Report on the Workshop
Proficiency Testing for Water Testing Laboratories with Training Course on Method Validation and Measurement Uncertainty

Dar es Salaam, Tanzania, 4 – 6 December 2007

Prepared by Dr.-Ing. Michael Koch

Summary

The workshop covered the evaluation of the 4th SADCMET Water PT round and all aspects that could be derived from the results. The results showed that there is - generally seen - not really an improvement over the 4 PT rounds. Most probably this is due to the absence of adequate corrective actions after failures in the PT.

Therefore one of the topics in the training session was the information how to do corrective actions as part of a method validation procedure.

Most of the participants are still very enthusiastic. It is highly recommended to continue the PT system for chemical analyses and to extend it to microbiology as discussed in 2006. The structure of local coordinators turned out to be very useful and should be further strengthened to minimize logistical problems and to increase the number of participants. The assessment procedure using limited standard deviations has again proven to be very effective, the statistical methods are in accordance with the internationally recommended procedures.

The SADC ASSOCIATION OF WATER TESTING LABORATORIES (SADCWATERLAB) had its general assembly meeting during the workshop. This association is the responsible body for the PT system and an opportunity for collaboration and information exchange between its members. The role of SADCWATERLAB should be strengthened by an officially memorandum of understanding. This MoU will be finalised within the next months.

Introduction

The workshop reported here followed previous workshops held in Windhoek, Namibia (February 2004), Pretoria, South Africa (November 2004), Dar es Salaam, Tanzania (November 2005) and Gaborone, Botswana (November 2006). The reports are available from http://www.sadcmet.org. As a result of these workshop the first and second proficiency tests for water testing laboratories were organised by Umgeni Water (Pietermaritzburg, South Africa), the following rounds after a training in Germany by Namwater (Windhoek, Namibia). One of the aims of this workshop in Dar es Salaam was the evaluation of the fourth PT round on chemical parameters.
Besides this the opportunity of the workshop was used to provide training courses on method validation and measurement uncertainty.
The cooperation of laboratories within he SADCWaterLab Association was also discussed during the workshop.

Participants and Organisation

The workshop was attended by 32 participants from the following countries:

- Botswana 1
- Ethiopia 1
- Kenya 2
- Madagascar 1
- Malawi 1
- Mauritius 1
- Namibia 3
- South Africa 2
- Swaziland 1
- Tanzania 14
- Uganda 2
- Zambia 1
- Zimbabwe 2

A complete list of participants is given in annex 1.

PT Workshop Programme

Tuesday, 04 December 2007:

Welcome, Opening of 4th PT evaluation and assessment

Wednesday, 05 December 2007:

Training course on Corrective Actions, Method Validation and Measurement Uncertainty

Thursday, 06 December 2007:

Lab visit at Tanzania Bureau of Standards
SADCWaterLab general assembly

Tuesday, 04 December 2007

Opening and Evaluation of and experiences from the 4th SADCMET Water PT

- Opening
- ***All Participants***: Introduction
- ***M. Conradie***: Experiences of the PT provider
- **Local coordinators:** Report
- **All participants:** Working group discussions 1
- ***M. Koch***: Assigned values for the 4th SADCMET Water PT
- ***M. Koch***: Presentation on the content of the workshop CD
- ***M. Koch***: Evaluation of the 4th SADCMET WATER PT
- ***M. Koch***: Development of standard deviations over the 4 PT rounds
- **All participants:** Working group discussions 2

Opening

The Workshop was officially opened by Charles Ekelege, acting director for the Tanzania Bureau of Standards.
The PTB representative Stefan Wallerath, the new SADCMET regional coordinator Donald Masuku and Mrs.Kezia Mbwambo as chair of SADC Water Lab also welcomed the participants.
All participants shortly introduced themselves.

M. Conradie: Experiences of the PT provider

Merylinda Conradie reported about her experiences with this 4th PT round. She listed the changes in participation from the member countries (table 1).

Table 1: Number of labs participating in the PT rounds

country	2004	2005	2006	2007
Angola	1	1	1	0
Botswana	2	2	2	4
Ethiopia	1	1	1	0
Kenya	2	2	4	3
Lesotho	1	1	0	1
Madagascar	0	0	2	2
Malawi	2	2	2	3
Mauritius	1	3	4	3
Mozambique	2	3	2	0
Namibia	2	2	3	3
Seychelles	1	2	2	1
Swaziland	1	1	0	1
Tanzania	2	8	5	12
Uganda	1	3	6	5
Zambia	1	4	2	3
Zimbabwe	2	3	3	5
total number	22	44	39	46

She listed the parameters to be analysed in this PT round (table 2). There was no change compared to 2006

Table 2: List of parameters in the 3rd PT round

Sulphate	Manganese
Chloride	Aluminium
Fluoride	Lead
Nitrate	Copper
Phosphate	Zink
Calcium	Chromium
Magnesium	Nickel
Sodium	Arsenic
Potassium	Cadmium
Iron	

She described the planning including the chemicals used for spiking, the necessary materials for sample preparation and packaging, choice of courier and necessary balances.
In detail she explained the preparation of the samples including

