



Device selection & Suitability- Selection & Installation, Certification


**By
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Environnement SA/PCME**

- Introduction
- European approach to CEMS
- CEMS overview
 - Gas sampling introduction
 - Gas analyser introduction
- Particulate introduction
 - Sample conditions, Technologies, configurations
- Installation sample location
- Certification-Gas and Particulate
- US experience certifying Particulate Monitors on Coal fired power plants
 - Drivers, Effect of Wet FGD on particulate
 - PS-11 certification and Procedure 2 approach
 - Comparison with European calibration and EN14181 approach
 - US certification and what we learnt
- Closing statement and Summary

Who are Environnement SA, and PCME ?



PCME
Particulate &
Flow Specialist



Environnement s.a.
The instrumentation of the environment
HQ
Gas Analyser Specialist
AQMS, CEMS, EGAS



Environnement s.a.
Deutschland
Mercury & Dioxin
Sampling Specialist

 **SAM-WI (ISÉO)**

 **XR PREMIUM (ISÉO)**

PCME are a UK Manufacturer of Particulate & Flow Monitors.

- ✓ Established in 1990.
- ✓ Experience in hundreds of applications with more than 35,000 particulate monitors world-wide.
- ✓ ISO 9001 and ISO 14001

Our aim is to improve environmental performance and satisfy the regulatory requirements through continuous monitoring.

Drivers Europe (Device Selection & Suitability)

Green and Clean?

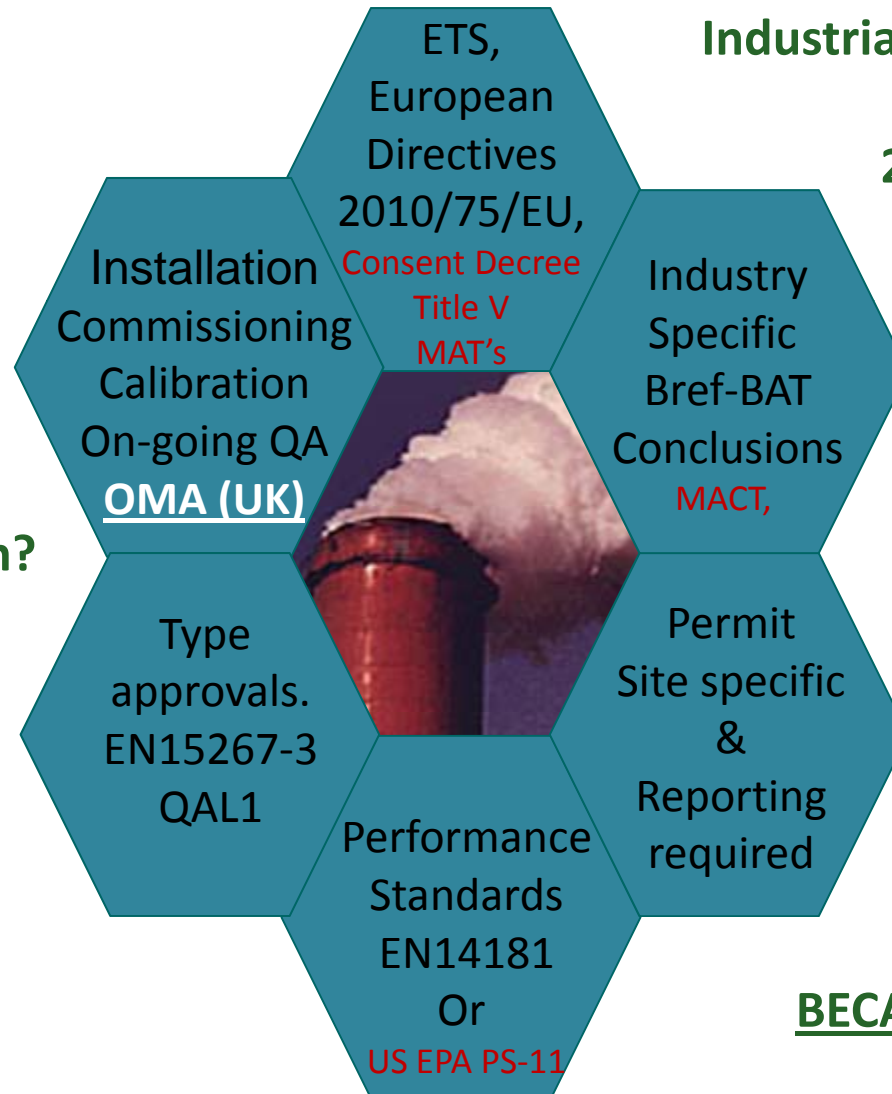
Industrial Emission Directive
(IED)
2010/75/EU

Process Optimisation?

