International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 3 Number 3 (2014) pp. 133-139**
http://www.ijcmas.com

Original Research Article

Assessment of air pollution emission from Cement Industries in Nimbahera, Rajasthan, India

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A B S T R A C T

Keywords

Gasious pollutant; Particulate matter; AQI..

This research work presents data of the ambient air quality status of Nambahera district of Chittorgarh Rajasthan, India. The Air quality was assessed based on New National Ambient Air Quality Standard. The selected parameters were SPM, $PM_{10,}$ SO_2, NOx. The average value of PM_{10} was found beyond the permissible limit at near power plant and near coal mill. The outcome of the study has been presented in the form of Air Quality Index. AQI was found moderate for PM_{10} and SO_2 & NOx were observed in good range. Findings of PM_{10} indicate that people with asthma or other respiratory disease are the group most at risk.

Introduction

Water is not a commercial product but, The construction sector had bloomed during the past few years. Many projects are being constructed including multi-stores residential building high. Raise commercial buildings as well as many other infrastructure projects due to the availability of raw material necessary for the manufacturing of cement (Garg et.al 2001; Kumar and Joseph 2006). 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 man-made carbon dioxide emissions originated from cement production (Chandrasekhran 1998). One of the most critical impacts of cement manufacturing is the dust generated during transport storage milling packing etc (Chaurasia et. al, 2013; Gupta et. al 2002). Atmospheric dust is an importance source of air pollution particularly in dry climates. It has been reported that 1kg of cement manufactured in Egypt generated about 0.07kg of dust in atmosphere. (Barman et. al 2008). Balaceanu and Stefan 2004, studied the metal distribution in soil around a cement factory in southern Jardan and found that all of the metals concentrations were found close the cement factory (Sirajuddin and Ravichanran 2010; Agrawal and Khanan 1997). The typical gaseous to air

form cement manufacturing plant inclued nitrogen oxides (NOx) sulphur dioxide (SO_2) Carbon oxides (CO and CO_2) and dust (Chaurasia et. al 2013; Chaulya 2004).

Air Pollution has potentially harmful or nuisance effect on human beings animal plant there biological communities and habitats on the soil (World Business Council for Sustainable Development 2005).

Air quality index

Air quality index values are divided into six ranges, and each range is assigned a descriptor and a colour code. 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 unusually 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 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.

Study Area

Nambahera district of Chittorgarh Rajasthan in India lies between longitude 74^0 38' 15.03" east and latitude 24° 39'12.61" north. It is facing multifarious problems of environmental degradation due to technological and industrial development and Wonder Cement plant having a total productions capacity 3.25 million tons per annum is located at 17 km. in the south of Chittorgarh.

Materials and Methods

The study was conducted for a period of two months at the interval of 15 days. At each site 4hrs samples were collected in each 15 days in the afternoon 2PM to 6PM. Four sampling sites for ambient air monitoring were selected. These are near main gate, near power plant, near coal mill and near dispensary. Monitored parameters were Suspended Particulate Matter (SPM), $PM_{10,}$ and gaseous pollutants SO_2 & NO_x. HVS (APM 460) was used for air sampling and analyzed as per slandered methods. Air Quality index (AQI) was calculated by airnow.gov/index.cfm ?action=resources. cocm_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.

Results and Discussion

Environmental management system is working in proper way in Wonder Cement Ltd according to their production capacity. Due to large production unit obviously there is air pollution in large extent yet there is also a better air quality management system to reduce air pollution. All analyzed values are given in Table-1.

The maximum concentration of SPM was observed 526µg/m^3 beyond the permissible limit (500µg/m^3) at near power plant on 15-01-2013 and minimum value was found 210µg/m^3 at on 15-01-2013 & 30-01-2013 respectively at near dispensary and near main gate. The maximum concentration of PM_{10} was obtained 132µg/m^3 at near power plant 15 02-2013 which was beyond the permissible limit 100µg/m^3 and minimum value was observed 20.4µg/m^3 near dispensary on 30-01-2013.

The maximum value of SO_2 was observed 24.2µg/m^3 at near coal mill on 28-02-2013 and minimum value was found 10.6µg/m^3 at near main gate on 15-01-2013. The maximum value of NO_2 was observed 27.1µg/m^3 at near dispensary on 15-01-2013. The maximum value of NO_x was observed 27.1µg/m^3 at near power plant on 28-02-2013 and minimum value was found12.3 µg/m^3 near dispensary & near main gate on 30-01-2013 & 15-02-2013 respectively.

