



Assessment of Ambient Air Quality in the Vicinity of Cement Industries

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ABSTRACT

Recent time Air pollution is a serious problem due to rapid industrialization such as Cement industry, Thermal power plant, steel and coal industries etc. Cement industry is a potential anthropogenic source of air pollution. The gases and dust from the cement plant is in no way less hazardous compared to other industries. Cement manufacturing is a highly energy intensive process in other word intensive fuel consumption for clinker making and resulting in emissions. Emissions from cement manufacturing are one of the major contributors in global warming. The cement dust produced by cement manufacturing unit i.e. calcining, crushing, grinding ,Packing, loading/unloading are considered one of the most hazardous pollutants such as PM_{10} , $PM_{2.5}$, SO_2 and NO_x which affect the surrounding environment . Increased concentrations of the pollutants may cause closure of leaf stomata, progressive reduction in the photosynthetic ability of leaves, reduction in growth and productivity of plants. The Air quality was assessed based on New National Ambient Air Quality Standard and outcome of the study has been presented in to the form of Air Quality Index.



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INTRODUCTION

Cement industry is one of the most basic industries involved in the development of a country. India is the second largest producer of cement due to availability of Lime stone belt after China. Cement is the most widely usable building material throughout the world. Air pollution continues to receive a great deal of interest worldwide due to its negative impacts on human health and welfare. Air pollution and certain diseases including asthma, bronchitis, nausea, chest pain, lung cancer shortness of breath and sore throat Agrawal and Khanam (1997); Balaceanu and Stefan (2004).The industry releases huge amounts of cement dust into the atmosphere which settle on the surrounding areas forming a hard crust and causes various adverse impacts. Extreme effects of air pollution include cardiovascular problems and high blood pressure. The World Health Organization states that 2.4 million people die each year from causes directly attributable to air pollution Barman et al. (2008) and Chaurasia et al. (2014). The main environmental issues associated with cement productions are emission to air and energy use. The energy use by cement industry is estimated at about 2% of global energy consumption 5% of global manmade carbon dioxide emissions originated from cement production Chandrasekharan et al. (1998); Chaurasia et al. (2013); Chaulya S.K. (2004) and Gupta et al. (2002).

. One of the most critical impacts of cement manufacturing is the dust generated during milling, packing, storage, transport etc.

Atmospheric dust is an importance source of air pollution particularly in dry climates. It has been reported that 01 kg of cement manufactured in Egypt generated about 0.07 kg of dust in atmosphere Chaurasia et al. (2013)

Air quality index

Values are divided into six ranges of Air quality index, and each range is assigned as colour code and descriptor. Standardized public health advisories are associated with each API range. These are as follows.

"Good" AQI is 0 - 50. Air quality is considered satisfactory, and air pollution poses little or no risk.

"Moderate" AQI is 51 - 100. Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people. For example, people who are usually sensitive to ozone may experience respiratory symptoms.

"Unhealthy for Sensitive Groups" AQI is 101 - 150. Although general public is not likely to be affected at this AQI range, people with lung disease, older adults and children are at a greater risk from exposure to ozone, whereas persons with heart and lung disease, older adults and children are at a greater risk from exposure to ozone, whereas persons with heart and lung disease, older adults and children are at greater risk from the presence of particles in the air. "Unhealthy" AQI is 151 - 200. Everyone may begin to experience some adverse health effects, and members of the sensitive groups may experience more serious effects.

"Very Unhealthy" AQI is 201 - 300. This would trigger a health alert signifying that everyone may experience more serious health effects.

"Hazardous" AQI greater than 300. This would trigger a health warning of emergency conditions. The entire population is more likely to be affected.

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Study Area

The study area was Surat and Junagarh district of Gujarat lies on 21°12'N 72°50'E and 21°31'N 70°27'E respectively. The relief is low in the most parts of the state and involves diverse climate conditions. The winters are mild, pleasant, and dry with average daytime temperatures around 29°C and nights around 12°C with 100 percent sunny days and clear nights. The summers are extremely hot and dry with daytime temperatures around 41°C and at night no lower than 29°C. In the weeks leading up to the arrival of the monsoon rains the temperatures are similar to above but with high humidity which makes the air feel hotter. Relief comes when the monsoon season starts around in mid-June. The day temperatures are lowered to around 35°C but humidity is very high and nights are around 27°C. Most of the rainfall occurs in this season, and the rain can cause severe floods. The sun is often occluded during the monsoon season. Though mostly dry, it is desertic in the north-west, and wet in the southern districts due to a heavy monsoon season.

