



## Experiences of the PT Provider

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NamWater



## Namibia Water Corporation (NamWater)



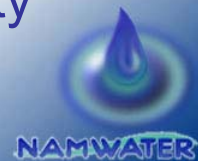
## Introduction

- Changes and progress of participation
- Growth of the SACMET PT scheme
- Changes and Progress of parameters
- Planning and steps of a PT round
- Details of the activities
- Sample distribution
- Evaluation & assessment
- Closure



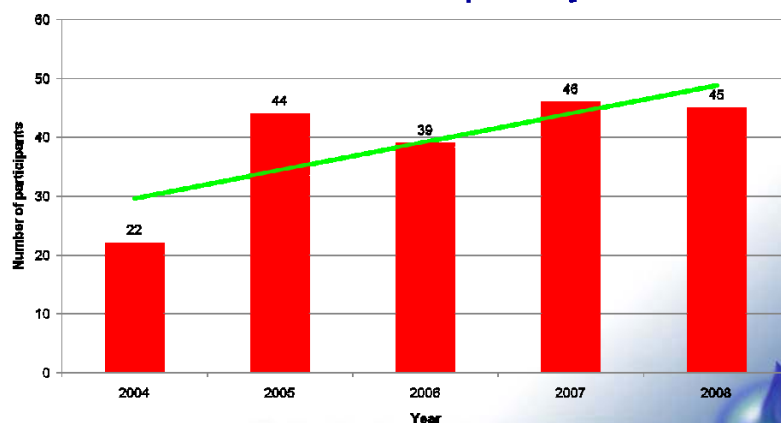
## Changes and Progress of participation

- PT participation should be motivated by global trade
- Need to participate create a trust in results from labs in a different country
- A reliable system of 3rd party evidence of competence is needed



## Overall Growth of the SADC MET PT scheme

Growth of the PT over the past five years



## Number of participants /country

Country	2004	2005	2006	2007	2008
Angola	1	1	1	0	1
Botswana	2	2	2	4	2
Ethiopia	1	1	1	0	0
Kenya	2	2	4	3	3
Lesotho	1	1	0	0	1
Madagascar	0	0	2	2	3
Malawi	2	2	2	3	1
Mauritius	1	3	4	3	5
Mozambique	2	3	2	0	0

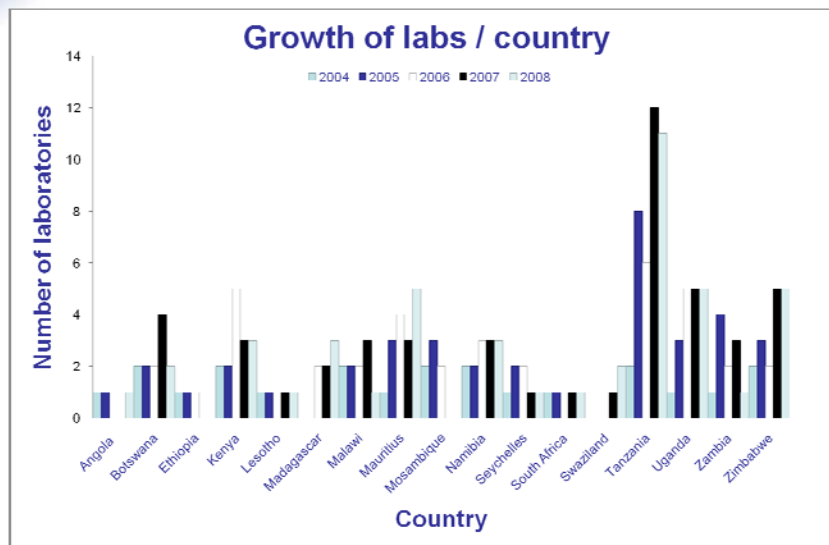


## Number of participants /country

Country	2004	2005	2006	2007	2008
Namibia	2	2	3	3	3
Republic of Seychelles	1	2	2	1	1
Swaziland	1	1	0	1	2
South Africa	0	0	0	1	1
Tanzania	2	8	5	12	11
Uganda	1	3	6	5	5
Zambia	1	4	2	3	1
Zimbabwe	2	3	3	5	5
Number of labs participating	22	44	39	46	45