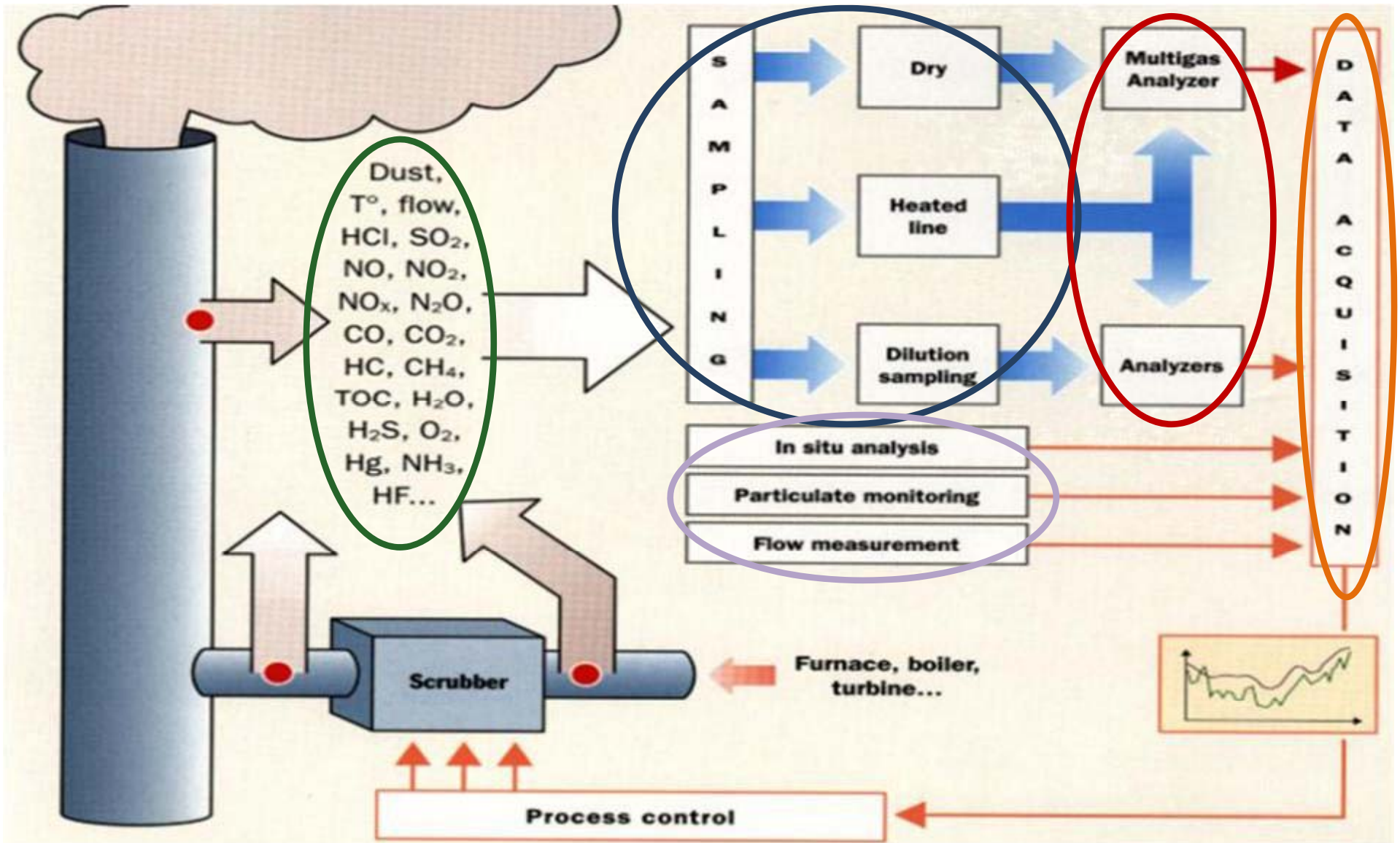
Legislation

Cost savings?

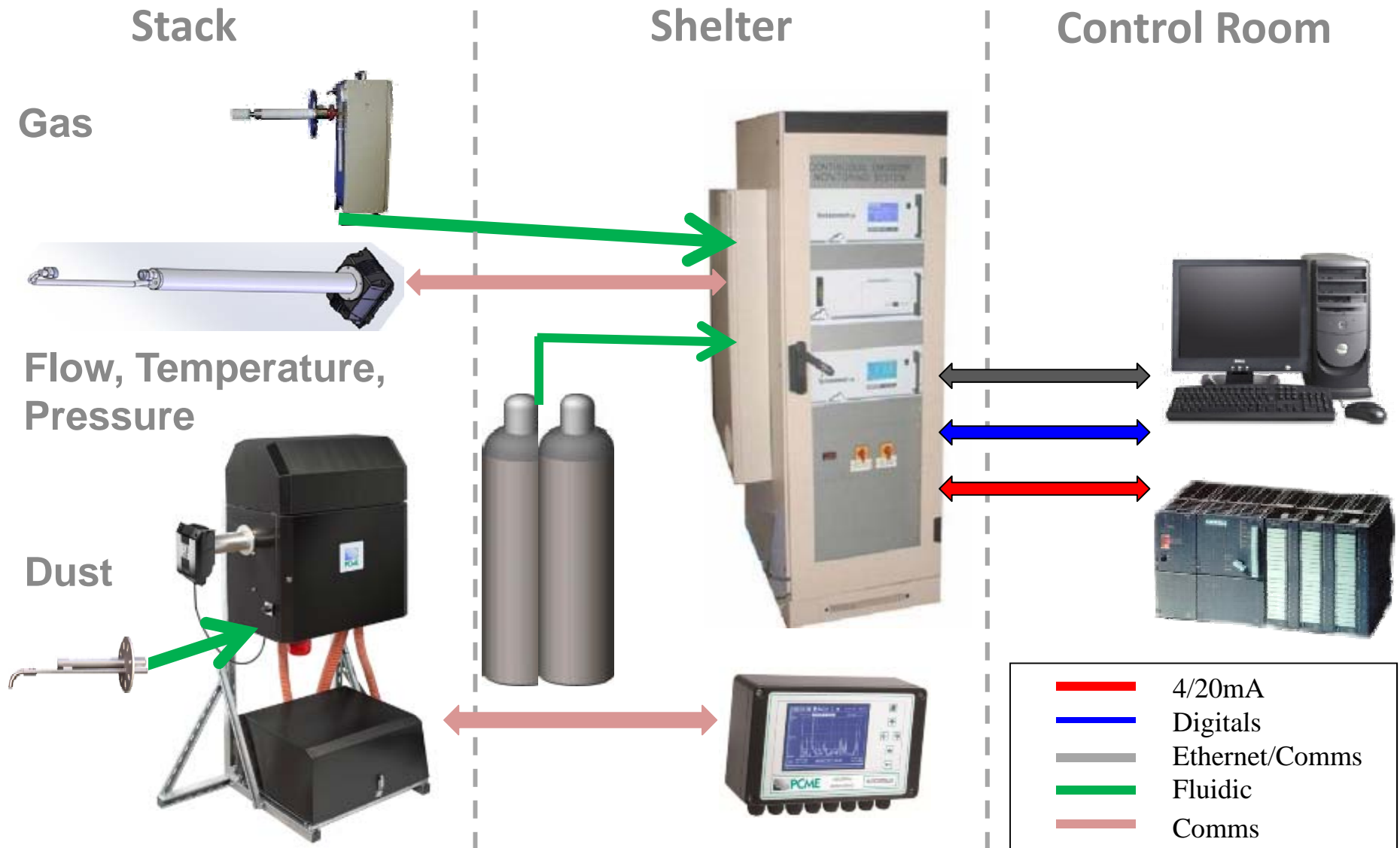
BECAUSE WE HAVE TOO!



Continuous Emission Monitoring System Device Selection & Suitability



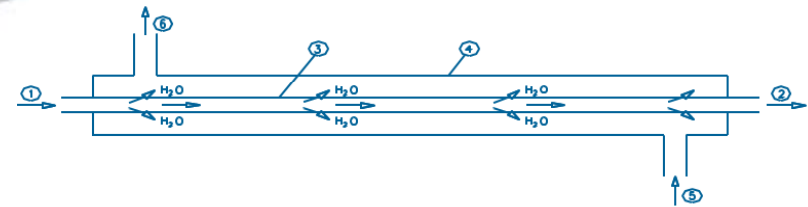
Typical CEMS Overview Device Selection & Suitability



Sampling overview (Device Selection & Suitability)

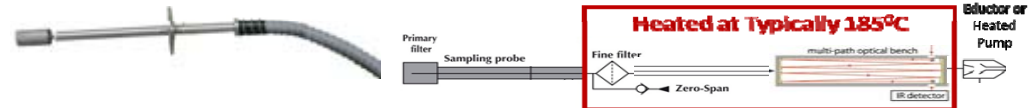
✓ Dry

Great solution for multi-gas water soluble gas
And corrosive gas applications.
Do not use if measuring NH₃



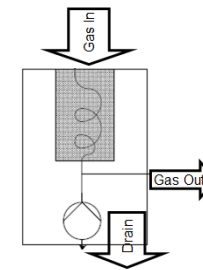
✓ Hot Wet-Heated

Good solution for multi-gas including corrosive
and soluble gas applications.