METHODOLOGY

The study was conducted for a period of three months at the interval of 01 month. At each site 08 hrs samples were collected in each location. One sampling site for ambient air monitoring was selected for each industrial unit. This was Near Main gate of the plant. Monitored parameters were PM₁₀, PM_{2.5} gaseous pollutants are SO₂ and NO_x. COMBO PM₁₀ and PM_{2.5} sampler Ecotech model AAS 271 consists of two different inlets, one for PM₁₀ and other for PM_{2.5} dusts

sampling. Gaseous pollutants sampler AAS118 was used for gaseous sampling and analyzed as per IS slandered methods APHA (1994). Air Quality index (AQI) was calculated by airnow.gov/index.cfm?action=resources.com_aqi_cacl website.

Air Quality Index (AQI) Values	Levels of Health Concern	Colors
0 to 50	Good	Green
51 to 100	Moderate	Yellow
101 to 150	Unhealthy for Sensitive Groups	Orange
151 to 200	Unhealthy	Red
201 to 300	Very Unhealthy	Purple
301 to 500	Hazardous	Maroon

Source- Chaurasia et.al, 2013.

RESULT AND DISCUSSION

Due to large production cement manufacturing units near by the all monitoring location obviously there are air pollution in large extent yet there is also a better air quality management system to reduce air pollution observed during the sampling period. All analyzed values are given in Table-1. The maximum concentration of PM₁₀ was observed 102µg/m³ beyond the permissible limit (100µg/m³) at near main gate of Ambuja Cement Ltd. Magdalla ,Surat on 17-02-2013 and minimum value was found 87µg/m³ under the permissible limit (100µg/m³) on 15-02- 2013 near main gate of Ultratech cement Ltd unit-NCMW,Surat. The maximum concentration of PM_{2.5} was obtained 63µg/m³ at near main gate 15-02-2013 at Ultratech Cement Ltd unit-NCMW, Surat which was beyond the permissible limit

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60 $\mu\text{g}/\text{m}^3$ and minimum value was observed 51 $\mu\text{g}/\text{m}^3$ under the permissible limit (60 $\mu\text{g}/\text{m}^3$) near main gate of Ultratech Cement Ltd unit-NCMW, Surat on 16-03-2013. The maximum value of SO₂ was observed 21 $\mu\text{g}/\text{m}^3$ under the permissible limit (80 $\mu\text{g}/\text{m}^3$) at near main gate of Ambuja Cement Ltd. Magdalla, Surat on 18-03-2013 and minimum value was found 07 $\mu\text{g}/\text{m}^3$ under the permissible limit (80 $\mu\text{g}/\text{m}^3$) at near main gate of Ultratech Cement Ltd unit-NCMW, Surat on 16-01-2013. The maximum value of NO_x was observed 33 $\mu\text{g}/\text{m}^3$ under the permissible limit (80 $\mu\text{g}/\text{m}^3$) at near main

gate of Ambuja Cement Ltd. Junagarh on 21-03-2013 and minimum value was found 18 $\mu\text{g}/\text{m}^3$ under the permissible limit (80 $\mu\text{g}/\text{m}^3$) at near main gate of Ultratech cement Ltd unit-NCMW, Surat on 16-01-2013.

Thus, concentration of PM₁₀ was found in the range of 91.66-97.66 $\mu\text{g}/\text{m}^3$ which was under the permissible limit 100 $\mu\text{g}/\text{m}^3$, PM_{2.5} was found in the range of 55.66-61 $\mu\text{g}/\text{m}^3$ which was slightly more than permissible limit 60 $\mu\text{g}/\text{m}^3$.

Table-1 Concentration of PM₁₀, PM_{2.5}, SO₂ and NO_x $\mu\text{g}/\text{m}^3$ at Various Stations.

