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Seasonal variation of PM_{10} around an upcoming airport

Arun Kumar Mishra[1], Prabhat Srivastava[2], R. S. Patil [3]

Assistant Professor, Department of Civil Engineering, .M.M.M. Govt. Engg. College Gorakhpur,.U.P.India[1]

Professor & Head , Department of Civil Engineering, S.P.College of Engg. Andheri, Bombay,,India [2]

Professor, Emeritus, Department of CESE, IIT Bombay,Mumbai,, India [3]

Abstract: In this paper an attempt has been made to study the variation of PM_{10} at different receptor locations around an upcoming airport at Navi Mumbai, India. Air monitoring was carried out during all seasons in the base year i.e premonsoon, monsoon, post monsoon and winter season and results were analyzed. It was observed that overall yearly average concentrations of PM_{10} are lower than permissible lower limit of CPCB except two stations. It was found that PM_{10} concentrations were highest during winter season and PM_{10} is decreasing during pre monsoon, monsoon and monsoon seasons. Aviation affects the environment through the emission of pollutants from the aircrafts and other supporting airport infrastructure facilities, resulting on human health and the atmosphere. Emitted pollutants resulting from the aircrafts include green house gases and particulates matter that contribute to forcing of climate and gases and particulate matter that are harmful to human health. Navi Mumbai in the state of Maharashtra, India has been chosen as the study area. The PM_{10} concentrations were compared with the National Ambient Air Quality Standards (NAAQS).

Key words : Airport, PM_{10} , secondary particles,NAAQS

I INTRODUCTION

Particulate matter is the term for particles and liquid droplets suspended in the air. Particles emitted directly into the air are called primary or direct PM.Other particles are forms indirectly in the atmosphere from the gaseous reaction of the pollutants known as precursors. Sources of direct PM and PM precursors include factories, power plants, vehicular traffic, airports, construction activity and natural sources such as fires and windblown dust.PM0 refers to the particles having diameter 10 micrometer or less.Urban air pollution due to vehicular emission is a matter of great concern because of exposure of large number of people to it.Vehicular emission is responsible for higher level of air pollutants like SPM, RSPM, SO2 and other organic, inorganic pollutants including trace metals and their adverse effects on human and environmental health (Caselles et al, 2002, Curtis et al. , 2006; ,Jayaraman, 2007). Vehicular exhaust is one of the most important source of fine particles (Nolte et al. , fang et al.,2005; Barman et al., 2008). Various types of vehicles and their different operating modes such as stop and start, idling, accelerating and decelerating combined with a high density of vehicles leads to a pollution source problem (Kumar et al., 2001). The respirable particles are responsible for cardiovascular as well as respiratory diseases (Segal et al., 1996) of human beings because these particles can penetrate deep into respiratory system and various studies concluded that smaller the particles, more severe the health impacts (Schwartz et al., 1996).

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II DESCRIPTION OF THE STUDY AREA

The site of Navi Mumbai airport is selected near Panvel town in an area admeasuring 2347 acres of land which is situated about 45 km away from the CBD of Mumbai/Santacruz airport. The airport is planned with two runways of 3700 M with parallel taxiways designed to suit the new generation large aircraft. The other facilities include the domestic terminal, international terminal, cargo terminal, airfield lighting, city side facilities etc. The phase wise development approach has been adopted to suit the air travel demand

The study area shown in Figure 1 covers the area around the airport falling within the radius of 10 kms. The study area is further divided in two parts namely core area and fringe area. The core area covers the area within the radius of 10 km, in which all the scooped environmental parameters have been studied to understand the magnitude of impact. In the remaining area i.e. fringe area places of historical importance, aesthetics, cultural including environmentally sensitive have been studied