- Cleaning of bottles
- Weighing of chemicals
- Traceability of the weighings by taking pictures with a digital camera
- Digestion of metals
- Preparation of stock solutions
- Labelling of bottles
- Preparation of final batches
- pH adjustment
- Ensuring homogeneity
- Sample dispensing
- Storage
- Preparation of documentation
- Packaging
- Information to courier
- Shipment

The participants from Angola and Lesotho reported customs problems.
Results were received by fax or e-mail. The deadline had to be extended because of courier problems.
The results were typed into an EXCEL spreadsheet. Evaluation was done using the programme developed especially for the SADCMET PT scheme.
Payments were made using bank drafts, transfers and cheques. Some payments were made, but the money is still outstanding. Namwater still experiences problems to identify the payments within Namwater due to insufficient informationfrom bank/participant. Some payments were not yet made at all.
Local coordinators were very helpful especially with the courier problems.
Details of the evaluation were explained by M. Koch in the following presentations.
The following challenges for 2008 were identified:

- The results should be used as a motivation to improve performance and apply corrective actions if necessary

- Strive to improve the success
- Increase the number of analysed parameters
- Reporting of results again caused problems with incorrect units (e.g as N and not NO_3 and as P and not PO_4
- Try and rectify the analyses not determined due to a lack of chemicals or problems with equipment
- Instrumentation or method should be stipulated clearly
- Once again very high standard deviations in the 2007 PT scheme to be improved in 2008

The PT provider experienced the following problems:

- Interruptions of sample preparation and evaluation by routine tasks in the laboratory
- Limited number of staff
- Late confirmations and requests of participation caused problems and unnecessary rearrangements with the courier
- The initial return date for the results was set as the 31st of August 2007 with an extension of three weeks for some of the laboratories due to transportation problems. Five laboratories did not submit results at all.
- Follow-up of participation where people did not respond on e-mails
- Late submitting of results due to courier problems delayed the submitting of the evaluation report
- Receipt of results by fax – unclear and difficult to get hold of the participant
- Three labs did not take part due to courier problems

M. Conradie expressed her thanks to PTB for the financial support, especially for the new balances, to SADCMET secretariat, to M. Koch, to the Namwater colleagues, the local distributors and all participants.
The full presentation is included in annex 2.

Local coordinators: Report

The local coordinators were asked to fill out a questionnaire (annex 3) for the report about their activities and to give a short oral report.
The completed questionnaires of the local coordinators from Madagascar, Zimbabwe, Uganda, Swaziland, Tanzania, Namibia, Mauritius, Kenya, Malawi and Zambia may be found in annex 4.
It was agreed that it is the local coordinators most important task to promote the PT system as much as possible. The activities of the local coordinator in Tanzania who succeeded in mobilising 12 participants could serve as an example for others. The use of personal contacts seems to be the most efficient way.

All participants: Working group discussions

The experiences of the participants were discussed in three working groups answering seven questions. The results can be summarized as follows:

1. **Announcement of the scheme – did you receive enough information in good time?**
    - Enough time
    - E-mail communication problems
    - Try to use fax if e-mail does not work
    - receipt of communication
    - clear and enough

2. **Registering – did you have any problems?**
    - see above

3. **Local coordinators – did it work? - have all interested/relevant laboratories got all the information from local coordinators?**
    - little problems
    - resources for communication
    - need of support from institutions
    - change from persons to institutions
    - letter to institution, not to persons
    - need of awareness creation
    - need to use national associations
    - not very effective, letter to be improved
    - coordination should be a task of the institutions

4. **Shipment – did you encounter any courier problems? - did everybody get the samples in time?**
    - no problem
    - some customs problems
    - delay in picking up the samples from LC

5. **Reporting of results – any problems?**
    - no problem
    - need for acknowledgement

6. **Payment / costs? – Is the fee affordable? – Problems with money transfer?**
    - Fee is affordable
    - no problem with transfer
    - need for proforma invoice
    - bank charges problems

7. **Are you, as a customer, satisfied with the organisation?**
    - very much satisfied
    - work very much appreciated

Need to expand to other areas

M. Koch: Assigned values for the 4th SADCMET Water PT

M. Koch explained the different possibilities for the determination of the assigned values as stated in ISO 13528. Since there no CRM and no reference measurements were available and the consensus means of the participants were not reliable enough, reference values from sample preparation were chosen as assigned values. The procedure for the sample preparation was explained in detail including the formula for the calculation of the assigned value from the different weighings, the molar masses, the purity of the chemicals, the density and the buoyancy correction factor. With this formula a measurement uncertainty budget was calculated according to the Guide to the Expression of Uncertainty in Measurement. The estimation of the uncertainty of the weighings from precision experiments and from manufacturers trueness information was explained. The estimation of all the other uncertainties as shown resulting in the low expanded relative uncertainties (k=2) shown in figure 1.

