

Data analysis of specific sector Cement from different state of India

Dr. Neha Singh

Research Associate
Central Pollution Control Boards, Delhi

Abstract: Climate change is considered as the major environmental challenge for the world. Technological advancement has resulted in Cement making companies being able to produce higher volumes compared to the past. However, the higher production levels have also been largely labelled as the leading cause of pollution (Zimwara et al., 2012)[1]. Emissions from Cement manufacturing are one of the major contributors in global warming and climate change. The gaseous and particulate emissions from cement plants are degrading air quality and thus creating considerable environmental pollution especially air pollution. A study has been conducted to find out the level of Particulate Matter concentration in environment. The average concentration value of PM was found under the below permissible limits (CPCB) standards.

Keywords: Gaseous Pollutant; Particulate matter, Cement Plants.

Introduction- Concrete is the most used in building industry. Cement is a basic component of concrete used for construction of building and civil engineering construction. On an average approximately one ton of concrete is produced each year for every human being in the world (Huntzinger and Eatmon and Eatmon. 2009) [2]. Despite the cement popularity and profitability, the industry producing cement faces many challenges due to environmental concerns and sustainability issues(Shraddha and Siddiqui., 2014)[3].

The cement industry contributes significantly to the imbalances of the environment; in particular air quality. The main pollutant emitted from cement industries is Particulate Matter, which is the cause of health related problems. Other emissions from cement industry are nitrogen oxides (NO_x), sulphur dioxide (SO₂) and grey dust (Albeanu et al., 2004).[4]. In order to control such emissions Ministry of Environment Forest and Climate Change (MoEF&CC) and CPCB had prescribed emission Standards [page of green book] and State Pollution Control Boards and PCCs have been given the responsibility of enforcement of these standards with a power to make these standards stringent as per area requirements but no power to relax these standards in any case for various pollutants as notified under the Environment (Protection) Act, 1986[act reference]. With rapid Industrialization of Cement Industries, it is impossible to regulate emissions from these industries by physical inspections, hence, regulators have directed all such industries falling in 17 categories of industries (as per CPCB demarcation) to install Online Continuous Emission and Effluent monitoring systems (OCEMS) and to transfer real time data to CPCB servers failing which these industries are closed down.

It is requiring to regulate compliance by industries with minimal inspection of industries.

ENVIRONMENTAL & HEALTH IMPACTS:

Historically, emission control regulations for cement plants have focused on particulate emissions only. Over the past decades, however, regulations for the control of NO_x and other hazardous pollutants have been also adopted. A major increase of the number of regulated pollutants is due to the increasing use of co-incineration of waste materials such as tires, used oil, etc. in addition to conventional fuels. Today, air pollutants associated with cement manufacturing (regulated and non-regulated) include particulate matter, NO_x, SO_x, CO, CO₂, hydrocarbons, HCl, HF, Hg, heavy metals and other substances. Some of the pollutants, however, may not be present at significant mass rates or measurable concentration levels for the respective plant. Gas analysis at the stack assures the compliance of the entire plant operation with the emission regulations set by the governmental or local authorities.

Cement industries in India:

Source: <https://www.....>

Figure 2: Emissions from a Cement Plant

Materials and methodology-

Study Area:

1. Cement Industry, Himachal, (Unit-1)
2. Cement Industry, Chhattisgarh, (Unit-2)
3. Cement Industry, Rajasthan, (Unit-3)
4. Cement Industry, Andhra Pradesh, (Unit-4)
5. Cement Industry, Madhya Pradesh, (Unit-5)
6. Cement Industry, Gujarat, (Unit-6)

Emission data from the six different cement plants (names were not disclosed) Cement industry Himachal,(Unit-1),Cement Industry, Chhattisgarh, (Unit-2) Cement industry-Rajasthan(Unit-3), Cement industry Andhra Pradesh, (Unit-4) Cement Industry, Madhya Pradesh, (Unit-5), Cement Industry, Gujarat, (Unit-6),Were collected during 2016 to 2019. Data were analysed for PM parameter.

