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### Urban Air Pollution- An emerging concern

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#### ABSTRACT

Air pollution in cities and urban sectors are increasing significantly on a time scale at global level. This alarming fact is substantiated with its gravity in the sense that more than 80% of people living in urban areas are exposed to air quality levels that exceed the World Health Organization (WHO) limits. The situation world over is more critical to populations in low - income cities which are most impacted. According to the urban air quality database, 98% of cities in low - and middle income countries with more than 100 000 inhabitants do not meet WHO air quality guidelines. However, the cities in high - income countries this percentage decreases to 56%. The WHO reveals the fact that around 3000 cities in 103 countries have started measuring air pollution levels and recognizing the associated health impacts. With declines of urban air quality, the risk of stroke, heart disease, lung cancer, chronic and acute respiratory diseases, including asthma, increases for the people who live in these cities. An effort has therefore been made by the authors in this paper to explain briefly some of the relevant factors responsible for urban air pollution such as heat island effect, albedo effect, urban planning with environmental inputs, climate change, urban environment policy parameters, sustainable urban transport, environmental sustainability etc. These issues need to be addressed globally on high scientific scale for effective reduction of urban air pollution.

**Keywords:** Air pollution, urban area, indoor/outdoor air pollution, health impacts, air pollution episodes

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## 1.0 Introduction:

Urban air pollution is a significant environmental problem in the developing and developed countries of the world. WHO and UNEP established an air pollution monitoring network as part of the Global Environment Monitoring System. Despite the very high levels observed, the countries have not taken serious steps to control urban air pollution. Millions of people reported serious health

effects and experiencing discomfort. With the rapid increase of urban population on a time scale and lack of air pollution control mechanism, there will be a serious threat in urban areas and the people living therein. Such a problem would become much more gigantic if adequate steps are not taken on all the issues responsible to urban air pollution in an integrated manner. Figure 1 tends to indicate the extent of most polluted cities in India.



**Figure 1: India's most polluted cities.**

## 2.0 Outdoor and indoor air pollution:

Air pollution is usually man - made and originates from poor combustion of fossil or biomass fuels in the form of. exhaust fumes from vehicles, furnaces or wood stoves, industries, household fuel burning and waste disposal or burning. Urban outdoor air pollution refers to the air pollution experienced by populations living in and around urban areas. Indoor air pollution refers to the pollutants found in indoors. The main cause of indoor air pollution is inefficient fuel combustion from technologies used for cooking, heating and lighting. There are also natural indoor air pollutants, like radon, chemical

pollutants from building materials and cleaning products which also impact health. Urban outdoor air pollution can be an important contributor to the indoor air quality, especially in homes near pollution sources. Similarly, indoor air pollution

sources may also be important causes of urban outdoor air pollution, especially in cities where many homes use biomass fuels or coal for heating and cooking. Ambient air pollution is a broader term used to describe air pollution in outdoor environments whereas urban outdoor air pollution is a more specific term referring to the outdoor air pollution experienced by populations living in urban areas. The significant contributors to urban air pollution are in the form of mobile and stationary sources. Mobile sources are usually vehicles and trains whereas stationary sources are industries, household fuel burning, waste disposal or burning, D.G sets, construction activities, etc. Out of these sources, automobile emissions are the predominant sources of urban air pollution

## 3.0 Health impacts:

The World Health Organization (WHO) has

revealed following alarming facts in respect of urban air pollution:

- Nine out of ten people in the world breathe polluted air.
- More than 7 million people die every year as a result of air pollution.
- Ambient air pollution alone caused some 4.2 million deaths in 2016, while household air pollution from cooking with polluting fuels and technologies caused an estimated 3.8 million deaths in the same period.
- Toxic particles such as sulphate, nitrate and soot are responsible for 25 percent of all deaths from heart disease and stroke whereas 30 percent from lung cancers and almost 50 percent from chronic obstructive pulmonary diseases.
- The risk of heart attacks, lung cancer and chronic breathing diseases is increasing particularly in poor countries.
- Majority of deaths are caused in low-income countries such as in Asia and Africa, where cooking is still more common on open fires, kerosene or wood burning.
- Overall 3 billion people, more than 40 percent of the world's population, have no access to safe technological equipment thereby breathe dirty air into their homes every day.
- "Air pollution is one of the main causes of disease and death".

#### 4.0 Urban air pollution episodes:

There are many episodes on account of air pollution in which many deaths were caused,

a list of such episodes are given hereunder:

- The Meuse Valley fog, 1930.
- The Donora smog, 1948.
- The St. Louis smog, 1939.
- The Great Smog of London, 1952.
- The Southeast Asian haze, 2006.
- The Bhopal disaster, 1984.

