

# A Review Study on Effectiveness of Stack in the Dispersion of Air Pollutants

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**Abstract**— Industrial air pollution is one of the major environmental problems faces by developing countries and the researchers keep on studying the various aspects of air pollution during the past years. In most of the studies I found that particulate matter and SPM are keep on exceeding the limits of National Ambient Air Quality Standards (NAAQS). Dispersion of air pollutants is one of the major environmental issue, hence dispersion modelling has emerged as one of the most widely used technique for the air pollution dispersion studies. Sulphur, nitrogen and carbon are the major pollutants arises from the various industries and coastal plants and gave rise to various environmental and human health problems which results in the form of neurological impairments, cardiovascular and respiratory diseases. This study considers a detailed study of various techniques for dispersion of air pollutants emitted through the stack under different conditions of mass flow rate and ambient cross flow.

**Key words:** SPM, NAAQS, Dispersion, Environmental, Modelling, Sulphur, Nitrogen, Carbon, Cross Flow and Mass Flow

## I. INTRODUCTION

The introduction of the air pollution from the sources of different varieties which lead to the change in the atmospheric composition and adversely affect the living species of environment. The air pollutants concentration depends upon the ability of atmosphere in the process of dispersion and changes with the values of meteorological and topographical conditions. Air quality checking systems provides the detailed composition of the pollutants present in the atmosphere.

Air pollution occurs when harmful or excessive quantities of substances including gases, particulates, and biological molecules are introduced into Earth's atmosphere. It may cause diseases, allergies and even death to humans; it may also cause harm to other living organisms such as animals and food crops, and may damage the natural or built environment. Both human activity and natural processes can generate air pollution.

In 2012, air pollution caused premature deaths on average of 1 year in Europe, and was a significant risk factor for a number of pollution-related diseases, including respiratory infections, heart disease, COPD, stroke and lung cancer. The health effects caused by air pollution may include difficulty in breathing, wheezing, coughing, asthma and worsening of existing respiratory and cardiac conditions. These effects can result in increased medication use, increased doctor or emergency department visits, more hospital admissions and premature death. The human health effects of poor air quality are far reaching, but principally affect the body's respiratory system and the cardiovascular system. Individual reactions to air

pollutants depend on the type of pollutant a person is exposed to, the degree of exposure, and the individual's health status and genetics. The most common sources of air pollution include particulates, ozone, nitrogen dioxide, and sulphur dioxide. Children aged less than five years that live in developing countries are the most vulnerable population in terms of total deaths attributable to indoor and outdoor air pollution.

Air pollution takes place due to various methods of manufacturing in different type of industries. This source of air pollution spews particulate matters and chemicals into the atmosphere. The exhaust from fertilizer industry includes oxides of carbon, sulphur and nitrogen as well as volatile organic compounds and particulates. Due to this air is polluted and this polluted air effect human health.

The Gaussian's dispersion model is the most widely used modelling method in the atmospheric dispersion modelling, the Gaussian's equation calculate the ground level pollutant concentrations depend upon time-averaged atmospheric variables.

## II. STUDY AREA

Type: Fertilizer Plant (Ammonia-Urea Plant)  
Area: Uttar Pradesh  
Annual Production: 1.08 million tonnes of Urea  
Owner: Indo Gulf Fertilisers Limited  
Shareholders: Aditya Birla Nuvo Limited  
Activity Since: 1988

Indo Gulf, the agri input business of Aditya Birla Nuvo, manufactures and markets urea, agricultural seeds and agrochemicals. Indo Gulf Fertilisers is the 8th largest urea manufacturer in India. The goal of the business is to become a 'total agri solutions provider' offering a full range of agri inputs - fertilisers, seeds, agrochemicals and specialties from sowing to harvesting.

Birla Shaktiman Urea - Neem coated and Gold continued to remain the products of first choice, for the farmers. Birla Shaktiman enjoys a market leadership position in entire zone of Uttar Pradesh, Bihar, Jharkhand and West Bengal, through excellent product quality and customer servicing. It is fulfilling aspirations of millions of farmers who reap a rich harvest of crops.

Indo Gulf's state-of-the-art manufacturing facility at Jagdishpur in Uttar Pradesh is considered one of the most energy efficient plants in the country. It's location at Jagdishpur - in the middle of the agricultural heartland of the Indo-Gangetic plains, gives it access to a large and growing market. The plant is operating at more than 100 per cent capacity utilisation and manufactured 10,21,447 tonnes of urea in 2014-15. Indo Gulf's marketing activities span the entire Indo-Gangetic plain - from Punjab in North to Odisha in the East. A strong marketing, distribution and customer

service network that includes the wholesalers' network, Birla Shaktiman accredited retailers and Birla Shaktiman service centres, helps the company sustain its leadership position.

The study area covers the air quality assessment and research work for studying the effects of pollutant dilution and dispersion and also their relation with the factors studied: stack height, plume rise and the height of terrain. The modelling of dispersion of air pollutants in the atmosphere is among the most challenging and important scientific problems nowadays. Many researchers provide a brief overview of the problems of air pollution modelling in the atmosphere. They discussed several possible modelling strategies and tools that can be used to support decision makers. The models can be successfully used for different purposes however, choosing an appropriate model in a particular case is a key to handling the problem and successfully estimating the dispersion of air pollutants. Atmospheric dispersion modelling approaches and their applicable scales are summarized.

In order to properly assess the concentrations of air pollutants in the studied area, there were taken into account not only the emissions from the activities on the premises of the main industrial platform, but also the contribution from the other pollution sources from the area of interest, such as other industries, residential heating, traffic, dump heaps. The mathematical modelling results, displayed as air pollutant dispersion maps, showed the significant influence of the complex terrain features and of the other pollution sources on the concentration levels in the region, usually associated with the emissions of the main industrial platform.

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