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## No. of Laboratories / countries



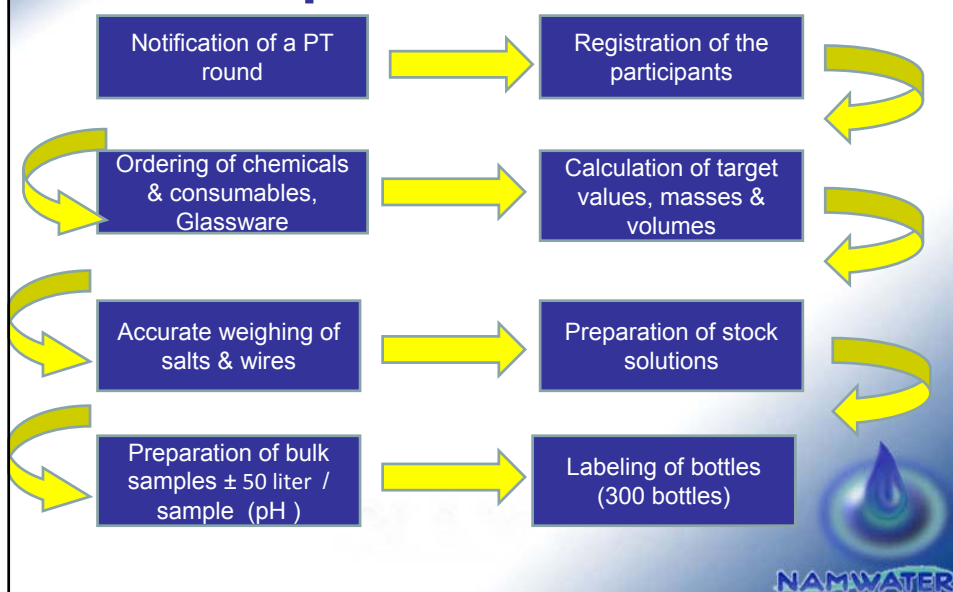
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## Changes and Progress Parameters

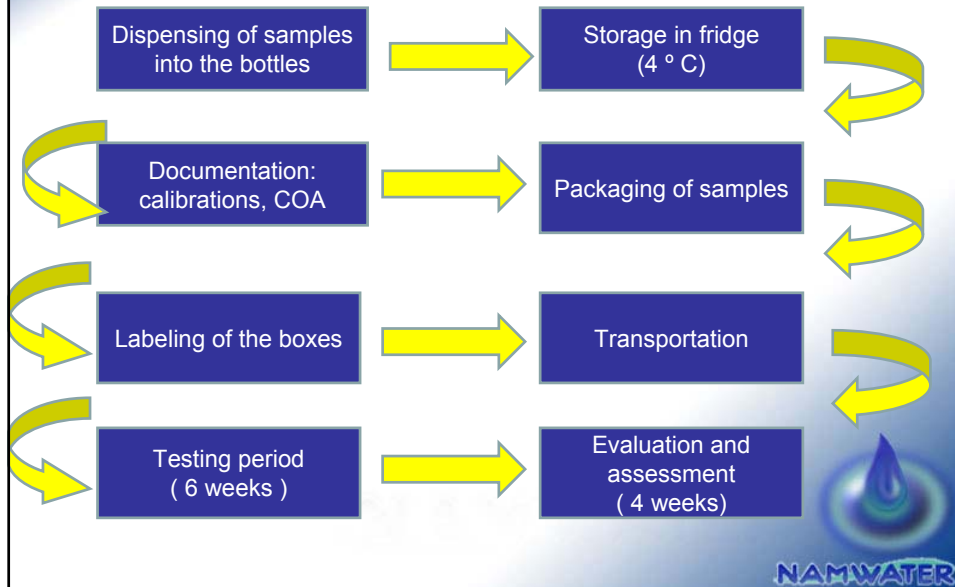
2004		2005		2006		2007		2008	
Anions	Cations	Anions	Cations	Anions	Cations	Anions	Cations	Anions	Cations
SO4	Ca	SO4	Ca	SO4	Ca	SO4	Ca	SO4	Ca
Cl	Mg	Cl	Mg	Cl	Mg	Cl	Mg	Cl	Mg
F	Na	F	Na	F	Na	F	Na	F	Na
NO3	K	NO3	K	NO3	K	NO3	K	NO3	K
	Fe	PO4	Fe	PO4	Fe	PO4	Fe	PO4	Fe
	Mn		Mn		Mn		Mn		Mn
	Al		Al		Al		Al		Al
			Pb		Pb		Pb		Pb
			Cu		Cu		Cu		Cu
			Zn		Zn		Zn		Zn
			Cr		Cr		Cr		Cr
			Ni		Ni		Ni		Ni
					As		As		As
					Cd		Cd		Cd
									Co
Total	11		17		19		19		20

