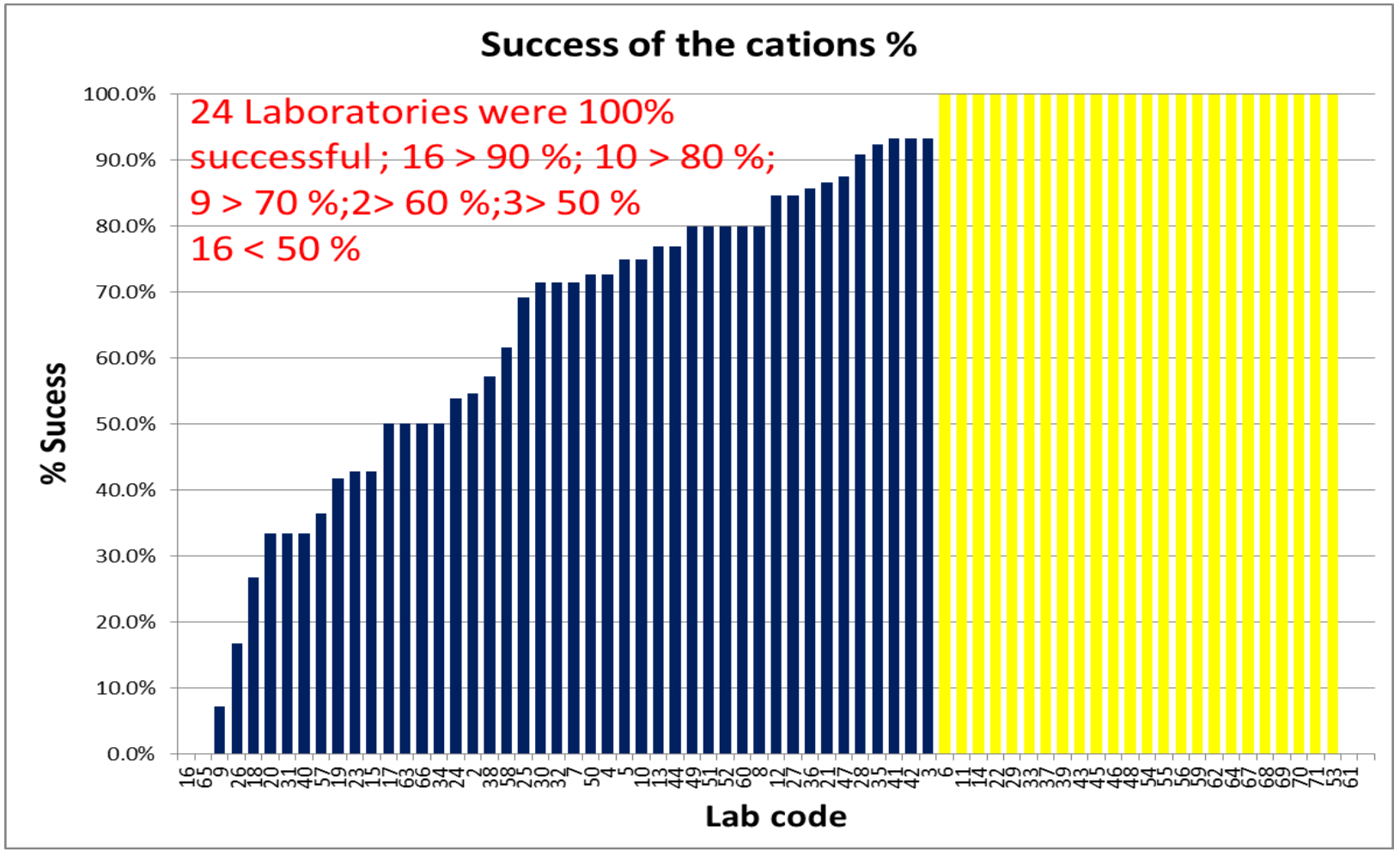
% OVERALL SUCCESS OF ANIONS





% OVERALL SUCCESS OF CATIONS





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