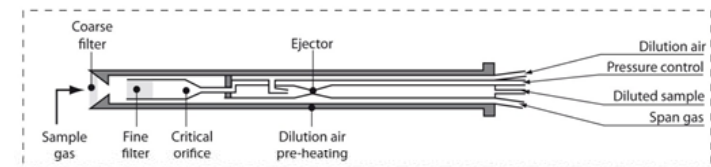
✓ Hot Wet -Coolers

Good solution for traditional combustion
Applications.



✓ Dilution

Good solution for zoned area, combustion
Applications.



All ESA sampling methodologies.

Analyser overview (Device Selection & Suitability)

- ✓ Single Gas.
(NDIR, FID, Chemi, UV etc etc).



- ✓ Multi-Gas
(IR GFC, FTIR, FTUV, or combined technologies).
(Rack Mount, Wall Mount, Close Coupled)



Rack mount Analysers Wall Mount Analysers

In Situ Analysers

Many technologies and packaging of ESA analysers.

Particulate-Process conditions (Device Selection & Suitability)

- ✓ Dry-The dust tends not to stick easily to Electrodynamic based systems so air purge is not required unless over 50mg/m³. Optical based systems will require air purge.



- ✓ Humid-The dust will stick to probe and optical based systems so air purge is required.
- ✓ Or insulated Electrodynamic probes can be considered.



- ✓ Wet-The water droplets will interfere on all in-situ dust measurement systems so extractive dust monitoring system will be required.



Consider the Dust load, Stack Diameter, Temperature and Velocity then decide product offering

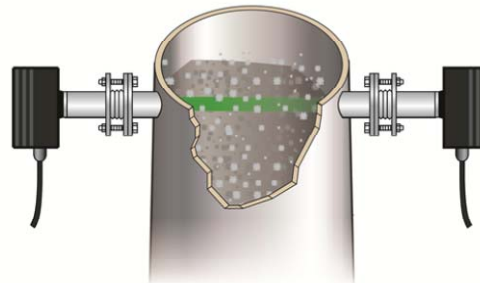
Particulate Technology overview (Device Selection & Suitability)

- ✓ **Electrodynamic.**
(Bag Filter, Cyclones, Dryers **not ESP**.)



- ✓ **Dynamic Opacity**

- ✓ **Opacity.**
(Large stacks & high concentration.
Mainly used outside Europe
suitable for US EPA PS1 applications)
Will require air purge and maintenance

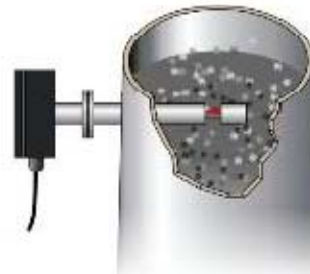


- ✓ **Pro-Scatter**

- ✓ **Forward Scatter**

- ✓ **Back Scatter.**

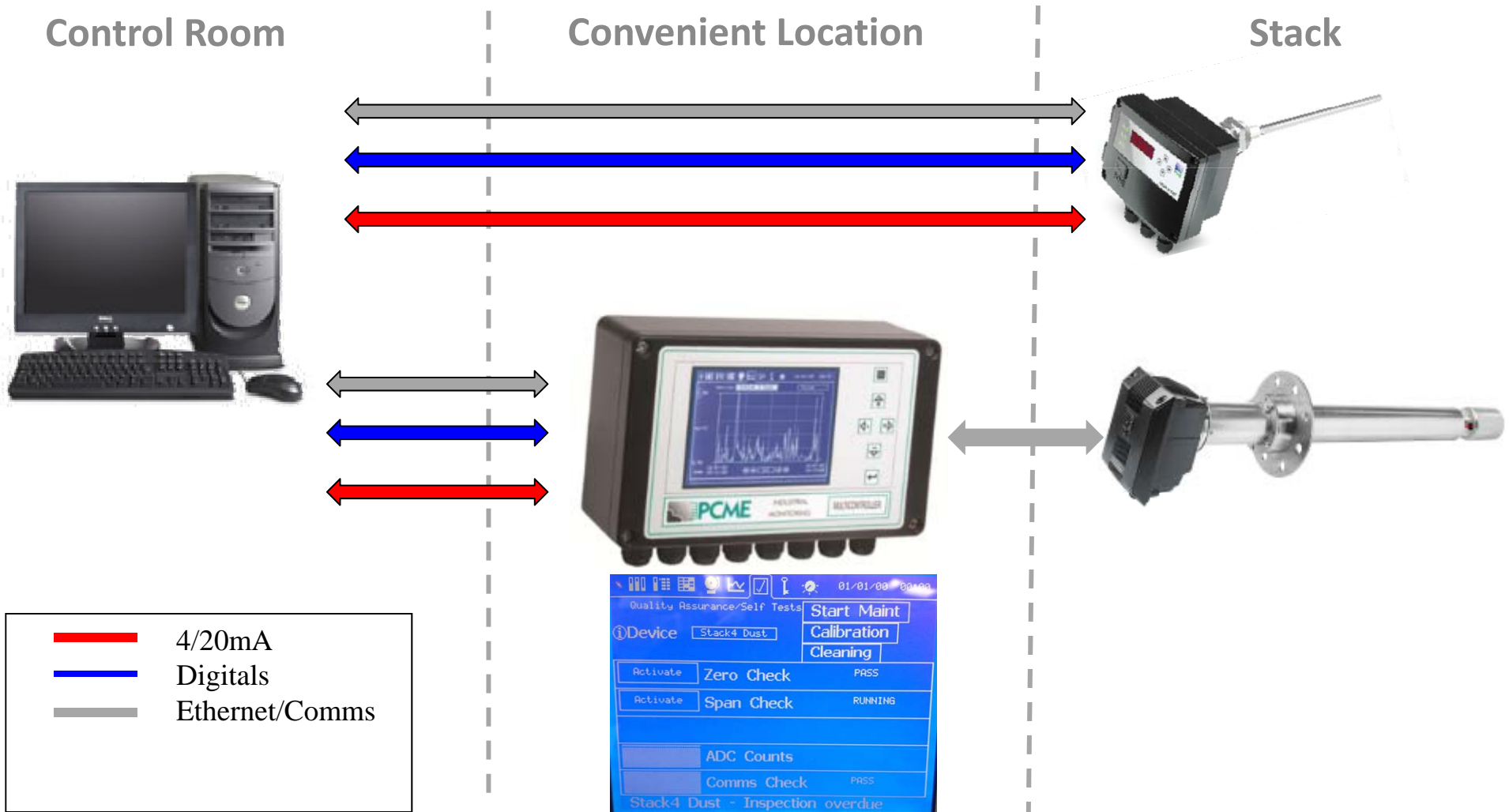
(Many applications including ESP)
requires air purge.



ESA/PCME offer a unique and most comprehensive range of technologies.

