Existing Procedures, Protocols and Challenges of Online Systems for EMISSION MONITORING

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CPCB POLICY FOR REAL TIME EFFLUENT & EMISSION DATA COLLECTION

Targets and Directions

- **Sectors covered:**
  - 17 categories of industries – 3377 Units
  - Common Effluent Treatment Plans - 175
  - Common Hazardous Waste Incinerator-25
  - Common Bio Medical Waste Incinerator- 179
  - Grossly Polluting Industries (Ganga) - 1109

Directions u/s 18 (1) (b) were issued on February 05, 2014 to all Chairmen of SPCBs and PCCs to direct industry for installation of online emission and effluent monitoring system by March 31,2015. (Extended till June 30, 2015)

CPCB issued directions directly to industrial units in July/August 2015 under Section 5 of EP Act.

Parameters to be monitored

- **Specific category- wise parameters prescribed**
  - **Based on available monitoring instruments**
  - **Based on process of the Industry**
  - **Following the prescribed standards of CPCB**

Parameters for online monitoring as per Guidelines

Annexure-1

Sl No	Category	Effluent Parameters	Emission Parameters
1.	Aluminium	pH, BOD, COD, TSS, Flow	PM, Fluoride
2.	Cement	-	PM,NOx,SO_2
3.	Distillery	pH, BOD,COD,TSS, Flow	PM
4.	Dye and dye intermediate	pH, BOD,COD, TSS, Cr, Flow	-
5.	Chlor Alkali	pH, TSS, Flow	Cl_2,HCl
6.	Fertilizers	pH, flow, Ammonical Nitrogen, Fluoride	PM, Fluoride, Ammonia
7.	Iron & steel	pH, Phenol, cyanide, flow	PM,SO_2
8.	Oil refinery	pH, BOD,COD,TSS, flow	PM,CO,NOx,SO_2
9.	Petrochemical	pH, BOD,COD,TSS, flow	PM,CO,NOx,SO_2,
10.	Pesticides	pH, BOD, COD, TSS, Cr, As , flow	-
11.	Pharmaceuticals	pH, BOD, COD, TSS ,Cr ,As, flow	-
12.	Power Plants	pH, TSS, Temperature	PM,NOx,SO_2
13.	Pulp & paper	pH, BOD, COD, TSS ,AOx, flow	-
14.	Sugar	pH, BOD,COD,TSS, flow	-
15.	Tannery	pH, BOD, COD, TSS, Cr, flow	-
16.	Zinc	pH, TSS, flow	PM SO_2
17.	Copper	pH, TSS, flow	PM SO_2
18.	Textile(GPI)	pH, COD, TSS, flow	-
19.	Diary(GPI)	pH, BOD,COD,TSS, flow	
20.	Slaughter House	pH, BOD,COD,TSS, flow	

Field Installations (Heterogeneity)

(In- Situ, Extractive, Heated Probe etc.)

- **Parameter- PM**
  - **Opacity**
  - **AC Tribo Mass Concentration Monitor**
  - **Beta-Attenuation**
  - **TEOM**
  - **DC Tribo Mass Flow Monitor**
  - **Electrodynamic**
  - **Light Scatter Technology**
  - **Wet Extractive Technology**

- **Parameter- SOx**
  - **Pulsed- Fluorescence**
  - **NDIR**
- **Parameter- CO**
  - **Gas Filter Co-relation**
  - **NDIR**

- **Parameter- NOx**
  - **Chemi- Luminisence**
  - **FTIR**
  - **IR- GFC**

Need of Technology Providers cum Data Submitters (TPDS)

- System was required for data transmission from existing instruments operational in the industries and new instruments to be installed.
- Functionalities like Remote Calibration, Diagnostics, Data Validation etc. were required .
- Polluter Pay Principle to be adopted.

In view of above, a mechanism has been developed introducing TPDS made responsible to help industries to submit Real Time data. Although entire responsibility of data submission lies with Industry.

