



Twinning Project IL/11

Implementation and Strengthening the Environmental Framework for  
IPPC, Resource Efficiency and Eco-Management in Israel



# CEM Standards - Overview

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## Task

### Operators obligation from law or permit:

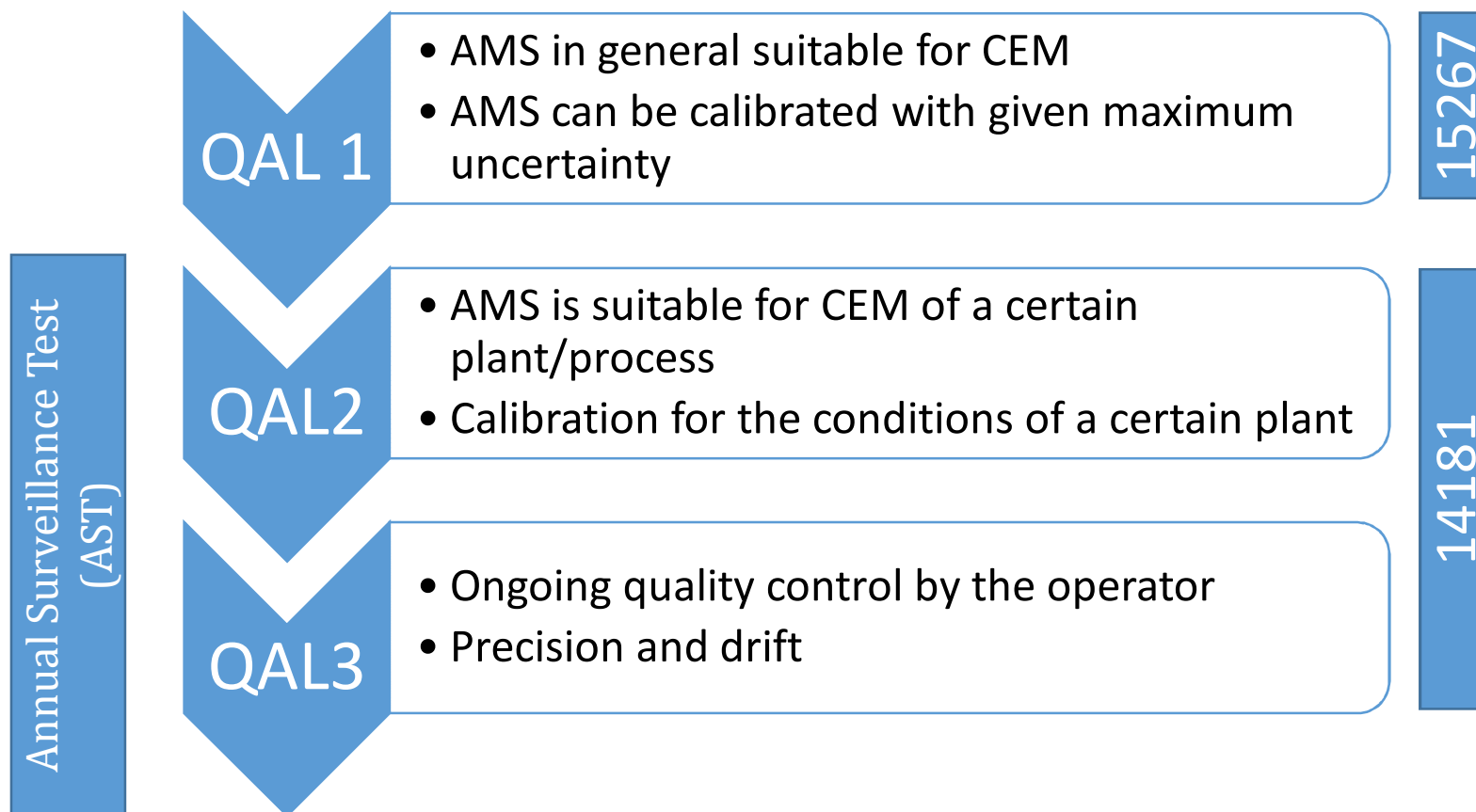
Measure the mass concentration of **x**  
continuously with a maximum  
uncertainty of **y** with an  
availability of **z**.

CEM standards describe how to fulfil the above  
stated requirements.