A single channel Particulate Monitor (Device Selection & Suitability)

Stand alone or Controller for convenient measurement

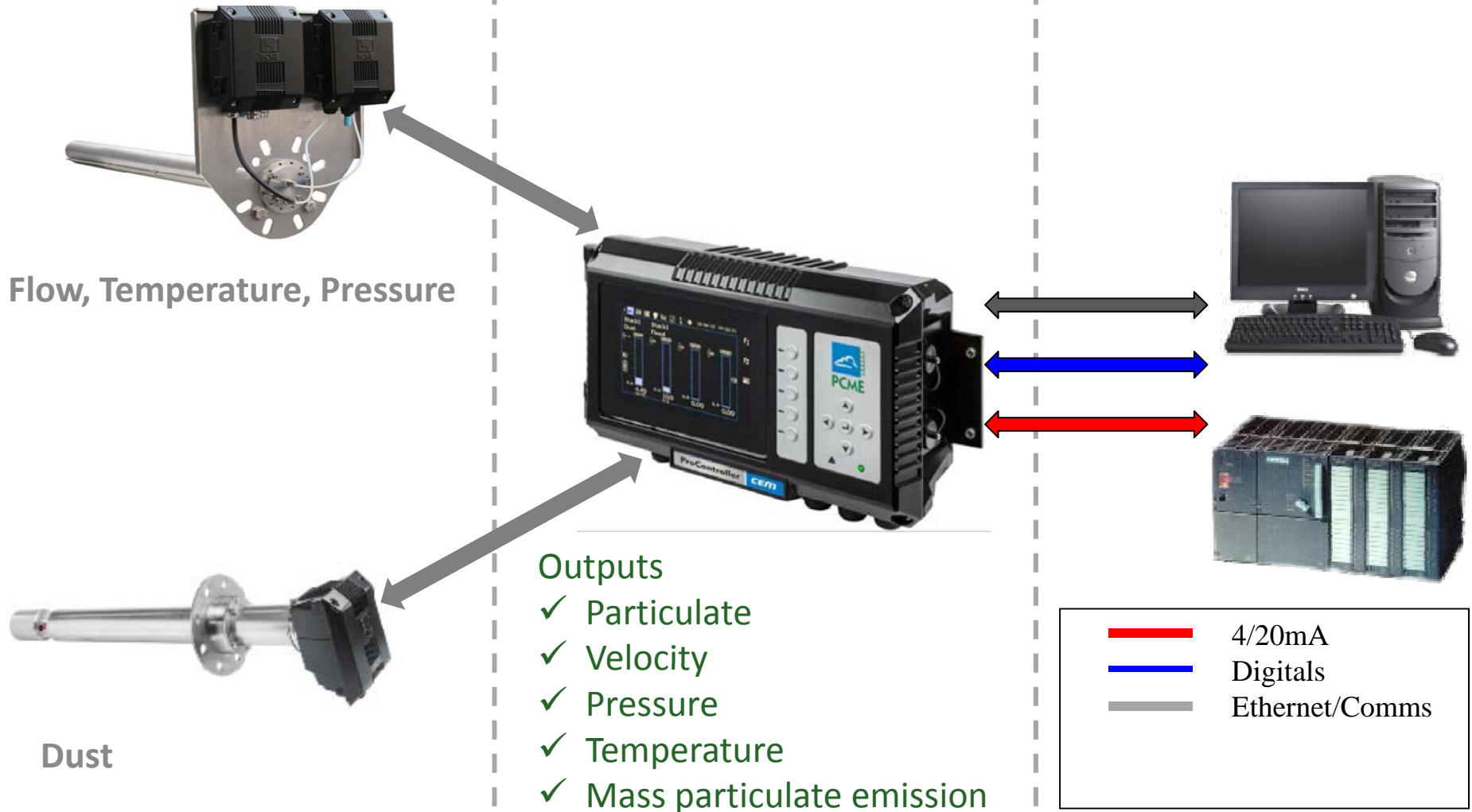


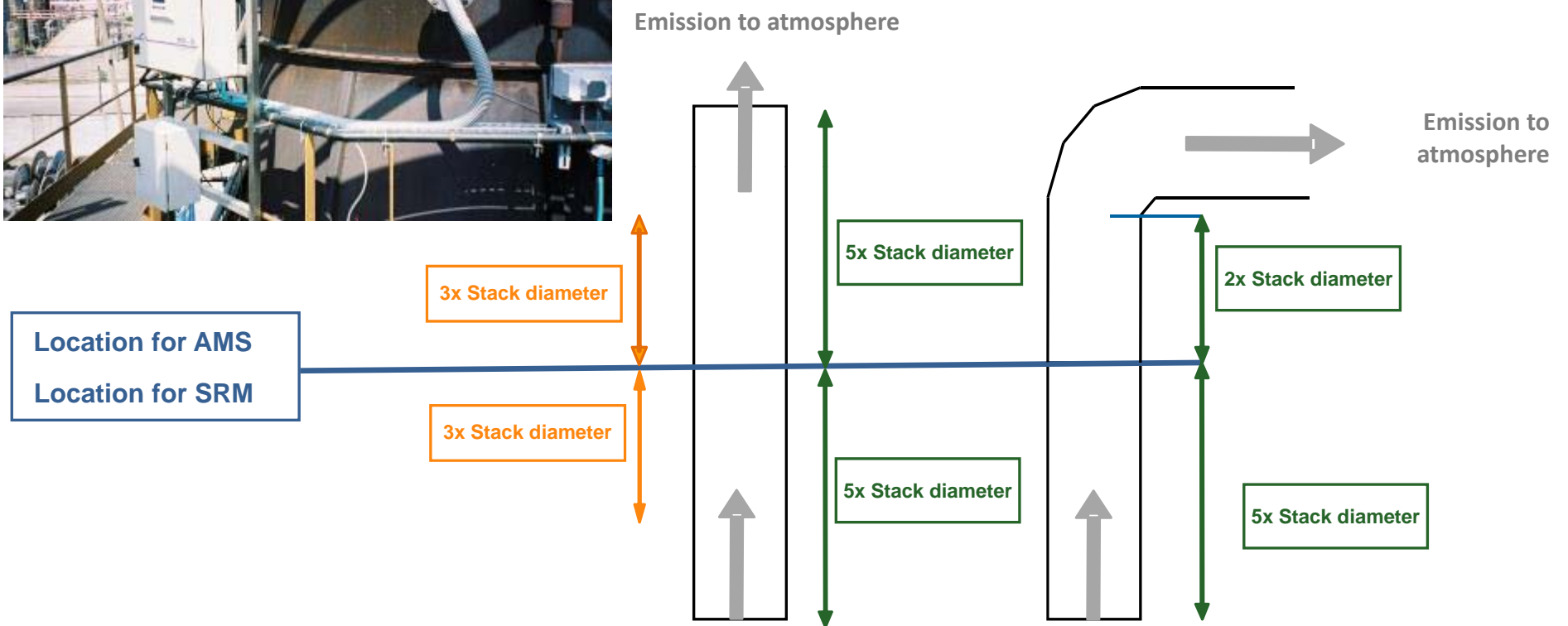
Multi Channel or Mass Particulate measurement (Device Selection & Suitability)

