OR 23/2010

Supporting the Ethekwini air quality monitoring network in preparations for accreditation

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Preface

The visit to the Ethekwini municipality and their air quality monitoring network was done as part of supporting the Ethekwini air quality monitoring network in preparations for accreditation.

I would like to thank the team from the eThekwini Health Department for their positive support and participation in all activities during my stay.

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Summary

In November 2009 a five days visit was made to the Ethekwini municipality and their air quality monitoring network with the purpose of supporing the municipality in their work to be accredited according to ISO 17025:2005.

During the visit existing documentation was evaluated, two stations and their workshop/Calibration lab inspected and some operations were demonstrated by the technicians. The findings were presented to and discussed with the team from the eThekwini Health Department.

Network operation is according to good practice and the operators are skilled. There is a lack of documentation at the station. The forms are adequate but SOPs are missing for many operations.

Quality control is done at several levels by different persons increasing the confidence in the final data. The personnel has good knowledge about their tasks.

The current workshop facilities will not cover the needs. A total of three rooms are necessary, a workshop, test room and storage room. The rooms should be in the same vicinity. The current room can be used as either of these rooms after refurbishing.

The existing quality maual is based on ISO standard 17025 and following its structure. It forms a good basis for further development into a system that will fulfill the requirments for accreditation according to the standard. It is however not a living document. It should be revised and completed. It references many suporting documents which function should be evaluated and updated as ncessary.

Supporting the Ethekwini air quality monitoring network in preparations for accreditation

1 Introduction

In November 2009 a five days visit was made to the Ethekwini municipality and their air quality monitoring network with the purpose of supporting the municipality in their work to become accredited according to ISO 17025:2005.

During the visit existing documentation was evaluated, the Ganges and Southern Works stations as well as their workshop/Calibration lab inspected. Quality control of data and some operations were demonstrated. The findings were presented to and discussed with the team from the eThekwini Health Department.

Below is a short summary of the visit:

23 November	Visit to Southern Works station to look at station facilities and station operation.
24 November	Visit to Ganges station to demonstrate on site dynamic calibration of an analyser.
25 Novmeber	Visit to the workshop/calibration lab to evaluate the facilities.
26 November	Inspection of data quality control and data handling.
	Inspection of documentation and identification of gaps according to ISO 17025.
27 November	Presentation of findings and discussions

During the stay there were open discussions on station operation, quality control, data handling, documentation, e.t.c. The team from the eThekwini Health Department was very supportive on all issues.

Soft copies of a number of of documents were handed over to the municipality as examples of quality system documentation, see appendixes.

2 Station operation

A visit was made to Southern Works station on 23 November 2009 to look at how a regular site visit is done. Several people attended the visit including Linda who is the responsible technician at the site.

The visit was conducted according to the Weekly Station Visit Check Sheet. Upon arrival the zero check on the gas monitors (NOx, SO2, TRS) was initiated. Zero air is produced by scrubbing ambient air in an activated charcoal canister, one for each analyser. Zero air is connected to the analyser AUX port. While performing the zero check the operater checked for shelter damage, water/dust in sampling manifold/tubes, met sensors and data sampling system as well as recorded status parameters for each analyser in their respectrive Instrument Check Sheet.

Span check is done using permeation tubes weekly and a travelling standard gas cylinder monthly. Gas cylinders are of low concentration type from well know gas suppliers such as Air Liquide. During the visit the travelling standard was used. The results from the span check was recorded in the Instrument Check Sheet and in a control chart that remain at the station.

Traceability is achieved through six-monhtly dynamic calibrations performed by C&M Consulting Engineers.

Inlet filters are checked weekly and changed if necessary. During the visit a filter change was done.

2.1 Comments

The operator had good knowledge of her work and understanding of what she was doing. The visit was conducted according to good practices. The forms were adequate but SOPs were missing for all instruments except the SO2 analyser.

The door to the station stayed open during the visit. The change in indoor temperature due to the open door can influence the results of the Zero/Span checks. The influence can be tested during a span check.

Upon entering the station there was a smell of ozon, probably from breakthrough in the ozon scrubber of the NOx analyser. The scrubber material should be changed.

While activated charcoal scrubs SO2 and NO2 well it does not scrubb NO as good. Purafil has been used before to scrub NO but with mixed results. The air is drawn through the scrubber by the analyser pump. The lower inlet pressure due to resistance in the canister can influence the zero measurement. This should be validated by checking against synthetic air from a gas cylinder. To avoid the pressure drop a pump with a needle valve and a vent rotameter can push the air through the canister. Zero air should be fed through the inlet port during the monthly Zero/Span check to test the inlet line.

To get the correct status of the analyser status parameters should be recorded before initiating the zero check.

To simplify the check of status parameters acceptance limits should be added to the Instrument Check Sheets.

None of the gas cylinders inside the shelter were secured. A tipping gas cylinder can cause injure to the operator as well as equipment. If the main valve on the cylinder is open and the regulator breaks off during a fall the gas cylinder will start spinning on the floor. Gas cylinders should be secured to the wall by a chain at two heights or by a clamp to the table. A gas cylinder handling procedure can be found in Annex A.

Span check on SO2 and SO2/TRS analsyers where performed using the same SO2 cylinder. Instead of performing the span checks in series they can be performed in parallel by the use of a Y-connector. It should be evaluated if the six-monthly check of the TRS converter by the external company is sufficient or if more frequent testing is necessary.

The procedure of using permeation tubes during weekly checks and a gas cylinder every four weeks is good. There is an insufficient number of gas cylinder regulators resulting in switching of regulators between cylinders. As far as possible NO and SO2 cylinders should not use the same regulator because SO2 residues inside the regulator can influence subsequent NO readings.

One should consider recording results from the zero check in a control chart similar to the span check control chart.

Inlet filter change was done without touching the filter by fingers but a pen cap was used to get the filter in place resulting in a possible contamination of the filter by the pen cap. Gloves and a tweezer shold be considered.

Visits are recorded sufficiently in the station log book at the station.

There is a station manual at the station but it is not in use. Neither SOPs nor forms where included in the manual. The station manual should be revised and accommodated to the network's needs. The same station manual format should be used at all stations.

2.2 Conclusion

The station is operated according to good practice and the operator is skilled. The use of calibration gases from well know suppliers and the six monthly dynamic calibrations performed by the external company help securing measurements of good quality. There is a lack of documentation at the station. The forms are adequate but SOPs were missing for all instruments except the SO2 analyser. The Station Manual should be revised and populated with the necessary SOPs and forms.

3 Dynamic calibration of analysers

Calibrations are crucial to maintaining good data quality. A visit was made to Ganges station on 24 November 2009 to make a dynamic calibration of a SO2 analyser. A TEI146C calibrator was brought to the station. SO2 gas was supplied from a high concentration gas cylinder and dilution air was supplied from a gas cylinder containing synthetic air.

