CEMS FOR COAL FIRED POWER STATIONS DEVICE CALIBRATION AND MAINTENANCE

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CONTINUOUS CEMS FOR THE POWER INDUSTRY

CONTENT

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- Regulatory requirements from a European perspective (CEMS)
  - Certification of CEMS according to EN 15267-3
- Where to install the CEMS ?
- EN 14181 Calibration and suitability test procedures (QAL2)
  - What is the QAL System
  - Elements of a QAL 2 Certification
  - Calibration
- CEMS Maintenance requirements and annual survellance (QAL3 and AST)
  - Benefits of reduced maintenance and reduced calibration frequencies
- Framework for India

  Overview of different analyzer designs

CONTINUOUS EMISSIONS MEASUREMENT

EMISSION LIMITS – EUROPE ACCORDING TO 2010_75_EU

	Emission limits for Large Combustion Plants fired with solid fuels, reference value = 6% O_2			
	IED 2011 Plant size and fuel		Limit value according to IED 2011 older plants 4) [mg/m^3]	Limit value according to IED 2011 new plants 5) [mg/m^3]
SO_2	25 - 50 MW		in development	
	50 - 100 MW	all others	400	400
		Bio mass	200	200
		Torf	300	300
	100 - 300 MW	all others	250	200
		Bio mass	200	200
		Torf	300	300
	> 300 MW	all others	200	150
		Fluidized bed	200	200
NO_2	25 - 50 MW		in development	
	50 - 100 MW	all others	300	300
		Lignite coal	450	400
		Bio mass, Torf	300	250
	100 - 300 MW	all others	200	200
		Bio mass, Torf	250	200
	> 300 MW	all others	200	150
		Lignite coal	200	200
Dust	25 - 50 MW		in development	
	50 - 100 MW		30	20
	100 - 300 MW	all others	25	20
		Bio mass, Torf	20	
	> 300 MW	all others	20	10
		Bio mass, Torf	not classified	20
CO	> 50 MW	no limits for CO		

CONTINOUS EMISSION MONITORING
LEGISLATION EUROPE

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- Certification of CEM‘s systems in Europe according to **EN15267**:
  - EN15267 – 1: General remarks
  - EN15267 – 2: Initial assessment of the AMS manufacturer‘s quality management system and post certification surveillance of the manufacturing process
    - All technical changes to the device have to be monitored and will be reviewed by the testing institute
  - EN15267 – 3: Performance criteria und test procedures
    - Laboratory test (cross sensitivity, linearity, measuring uncertainty,...)
    - Field test (availability, calibration function, reproducability, **maintenance interval,**....)
    - For overall certification: Field test at **3** types of plants necessary! (waste incinerator, power plant, cement plant)

- Quality assurance of the AMS according to **EN14181**
  - QAL1: Type approval for general applicability
  - QAL2: Function control and inital calibration at plant
  - QAL3: Ongoing quality assurance control within maintenance interval
  - AST: Annual surveillance test

http://qal1.de

| Home | Manufacturer | Systems | Components | Certificates | Contact | Imprint |

Deutsch | English

Certified measuring- and evaluating-systems according to EN 15267

Tested and certified equipment for continuous emission and ambient air monitoring is the basis of an optimal pollution control.

According to EN 14181 only suitability tested measuring and data acquisition systems are admited for continuous measurement and monitoring on governmental decree.

- The basis for the **certification** of measuring- and evaluating-systems is the European standard:
  - EN 15267 Air quality – Certification of automated measuring systems
    - part 1: General principles
    - part 2: Initial assessment of the AMS manufacturer´s quality management system and post certification surveillance for the manufacturing process
- **Emission mesurement systems** apply to the requirements of
  - EN 15267 part 3: Performance criteria and test procedures for automated measuring systems
    for monitoring emissions from stationary sources
- **Ambient air monitoring systems** apply to the requirements of
  the standard series VDI 4202 as well as the
  specific EN standards for gases respectively the EC guideline for particle.
- **Emission data aquisition and handling systems (DAHS)** apply to the requirements of
  "German uniform practice for emission monitoring,
  suitability test of measuring and evaluating-systems for continuous emission measurement",
  and the definitions for remote data transmission

Please send us your eMail address.
We will infom you about updates.
> name@company.xx <
send

Certified measuring- and evaluation systems:

- sorted by manufacturer
- sorted by system
- sorted by components
- sorted by certificate number

- Overview (pdf 409 kB, 2015-07-03)

Umwelt Bundes Amt
For our Environment

TÜVRheinland®
Precisely Right.