Stack

Convenient Location

Control Room

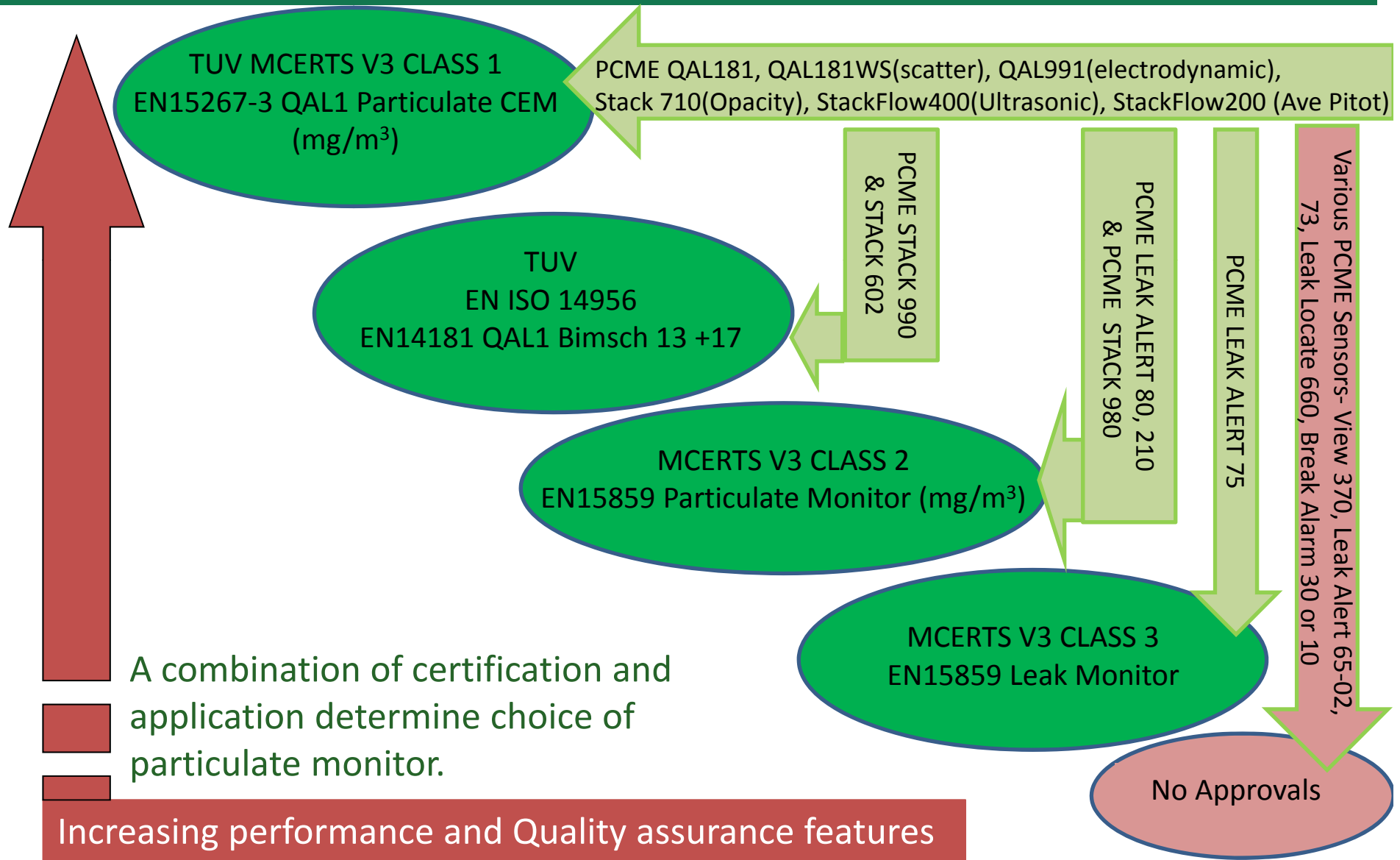




**Automated Monitoring System (AMS)
Standard Reference Method (SRM)**

**For selection of a suitable monitoring
location CEN 15259 is used across Europe**

Certification for Gas and Particulate



US experience certifying Particulate Monitors on Coal fired power plants



An Improved Forward Scatter
monitoring technique for Wet applications
using the PCME Stack 181WS



Regulatory Drivers for PM Monitoring of Electric Generating Units (EGU) sources

- Consent decrees with federal, state or local regulators for compliance with particulate emission limits
- Compliance Assurance Monitoring to fulfill Clean Air Act (CAA) Title V requirements
- In the case of wet FGD EGU stacks, Site can seek relief from state and local opacity limits and associated reporting.
 - Wet FGD are a good particulate removal device.
 - Opacity is also not suitable for use after Wet FGD as it does not have the sensitivity for lower ELV's and water droplets interfere.
- Compliance with particulate emission limits in the Mercury Air Toxics Standards (MATS) rule
 - PM limit for existing bituminous coal fired EGU's
 - 0.03 lbs/mmBTU - Approx 26 mg/m³ on wet basis, CO₂ of 11%, at stack temperature of 130°F (54°C).
 - PS-11 is used for Particulate (much lower sensitivity than Opacity)

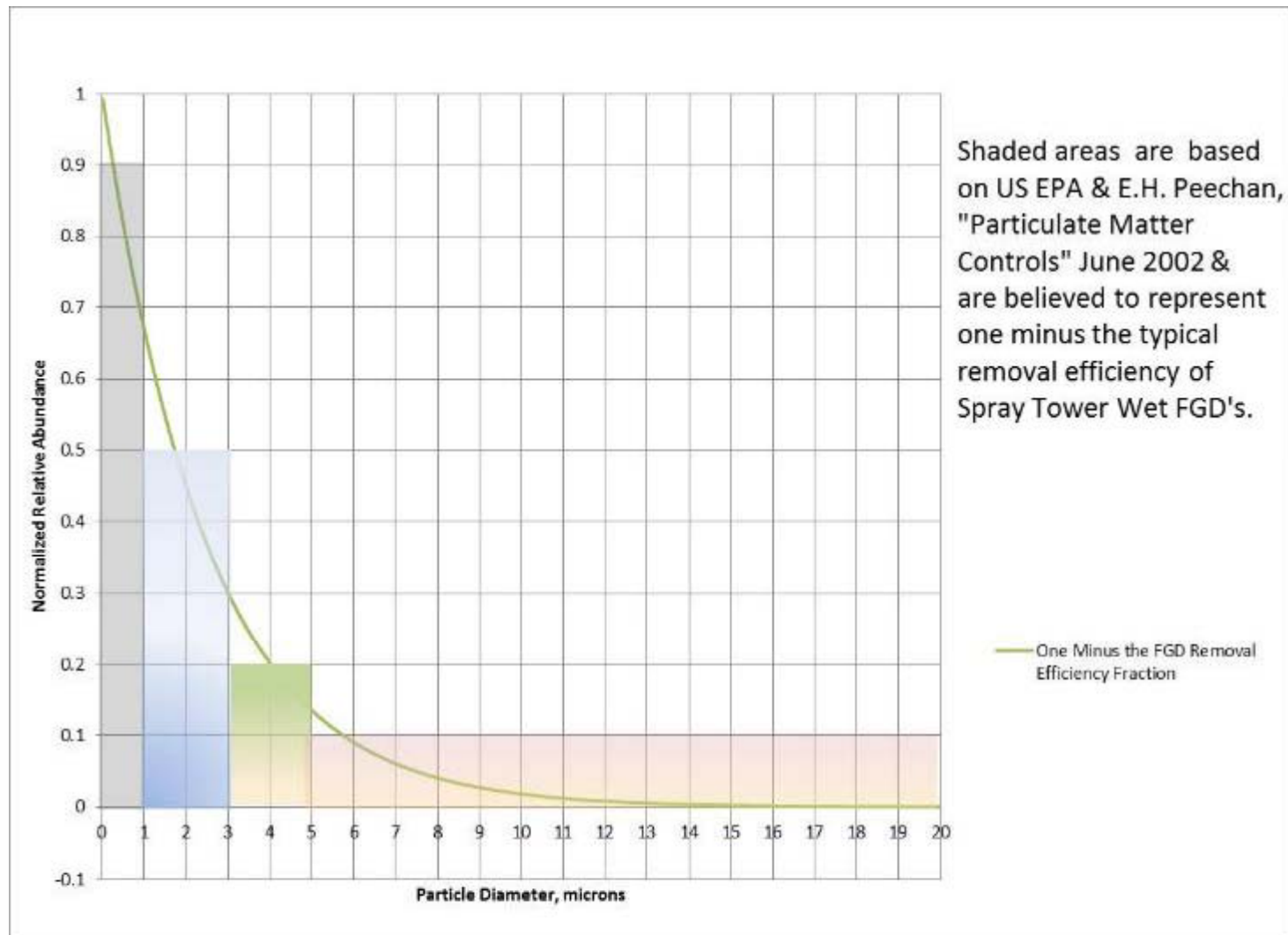
MATS PM Compliance requirements for Wet FGD Sources