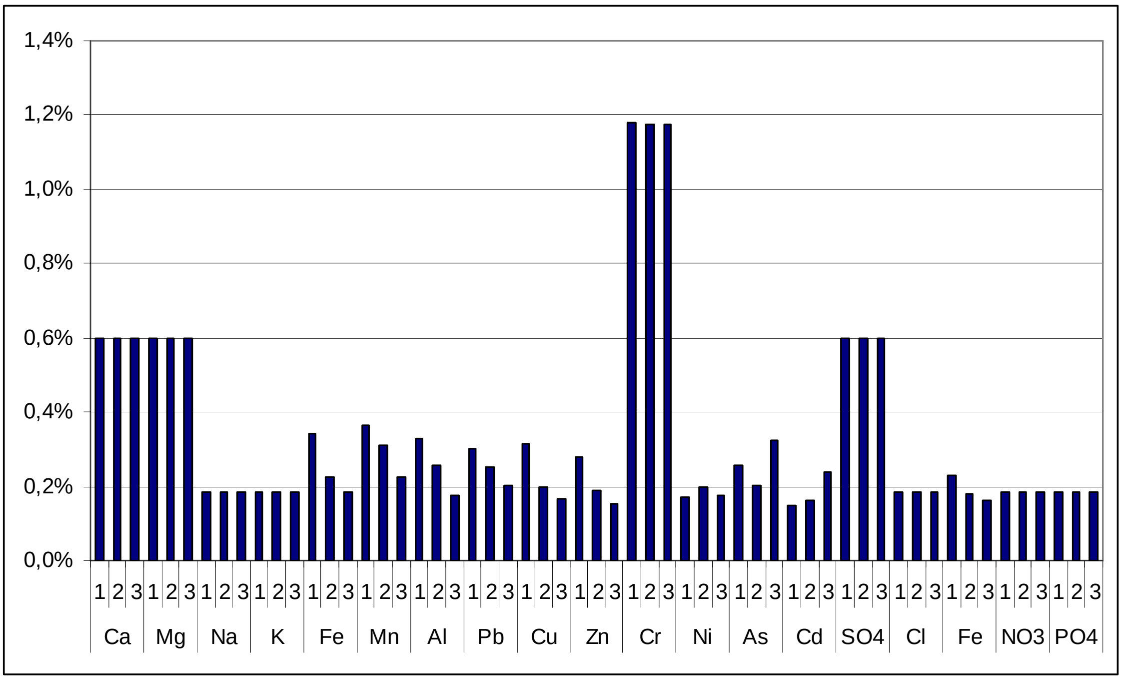

Figure 1: Expanded relative uncertainties of the reference values

M. Koch: Evaluation of the 4th SADCMET Water PT

M. Koch explained in detail the result of the evaluation of the PT round. As in the last round the assigned values were derived from the weighings made for the preparation of the samples. the standard deviations were calculated using Algorithm A from ISO 13528. These standard deviations were used for the calculation of z-scores, if they were below the limits for the standard deviations agreed upon during the previous workshops (table 3).

Table 3: Limits for standard deviations

Parameter	limit in %
Sulphate	10
Chloride	10
Fluoride	12
Nitrate	15
Phosphate	10
Calcium	10
Magnesium	10
Sodium	10
Potassium	10
Iron	<1 mg/l: 20, >1 mg/l: 12
Manganese	<1 mg/l: 20, >1 mg/l: 12
Aluminium	30
Lead	< 0,5 mg/l: 40, > 0,5 mg/l: 25
Copper	20
Zinc	20
Chrome	25
Nickel	25
Cadmium	30
Arsenic	30

In order not to affect the statistical calculations by gross outliers all values outside the range ref.-value/8 to ref.-value*8 were excluded prior to these calculations.
The detailed presentation is included in annex 5.
For the individual parameters the following conclusions could be derived from the data:

- Sulphate: The means of the data were higher than the reference value, showing positive bias. The standard deviations were higher than the limits. The gravimetrically determined values showed a high portion of too high values
- Chloride: There was a quite good agreement between the data means and the reference values. The standard deviations were around the limit. As in the previous round it was not clear, what was meant with the statement “titrimetric” as method. So the method specific evaluation was not very clear. Nevertheless the data showed many outliers (with too high values) for the colorimetric and potentiometric method
- Fluoride: The mean values were around the reference values. For low concentrations the standard deviations were higher than the limit. The colorimetrically determined values had a very high portion of non-reliable values.
- Nitrate: As in the previous rounds some values obviously were reported in wrong units. Therefore the mean values were quite low and the standard deviations high. The average quality of the data is very bad. The parameter needs more emphasis. Harmonization of methods could help.
- Phosphate: Some values also were reported with wrong units. Generally the standard deviation and the number of outliers were high. The data set of colorimetrically determined values contained a high number outlying values, which partially was due to reporting in wrong units.
- Calcium: The mean of the values were close to the reference values. The standard deviations were above the limit. A tendency to lower values could be recognised for AAS-values, a tendency to higher values for titrimetric values