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## Steps of a PT round



## Steps of a PT round II



## Sample bottle preparation I

- Bottles were first to arrive
- Wash all 400 bottles which was ordered
- Planned for 51 participants
- Bottles were rinsed twice with demonized water
- Bottles & caps were put in the oven @ 60 ° C overnight



## Sample bottle preparation II

- Next day – check completely dry
- Closed bottles immediately to prevent them from dust
- Store them in the crates until needed



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## Accurate weighing of salts /wires

Weigh target weight of salt / wires



Weigh the 20 substances for three levels



Continue to prepare the stock solution



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## Weighing of wires

- Start of by weighing the different target masses for the 3 levels of each parameter
- Continue with the weighing of the metals where different wires were used



## Digestion of metals

- Digestion of the pure metals e.g.
- Water and HNO<sub>3</sub> acid was added for digestion / As 32 % NaOH
- Left on a hot plate at very low temperature setting until the metals were completely dissolved





## Weighing of the salts

- Continue with weighing of the salts
- Weigh the substances for three levels
- Continue to prepare the stock solution



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## Preparation of stock solutions

Fill the 500 ml volumetric flask by weight



Wash accurately into a 500ml volumetric flask



Repeat for all 20 parameters – 3 levels



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## Preparations for the 200g weighings



## Preparation of the 200g weighing

- Weigh the empty container
- Weigh the calculated amount of the different stock solutions
- Add water into the big container
- Add the calculated amount of the stock solution (by weight)
- Rinse over in the 100 l container
- Fill by weight



## Traceability of the weighing

- Traceability is very important in a PT scheme
- Biggest problem during PT 2007 - Balances had no possibility for a printer connection – took photos
- Problem solved - donation of the balances by the PTB



## New balances – donated by **PTB**



## Documentation of weighing

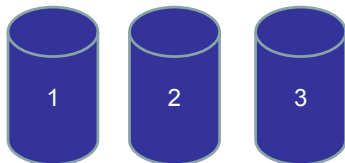
- Proof of printings were pasted against all weighings
- Cut and pasted next to the written weighing for proof of the traceability
- Calculation were checked signed
- Confirmed by 2<sup>nd</sup> person

SADC MET Water PT		
Parameter	SO <sub>4</sub> <sup>2-</sup>	
Stock solution for	level	1
Substance	K <sub>2</sub> SO <sub>4</sub>	
Net weight (g)	13.8709	
In (mL)	500	
Execution net weight		
	Value	Print out balance
Vessel empty (g)	57.9327	02/18 + 41.9057 g
Vessel + substance (g)	57.8747	02/18 + 37.9747 g
Net weight substance (g)	15.9420	
Top up		
	Value	Print out balance
Flask empty (g)	124.33	
Flask completed (g)	630.10	09-24-2008 144 33 20
Total net weight (g)	505.77	02/18 + 139.75 g 02/18 + 645.15 g
Date:	19-7-2008	Signature 1: <i>[Signature]</i>
		Signature 2: <i>[Signature]</i>

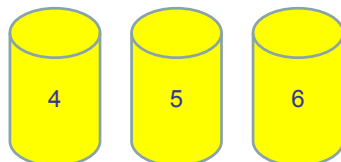
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## Preparation of bulk samples

**Anions** : SO<sub>4</sub>, Cl, NO<sub>3</sub>, F, PO<sub>4</sub>



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



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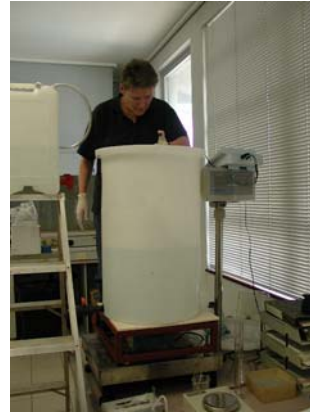
## pH adjustment