CERTIFICATE

about Product Conformity (QAL1)

Number of Certificate: 0000025926_01

Certified AMS:	MCS 100 FT for O_2, CO, SO_2, NO, NO_2, HCl, HF, CH_4, CO_2, H_2O, N_2O, NH_3 and TOC
Manufacturer:	SICK MAIHAK GmbH Dr. Zimmermann Straße 18 88709 Meersburg Germany
Test Institute:	TÜV Rheinland Energie und Umwelt GmbH

This is certifying that the AMS has been tested and found to comply with:

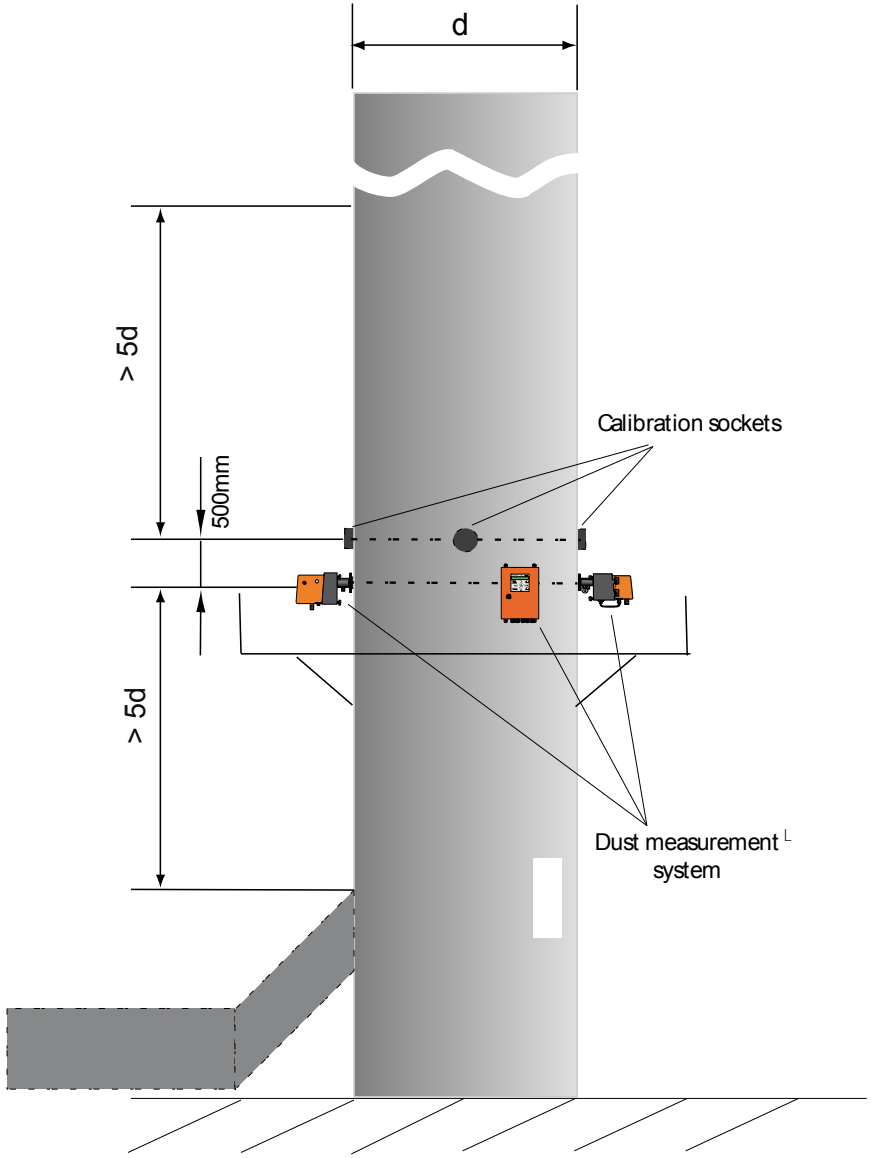
EN 15267-1: 2009, EN 15267-2: 2009, EN 15267-3: 2008 and EN 14181: 2004

Certification is awarded in respect of the conditions stated in this certificate (see also the following pages).
The present certificate replaces Certificate No. 0000025926 of 2010-02-12

GUIDE TO CHOOSING A CEM SOLUTION

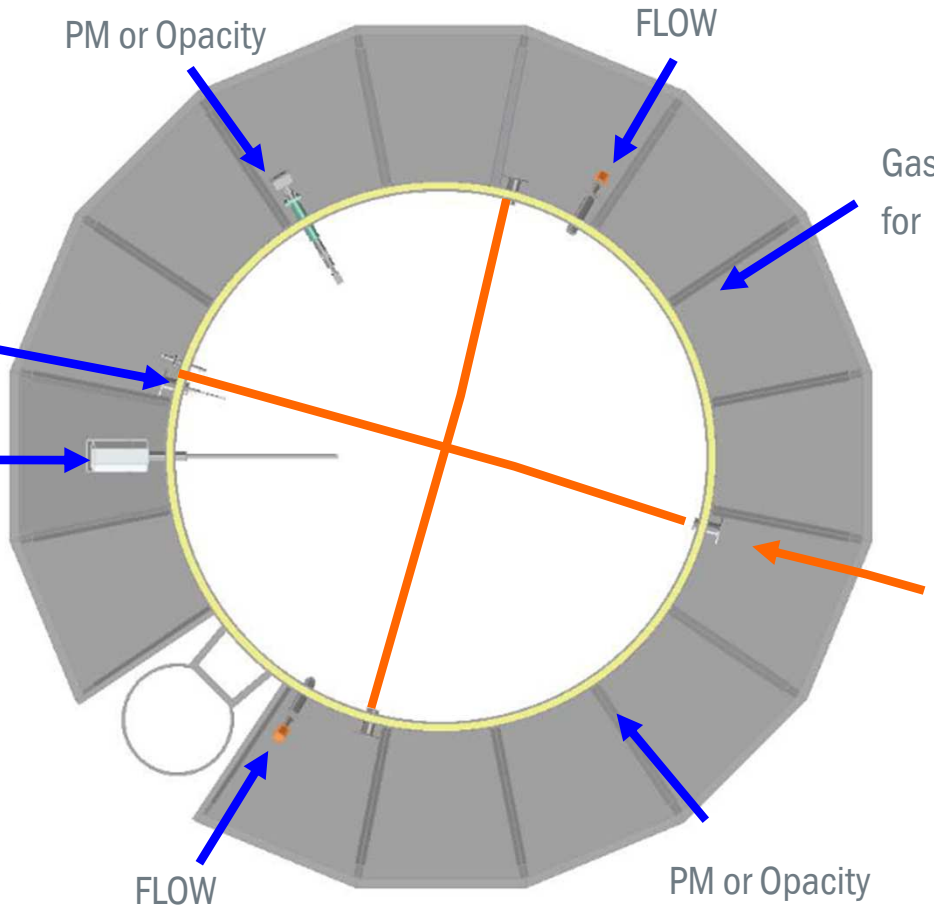
Determine the process parameters, Mounting location, measuring ranges