S No	Name	Location	Date	PARAMETERS			
				PM ₁₀ ($\mu\text{g}/\text{m}^3$)	PM _{2.5} ($\mu\text{g}/\text{m}^3$)	SO ₂ ($\mu\text{g}/\text{m}^3$)	NO _x ($\mu\text{g}/\text{m}^3$)
1.	Ultratech cement unit-NCMW, Surat	Near Main gate	16-01-2013	98	53	07	18
			15-02-2013	87	63	10	21
			16-03-2013	91	51	13	30
			Average	92	55.66	10	23
			S.D.	5.56	6.42	3	6.24
2	Ambuja Cement Ltd. Magdalla, Surat	Near Main gate	18-01-2013	93	62	13	19
			17-02-2013	102	59	17	23
			18-03-2013	98	62	21	26
			Average	97.66	61	17	22.66
			S.D.	4.50	1.73	4	3.51
3	Ambuja Cement Ltd. Junagarh	Near Main gate	21-01-2013	90	60	11	32
			20-02-2013	97	57	20	27
			21-03-2013	88	58	18	33
			Average	91.66	58.33	16.33	30.66
			S.D.	4.72	1.52	4.72	3.21

****NAAQ Standard limit for PM₁₀, PM_{2.5}, SO₂ and NO_x are 100, 60, 80 and 80 respectively.**



Table.2 Air Quality Index of different parameter at selected stations.

Locations/Colour code	Parameters ($\mu\text{g}/\text{m}^3$)		
	PM ₁₀	SO ₂	NO _x
Ultratech cement Ltd unit-NCMW, Surat	69	14	22
Colour code	Yellow	Green	Green
Level of health concern	Moderate	Good	Good
Ambuja Cement Ltd. Magdalla, Surat	72	24	21
Colour code	Yellow	Green	Green
Level of health concern	Moderate	Good	Good
Ambuja Cement Ltd. Junagarh	69	23	28
Colour code	Yellow	Green	Green
Level of health concern	Moderate	Good	Good

AQI was found of PM₁₀ at moderate and SO₂ and NO_x were observed in good range (Table-2). From the study it can be concluded that overall management and control of air pollution and management is not Satisfactory in term of PM_{2.5} Finally from Indian AQI it can be said that Near Ambuja Cement Ltd. Magdalla, Surat falls in yellow zone. Findings of PM₁₀ and PM_{2.5} indicate that people with asthma or other respiratory disease are the group most at risk.

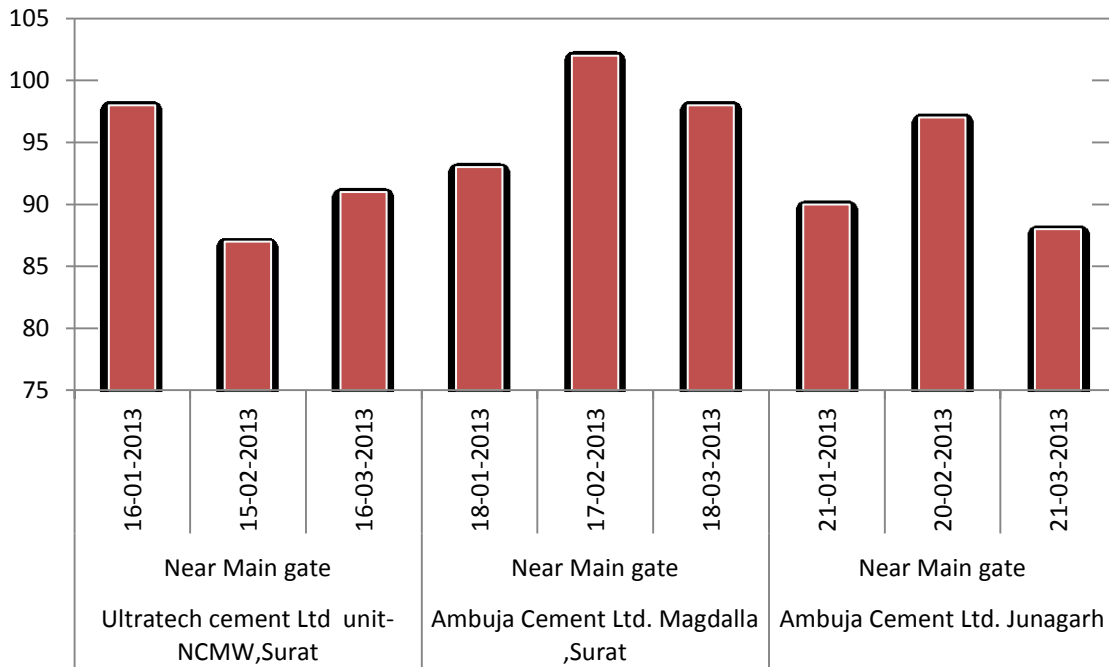
Concentration of SO₂ was observed in the range of 10-17 $\mu\text{g}/\text{m}^3$ and concentration of NO_x was found in the range of 22.6-30.6 $\mu\text{g}/\text{m}^3$ (Table-1), which was also under the permissible limit 80 $\mu\text{g}/\text{m}^3$.

