Development & Perception of Continuous Emission Monitoring System (CEMS) in India

Regulators Training on CEMS
From Understanding to Implementation
8 – 12th August 2016

Contents

- Background
- Introduction to CEMS
- Policy Perspective for implementation of CEMS
- Initiative and Implementation Status
- Issues in Implementation
- Provision under Law

Background

SN	Events	Date
01	DIRECTIONS UNDER SECTION 18(1)(b) OF THE WATER (PREVENTION CONTROL OF POLLUTION) ACT, 1974 and THE AIR (PREVENTION Et CONTROL OF POLLUTION) ACT, 1981 IN THE MATTER OF POLLUTION CONTROL IN 17 CATEGORY OF HIGHLY POLLUTING INDUSTRIES , CETPs AND COMMON HAZRDOUS WASTE 8 BIOMEDICAL WASTE INCINERATORSREGARDING SELF MONITORING OF COMPLIANCE	05.02.2014
02	Same as above	02.03.2015

- Directions issued under (NGRBA) dated 27.03.2015
- Letters to Chairmen of SPCBs dated 29.05.2015
- Draft Notification on online monitoring protocol dated 19.04.2015
- Online Monitoring IT Protocol dated 11.06.2015
- Minutes of the Meeting with Industrial Associations dated 16.06.2015
- Guidelines on Effluent Monitoring dated 07.11.2014
- List of Revised Parameters
- List of CPCB Officers for 17 Categories
- List of 17 Categories of Industries alongwith Industry Codes (Master List of 3260)
- List of Instrument suppliers updated 30.06.2015

CEMS (Continuous Emissions Monitoring System)

The system composed of Equipment, Instrument to draw, condition, analyze the flue gas sample and provide permanent record of emissions or process control parameters continuously at real time basis is called Continuous Emissions Monitoring System (CEMS)

Benefits of CEMS

- Provides real time data.
- Remotely accessible to operator/regulator.
- Greater transparency in monitoring of performance.
- Continuous performance check of Air Pollution Control Devices and optimization of resources used.
- Time series analysis possible with continuous data.
- Reduction in regulatory cost as well as long term monitoring cost.
- Expected better compliance through self regulation by industry, hence lower emission.
- Primary requirement for participation in market driven pollution control venture (ETS)

COMPONENTS OF A CEMS

- **Sample Collection — sampling device**
- **Interface – Sample conditioning & transportation wherever required**
- **Analyzer — Specific to pollutants, generates an output signal proportional to the concentration**
- **Calibration devices – Analyzer control system, calibration gases, recording etc.**
- **Data Acquisition – Data logging system record electrical signals in defined number of channels**
- **Data Handling System— Pick, calculate, record, transfer the data in report form to desired destination**

CEMS Policy in India

- **Preparedness for transparent, self regulatory air pollution control regime in India**

Initially Highly Polluting Industries 17 Categories Industries along with BMW and HWI were asked to install CEMS by CPCB

Emission Limits for Selected Industries

S.N	Industries / Facilities	Units of Operation	Parameters prescribed	Notified Standard Emission Limits	Remarks / Possible Types of CEMS
01	Aluminum	Raw Material Handling	PM	150 mg/NM^3	In situ PM CEMS NDIR for CO FTIR for CO and F DOAS for all
		Calcinations	PM CO	250 mg/NM^3 1% (Max)	
		Green Anode Shop	PM	150 mg/NM^3	
		Anode Bake Oven	PM Total Fluoride	50 mg/NM^3, 0.3 Kg/MT of Al	
		Pot room	PM, Total Fluoride	150 mg/NM^3 Total F^- 2.8 Kg/MT (Soderberg Tech.) 0.8 kg/t (Pre-baked Technology)	
02	Cement without Co-processing	Rotary Kiln	PM NO_X SO_2	30 / 50 / 100 mg/NM^3 600 / 800 mg/NM^3 100 mg/NM^3	Cross Duct PM CEMS UV Photometry and Chemiluminescence for Extractive dilution system NDIR for CO IR GFC, FTIR, DOAS for multi-gas analysis
		Vertical Shaft	PM NO_X SO_2	50 / 75 / 100 / 150 mg/NM^3 500 mg/NM^3 200 mg/NM^3	
	Cement Co-processing	Rotary Kiln	PM NO_X SO_2	30 mg/NM^3 600 /800 / 1000 mg/NM^3 100/700/1000 mg/NM^3	
03	Distillery	Boiler	PM	150 mg/NM^3	In situ / Cross Duct PM CEMS
04	Chlor-Alkali	(Hypo tower) HCl Plant	Cl_2 HCl	15 mg/NM^3 HCl vapour and Mists – 35 mg/NM^3	FTIR, DOAS Mist Not Possible
05	Fertilizers	Phosphate Urea (Old)before 01.01.1982 Urea (New)after 01.01.1982	PM, Fluoride PM Fluoride PM Fluoride	PM – 150 mg/NM^3 Total Fluoride – 25 mg/NM^3 150 mg/NM^3 2 Kg/MT of product 50 mg/NM^3 0.5 Kg/MT of product	In situ / Cross Duct PM CEMS FTIR / DOAS for F

Emission Limits for Selected Industries ..... Contd.