- Measuring location
  - Analyzer mounting position
  - Calibration ports on the stack?
  - Platform availability?
  - Wall thickness of stack?
  - Double- or single-walled stack?
  - Coated or not coated stack?
  - Stack material?
  - Insulation thickness?
  - Power supply?
  - Signal distribution?
  - Instrument air availability?



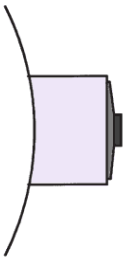
GUIDE TO CHOOSING A CEM SOLUTION

Determine the process parameters, Mounting location, measuring ranges



Calibration Ports

- Typically DN 125 mm
- for gravimetric comparison measurement (number of calibration ports are depending on the stack diameter)



Non-Homogeneous flow profile

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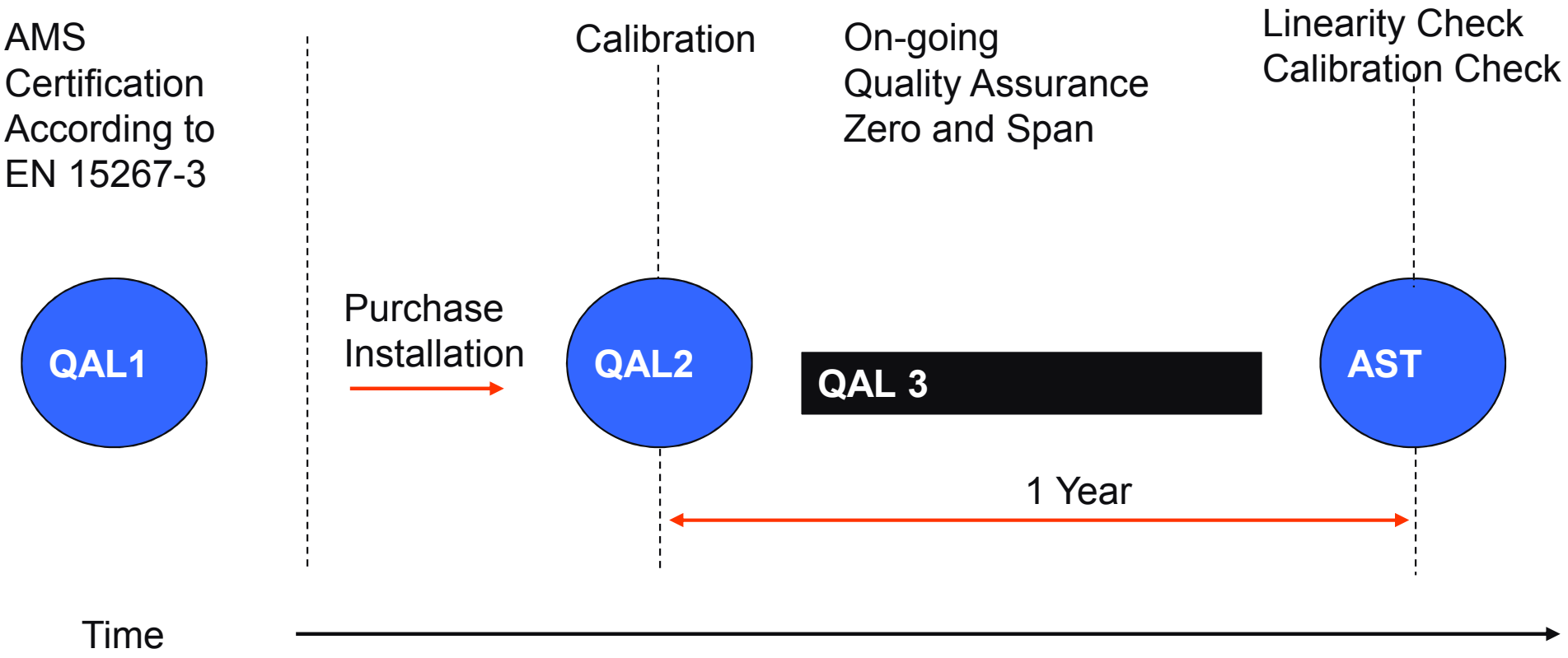
Consider the ambient situation