The calibrator can be run in both manual mode, where you specify gas and dilution air flows, or automatic mode, where you enter the cylinder gas concentration and an output gas concentration. Both modes where tested successfully. In automatic mode the output gas flow was automatically set to about 650 ml/min. This will be too little if more than one analyser is calibrated at the time. No explanation to the phenomenon was found and the operating manual should be consulted.

The SO2 analyser locked during the test at an offset of 100 ppb for unknown reasons. The offset disappeared after forcing the analyser to run a zero reference.

After subtracting the offset the results where entered into a calibration sheet provided by NILU, see Annex B.

3.1 Comments

The results from the dynamic calibration shows very good linearity indicating that both the analyser and calibrator are working good.

The calibrator has neither supporting SOPs nor forms. A SOP and necessary forms should be developed and training in use of the calibrator conducted.

Once in operation the calibrator can be used to check analysers after repair as required by SANAS and to calibrate periodically travelling standard gas cylinders in the network.

3.2 Conclusion

The dynamic calibrator is working good. A SOP and necessary forms for the use of the calibrator should be developed and training in use of it conducted.

4 Data quality control

Data is collected automatically into ENVISTA. ENVISTA will stores the unchanged raw data. Data is evaluated (technical quality control, TQC) in ENVISTA by the station operator daily. Invalid data, e.g. from zero/span checks are flagged and notes on invalid data is made in the data validation log file, one for each station.

Quality control data, measurement data and charts of all components are exported from ENVISTA to Excel by Sylvia after the end of the month. Sylvia will check the data any need for further data discrimination is discussed with the station operator and updated in ENVISTA as necessary. A new download to Excel is made If any changes are done in ENVISTA.

Nozipho will receive the Excel sheets from Sylvia. She will perform a locigal quality control (LQC) on the data based on e.g. comparison of data between stations, comparison with historic data, e.t.c. Any questionable data will be reported to Sylvia who will discuss it with the operator and make changes in ENVISTA if necessary. Comunication between LQC and TQC is documented in forms.

After LQC the last month’s data availability is presented in a management meeting. After being finally approved data is copied to AirQUIS.

The data base is in ENVISTA. Data in AirQUIS is used for reporting and other purposes, e.g. modeling.

4.1 Comments

The system seems to be working well. Data is checked at three levels, daily TQC in ENVISTA, monthly (weekly for priority stations) TQC in Excel and monthly LQC in Excel with support from AirQUIS. The quality control is strengthen by QC done at multiple levels by different persons using different tools.

QC procedures at the different levels are documented in SOPs . Transfer of data between QC levels are documented in forms. It is not certain if a SOP exists for LQC as it was not presented.

There are many steps in the QC and care must be taken not to make any errors in preparing the Excel sheets. It is vital to update the ENVISTA data base after discriminating data in Excel. One could investigate the possibility of doing both TQC and LQC in ENVISTA to strengthen the integrity of the data.

4.2 Conclusion

QC is done at several levels by different persons increasing the confidence in the final data. The personnel has good knowledge about their tasks. Part of the QC is done outside the data base system (ENVISTA) and there will be inconsistancies in the data base if results from the external QC is not updated in ENVISTA.

5 Work facilities at home office

The Pollution Control Support Section uses a former projector room as combined workshop, test lab and storage room, mostly the latter. The room is long and narrow and is next to an auditorium. It is open to the auditorium through holes in the wall. A tall bench runs along on wall and a narrow bench runs along the parallel wall. The room was packed with gas cylinders, old analysers and packing boxes.

5.1 Comments

The two benches are too high and too narrow respectively for use as work benches. To make the room suitable for working on air quality measurement equipment it will have to be emptied completely and new work tables of proper height and width installed. A steel framed shelf for storing analysers could be installed along the far wall. The holes in the wall must be closed to prevent noise from pumps and instruments disturbing the audience in the auditorium. After refurbishing it will still be only one room for repairs, testing and storage which is not adequate.

A typical schedule when an anlyser is returned for service or repair is:

1. Repair and service analyser
2. Let the analyser run on test for a few days
3. Calibrate the analyser
4. Prepare the analyser for shipment or store it

Repair and service is done with the analyser off. This can take anyting from a few hours to days. During testing and calibration the analyser, pump, e.t.c. will run continuously. The noise is large and one should use hearing protection if working in the same room for longer periods. It will not be possible to combine the test area with office space. It is necessary to have a storage area for various equipment, e.g. analysers, pumps, packing boxes and gas cylinders. Especially gas cylinders must be stored separately from work areas as they have to be secured properly to prevent them from causing injuries when falling over.

In order to separate the noisy test area from the repair and service area and have secure storage of gas cylinders and other equipment three rooms are required, a workshop, a test room and a storage room. An example is shown in Annex C. The example is a minimum requirement including a 24 m^2 workshop, 16 m^2 test room and a 10,5 m^2 storage room.

5.2 Conclusion

The current room will not cover the needs. It can be used as either a workshop, test room or storage room after refurbishing but. A total of three rooms are necessary. The rooms should be in the same vicinity.

6 Accreditation and gaps

The Pollution Control Section aims at being accredited according to ISO 17025. The work is started and a draft Quality Manual has been developed. The chapter numbering of the Quality Manual follows the chapter numbering of ISO 17025 which is good. The conentent of the Quality Manual is good.

The Quality Manual makes references to a number of supporting documents which status is unknown, see Table 1.

Table 1. Supporting documents

Reference	**Possible title or content**
MP012	Training of personnel Continuous improvement of the management system
MP001	Control of records
MR002	Customer feedback and manangement reviews
MP003	Document control and management procedures
MP004	Contract andling
MP005	Supply chain management and suppliers list
MP007	Weekly report note and data administor's emailing stakeholders
MP008	Customer complaint procedure
MP009	Corrective actions Preventive actions and improvements
MP010	Internal audits and schedule
MP011	Actions after management review
MP013	Protection of electronically stored data
TP001	Data collection or validation Sampling in an automated environment
TP002	Data flagging/QC Station visit and check
TP003	Intermediate calibration checks Method validation
TP004	Uncertainty estimation
TP005	Protecting data from computers and automated equipment
TP006	Equipment handling and calibration procedure, calibration schedule
TP007	Safe handling, transport and storage of testing equipment
TP008	Equipment maintenance
TP013 TP014 TP015 TP016	Report amending and new report
TP017	Result reporting
TP	Year planner for scheduled maintenance
TP xxx	Data protected from external interference

The function and use of the supporting documents has to be evaluated. All of them are probably necessary in one form or the other to fulfill the requirements of ISO 17025.

The quality manual references in addition a number of other documents, see Table 2.