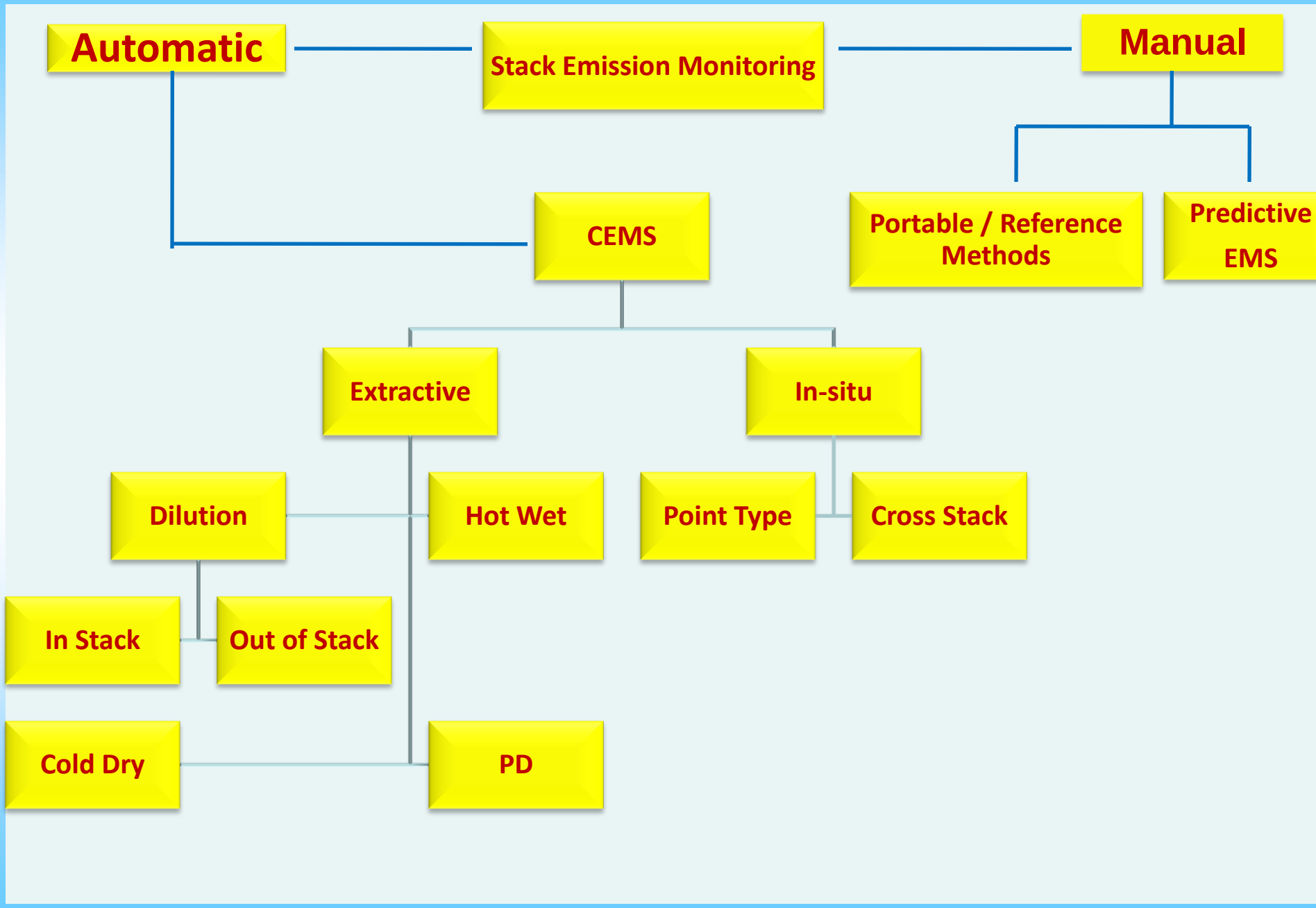
S.N	Industries / Facilities	Units of Operation	Parameters prescribed	Notified Standard Emission Limits		Remarks
06	Iron & Steel	Coke Oven Plant New Batteries Rebuild Batteries Existing Batteries	 PM SO2 NOX	 50 mg/NM3 800 mg/NM3 500 mg/NM3		Cross Duct PM CEMS UV Photometry and Chemiluminescence for SO2 and NOX Extractive dilution system NDIR for CO IR GFC, FTIR, DOAS for multi-gas analysis
		Sintering Plant	PM	150 mg/NM3		
		Blast Furnace	 PM SO2 NOX CO	Existing Units 50 mg/NM3 250 mg/NM3 150 mg/NM3 1% (Max)	New Units 30 mg/NM3 200 mg/NM3 150 mg/NM3 1% (Max)	
07	Oil refinery	Furnace, Boiler and captive power plant Gas based	 PM SO2 NOX CO	Before 2008 10 mg/NM3 50 mg/NM3 350 mg/NM3 150 mg/NM3	After 2008 5 mg/NM3 50 mg/NM3 250 mg/NM3 100 mg/NM3	Cross Duct / Insitu PM CEMS UV Photometry and Chemiluminescence for SO2 and NOX Extractive dilution system NDIR for CO IR GFC, FTIR, DOAS for multi-gas analysis
		Furnace, Boiler and captive power plant Liquid Fuel based	 PM SO2 NOX CO	Before 2008 100 mg/NM3 1700 mg/NM3 450 mg/NM3 200 mg/NM3	After 2008 50 mg/NM3 850 mg/NM3 350 mg/NM3 150 mg/NM3	
		Sulphur Recovery Unit (SRU)	 H2S NOX CO	Existing SRU 15 mg/NM3 350 mg/NM3 150 mg/NM3	New SRU 10 mg/NM3 250 mg/NM3 150 mg/NM3	
08	Petrochemical	Furnace, Boiler Heater Vaporizer Liquid Fuel based	 PM, SO2 NOX CO	Existing Plant 100 mg/NM3 450 mg/NM3 1700 mg/NM3 200 mg/NM3	New / Expansion 50 mg/NM3 350 mg/NM3 850 mg/NM3 150 mg/NM3	Cross Duct / In situ PM CEMS UV Photometry and Chemiluminescence for SO2 and NOX Extractive dilution system NDIR for CO IR GFC, FTIR, DOAS for multi-gas analysis
		Furnace, Boiler Heater Vaporizer Gas based	 PM, SO2 NOX CO	Existing Plant 10 mg/NM3 50 mg/NM3 350 mg/NM3 150 mg/NM3	New / Expansion 5 mg/NM3 50 mg/NM3 250 mg/NM3 100 mg/NM3	