## Levels of Quality Assurance for CEM





## Agenda

- Presentation on type testing DIN EN 15267
- Example for quality assurance of AMS in the next talk





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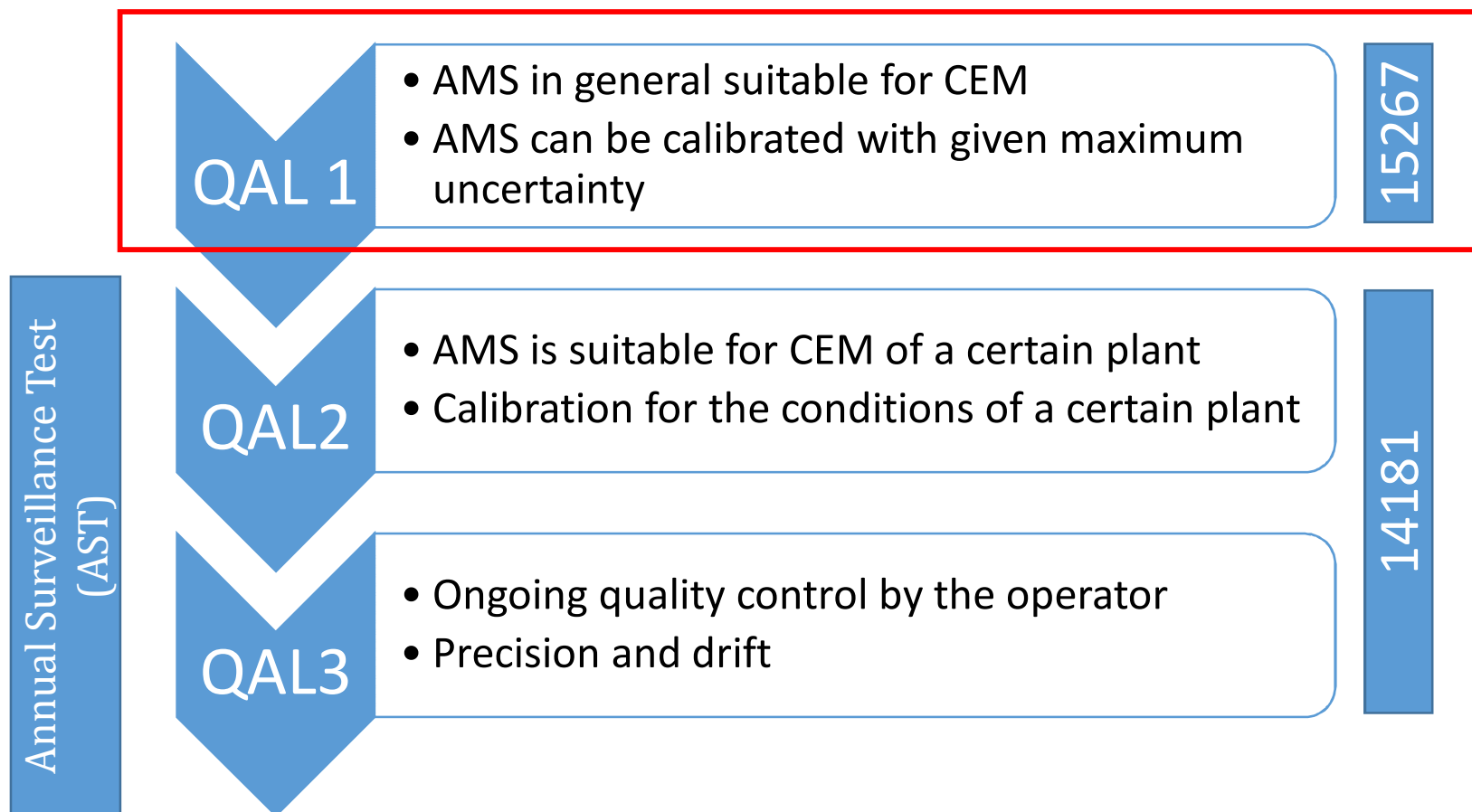
## DIN EN 15267

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## Levels of Quality Assurance for CEM





## Legal Requirements in Germany

- IE Directive (13. & 17. BImSchV)
  - Operator must ensure that CEM is state of the art
  - Operator has to use **suitable** AMS, which fulfil the requirements regarding the maximum uncertainty (Appendix of IED)
  - Operator has to ensure that the quality control of the AMS is in line with the current CEN standards
- TA Luft Nr. 5.3.3.4
  - **Suitable** AMS have to be used
  - Federal ministry designates **suitable** AMS





