

Adverse Health Effect of Air Pollution- A Review

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Abstract—Harmful effects of air pollution can be observed on human health, the environment and property damage. Various researches have proven the connection of air quality and human health. From various research studies carried out around the world, it is observed that ambient air pollutants such as Particulate Matters, O₃, SO₂ and NO₂ contributed to various respiratory problems including bronchitis, emphysema and asthma. This review paper is focusing on the findings from air quality literature and the significant health effects related to it.

Keywords—Pollution, Health, Air Quality Index.

I. INTRODUCTION

For good health and well being of human and animals clear air is required. However, due to unstoppable urban development, the air is continuously polluted. Urban ambient air is more polluted than overall atmosphere, due to high density of human population and their activities in urban areas; it produces air pollutants with a higher rate as compared to less-developed areas and natural environment². Decrease in air quality is observed in Klang Valley of Malaysia due to high volume of traffic and high density of developments. From various studies carried out in Malaysia clear increasing trend in the number of unhealthy or hazardous days which increased from 11 days in 2001 to 67 days in 2005 at Kuala Lumpur¹. Apart from that, studies showed that in August 2012, air quality monitoring at Port Klang, Selangor showed the worst (unhealthy) Air Pollution Index of 118 due to the influenced of monsoon wind from Sumatera. As per the study carried out by UN in 2001, most cities in the developing countries like Klang Valley, are facing increasing environmental pollution from vehicle emissions, and from industries and domestic heating sources at a level that exceeds the capacity to disperse and dilute emissions to non-harmful exposure levels. As per the statement of the World Health Organization (WHO) urban air pollution is a critical cause of public health problem, and more than 2 million premature deaths each year are attributed to the effects of urban outdoor air pollutant and indoor air pollutant (WHO, 2006).

The consequences of air pollution apart from public health which are measured in terms of sickness and death are lost productivity and missed educational and other human development opportunities (UN, 2001). The adverse health effects on humans, such as respiratory morbidity, cardiovascular diseases and

mortality, have created a public awareness to the urban air pollution. Study of air pollutants have become more important as they have very significant role in carrying out a reformulation or review on the current air quality standards. The pollutants such as sulphur dioxide, carbon monoxide, particulates, volatile hydrocarbons, photochemical oxidants, and lead were regarded as a threats to human health as per the clean air act 1970⁴. The capabilities of these pollutants to threat the human health, environment and significant damages to properties could not be denied. As various studies carried by numerous scholars, particle pollution and ground level ozone are at the pinnacle among six other pollutants as the most threatening factors to the human health. The research studies also demonstrated that ambient air pollutants (for example, PM, O₃, SO₂ and NO₂) contributed to various respiratory problems including bronchitis, emphysema and asthma (Ling et al, 2012). Health fact of Malaysia in 2012 by Ministry of Health Malaysia (MoH) stated that, in 2011, diseases of the respiratory system are one of the principal causes of hospitalization in government hospital with the percentage of 10.36% . Surprisingly, one of the principal causes of death at MoH hospital in 2011 was also diseases of the respiratory system with percentage of 19.48%.

II. HEALTH EFFECTS OF AIR POLLUTION IN ASIA

Various research conducted and their publication shows large variation of air pollution between developed and developing countries and it is observed that air pollution levels are often still higher as compared to developed countries. The studies related with health effects of high pollution exposures related to indoor biomass burning, and related to pollution from industry, energy production and traffic in large cities is understandably a matter of high priority and these types of studies were carried out widely and available in abundant. Out of all available studies, some studies have addressed pollution effects other than those related to indoor biomass smoke or outdoor urban exposures. These studies include, studies of haze events related to forest fires, and studies of 'dust' events related to long-range transport of pollutant-enriched windblown desert dust.

A panel study was conducted by a panel of Indian Institute of Technology Kanpur, India⁵ where Air PM₁₀ levels ranged from about 100—500 µg/m³ and were

found to be associated with reduced Peak Flow on high pollution days. Similar investigation were carried out to compare respiratory health of adult inhabitants of two small towns in northern India with different pollution levels (PM10 113 vs. 76 $\mu\text{g}/\text{m}^3$)⁶. During study carried it is observed that town having steel industry carries more pollutants as compared to the city having sugar cane facility. Health problems associated with respiratory system such as bronchitis, wheeze and shortness of breath were higher in men as well as women living in the more polluted town. Similar is the case for airway obstruction and it was twice more common in the more polluted town than in the less polluted town. Mistry and others⁷ investigated children living in Galle, Sri Lanka, and Chandigarh, India. For example of a town where outdoor air is polluted by traffic and industrial emissions, Galle was chosen. Indoor air is polluted by kerosene stoves and firewood burning in the same city. As compared with Galle, Chandigarh is observed as a city with low industrial emission and for the purpose of cooking and heating gas is used. The difference between the wheeze between Galle and Chandigarh is observed as 28.7% v/s 12.5% which is twice of Chandigarh as compared with Galle.