Data Policy for SPCB

- **SPCB should:-**
  - **Obtain Real Time Data from existing portals of TPDS operational within their jurisdiction.**
  - **Develop their own RTDMS with required capabilities using the data from existing TPDS' portals.**
  - **Not to force industry to shift to a new TPDS.**
  - **Communicate OCEMS related additional requirements if any, to CPCB.**
  - **Enhance their ambit to other categories of industries like Red, Orange etc.**
  - **Display the data in public domain through their own system**

Data Policy for Technology Provider cum Data Submitters (TPDS)

- **TPDS have to submit data as per CPCB Requirements mentioned at**

http://cpcb.nic.in/Online/Procdure_data-submission_CPCB.pdf

- **Ownership of Real Time OCEMS data collected on web Portals of TPDS lies with CPCB and SPCB.**
- **TPDS will not charge any additional cost to the industry for transferring this data to any other Govt. Agency or SPCB etc.**

Data Policy for Industry

- **Sole Responsibility of Real Time data submission lies with the Industry.**
- **Each Industry has to ensure 85% data availability every month for all its stations and parameters to be monitored as per C.T.O. given by SPCB and Environmental Clearance given by MOEF & CC.**
- **Industry can migrate to another TPDS ensuring data availability from old TPDS to new TPDS's portal, sharing details with CPCB.**

Protocol of
Online Systems
for EMISSION MONITORING

PART E1: Protocol for Selection and Installation of PARTICULATE MATTER (PM)

Industry: **Date:**

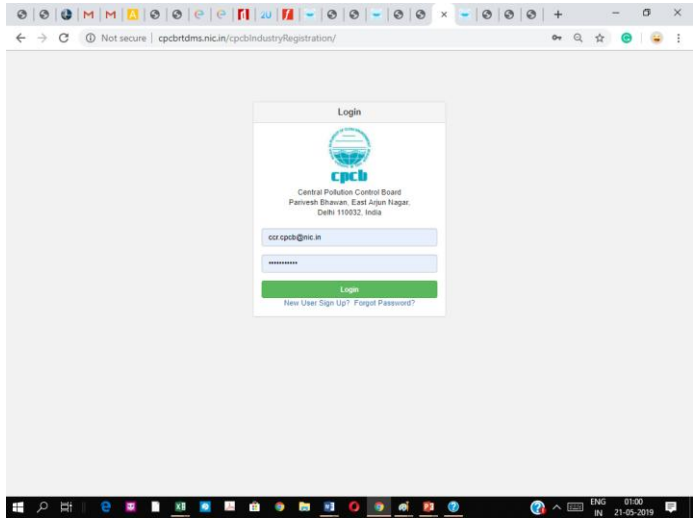
Process to which OCEMS attached: **Stack ID:**

(If discharge points are multiple, submit multiple copies of this format separately for each ID)