## What means suitable?

- The AMS has to measure the emissions correctly / comparable under all foreseeable conditions.
  - Requirements concerning uncertainty
  - Requirement that AMS can be calibrated according EN 14181
  - Requirement of robustness against changes in ambient or operating conditions
  - Requirement of stability (drift)
  - These abilities can be shown in a type test
- It is necessary to ensure that the proficiency shown in the type test is maintained in mass production
  - Certification of manufacturer and external quality audits
- Requirements of 15267-1...3







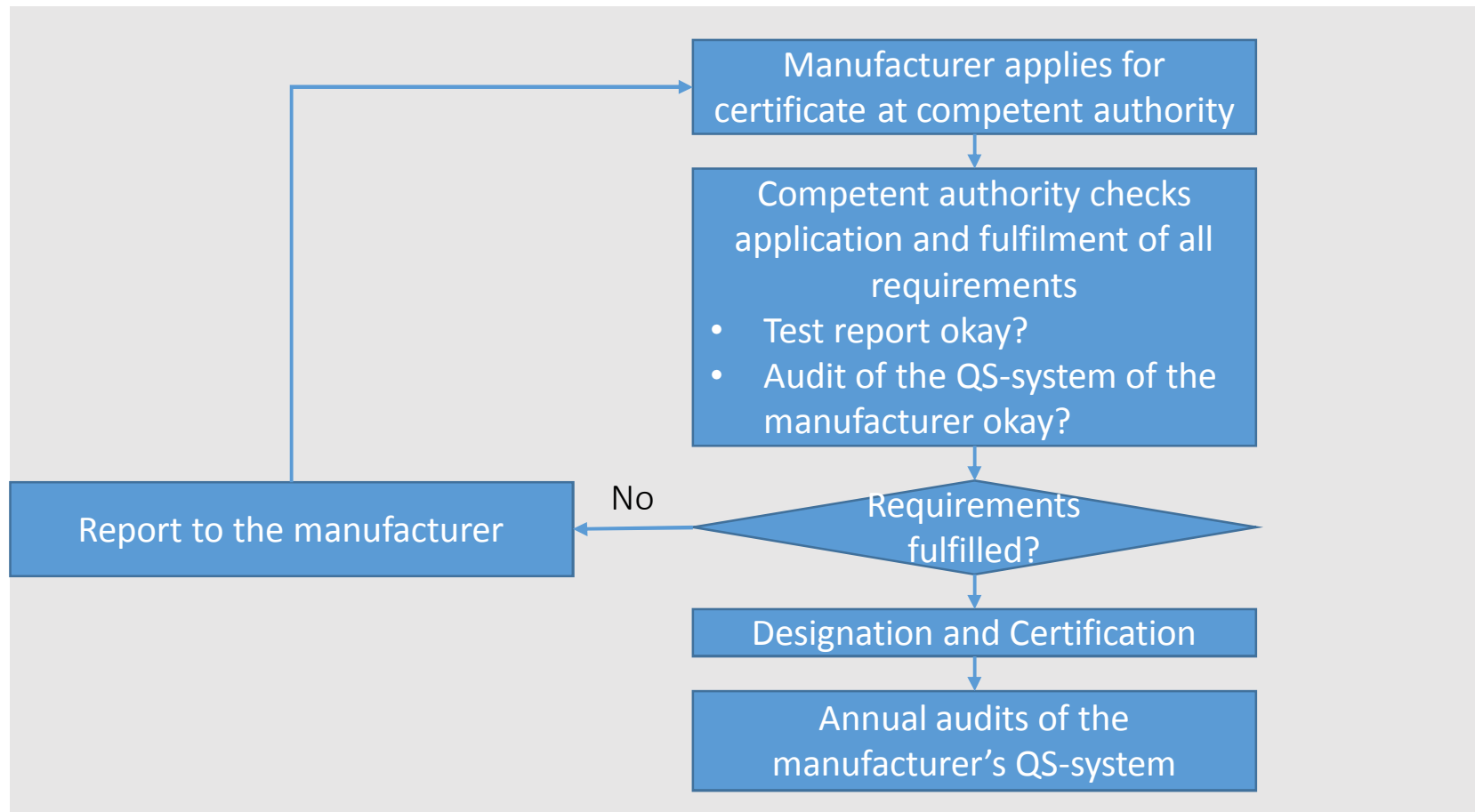
## Requirements and regulations of DIN EN 15267-1

- Requirements for Manufactures and test labs
  - Test lab
    - Accredited for type tests according to EN 15267-3 in the framework of EN ISO 17025
  - Manufacturer
    - Has to maintain a QS-system according to EN 15267-2 (similar ISO 9001)
    - Has to evaluate the effects of changes in its production on the proficiency of the AMS
- Competent authority
  - Issues certificate
  - Checks compliance
  - In Germany: Federal Environment Agency in cooperation with Environment Agencies of the states





# EN 15267-1 Process of Certification (and Designation)





## Scope of the certificate

- The certificate states, that an AMS is in principle suitable for monitoring a
  - certain ELV (given by the certification range)
  - at a certain type of plants/certain processes
- A certificate might contain limitations and special requirements for operating the AMS
- Just the existence of an certificate does not mean that the corresponding AMS can be used for monitoring at every plant.