- Magnesium: The mean values were around the reference values, but the standard deviations were too high. Titrimetrically determined values in general were not reliable.
- Sodium: The means were close to the reference values. The standard deviations were too high. Many values determined with FEP were too high, many of the AAS-values were not reliable.
- Potassium: The means of the values were close to the reference values, the standard deviations a bit higher than the limit. AAS values contained many non-reliable data.
- Iron: The means were lower than the reference values and the standard deviations were higher than the limit. The colorimetric method delivered many outlying values.
- Manganese: The means were about 4% below the reference values, the standard deviation around the limit. AAS values showed a broad statistical distribution
- Aluminium: Only few participants analysed this parameter. Therefore the number of values was small. The mean were a bit below the reference values.
  Lead: The means of the datasets were only a bit below the reference values. Compared with the limit the standard deviations of the datasets were quite low.
- Copper: For this parameter the data means also were in good agreement with the reference values and the standard deviations also were low.
- Zinc/Chromium/Nickel: The data means also showed no bias for the determination of zinc and the standard deviations were around the limit.
- Arsenic: Only a few laboratories analysed for arsenic. So the number of values was very low. The means of the dataset were close to the reference values and the standard deviations were around the limit
- Cadmium: The mean values of the data sets were slightly below the reference values.

Only 4 participants analysed all parameters. The percentage of participation per laboratory is shown in fig. 2.

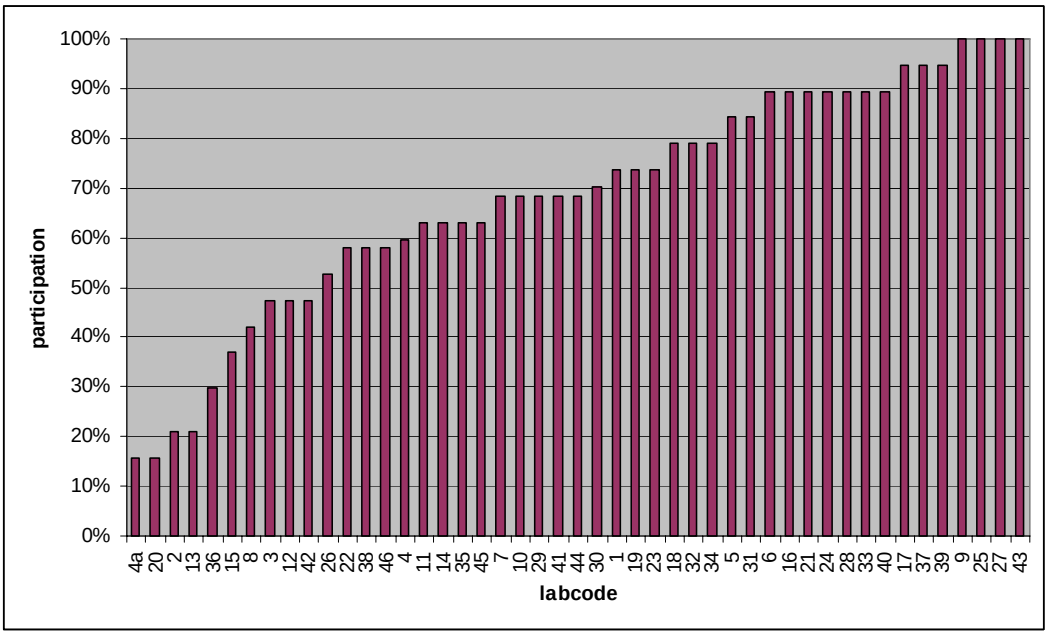

Figure 2: Percentage of participation for each participant

17 participants managed to analyse more than 80% of their values within the tolerance limits (compared to 10 labs in 2006). Fig. 3 shows the proportion of successfully analysed parameters for each participant.
For the laboratories with more than 80% successfully analysed values the number of values delivered is also shown in the diagram.