Thus, the average concentration of SPM was found in the range of 266-389.75µg/m^3, concentration of PM_{10} was found in the range of 63.35-111.5µg/m^3which was beyond the permissible limit 100µg/m^3, concentration of SO_2 was observed in the range of 13.58-19.70µg/m^3 and concentration of NOx was found in the range of 15.58-22.20µg/m^3 (Table-1 and Fig-1 to 4). AQI values were calculated also. AQI was found of PM_{10} at moderate and SO_2 and NOx were observed in good range (Table-2). Table-3 shows correlation between selected parameters. All the parameters are showing significant positive correlation.

From the study it can be concluded that overall management and control of air pollution and management is not satisfactory in term of SPM and PM_{10}. Finally from Indian AQI it can be said that Wonder Cement Ltd. falls in yellow zone as it has not efficient management plan to avoid pollution to protect environment. Findings of SPM and PM_{10} indicate that people with asthma or other respiratory disease are the group most at risk.

Table.1 SPM, PM_{10}, SO_2 and NO_x Concentration ($\mu g/m^3$) at Various Stations

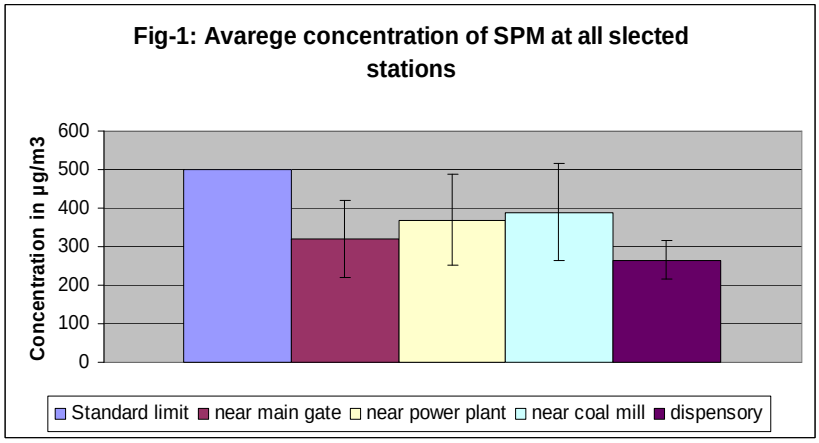
S. No.	Parameters ($\mu g/m^3$)	Standard Limit	Date of sampling	Stations			
				Near Main Gate	Near Power Plant	Near Coal mill	Near Dispensary
1.	SPM ($\mu g/m^3$)	500 ($\mu g/m^3$)	15/01/2013	406	526	325	210
			30/01/2013	210	230	245	303
			15/02/2013	263	425	503	315
			28/02/2013	400	325	486	236
			Average	**319.75**	**376.50**	**389.75**	**266.00**
			S.D.	±98.56	±117.68	±125.47	±51.00
2.	PM_{10} ($\mu g/m^3$)	100 ($\mu g/m^3$)	15/01/2013	56	103	123	87
			30/01/2013	40	111	98	20.4
			15/02/2013	83	132	103	56
			28/02/2013	80	100	94	90
			Average	**64.75**	**111.5**	**104.50**	**63.35**
			S.D.	±21.23	±14.43	±12.47	±32.44
3.	SO_2 ($\mu g/m^3$)	80 ($\mu g/m^3$)	15/01/2013	11.3	13.6	12.2	10.6
			30/01/2013	18.3	21.7	20.1	16.4
			15/02/2013	16.2	18.6	22.3	14.8
			28/02/2013	14.3	19.7	24.2	12.5
			Average	**15.03**	**18.40**	**19.70**	**13.58**
			S.D.	±2.97	±5.83	±5.27	±2.54
4.	NO_x ($\mu g/m^3$)	80 ($\mu g/m^3$)	15/01/2013	13.5	19.1	25.3	24.9
			30/01/2013	16.2	14.2	18.7	12.3
			15/02/2013	12.3	15.9	20.2	13.5
			28/02/2013	20.3	27.1	24.6	20.2
			Average	**15.58**	**19.08**	**22.20**	**17.73**
			S.D.	±3.54	±5.72	±3.15	±5.91