III. HEALTH EFFECTS OF AIR POLLUTION

Humans have used the resources of the environment for their different personal uses, without taking care of its impact on the environment but with the passage of time its adverse effects can be observed. The analogy of environment and pollution given by Wagner in 1994 was Earth can be compared to a fish bowl. That is, the Earth, like a fish bowl, is a contained environment; what goes in stays in. Pollutants emitted by us by various activity, remains in our environment and with the passage of time they show their effect on us. To fulfill the demands of present various activities are performed in every country in terms of industrialization, urbanization etc., which increases the risk of pollution effect. Millions of premature deaths were observed in and around the world due to the effects of urban outdoor air pollution and indoor air pollution (caused by the burning of solid fuels etc.). Severe diseases like heart attacks, respiratory diseases, and lung cancer are all significantly higher in people who breathe polluted air compared to matching groups in cleaner environments which is not or less polluted⁴. Many cases were observed where a significant number of deaths were directly related to poor air quality in that particular area. One such case occurred in Donora, Pennsylvania in October 1948. Pollutants in that area came from a zinc plant and steel mills were trapped in the valley due to which dense smog formed. Result of this was observed as death of seventeen people and and 5910 persons were found ill. This polluted atmosphere affected nearly 50 percent of the city's 12,300 inhabitants⁸.

One of the effects of air pollution is observed on the birth of the child. Study published in Lancet Respiratory

Medicine shows that air pollution during pregnancy may increase the risk of lower birth weight babies, this effect is observed even at the lower air pollution level acceptable by the current European Union air-quality directives. Study conducted by European Study of Cohorts for Air Pollution Effects (ESCAPE) on 74000 women who had singleton babies between 1994 and 2011 were analyzed. This study shows that all air pollutants, particularly fine particulate matter (PM 2.5), and traffic density reduced the average head circumference of a child at birth and increased risk of low birth weight at term. During this study the exposure of the average pollution level ranged from less than 10 micrograms per cubic meter ($10\mu\text{g}/\text{m}^3$) to almost $30\mu\text{g}/\text{m}^3$. 18% risk of low birth weight was found to be increased for every increase of $5\mu\text{g}/\text{m}^3$ in exposure to fine particulate matters throughout pregnancy⁹. In referring to Enger & Smith (2000), several hours of exposure to air containing 0.001 percent of carbon monoxide can cause death. This is because CO remains attached to hemoglobin for a long time even with small amounts it tends to accumulate and reduce the blood's oxygen-carrying capacity. In addition, carbon monoxide produced in heavy traffic can cause headaches.

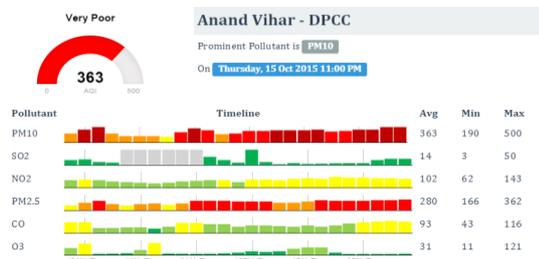
IV. HEALTH EFFECTS OF INDOOR EXPOSURE TO BIOMASS AND COAL SMOKE

Indoor exposure to biomass fuel combustion products was observed to be very high in developing countries as compared to developed counterparts. A study conducted in Nepal¹⁰ found increased respiratory problem in children in relation to indoor pollution which is mainly caused by biomass burning. Research studies in Nepal shows that this problem is showing severe health on peoples of that area¹¹ and likely elsewhere. Research studies¹² shows that currently, more than half of the world population was probably exposed to high levels of indoor pollution from biomass burning, with severe consequences on human health. The WHO Global Burden of Disease project recently estimated that death of young children in large number in developing countries is due to acute respiratory infections was worsened by indoor biomass smoke exposure¹³. Research carried by Indian scientist has suggested that use of biomass fuel can also lead to lung cancer.¹⁴ Use of indoor biomass consumption in developing countries has resulted in burden of illness and death from this¹⁵. With the use of appropriate instruments for measurement of PM levels, it is found very high in household using biomass for heating and cooking fuel. As compared to outdoor pollutants of megacities, the PM levels due to indoor pollutants were observed as extremely high. Rural women in different developing countries have higher indoor PM exposures than urban women, and have more chronic disease related with respiratory as a consequence. Coal smoke exposure indoors may be particularly enriched with carcinogenic