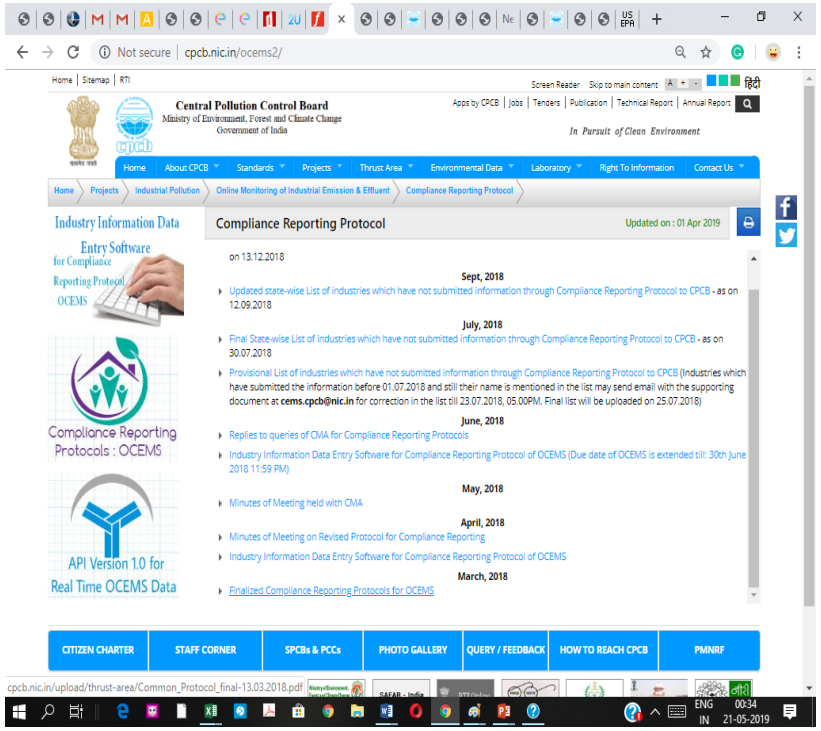
S. No.	Information on	Detail information								Remarks
1.	Type	In-situ	☐							
		Extractive	☐							Pipe Heating mechanism is must
2.	Technology In Situ	A) Triboelectric or Electro-dynamic	☐	AC	☐	DC	☐	AC / DC	☐	Industry installed DC Tribo must have Flow measuring Device
		B) Opacity	☐							Not applicable for <2 m path
		C) Optical Scintillation	☐							Not suitable for >15% Moisture
		D) Light Scattering	☐	Forward	☐	Back	☐			Only Backward / Side Proscatter/opacity is allowed at >4m stack diameter
		Forward Proscatter ☐	Other Forward ☐	Backward Proscatter ☐	Back/Side Scatter ☐					
3.	Technology Extractive	A) Light Scattering	☐	Forward	☐	Back	☐			The Sampling should be Online Isokinetic in all cases
		B) Optical Scintillation	☐							
		C) Beta Attenuation	☐							
	Distance of Measurement Bench (m)	☐								Heated Transfer line is must. Heating shall not be less than 100 ± 10 °C
	Whether Heated line installed for sample transport	Yes ☐		No ☐						

VARIOUS PORTALS IN OPERATION FOR OCEMS

http://cpcbrtdms.nic.in/cpcbIndustryRegistration/



https://orp.cpcbccr.com/



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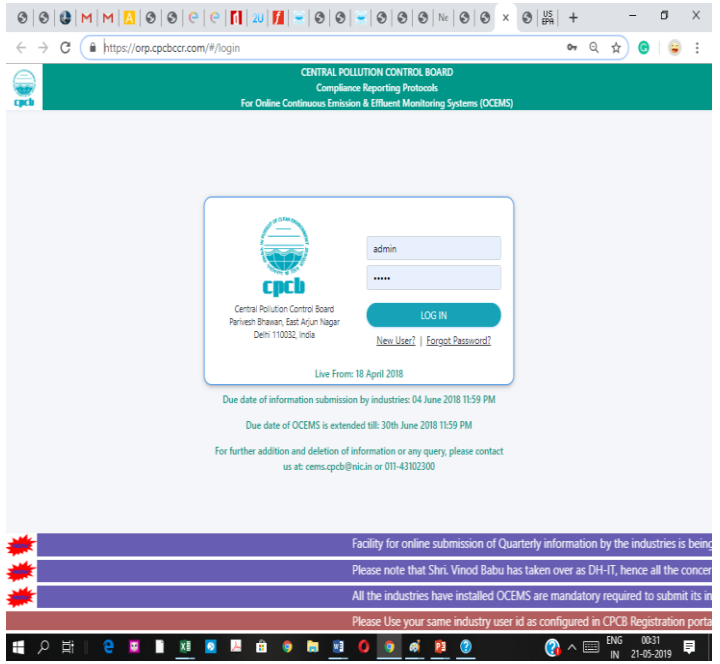


ONLINE CONTINUOUS EMISSION MONITORING SYSTEMS

STRICT PROTOCOL FOLLOWED

- Strict Protocol followed in OCEMS which enabled CPCB to have
  - Direct Access to OCEMS remotely
  - QUALITY CONTROL remotely through calibration
  - QUALITY CONTROL through Diagnostic feature
  - QUALITY CONTROL through Remote Auditing
  - DATA VALIDATION through online system only
  - Remote Management had inculcated a fear in Industry that a Quality System has to be installed which operates with proper QA/QC