#### 5.0 Air Pollution - Turning Silent Killer:

The world health organization (WHO) reveal the fact that air pollution levels are alarmingly high in many parts of the world in as much as that 9 out of 10 people breathe air containing high levels of pollutants. Besides, it has also been reported by WHO that an alarming death toll of 7 million people every year caused by ambient (outdoor) and household (Indoor) air pollution. Moreover, over 3 billion people out of whom mostly women and children are still breathing poisonous smoke every day from using polluting stoves and fuels in their homes. The WHO also reveal the fact that fine particles in polluted air penetrate deep into the lungs and cardiovascular system, causing diseases including stroke, heart disease, lung cancer, chronic obstructive pulmonary diseases and respiratory infections, including pneumonia. It has been reported that 21 percent death caused due to pneumonia, 20 percent from stroke, 34 percent from ischemic heart diseases, 19 percent from chronic obstructive pulmonary disease (COPD) and 7 percent from lung cancer [3] as shown in Figure 2. Moreover, as per WHO the Worldwide ambient air pollution accounts for:

- 25% of all deaths and disease from lung cancer.
- 17% of all deaths and disease from acute lower respiratory infection.
- 16% of all deaths from stroke.
- 15% of all deaths and disease from ischemic heart disease.
- 8% of all deaths and disease from chronic obstructive pulmonary disease.

#### 6.0 Effects of Air Pollutants:

The effects of air pollutants on human health are given hereunder:

##### 6.1 Sulphur Compounds:

Flue gas desulphurization plants (FGD), coal power plant about 0.02-2% of emission, furnace oil (Sulphur content is generally 2.3 per cent by weight), paper mills, steel industry, refineries and sewage treatment plants, petroleum refinery and vehicles engines, burning rubber, crackers

and match smoke emit sulphur compounds. Naturally sources such as volcanoes, marshes, bogs and swamps emit sulphur compounds. US, China and Russia are leading sulphur emitting countries. Found as SO<sub>2</sub>, H<sub>2</sub>S, CS<sub>2</sub>, COS, Methyl mercaptan, Dimethyl sulphur, and Dimethyl disulphide. Health effects are generally wheezing, bronchoconstriction, chronic bronchitis, Chronic obstructive and lung disease.

### 6.2 Nitrogen compounds:

Major source is combustion where NH<sub>3</sub> come from fertilizers, livestock & poultry wastes, and vegetation, burning of biomass and ocean spray, energy production, petroleum refinery, forest fire, volcanic activity, bacterial breakdown of organic nitrates. It promotes acidification in which NO<sub>2</sub> favours photochemical smoke thereby reduce visibility. 77% of combustion gas of coal consist oxides of Nitrogen where high concentration causes pulmonary edema, airway injury, impaired lung defences, dissolved atmospheric NO<sub>x</sub> as in acid rain destroys fish and plant life and N<sub>2</sub>O is a greenhouse gas causes global warming. Moreover, it causes leaf damage or affects the photosynthetic activities of plants and causes respiratory problems in mammals.

### 6.3 Carbon monoxide:

CO is a colorless, odorless, toxic yet non - irritating gas. It is a product of combustion of fuel such as natural gas, coal or wood. Vehicular exhaust contributes to the majority of carbon monoxide which discharge into our atmosphere. It creates a smog type formation in the air which has been linked to many lung diseases and disruptions to the natural environment and animals. In 2013, more than half of the carbon monoxide emitted into our atmosphere was from vehicle traffic and burning one gallon of gas will often emit over 20 pounds of carbon monoxide into the air.[12] It causes difficulty in breathing as it compete with oxygen by forming carboxyhemoglobin, Asphyxia, damage to heart and nervous system. Moreover, it affects the respiratory activity as hemoglobin has more affinity for CO than for oxygen thereby combines with HB to reduce the

oxygen-carrying capacity of blood. This also results in blurred vision, headache, unconsciousness and death due to asphyxiation (lack of oxygen).

### 6.4 Carbon dioxide:

CO<sub>2</sub> is considered as an air pollutant as it is a greenhouse gas causing global warming. CO<sub>2</sub> emission is available from all kind of combustion both natural and manmade.