AQI values were calculated also.

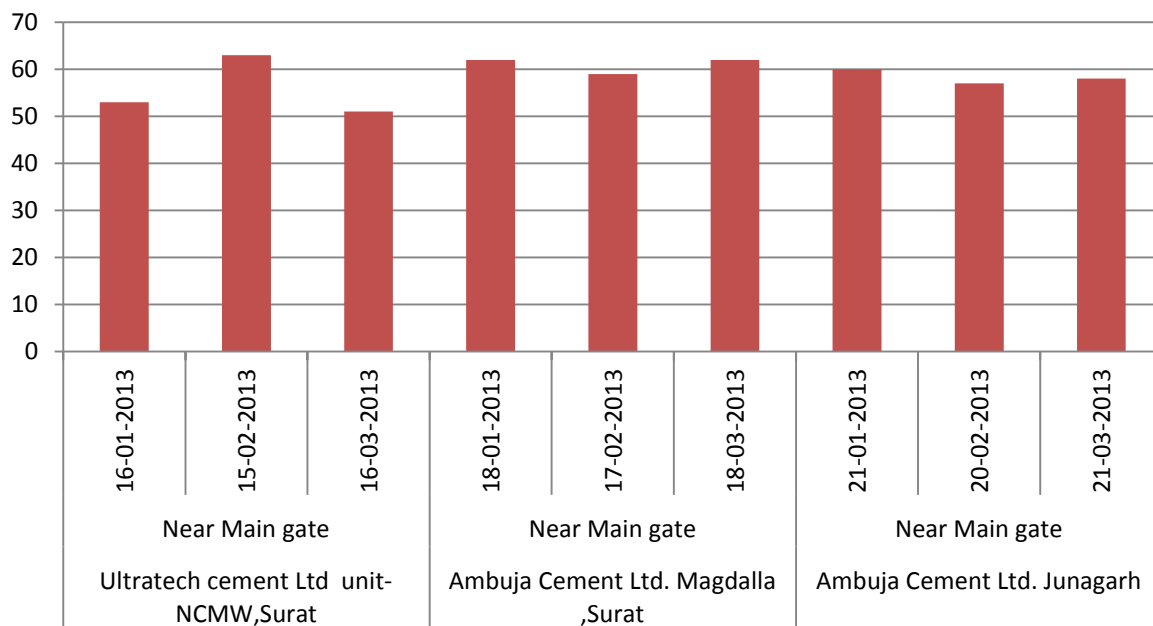
Recommendations

1. For the sustainable development it is recommended to focus on effective emission control technology and energy efficiency.
2. For cement plant Emission standard as notified under EP Act 1986 and CPCB for control of fugitive emission etc to be strictly enforced.
3. Continuous monitoring of specified pollutants to be initiated in nearby the habitat of cement plant to check Ambient Air Quality.
4. Incorporate interlocking mechanism to all the pollution control equipment and process unit.
5. Water sprinkling is practiced during transport activity.