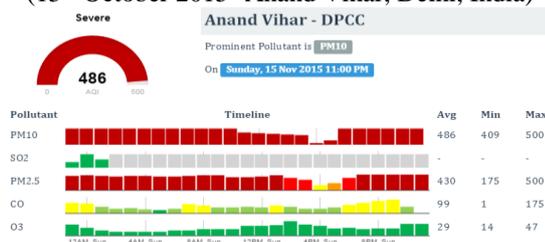
substances, and a case control study from various developing countries found that lung cancer was higher in households using coal for heating and cooking than in households using biomass fuels. Effect of solid fuels such as coal, biomass etc. resulted in increased risk of lung cancer claims a European multi center study¹⁶. Study in developing countries shows that exposure to pollutants generated from heating cooking oils to high temperatures has also been associated with lung cancer. Research studies confirms that both indoor coal smoke and cooking oil vapors increase the risk of lung cancer.

V. OBSERVATION

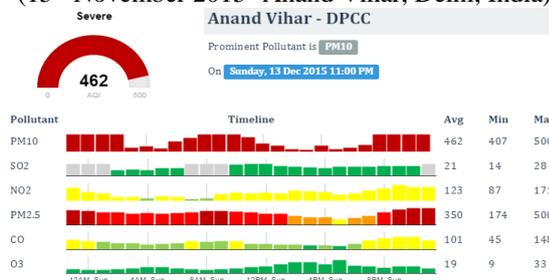
Presence of ambient air pollutants in Anand Vihar¹⁷, Delhi (India) can be observed with this Air Quality Index. An air quality index (AQI) is a number used by government agencies to communicate to the public how polluted the air currently is or how polluted it is forecast to become. As the AQI increases, an increasingly large percentage of the population is likely to experience increasingly severe adverse health effects. AQI of certain Indian cities-



(15th October 2015- Anand Vihar, Delhi, India)



(15th November 2015- Anand Vihar, Delhi, India)



(13th December 15- Anand Vihar, Delhi, India)

Certain standards for ambient air quality were defined by the agencies of the country. National Ambient Air Quality Standards of India is as follows. In exercise of the powers conferred by sub-section (2) (h) of section 16 of the Air (Prevention Control of Pollution) Act, 1981 (Act No. 14 of 1981), and in supression of the

Notifications No(s). S. O. 384(E), dated 11th April, 1994 and s. O. 935(E), dated 14th October, 1998, the Central Pollution Control Board hereby noyify the National Ambient Air Quality standards with immediate effect.

Sr. No.	Pollutant	Time Weighted Average	Concentration in Ambient Air	
			Industrial, residential, Rural and Other Area	Ecologically Sensitive Rea
1	Sulphur Dioxide	Annual 24 Hours	50 80	20 80
2	Nitrogen Dioxide	Annual 24 Hours	40 80	30 80
3	PM (less than 10 micro m)	Annual 24 Hours	60 100	60 100
4	PM (size less than 2.5 micro m)	Annual 24 Hours	40 60	40 60
5	Ozone	8 Hours 1 Hours	100 180	100 180
6	Lead	Annual 24 Hours	0.50 1.0	0.50 1.0
7	Carbon Monoxide	8 Hours 1 Hours	02 04	02 04
8	Ammonia	Annual 24 Hours	100 400	100 400
9	Benzene	Annual	05	05
10	Benzo Pyrene Particulate	Annual	01	01
11	Arsenic	Annual	06	06
12	Nickel	Annual	20	02

VI. CONCLUSION

Air pollution has negative effects on the health of populations worldwide. Studies from the developing countries suggest that short term variations in PM and several gaseous pollutants are associated with short-term variations in mortality, with effect estimates being as high as or higher than those reported from North America or Europe. Studies on effects of long-term exposure to air pollution are still scarce in developing countries, and conducting such studies is a priority and a challenge for the near future. A large fraction of the world population lives in China, India and other rapidly developing economies in Asia with associated large increases in energy production and consumption. Air pollution emissions are high, producing widespread “atmospheric brown clouds” with negative impacts on air quality at very large distances from the main source areas. It will be a major challenge to reduce the negative environmental effects of the economic development needed to provide better standards of living in this part of the world.

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