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Analysis of Air Pollutant Emission and Control System in Cement Industries around Ariyalur District

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Abstract: ***This research work presents data of the ambient air quality status of Ariyalur district of Tamilnadu, India. The air quality was assessed based on new national ambient air quality standard. The selected parameters were $PM_{2.5}$, PM_{10}, SO_2, NO_2. 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 $PM_{2.5}$, SO_2 & NO_2, were observed in good range. Excess of PM_{10} is control in water spray system ,road cleaning vehicles, choosing cleaner fuel system and consider alternative fuels such as gas instead of coal by reduced the coal. Adopted the electrostatic precipitator in coal mill. Modern ESP are designed to have high collection efficiencies of all types of fly ash, some are marketed as applicable to worldwide coal firing; collection efficiencies are now up to 99.81%.***

Keywords: Gaseous pollutant; Particulate matter; NAAQS; AQI ; ESP

1. Introduction

Air pollution is a chemical or particulate matter or biological agent that changes the natural characteristics of the atmosphere. Air pollution due to lime and cement producing industries has been found to cause serious occupational health hazards, and adverse effects on crops, orchards and buildings. The people residing in the vicinity of these industries may be exposed to higher levels of pollutants. Cement production requires massive amount of energy, mostly in the form of coal, which produces a considerable amount of carbon dioxide emission as an undesirable by-product. The emission of carbon dioxide depends on the type of production processes, their efficiency, fuel used etc. One of the most important impacts of cement manufacturing is the dust generated during storage, milling, packing and transport.

Atmospheric mineral dust is an important source of air pollution contains high concentrations of many metals known to have toxic effects not only on plants and animals but also on humans. On account of the gravity of the problem, this paper presents predictions of air pollutants such as sulphur dioxide (SO2), nitrogen dioxide (NO2), carbon mono oxide (CO) and suspended particulate matter (SPM) during the manufacturing months with the causes, effects and the cost to the mankind, with special reference to the Ariyalur District Of Tamilnadu, India region. The proposed measures should limit the ambient air pollutant concentrations to be in compliance with the standard values The selected parameters were SPM, PM10, SO2, NO2.

2. 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.

3. Study Area

There are about 7 cement industries in Ariyalur district of Tamilnadu, India. It is facing multifarious problems of environmental pollution due to technological and industrial development and Cement plant having a total productions capacity 3.25 million tons per annum is located at 30 km in the Perambalur District.

4. Materials and Methods

The study was conducted at Cement Industry. Samples are collected for 8hrs at each site for every month at the time from 9AM to 5PM. Six sampling sites for ambient air monitoring were selected. They are near main gate, power plant, coal mill and dispensary. Monitored parameters were $PM_{2.5,}$PM10, and gaseous pollutants such as SO_2 & NO_2. Respirable Dust Sampler Envirotech APM 460(NL) was used for air sampling and analyzed as per standard methods. Air Quality index (AQI) was calculated.

5. Results and Discussion

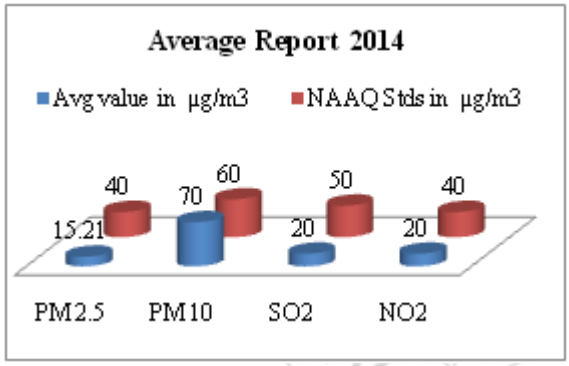
National Ambient Air Quality Standards (NAAQS)