## Type Testing According to EN 15267-3

- To be shown:
  - Measurement Uncertainty of the AMS complies with legal limit.
    - The determined uncertainty must be below 75% of the legally permitted uncertainty. (No. 14 of EN 15267-3)
  - The AMS fulfils certain requirements concerning
    - Robustness against changes of ambient conditions
    - Technical features
    - Requirements concerning cross-sensitivity, linearity, ...
- The type test consists of a lab and a field test
- Only complete AMS can be type tested
  - I. e. the certificate covers only AMS which are technically identical with the type tested AMS (e. g. special combination of analyzer and flue gas conditioning system)





## Certified Range (No. 5.2.1)

- The AMS will be used to check compliance of a plants emission with the corresponding ELV
- The AMS has to prove to be able to check the compliance with a given uncertainty
  - All tests of the type testing procedure are evaluated in respect to a “certified range”.
  - The certified range must be below 1,5 times the ELV for waste incinerators and other plants
  - The certified range must be below 2,5 times the ELV for combustion plants
- The manufacturer chooses which measurement ranges are covered by the type testing





## General Requirements and Regulations

- The type testing has to be performed with a “complete” AMS. The results are only valid for the configuration tested.
- General Requirements for the AMS (No. 6)
  - The AMS has to have a protection mechanism against unauthorized changes
  - The AMS has to have a live zero (i. e. the output range has to cover negative values)
  - The AMS needs to have a display to show its status and measurement values
  - The AMS needs to have output channels for:
    - The measurement signal
    - The status of the AMS





## Special requirements for optical in-situ AMS

- Prevention of and against soiling of optical interfaces (No. 6.7)
  - If an in-situ AMS relies on an optical measurement principle it has to have technical solution to avoid or compensate soiling of its optical interfaces.
- Deviation of the measurement light beam (No. 6.8)
  - At maximum deviation (as specified by the manufacturer, but at least  $0.3^\circ$ ) of the cross stack measurement light beam the measurement signals change must not exceed 3% of the measurement range.





## Checkpoints of labtest for gaseous components except O<sub>2</sub>

- All relative criteria are in respect to the upper limit of the certification range
- Response time  $\leq 200$  s /  $\leq 400$  s (NH<sub>3</sub>, HCl, HF)
- Standard deviation of repeatability at span and zero point  $\leq 2,0\%$
- Lack-of-fit (Linearity)  $\leq 2,0\%$
- Influence of temperature changes (-20 ... +50 °C / 5 ... 40°C) at span and zero point  $\leq 5,0\%$
- Influence of supply voltage changes (-15 ... +10%)  $\leq 2,0\%$
- Influence of vibrations  $\leq 2,0\%$
- Cross sensitivities (sum)  $\leq 4,0\%$
- Converter efficiency (NO<sub>x</sub>)  $\geq 95,0\%$







## Field test

- The field test is an endurance test
  - Two identical AMS are installed at an industrial plant for at least three month.
  - The components have to be in relevant concentrations in the flue gas of the chosen industrial plan (30-100% of ELV)
- During the field test the QS measures of EN 14181 are applied





## Checkpoints of field test for gaseous components except O<sub>2</sub>

- All relative criteria are in respect to the upper limit of the certification range
- Response time  $\leq 200$  s /  $\leq 400$  s (NH<sub>3</sub>, HCl, HF)
- Correlation coefficient  $R^2 \geq 0,90$
- Lack-of-fit (Linearity)  $\leq 2,0\%$
- Availability  $\geq 95,0\%$
- Minimum maintenance interval: 8 days
- Drift at zero and span point during maintenance intervall  $\leq 3,0\%$
- Repeatability  $\leq 3,3\%$





## Uncertainty check

- The relative uncertainty is calculated based on the results of lab and field test
- The uncertainty must be below 75% of the legal limit
  - The remaining 25% are reserved for additional errors caused by the installation at the plant.
- If all criteria are fulfilled → Type testing passed

