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ENVIRONMENTAL ISSUES : AIR POLLUTION PREVENTION AND CONTROL

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ABSTRACT

Air pollution is the introduction of particulates, biological molecules, and many harmful come from substances into Earth's atmosphere, causing diseases, allergies, death to humans, damage to other living organisms such as animals and food crops, or the natural or built environment. Air pollution anthropogenic or natural sources. The atmosphere is a complex natural gaseous system that is essential to support life on planet Earth. Indoor air pollution and urban air quality are listed as two of the world's worst toxic pollution problems in the 2008 Blacksmith Institute World's Worst Polluted Places report. According to the 2014 WHO report, air pollution in 2012 caused the deaths of around 7 million people worldwide, an estimate roughly matched by the International Energy Agency. Contamination of undesirable gases smoke from chimney, large industrialisation, and also human activities responsible for air pollution. The graph of air pollution is considerably increases during last few years. So many different authorities by having there environmental survey suggesting us time to time about its terrible effects. Now a days it become huge issues for all countries. It is affecting not only human life. Due to constantly rising air pollution levels as well as an increasing awareness of the hazardousness of air pollutants, new laws and rules have recently been passed. Although there has been a large amount of research on this topic, bibliometric data is still to be collected. Thus this study provides a scientometric approach to the material published on this subject so far.

Keywords- Air Pollution, Environmental etc.

I. INTRODUCTION

Air pollution may be described as contamination of the atmosphere by gaseous, liquid, or solid wastes or by-products that can endanger human health and welfare of plants and animals, attack materials, reduce visibility (To read about how Haze caused by air pollution can affect visibility, or produce undesirable odors. Although some pollutants are released by natural sources like volcanoes, coniferous forests, and hot springs, the effect of this pollution is very small when compared to that caused by emissions from industrial sources, power and heat generation, waste disposal, and the operation of internal combustion engines. Fuel combustion is the largest contributor to air pollutant emissions, caused by man, with stationary and mobile sources equally responsible. The air pollution problem is encountered outdoor as well as indoor. To read more about the Outdoor Air Pollution and to read more about the Indoor Air Pollution.



The indoor air pollution came to our attention during 80's while outdoor air pollution has been around for some time. The major pollutants which contribute to indoor air pollution include radon, volatile organic compounds, formaldehyde, biological contaminants, and combustion by-products such as carbon monoxide, carbon dioxide, sulfur dioxide, hydrocarbons, nitrogen dioxides, and particulate. The major pollutants which contribute to outdoor air pollution are sulfur dioxide, carbon monoxide, nitrogen oxides, ozone, total suspended particulate matter, lead, carbon dioxide, and toxic pollutants.

There are several reasons to worry about air pollution. Some are:

1. Air pollution affects every one of us.
2. Air pollution can cause health problems and, may be, death.

3. Air pollution reduces crop yields and affects animal life.
4. Air pollution can contaminate soil and corrode materials.

Global warming is another international issue being debated by scientists and politicians. The rise in global average temperatures is being related to the increase in concentration of carbon dioxide and green house gases in earth's atmosphere. This is due to burning of fossil fuels, the production of chlorofluorocarbons, deforestation and other forces. The pollution problem in a country depends on business cycles. In the US, business is moving from manufacturing base to service industry. This has also created a need to look at the pollution due to recreational type activities.

Most polluted cities by PM ^[97]	
Particulate matter, $\mu\text{g}/\text{m}^3$ (2004)	City
168	Cairo, Egypt
150	Delhi, India
128	Kolkata, India (Calcutta)
125	Tianjin, China
123	Chongqing, China
109	Kanpur, India
109	Lucknow, India
104	Jakarta, Indonesia
101	Shenyang, China

II. CAUSES

1. Burning of Fossil Fuels: Sulfur dioxide emitted from the combustion of fossil fuels like coal, petroleum and other factory combustibles is one the major cause of air pollution. Pollution emitting from vehicles including trucks, jeeps, cars, trains, airplanes cause immense amount of pollution. We rely on them to fulfill our daily basic needs of transportation. But, there overuse is killing our environment as dangerous gases are polluting the environment. Carbon Monoxide caused by improper or incomplete combustion and generally emitted from vehicles is another major pollutant along with Nitrogen Oxides, that is produced from both natural and man made processes.



