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ANALYSIS OF AIR POLLUTANTS SO_2, NO_2, NH_3, CO, SPM AND ITS EFFECTS ON HUMAN HEALTH IN NFL VIJAIPUR GUNA M.P.

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ABSTRACT

Air pollution data is obtained from a number of fixed site monitors located throughout the study region. These monitors measure background pollution levels at a number of time intervals throughout the day and a daily average is typically calculated for each site. A number of pollutants are measured including, SPM, NO2, SO2, NH3 and CO. N.F.L. Vijaipur is nitrogenous fertilizer plant producing urea on high unit. With the commencement of commercial production of the Expansion project the gas based unit at Vijaipur now comprises of two 1520 ton per day Ammonia streams and four 1310 ton per day Urea streams and related off-site facilities. The level of PM10 in summer time is noticeable higher than in winter time. The number of respiratory cases varies with the increases of air pollution and the changes between winter and summer time. To overcome this pollution my suggestion to N.F.L. Vijaipur that employees should use public transport at the time of office.

KEYWORDS:Suspended Particulate Matter (SPM), Nitrogen Dioxide (NO2), Sulphur Dioxide (SO2), Ammonia (NH3), Carbon Monoxide (CO) and N.F.L. as National Fertilizer Limited.

INTRODUCTION

N.F.L. (National Fertilizer Limited- a Govt. of India Undertaking) is India's one of the highest producer of nitrogenous fertilizers. The company has four plants which are located at Nangal and Bathinda in Punjab Panipat in Haryana and Vijaipur in M.P. N.F.L. Vijaipur project is located in Guna district of Madhya Pradesh (35 Kilometres from Guna). It is spread over 1250 acres of lush green landscaped area comprising the factory area of 650 acres and the township which is spread in an area of 600 acres. The township is inhibited by approx. 6000 people. The factory area consists of various plants like Ammonia (I&II), Urea(I&II), Captive Power, DM, Cooling Towers (Urea & Ammonia), Bio-Fertilizer, Bagging, Pre-Treatment and Effluent Treatment plants in addition to Office buildings, Administration building, Conference halls, Fire Station, Canteens, Product handling conveyors, Urea Storage Silo (I&II).

Air pollution occurs when air contains gases, dust, fumes or odour in harmful amounts that are injurious to human beings, plants and animals. In India particulates are one of the major pollutants. Thus it causes impact only on skin, eyes and soiling of clothes and surfaces.

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Figure1. GIS map of the NATIONAL AMBIENT AIR QUALITY STANDARDS sampling location.

EXPERIMENTAL WORK

For the purpose of this study SPM, NO2, SO2, NH3 and CO I have measured at three different station or spot to compare the pollution at different season in N.F.L. Vijaipur Guna in M.P. using High Volume Sampler machine. The results obtained are tabulated as below.

Fig2: Exposed Filter Paper (SPM)

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Fig3: High Volume Sampler Model

Fig4: Impinger tube containing absorbing solution.

RESULTS AND DISCUSSION

Air is drawn into a covered housing and through a filter by a high flow-rate blower at 1.1 to 1.5 m3/min that allows total suspended particulate matter with diameters of <100µm (Stokes equivalent diameter) to collect on the filter surface. Particles with diameters of 0.1 to 100µm are ordinarily collected on glass fiber filters.
The SPM concentration using the following equation:

$$\boldsymbol{SPM}\ (\mu \boldsymbol{g/m^3}) = \frac{(\boldsymbol{W_f} - \boldsymbol{W_i}) \times \boldsymbol{10^6}}{\boldsymbol{V}}$$

Where V = Volume of air sampled, m^3
W_f = Weight of exposed filter, grams.
Wi = Weight of blank filter, grams.

For calculation of NO_2, SO_2 and NH_3 (µg/m3) $= \frac{\boldsymbol{Sample\ absorbance\ value \times Calibration\ factor}}{\boldsymbol{Volume\ of\ air\ sampled}}$

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Fig5: Test of NH3 using Nessler reagent.