S.N	Industries / Facilities	Units of Operation	Parameters prescribed	Notified Standard Emission Limits		Remarks
09	Power Plant	TPP Installed before 31st December 2003	PM NOX SO2 Hg	Less than 500 MW 100 mg/NM3 600 mg/NM3 600 mg/NM3 0.03 mg/NM3	More than 500 MW 100 mg/NM3 600 mg/NM3 200 mg/NM3 0.03 mg/NM3	Cross Duct PM CEMS UV Photometry and Chemiluminescence for SO2 and NOX Extractive dilution system IR GFC, FTIR, DOAS for multi-gas analysis For Hg Gold amalgamation or Thermal desorption followed by AAS / AFS
		TPP Installed before 1st January 2004 upto 31st December 2016	PM NOX SO2 Hg	Less than 500 MW 50 mg/NM3 300 mg/NM3 600 mg/NM3 0.03 mg/NM3	More than 500 MW 100 mg/NM3 600 mg/NM3 200 mg/NM3 0.03 mg/NM3	
		TPP Installed before 1st January 2017 onward	PM NOX SO2 Hg	30 mg/NM3 100 mg/NM3 100 mg/NM3 0.03 mg/NM3		
10	Zinc	Smelter SRU	PM SO2	Old units 100 mg/NM3 1370 (Upto 300 T) 1250 (above 300 T)	New Units 75 mg/NM3 1250 (Upto 300 T) 950 (above 300 T)	Cross Duct / Insitu PM CEMS Cross Duct PM CEMS UV Photometry Extractive dilution system ,IR GFC for in situ system
11	Copper	Smelter SRU	PM SO2	Old units 100 mg/NM3 1370 (Upto 300 T) 1250 (above 300 T)	New Units 75 mg/NM3 1250 (Upto 300 T) 950 (above 300 T)	
12	Biomedical Incinerator	Incinerator Stack	PM NOX HCl CO & CO2 Temp. P.C.C Temp. S.C.C.	150 mg/NM3 450 mg/NM3 50 mg/NM3 Combustion Efficiency 99% 850 ± 50 °C 1050 ± 50 °C		Insitu PM CEMS, UV Photometry and Chemiluminescence for SO2 and NOX Extractive dilution system IR GFC, FTIR, DOAS for multi-gas analysis Hot Extractive system is the best
13	Common Hazardous Waste Incinerator	Incinerator Stack	PM HCl, SO2 CO NOX HF, O2 TOC	50 mg/NM3 50 mg/NM3 200 mg/NM3 100 (30 min); 50 (24 hourly) mg/NM3 400 mg/NM3 4 mg/NM3 ≤ 11% 20 mg/NM3		Cross Duct / Insitu PM CEMS UV Photometry and Chemiluminescence for SO2 and NOX Extractive dilution system IR GFC, FTIR, DOAS for multi-gas analysis Hot Extractive system is the best