2. Agricultural activities: Ammonia is a very common by product from agriculture related activities and is one of the most hazardous gases in the atmosphere. Use of insecticides, pesticides and fertilizers in agricultural activities has grown quite a lot. They emit harmful chemicals into the air and can also cause water pollution.



3. Exhaust from factories and industries: Manufacturing industries release large amount of carbon monoxide, hydrocarbons, organic compounds, and chemicals into the air thereby depleting the quality of air. Manufacturing industries can be found at every corner of the earth and there is no area that has not been affected by it. Petroleum refineries also release hydrocarbons and various other chemicals that pollute the air and also cause land pollution.



Source type	NO/NO _x
Industrial boilers	
Natural gas	0.90-1.0
Coal	0.95-1.0
No. 6 fuel oil	0.96-1.0
Motor vehicle	
Internal combustion engine	0.99-1.0
Diesel-powered car	0.77-1.0 ^a
Diesel-powered truck and bus	0.73-0.98
Uncontrolled tail gas from nitric acid plant	~0.50
Petroleum refinery heater: natural gas	0.93-1.0
Gas turbine electrical generator: No. 2 fuel oil	0.55-1.0 ^b

NO/NO_x RATIOS IN EMISSIONS FROM VARIOUS SOURCE TYPES

4. Mining operations: Mining is a process wherein minerals below the earth are extracted using large equipments. During the process dust and chemicals are released in the air causing massive air pollution. This is one of the reason which is responsible for the deteriorating health conditions of workers and nearby residents.



5. Indoor air pollution: Household cleaning products, painting supplies emit toxic chemicals in the air and cause air pollution. Have you ever noticed that once you paint walls of your house, it creates some sort of smell which makes it literally impossible for you to breathe.



Suspended particulate matter popular by its acronym SPM, is another cause of pollution. Referring to the particles afloat in the air, SPM is usually caused by dust, combustion etc.

III. POLLUTANTS

national air quality standards for [six common pollutants](#) (also referred to as "Let us now turn our attention to common air pollutants. EPA has set criteria" pollutants):

i. sulfur oxides: Sulfur dioxide is considered a primary precursor of acidic precipitation. The sources of SO_2 are natural sources such as volcanoes and manmade sources such as power plants and industrial sources that burn coal or fuel. During the burning of fossil fuels 2 lb of SO_2 is produced for each pound of sulfur present in the fuel. It can harm human, and animal lungs, as well as plants and trees. Sulfur dioxide is the main contributor to acid rain.

ii. carbon monoxide: It is a colorless, odorless and tasteless gas and affects the central nervous system of humans. The gas is emitted when vehicles burn gasoline and when kerosene and wood stoves are used to heat homes. The gas reduces the ability of hemoglobin to carry oxygen to body tissue.

iii. nitrogen dioxide: Nitrogen Oxides are formed naturally by bacteria in soil and play an important role in plant growth. However, nitrogen oxides that enter the air through exhaust from vehicles and some power plants can be harmful. They can combine with water to make acid rain, react in the air to produce ozone and other pollutants, or be harmful by themselves as a gas in the air. Nitrogen dioxide is of greatest concern and is brown- red in color.

iv. ozone: Ozone is a gaseous, secondary pollutant and is formed during photochemical smog in the atmosphere. The interaction of NO_2 with VOCs produces ozone in the presence of sunlight. If the air over the city does not move, pollutants become trapped close to the earth's surface forming smog and increasing ozone problems which can lead to breathing problems. High ozone levels at the ground level harm plants, including trees and crop plants, and causes the accelerated deterioration of materials such as rubber and fabrics.