Pollutant	*Time weighted average*	*Concentration in ambient air*		*Method of Measurement*
		Industrial& Residential Area	Sensitive Area	
Sulphur Dioxide(SO_2)	Annual Average	50µg/m^3	20µg/m^3	Improved west & Geake Method
	24H Average	80µg/m^3	80µg/m^3	
Nitrogen Dioxide(NO_2)	Annual Average	40µg/m^3	30µg/m^3	Jacob & Hoochheiser Modified(NaoH-Na Aso_2)Method
	24H Average	80µg/m^3	80µg/m^3	
Particulate Matter(PM2.5)	Annual Average	40µg/m^3	40µg/m^3	High Volume Sampling Method
	24H Average	60µg/m^3	60µg/m^3	
Particulate Matter(PM10)	Annual Average	60µg/m^3	60µg/m^3	Respirable Particulate Matter Sampler
	24H Average	100µg/m^3	100µg/m^3	

Average Ambient Air Pollution Level In Cement Industries Around Ariyalur District

Sl. No	Cement Industries Name	Pollutants in µg/m^3			
		$PM_{2.5}$	PM_{10}	SO_2	No_2
1	Arasu Cement Industry	25.8	77	45	48
2	Ramco Cement Industy(1)	12.8	68	15.5	16.4
3	Ramco Cement Industry(2)	15	67	13.70	12.9
4	Dalmia Cement Industry				
5	Chettinad Cement Industry				
6	Ultra Tech Cement Indutry				
7	India Cement Industry	12.3	69	17.4	13.8

Average Ambient Air Pollution Level In Cement Industries Around Ariyalur District In Bar Chat



Air Quality Index - Range & Color from WHO

Air Quality Index Value(µg/M^3)	*Level Of Health Concern*	*Color*
0-50	"Good"	"Green"
51-100	"Moderate"	"Yellow"
101-150	"Un healthy for sensitive groups"	"Orange"
151-200	"Un healthy"	"Red"
201-300	"Very un healthy"	"Parple"
301-500	"Hazardous"	"Maroon"

Air Quality Index Value For Cement Industries

Pollutants	*AQI-Values*	*Levels of Health Concern*	*Color*
PM2.5	15.21	"GOOD"	"GREEN"
PM10	70	"MODERATE"	"YELLOW"
SOX	20	"GOOD"	"GREEN"
NOX	20	"GOOD"	"GREEN"

Excess NAAQS Level-Control

Ambient air quality was assessed using six monitoring stations inside the cement industries ,the studies have clearly revealed the levels of air pollutants for $PM_{2.5}$, PM_{10}, NO_x and SO_2.The values of all these pollutants (particulates and gaseous) are observed to be very much below National Ambient Air Quality Standards except the PM_{10}, that is the residential area

PM_{10} – Control System

- Water spray system
- road cleaning vehicle
- Choosing cleaner fuels - Natural gas used as fuel emits negligible amounts of particulate matter.
- Reduction of ash by coal cleaning reduces the generation of Particulate Matter (PM) emissions.
- Consider alternative fuels such as gas instead of coal.
- Consider fuel-cleaning options such as coal washing, which will reduce ash content by up to 40%.
- Adopted the electrostatic precipitator in coal mill

Consider Alternative Fuels Such as Gas Instead of Coal

Fuels made from waste have been used in many countries for over 10 years. They are used by power plants and various industrial plants using high-temperature processes, including cement plants. The fuels applied can be solid or liquid, made from municipal waste, industrial waste, or their mixtures. Replacement of some conventional fuels with alternative fuels brings both ecological and economic benefits. An industry that is especially suitable for the application of such fuels, from the technological and environmental points of view, is the cement industry. Alternative fuels are used in many cement plants throughout the world. Several cement plants in Poland are using alternative fuels.

The incineration of alternative fuels in cement plants is a safe method for the utilization of waste that is ecologically friendly and profitable for the industrial plants and society alike (Jenkins BG, 1997). The cement industry is an energy intensive industry. The average energy demand for the production of 1 ton of cement is about 3.3. GJ (Feng L, 1995) which corresponds to 120 kg of coal with a calorific value of 27.5 MJ per kg. Energy costs account for 30–40% of the total costs of cement production (Personal communication with Dr. Pandey and Log sheet, Vikram Cement).

Types of Alernative Fuels

Category	*Fuels*
Gaseous fuels	Refinery waste gas, landfill gas, pyrolysis gas, natural gas
Liquid fuels	Tar, chemical wastes, distillation residues, waste solvents, used oils, petrochemical waste, asphalt slurry, paint waste, oil sludge

Solid fuels	Petroleum coke (pet coke), paper waste, rubber residues, pulp sludge, sewage sludge, used tires, battery cases, plastics residues, wood waste, domestic refuse, rice husks, refuse derived fuel, nut shells, oil-bearing soils, diapers, etc.