- Installation and certification of a PM CEMS according to 40CFR60 Appendix B PS-11 and quality assurance as per Appendix F Procedure 2
- Reference method testing using metals or filterable particulate mass MATS method 5



Effect of Wet FGD on Particle Size

- Wet Spray Tower FGD's (common in US EGU's) generally remove large, high mass particles very well but are not efficient at removing small particles.

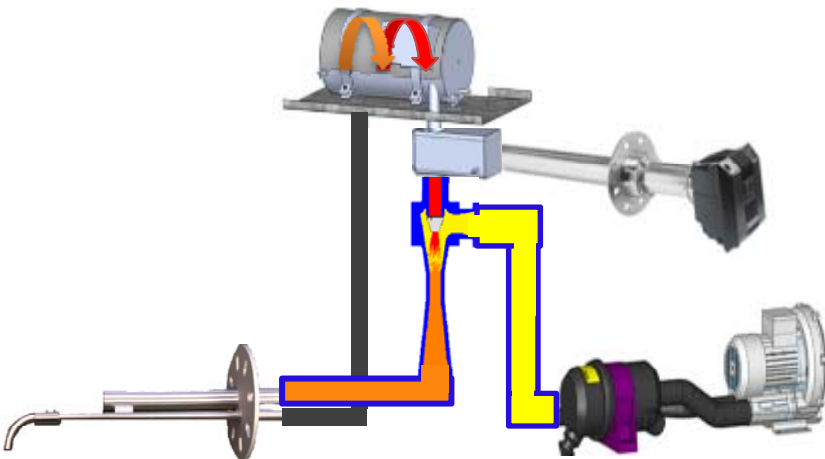


PCME QAL181-WS

For Wet Stack Particulate Monitoring



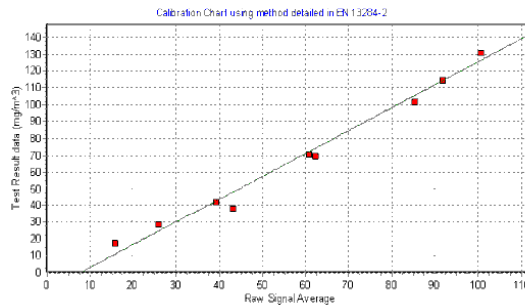
- ✓ Continuous, Direct, Temperature Regulated Extractive Sampling System.
- ✓ Two modes of sampling
 - ✓ Isokinetic (flow signal required modbus or 4/20mA).
 - ✓ User defined sampling velocity with automatic flow control.
- ✓ *ProScatter*TM An improved Forward Scatter monitoring technique for high accuracy measurements.
- ✓ Low Limit of Detection and dynamic measurement range.
- ✓ Range of probe materials and lengths to suit sample conditions.
- ✓ Easy to install and maintain on site.



US EPA PS-11 & Procedure 2 Approach (Certifying the system-On site only!)

Allow 2-4
weeks
minimum as a
settling
period

PS-11 Correlation Test

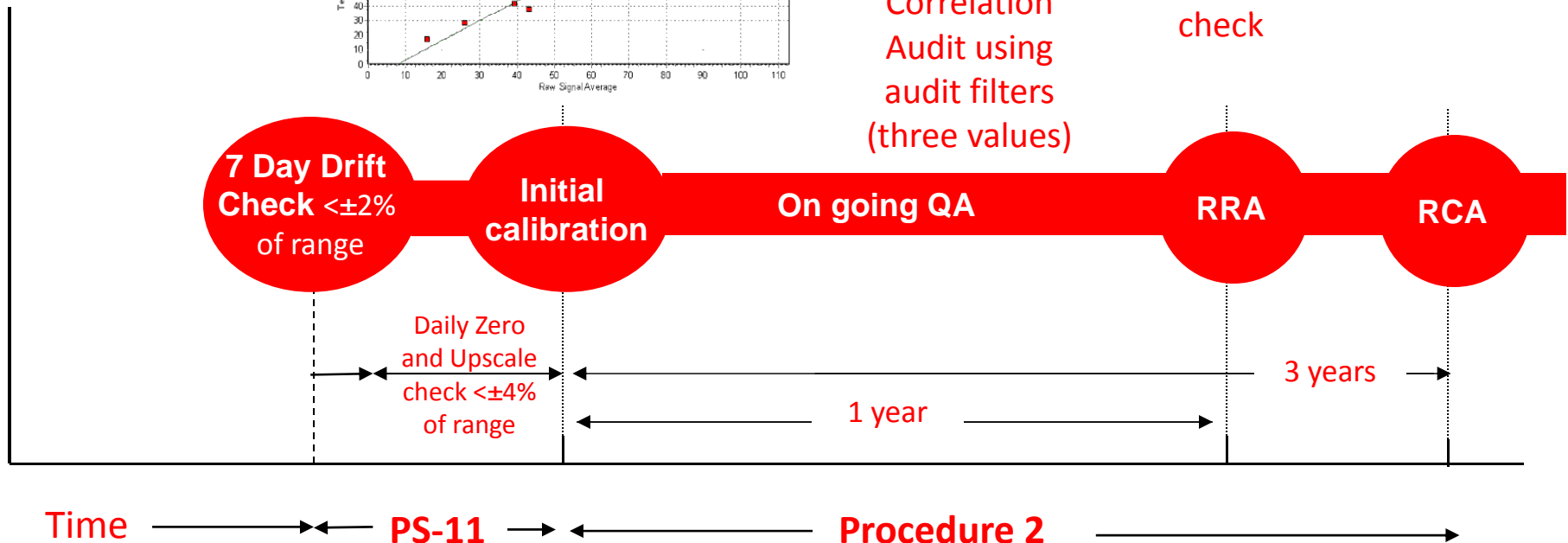


Daily Zero and
Upscale check
<±4% of range

Quarterly
Absolute
Correlation
Audit using
audit filters
(three values)