v. **total suspended particulate matter:** TSP is mostly a primary pollutant, but some of it is formed as secondary pollutant. It consists of soot, dust, tiny objects of liquid, and other material. An increase in the incidence of respiratory diseases and gastric cancer has been linked with the increase in particulate level. The natural sources include volcanoes, forest fires, and desert land. Some manmade sources are steel industry, power plants, and flour mills. Agricultural activities also contribute to TSP loading. Particulate gradually settle back to earth and can cause people to cough, get sore throats, or develop other more serious breathing problems. Particulate matter also causes discoloration of buildings and other structures.

vi. **lead:** Lead is fairly abundant and is derived from ore bearing minerals. The gray metal can be easily molded, formed and worked. It can withstand weathering and chemical erosion. Lead has been used in the manufacture of pipes, paint house hold pottery, gasoline additives and storage batteries. In the U.S. the major source of lead mining is the state of Missouri. Automobiles and leaded gasoline are major sources of atmospheric lead. Lead was more of a problem a few years ago when all vehicles used gasoline with lead additives. When lead gasoline is burned, lead is released into the air. When people or animals breathe lead over a period of time, it accumulates in their bodies and can cause brain or kidney damage.

The other class of air pollutants which are of concern are hazardous and toxic air pollutants. The later area is rapidly expanding because of public pressure, concern over adverse health effects and accidental environmental damage. In this section seven criteria pollutants and some other pollutants are discussed. To view

- Areas where air pollution levels persistently exceed national air quality standards.
- Locations of air pollution monitoring sites, operated by state and local agencies.
- The 25 largest individual sources of each pollutant in the United States.
- Location of major stationary sources of air pollution.

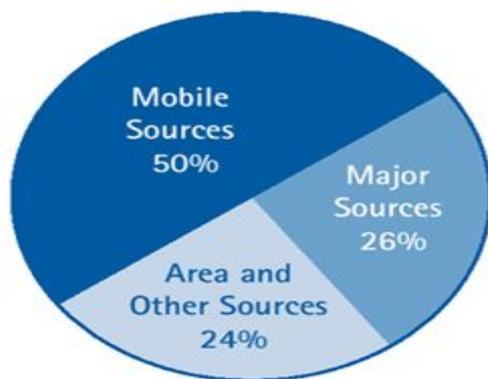
air pollutants may originate from natural sources such as volcanoes as well as from manmade sources such as stationary and mobile sources. The stationary sources serve as major contributors to air pollution, since they include factories, refineries, or power pollutants, which are constantly emitting pollutants into the atmosphere. The following table shows the criteria air pollutant monitors in the US from 1970 to 1990.

Source: <http://www.epa.gov/aboutepa/oar.html>

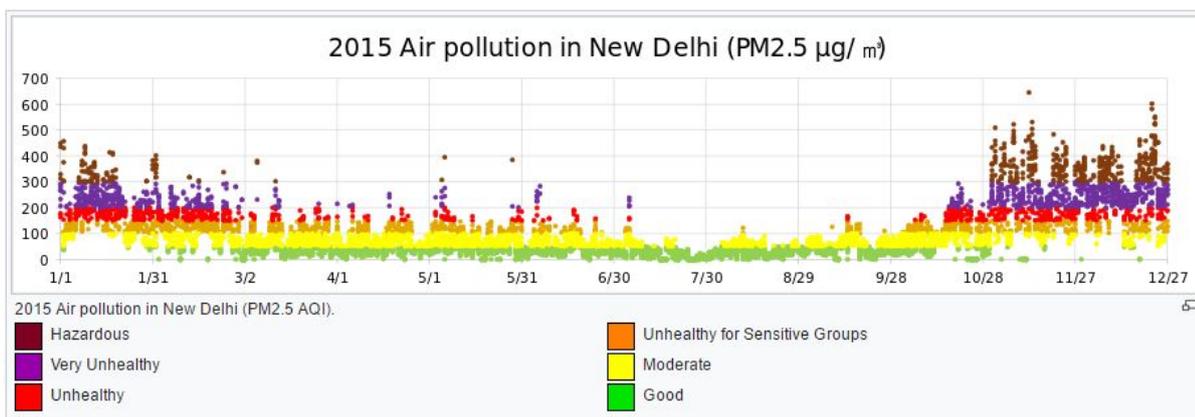
Year	PM ₁₀	O ₃	NO ₂	SO ₂	CO
1970	245	1	43	86	82
1975	1120	321	303	827	494
1980	1135	546	375	1088	511
1985	970	527	305	906	458
1990	720	627	345	743	493