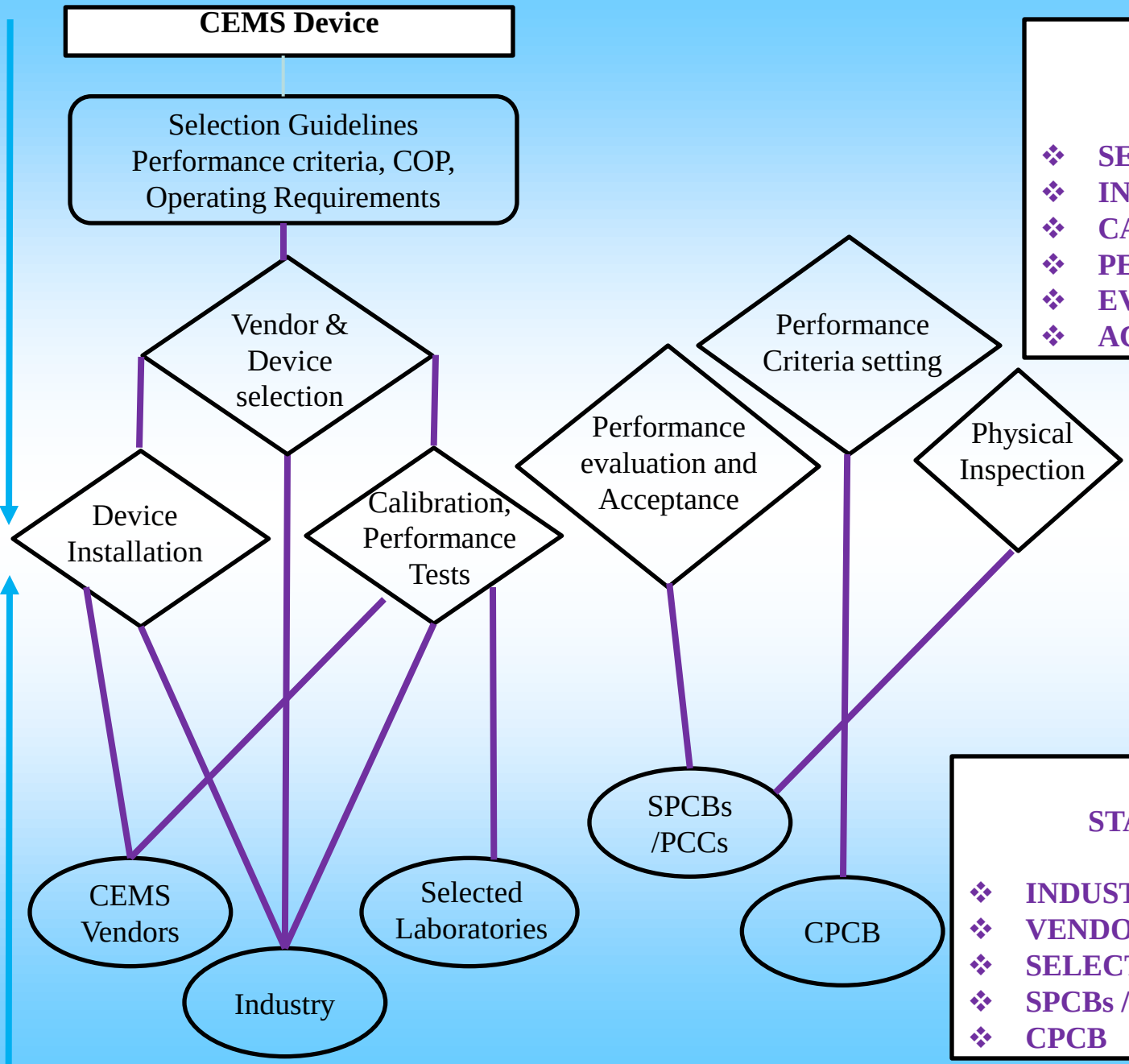
REVISED EMISSION PARAMETERS for 17 Cat

PM, NO_X, SO_2, CO, HCl. Cl_2, NH_3 and F

Methods & Options for Source Emission Monitoring



FIRST STEP OF IMPLEMENTATION OF CEMS



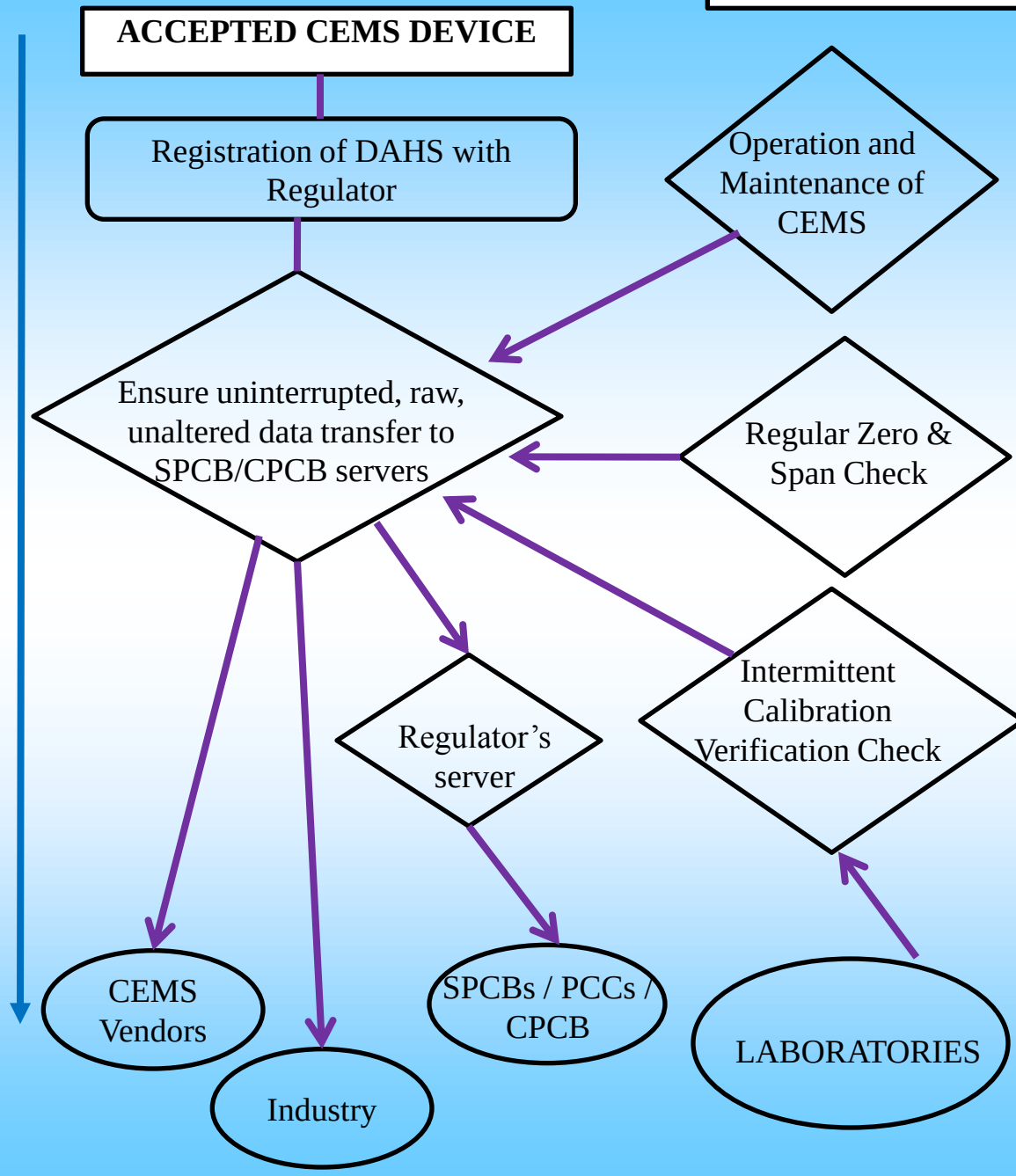
ACTIVITIES

- SELECTION
- INSTALLATION
- CALIBRATION
- PERFORMANCE TESTS
- EVALUATION
- ACCEPTANCE

STAKEHOLDERS

- INDUSTRY
- VENDOR
- SELECTED LABORATORIES
- SPCBs / PCCs
- CPCB

SECOND STEP OF IMPLEMENTATION OF CEMS



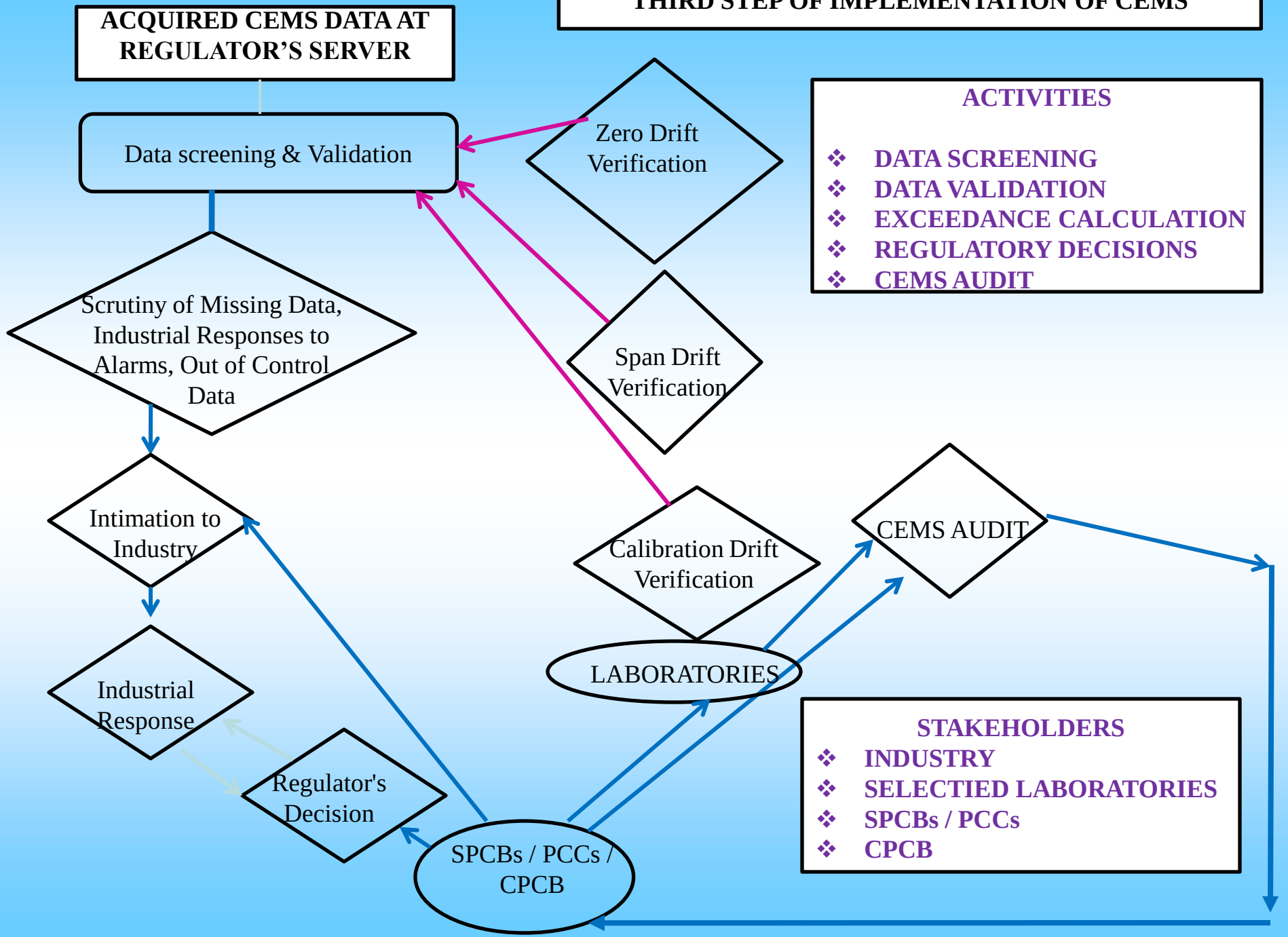
ACTIVITIES

- DAHS CONNECTIVITY
- O & M OF CEMS
- ZERO – SPAN CHECK
- CAL VERIFICATION
- ALARM AND ACTIONS

STAKEHOLDERS

- INDUSTRY
- VENDOR
- SELECTIED LABORATORIES
- SPCBs / PCCs
- CPCB

THIRD STEP OF IMPLEMENTATION OF CEMS



Implementation Status of CEMS in India

Out of 3260 industries listed under 17 Categories about 1700 has complied with installation of CEMS

Issues in Implementation of CEMS in India

- **Issues among the industries regarding CEMS selection**
  - ✓ **Hyperactive business strategy of Vendors**
  - ✓ **Knowledge gaps among Industries and even regulators**
  - ✓ **Number of Stacks to be covered**
- **Presently Industries are interested to just comply with the direction by installing CEMS irrespective of fitness and performance of devices, investment is the only driving factor**
- **SPCBs are putting CEMS installations in Consent conditions in addition to the directed industries**
- **Most of the systems already installed are either not calibrated or wrongly calibrated**
- **In absence of any guidelines and limited clarity in issued direction the selection of components for a CEMS are not holistic to satisfy the requirement of regulation**

Technical issues require immediate attention

- **Number of Stacks to be covered under notification immediately**
- **CEMS Selection Guideline**
- **CEMS Installation Guideline**
- **Range Selection for operation**
- **Calibration Protocol**
- **CEMS initial performance evaluation Protocol**
- **Intermittent performance verification protocol**
- **Excess Emission issues**
- **Empanelment of Laboratories for CEMS**
- **CEMS Audit Protocol**
- **Regulatory framework**

Any Other? : Feed back from stakeholders

International Certification for CEMS

European Union	USA
QAL I - Quality assurance level I (Certification of Product, COP) **QAL II -** Quality assurance level II (Performance evaluation at site) **QAL III -** Quality assurance level III (Audit verification and validation)	US has no certification process at product quality level for sampler/analyser (USEPA) has parameter wise performance standards (PS I to PS XI), which is equivalent to QAL II and QAL III
TÜV (Germany) (Technical watch-over Association) – a Product standard	**MACT** (Maximum Achievable Control Technology); this is an objective oriented quality certification applicable to US only
MCERTS (UK) (Monitoring Certification Schemes) – a Product standard	

Fitness of India for CEMS with international criteria

European Union / USEPA	Indian Scenario