Particulate matters (PM₁₀, PM_{2.5})

The main pollutant emitted from cement industries is Particulate Matter, Particulate matters are emitted from quarrying, hauling, crushing, grinding of raw material and clinker, fuel preparation, clinker grinding and cement packing. Particulate matter is consisting of fine particles that can remain suspended in the air which include dust, soot, and liquid droplets [3].

There are two main types of Particulate Measurement Techniques:

A. In-Situ Systems (Point or Cross-duct) for application in flue gas stream with temperature above dew point (>95 °C)

- a) Light Attenuation
- b) Light scattering:
- c) Probe Electrification
- d) Optical Scintillation

B. Extractive Systems for applications with entrained water droplets in the gas stream

- a) Beta Attenuation
- b) Extractive Light Scatter

Techniques/ Instrumentation for Online Gaseous Pollutant Monitoring are:

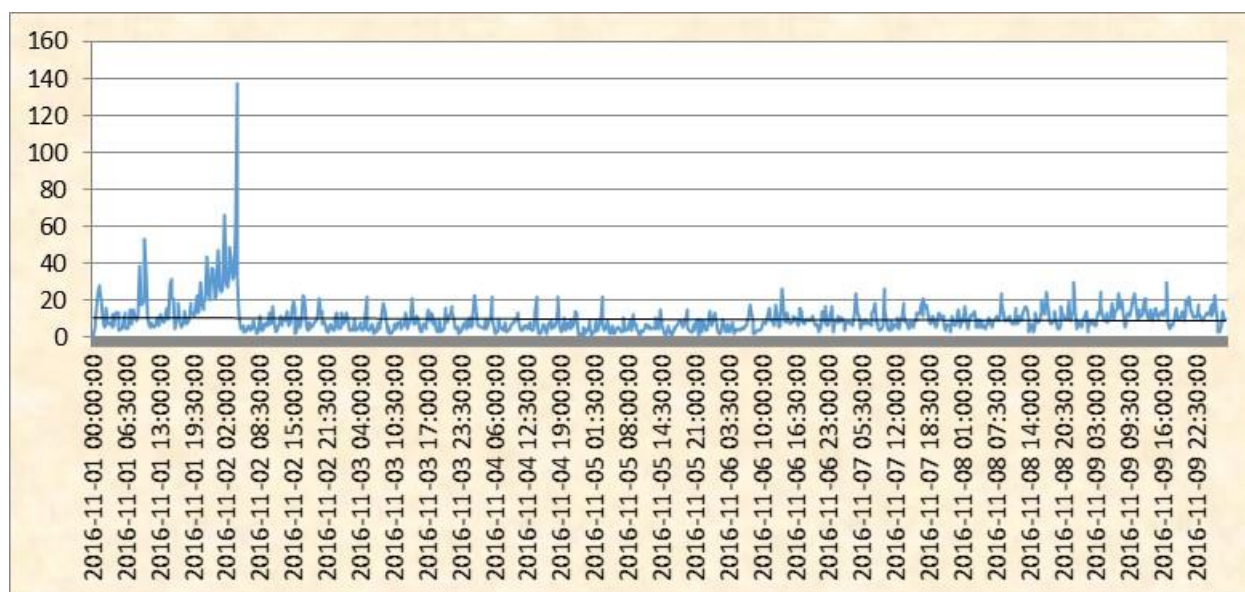
- a) Non Dispersive Infrared (NDIR)
- b) Photoacoustic Detector
- c) Gas Filter Correlation (GFC) NDIR

Table 1: As per the CPCB Guidelines 2018, PM Parameter specific Emission Standards for Cement industries need to install CEMS