RRA:
(Relative
Response
Audit)
3 Run
Calibration
check

RCA:
(Relative
Correlation
Audit) 12 Run
Calibration
check



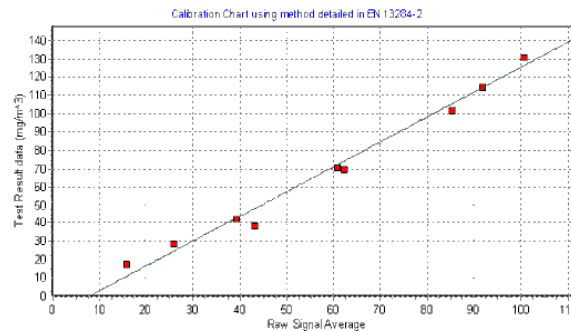
Upscale particulate achieved by detuning plant (removing precipitator banks, turning off FGD pumps)

European EN14181 Approach

(Certification pre purchase plus Calibration on site!)

**PURCHASE &
Install QAL1
equipment!**

Calibration
QAL 2 – EN 13284-1 (Europe)

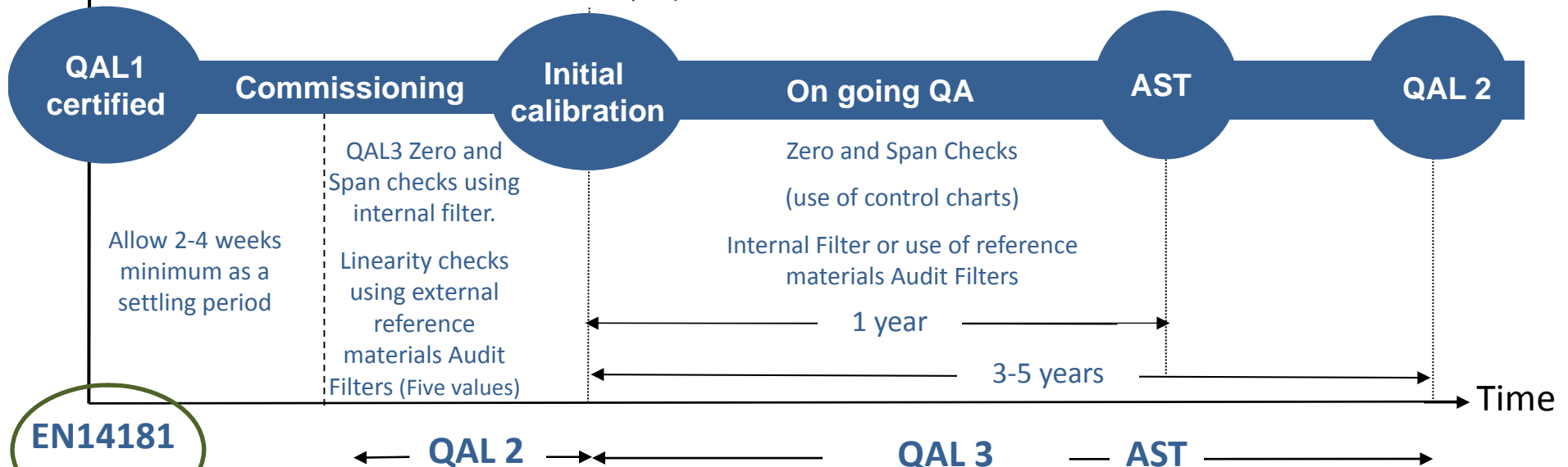


**Annual Surveillance
Test**

(5 Run Calibration check)

AST includes yearly
Linearity check using
Audit Filters

QAL 2
Every 3-5
years



**EN14181
QAL 1**

EN15267-3 testing by national accreditation laboratories TUV or MCERTS
Provides '*Peace of mind*' that equipment has been tested by a third party prior to purchase and installation

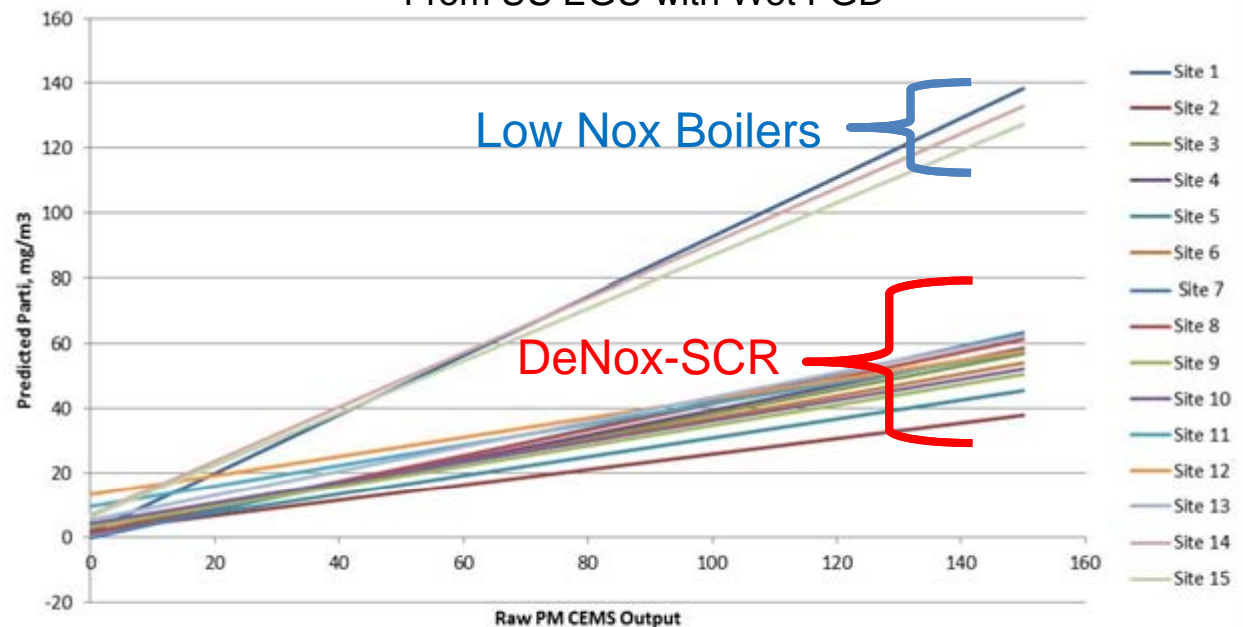
Summary of Fifteen Calibrations in the US MATS Method 5B

PS-11 Correlation Curve Coefficients

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15
b0	1.751	1.945	1.416	1.211	1.758	3.11	-0.146	1.528	3.30	4.29	9.59	13.30	5.43	6.95	6.41
b1	0.910	0.24	0.37	0.383	0.292	0.34	0.424	0.399	0.315	0.32	0.32	0.30	0.38	0.84	0.81
b2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