QAL I - Quality assurance level I (Certification of Product, COP)	Does not exist as there is no certifying agency Indian agency should come up in near future
QAL II - Quality assurance level II (Performance evaluation at site)	Possible through performance evaluation; however criteria may be little relaxed
QAL III - Quality assurance level III (Audit verification and validation)	Possible but SPCBs/CPCB and empanelled Laboratories must be trained Provision for ILC shall be developed for QC requirement Availability of certified standard gases should be ensured
Performance standards (PS I to PS XI), which is equivalent to QAL II and QAL III	Implementation Possible; however criteria may be little relaxed

PM CEMS Selection Matrix

Selection Criteria	Types of Particulate CEMS					
	Probe Electrification		Opacity	Light Scattering	Light Scintillation	Extractive
	AC Triboelectric	DC Triboelectric				
Duct < 1m	√	√	X	√	X	√
Duct 1 – 4 m	√	√	√	√	√	√
Duct > 4 m	X	X	√	X	√	√
Temperature of Flue gas > 500 ^{o}C	X	X	√	√	√	√
Temperature below dew point (Water droplet)	√	X	X	X	X	√
Larger Particles > 20 µm	√	√	√	X	√	√
After ESP	X	X	√	√	√	√

Notes: Irrespective of the technology chosen the industry has to install and follow

- ***Flue gas velocity, Temperature, moisture, CO_2 and/or O_2 measurement are compulsory for all installation.***
- ***Installation using dilution techniques must have CO_2 measurement facilities at stack and at the instrument end.***
- ***All the data has to be corrected to mass/volume at STP (760 mm Hg Pressure and 298 K temperature).***

Technical Matrix for Selection for Gaseous CEMS

Technique	Type	Parameter(s) Measured	Comments
Chemiluminscence	Extractive	NO, NO_X, NO_2*	* NO_2 calculated (NO_X – NO)
UV Fluorescence	Extractive	SO_2, H_2S*, TRS* (Total Reduced Sulphur)	* Cannot be measured simultaneously with SO_2
IR Gas Filter Correlation (GFC)	Extractive	CO, CO_2, NO_X, SO_2 and N_2O	Multiple gases maximum upto 5 can be accommodated
Fourier Transformed Infra Red (FTIR)	Extractive / Path	CO, CO_2, SO_2, NO_X, NH_3, Moisture (H_2O), HCl, HF etc.	Multiple gases preferably more than 5 may be cost effective
Differential Optical Absorption Spectroscopy (DOAS)	Path	CO, CO_2, SO_2, NO_2, NH_3, VOC, HCl, HF etc.	Multiple gases preferably more than 5, but has maintenance/calibration issues
Flame Ionization Detector	Extractive	Total HC	Requires H_2 gas for flame and carrier
Tunable Diode Laser	Path	CO, CO_2, NH_3, Moisture (H_2O), HCl, HF, CH_4 etc.	Cost effective but not suitable for SO_2 and NO_X
Zirconium Oxide Cell	In-situ	O_2	Widely used, maximum temperature tolerance is 500°C
Paramagnetic	Extractive	O_2	Stable and accurate
Photo-acoustic Spectroscopy	Extractive	CO, CO_2, SO_2, NO, NO_2, NH_3, Moisture (H_2O), HCl, HF etc.	Can measure any Gas that absorb IR

Note:

I. Any CEM System must have Flow (Velocity) measurement device and direct measurement facilities for O_2 and CO_2 Temperature and Moisture (wherever required) installed

II. Any dilution extractive system must have CO_2 measurement facility at source and measuring point to prove the correctness of the selected dilution ratio.