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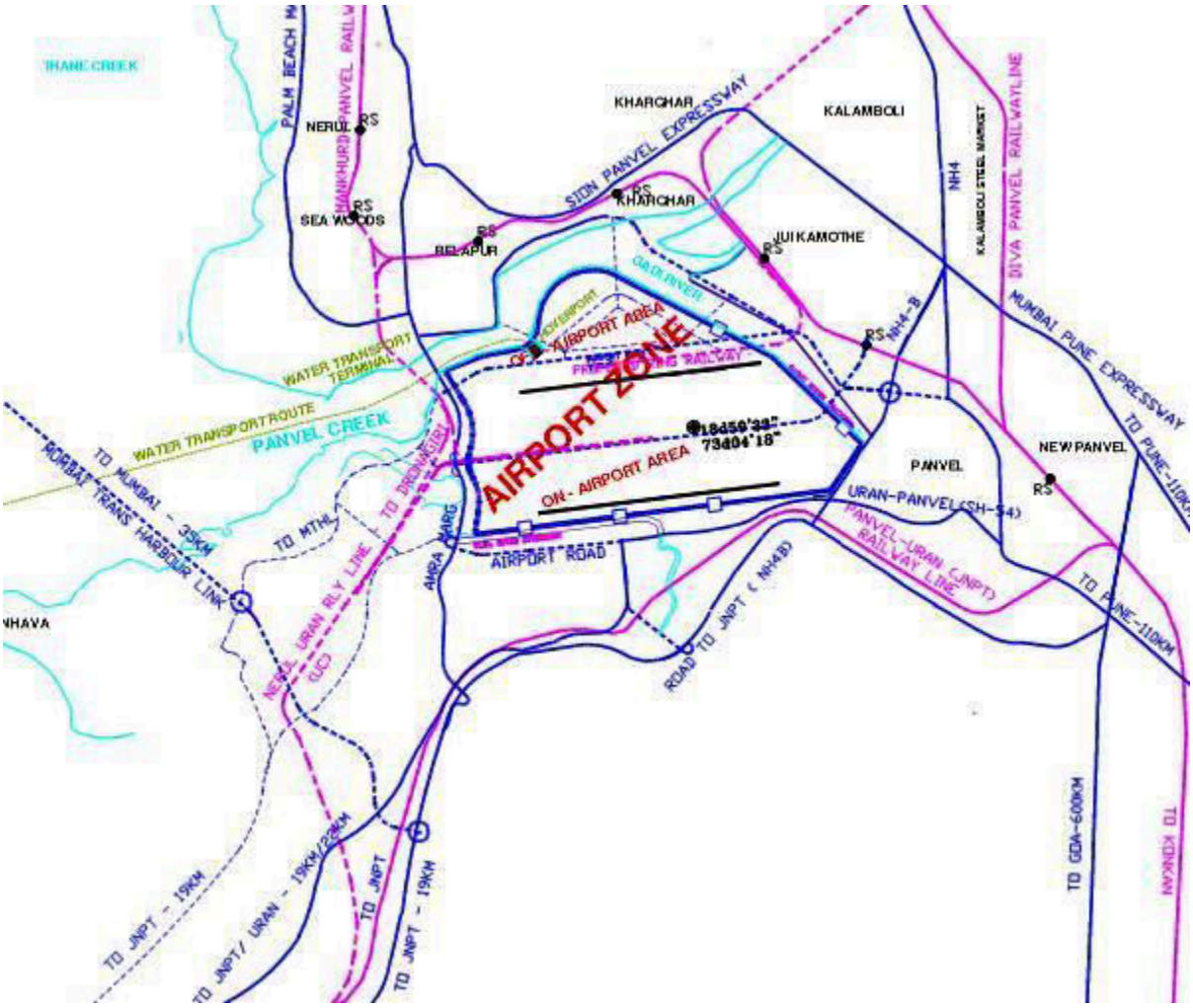

Fig 1: Location map of Navi Mumbai International Airport

III SAMPLING AND ANALYSIS

Air quality assessment of the project area was carried out by monitoring the pollutants at different receptor locations (Fig.2). The pollutants which were monitored are;, Total Suspended Particulate Matter (TSPM), Respirable Particulate Matter (RSPM or PM_{10}), Oxides of Nitrogen (NO_x), Sulphur dioxide (SO_2), Carbon Monoxide (CO), and

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Hydrocarbons (HC). The selections of stations were based on WHO (1981) guidelines. The monitoring was done during all seasons of the base year i.e premonsoon, monsoon, post- monsoon and winter season at a frequency of twice a week at each station for 24 hours. Respirable Dust Sampler and High Volume Sampler were used for monitoring of RPM, TSPM and gaseous pollutants like SO_2 and NO_x. To monitor the traffic pollutant Carbon Monoxide, a portable multi gas monitor with digital display was used. CO pollutant was monitor at all the 10 locations at a frequency of twice a week at each station for 24 hrs. Anemometer was used to note the wind speed and direction. Digital thermometer was used to record the existing temperature. Horizontal and vertical dispersion parameters were taken based on the atmospheric stability class B and downwind distance.