Mounting location indoor or outdoor? e.g. shelter, sunroof

Guideline EN 14181

: Overview on the QAL “EN14181” systematic



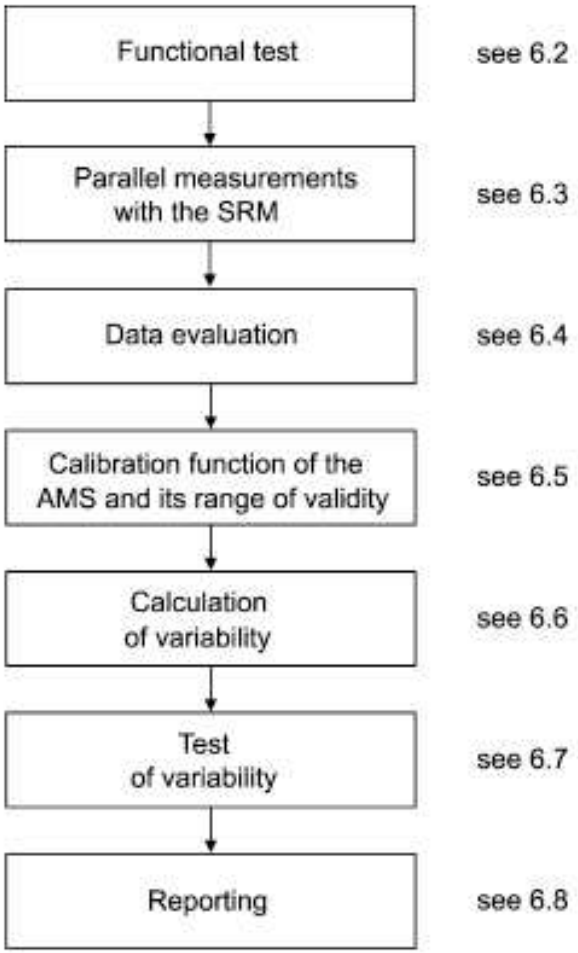


Figure 3 — Flow diagram for the calibration and variability tests

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Table A.1 – Specification of individual steps of the functional test to be performed during QAL2 and AST

Activity	Extractive AMS	In-situ AMS
Alignment and cleanliness		X
Sampling system	X	
Documentation and records	X	X
Serviceability	X	X
Leak test	X	
Zero and span check	X	X
Linearity	X	X
Interferences	X	X
Zero & span drift (QAL3 audit)	X	X
Response time	X	X
Report	X	X

CONTINUOUS EMISSION MONITORING

EN 14181 PARALLEL MEASUREMENTS AND GENERATION OF CALIBRATION FUNCTION

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Table E.3 — QAL2 measurements by the SRM

Sample number	SRM measured value at AMS conditions	Temperature	Water vapour content	O_2-content in dry flue gas	SRM measured value at standard conditions
i	y_i	t_i	h_i	o_i	$y_{i,s}$
	mg/m³	°C	%	%	mg/m³
1	8,4	85	15,4	10,7	12,6
2	9,1	85	15,8	10,7	13,8
3	8,7	85	15,8	10,7	13,2
4	9,0	86	14,8	10,8	13,6
5	8,3	86	13,9	10,8	12,4
6	8,5	85	15,3	10,7	12,8
7	10,8	86	14,3	10,7	16,1
8	10,0	87	16,3	9,8	14,1
9	10,6	86	15,5	9,7	14,6
10	10,6	86	15,1	10,8	16,1
11	11,6	80	14,5	9,8	15,7
12	12,0	81	16,8	9,7	16,6
13	13,5	79	15,0	10,9	20,3
14	12,2	79	14,4	9,9	16,6
15	9,4	84	15,8	9,9	13,2

E.2.3 Calibration function

The calibration function is described by Formula (E.2):

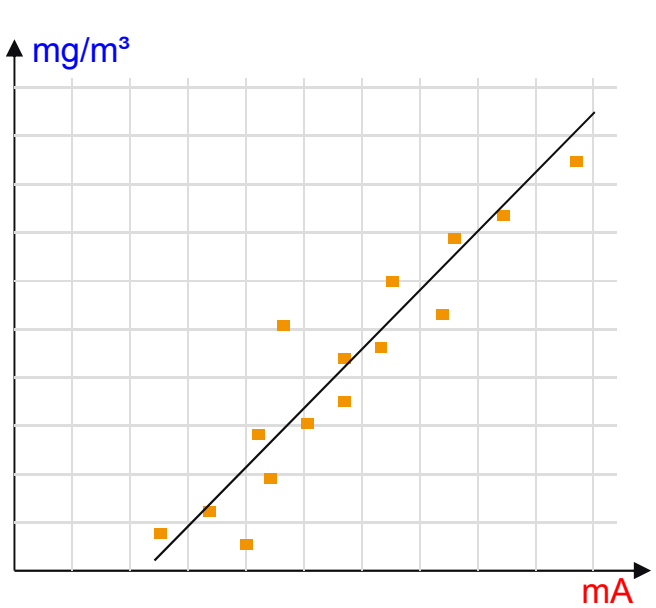
$$y_i = a + b\, x_i \qquad \text{(E.2)}$$