Table 2. Other documents

Appendix 02 Authority and resources held by managerial and technical personnel
Municipal Manager's circular No. 20/2002
eThekwini Municipality City Managers Circular No. 04/2006
Monthly meeting schedule
Document control and management procedure in Pollution Control Section
The laboratory's Master list of documents in the quality system
Records of Contract reviews (contracts with customers)
Records of actions to assure that purchase of supplies and services has sufficient quality
Purchasing procedure
Weekly report note
Data administor's emailing stakeholders
Complaint report
Personnel job descriptions
Records of competence (CVs) of personnel
Recording of environmental conditions according to SANAS RO7-01
Invetory list of all equipment and software used at stations and in office
List of all testing (measurement) methods used
Documentation of calculations and data transfer

Likewise the function and use of these documents has to be evaluated too.

In addition to the documents listed above several SOPs and forms exists. A complete list of existing documentation should be compiled and the need for more SOPs and forms evaluated. In principle all activities that may effect the quality of data has to be documented.

A suggested way forward is to familiarize oneselves with the Quality Manual by reading it in parallel to ISO 17025. This is quite informative and helps explain some of the issues of the standard. It is helpfull that the chapter numbering is almost identical in the Quality Manual and the standard. A next step is to identify the supporting documents in Table 1 and 2 as well as identify other necessary procedurs and forms and start developing what is necessary.

The need for an inventory data base and history log book of equipment was discussed. Annex D shows a simple example of how this can be combined into one Excel sheet. The application can be developed into an Access data base and become even more powerfull. Annex E shows an example of a Service report that can be used for service, repairs and regular maintenance. It includes a parts list.

Some other documents and forms were discussed and modified during the visit, see Annex F. They include:

- Station history file. The history log book of the station
- Station manual . The compilation of documents kept at the station
- Incident report. Report file from site visits.
- Routine site visit. ML9850 SO2 monitor. Registration form.
- Routine site visit. R&P TEOM1400 (A, AA, AB) particulate monitor. Reg. form.

A presentation on requirements for accreditation was given to the staff, see Annex G.

Appendix A

Gas cylinder handling procedure

SOP Installing a gas cylinder

Contents of SOP:

1 Purpose of SOP

To describe how to assemble and disassemble a gas cylinder and regulator.

2 Applicability and description of equipment

This SOP applies to handling of gas cylinders.

The gas cylinder unit consists of the gas cylinder, protective cap, gas pressure regulator, gas output tube and a mounting bracket.

Gas cylinders may contain high or low concentration gas. High concentration gas is always diluted in a calibrator before it is fed to the analysers. Low concentration gas cylinders contain “outdoor” concentration gas. They are connected directly to the analyser but without pressuring it.

Never transport a gas cylinder without its valve-protection cap firmly in place. During transportation, cylinders should be properly secured to prevent them from falling or dropping. Before removing the valve-protection cap, gas cylinders should be properly secured by using a floor stand, wall bracket or bench bracket.

3 Responsibilities

Personnel handling gas cylinders will be thoroughly knowledgeable of the contents of this SOP and will comply with its requirements when handling gas cylinders.

1 Instrumentation

This SOP assumes the following instrumentation:

- Gas cylinder
- Regulator
- Dwyer MiniMaster rotameter (low concentration cylinders)
- Y-connector (6 mm) with silicon sleeves (low concentration cylinders)

The regulator type depends on the gas cylinder type. Table 1 show some typical reference and working/travelling standard regulators.

Table 1. Gas cylinders and typical regulators

Gas cylinder	**Pressure regulator**	
	Model	**Threading**
NO	Two stage, Stainless steel	Clockwise inside
SO2	Two stage, Stainless steel	Counter clockwise inside
CO	Two stage, Brass	Counter clockwise outside
HC	Two stage, Brass	Counter clockwise outside

2 Gas cylinder dismantling procedure

<u>Dismantling a gas cylinder:</u>

3 Close the cylinder valve.

4 Close the output needle valve by turning it clockwise.

5 Close the regulator adjusting knob by turning it counter clockwise until it runs freely.

6 Disconnect the gas output tube at the regulator using a spanner turning it counter clockwise.

7 Open the regulator adjusting knob by turning it clockwise.

8 Open the output needle valve a litle by turning it counter clockwise. The regulator is no pressureless

9 Close the output needle valve by turning it clockwise.

10 Close the regulator adjusting knob by turning it counter clockwise until it runs freely.

11 Disconnect the regulator from the gas cylinder using an adjustable spanner turning it in the proper direction depending upon the regulator type.

12 Install the protection cap on the cylinder valve.

Quality Manual		AQM Network NNNN - MMMM
Document:	Page	: 3 of 1
SOP Installing a gas cylinder	Date	: 2006.09.01
	Issue No	: 001

1 Gas cylinder installation procedure

Installing a gas cylinder:

- Properly secure the gas cylinder by using a floor stand, wall bracket or bench bracket.
- Remove the protection cap.
- Remove any dust or dirt from the regulator or cylinder valve output with a clean cloth.
- Stand on the side of the cylinder opposite the cylinder valve output and open the cylinder valve for 1 second to blow away any remaining dust in the valve output.
- Connect the regulator to the gas cylinder using an adjustable spanner turning it in the proper direction depending upon the regulator type. Tilt the regulator to horisontal position to let it swing back to vertical position during tightening.
- Close the output needle valve by turning it clockwise.
- Close the regulator adjusting knob by turning it counter clockwise until it runs freely.

During operation the gas flow through the regulator is very small. After the regulator has been connected to the cylinder it must be flushed to remove all residues of ambient air.

Flushing the regulator:

2 Disconnect any output line at the output needle valve.

3 Close the output needle valve by turning it clockwise.

4 Close the regulator adjusting knob by turning it counter clockwise until it runs freely.

5 Open the cylinder valve until the high pressure gauge indicates the full cylinder pressure.

6 Turn the regulator adjusting knob clockwise till the secondary pressure gauge indicator begins to move and indicates 2-5 bar.

7 Close the cylinder valve.

8 Open the output needle valve slowly and close it again just before the secondary pressure drops to zero.

9 Close the regulator adjusting knob.

10 Repeat steps 4 to 8 four times.

<u>Connecting the gas cylinder to external equipment:</u>

2. Close the output needle valve by turning it clockwise.
3. Close the regulator adjusting knob by turning it counter clockwise until it runs freely.
4. Connect the gas output tube at the regulator output needle valve, thightening the nut using your fingers.
5. Tighten the nut using a spanner and turning it clockwise ½ turn.
6. Disconnect the other end of the tube in order to flush the tube with gas.
7. Open the cylinder valve till the high pressure gauge indicates the full cylinder pressure.
8. Turn the regulator adjusting knob clockwise till the secondary pressure gauge indicator begins to move and indicates approx. 20 bar. See calibrator manual if the cylinder will be connected to a calibrator.
9. Open the output needle valve. Flush the tube for 5 seconds.
10. Close the output needle valve by turning it clockwise.
11. If the cylinder will not be connected to a calibrator skip the rest of ths section.
12. Connect the output tube to external equipment (calibrator, etc.).
13. Open the output needle valve.
14. Give sufficient time for flushing the external system before first time use

When connecting a low concentration gas cylinder to an analyser it is important not to pressurise the instrument. A rotameter is connected via a Y-connector to the regulator output needle valve. The third end of the Y-connector is connected to the monitor inlet tube during calibrations. The rotameter indicates correct flow and ventilates excess gas.