Fig6: UV Spectrophotometer

Table1. Rainy Season: July 2015

Stations	SPM (µg/m^3)	NO_2 (µg/m^3)	SO_2 (µg/m^3)	NH_3 (µg/m^3)	CO (µg/m^3)
Central Lab	70	15.5	<3.0	32	<1.0
Cooling Tower	80	12.9	<3.0	70	<1.0
Bio/TEP Area	76	16.4	<3.0	78	<1.0

August 2015

Stations	SPM (µg/m^3)	NO_2 (µg/m^3)	SO_2 (µg/m^3)	NH_3 (µg/m^3)	CO (µg/m^3)
Central Lab	100	10.9	<3.0	40	<1.0
Cooling Tower	132	24.4	<3.0	74	<1.0
Bio/TEP Area	144	20.5	<3.0	78	<1.0

Table2. Winter Season: November 2015

Stations	SPM (µg/m^3)	NO_2 (µg/m^3)	SO_2 (µg/m^3)	NH_3 (µg/m^3)	CO (µg/m^3)
Central Lab	136	15.8	<3.0	36	<1.0
Cooling Tower	138	11.9	<3.0	60	<1.0
Bio/TEP Area	140	14.1	<3.0	43	<1.0

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December 2015

Stations	SPM (µg/m^3)	NO_2 (µg/m^3)	SO_2 (µg/m^3)	NH_3 (µg/m^3)	CO (µg/m^3)
Central Lab	139	14.2	<3.0	24	<1.0
Cooling Tower	142	15.5	<3.0	66	<1.0
Bio/TEP Area	167	16.5	<3.0	55	<1.0

Table3. Summer Season: April 2016

Stations	SPM (µg/m^3)	NO_2 (µg/m^3)	SO_2 (µg/m^3)	NH_3 (µg/m^3)	CO (µg/m^3)
Central Lab	204	21.5	<3.0	32	<1.0
Cooling Tower	291	25.4	<3.0	64	<1.0
Bio/TEP Area	256	22.4	<3.0	55	<1.0

May 2016

Stations	SPM (µg/m^3)	NO_2 (µg/m^3)	SO_2 (µg/m^3)	NH_3 (µg/m^3)	CO (µg/m^3)
Central Lab	208	24.5	<3.0	38	<1.0
Cooling Tower	299	29.5	<3.0	70	<1.0
Bio/TEP Area	263	28.5	<3.0	60	<1.0

CONCLUSION

The most important finding is: (i) In generally, SPM, *NO_2, SO_2, NH_3 and CO* concentration (24hours) of six months (April, May, July, August, November and December) in research area is within municipal guidelines and it varies with the change of seasons. From an above results I conclude that level of pollutants in summer time is noticeable higher than in winter time. (ii) The number of respiratory cases varies with the increases of air pollution and the changes between winter and summer time. To overcome this pollution my suggestion to N.F.L. Vijaipur that employees should use public transport at the time of office. Due to more vehicle's used in township and factory too much pollution is occurring. Sometimes pollution control at source is not possible by preventing the emission of pollutants. Then it becomes necessary to install pollution control equipment to remove the gaseous pollutants from main gas stream. The pollutants are present in high concentration at the source and as their distance from the source increases they become diluted by diffusing with environmental air. Pollution control equipment to be used are wet collectors' scrubbers gravitational settling cyclone separators and fabric filters. The above results are within limit as given in table of national ambient air quality standards guidelines.

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NATIONAL AMBIENT AIR QUALITY STANDARDS (2009)

Pollutants	Time Weighted Average	Concentration in Ambient Air- Industrial, Residential, Rural and other Areas	Concentration in Ambient Air- Ecologically Sensitive Area	Methods of Measurement
Sulphur Dioxide (SO_2), µg/m^3	Annual * 24 Hours **	50 80	20 80	-Improved West and Geake Method -Ultraviolet Fluorescence
Nitrogen Dioxide (NO_2), µg/m^3	Annual * 24 Hours **	40 80	30 80	-Jacob & Hochheiser modified ($NaOH$-$NaAsO_2$) Method -Gas Phase Chemiluminescence
Suspended Particulate Matter (SPM), µg/m^3	24 Hours **	500	500	-High Volume Sampler
Ammonia (NH_3), µg/m^3	Annual * 24 Hours **	100 400	100 400	-Chemiluminescence -Indophenol blue method
Carbon Monoxide(CO), µg/m^3	8 Hours ** 1 Hour **	02 04	02 04	-Non dispersive Infrared (NDIR) Spectroscopy

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