Based on 1996 National Toxics Inventory data, major sources account for about 26 percent of air toxics emissions, smaller area sources and other sources (such as forest fires) for 24 percent, and mobile sources for 50 percent. Accidental releases, which also contribute air toxics to the atmosphere, are not included in these estimates.

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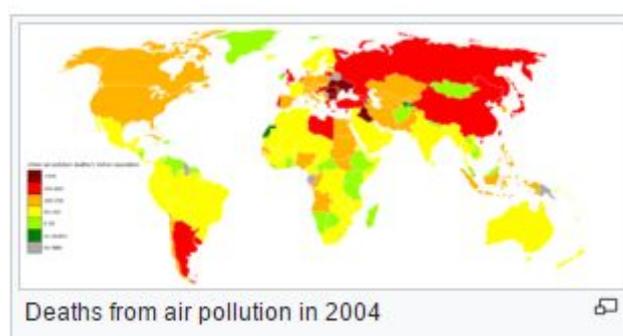


IV. MAJOR DISASTER OF AIR POLLUTION

The public concern is also based on news stories on air pollution accidents and episodes reported by the media. It is important for us to look at these pollution episodes.

During a 3 day fog in 1930, 60 people died in Meuse Valley, Belgium, while 592 people died in Manchester, England in 1931 during a 9 day fog. The 1948 plant emissions and atmospheric conditions in Donora, Penn. USA caused a 4 day fog and 7000 people were reported sick and 20 people died. The 4 day fog of 1952 in London, England resulted in 4000 deaths and concentration levels were several times higher than the current air quality standards in the United States. To read the September, 1998, EPA announcement of the final rule to protect Eastern US from Smog. A four hour release of methyl isocyanate at a chemical plant owned by Union Carbide in 1984 killed 2800 people in Bhopal, India and opened the eyes of government agencies and public around the world. This Bhopal gas tragedy can be read in a nutshell in the following table:

Accident	Bhopal Gas Tragedy
Location	Bhopal, Madhya Pradesh, India
Year	1984
Pollutant	Methyl isocyanate
Physical Properties of Methyl Isocyanate	Methyl isocyanate is a colorless liquid that has a sharp odor. The odor threshold for methyl isocyanate is 2.1 ppm. The chemical formula for methyl isocyanate is C ₂ H ₃ NO, and the molecular weight is 57.05 g/mol. The vapor pressure for methyl isocyanate is 348 mm Hg at 20 C.
Pathway	Inhalation
# of Deaths	2000
Cause of Death	Primarily : Pulmonary edema Secondary : Respiratory infections such as bronchitis and bronchial pneumonia.
Adverse health effects on	More than 170, 000 survivors
Reproductive adverse effects	Leucorrhoea, pelvic inflammatory disease, excessive menstrual bleeding, and suppression of lactation and also stillbirths and spontaneous abortions



V. SIDE EFFECT ON HEALTH OF AIR POLLUTION

1) Air pollution is a significant risk factor for a number of [pollution-related diseases](#) and health conditions 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 room 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

2) 5.1 Cardiovascular disease

A 2007 review of evidence found ambient air pollution exposure is a risk factor correlating with increased total mortality from cardiovascular events (range: 12% to 14% per 10 microg/m³ increase). Air pollution is also emerging as a risk factor for stroke, particularly in developing countries where pollutant levels are highest. A 2007 study found that in women, air pollution is not associated with hemorrhagic but with ischemic stroke.