### 6.5 Ground level Ozone:

Auto mobile emission, air craft cabins etc., are Ozone generators. Ground level ozone (O<sub>3</sub>) formed from NO<sub>x</sub> and VOCs and Ozone (O<sub>3</sub>) is a key constituent of the troposphere. It is also an important constituent of certain regions of the stratosphere commonly known as the Ozone layer. Photochemical and chemical reactions involving it drive many of the chemical processes that occur in the atmosphere by day and by night. At abnormally high concentrations brought about by human activities, it is a pollutant and a constituent of smog.

### 6.6 Polycyclic aromatic hydrocarbon(PAH)

PAH are released from cigarette smoke and stove smoke, can cause lung cancer.

### 6.7 Radon:

Released naturally from volcanic eruption, it is a radioactive material ionizes biological molecules, causes cell disruption and causing lung cancer. Radon is a colourless, odourless, naturally occurring, radioactive noble gas which is formed from the decay of radium. It is considered to be a health hazard. Radon gas from natural sources can accumulate in buildings, especially in confined areas such as the basement and it is the second most frequent cause of lung cancer, after cigarette smoking.

### 6.8 Asbestos:

Asbestos fibre dust released from building material, mines, mills and insulations causes Mesothelioma, lung cancer, Asbestosis.

### **6.9 Arsenic:**

Found in copper smelters and cigarette smoke causing in lung cancer.

### **6.11 Allergens:**

House dust, Pollen, animal dander causes Asthma and rhinitis.

### **6.12 Particle matter SPM, PM10, PM 2.5:**

Suspended particles are formed in every type of combustion and originated from various sources; PM 2.5 can even reach the blood circulation via the respiratory tract. Increased levels of fine particles in the air are linked to health hazards such as heart disease,[13] altered lung function and lung cancer. Particulates are related to respiratory infections and can be particularly harmful to those already suffering from conditions like asthma.[14]

### **6.13 HCl:**

Released naturally from volcanic activities, causes eye irritation and damages mucus membrane and affects respiratory system.

### **6.14 Dioxin:**

Dioxin is a toxic gas produced from burning of electronic wastes and plastic materials; it could cause cancer and affect the immune system and leads to developmental reproductive disorders.

### **6.15 Furans:**

Furans are released during the burning of plastic products such as nylon, containing various harmful compounds.

### **6.16 Odour:**

Odour also causes irritation causing nausea and headache.

### **6.17 Mercury:**

Gold refinery is the major source of Mercury and it is a known carcinogen. Moreover, mercury may also cause brain & kidney damage.

### **6.18 Lead:**

Lead particle found in petrol smoke and cause

health issues such as affects respiratory system, blood and kidneys also cause dyslexia and hyperactivity in children, however currently it is completely banned from fuel as use of lead free gasoline. Burning of lead containing electronic wastes causes the adverse effect to the atmosphere.

### **6.19 Compounds of Cadmium, Antimony, Arsenic, Zinc and Copper:**

These metallic elements often toxic and irritating smoke causes adverse health effects, generally found in pesticides and fumes and gas emission during the burning of plastic and electronic wastes.

### **6.20 Volatile organic compounds (VOCs):**

VOCs are xylene, ethyl benzene and tri - methyl benzene compounds commonly found in Air freshener, air cleaners (with ozone), cleaning and disinfecting chemicals, cosmetics, gasoline, fuel oil, moth balls and vehicle exhaust. There is an array of compounds listed in this category such as Acetone, Benzene, Ethyl glycol, Formaldehyde, Methylene chloride, Perchloro ethylene, Toluene, Xylene, 1, 3 - butadiene. Short time exposure may result irritation in eye and nose, headache, nausea, vomiting, dizziness and asthma. Continues exposure damages central nervous system, kidney and liver, some are carcinogens causing cancer.

### **6.21 Persistent Organic Pollutants (POPs):**

These substances could persist in the environment, causing bioaccumulation via the food chain, they are found in chemicals which transport for long range by air current to countries that even not produce them. Main sources are industrial products such as Polychlorinated biphenyl (PCB), pesticides such as DDT, industrial by products and burning of waste products such as dioxins and furans. (European commission,' 2014).

### **6.22 Sulphur dioxide:**

Sulphur dioxide is generated from industries, burning of fossil fuels, forest fires, electric

generation plants, smelting plants, industrial boilers, petroleum refineries and volcanic eruptions which causes respiratory problems, severe headache, reduced productivity of plants, yellowing and reduced storage time for paper, yellowing and damage to limestone and marble, damage to leather, increased rate of corrosion of iron, steel, zinc and aluminum.

### 6.23 Hydrocarbons

Hydrocarbons are in the form of Poly-nuclear Aromatic Compounds (PAC) and Poly-nuclear Aromatic Hydrocarbons (PAH) which originate from automobile exhaust and industries, leaking fuel tanks, leaching from toxic waste dumping sites and coal tar lining of some water supply pipes. These are carcinogenic in nature and may cause leukemia.