Appendix B

Calibration sheet

SO2 analyser calibration report - ML9850 A/B

Client	eThekwini Mun.	Calibrating inst.	eThekwini Mun.		
Analyser Serial No.		Performed by	Stembiso / Leif		
Location	Ganges station	Date	2009.11.24		
Purpose	Calibration	Time Begin/End	10:00	14:00	
		Testing Before (B) or After (A) adjusting:			A

Calibration Equipment

Calibrator Model	TEI146C	Reference gas cylinder		
Serial No.		Serial No.		
Zero Air Model	Synth. air gas cyl.	Concentration SO2 [ppm]	93.55	
Serial No.		Expiry Date		
		Pressure [Bar]		

Environment

Temperature [°C]		Rel. humidity [%]		Pressure [hPa]	

Displayed Instrument Parameters

Flow [l/min]	0.47 - 0.53					
Pressure [torr]	510 - 800					
Cell temp.	47 - 53					
Chassis temp.	15 - 55					
Flow temp.	45 - 55					
Cooler temp.	8 - 12					
					Instrument Units	ppb

Two Point Calibration

Response Before (B) and After (A) adjustment

	Instr. Gain (K)	Instr. Offset [ppb]	Zero Reference [ppb]	Zero Measure [ppb]	Span Reference [ppb]	Span Measure [ppb]	True=a*Meas+b True=a*(Meas-Zero) a	b	PASS/ FAIL
SO2 (B)			0.0	100.0	696.4	838.0	0.944	-94.36	
SO2 (A)			0.0	0.0	694.4	738.0	0.941	0.00	FAIL!

Post calibration check (A) shall be within 1 % of expected span value for both span and zero

Use **Before adjustment** if purpose of calibration is to document status before maintenance, service or repairs

Use **After adjustment** if purpose of calibration is to document status after maintenance, service or repairs

Response Time Test	Relevant? (y/n)	N

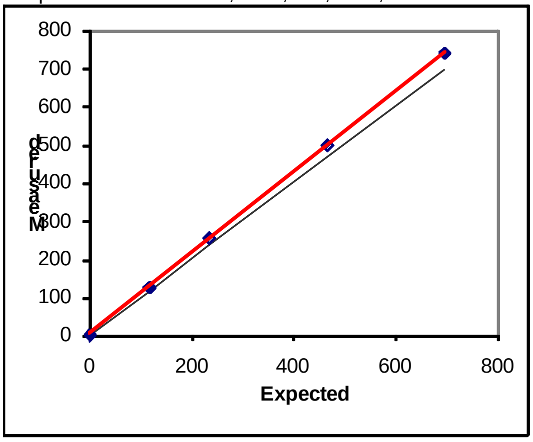
	Span level [ppb] Expected	Measured	90% level [ppb]	Rise time [sec]	10% level [ppb]	Fall time [sec]	Diff. [sec]	Rel. diff. [%]	PASS/ FAIL
SO2							0.0		

Maximum allowed relative difference between rise and fall time is 10% or 10 seconds
Response time shall be less then or equal to 180 s

Linearity Test	Relevant? (y/n)	Y

Level % of CR	Use MFCs Zero air [LPM]	Gas [SCCM]	SO2 [ppb]	SO2 Expected [ppb]	Meas. [ppb]	Relative residual
Zero	4.000	0.0	0.0	0.0	0.0	-2.4
20% CR	4.000	5.0	116.8	116.8	125.0	-1.0
40% CR	4.000	10.0	233.3	233.3	254.0	1.9
60% CR	4.000	20.0	465.4	465.4	497.0	0.3
80% CR	4.000	30.0	696.4	696.4	738.0	-0.3
95% CR						

Sequence shall be: 80%, 40%, 0%, 60%, 20% and 95% of Certification Range (CR)



Measured = a * Expected + b
a: 1.059
b: 2.43
r2: 0.99998

Zero res. test	PASS
Max res. test	PASS

Maximum allowed relative residual between regression line and measured value is 6 %
Maximum allowed residual between regression line and measured value at zero is 5 ppb

Internal Zero/Span Source Test	Relevant? (y/n)	N

Zero source	
Serial number	

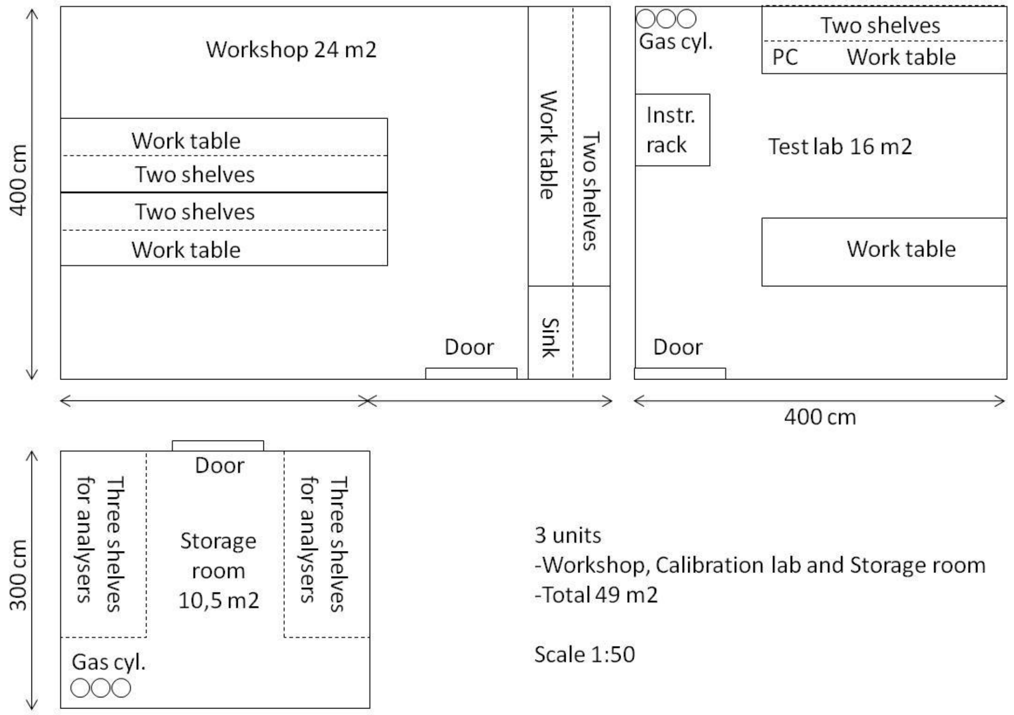
Span source	
Serial number	

	SO2 [ppb] Zero [ppb]	Span [ppb]
Old certified conc.		
Measured conc.		
New certified conc.		
Abs / Rel. dev. [%]		