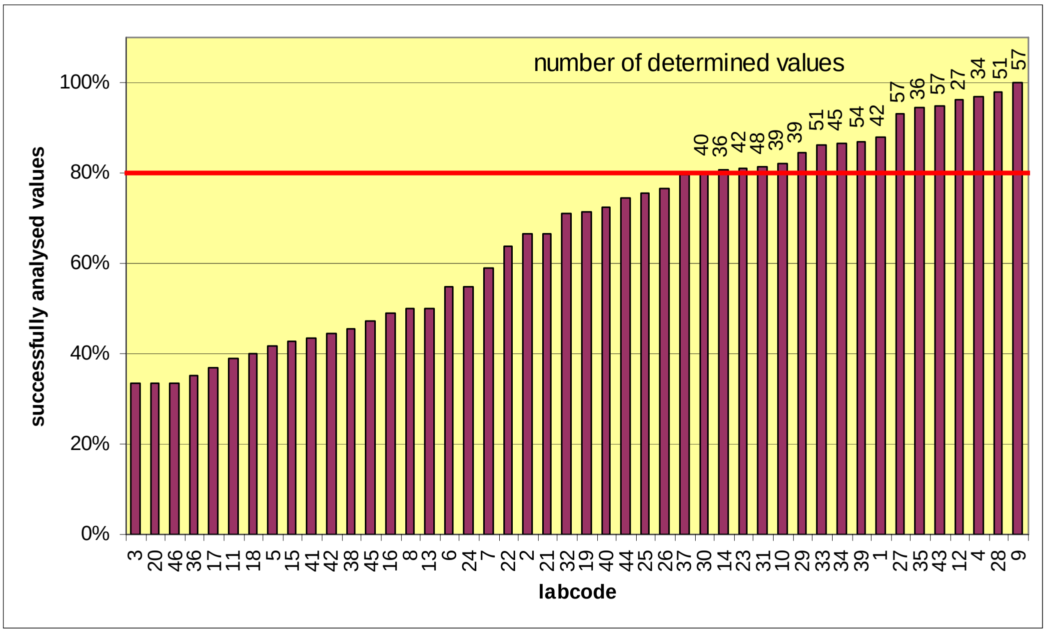

Figure 3: Percentage of successfully analysed values for each participant

The definition of fitness-for-purpose criteria (in the form of limits for the standard deviation) resulted in a higher proportion of values outside the tolerance limits. Experience from Germany shows that normally up to 20% of non-successfully analysed values can be expected for each parameter.
Fig. 4 shows for each parameter the percentage of values outside the tolerance limits. The figure shows that – on the basis of the current fitness-for-purpose-criteria - improvement is still necessary for most of the parameters.

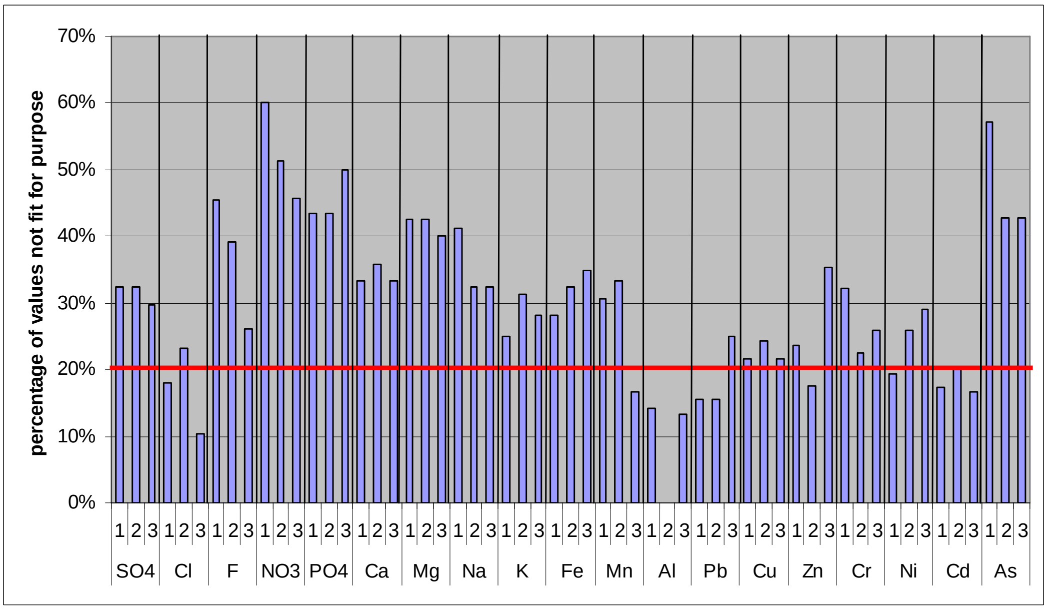

Figure 4: Percentage of values outside the tolerance limits for all samples

Michael Koch came to the following conclusions:

- The PT Provider did a very good job
- The evaluation and assessment procedure is fit for the purpose
- The SADCMET Water PT is a good possibility for the participants to compare with peers and with stated fitness-for-purpose criteria
- The results of many laboratories are still not satisfactory and need improvement
- Special emphasis should be put on corrective actions after unsatisfactory participation

M. Koch: Development of Standard Deviations over the 4 PT rounds

M. Koch showed in his presentation (annex 6) the development of the standard deviations over the four SADCMET PT rounds for all parameters. The comparison of the standard deviations of the 4th round with the previous rounds is summarized in table 4:

Table 4: Assessment of the standard deviations of the 3rd round from a comparison with the previous rounds

better	potassium, arsenic
no change	sulphate, chloride, fluoride, phosphate, sodium, iron, manganese, aluminium, lead, copper, zinc
worse	nitrate, calcium magnesium

During the previous workshops the participants agreed on quality standards (limits for the standard deviation) for all parameters. The comparison of the standard deviations calculated from the data sets with these quality standards gives the results shown in table 5.

Table 5: Comparison of calculated standard deviations with the quality standards set during the previous workshops.

good	aluminium, lead, copper, zinc
still acceptable	chloride, potassium, iron, manganese, chromium, nickel, cadmium
not acceptable	fluoride, arsenic
bad	sulphate, nitrate, phosphate, calcium, magnesium, sodium

The main question remaining from these data is, why we can't see a clear improvement after 4 PT rounds. This was also discussed during the following working group discussions.