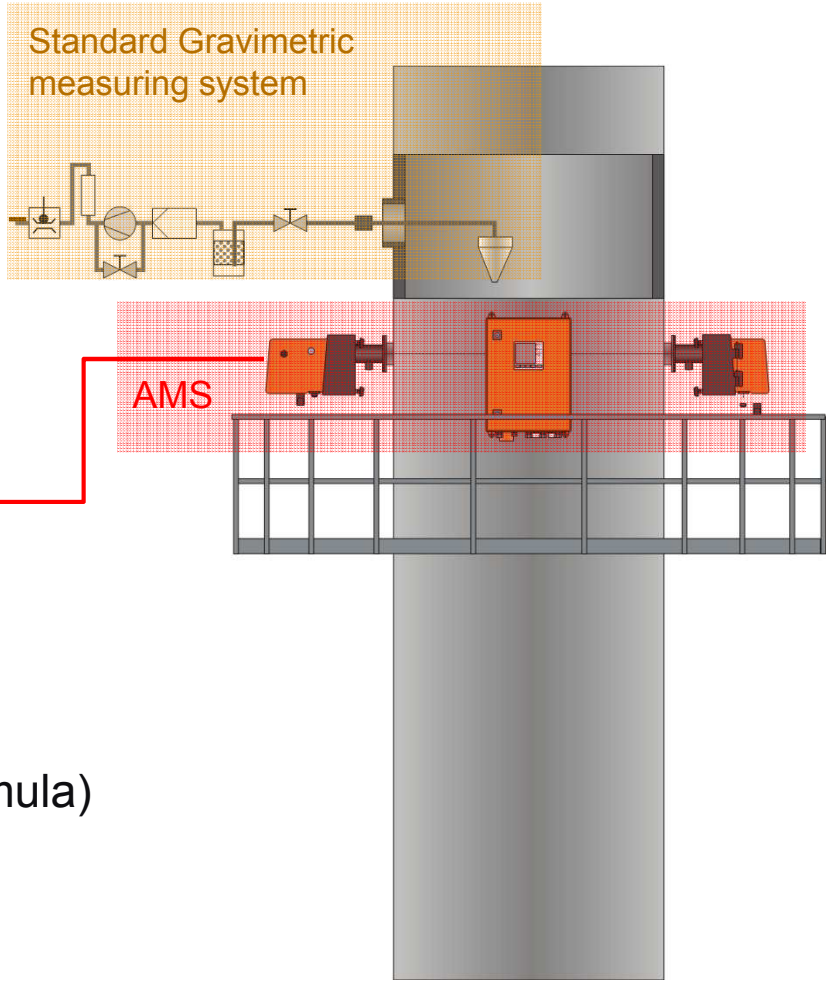
MERCEM300Z in the field test: Parameter system 1. 1st calibration

Component	Hg	
Gas condition AMS	nf	
Measuring range	0 - 43.7	µg/m³
Certification range	0 - 45	µg/m³
Calculation method *)	Straight line between all points	
Slope b	2.754	µg/m³ / mA
Axis intercept a	-11.344	µg/m³
Standard deviation s_D	1.03	µg/m³
Correlation coefficient R^2	0.9776	
Emission limit value (E)	30	µg/m³
Confidence interval	40	% of limit value
Confidence interval	12	µg/m³
15 % of limit value	4.5	µg/m³
Difference y_{smax} - y_{smin}	28.9	µg/m³