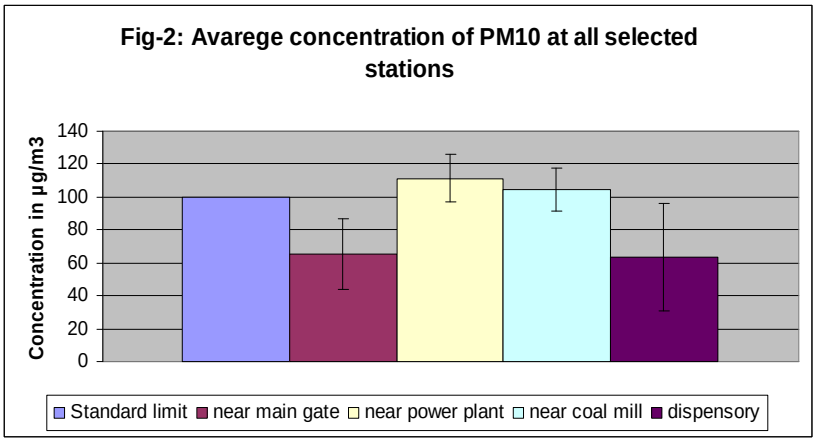
Table.2 Air Quality Index of different parameter at selected stations.

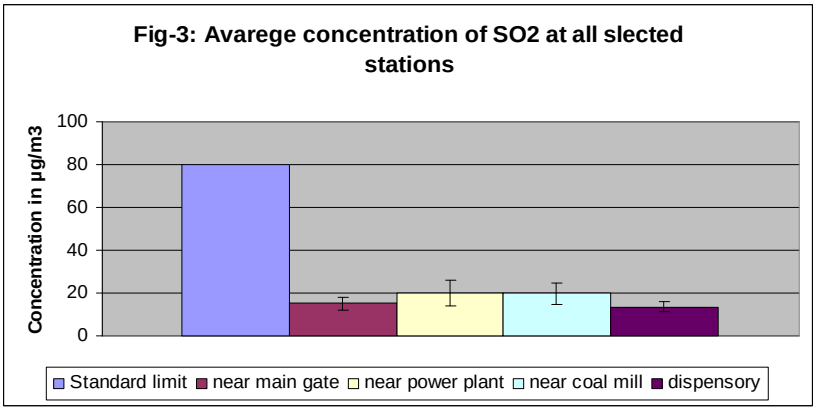
Locations/Colour code	Parameters ($\mu g/m^3$)		
	PM_{10}	SO_2	NO_x
Near Main Gate	55	21	14
Colour code	Yellow	Green	Gen
Level of health concern	Moderate	Good	Good
Near Power Plant	79	26	18
Colour code	Yellow	Green	Green
Level of health concern	Moderate	Good	Good
Near Coal mill	75	27	21
Colour code	Yellow	Green	Green
Level of health concern	Moderate	Good	Good
Near Dispensary	55	19	16
Colour code	Yellow	Green	Green
Level of health concern	Moderate	Good	Good

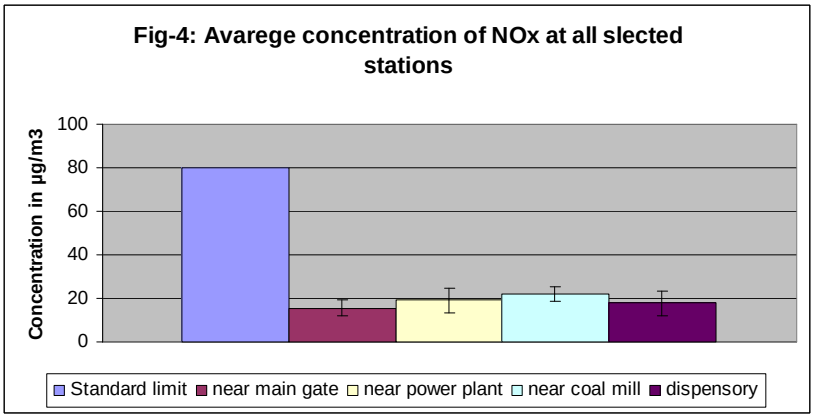
Table.3 Correlation between parameters

Parameters	**SPM**	**PM_{10}**	**SO_2**	**NOx**
SPM	1			
PM_{10}	0.994908	1		
SO_2	0.997777	0.9994	1	
NOx	0.999499	0.997334	0.99926	1









Recommendations

1. Emission standard as notified under EP Act 1986 and CPCB for control of fugitive emission etc for cement plant to be strictly enforced.
2. Continuous monitoring of specified pollutants to be initiated in all the locations in cement and power plant for ambient and stack respectively. Data to be provided in plant website with linkage to SPCB website.
3. Incorporate interlocking mechanism to all the pollution control equipment and process unit.
4. Water sprinkling is practiced during transport activity.

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