Challenges of Online Systems for EMISSION MONITORING

Challenges for Industries for:

1. Decision of Number of Stacks to be covered
2. Selection of Technology
3. Location of Instruments
4. Range Selection of Instruments
5. Calibration of Instruments
6. Operation and Maintenance of Instruments
7. Verification through Audits
8. Regulatory framework understanding

Selection of Technology

Parameter Specific:

Emission:

- PM,
- SOx
- NOx,
- CO,
- O2,
- Flow

Clear demarcation of parameters to be monitored by OCEMS in various secto

Annexure-I

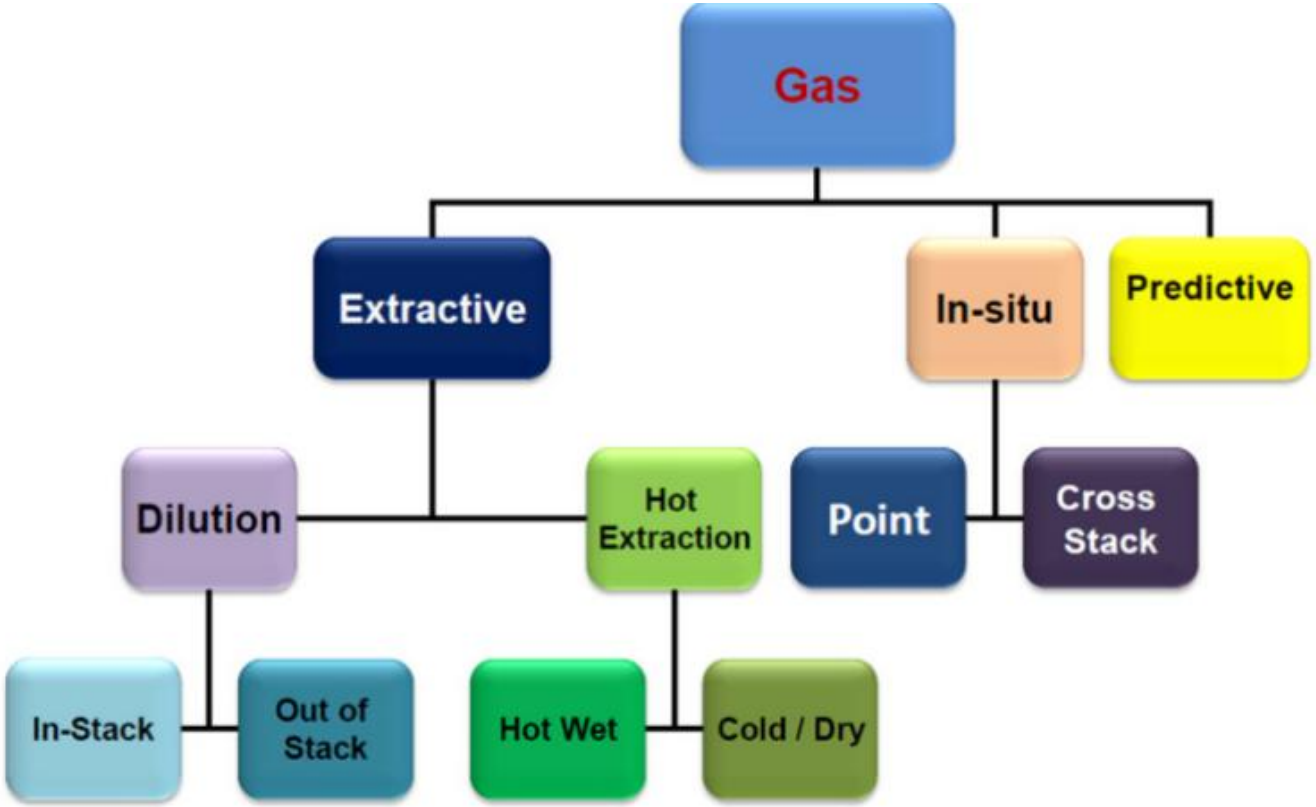
12. Parameters for online monitoring as per Guidelines