Stirring took place continuously during the process

Filled container by weight

Final stirring for 15 minutes

Document the final pH



## Homogeneity

- All analytes were physically dissolved
- Continuous and proper stirring ensure the homogeneity of the samples
- Final stirring for 15 minutes
- Conductivity check on the first samples and every 10<sup>th</sup> samples

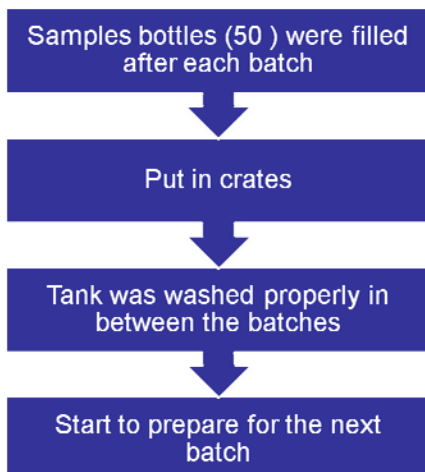


## Labeling of the bottles

- Prepare labels for each sample bottle with a short description of the information
- Print labels
- Stick on the samples bottles for identification of the samples
- Put sellotape over the labels – to protect the labels
- Bottles were ready for the filling process



## Sample dispensing



## Storing

- Space was limited in the fridge
- Crates were very handy – stacked all the samples
- All samples were stored at 4 ° C until all six batches were prepared



## Preparing for packaging of the samples

- Packed six polyethylene bottles into each box
- Shredded paper was used for the packaging material
- sealed with packaging tape



## Folding of boxes II

- Strong packaging was once again a requirement
- Flat cartons needed to be fold into boxes
- Staple it together



## Complete boxes





## Packaging of the samples



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## Labeling & sorting



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## Packaging



## Preparation of the documentation

- Hard copies of the forms for the results and the method information were included in each box
- Labels of all the participants were prepared



## Ready for pick up

- Samples ready to be picked up by the courier for distribution to the local coordinators



## Calculated mass - Anions

Parameter	Chemical	Purity %	Sample 1	Sample 2	Sample 3
Sulphate	$K_2SO_4$	99.5	70.1261	18.7233	44.4188
Chloride	KCl	99.6	31.5473	69.672	12.598
Fluoride	KF	100	0.2054	1.3201	0.9804
Nitrate	$KNO_3$	99.3	56.8247	28.0509	9.9669
Phosphate	$KH_2PO_4$	99.9	3.2029	21.2784	11.3419