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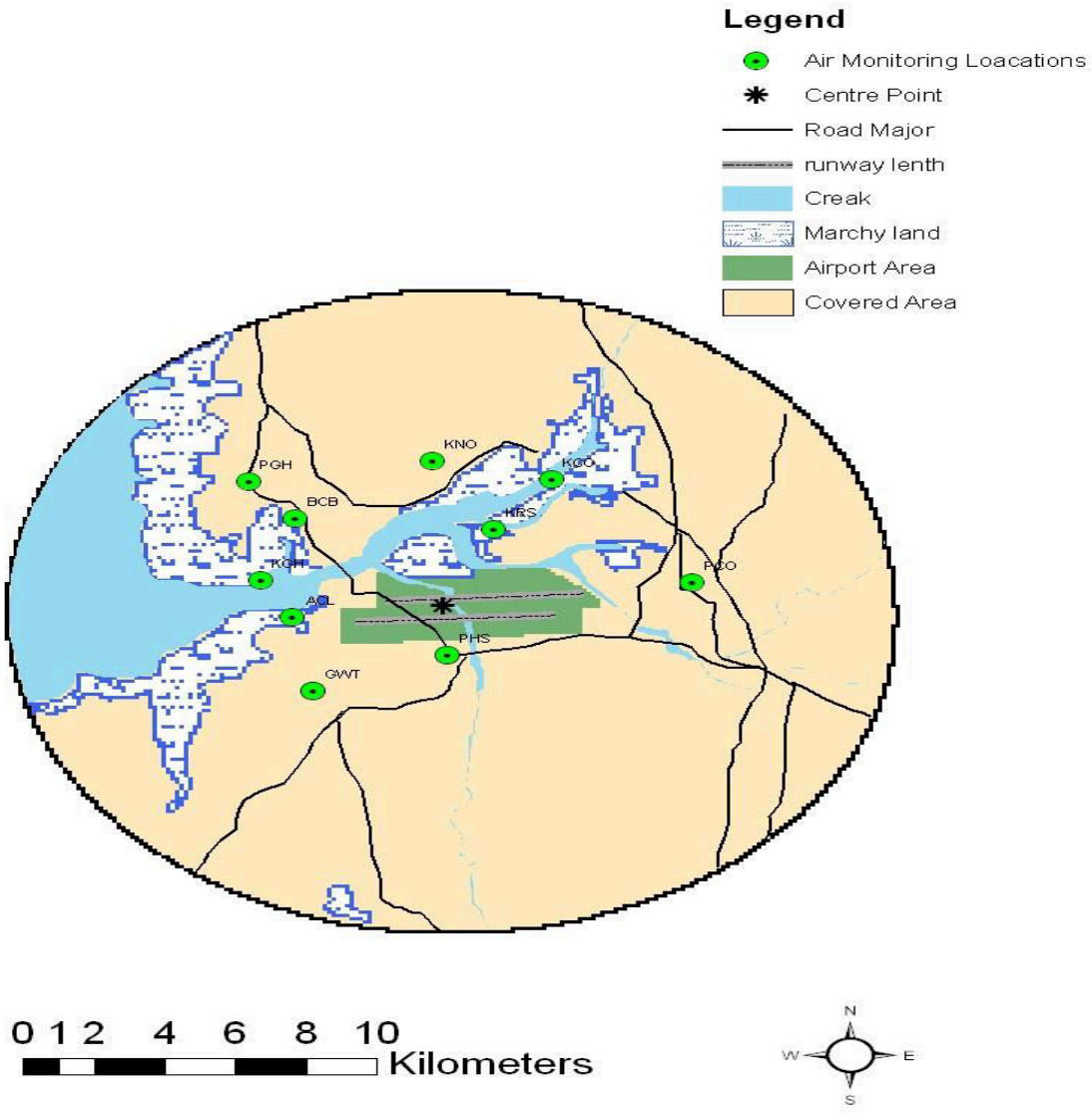

Fig. 2: Monitoring stations along the road network of the study area

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Table 1: **Location of the Air Monitoring Stations in the Project Area**

Sr. -	Station Code -	Station	Remarks
1.	PCO	Panvel CIDCO Office	Location of meteorological station and in residential zone
2.	KRS	Khandeshwar railway station	Commercial activity centre
3.	KCO	Kalamboli CIDO Office	Receptor oriented as it is in residential zone
4.	KNO	Kharghar Nodal Office	Receptor oriented as it is in residential zone
5.	BCB	Belapur CIDCO Bhavan	Major commercial activity centre, heavy traffic movement
6.	PHS	Pargaon High School	Rural and mixed area
7.	GWT	Gavanphata Water Tank	Near to main Traffic Junction and hence heavy traffic movement
8.	ACL	Ambuja Cement Ltd.	Industrial activity centre
9.	KGH	Kille Gaothan Gueust House	Receptor oriented as it is in residential zone
10.	PGH	Panchsheel Guest House	Receptor oriented as it is in residential zone

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Table 2: Traffic growth rate for different links

Category	Car, Taxi, Van	2/3 Wheelers	Buses	Trucks
Upto 2008	4.5	10.0	5.0	7.5
2009-2015	4.5	10.0	5.0	6.0
2015-2030	4.0	10.0	5.0	3.0