Flow / Velocity meter selection matrix

Parameters	Types of Flow (Velocity meter)				
	Impact Differential Pressure (Pitot Tube)		Thermal anemometer[1]	Bi-directional ultrasonic	Infrared correlation
Irregular Flow	Single point	Multiport			
Max Flue Gas Temperature	X	√	√ [2]	√ [2]	√
Wet stack	Up to 550°C	Up to 550°C	200 – 300oC (model specific)	450° C - 850 °C (model specific)	Up to 1000oC
Low speed	X	X	X	√	√
High Speed	X	√	√	√	√
Calibration	Factory / Site	Factory / Site	Factory / Site [3]	Factory / Site	Factory / Site

[1] Pressure Transmitter (PT) and Temperature Transmitter (TT) are not installed with a Thermal Anemometer as it directly measures Mass Flow which is usually the required quantity. However, for the purpose of ETS in Type 2 CEMS configuration, Volumetric Flow is required and hence PT and TT are necessary to calculate density and convert mass flow calculated by the anemometer to volumetric flow.

[2] Can be accounted for by using multiple probes/sensors

[3] Calibration depends on physical properties (thermal conductivity, specific heat) of the gas whose flow is to be measured. Thus variation in properties of stack gas from factory calibrated values can result in inaccurate measurement.

Where to Install CEMS ?

Firstly The location satisfies the minimum siting criteria of Emission Regulation Part III (i.e., the location is greater than or equal to eight stack duct diameters downstream and two diameters upstream from a flow disturbance

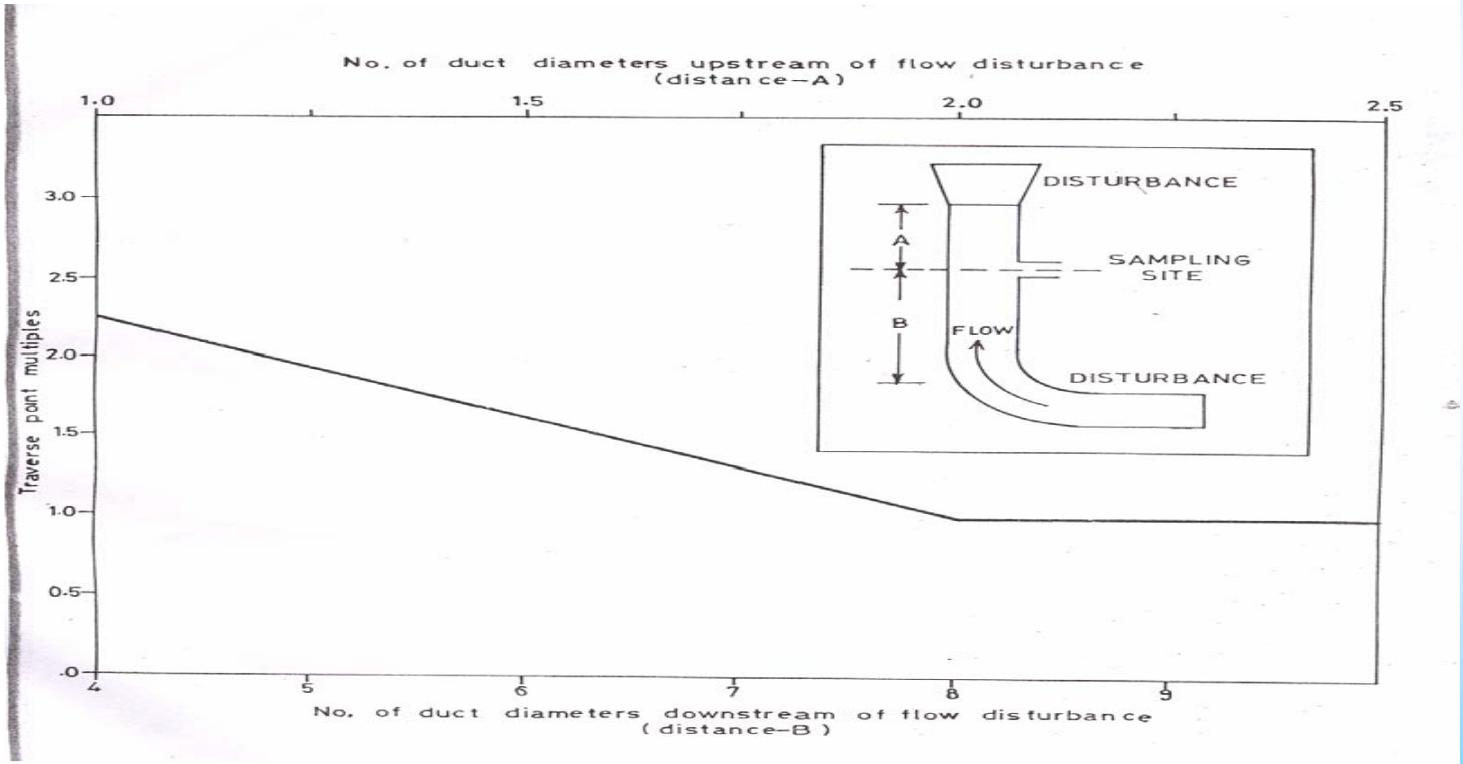
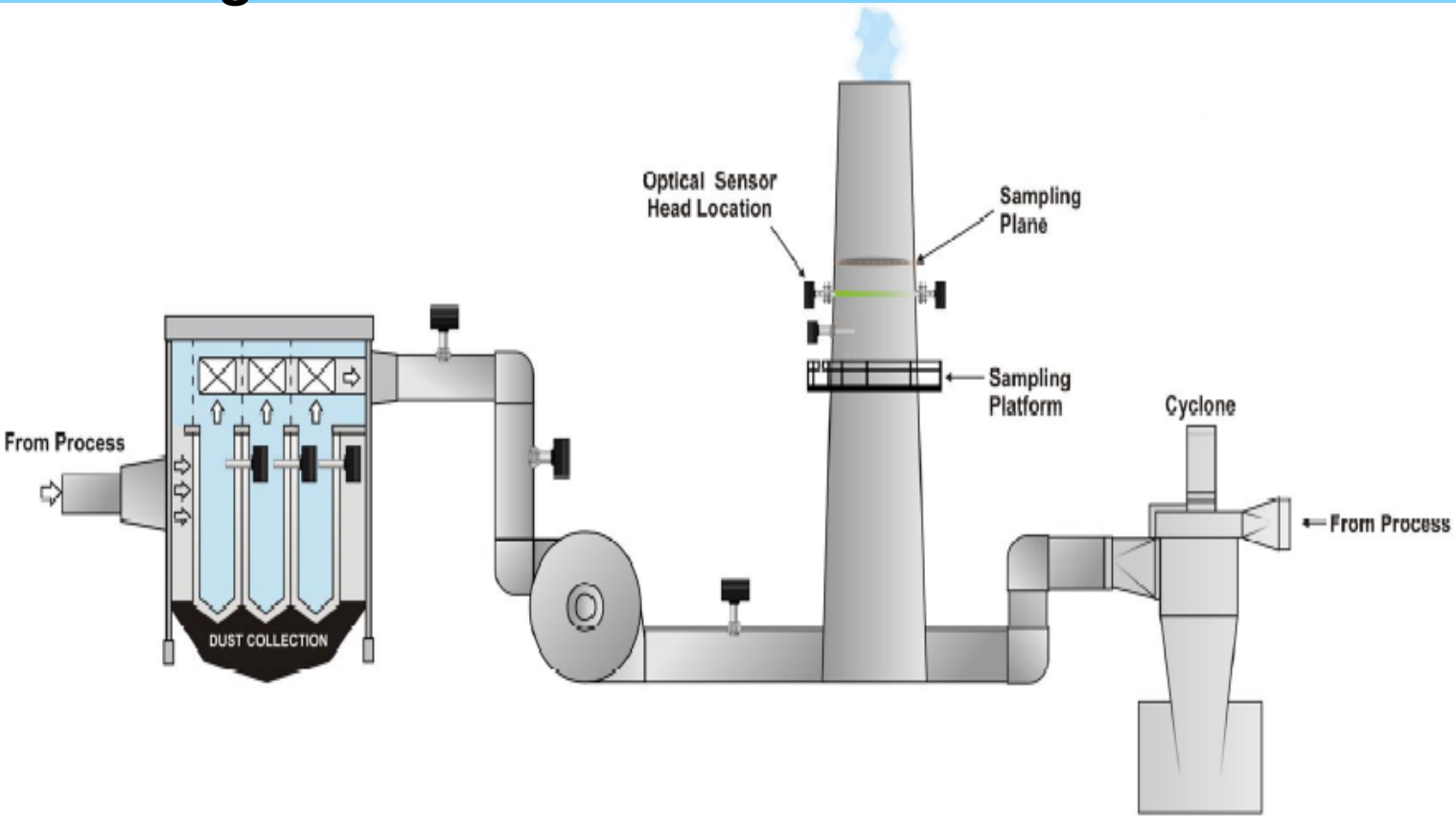