Adjusted based on (A)

Appendix C

Work shop facilities


Workshop 24 m2
Work table
Two shelves
Two shelves
Work table
Work table
Two shelves
Sink
Door
400 cm
Gas cyl.
Two shelves
PC
Work table
Instr. rack
Test lab 16 m2
Work table
Door
400 cm
Door
Three shelves for analysers
Storage room 10,5 m2
Three shelves for analysers
300 cm
Gas cyl.
3 units
-Workshop, Calibration lab and Storage room
-Total 49 m2
Scale 1:50

Appendix D

Inventory database

INVENTORY DATABASE

Status:

E = Empty cyl. A = Att. R = Rep. Blank = OK

Station	Item	Make	Model	Comp	SerNo	BarCode	Status	2009.11.26
Ganges								
Ganges	Analyser	Monitor Europe	ML9841B	NOx	M1916-M776			
Ganges	Analyser	Monitor Europe	ML9850B	SO2	M1918-M713			
Ganges	Analyser	R&P	TEOM1400	PM	1400AB247920 309			
Ganges	Gas cylinder							
Ganges	Logger Hub	Office connecti		na	0100/LT3G2E0 234902			
Ganges	Logger Keyboar	Lenovo	KU-0225	na	1280590			
Ganges	Logger Monitor	Lenovo	9227-AC6	na	V6-B4772			

Appendix E

Service report

Service Report

Instrument: Serial no: Make:	Other: Serial no:
Services ☐ Maintenance ☐ Calibration ☐ Repairs – Symptom: Other:	
Date received: From: Status on receival:	
Date returned: To: Status on return:	
Actions 1.	

Part name	Part no.	#	Unit cost	Total cost
			Grand total:	

Date: Init: Signature: ____________________________

Appendix F

Additional forms

- Station history file. The history log book of the station
- Station manual . The compilation of documents kept at the station
- Incident report. Report file from site visits.
- Routine site visit. ML9850 SO2 monitor. Registration form.
- Routine site visit. R&P TEOM1400 (A, AA, AB) particulate monitor. Reg. form.

STATION HISTORY FILE

STATION:

CONTENTS:

1. STATION CHECK SHEETS

2. INSTRUMENT CHECK SHEETS

3. INCIDENT REPORTS

4. STATION HISTORY LOG

5. LIST OF DOCUMENTATION

6. STATION DATA SHEET

7. TECHNICAL INFORMATION SHEET

Station history log contains only information that can be not recorded in the Inventory data base

STATION DATA SHEET

<table>
<tr><td colspan="2">SHELTER:</td></tr>
<tr><td>MANUFACTURER (name, address, tel, fax):</td><td rowspan="2">MODEL:</td></tr>
<tr><td>SALES REPRESENTATIVE (name, address, tel, fax):</td></tr>
<tr><td colspan="2">SERIAL NUMBER:</td></tr>
<tr><td>DATE RECEIVED:</td><td>NEW ❑ USED ❑
OK ❑ DAMAGED ❑</td></tr>
<tr><td colspan="2">REMARKS ON MALFUNCTIONS AND WARRANTY CLAIMS ON RECEIVING:</td></tr>
</table>

Date:_______________ Signature:__________________________________

TECHNICAL INFORMATION SHEET

<table>
<tr><td colspan="2">STATION:</td><td>STATION ID:</td></tr>
<tr><td>ADDRESS:</td><td colspan="2">COORDINATES (X / Y):</td></tr>
<tr><td>OWNER OF PREMISES (name, address, tel, fax):</td><td colspan="2">LOCAL CONTACT PERSON (name, address, tel, fax):</td></tr>
<tr><td colspan="3">PERSON RESPONSIBLE FOR STATION (name, institution, address, tel, fax):</td></tr>
<tr><td>TECHNICAL SPECIFICATIONS:
Yes No
Stand-alone shelter: ☐☐
Air Condition: ☐☐
Windows: ☐☐
Floor number: ______
Access:
___________________________________</td><td colspan="2">TECHNICAL SPECIFICATIONS (cont.):
Electrical power circuits (no. of): ______
Electrical power sockets (no. of): ______
Intake holes in walls/ roof (no. of): ______
Benches (meter): ______
Size (L x W x H, meter): _____________
Instrument racks (no. of): ______
Telephone number: ____________________</td></tr>
<tr><td colspan="3">REMARKS:</td></tr>
</table>

STATION MANUAL

STATION:

CONTENTS:

1. PERFORMANCE ACCEPTANCE CRITERIA

2. STANDARD OPERATIONS PROCEDURES AND FORMS

3. INCIDENTS REPORT (blank forms)

The StationVisit Log is in a separate book

INCIDENT REPORT

STATION:		
Date of travel:		
Name of operator:		
Observations, results and actions:		
Notes on incidents		
Instrument		
Type / model	Serial number	Observations, results, actions etc.

Date

Signature

Routine site visit. ML9850 SO2 monitor

Site name	Site ID	Operator	Instr. sn.	Span gas Sn.	Type	SO2 concentration
				Zero air conc.		Type

	Date				
Time	Start time/End time				
Ambient	Monitor				
Operating mode					
Instr.	Flow [l/min]	0.47 - 0.53			
status	Pressure [torr]	510 -800			
	Cell	47 - 53			
System	Chassis	15 - 55			
temp. [°C]	Flow	45 - 55			
	Cooler	8 - 12			
	Changed	Inlet filter			
Maintenance	Cleaned	Fan filter			
		Interior			
Span gas		Cyl. pres.			
		SO2			
	Zero air	Min			
		Max			
Instrument		SO2			
	Span gas	Min			
		Max			
		SO2			
	Zero air	Min			
		Max			
Data logger		SO2			
	Span gas	Min			
		Max			
Inside action		Zero air			
criteria?		Span gas			
	Inlet connected to manif.				
NB!	Gas cylinder closed				
	ZAG turned off				
Comments					
Signature					

Routine site visit. R&P TEOM1400 (A, AA, AB) particulate monitor

Site name	Site ID	Operator	Instr. sn.	Inlet Sn.	
				Type	
			SES sn.	Fraction	

Time	Date				
	Start time/End time				
Ambient	Monitor	Mass Conc			
Status	Condition				
	Mode				
	Filter Load				
Temp	Case				
	Air				
	Cap				
Flow	Main				
	Auxiliary				
Mass trans.	Noise	< 0.1			
	Frequency	Noise<0.00010			
Filter	Changed y/n				
	Mode 4 OK				
	Noise	< 0.1			
	Frequency	Noise<0.00010			
	Load				
Replaced	In-line-filter	Main			
		Auxiliary			
	Flow ctrl. filters				
Cleaning	PM inlet				
	Flow splitter				
	Inlet tube				
Leak check	OffsetMain				
	OffsetAux				
	Main-OffsetMain < 0.15 l/min				
	Aux-OffsetAux < 0.15 l/min				
Comments					
Signature					