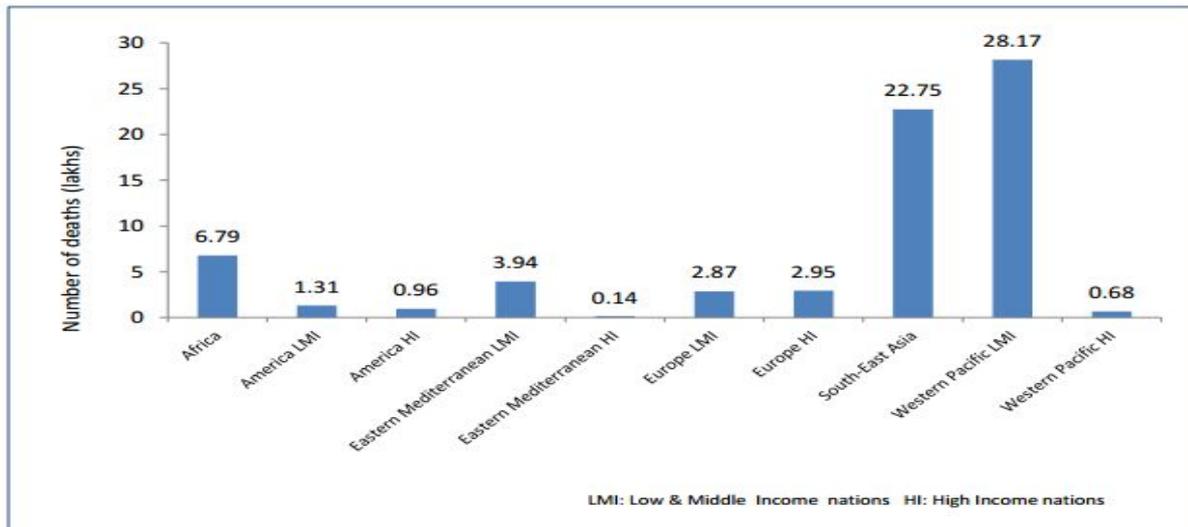
3) 5.2 Lung disease

[Chronic obstructive pulmonary disease](#) (COPD) includes diseases such as chronic bronchitis and emphysema.

Research has demonstrated increased risk of developing asthma and COPD from increased exposure to traffic-related air pollution. Additionally, air pollution has been associated with increased hospitalization and mortality from asthma and COPD

4) 5.3 Cancer

A review of evidence regarding whether ambient air pollution exposure is a risk factor for cancer in 2007 found solid data to conclude that long-term exposure to PM2.5 (fine particulates) increases the overall risk of non-accidental mortality by 6% per a 10 microg/m³ increase. Exposure to PM2.5 was also associated with an increased risk of mortality from lung cancer (range: 15% to 21% per 10 microg/m³ increase) and total cardiovascular mortality (range: 12% to 14% per a 10 microg/m³ increase). The review further noted that living close to busy traffic appears to be associated with elevated risks of these three outcomes --- increase in lung cancer deaths, cardiovascular deaths, and overall non-accidental deaths.



Total global deaths attributable to household and ambient air pollution in 2012 (region-wise)

Source: WHO 2014

5) 5.4 Central nervous system

Data is accumulating that air pollution exposure also affects the [central nervous system](#).

In a June 2014 study conducted by researchers at the [University of Rochester](#) Medical Center, published in the journal [Environmental Health Perspectives](#), it was discovered that early exposure to air pollution causes the same damaging changes in the brain as [autism](#) and [schizophrenia](#). The study also shows that air pollution also affected short-term memory, learning ability, and impulsivity. Lead researcher Professor Deborah Cory-Slechta said that "When we looked closely at the ventricles, we could see that the white matter that normally surrounds them hadn't fully developed."

VI. ENVIROMENTAL EFFECT OF AIR POLLUTION

Air pollution is a problem for all of us. However, some groups of people are especially sensitive to common air pollutants such as particulates and ground-level ozone. Sensitive populations include children, older adults, people who are active outdoors, and people with heart or lung diseases, such as asthma. If you are sensitive to air pollution, you need to be aware of steps you can take to protect your health

Along with harming human health, air pollution can cause a variety of environmental effects:

6.1 ACID RAIN : Acid rain is precipitation containing harmful amounts of nitric and sulfuric acids. These acids are formed primarily by nitrogen oxides and sulfur oxides released into the atmosphere when fossil fuels are burned. These acids fall to the Earth either as wet precipitation (rain, snow, or fog) or dry precipitation (gas and particulates). Some are carried by the wind, sometimes hundreds of miles. In the environment, acid rain damages trees and causes soils and water bodies to acidify, making the water unsuitable for some fish and other wildlife.