FIGURE 1.3 Travers point multiples to determine minimum number of traverse points requirement when a < 2 dia or b < 8 dia

Secondly It should be at the plane 500 mm above the Isokinetic testing Port



Positions to be considered for installation of Particulate Monitors

The installation should have logistic support like easy approach for calibration, Audit and maintenance etc.

CEMS Specific Location as per CFR Part 60 and Part 75

- ✓CEMS must be accessible, representative, and capable of passing a Relative Accuracy Test
- ✓At least 2 duct/stack diameters downstream of any “disturbance”
- ✓At least 1/2 diameter upstream of any “disturbance”
- ✓Any other location demonstrated to be acceptable if stratification correction is made
- ✓PM CEMS has no relaxation from 8D and 2D at laminar flow zone

India may also adopt the same criteria in extreme cases

CEMS Span and Range Part 60 vs Part 75

Span is a subset of Range (range is always ≥ Span)

Part 60 Sources – Usually Specified Span by the Subpart

Part 75, Appendix A, Section 2, gives Span Calculations

EPA's Objective to set range such that majority of measurement reading are in 20% to 30% range

So, Optimization of System after initial calibration and Performance test is required. Final Range of Measurement and Range of Span should be decided only after acquiring some monitoring data and estimation of actual spread of emission data

Steps for Calibration of PM CEMS

- Perform repeated isokinetic sampling (minimum 6 points) for PM
- Convert the manual reference method test data into measurement units (e.g., mg or mg/sec) consistent with the measurement conditions of your PM CEMS.
- Calculate the correlation equation(s) by drawing Regression curve (Linear)
- Do the variability test (statistical accuracy test)

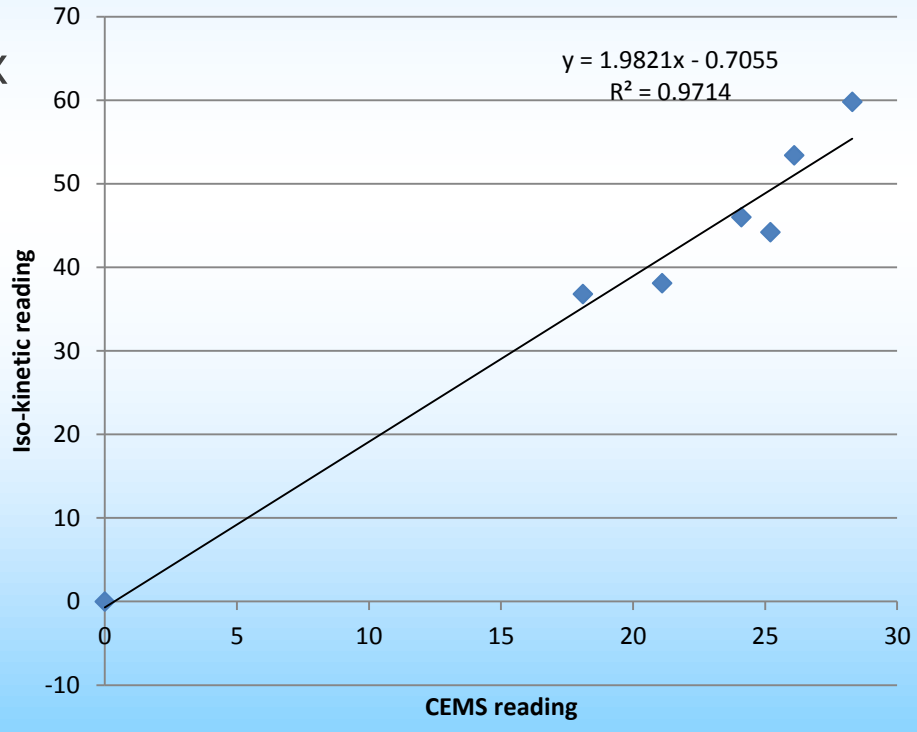
PM CEMS Calibration Procedure

Draw the scatter plot and fit the regression line

- In the scatter plot, CEMS reading should be on X-axis and Iso-kinetic reading on Y-axis.
- Find out the equation : y = a + bx

i.e: New CEMS reading = a + b*
(Old CEMS un-calibrated reading)