All Participants: Working group discussions - PT evaluation

Five questions were discussed in three working groups.
Results of the discussion:

1. How do you judge the outcome of the PT round?

- some parameters (Ca, Mg) good, bad for some others (Nitrate)
- quality of results should be improved
- standard deviations quite high
- general commitment observed (increased number of labs)
- not that good

2. **Is the evaluation procedure ok?**
    - yes
    - more sample volume for re-testing?
    - no doubt

3. **How can we help national coordinators to better promote the PT scheme?**
    - need to support
    - national workshops
    - creation of awareness
    - participants to be ambassadors
    - collect samples at LC instead of national transport
    - talk to other people
    - dissemination of information by participants

4. **What has to be changed in the system? (fee, time schedule, …)**
    - appointment of LC more official
    - announcements earlier
    - nothing

5. **Why can't we see a clear improvement after 4 PT rounds?**
    - corrective actions were not taken
    - no appropriate quality management system in the labs
    - training of trainers need
    - problems not properly recognized
    - procedure to find the proper corrective action is not clear
    - improve equipment
    - proper storage procedures needed
    - update methods regularly – harmonize
    - takes long time to get chemicals
    - bad quality of chemicals
    - high level of staff fluctuation

Further discussions and agreements were made during the SADCWaterLab General Assembly (see below).

Wednesday, 05 December 2007

Training

- ***C. Modika***: SABS Proficiency Testing Scheme
- ***M. Koch***: Content of the Workshop CD
- ***M. Koch***: Types of errors / corrective actions
- ***M. Koch***: Method validation
- ***M. Koch***: Explanation of EXCELKONTROL 2.0 – software for control charts
- ***M. Koch***: Measurement uncertainty revisited

C. Modika: SABS Proficiency Testing Scheme

C. Modika presented the SABS proficiency testing programme with special emphasis on the water check scheme. The complete presentation may be found in annex 7.

M. Koch: Content of the workshop CD

A CD was distributed to all participants by M. Koch with the following content:

- European Union - COUNCIL DIRECTIVE 98/83/EC of 3 November 1998 on the quality of water intended for human consumption
- Accreditation
    - CITAC_EURACHEM Guide to Quality in Analytical Chemistry 2002
    - EA-4-09rev01Accreditation for Sensory Testing Laboratories
    - EA-4-10rev02Accreditation for Microbiological Laboratories
    - EA-4-15rev00Accreditation for Bodies Performing non-Destructive Testing
    - EURACHEM_EA Accreditation for Microbiological Laboratories 2002
    - Ilac-g4 Guidelines on Scopes of Accreditation
    - Ilac-g10 Harmonised Procedures for Surveillance & Reassessment of Accredited Laboratories
    - Ilac-g14 Guidelines for the Use of Accreditation Body Logos and for Claims of Accreditation Status
    - Ilac-g15 Guidance for Accreditation to ISO-IEC 17025
    - Ilac-g18 The Scope of Accreditation and Consideration of Methods and Criteria for the Assessment
    - Ilac-g19 Guidelines for Forensic Science Laboratories
- Control charts
    - NORDTEST TR 569 Internal Quality Control
    - ***new:*** EXCELKONTROL 2.0 – Software for Quality Control Charts
    - Manual for EXCELKONTROL
- General
    - Harmonised Guidelines for the Use of Recovery Information in Analytical Measurements 1998
    - Quality Assurance for Research and Development and Non-routine Analysis
- Measurement uncertainty
    - A2LA Guide for the Estimation of Measurement Uncertainty In Testing
    - VAM Project 3.2.1 Development and Harmonisation of Measurement Uncertainty Principles - Part (d): Protocol for uncertainty evaluation from validation data
    - EA-4-16rev00EA Guidelines on the Expression of Uncertainty in Quantitative Testing
    - Ilac-g17 Introducing the Concept of Uncertainty of Measurement in Testing
    - NORDTEST - Uncertainty of quantitative determinations derived by cultivation of microorganisms
    - NORDTEST – Handbook for Calculation of Measurement Uncertainty in Environmental Laboratories
    - EURACHEM/CITAC Quantifying Uncertainty in Analytical Measurement, 2nd Edition 2000
    - ***new:*** Eurachem/EUROLAB/CITAC/Nordtest Guide (Draft 2007): Estimation of measurement uncertainty arising from sampling

    - ***new:*** EUROLAB Technical report No. 1/2007: Measurement uncertainty revisited: Alternative approaches to uncertainty evaluation
    - ***new:*** EURACHEM/CITAC Guide: Use of uncertainty information in compliance assessment. First edition 2007
- Proficiency Testing
    - EA-3-04-rev01Use of Proficiency Testing as a Tool for Accreditation in Testing
    - ***new:*** Ilac-g13 Guidelines for the Requirements for the Competence of Providers of Proficiency Testing Schemes 8/2007
    - Ilac-g22 Use of Proficiency Testing as a Tool for Accreditation in Testing
    - IUPAC - The International Harmonized Protocol for the Proficiency Testing of Analytical Chemistry Laboratories 2006
    - Selection, Use and Interpretation of Proficiency Testing (PT) Schemes by Laboratories 2000
- Reference Materials
    - EA-4-14rev00The Selection and Use of Reference Materials
    - Ilac-g9 Guidelines for the Selection and Use of Certified Reference Materials
    - Ilac-g12 Guidelines for the Requirements for the Competence of Reference Materials Producers
    - The Selection and use of Reference Materials 2002
- Traceability
    - EA-4-07 Traceability of Measuring and Test Equipment to National Standards
    - Ilac-g2 Traceability of Measurements
    - EURACHEM/CITAC - Traceability in Chemical Measurement 2003
- Validation
    - EURACHEM - The Fitness for Purpose of Analytical Methods - A Laboratory Guide to Method Validation and Related Topics 1998

M. Koch: Types of errors / corrective actions

M. Koch explained how the graphical displays of lab results vs. assigned values provided with the evaluation report of the PT may be used to get hints for the type of errors in the case of non-satisfactory participation (annex 8).