*) Difference ysmax - ysmin is higher or equal to 15 % of the limit value

CALIBRATION – GRAVIMETRIC METHOD





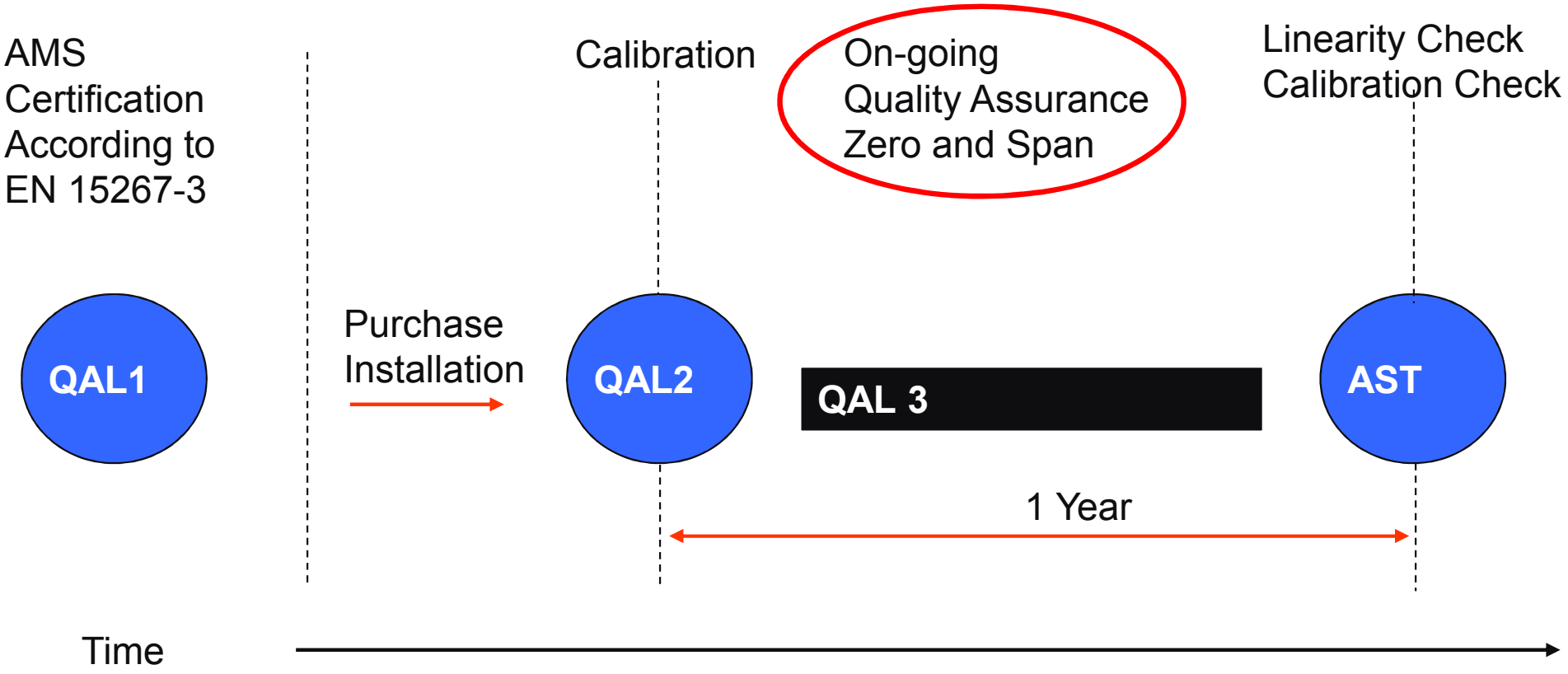
Calculation of a regression function (quadratic or linear formula)

$$\text{Concentration} = cc2 \cdot mA^2 + cc1 \cdot mA + cc0$$

Implementation into the dust monitor or in a emission measurement computer

Guideline EN 14181

: Overview on the QAL “EN14181” systematic



EN 15267 - Performance criteria and test procedures

Maintenance intervals

- **The maintenance interval shall be derived from the shortest interval between the requisite maintenance work operations. This also includes manual zero and span point checks.**
- **The maintenance interval is important for QAL3 according to EN 14181:**
  - **It defines the time span between QAL3 readings**

Maximum allowable maintenance intervals

Field test duration	Maximum allowable maintenance interval
3 months	1 month
6 months	3 months
12 months	6 months
24 months	12 months