Sr. No.	CEMS reading	Iso-kinetic reading
	0	0
1	25.2	44.2
2	26.1	53.4
3	24.1	46
4	28.3	59.8
5	21.1	38.1
6	18.1	36.8



Steps for Calibration of Gaseous CEMS

- Perform repeated injection of Standard Known Concentration at the range actual emission is expected (minimum 3 levels in between Zero and Span)
- Span should be at 80% of the preferred range selected for the instrument to operate. As a thumb rule the range of operation is generally selected at 1.5 to 2.0 times of Emission Limit (EL)
- Calculate the correlation equation(s) by drawing Regression curve (Linear)

Requirement of Calibration gas levels and acceptance Criteria

40 CFR 60	40 CFR 75
2 calibration gases: 20-30% and 50-60% of monitor span Criteria ± 15% or ± 5 ppm	3 calibration gases: 20-30%, 50-60%, & 80-100% of monitor span Criteria ± 5% or ± 5 ppm

- When Daily Calibration Error or Linearity Check is Found Out-of-Control, The Emissions Data is Invalid.
- Invalid Data Starts At The Time That Calibration Error or Linearity Showed Out-of-Control Status, And Remains Invalid Until Corrective Action Shows No Out-of-Control Status
- Missing Data Substitution Must Be Used

We may set different approach

Performance Specification for SO_2, NO_X and CO

S.No.	Specification	Tolerance ranges/values
01	Zero Drift 24 hr.	≤ ± 2 % of Span
02	Span Drift 24 hr.	≤ ± 4 % of Span
03	Analyzer's Linearity	≤ ± 2 % of Span from calibration curve
04	Performance Accuracy	≤ ± 10 % of compared Reference measurement

Performance Specification for O_2, and CO_2

S.No.	Specification	Tolerance ranges/values
01	Zero Drift 24 hr.	≤ ± 0.5 % of O_2
02	Span Drift 24 hr.	≤ ± 0.5 % of O_2
03	Analyzer's Linearity	≤ ± 0.5 % of O_2
04	Performance Accuracy	≤ ± 10 % of compared Reference measurement or within 1% of O_2

Performance Specification for PM CEMS

S.No.	Specification	Tolerance ranges/values
01	Zero Drift between two servicing intervals	≤ ± 2 % of Full Scale range
02	Reference point Drift between two servicing intervals	≤ ± 2 % of Reference value range
03	Analyzer's Linearity	The difference between the actual value and the reference value must not exceed ±2 percent of full scale (for a 5 point check).
04	Performance Accuracy	≤ ± 10 % of compared Reference measurement

CEMS Data: Broad System View

CEMS DEVICE AT INDUSTRY SITE	• Technology selection guidelines • Installation, calibration and maintenance procedures and performance standards
DATA TRANSFER AND COMMUNICATION	• Open, transparent, vendor neutral system connecting CEMS device and PCBs server • Reliability, quality, availability
SPCB SERVER	• Storage, validation, analysis of CEMS Data • Facilitating regulatory functions and other administrative requirements

How to deal with Excesses emission:

(i) Any Exceedence of values over the prescribed standards or norms shall be considered as violation.

(ii) Instantaneous elevated data i.e. spikes with duration less than one minute shall be dealt separately and not considered for data averaging.

(iii) Continuous Exceedence of values upto 10% over the standards/norms for more than half an hour shall require preventive action from the industry.

(iv) Frequent Exceedence of the values i.e. more than 5% of the total data capture in a day of the prescribed standards/norms shall invite action from SPCBs/PCCs

(v) Any Exceedence of the monitored values as against the standards shall invite SMS & email to the industry from SPCBs/PCCs, requiring immediate feedback on the corrective action initiated/taken.

(vi) In case the emission/ discharge quality exceeds continuously the prescribed norms by 10% over the standards and for duration of one hour or more, the industry shall inform the SPCBs/PCCs of the action initiated to control the emission/discharges and the effectiveness of the measures taken. In case the industry fails to control the emissions/discharges within the norms it shall move towards closure of its operation following the laid down standard operating practices.

(vii) For any second failure of the industry to keep the emissions/discharges within 10% of the norms for period exceeding one hour the industry shall immediately move towards closure of its operation under intimation to SPCBs/PCCs.

(viii) The values recorded during calibration or during preventive maintenance shall not be considered for Exceedence and assessing the data capture rate.

(ix) Plant start-up or batch process starting emissions shall not be considered for averaging for the initial, 30 minutes period in case of batch processes or small furnaces/ boilers not operating continuously.

A more rational and scientific approach to deal with Excesses emission:

The German approach to using a PM CEMS is to build the statistical uncertainty (due to the factors of particle composition and size distribution) into the emission limit value. The correlation relation is not required to achieve a specific statistical accuracy (e.g., a confidence interval #10 percent at the emission limit value) to be approved. This approach is illustrated in the following example.

A municipal waste combustion facility has a base PM emission limit (EL) of 30 mg/dscm. Assume a specific source's PM CEMS correlation has a confidence interval (CI) at the emission limit of 4 mg/dscm (13 percent) and a tolerance interval (TI) at the emission limit of 11 mg/dscm (37 percent). Then, that specific source would have the following PM limitations

- No 30-minute average may exceed: 2*EL + TI = 60 + 11 = 71 mg/dscm.
- 97 percent of the annual 30-minute averages may not exceed: 1.2(EL + CI) = 36 + 5 = 41 mg/dscm.
- No daily average may exceed: EL + CI = 30 + 4 = 34 mg/dscm.

Even with the uncertainty in the PM CEMS measurement, the correlation relationship can still be used as a basis for compliance. Traditionally, the EPA regulations have taken this uncertainty into account when a CEMS-based standard is adopted.

Need Legal Support

Way Forward

1. Development of CEMS calibration protocol
2. Training to Laboratories for calibration of laboratories
3. Laboratory Accreditations for CEMS calibration
4. Data requirements / Data formatting for data robustness, outlier-values, missing data, spike-values etc.
5. Data capture & data utilization / data use
6. Revision in the standard (CEMS based Compliance)

THANK YOU

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