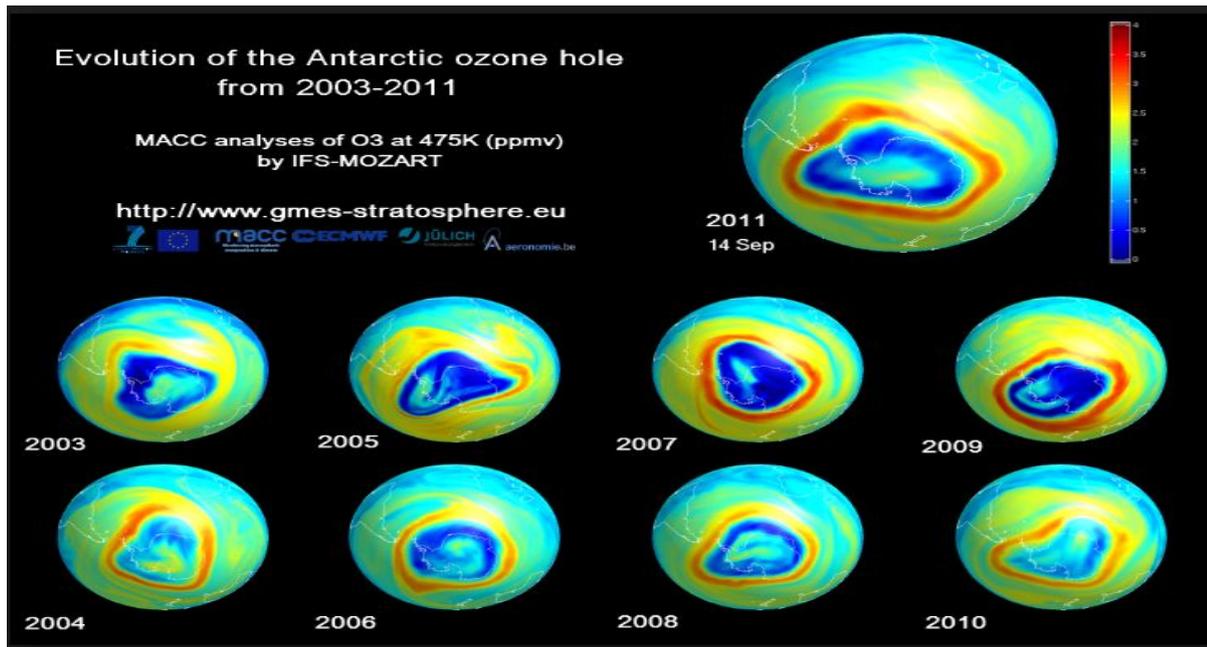
6.2 EUTROPHICATION : Eutrophication is a condition in a water body where high concentrations of nutrients (such as nitrogen) stimulate blooms of algae, which in turn can cause fish kills and loss of plant and animal diversity. Although eutrophication is a natural process in the aging of lakes and some estuaries, human activities can greatly

accelerate eutrophication by increasing the rate at which nutrients enter aquatic ecosystems. Air emissions of nitrogen oxides from power plants, cars, trucks, and other sources contribute to the amount of nitrogen entering aquatic ecosystems.