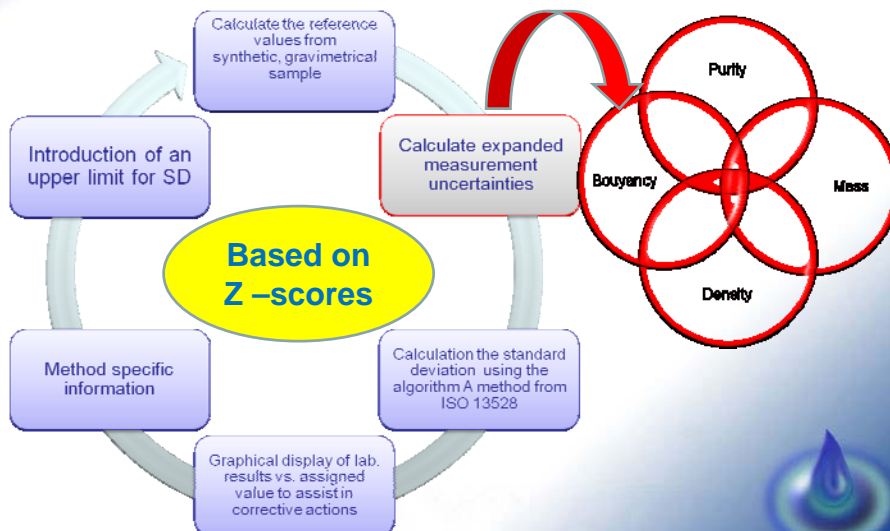
## Calculated mass – Cations

Parameter	Chemical	Purity %	Sample 4	Sample 5	Sample 6
Calcium	CaCl <sub>2</sub> ·2H <sub>2</sub> O	99.5	60.2338	8.3455	25.4282
Magnesium	Mg(NO <sub>3</sub> ) <sub>2</sub> ·6 H <sub>2</sub> O	99.5	11.4381	39.8732	18.846
Sodium	NaCl	99.6	80.6041	10.0962	43.7208
Potassium	KCl	99.6	12.3007	17.4761	20.7153
Iron	Fe-Wire	99.95	2.7394	2.0341	0.5379
Manganese	Mn-Powder	99.4	1.5026	5.1096	0.899
Aluminium	Al-wire	99.9995	2.2303	0.8237	4.3905
Lead	Pb(NO <sub>3</sub> ) <sub>2</sub>	99.7	3.3057	1.1191	0.5793
Copper	Cu-wire	99.999	0.7036	3.5446	1.0896
Zinc	Zn-wire	99.99995	2.4813	0.8812	4.4332
Chromium	Cr-powder	99.6	0.7725	1.7668	0.4808
Nickel	Ni-wire	99.9975	0.7667	0.5443	3.1043
Arsenic	As <sub>2</sub> O <sub>3</sub>	99.5	0.1318	0.5782	0.3794
Cadmium	CdCl <sub>2</sub>	99.995	0.7345	0.1195	0.4915
Cobalt	Co-powder	99.6	2.5864	0.9051	2.7127

The samples matrix was pure water. Sample 4, 5 and 6 were constituted as follows with HNO<sub>3</sub> acid preservation to a pH 2.1. The final weight for the cation samples was 49.900g with the Density (Deionised water) = 0.998g/ml and the temperature 24.0 °C.

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## Evaluation and assessment



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## Interpretation of the Z –score

- ‘z-score’: This score reflects the actual accuracy achieved (i.e., the difference between the participant’s result and the reference value)
- A score of zero implies a perfect result
- Laboratories will commonly produce scores falling between - 2 and 2.
- The sign (i.e., + or -) of the score indicates a negative or positive error respectively.

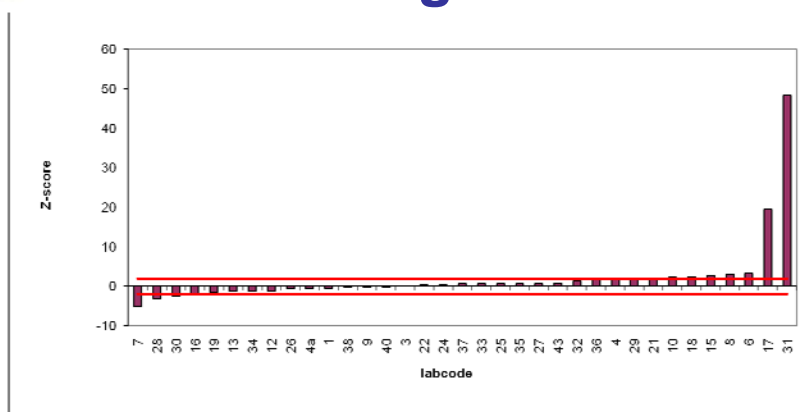
$|z\text{-Score}| \leq 2$  – satisfactory