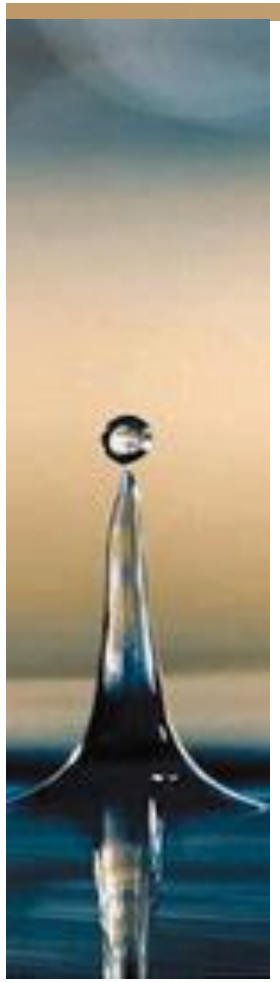
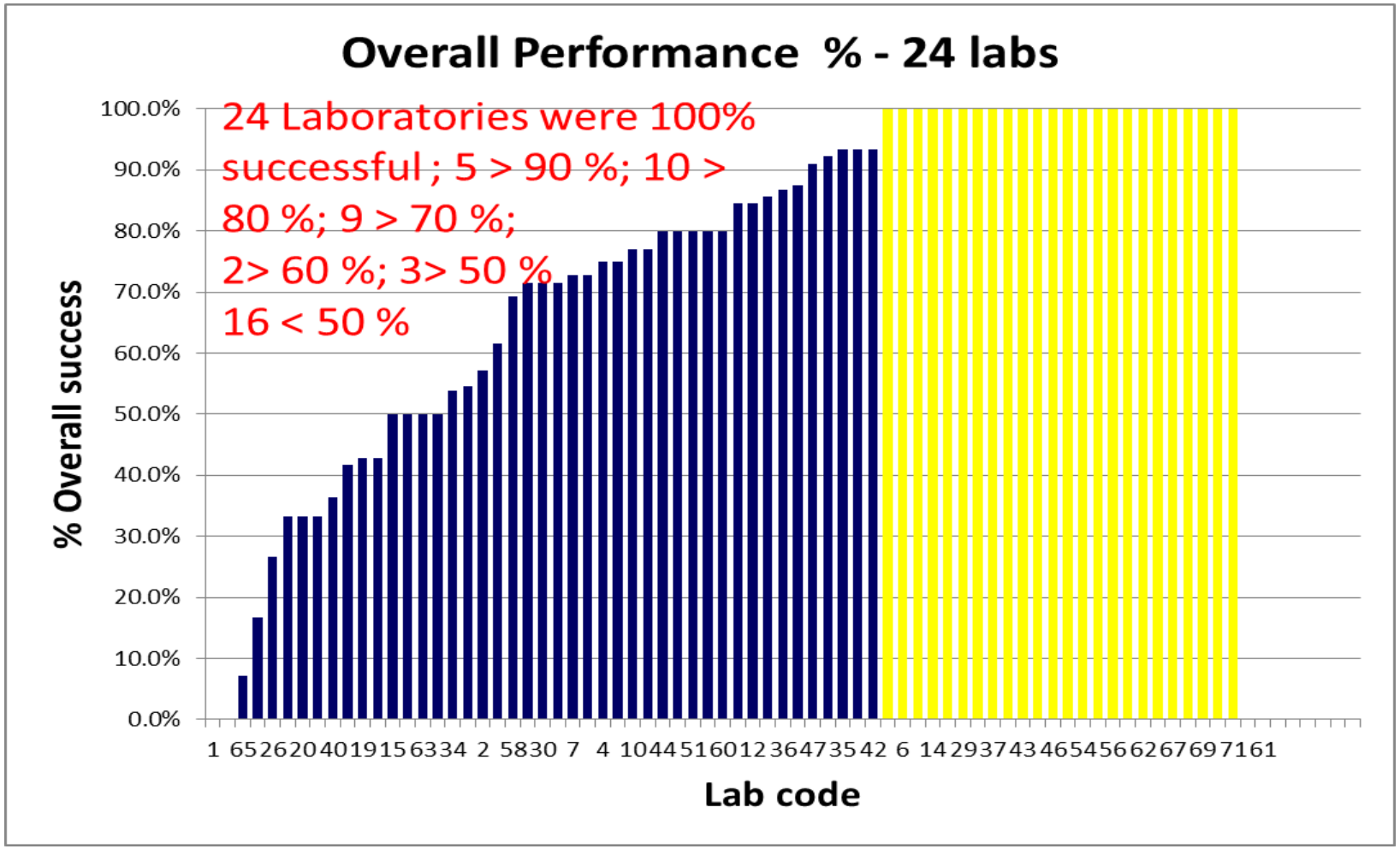
% OVERALL PERFORMANCE