CEMS MAINTENANCE

Ensure support resources for the CEMS

- Training for maintenance staff
- Training on different Level

CEMS MAINTENANCE

Ensure support resources for the CEMS

Target: System availability > 95%

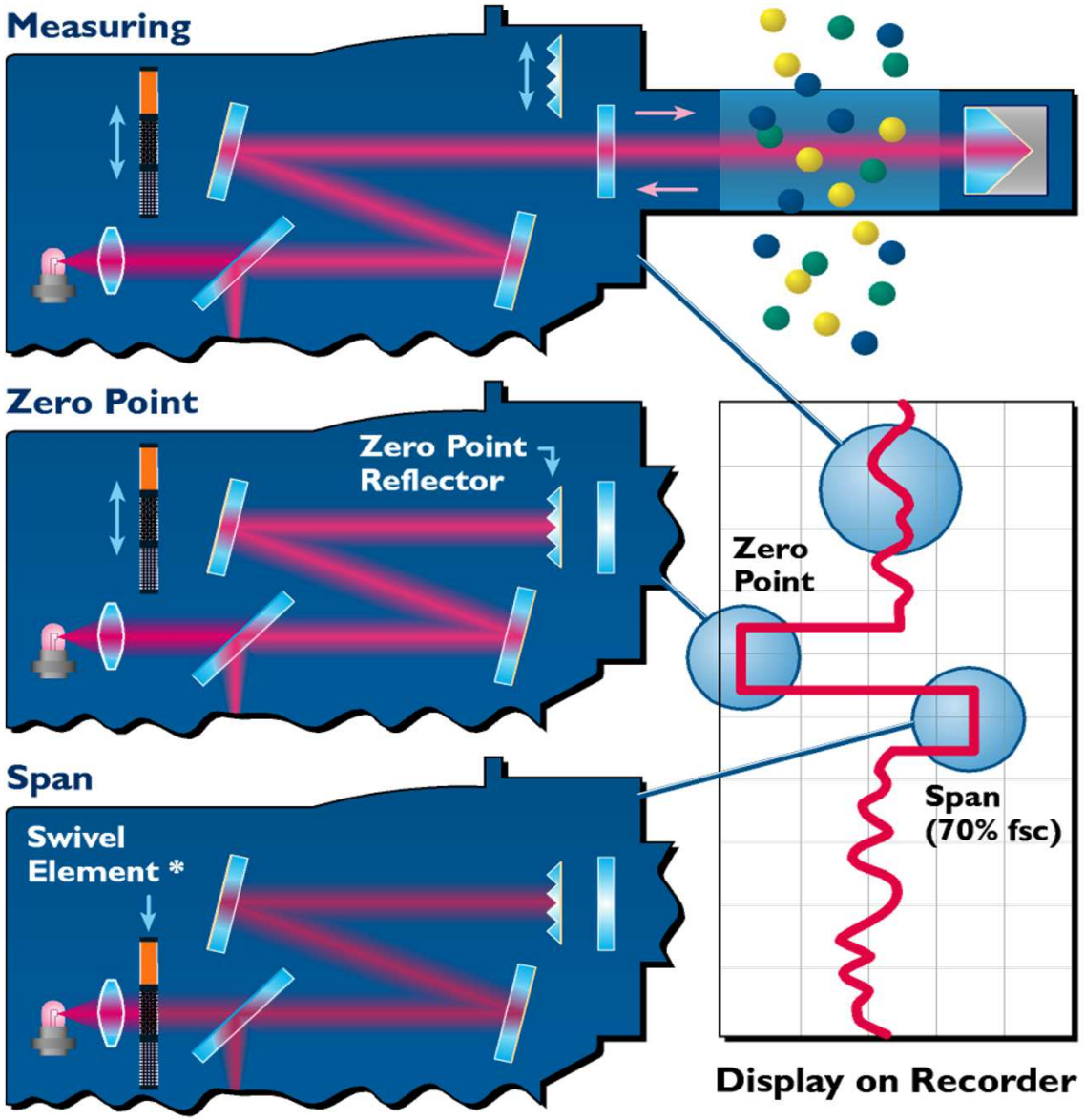
Support requirements:

- full support (engineering, installation, commissioning and start -up)
- availability of consumables on-site
- availability of critical spare parts from stock (local supplier organization)
- QAL3 zero and span without test gases
- training
- maintenance concept (e.g. Remote access)