According to M. Koch the following corrective actions should be applied:

- If you found a proportional systematic error: Check calibration
- Check for precision using internal quality control data (Control Charts)
- Check for bias using a certified or in-house reference material
- If you can't find the problem, carry out full method validation

M. Koch: Method validation

M. Koch explained the principals of method validation and what is necessary under given circumstances. After a definition and introduction he put special emphasis on the calibration including linearity, residual analysis, homogeneity of variances and outlier tests. He described methods for the determination of l.o.d. and l.o.q. Selectivity and robustness of methods were also described. Finally the standard addition procedure – a calibration in the real sample – was explained. The full presentation is attached in annex 9.

M. Koch: Explanation of EXCELKONTROL 2.0 – software for control charts
M. Koch explained the new version of EXCELKONTROL 2.0 – a freeware tool for control charts programmed by Michael Gluschke and Michael Koch. The programme is included in the workshop CD.

M. Koch: Measurement uncertainty revisited
Based on the EUROLAB Technical Report No. 1/2007 “Measurement Uncertainty Revisited” M. Koch described alternative approaches to uncertainty evaluation. These approaches can be grouped into

- two intralaboratory approaches
  - Modelling approach (often called the “GUM approach”)
  - Single laboratory validation approach
- two interlaboratory approaches
  - Interlaboratory validation approach
  - PT approach

The full presentation is included in annex 10.

Thursday, 06 December 2006

Lab visit

SADCWaterLab General Assembly

Lab visit
In the morning the participants could visit the laboratory facilities of the Tanzania Bureau of Standards.

SADCWaterLab General Assembly
Kezia Mbwambo welcomed all members as chair of SADCWaterLab and gave a short introduction for new participants. Donald Masuku, the secretary, presented the agenda, which was adopted by the participants.
Kezia Mbwambo gave a short **report about the PMC meeting** on Monday. All subjects discussed at the PMC meeting were also on the agenda for the general assembly.
Some discussion points **remained from the previous meeting in Gaborone**. D. Masuku stated, that due to SADC regulations it is not possible to have voting rights for associate members.
The **Memorandum of Understanding (MoU)** could not yet be finalised. But this will be done during the next months.
D. Masuku reported about the status of the **new SADC standard on drinking water**. The draft at present is on the committee stage. There it goes to all members for 6 months for comments. Those will be collected by the secretary. A 3 months approval stage will follow. So the new standard is expected to be ready in September 2008.
Discussion of **parameters** in the Water PT resulted in Cobalt to be added in 2008.
Standard deviation limits were also discussed. It was agreed, that the limits for parameters where the calculated standard deviations were significantly lower than the limits should be adjusted. M. Koch will make proposals.

Patricia Ejalu sent a **status report for the microbiology PT**. This report is attached as annex 11. The Uganda National Bureau of Standards received all necessary equipment except sterile plastic bottles for sample distribution, which will be provided by PTB, staff is trained, some trial runs are in progress.
A brainstorming on possible mutual help within SADCWaterLab resulted in the following ideas:

- **exchange test methods for harmonization**
- help is needed for laboratories **how to write a quality manual**
- **training through SADCAS on quality management** issues is proposed for the next evaluation workshop
- **staff exchange** (especially visits in accredited labs for about 2 weeks) would be helpful. This could promote exchange of information on accreditation issues and technical know-how as well as harmonization of methods. Sponsorship of such staff exchange through PTB might be possible.

The **next evaluation workshop** should be held in Kampala (Uganda) together with the evaluation workshop for the microbiology PT. If this is not possible, Windhoek could be a suitable venue.
Sustainability of the PT system (without sponsoring in future) can only be achieved by **increasing the number of participants**. Therefore **national workshops** could be a good tool to raise awareness. Promotion of the PT scheme within the **SADC structures** also could be helpful.
Under the topic “any other business” the following was discussed:

- focus for next years training:
    - quality management
    - basic statistics
    - if possible there should be basic as well as advanced training to fulfil all requirements
- it was recommended to extend the EAC PT systems (with other matrices) also to SADC countries.

The discussions were summarized in the work programme 2008 for SADCWaterLab (table 6).