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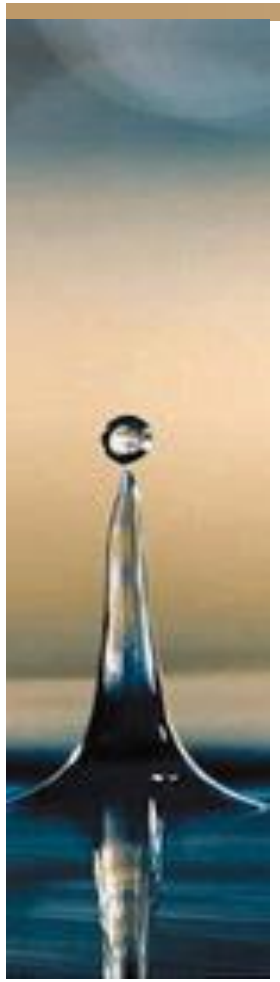
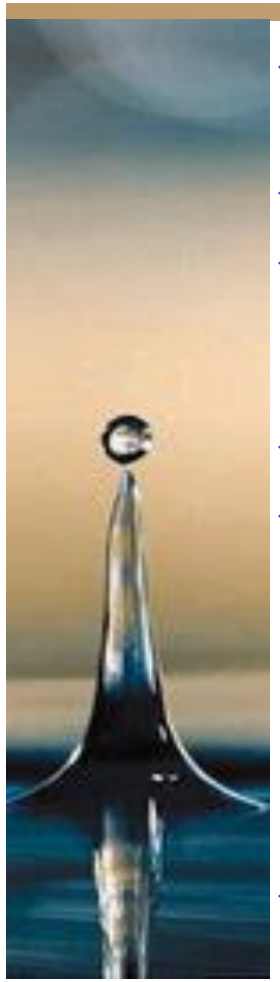
CHALLENGES 2017



- ✓**Adhere to the stated deadlines**
- ✓**Clear and fully completed registration forms will be a requirement for participation.**
- ✓**Absence of registration forms complicates communication**
- ✓**Results submission done after the due date delay the reports**
- ✓**We need to improve– still high standard deviations**
- ✓**Use of non-standard methods are high**
- ✓**The same mistakes are being done - Reporting of results in wrong units**
- ✓**Corrective actions are still not implemented**
- ✓**Laboratories are still not sending their proof of payments**
- ✓**Problems with the website (back to manually submitting results)**
- ✓**Laboratories that registered and requested samples should aim to analyse them as well**

CONCLUSION



- ✓Overall the results of this PT round show a good performance for many labs - Too many outliers for most of the parameters
- ✓SDS are still high for some parameter and levels.
- ✓There are still many labs that are not putting enough emphasis on corrective actions after unsatisfactory results - PT participation does not add any value if corrective actions are not done
- ✓Root cause analyses are not done
- ✓ Method selection is still a big problem - Laboratories should identify the gaps that prevent them from applying a proper method
  - A list of recommended methods were compiled and it is sent to all participants – but they do not use it
  - "ICP" reported as a method is not an international method - ISO 11885:1996- ICP-AES is !
- ✓The same mistakes are being done - Reporting of results in wrong units (N and not NO3 and as P and not PO4
- ✓The evaluation and assessment procedure is fit for the purpose

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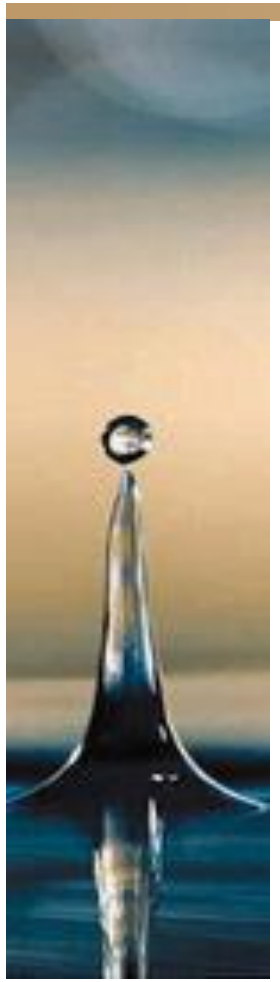
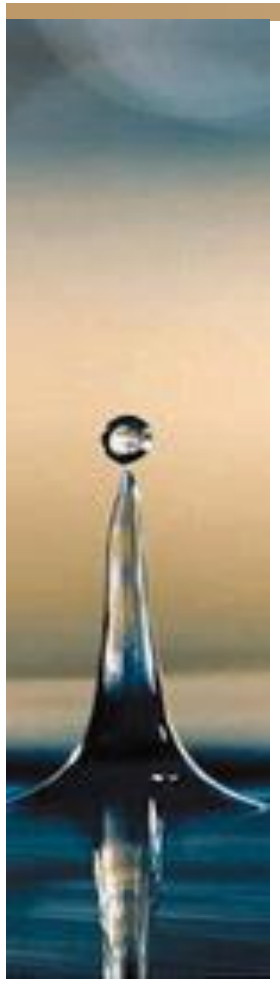
CONCLUSION