### 6.24 Silicon dioxide:

It originates from stone cutting, pottery, glass manufacturing and cement industries which causes silicosis and a cancerous disease.

### 6.25 Ground level Ozone:

It is the major component of Fog and it is produced by the photochemical reaction between NOx and Volatile Organic Compounds. Causes breathing difficulty and aggravates the lung diseases such as Emphysema and chronic bronchitis.

### 6.26 Peroxyacetyl Nitrate (PAN):

PAN is formed due to photochemical reaction of NOx with hydrocarbons in the sunlight, it is a component of photochemical smog, smog is a mixture of air pollutants such as gases and particles react with sun light. PAN often causes irritation to eye and together with Ozone it lowers the lung capacity and increases breathing rate. (Ron Brecher, 2003).

### 6.27 CFC:

Chloro - fluoro carbons (CFCs) originates from refrigerators, air conditioners, foam shaving cream, spray cans and cleaning solvents which unfortunately destroy ozone layer leading to permitting harmful UV rays to enter the atmosphere. The ozone layer protects the earth from the ultraviolet rays sent down by the sun. If the ozone layer is depleted by human action, the effects on the planet could be catastrophic.

### 6.28 Halons:

Brominated organic compounds used as fire retardant which is also an Ozone depleting compound.

### 6.29 H2SO4

Sulphuric acid formed due to the reaction of oxides of Sulphur with atmospheric water vapour, causes acid rain and respiratory problems.

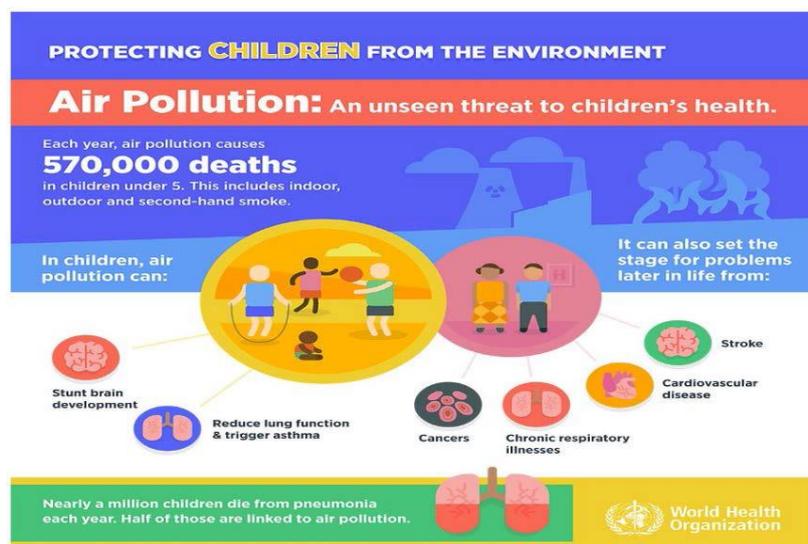


Figure 2: shows air pollution effects on children's health according to WHO.

## 7.0 Air Pollution Control Approach:

The present paper highlights an integrated approach which inter-alia include Source Control, Pathway control, and Receptor control. Brief details are given hereunder:

### 7.1 Pathway Control:

Pathway control is a control system through which the air pollutants are restricted or arrested between a source and receptor through the mechanism of scavenging and filtration. This can be achieved by having a green belt of suitable species between source and receptor. Such a green belt would be able to absorb the air pollution gases and would also act as filtering media for the particulate matter. Sometimes in certain situations, curtains in the form of high walls or other means are also provided between sources and receptor to restrict air pollutants to reach receptors.

### 7.2 Receptor control:

Receptor control is governed by an integrated urban and rural planning which should invariably incorporate environmental policy parameters in the form of following:

- Atmospheric stability condition.
- Aerodynamic effects.
- Albedo - effect.
- Heat island effect.
- Ventilation coefficients.
- Optimization between concreting and non-concreting surface area.
- Optimization between vertical to horizontal expansion of urban area.
- Sustainable urban and industrial planning.

If the above issues are adequately and scientifically addressed, the level of air pollution at the receptor urban area shall be significantly low.

### 7.3 Source control:

Main stress is usually laid on source control techniques with the focus on two fronts, one on "transformation of waste gasses / materials into

usable products" and second on "end of the pipe treatment". The first approach is gradually coming to fore front with the advancement of research and developmental activities and which has economic value addition. The second approach is cost intensive in which pollution control equipment or devices are installed to restrict air pollution into atmosphere. Source control is also associated with introduction of cleaner technologies, optimization of processes, controlled combustions, use of cleaner raw materials or fuels etc.