Table 6: SADCWaterLab work programme 2008

Put presentations on the web and inform participants	Dec 07	Michael
MoU to be finalised	Jan 08	Donald
recirculate questionnaire on used instrumentation	Feb 08	Donald
search for useful used instrumentation	ongoing	Michael/Stefan
clarify local coordinators	Jan 08	Donald
write new letter for nomination of local coordinators directly to institutions	Jan 08	Donald
redesign PT leaflet	Feb 08	Donald
microbiology PT according to work plan in report	announcement Jan 08	Patricia
install mailing list	Jan 08	Donald
PT provider to contact well performing labs in nitrate and phosphate to precisely describe their methods in the mailing list	Feb 08	Merylinda
next chemistry PT	according to decided schedule announcement Feb 08	Merylinda
evaluation workshop in Kampala (if not possible: Windhoek)	Nov/Dec 08	all
promote the PT scheme	ongoing	all
raise awareness through national workshops	ongoing	all

Evaluation questionnaire

M. Koch distributed an evaluation questionnaire (annex 12) for the workshop to be filled out by all participants.
The results of this questionnaire were as follows:

The judgement of the participants regarding

- **The venue of the workshop:**
  Very good 9
  Good 15
  Mean: 1.63 (1 for very good, 2 for good)
- **The content of the presentations:**
  Very good 9
  Good 14
  Fair 1
  Mean: 1.67 (1 for very good, 2 for good, 3 for fair)
- **The material distributed:**
  Very good 8
  Good 12
  Fair 3
  Mean: 1.78 (1 for very good, 2 for good, 3 for fair)

- **The working group discussions:**
  Very good 8
  Good 14
  Mean: 1.64 (1 for very good, 2 for good)

The judgement of the participants regarding the different parts of the workshop on a scale from 1 (very useful) to 5 not useful):

- **Evaluation of the chemistry PT**
  1: 20
  2: 3
  3: 0
  4: 0
  5: 0
  Mean: 1.13
- **Training**
  1: 12
  2: 7
  3: 4
  4: 1
  5: 0
  Mean: 1.75
- **Lab Visit**
  1: 12
  2: 11
  3: 1
  4: 0
  5: 0
  Mean: 1.54
- **SADCWaterLab Meeting**
  1: 14
  2: 9
  3: 1
  4: 0
  5: 0
  Mean: 1.46

The most important topics (in brackets the number of participants mentioning this point):

- Measurement uncertainty training (21)
- Method validation training(20)
- Evaluation of Chemistry PT (12)
- Control charts (6)
- Experience of the PT provider (5)
- Lab visit (5)
- Quality Assurance (3)
- SADCWATERLAB meeting (3)
- PT sample preparation (3)
- Limit of quantitation (2)
- Corrective actions (2)
- Comparison of PTs (2)

- Sampling (2)
- Method performance (1)
- Calibrations (1)
- Internal auditing (1)
- Discussion of colleagues (1)
- Discussions on the way forward (1)
- Sustainability of PT (1)

Did the workshop fulfil your expectations?

Yes: 21
No: 2
Partly: 1

reasons for no or partly:

- no answer
- Time for training was too short (twice)

What benefits did you draw from the workshop?

- The training on method validation and uncertainty
- PT sample preparation, modelling approach, purity of chemicals from manufacturer, evaluation of x-charts
- It helped me to correct my mistakes; to identify the method best for the parameter; to know how provider take trouble to prepare the sample; to exchange ideas with other participants; GUM approach of measurement uncertainty
- to make sure the instrument is fully calibrated and all equipment used are rinsed properly and reporting in correct units
- ExcelKontrol software; CD on the whole workshop
- How to draw and use the control chart and how to do method validation
- Good analytical results can be obtained by proper analytical methods, good reagents etc.
- PT is a vital tool to our lab to met the national requirements; to go home and arise awareness to other labs to participate in the PT scheme; GUM approach
- too much to mention; much I expect to gain
- I learnt more about the process involved in PT preparation and dispatch; I learnt more about the various methods that give better results.; I gathered helpful suggestions from the discussions
- I learnt enough on method validation
- Better understanding of measurement uncertainty to be used in full implementation of the ISO/IEC 17025 system
- None
- General ideas in labs performance in the SADC region. But I recommend, the SADCMET to extend the testing parameters including PESTICIDE RESIDUES in water (drinking water?)
- Uncertainty
- The PT evaluation assisted me to continue improving our laboratory performance by identifying the corrective actions to be undertaken
- Exchange of ideas and knowledge. Opportunities of acquiring donated equipment. Sponsored forum which may not have ben possible, if countries were self sponsored. Training materials which are very useful. The PT is being used as a yardstick for improvement in the performance of the lab

- Knowledge and continuous improvement
- Exposure and communication establishment with the different participants
- Training on different approaches for measurement uncertainties
- Enrichment of my knowledge in method validation, calculation of uncertainties, control charts, information derived from the evaluation of the PT results
- An idea on how to go about correcting unsatisfactory results

Any other comments:

- The one week (or so) training has been so intensive, which is a good thing. However the organisation of the future evaluation workshops should leave some time at the end (say half a day) for the participants to visit some sites in the country and also to relax.
- The time schedule for technical trainings should be extended; the time for lab visits should also be increased to provide more time for healthy information exchange and discussions

Closure of the meeting

Kezia Mbwambo, Donald Masuku, Stefan Wallerath and Michael Koch closed the workshop and thanked all participants for their cooperation.

Report prepared by Dr.-Ing Michael Koch
Stuttgart, 10.1.2008