$2 < |z\text{-Score}| \leq 3$  – questionable

$|z\text{-Score}| > 3$  - unsatisfactory



## z-Score-classification and diagram



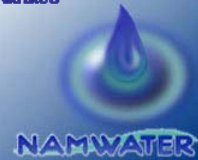
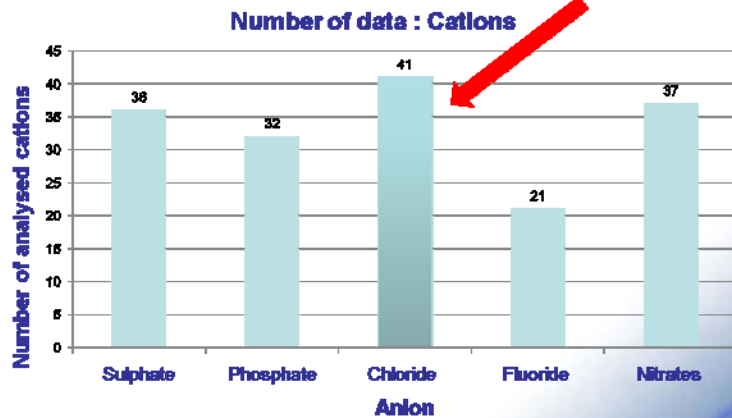
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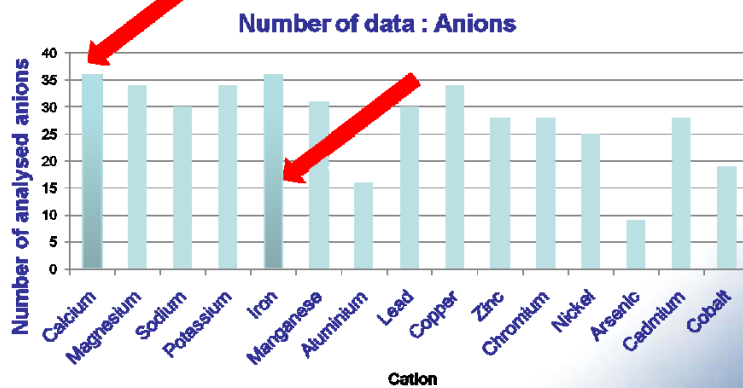
$|z\text{-Score}| > 3$  - unsatisfactory



## Number of data : Anions



## Number of data : Cations



## Information to courier

- Supplied the correct address list of the local distributors to the courier with the total weight of one parcel
  - Determine the weight of bottle filled with deionised water
  - Determine the weight of empty box
  - Determine the weight of envelope filled with documentation



## Shipment

- The courier was DHL and TNT
- Total Transport cost = U\$ 4720
- Much higher than 2007 – increase fuel price
- Participants were notified by e-mail
- Parcels were shipped to the address of the local distributor
- Samples were delivered without any problems
- Some leakage problems were reported
- Nobody reported custom problems



## Reporting of results

- Results were received by fax or e-mail
- Deadline was extended on request because of courier problems
- Last results received - 07th October 2008
- Nobody complained about custom problems



## Evaluation

- Results were typed into a spreadsheet
- Copied and paste into different parameter files
- All the files were created for the different laboratories in Excel
- Excel files were converted to a pdf format to reduce the size of the file and to ensure all the participants will be able to read the file.
- Precision tests were run on the balances
- Measurement uncertainty was taken in consideration according to the method told by Angelique in the 2005 workshop





## Confidentiality

- Confidentiality was once again very important
- Lab codes are changed in every round
- It is also the responsibility of everybody involved to keep all the data and items of information relating to inter-laboratory confidential

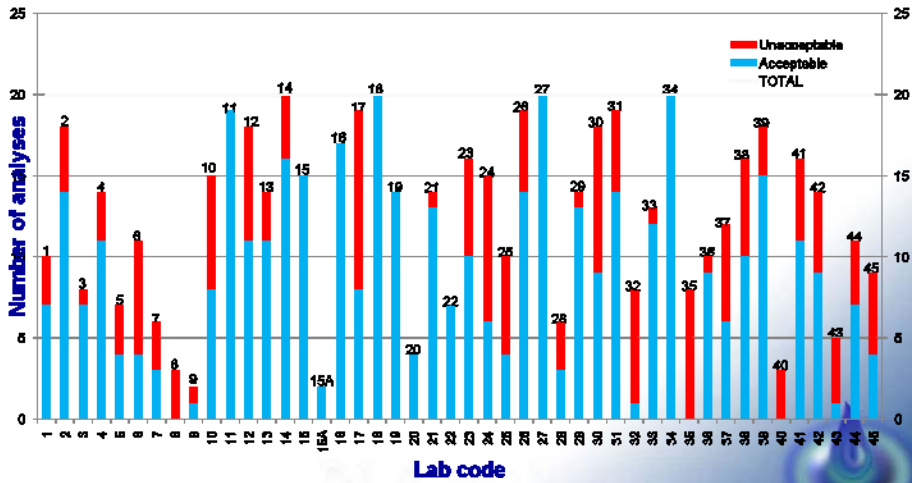


## Documentation

- All certificates of analyses COA were downloaded from the internet – available
- **All** the weighing were printed and readings were pasted next to the weighing of the salts and the wires
- Calibration certificate for temperature, pycnometer and balance were documented