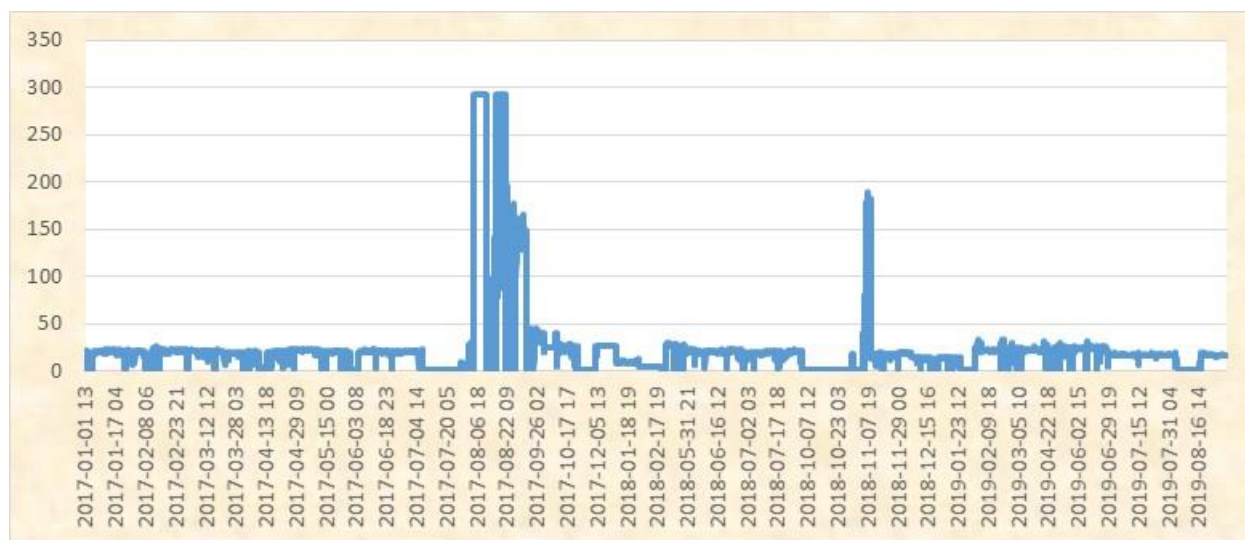
S.No.	Industry	Units of Operation	Parameters Prescribed	Emission Limits
1.	Cement Plant (without co processing), Standalone Clinker Grinding Plant or, Blending Plant	Rotary Kiln – without co processing	PM	30 mg/Nm3
2.	Cement Plant with co processing of wastes	Rotary Kiln – with co processing of Wastes	PM	30 mg/NM3