Appendix G

Presentation on requirments for accreditation


Requirements for Accreditation
Presentation at eThekwini Municipality
November 2009
Leif Marsteen, NILU
NILU
Ethekwini November 2009
Leif Marsteen
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What is quality?
It depends on your needs
Horse racing - Speed
Farming
- Strength
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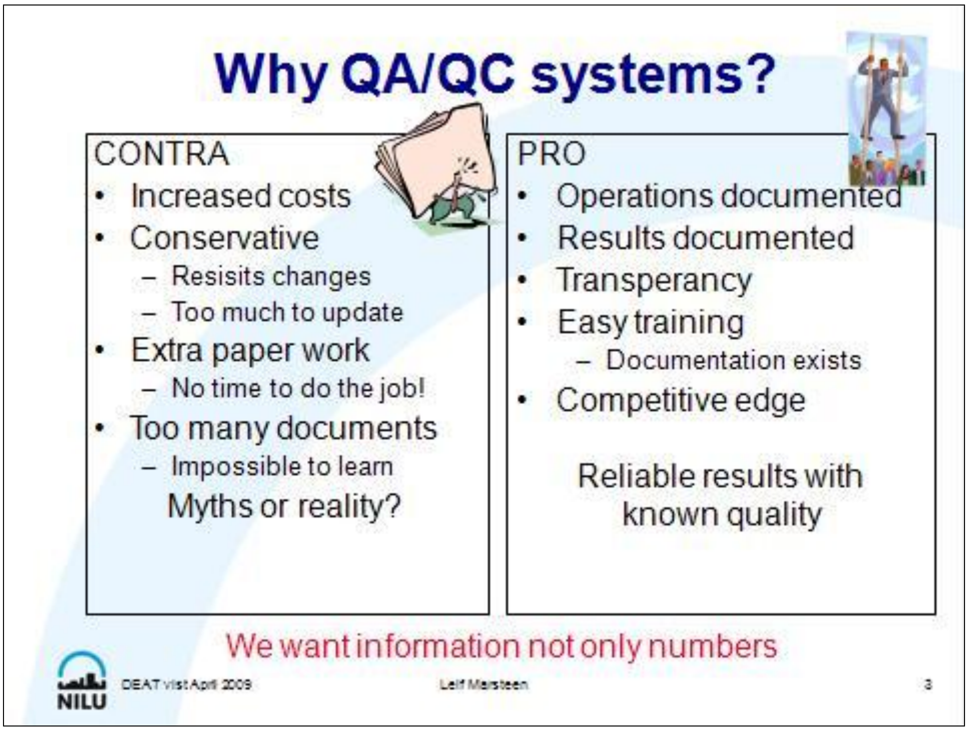
Why QA/QC systems?
CONTRA
• Increased costs
• Conservative
– Resisits changes
– Too much to update
• Extra paper work
– No time to do the job!
• Too many documents
– Impossible to learn
Myths or reality?
PRO
• Operations documented
• Results documented
• Transperancy
• Easy training
– Documentation exists
• Competitive edge
Reliable results with known quality
We want information not only numbers
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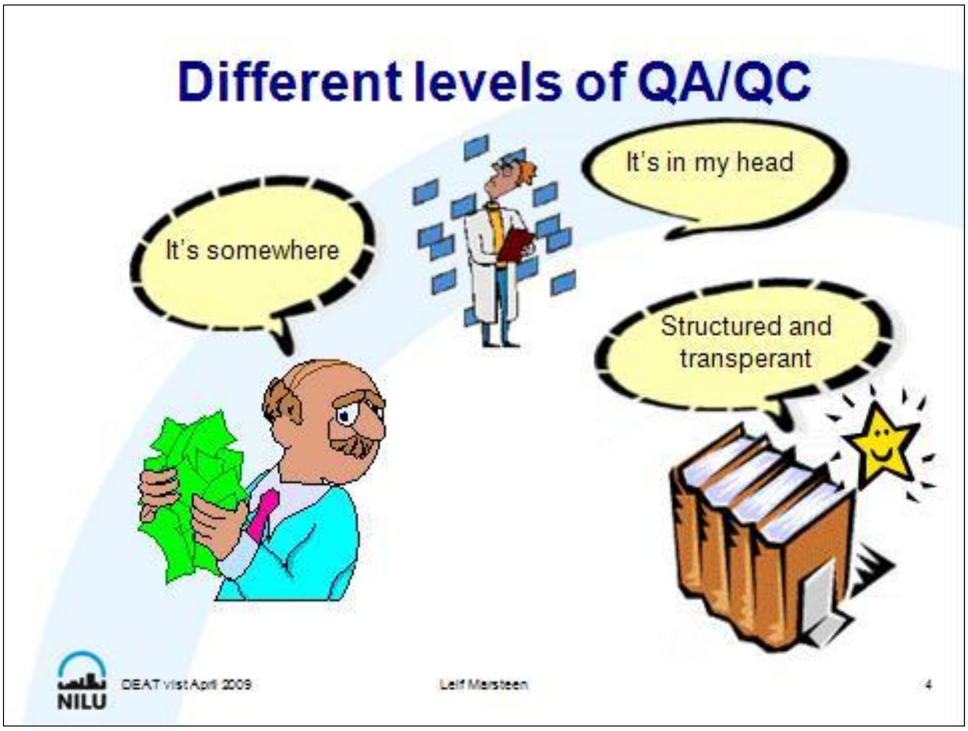
3


Different levels of QA/QC
It's somewhere
It's in my head
Structured and transperant
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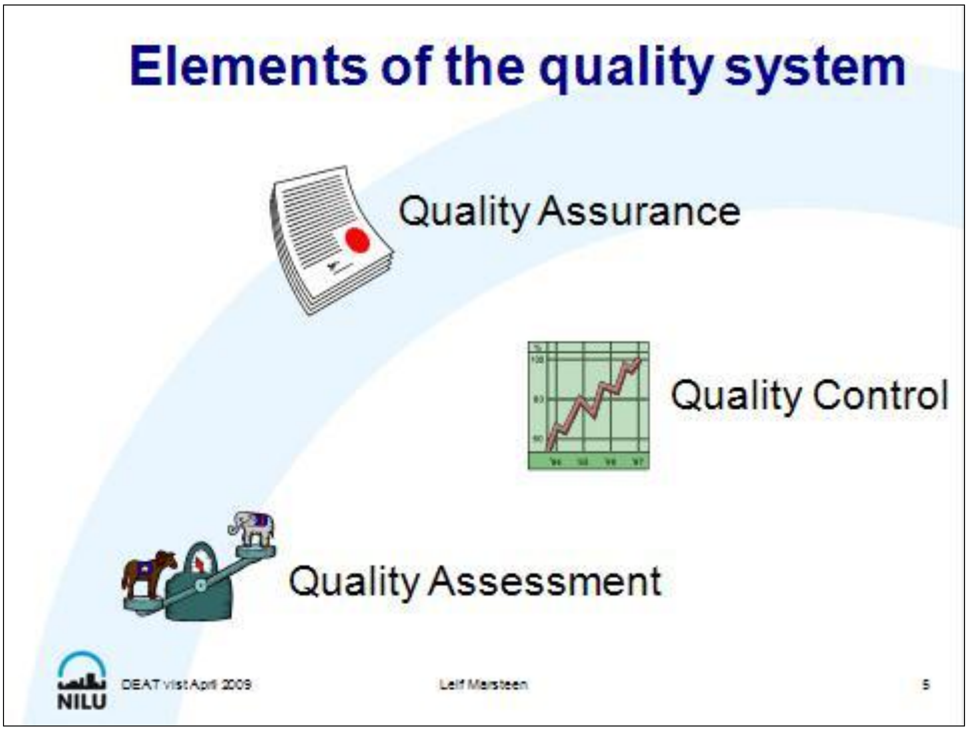
4