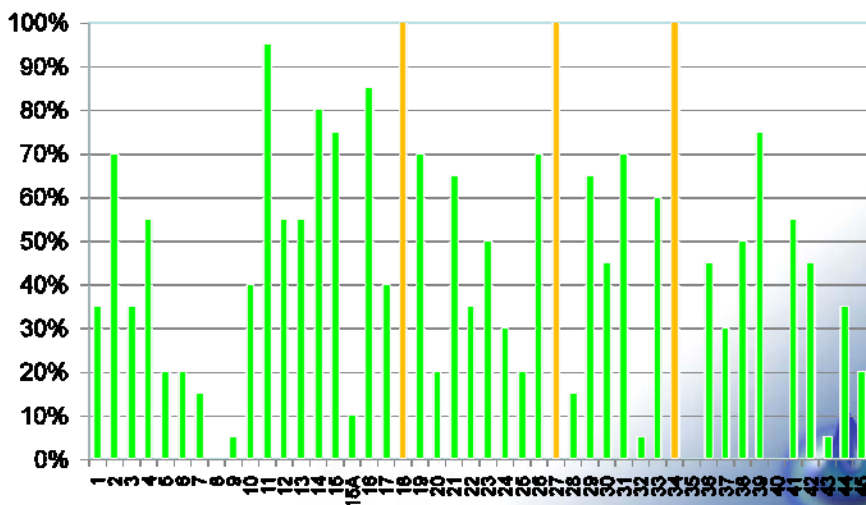


## Number of parameters analyzed



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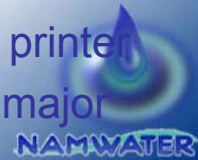
## % Overall Success



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## Successes of 5<sup>rd</sup> PT

- 10 laboratories – 100 % of parameter which they did correct
- Tanzania once again - country with most participants
- No courier problems reported
- Local distributors were very important and very helpful with confirmations
- Traceability easier with balances & printer
- Uncertainty of the mass of the lot - major improvement



## Successes of 5<sup>rd</sup> PT

- Tanzania once again - country with most participants !
- No courier problems reported
- Local distributors were very important and very helpful with confirmations.  
Traceability easier with balances & printer
- Uncertainty of the mass was a major improvement



## Problems

- Dedicated time for the preparation
- Limited number of staff
- Contract with local electricity supplier - Urgent reporting of results
- Desalination activities for the first six months 2008
- Late confirmations and requests of participation
- Extension of the closing date for some participants delayed the evaluation report
- Six laboratories did not submit results - due to unknown reasons
- Some leakage problems



## Payment

- Payments were made by bank drafts, transfers and cheques
- Some participants e-mail the proof of payment.
- NamWater still experiences problems to identify the payments within NamWater due to insufficient information from bank/participant
- Many payments not yet made



## Challenges for 2009

- The results should be used as a motivation to improve performance and apply corrective actions if necessary
- Rectify errors and improve on the standard deviations in the 2009
- Performance need to be improved make use of quality PT samples for quality control
- Strive to improve the success
- Reporting of results again caused problems with incorrect units (e.g as N and not NO<sub>3</sub> and as P and not PO<sub>4</sub>)
- Instrumentation or methods used must be a high priority to correct



## Conclusions

- The results of many laboratories are still not satisfactory and need improvement
- SADC MET lab association is a good platform for discussions, how to improve and for mutual help – **USE** it
- Proof competence in the field of testing
- It is a regular, external and independent check on the data quality of the laboratory and w\one should strive to allways improve



PT schemes is a dust speck in the universe  
– but a very significant tool !



## Thank you

- **PTB assistance**
- Stefan Wallerath
- Annedore Heinichen
- **SADCMET**
- Donald Maseku
- Margaret Ngobeni
- **University of Stuttgart**
- Dr Michael Koch
- **NamWater colleagues**
- **Assistance of Local distributors**
- **Participants**