- ✓ **Software & report developments**
  - **New software was develop by Dr M Koch to address the changes from ISO/IEC 17043 and ISO 13528.**
  - **Name and address of the PT provider and name of the round can be inserted**
  - **Usage of median is not possible anymore**
  - **Graphical display of kernel densities included. You may find more information about kernel density diagrams http://www.rsc.org/images/data-distributions-kernel-density-technical-brief-4_tcm18-214836.pdf**
  - **z-scores are rounded to one digit after decimal point as requested by ISO/IEC 17043 and ISO 13528**
  - **assessment changed to satisfactory, questionable, non satisfactory as requested by ISO/IEC 17043 and ISO 13528**

CONCLUSION



- ✓ **PT plays a vital role in laboratory management for ongoing maintenance of confidence and improvement, irrespective of whether or not the laboratory needs to participate for accreditation.**
- ✓ **The SADCMET Water PT schemes offers an additional educational role for participants to help the participants to improve – do not to miss this opportunity!**
- ✓ **The SADCMET Water PT is a good possibility for the participants to compare with peers and with stated fitness-for-purpose criteria**
- ✓ **Frieda Nambahu did a very good job**

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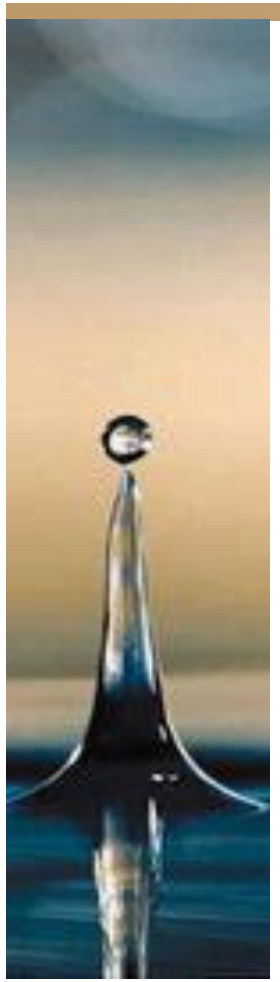
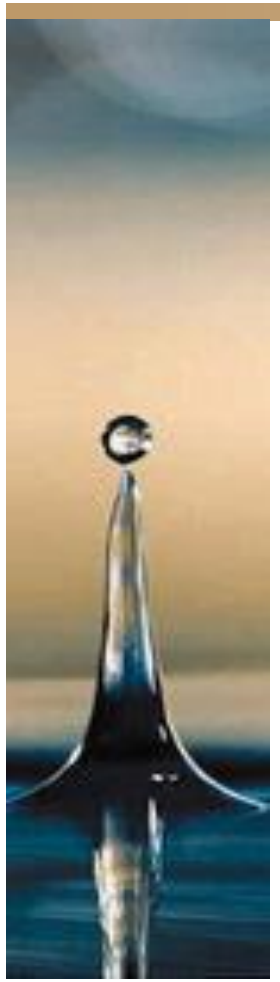
ACKNOWLEDGMENTS



- ✓**PTB payment of sample distribution**
  - Kathrin Wunderlich
  - Karin Vondeberg
- ✓**SADCMET**
  - Donald Masuku
  - Blossom Nkombisa (NMISA)
- ✓ **University of Stuttgart**
  - Dr Michael Koch
- ✓**Expert labs – NMISA; ISWA; IWW**
- ✓**NamWater personnel**
- ✓**Local coordinators**
- ✓**Participants**
- ✓**TFDA**

QUESTIONS



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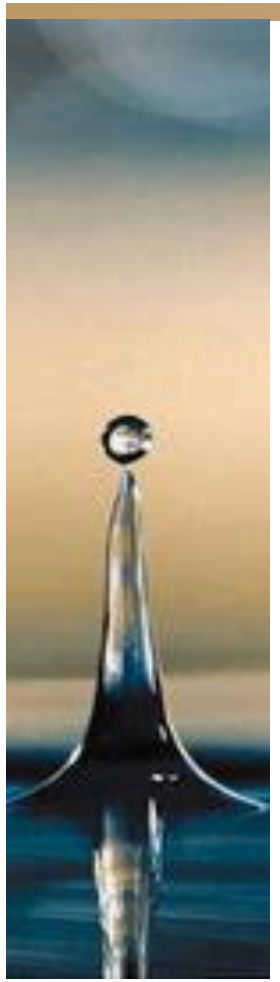

THANK YOU

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