Elements of the quality system
Quality Assurance
Quality Control
Quality Assessment
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Quality Assurance
All planned and systematic activities which are needed to assure and demonstrate the predefined quality of data
(ISO 8402, 1994)
Described in the Quality Plan
Client's assurance that Contractor is in control
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Quality Control
Operational techniques and activities that are undertaken to fulfil the quality requirements
(ISO 8402, 1994)
Calibration and maintenance plan
Standard Operations Procedures (SOPs)
Describes how to perform and document all operations
Maintenance, calibration, repairs, data validation, e.t.c.
All operations are documented in forms
All forms are stored for later reference
No SOP!
Makes operations traceable for Client
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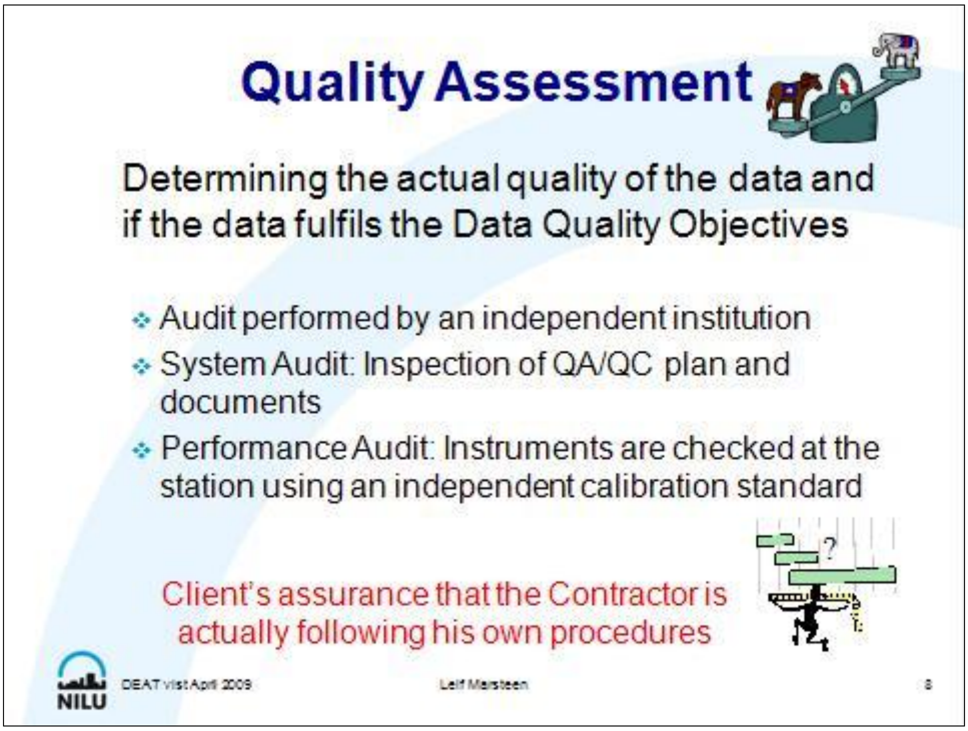
Quality Assessment
Determining the actual quality of the data and if the data fulfils the Data Quality Objectives
Audit performed by an independent institution
System Audit: Inspection of QA/QC plan and documents
Performance Audit: Instruments are checked at the station using an independent calibration standard
Client's assurance that the Contractor is actually following his own procedures
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Legal background for QA/QC systems

- EU directive (in Europe)
  - Requires QA/QC system
  - Refers measurement methods to CEN
- CEN develops standards
  - Measurement methods and QC measures
  - Laboratories must follow the standards
- ISO 17025 describes the quality organisation
  - Used by laboratories to develop quality systems
  - Used by accreditation bodies when auditing labs

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Some CEN standards

Component	Measurement method	Reference to standard
NO, NOx, NO2	Automatic Chemiluninecsence	CEN/EN142111, Standard method for the measurement of the concentration of nitrogen dioxide and nitrogen monoxide by chemiluminescence
SO2	Automatic Ultraviolet fluorescence	CEN/EN14212, Standard method for the measurement of the concentration of sulphur dioxide by ultraviolet fluorescence
O3	Automatic Ultraviolet photometry	CEN/EN14625, Standard method for the measurement of the concentration of ozone by ultraviolet photometry
CO	Automatic Nondispersive infrared spectroscopy	CEN/EN14626, Standard method for the measurement of the concentration of carbon monoxide by nondispersive infrared spectroscopy
BTX	Automatic, GC	CEN/EN14662, Ambient air quality - Reference method for measurement of benzene concentrations

Europe - CEN: http://www.cen.eu/cenorm/homepage.htm
World - ISO: http://www.iso.org/iso/home.htm

