Continuous Emission Monitoring System for Particulate Matter Emission: A tool to strengthen the regulatory framework

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Abstract -Air pollution in India is a critical issue. India is 21st out of 30 most polluted cities in the world in year 2019. (Source: State of global air 2019). The current system of environmental regulation is widely perceived as ineffective and imposing large burdens on polluting industries. It is high time to plan and adopt regulatory reforms and keep vigil and ensure the implementation of the regulation more transparently and effectively.CEMS installation is self-regulatory mechanism for industries alsoindustries are being continuously watched, violations are reduced

***Key Words*:** Continuous Emission Monitoring System(CEMS), PM10- Particulate Matter,

1. Introduction

Air pollution in India is a critical issue. India is 21st out of 30 most polluted cities in the world in year 2019. (Source: State of global air 2019). At least 140 million people in India breathe air that is 10 times or more over the WHO safe limit as per survey of year 2016 data. In Air pollution51% by industrial pollution, 27 % by vehicles, 17% by crop burning and 5% by fireworks. Premature deaths of 2 million Indians every year occurs due to Air pollution. (Source: National Institute of Environmental Health Sciences, September 2018). The current system of command-and-control approach to environmental regulation is widely perceived as ineffective and imposing large burdens on polluting industries. It is high time to plan and adopt regulatory reforms and keep vigil and ensure the implementation of the regulation more transparently and effectively. Using ContinuousEmission Monitoring System (CEMS), it is possible to estimate the total mass of particulate matter (PM) pollution released into the atmosphere over any time period. CEMS device measure minute by minute emissions from the stacks of the industry.

2. Basics of CEMS devices

The CEMS is basically an electronic device, which captures electronic signals, e.g. in milliamps (mA), which are collected and stored in a data logger

Physical principles as the basis of measurement include:
(I) Light scattering
(ii) Probe electrification
(iii) Light extinction
(IV) Optical scintillation
(v) Beta attenuation
All technologies require calibration to smoke stack conditions before use

3. Benefits of CEMS data

There are many benefits of continuous emission monitoring system data compare over manual stack sampling at specified intervals. Through CEMS real time information on particulate emissions and trend of emission can be tracked. It also generate time series data for particulate emissions. PM CEMS technologies gives high quality, on-going information on emissions from source emission to industries, regulators and potentially to the public which turns transparent and clear regulations. Industries can predict the costs of compliance and plan accordingly also encourages self-regulation among industries and reducing pollution levels thereby.

4. Fundamentals of PM10-CEMS device

PM10 CEMS device mainly has hardware, software component with data acquisition system

a) **Hardware components**:

For measurement of mass flow emission rate and a volumetric flow meter. A data logger is required for storing the CEMS data

b) **Software components:**

It comprise two software programs, both installed on the industry's dedicated CEMS computer. The CEMS vendor software provided by either the CEMS device supplier or a third party software vendor or a data fetching software which sends the local data generated by the CEMS vendor software on the same industry computer to the regulator's server

c) Data Acquisition System (DAS):

It is a dedicated on site computer with fast and reliable internet connectivity to record the CEMS device reading.

5. Types of CEMS device

There are basically two types of CEMS devices widely available in India for Particulate Matter emission measurement

Type 1 device:
It is based on PM10 Mass Flow Based Technology in which device directly measures PM10 mass flow through tribo electric probe. The CEMS device is calibrated for PM10 mass flow using iso-kinetic sampling and provides mass flow data directly

Type 2 device:
The device gives PM10 Mass Concentration on based technology with Volumetric Flow Meter. The device measures mass concentration and a separate flow meter that measures volumetric flow of the flue gas through opacity meters and light-scattering devices. Each device must be calibrated separately. The final reading is obtained through multiplicationof readings from PM10 CEMS device and volumetric flow meter

6. CEMS installations in industries

It is a self-regulatory mechanism. Continuous monitoring helps regulator as well as the industry to keep pollution levels in check on real-time basis. As industries are being continuously watched, violations are reduced. Repeat offenders can be identified easily by regulator with less infrastructure and manpower efficiency output can be possible through CEMS data. Since CEMS system is automated, it can be of great use in India where resources are meagre and infrastructure is weak. However, industries do not have technical knowledge or skilled manpower to select the suitable technology. They also lack awareness about the correct way to install CEMS devices. Even when an appropriate equipment is installed, lack of knowledge pushes them to place it incorrectly, resulting in inaccurate data. Calibration plays an important role in achieving data accuracy.Bi-annual Calibrations of CEMS Devices is must to ensure accurate data.

7. CEMS data analysis in pilot industries

75 industries from Surat Industrial cluster of Gujarat is mainly considered for pilot study for CEMS data. CEMS reading for two months have been studied and analyzed. It is observed from the study that a dedicated computer on-site with fast internet connection and adequate storage is required to avoid data loss. The software should generate and record proper data and readings. For adequate and uninterrupted reading Bi-annual Calibrations of CEMS Devices is must. Proper maintenance of the CEMS Device increases the lifespan of the instrument also generate high quality of data.