Sl. No	Category	Emission Parameters
1	Aluminium	PM, Fluoride
2	Cement	PM,NOx,SO_2
3	Distillery	PM
4	Dye and dye Intermediate	-
5	Chlor Alkali	Cl_2, HCl
6	Fertilizers	PM, HF, Ammonia
7	Iron & steel	PM,SO_2, NOx
8	Oil refinery	PM,CO,NOx,SO_2
9	Petro chemical	PM,CO,NOx,SO_2
10	Pesticides	-
11	Pharmaceuticals	-
12	Power Plants	PM, NOx, SO_2
	Thermal Power Plants	PM, NOx, SO_2, Total Mercury(Gaseous)**
13	Pulp & paper	-
14	Sugar	-
15	Tannery	-
16	Zinc	PM, SO_2
17	Copper	PM, SO_2
18	Textile (GPI)	-
19	Dairy (GPI)	-
20	Slaughter House	-
21	Boiler	SO_2, NOx, PM

** Online CEMS for Mercury may be applicable in case such condition is stipulated in EC issued by MoEF&CC / SEIAA

ONLINE CONTINUOUS EMISSION MONITORING SYSTEMS

Methods – Gaseous Parameters



Influencing Parameters

Flue gas temperature

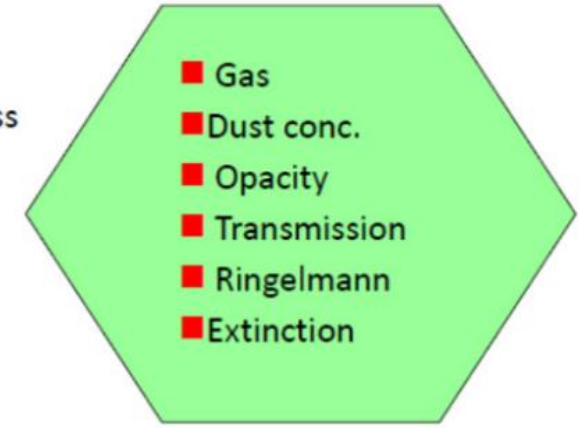
Wall and insulation thickness

Duct/stack diameter

Pressure

Wet or dry gas

Ambient temperature



Technology Selection

Scenarios :

- A. Concentration Levels dependent –High/Low
  - Very High – Dilution Technique - Like in Refinery Range- 50 to 1700mg/Nm3 (liquid)
  - Dynamic Limits are applied based on gas and liquid ratio- Hence Dynamic limits verification is to be implemented
  - FTIR – technique is very useful for low level measurements
- B. Process dependent: - Humidity Levels are high in flue gases
  - Incinerators CHWI, CBMWI- Measurement techniques which removes humidity can only be successful.

Technology Selection ……contd.

Scenarios :

- C. Size of Stack –
  - less than 2 mtrs stack Opacity measurement technique is not suitable in low ranges
- D. Requirement of Specific Technology like
  - if industry installs DC Triboelectric based technology, than installation of flow measurement device is compulsory.
  - PM Scintillation technique is Not suitable for >15% Moisture in stack
  - TLDS- Tunable Laser Diode system - requires moisture correction
- E. Instrumental Range Selection: atleast 2.5-3.0 Times expected conc.