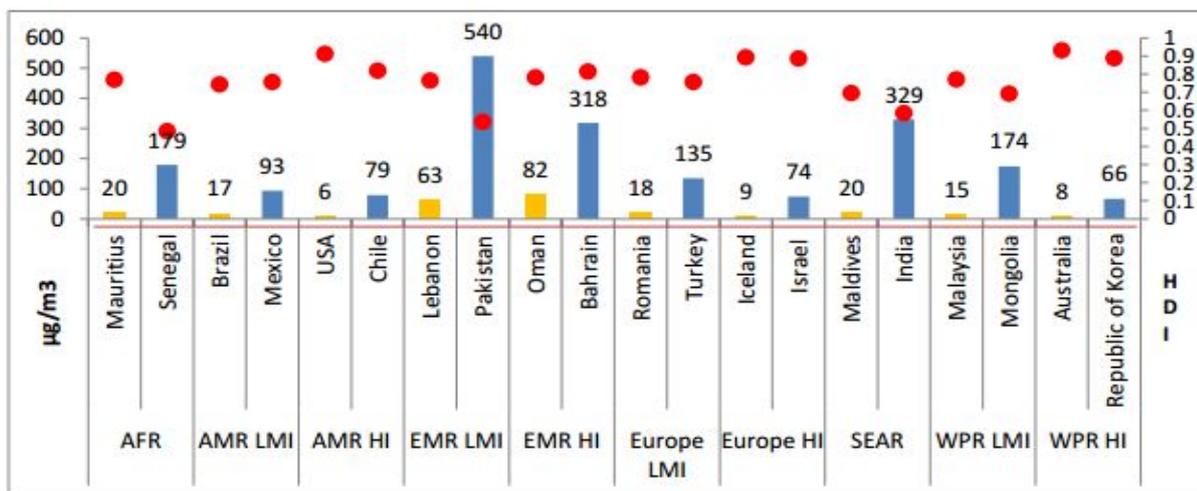
6.3 EFFECTS ON WILDLIFE : Toxic pollutants in the air, or deposited on soils or surface waters, can impact wildlife in a number of ways. Like humans, animals can experience health problems if they are exposed to sufficient concentrations of air toxics over time. Studies show that air toxics are contributing to birth defects, reproductive failure, and disease in animals. Persistent toxic air pollutants (those that break down slowly in the environment) are of particular concern in aquatic ecosystems. These pollutants accumulate in sediments and may biomagnify in tissues of animals at the top of the food chain to concentrations many times higher than in the water or air



6.4 OZONE DEPLETION : Ozone is a gas that occurs both at ground-level and in the Earth's upper atmosphere, known as the stratosphere. At ground level, ozone is a pollutant that can harm human health. In the stratosphere, however, ozone forms a layer that protects life on earth from the sun's harmful ultraviolet (UV) rays. But this "good" ozone is gradually being destroyed by man-made chemicals referred to as ozone-depleting substances, including chlorofluorocarbons, hydrochlorofluorocarbons, and halons. These substances were formerly used and sometimes still are used in coolants, foaming agents, fire extinguishers, solvents, pesticides, and aerosol propellants.



6.5 GLOBAL CLIMATE CHANGE : The Earth's atmosphere contains a delicate balance of naturally occurring gases that trap some of the sun's heat near the Earth's surface. This "greenhouse effect" keeps the Earth's temperature stable. Unfortunately, evidence is mounting that humans have disturbed this natural balance by producing large amounts of some of these greenhouse gases, including carbon dioxide and methane. As a result, the Earth's atmosphere appears to be trapping more of the sun's heat, causing the Earth's average temperature to rise - a phenomenon known as global warming.



Annual mean concentration of PM10 (µg/m3) in regions of the world

note: Yellow bar denotes lowest value for the region and blue bar denotes highest value for the region. These are based on data for a particular region and are not average values for a region. The orange line denotes the permissible limit of 20 µg/m3 The red dots depict the HDI value

SOURCE: Ambient Air Pollution Database, WHO (2014)

VII. PREVENTION

The fact is that human activities contribute the most to any type of pollution. Hence, it is our responsibility to find solutions. And considering the harmful effects of air pollution, it is high time that everyone contributes a bit to prevent release of pollutants. There are certain ways that one can follow for reducing emission of air pollutants in the atmosphere. For clear understanding, refer to the following tips for preventing air pollution.

Car Pool: Forming and implementing a car pool will reduce the number of cars, thereby, preventing air pollution by cutting down the use of fossil fuels. This way, it will help in the sustainable use of fossil fuel and its conservation for the future generations.