8. PM CEMS data of pilot industries

It is observed that about 43 industrial units have generated about 90% data availability. About 5 industries have exceeded emission thanpermissible limiti.e. 150 mg/Nm^{3}during study period of two months.

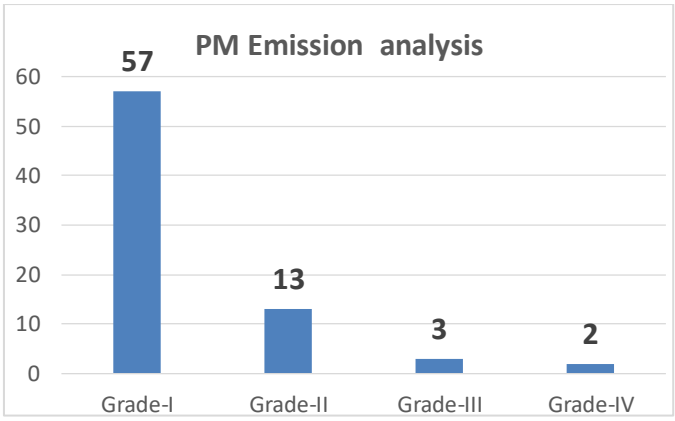

Figure1: PM emission analysis of pilot study

Grade	I	II	III	IV
No.	57	13	3	2
PM data	Upto 75 mg/Nm^3	75 -150 mg/Nm^3	150-225 mg/Nm^3	>225 mg/Nm^3

Table 1. PM emission data of pilot industries

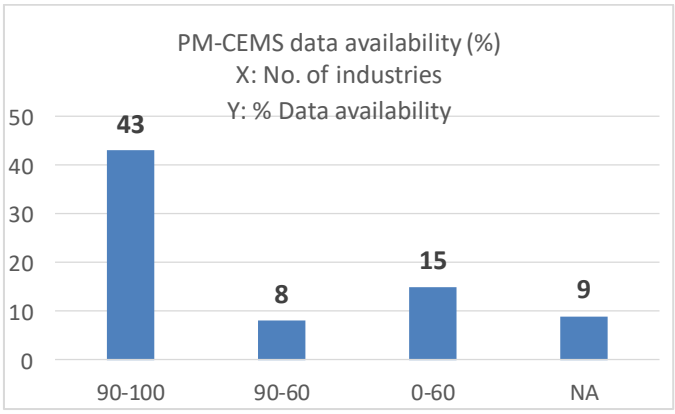

Figure2: PM CEMS data availability

9.Use of CEMS data for regulatory framework

The following path shall be used by regulator for using CEMS data in regulatory framework

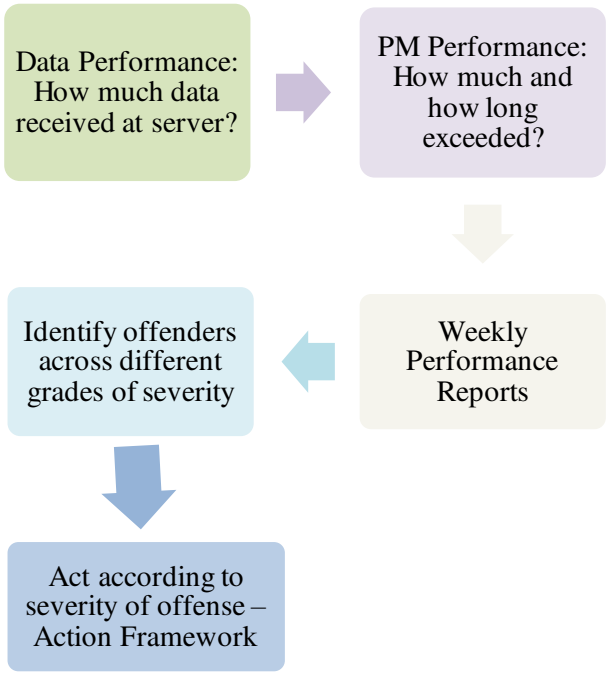

Figure 3: Use of CEMS data as regulatory framework

10. Conclusion

It is concluded that using PM CEMS device real time and time series data of particulate matter emission is obtained. The data is automated hence can be of great use and strengthened the monitoring of regulator with less infrastructure and manpower. CEMS also encourages self-regulation among industries.Bi-annual Calibrations of CEMS Devices is must to ensure accurate data. Capacity building of all stakeholders is required to implement CEMS into regulatory framework successfully.

Acknowledgement

The heading should be treated as a 3rd level heading and should not be assigned a number.

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