Data Analysis

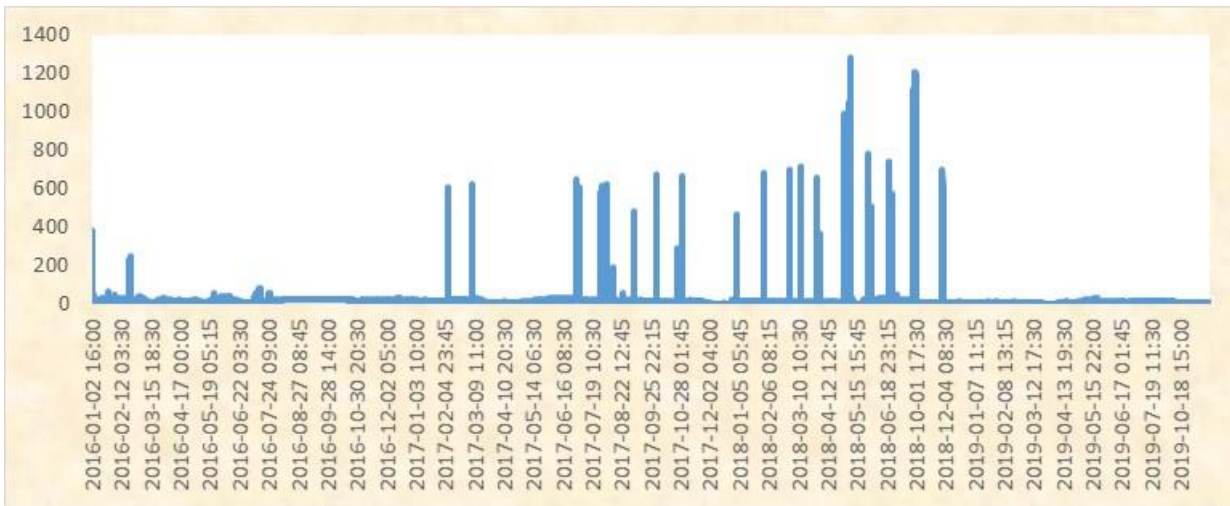
Cement unit-1, Himachal



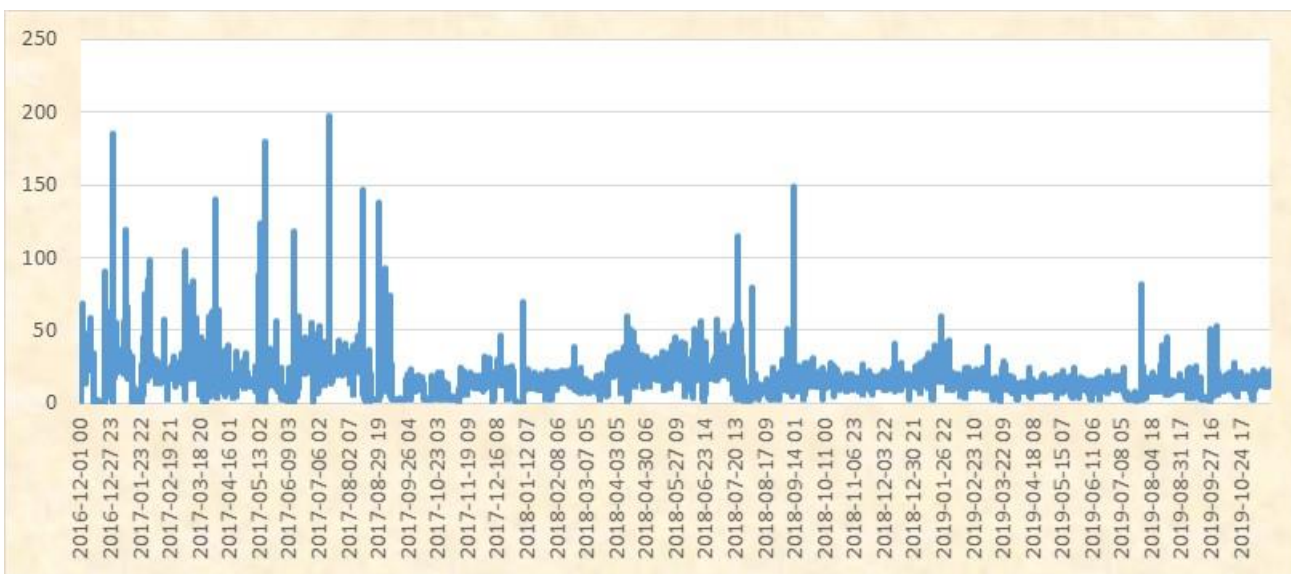
Cement unit-2 Chhattisgarh



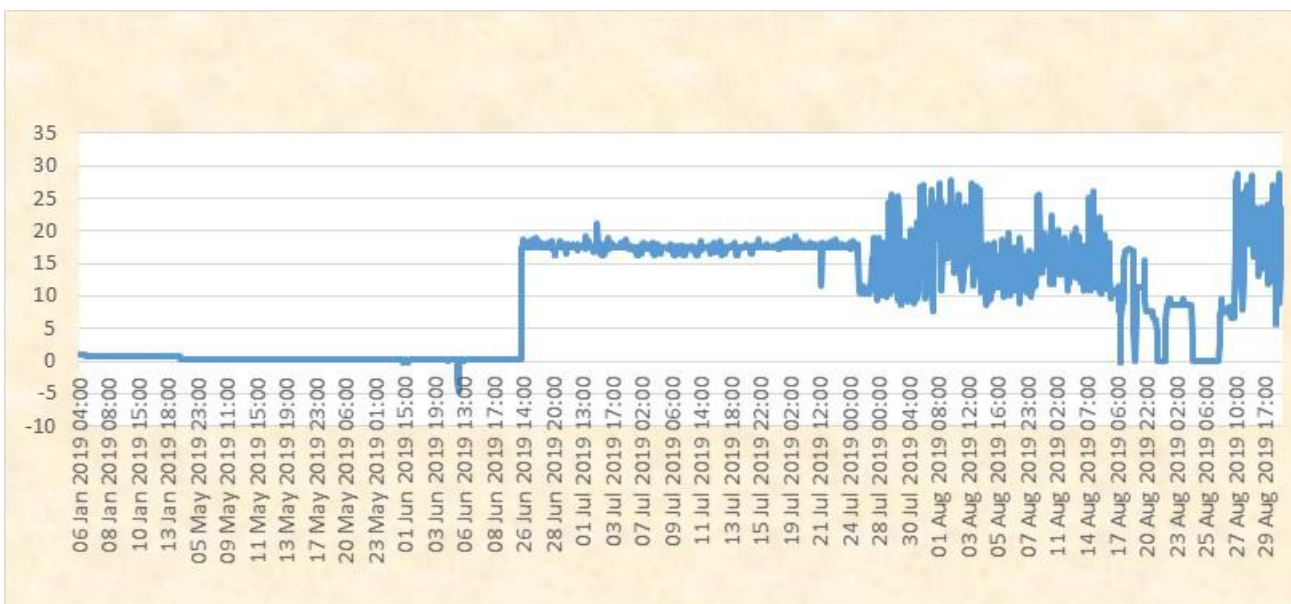
Cement unit -2 Rajasthan



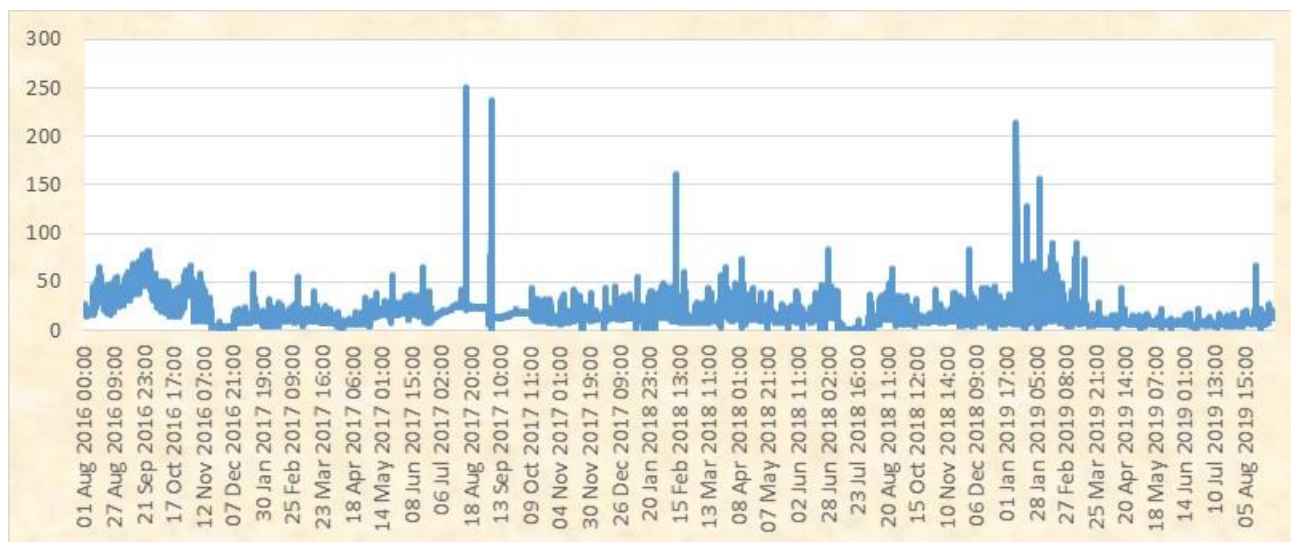
Cement Unit – 3 Andhra Pradesh



Cement unit- 4 Madhya Pradesh



Cement unit - 5 Gujarat



Statistical Analysis

Simple Statistical Analysis has been carried out for five Cement industries to find out the Emission level of PM Parameter in the environment.

Result and Discussion

The average results of the Particulate matter (PM) for different six industries in table-1

PM emission level in Cement Unit-1 - Himachal

In the present investigation it was found that values of Mean 4.77, Median 4.0, Mode 0.14, Standard Deviation 4.39 and Relative Standard Deviation 92% in Himachal Pradesh unit was under the prescribed limit.