Vehicle Care: Timely servicing of the car helps to keep it in a good condition, and also minimizes fuel exhaust. Driving the car at an average speed and turning off in traffic are the thumb rules to save fuel. Make sure to use unleaded petrol and opt for regular pollution checking of your car.

Public Transport: Whenever possible, try to travel by public transports. This helps in two ways; prevents air pollution and increases public income. If you are going to a nearby place, go by walking or use a bicycle, instead of using your vehicle. The objective is to minimize the use of fuels as far as possible.

Alternative Energy Source: Another effective way to prevent air pollution is to use alternative energy sources such as solar energy, hydroelectric energy, and wind energy. Nowadays, sophisticated technologies such as wind turbine, solar water heaters are introduced to generate electricity and other energy forms for household uses.

Saving Energy: Saving energy will, of course, help to prevent air pollution. Switch off the lights, fans, air conditioners, televisions, and other appliances, when not in use. You can also share a room with others when the air conditioner or fan is on, instead of switching them on in every room.

Minimize Air Pollutants: Always try to minimize smoke emission, as it contributes a lot to air pollution. One way is to compost dried leaves and kitchen waste, instead of burning them. Composting will also give you organic fertilizer for your garden. Other tips include replacing old wood stoves or gas furnaces, avoiding solvents, and most importantly, do not smoke in the home.

Recyclable Materials: Recycling is a simple approach to reduce pollution in two ways; save energy which is required for disposing and minimize the pollutants released during manufacturing. The list of recyclable materials include plastic bottles, aluminum cans and utensils, paper, craft papers, cardboard, corrugated boxes, and glass bottles.

Smart Purchasing: Remember to carry paper bags and minimize using plastic bags. While buying the products, always choose air-friendly and recyclable products that will minimize the emission of pollutants. Also, shop for only energy-efficient appliances that use less packaging. Lastly, buy rechargeable batteries for frequently used devices.

Social awareness about air pollution is the most essential step to be taken for the prevention of air pollution. Awareness programs and/or advertisements should be encouraged, so that people understand the potential health hazards of pollution. Improvement of transport facilities and proper use of land for the sake of social benefits are equally important for controlling air pollution.

VIII. CONCLUSION

Air pollution is a serious environmental concerns all around the globe. Over the last few decades, the intensified process of industrialization and urbanization, coupled with rapid population growth has resulted in sever environmental degradation. In particular, harmful pollutants such as Sulphur Dioxide (SO₂), Nitrogen Dioxide (NO₂), Ozone (O₃), Total Suspended Particles Matter (TSPM) etc, are emitted and these pollutants even exceed air quality guidelines recommended by the World Health Organization (WHO, 2005).Particulate and gaseous emissions of pollutants from industries and auto exhaust are responsible for rising discomfort, increasing airborne diseases, decreasing productivity and deterioration of artistic and cultural patrimony urban center. India is not an exception, where majority of the population is exposed to poor air quality. India faces the similar challenges of both strengthening its economy and protecting its environment. Air quality has deteriorated in large cities in India. The major sources of air pollution include road dust re-suspension, diesel combustion, construction activities, biomass burning, certain contribution from gasoline which has polluted cities like Delhi, Mumbai, Kolkata, Chennai, Ankleshwar, Dhanbad, Howrah, Jharia, Surat, Jamshedpur, Sindri, Pune, Agra, Noida, Kanpur, Faridabad, Firozabad, Ghaziabad, etc.

REFERENCES

1. *global warming seminar series 2011 abstract ,francis zwiers director of the pacific climate impact consortium university of vectority ,b.c. held on 23er feb 2011*
2. *Robert j .ruhlf in 1999. He currently work as aprogramme evolutor with the center for science mathematic programme improvement (SAMPI) at the western michigon university*
3. *climate change impact google Wikipedia*
4. *global warming fact google Wikipedia*
5. *Global Warming's Increasingly Visible Impacts authors Dr. James Wang Dr. Bill Chameides*