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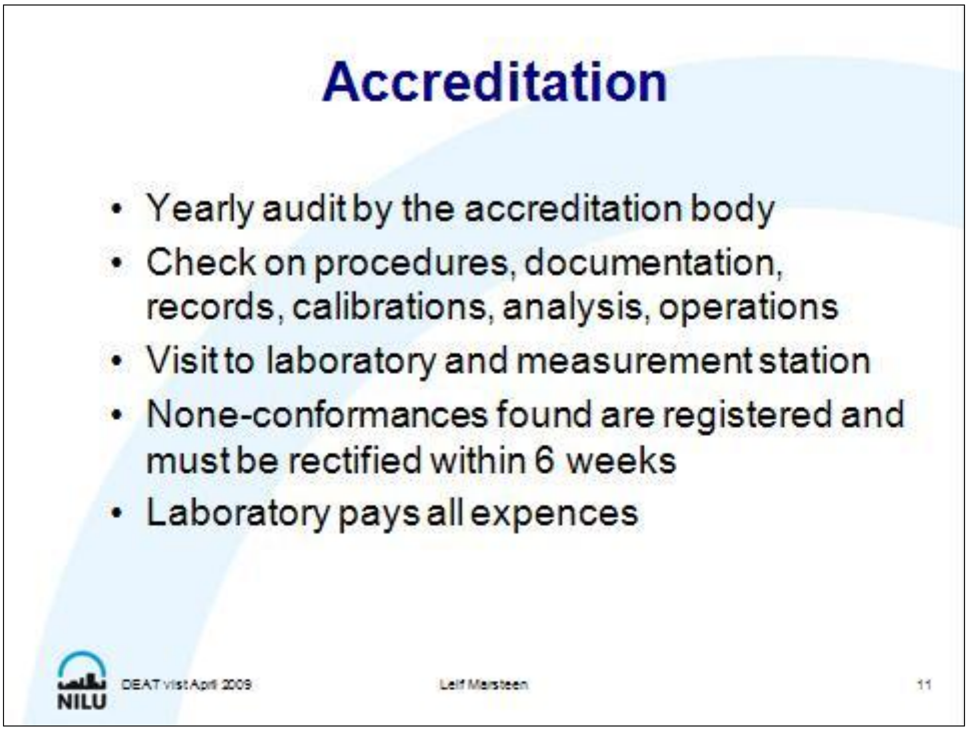
Accreditation
• Yearly audit by the accreditation body
• Check on procedures, documentation, records, calibrations, analysis, operations
• Visit to laboratory and measurement station
• None-conformances found are registered and must be rectified within 6 weeks
• Laboratory pays all expences
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Why accreditation
• Proof of performance
• Competitive edge
• Customer requires it
• Yearly external audit forces the organisation to keep systems in order and to improve
• Accreditation is mutually recognised
– Any accreditation body can give you an accreditation and then audit you
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Proofing of quality system
Accreditation

- Acceptance by an accreditation body
- Assures that your operation is according to ISO 17025

Most countries have an accreditaion body

- UKAS in England
- SANAS in South Africa
- NA in Norway

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Quality system requirements
EN ISO 17025:2005

- Management requirements
- Technical requirements

- Requirements found in
  EN ISO 17025:2005 General requirements for the competence of testing and calibration laboratories

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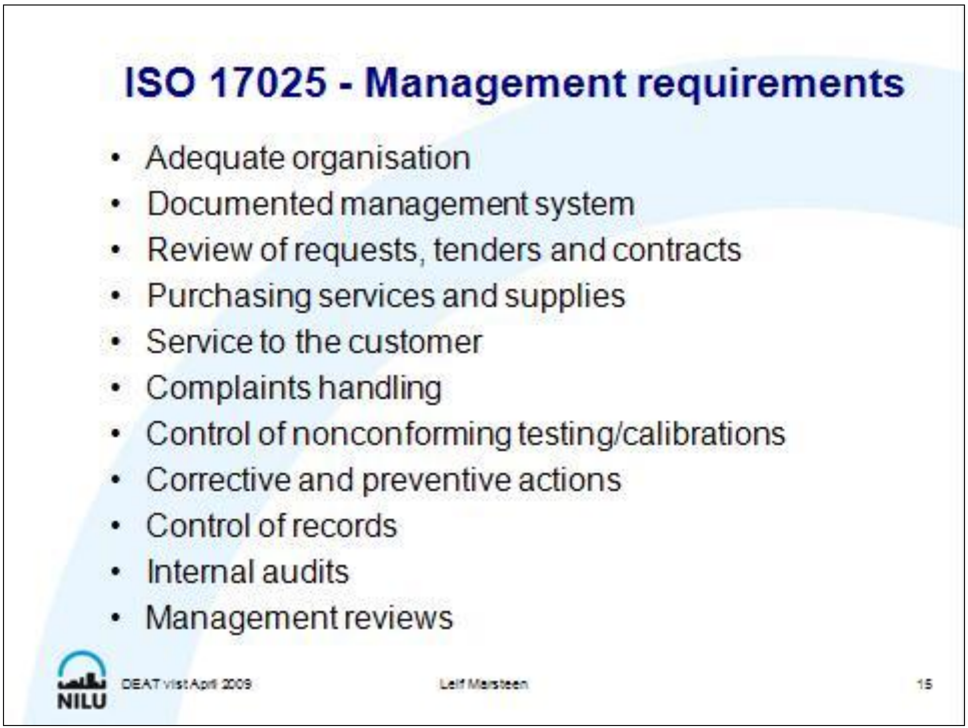
ISO 17025 - Management requirements
• Adequate organisation
• Documented management system
• Review of requests, tenders and contracts
• Purchasing services and supplies
• Service to the customer
• Complaints handling
• Control of nonconforming testing/calibrations
• Corrective and preventive actions
• Control of records
• Internal audits
• Management reviews
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ISO 17025 - Technical requirements
• Adequate personnel
• Accomodation and environmental conditions
• Testing and calibration, method validation
• Adequate equipment
• Measurement traceability
• Sampling procedures
• Assuring the quality of results
• Reporting results
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Some examples of management requirements

Adequate organisation

- List of key personnel
- Authorities and resources to carry out duties
- Define organisation, organogram
- List of personnel and their responsibilities
- Name a quality manager

Documented management system

- Define quality policy
  - Professional practise, standard of service, purpose of quality system
- Top management's commitment
- References to SOPs and other docs.
- Roles of Technical and Quality managers

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Corrective action

- Document nonconforming work, e.g.:
  - Gas cylinder concentration has changed
  - Invalid values has been reported
- Record:
  - Incident
  - Cause analysis
  - Actions
- Learn from registrations

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Thank you
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		NILU PROJECT NO. O-102092	
AUTHOR(S) Leif Marsteen		CLASSIFICATION * A	
		CONTRACT REF. (0) IM/AIR PH2 Mr. Ibbie Mahomed	
REPORT PREPARED FOR Ethekwini municipality			

ABSTRACT
The Ethekwini air quality monitoring network is reparing for accreditation according to ISO standard 17025. A visit was made to Durban to evaluate the current quality system and operations and to identify gaps. This report documents the evaluations, gaps found and gives recommendations.

NORWEGIAN TITLE
Støtte til Ethekwinis målenett for luftkvalitet i deres forberedelser til akkreditering

KEYWORDS		
Support	Monitoring	Accreditation

ABSTRACT (in Norwegian)
Ethekwinis målenett for luftkvalitet ønsker å bli akkreditert i henhold til ISO 17025. I den forbindelse ble det foretatt et besøk til Durban for å evaluere deres kvalitetssystem og organisasjon samt å identifisere mangler. Denne rapporten dokumenterer evalueringen og mangler og foreslår forbedringer.

** Classification*	*A*	*Unclassified (can be ordered from NILU)*
	B	*Restricted distribution*
	C	*Classified (not to be distributed)*

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DATE: March 2010
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