PM emission level in Cement Unit-2 - Chhattisgarh

In the present investigation it was found that values of Mean 23.26, Median 19.35, Mode 0.00, Standard Deviation 41.79 and Relative Standard Deviation 179.66% in Chhattisgarh. In analysis it was observed that many times PM level higher than prescribed limit.

PM emission level in Cement Unit-3 - Rajasthan

In the present investigation it was found that values of Mean 12.24, Median 19.35, Mode 0.70, Standard Deviation 26.10 and Relative Standard Deviation 213.23% in Rajasthan. In the analysis of unit 3 it was found that many times PM level higher than the prescribed limit.

PM emission level in Cement Unit-4 -Andhra pradesh

In the present investigation it was found that values of Mean 14.50, Median 13.12, Mode, 0.0, Standard Deviation 9.21 and Relative Standard Deviation 63.51% in Andhra Pradesh unit was under the prescribed limit.

PM emission level in Cement Unit-5 -Madhya Pradesh

In the present investigation it was found that values of Mean 9.69, Median 11.28, Mode 0.2 Standard Deviation 8.31 and Relative Standard Deviation 85.75% in Madhya Pradesh unit was under the prescribed limit.

PM emission level in Cement Unit-6, Gujarat

In the present investigation it was found that values of Mean 15.06, Median 12.57, Mode 0.0, Standard Deviation 11.54 and Relative Standard Deviation 72.57% of particulate matter in Gujarat unit was under the prescribed limit.

Table 1. Average results of the PM parameters

	Site-1 Cement, Unit-1 Himachal	Site-2 Cement Unit-2 Chhattisgarh	Site-3 Cement Unit-3 Rajasthan	Site-4 Cement-4 Andhra Pradesh	Site-5 Madhya Pradesh	Site-6 Cement Unit-Gujarat
Mean	4.77	23.26	12.24	14.502	9.69	15.06
Median	4.0	19.35	10.23	13.12	11.28	12.57
Mode	0.14	0.00	0.70	0.00	0.2	0.0
Standard Deviation	4.39	41.79	26.10	9.21	8.31	11.54
Relative Standard Deviation	92%	179.66%	213.23%	63.51%	85.75%	72.57%

It is well known fact that air pollution is hazardous to environment and human health. Due to infrastructure developmental activities cement industry is flourishing and resulting in the environmental deterioration and in turn degradation of the human health worldwide. The gaseous and particulate emissions from cement plants are degrading air quality and thus creating considerable environmental pollution especially air pollution.

Conclusion

From the study it was concluded that-

All the sites show the average concentration value below the permissible limits (CPCB) standards value of PM parameter. On the basis of result the study site (Cement Unit, Rajasthan and Chhattisgarh) is most affected having PM range. Sites (Cement unit-Himachal, Madhya Pradesh, Gujarat and Andhra Pradesh) Least affected having PM range.

Among all six sites the quality of air follows as. Site3>Site2>Site1>Site5>Site6>Site4.

References:

1. Zimwaral, L. Mugwagwa1, and T.R Chikowore.2012. Air Pollution Control Techniques for the Cement Manufacturing Industry: A Case Study forZimbabwe. Department of Industrial and Manufacturing Engineering. National University of Science and Technology, Zimbabwe, CIE42 Proceedings, 16-18 July 2012, Cape Town, South Africa. CIE & SAIIE. P. No .37-1 -37-13.
2. Huntzinger and Eatmon and Eatmon., 2009
3. (Shraddha Mishra, Dr. Nehal Anwar Siddiqui., 2014)[3].
4. Albeanu G, Madsen, Popentiu F, and Thyregod P. 2004. Computer Aided Statistical Modelling and Optimization for Pollution Control in Cement Plants
5. Potgieter Johannes H. An Overview of Cement production: How “green” and sustainable is the industry?, 2012
6. Albeanu G, Madsen, Popentiu F, Thyregod P. 2004. Computer Aided Statistical Modeling and Optimization for Pollution Control in Cement Plants.
7. Hesham G. Ibrahim, Aly Y. Okasha, Mokhtar S. Elatrash and Mohamed A. Al-Meshragi, Emissions of SO₂, NO_x and PMs from Cement Plant in Vicinity of Khoms City in Northwestern Libya, 2012