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Hygienic Standards of Atmospheric Environment at Some Urban /Industrial Hotspots: A Qualitative Study

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Abstract: **Hygienic standard of atmospheric environment depends upon the quality of air we inhale. High pollutant concentration is hazardous and degrades the quality of ambient air resulting in an unhygienic atmospheric environment. Many cities and industrial hotspots around the world are affected by persistently high concentrations of pollutants. As hygienic condition of atmospheric environment is associated with the concentration and composition of pollutants, data on concentration of pollutants is analyzed to obtain qualitative features of temporal variations. These results are used to find temporal - patterns in hygienic conditions of the atmospheric environment at the representative places/cities. Based on these observations, it has been suggested that these temporal - patterns could be used (like weather reports) to predict the future hygienic conditions of the hotspots and minimize possible health risks posed by the atmospheric environment.**

Keywords: **hygienic, temporal, periodic, weather-report, health-hazard]**

1. INTRODUCTION

Air pollutants can be divided into two parts: gaseous and particulate types. Both are produced naturally as well as anthropogenically. Volcanic-eruption, forest-fire, and dust-storm or wind assisted transport are well known natural sources of particulate matter. Various anthropogenic activities like vehicular activities, waste incineration, Industrial, agricultural biomass burning, fossil-fuel burning, construction & associated activities, traditional methods of sweeping [Thurston and Spengler, 1985; Querol et. al., 2008; Penner et.al. 1993; Tandon et. al., 2008] etc., together produce enormous particulate matter that makes its way into the atmospheric air.

High concentration of pollutants, particularly carbon and sulfer has been found to reduces the normal visibility [Japar et. al. 1986; Waggoner et. al. 1981; Groblicki et. al. 1981;] to a significant extant affecting surface as well air traffic. High concentrations of pollutants and their long-persistence, a result of numerous anthropogenic activities, have resulted in deteriorating the hygienic condition of atmospheric environment at several metropolitan and industrial hotspots around the world. Studies show that pollutant concentration above certain limit (50μg/m^3) [WHO, 2006] increases the risk of respiratory problems and may lead to various lungs related diseases (Pope, 2000). Several epidemiological studies have even established a close relationship between atmospheric particulate matter and the human mortality rate [Dockery and Pope, 1996; Dockery et. al., 1993; Adler and Fisher, 1994; Schwartz and Dockery, 1992].

Increasing incidents of mortality in urban areas is a consequence long exposure to persistently high levels of pollutants. Despite several remedial measures initiated by governments to reduce/control the persisting high levels of pollutants, many urban and industrial hotspots continue to experience significantly high concentrations of pollutants and pose a serious threat to the human health.

When most efforts, to reduce/control production of pollutants, are exhausted and pollutant concentration still high, one needs to resort to protective measures to minimize possible health risks. To initiate protective measures to mitigate health risks, prior knowledge of atmospheric environment and its health hazard potential is needed. This requires a database of comprehensible information on atmospheric environment of the hotspots. In this article, qualitative data of pollutant concentration of a few representative places is analyzed and presented. The results obtained are used to identify temporal /spatial - patterns (periodic or non-periodic) in the pollutant-concentration profile of the atmospheric environment.

2. DATA & DISCUSSION

Figure1 shows the concentration profile of black carbon and SO_2 in Dublin (County Borough) through 1984 to 1992 [Clancy et.al., 2000]. The vertical line indicates the date when coal sale was banned in the city of Dublin. Mean black carbon concentration is highest (indicated by black circles) in winter. The mean concentration is reduced significantly after the coal sale ban. The black circles (the highest concentrations) in the figure follow a periodic pattern in the concentration profile. Though concentration of black smoke after coal sale ban is reduced significantly, its periodic nature is unchanged.

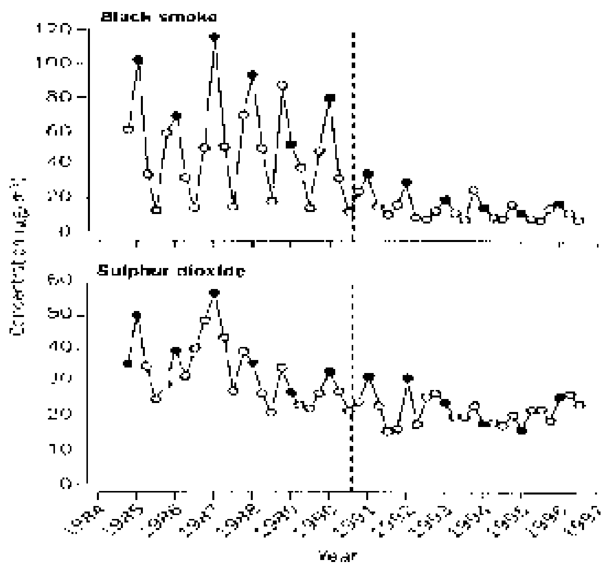

Fig.1: Mean values of black smoke and sulphur dioxide (below) concentrations through 1984-1996. Data is sourced from Clancy et.al., 2000.

Sydney is Australia's biggest city where annual average of mean PM_{10} concentration is $20\mu g/m^3$. The time-series plot of daily counts of all-cause, cardiovascular, and respiratory mortality through 1989 to 1993 for Sydney basin are shown in Fig.2 [Morgan et. al., 1998]. Each year, mortality rate is highest during August-September and follows a periodic pattern. Since several epidemiological studies have established a close relationship between atmospheric particulate matter and mortality rate, concentration of pollutants and mortality data is used to drive corresponding variations in hygienic conditions of atmospheric environment.