Table 4: PM CEMS Technology Applications and Limitations

Measurement Technology		Technology	Stack Diameter (m)	Concentration (mg/m³)		Filter Type	Self-checks		Dry	Humid	Wet	Type of dust		Velocity Dependant
				Min	Max		Sensor contamination check	Zero & span				Same	Changing	
Probe Electrification	Charge Induction (AC)	ElectroDynamic	0.2-4	0.05	1000	Bag,Cyclone, Drier,Scrubber[5], None[6]	✓ (7)	✓ (7)	✓	✓	x	✓	x	No [8]
	Contact Charge Transfer (DC)	DC Triboelectric	0.2-2	1	1000	Bag,Cyclone, None[6],ESP[10]	x	x	✓	x	x	✓	x	Yes
	Combination AC & DC	Combination AC & DC/ Tribo	0.2-2	1	1000	Bag,Cyclone, None[6]	x	✓ (7)	✓	x	x	✓	x	Yes
Transmisometry	Ratiometric Opacity	Dynamic Opacity	1-15[1][2][7]	10[3]	1000	Bag[1],Cyclone,EP,None	✓	✓ (7)	✓	x	x	✓	x	No
		Dyanamic Detection Principle	1-10[1][2]	20	1000	Bag[1],Cyclone,EP,None	✓	x	✓	x	x	✓	x	No
	Opacity	Opacity	2-10[1][2]	30[4]	1000	EP,None	✓	✓	✓	x	x	✓	x	No
		Non Comliance Transmittance	2-10[1][2]	30[4]	1000	EP,None	x	x	✓	x	x	✓	x	No
Scattered Light	Light Scattering	Forward Scatter	1-3[2]	0.1	200	Bag,Cyclone,EP,None	✓	✓	✓	✓	✓ (9)	✓	X	No
	Light Scattering	Backward / Side Scatter	1-4[1][2]	25	500	Bag[1],Cyclone,EP,None	✓	✓	✓	x	x	✓	X	No

Notes: (1) Concentration dependent
(2) Representative Flow dependent
(3) Application specific
(4) Stack diameter dependent
(5) No water droplets
(6) No filter-not advised
(7) Model specific
(8) Varying velocity range 8-20 m/sec
(9) Using extractive wet stack monitoring system
(10) Advised with Faraday Shield/edge

There are a number of Opacity instruments with TUV approvals for particulate measurement. The certification ranges for opacity monitor are dependent on path length. The measuring range of 0-1000mg/m3 is suggested for a path length of 0.5 to 15 mt. However, low range i.e. 0 to 10 mg/Nm3 can be monitored in stack with minimum 5m path length.

This information is meant as a guide and reflects the majority of technology limitations of instruments currently commercially available, however specific models may offer decreased or increased capability the actual stack conditions will dictate instrument suitability.

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	Distance of Measurement Bench (m)	☐								Heated Transfer line is must. Heating shall not be less than 100 ± 10 °C
	Whether Heated line installed for sample transport	Yes ☐		No ☐						

Location of Installation of OCEMS Sampling Probe

For Circular Stacks PM Monitoring location

- At 8D:2D (2D from top)

For Stacks SOx and NOx monitoring

- Either at 8D:2D Location or in the Duct
  - Without disturbance due to turbulence in flue gas
  - Verified through stratification study
- Direction of OCEMS Probe
  - Inlet vertically down
- Location of OCEMS probe vs. Manual monitoring probe
  - 50 mm above the manual sampling probe

Calibration Protocol

- SPAN: As prescribed by Manufacturer of Instrument
  - Protocol: As suggested by Manufacturers
    - If frequency is high means stability of the instrument is low in long duration
- Span Gas Concentration of calibration gas: Near to 3/4th of the measurement range
- Data: Atleast last one year calibration details for verification
- Performance verification check conditions stipulated for:
  - Zero drift
  - Span drift
  - Linearity
  - Less than 10% of compared reference measurement

Operation of Instruments

- Zero on daily basis at 10 am through automatic process
- Span on fortnightly basis through automatic process
- Upon major maintenance each time
- Environmental conditions management
- Continuous flow monitoring ensured
- System Alarm Management

Data reporting

- Continuous reporting of all parameters as per method prescribed
  - Data
  - Diagnostic data
  - Calibration data
- Compliance Reporting Protocol
  - Initial installation data reporting
    - Linearity check data - on the basis of different load conditions – Once after installation
  - Continuous reporting after every three months
  - Quarterly reports submission for calibration and maintenance done

THANK YOU