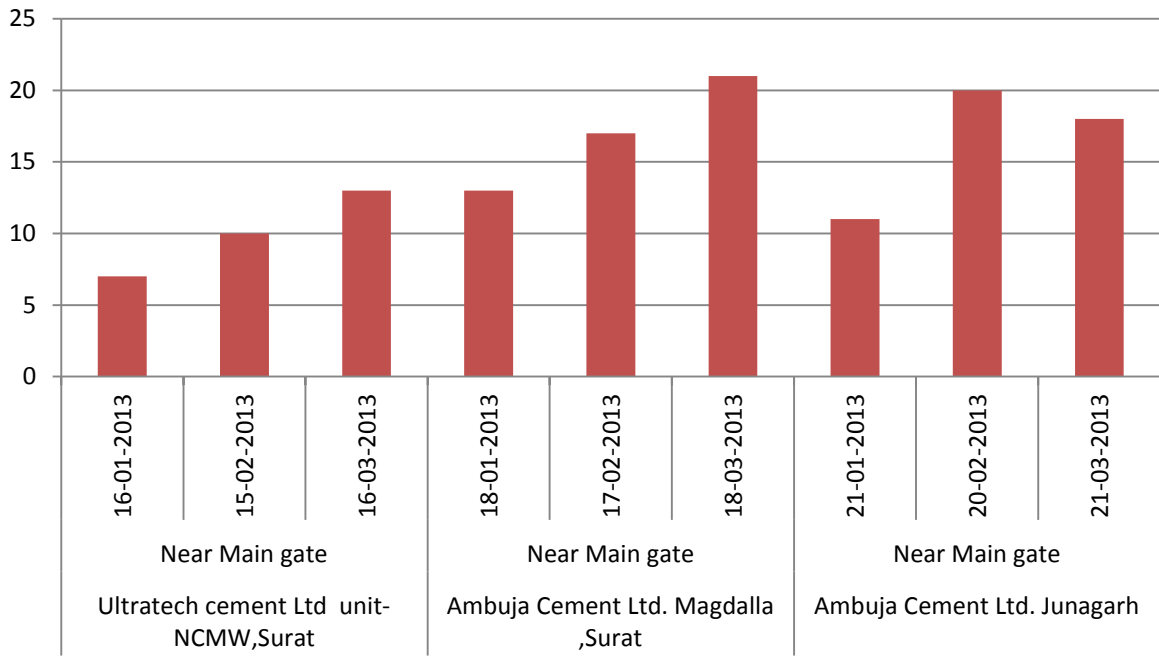
VALUE OF PM10 ($\mu\text{g}/\text{m}^3$)



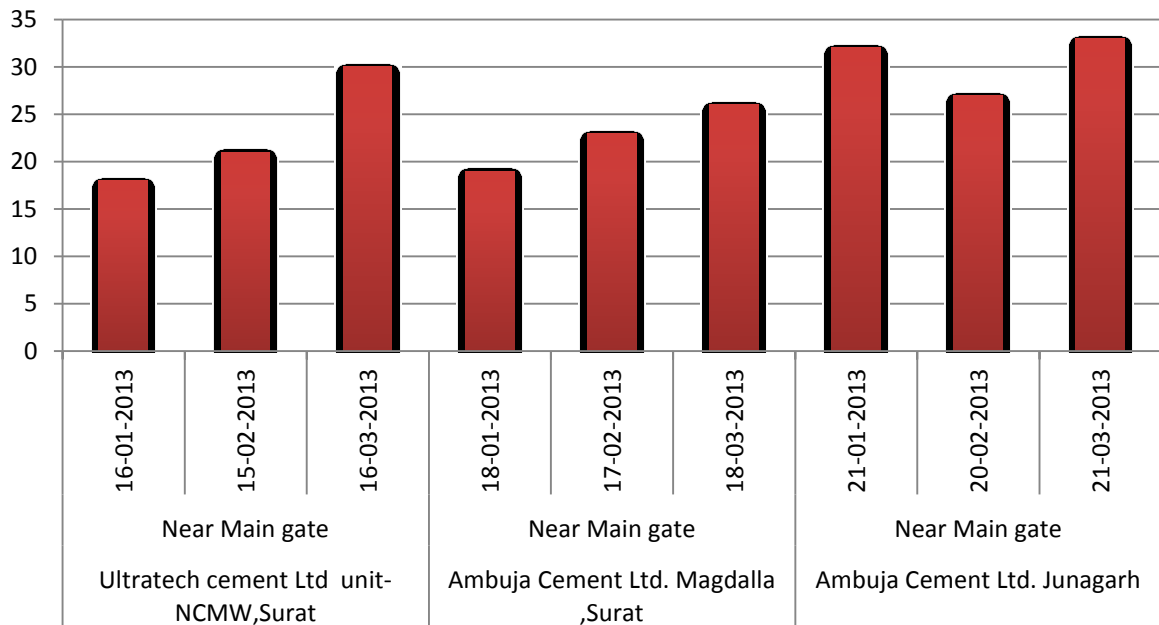
VALUE OF PM2.5 ($\mu\text{g}/\text{m}^3$)



VALUE OF SO₂ (µg/m³)



VALUE OF NO_x (µg/m³)



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