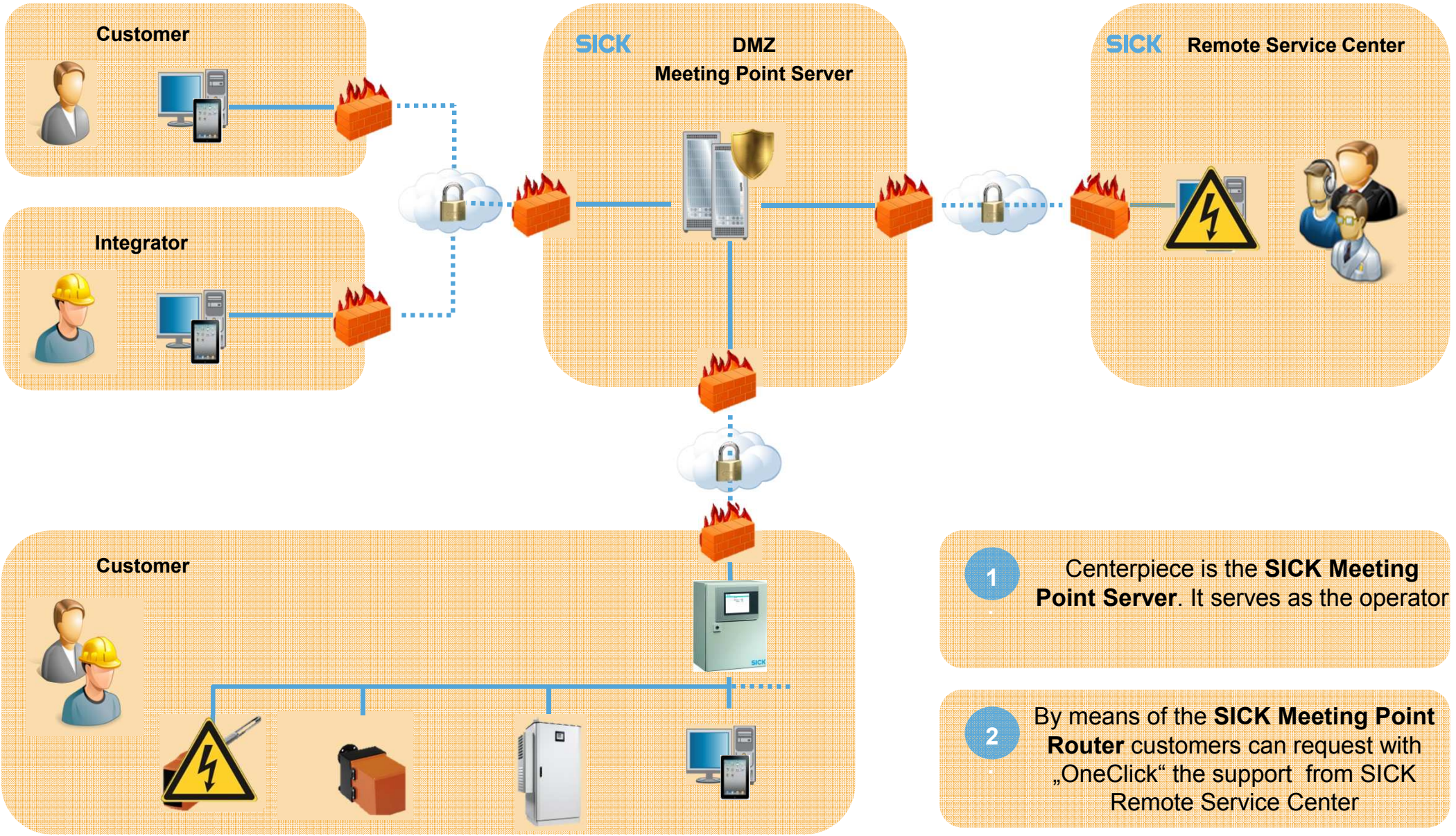
GM32: DRIFT CHECK W/O TEST GAS

: Reference cycle:
The regualar drift test is done automatically without test gas

- No cost for test gas and logistics
- No risk of wrong use
- Excellent stability proven at TUV test



SICK REMOTE SERVICE PLATFORM INFRASTRUCTURE



1. Centerpiece is the **SICK Meeting Point Server**. It serves as the operator

2. By means of the **SICK Meeting Point Router** customers can request with „OneClick“ the support from SICK Remote Service Center

CEMS MAINTENANCE

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Ensure support resources for the CEMS

Maintenance Manual

Preventive Maintenance

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Ensure support resources for the CEMS

Maintenance Intervals

Maintenance items	refer to	w[1]	q[1]
Visual inspection			
Check if measured values are plausible in the control room		x	x
Check if control cycle is (zero/span) valid (control room or recorder)		x	x
Check if there is any error message (control room)		x	x
Check mechanical damage			x
Check attachments and conditions			x
Connection unit with integrated purge air supply			
Cleaning or replace the filter insert and housing of the purge air supply, part no. 5306091	→ S. 14, §3.2.1		x
External purge air unit (option)			
Check the hoses and ring nozzles	→ S. 17, §3.2.4		x
Replace the filter insert and check housing of the purge air sup-	→ S. 16, §3.2.3		x

Framework for CEMS in India

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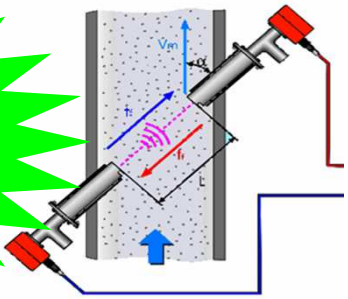
CEMS Technology Benchmarking

What are the most suitable CEMS measurement technologies for the required task?

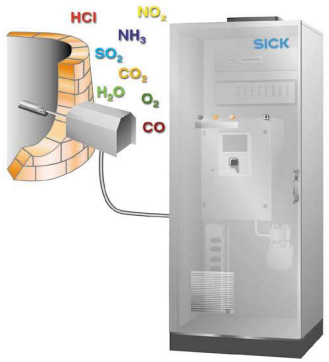
In-situ, cross-duct or probe

In-situ, flow



Technologies

Extractive COLD DRY



Extractive Hot WET

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CEMS Technology Benchmarking

		In-situ	Extractive sampling			
			Dilution	Cold dry	Hot wet FC	Hot wet FT-IR
Step 1	Maximum no. of measuring components	O	O	O	+	++
Step 2	EU compliance	+	-	+	+	+
	EPA compliance	-	+	+	+	+
Step 3	Fit for future requirements: HCl, NH_3, GHG, ...	O +	-	-	+	+
Step 4	Tolerance to alternative fuels	++	+	-	++	O
Step 5	Tolerance to critical gas components	++	+	-	++	+
Step 6	Detection limits	+	O	O	+	+
Step 7	Investment (for a typical CEMS)	O	+	+	++	+
	Lifetime cost: test gas, instrument air	++	-	-	+	+ / O *
Step 8	Demand for maintenance	++	-	--	+	O / - *
Step 9	Robustness	++	O	-	+	O

*Notes. * Depending on supplier; FC: filter correlation; FT-IR: fourier transform infrared spectroscopy*

Framework for CEMS in India

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Summary

Selection of technology depends on the CEMS- and application requirements, e.g.

- Local regulation requirements
- Gas conditions (gas matrix, gas “wet” or “dry”?)
- Certification of Analyzer by a third party
- Reliability of the Analyzer according to gas conditions
- Measurement task
- Maintenance frequency and availability of support personnel

Each solution is also dependant on investment in comparison with operational costs

Local regulation and engineering and consultancy.

MANY THANKS FOR YOUR ATTENTION.

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