Alternative Fuels Used In Indian Cement Industries

1) Tired Derived Fuels(TDF)
2) Hazardous Waste(HW)
3) Municipal Solid Waste(MSW)
4) Biomass(BM)

The use of alternative fuels will help in reducing energy costs and providing a competitive edge for a cement plant further more, this will reduce the burden of waste disposal considerably.

Particulates Emissions Control In ESP

Modern ESP are designed to have high collection efficiencies of all types of fly ash, some are marketed as applicable to worldwide coal firing; collection efficiencies are now up to 99.81%

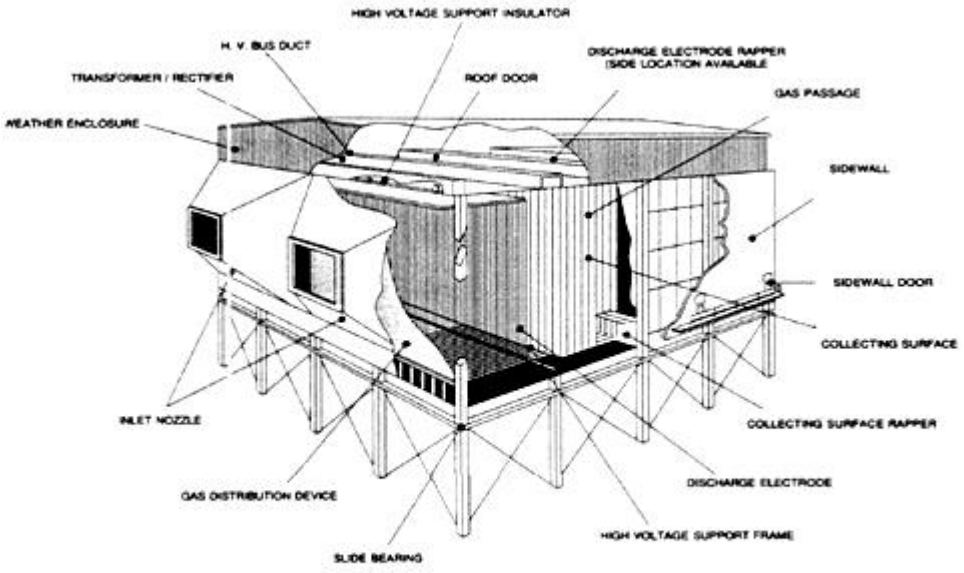


Figure 3.1: Electrostatic Precipitator Components
(Courtesy of the Institute for Clean Air Companies)

6. Conclusion

Ambient air quality was assessed using six monitoring stations inside the cement industries ,the studies have clearly revealed the levels of air pollutants for $PM_{2.5}$, PM_{10}, NO_x and SO_2.The values of all these pollutants (particulates and gaseous) are observed to be very much below National Ambient Air Quality Standards except the PM10, that is the residential area, dispensary. This increase in AQI at this site is probably due to the increased transportation on the road in front of it and the school that is responsible for this increase in traffic. The air quality is giving the holistic view of air pollution levels. So from the result, it is evident that for the time being, the ambient air inside cement industries do not need any attention from the policy makers except the residential area, but may be in the future we need to formulate some ways to counteract the increase in air pollution at specific sites as we may never know when the growing urbanization and the traffic will increase the air pollution level inside the cement industries much more than the maximum permissible limits. Excess of PM_{10} is control in Water spray system, Road cleaning Vehicles, Choosing Cleaner fuel system and Consider alternative fuels such as gas instead of coal by Reduced the coal. Adopted the electrostatic precipitator in coal mill. Modern ESP are designed to have high collection efficiencies of all types of fly ash, some are marketed as applicable to worldwide coal firing; collection efficiencies are now up to 99.81%

7. Suggestion for Cement Industries

- Control the particulate matter PM10
- Used alternate fuel(Waste fuel or material)
- Reduce the non-renewable sources(coal)
- Adopted the electrostaticpriciptetor in coal mill

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