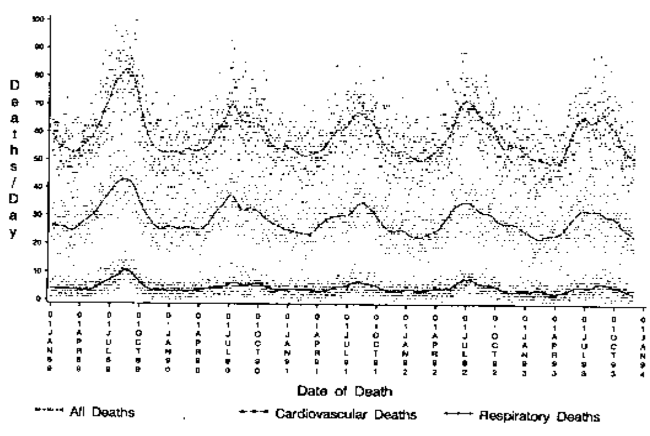

Fig. 2:Time series plot of daily counts of all cause, cardiovascular and respiratory mortality in Sydney, Australia through 1989-1993. Data is sourced from Morgan et.al., 1998.

London smog episode in 1952 was associated with a twofold to threefold increase in mortality and showed that air pollution episodes are harmful to health [Ministry of Health 1952]. Subsequent episodes were also found to be associated with increased mortality [Martin 1964]. The analysis of data for 1958-1972 established it beyond doubt that daily mortality is associated with pollution levels [Mazumdar 1982; Schwartz 1990; & Ito 1993]. All-cause mortality for Greater London through April 1987 to March 1992 is shown in Fig.4 [Anderson et. al., 1996]. Each year, mortality rate is high in summer (April to September) and peaks in the month of June. It follows a periodic pattern throughout the study period (1988 to 1992).

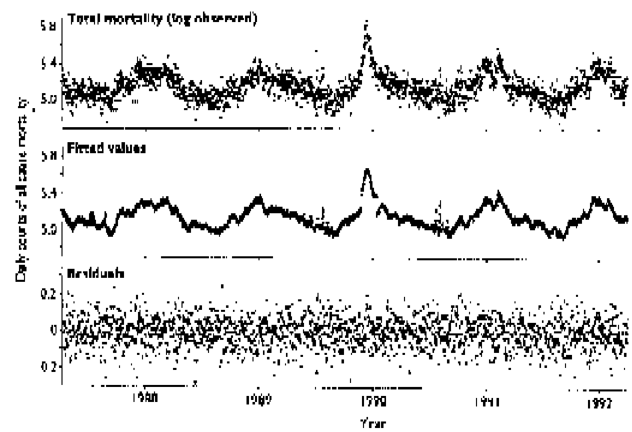

Fig.3: Time series of daily counts of all cause mortality during 1988-1992. Data is sourced from Peters et. al., 2000.

Increased mortality associated with elevated concentration of particulate matter has been observed in European cities and U.S.A. The SO_2 and TSP data for highly polluted regions of Czech-Republic and a site in north-east Bavaria, Germany is shown in Fig.3 [Peters et. al., 2000]. Every year, concentrations of TSP and SO_2 are high for certain period and this periodic variation is observed all through the study period (1982 to 1994). Though highest concentration of TSP and SO_2, as compared with the corresponding values for Bavarian region, for coal basins of Czech Republic is significantly high periodic variations for both the regions remain the same.

Periodic variations, in mortality rate and concentration of pollutants, at a number of representative cities/places suggest a fluctuating hygienic condition of atmospheric environment. The atmospheric environment with varying hygienic conditions may pose a serious threat to the human health during low hygienic levels or un-hygienic condition of the atmospheric environment. Increase in mortality rate during certain period of time every year in all representative cases is a clear-evidence that the hygienic condition of atmospheric environment deteriorates each year and follows the same pattern as that of daily counts of all-cause deaths or respiratory death or atmospheric pollutant concentration. Though availability of the data may limit the utility of temporal-variations of hygienic-standards, a comprehensive database on hotspots could be useful for predicting future hygienic condition of the atmospheric environment and protect us from the hazards of atmospheric pollutants.

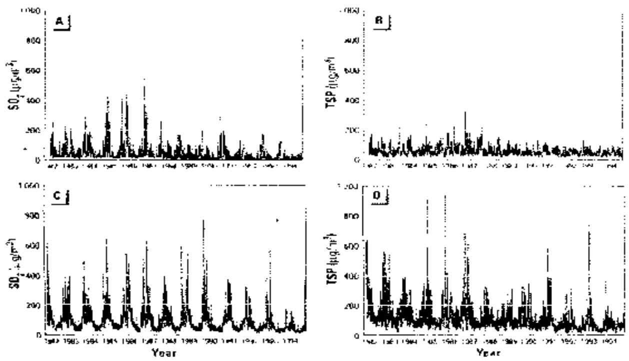

Fig.4: ***Daily concentrations of SO_2 (top-left) and TSP (top-right) for northeast Bavaria study area. Daily concentrations of SO_2 (bottom-left) and TSP (bottom-right) for the coal basin study area of Czech Republic. Data is sourced from Anderson et. al., 1996.***

3. CONCLUSION

Periodic temporal-variations, in mortality rates and concentration profiles of pollutants, at some representative places suggest fluctuating hygienic conditions of the atmospheric environment. Hygienic standard derived from mortality and pollutant concentration data, with simple correlation (Higher the mortality rates or pollutant concentration lower the hygienic standard), is shown to be periodic in nature. It is suggested that this data could be used, like weather report, to predict future hygienic conditions of the atmospheric environment. This information would enable visitors know the hygienic standards of hotspots in advance and minimize possible health risks.

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