IV RESULTS AND DISCUSSION

In this study the mass concentration of PM_{10} and its associated chemicals constituents analyzed. Results obtained from the analysis were compared from the standards prescribed by CPCB and these results are given in following table 3

Table 3: Average values of different air pollutants concentration at various stations of the study area during winter season

Station Code	PM_{10}			
	Pre monsoon Season	Monsoon Season	Post monsoon Season	Winter Season
KRS	88	34	137	202
BCB	203	52	161	269
ACL	79	38	137	168
GWT	170	42	193	411
PCO	114	53	144	222

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KCO	137	45	193	259
KNO	113	38	125	176
PHS	105	53	161	170
KGH	112	32	116	210
PGH	107	38	117	199

V CONCLUSION

- The average concentrations of PM_{10}, in the study area during post monsoon season were in the range of 116-193 µg/ m^3 ,
- The average concentrations of, PM_{10}, in the study area during winter season were in the range of 170-411 µg/ m^3
- The average concentrations of PM_{10}, in the study area during pre monsoon season were in the range of 79-203 µg/ m^3 ,
- The average concentrations of PM_{10}, in the study area during monsoon season were in the range of, 32-53 µg/ m^3
- The average concentrations of PM_{10}, NO_x, SO_2, NH_3, CO and HC in the study area during winter season were in the range of, 170-411 µg/ m^3 , 20.4-32.0 µg/ m^3 ,3.4-4.7 µg/ m^3 , 27.0-37.6 µg/ m^3 , 0.6-0.8 µg/ m^3 , 2.01-2.30 µg/ m^3 respectively.
- Air monitoring results of the study period showed that PM_{10} were highest during winter season whereas concentration of PM_{10} was observed to be decreased during pre monsoon, monsoon and post monsoon season. Winter season is the worst time for air quality, since surface atmospheric temperature drops down with an inversion condition. Little mixing or dilution of pollutants takes place at this stability condition (low mixing height) of the atmosphere and hindered pollutant dispersion during winter months. Moreover, suspended particles in the study area are natural and not chemical in nature and may not have adverse effect on human health.

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REFERENCES

[1] Barman. S.C., R. Singh, M.P.S Negi and S.C. Bhargava. Fine particles ($PM_{2.5}$) in residential areas of Lucknow city and factors influencing the concentration. *Clean Soil Air Water*, Vol.36, pp. 111-117, 2008

[2] Caselles, J., C. Colliga and P. Zornoza: Evaluation of trace elements pollution from vehicle emissions in Petunia plants. *Water Air Soil Pollut*., 136.1-9 (2002).

[3] CPCB: (1994). "National Ambient Air Quality Standards". Central Pollution Control Board. Gazzete Notification, New Delhi

[4] Curtis. L.W. Rea, P.Smith-Willis, E. Fenvyes and Y. Pan: Adverse health effects of outdoor air pollutants. *Environ. Intern*., Vol. **32, ,** pp. 815-830, 2006

[5] Fang, G.C., Y.S. Wu, S.H. Huang and J.Y. Rau: Review of atmospheric elements in Asia during 2000-2004. *Atmos.Environ.,* Vol. **39,** pp.3000-3003, 2005

[6] Jayaraman, G.N.:2007 "Air quality and respiratory health in Delhi". Environ. Monitoring. Assesses DOI 0.007/s 1066-007-965-007-

[7] Kaushik, CP., K. Yadav: Assessment of ambient air quality in urban centres of Haryana (India) in relation to different anthropogenic activities and health risk. *Environ. Monit. Assess*.,Vol. **122**, , pp. 27-40, 2006

[8] Kumar. A.V., R.S. Patil and K.S.V. Nambi: Source appointment of suspended particulate matter at two traffic unction at Mumbai., India. *Atmos. Environ*., Vol.**35**, , pp.4245-425, 2001

[9] Nolte. C.G., J.J. Schauer, G.R. Cass and G.R. Simoneit: Trimethylsilyl derivatives of organic compounds in source samples and in atmospheric fine articulate ,matter. Environ. Sci. Technol*.,* Vol.**36**, pp.4273-4281, 2002.

[10] Sagai.M., A. Furnayama and T. Ichinose: Biological effects of diesel exhaust particles (DEP). III. Pathogenesis of asthma like symptoms in mice. Free Rad, Biol.Med., Vol.**21**, pp.199-209, 1996.

[11] Schwartz, J., D.W. Dockery and L.M. Neas: Is daily mortality associated specifically with fine particles ? J. Air Waste Manage. Asso., Vol. **46**, pp.927-939, 1995.