- Plant configurations
 - All had Wet FGD & Electrostatic Precipitators
 - Slopes clustered in two groups
 - 0.24 to 0.42
 - 0.81 to 0.91
- Why the difference?
- Can almost consider factory preset curves

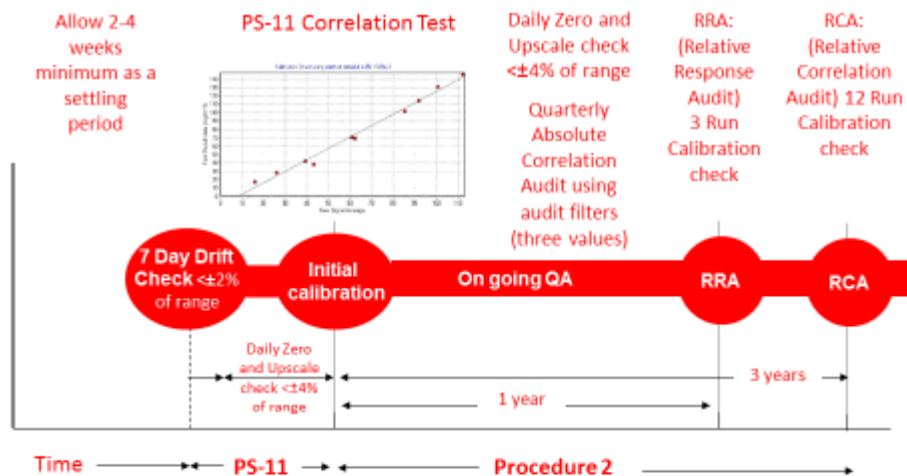
PCME STACK 181WS Correlation Test Slopes
From US EGU with Wet FGD



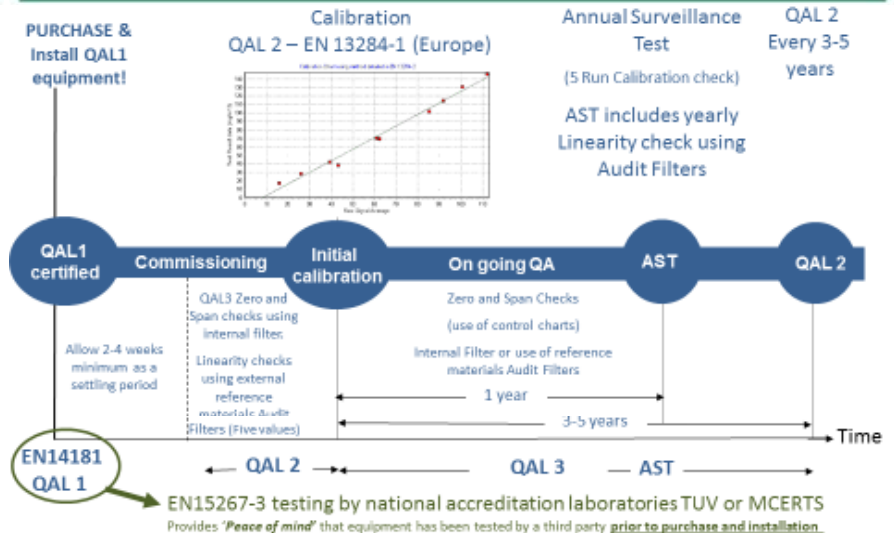
Closing Statements

US EPA & European Comparison and Preference

US EPA PS-11 & Procedure 2 Approach (Certifying the system-On site only!)



European EN14181 Approach (Certification pre purchase plus Calibration on site!)



My Preference

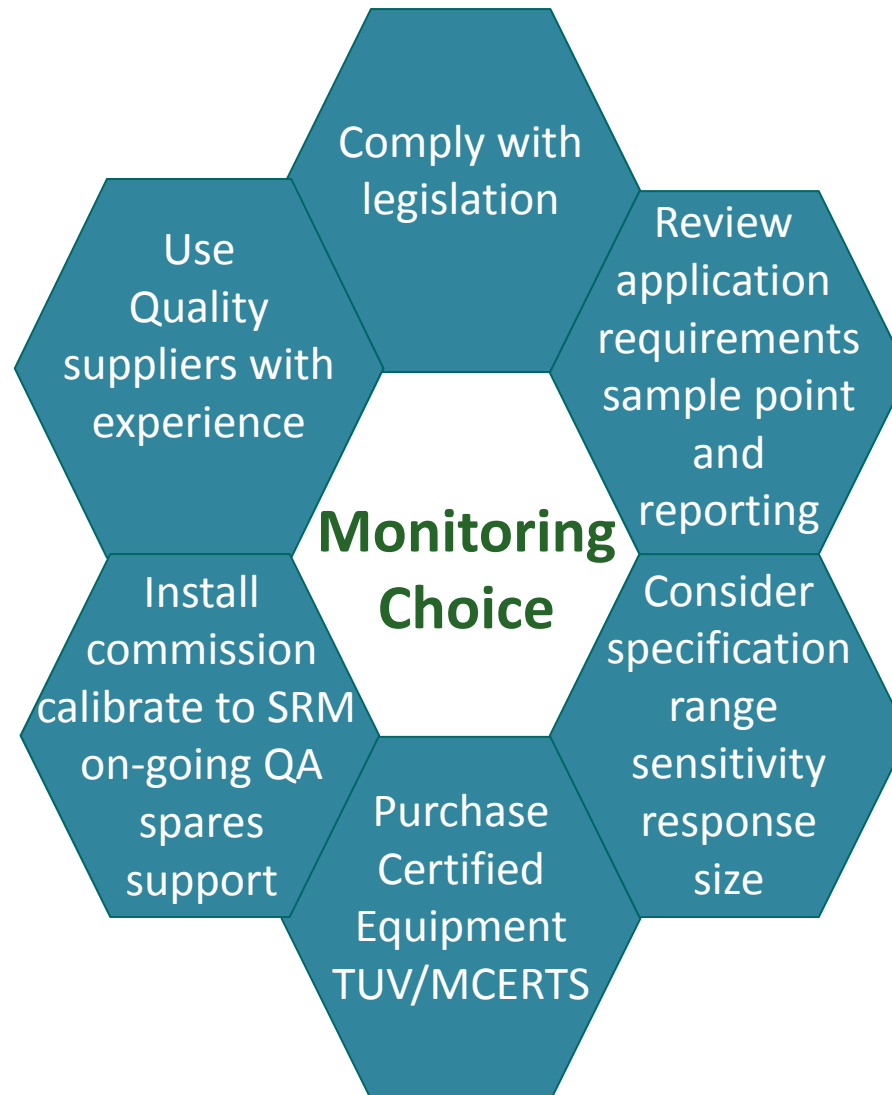
✓ European approach

Why

✓ Equipment that has been tested by national accredited laboratories (TUV & MCERTS) to EN15267-3 with QAL1 as defined by EN14181 provides 'Peace of Mind' that the equipment has been tested by an independent third party prior to purchase, installation and commissioning.

Device selection & Suitability- Selection & Installation, Certification

Summary





Environnement S.A.
The instrumentation of the environment

Any Questions

Passionate
about
Particulate



Thank You