## 8.0 Air Pollution Control Systems:

### 8.1 Particulate Matter Control:

There is various air pollution control equipment for the control of dust emissions depending upon particle size, minimum loading, desired efficiency, typical velocity, maximum gas pressure drop, and space requirements. This control equipment's are dry collectors, as well as, wet collectors depending upon the basic characteristics of gas and local conditions.

The dry collecting devices are:

- Settling chambers.
- Baffle chambers.
- Lower chambers.
- Cyclone chambers.
- Multiple cyclones.
- Impingement.
- Fabric Filters.
- Electrostatic precipitators.

### 8.2 Control of gas emissions:

The wet devices are used where in water or scrubbing media is usually used to control gas emissions. These control devices are:

- Gravity spray tower.
- Centrifugal Collectors.
- Impingement chambers.
- Packed tower.
- Jet spray scrubbing tower.
- Ventury scrubber.

## 9.0 Top air polluted cities of the world:

Air quality in most cities is exceeding pollution levels prescribed by the World Health Organization. Delhi has the highest airborne particulate matter with PM<sub>2.5</sub> as 153 micrograms per cubic meter. Not far behind is another Indian city, Patna with 149ug/m<sup>3</sup>. These figures are six times higher than WHO a "safe" limit of 25ug/m<sup>3</sup>. Half of the top 20 cities in the world with the highest levels of PM<sub>2.5</sub> were in India, according to the pollution data released by the WHO, which included 1,600 cities. Other cities with high levels were located in Pakistan and Bangladesh. Brief facts of 11 most air polluted countries in the world are given hereunder:

### 9.1 Pakistan:

Pakistan has an average concentration of PM<sub>2.5</sub> of 101ug/m<sup>3</sup>. This is the highest rate of pollution in the world. The country, with a population of 196.17 million, is among the most populated countries in the world. The outdoor air in Pakistan is of the worst quality. There are various cities that make the top ten lists of the dirtiest cities. Three of them are from Pakistan, making the country the most polluted. Consequently, there has been an increase in the respiratory diseases caused by the polluted air.

### 9.2 Qatar:

Qatar has an average concentration of PM<sub>2.5</sub> of 92ug/mg<sup>3</sup>. It is one of the smallest countries in the world but has one of the biggest GDP (PPP) per capita making it a country for the luxury. Like Pakistan, the country has a few cities in the top polluted cities with its own capital city, Doha. The air pollution in Qatar is caused by carbon emissions from private cars as well as air traffic.

### 9.3 Afghanistan:

It has an average concentration of PM<sub>2.5</sub> of 84ug/mg<sup>3</sup>, making it the third most polluted country in the world. In comparison with Qatar, it has a very low GDP (PPP) per capita but a high population. Air pollution is mainly caused by the

burning of rubber and plastics along with vehicular emissions.

### 9.4 Bangladesh:

It has an average concentration of PM<sub>2.5</sub> of 79ug/m<sup>3</sup>. The country has over 150 million people. This population is a strain to the available resources such as air. For this reason, there is a lot of pollution from industries and human activities. Also, there are three cities of Bangladesh that appear among the top most polluted cities.

### 9.5 Iran:

This Middle East country has average concentration of PM<sub>2.5</sub> of 76ug/m<sup>3</sup>. The country is quite populous with a population of 77 million. It has a good GDP (PPP) per capita which is close to that of Qatar. The country has lot of minerals including oil. These materials have sulfur, carbon and asbestos, which are poisonous when inhaled. This makes the air in Iran toxic. Khorramabad is the most polluted city in Iran and is among the most polluted cities in the world.

### 9.6 Egypt:

This is the most polluted African country with an average concentration of PM<sub>2.5</sub> of 74ug/m<sup>3</sup>. Moreover, it is one of the most populated countries both in Africa and fairly in the world with a population of around 87 million. Many towns and cities have emerged as a result of the growth of industries. Cities such as Cairo and Alexandria have grown to become great industrial cities which are most populated and polluted. On this account, the air pollution in this country is caused by the toxic air releases by the factories in the delta region to the atmosphere as reflected in figure 3.

### 9.7 Mongolia:

This is a small country, just as Qatar but with a very low GDP (PPP) per capita. With an average concentration of PM<sub>2.5</sub> of 64ug/m<sup>3</sup>, it is the 7th most polluted country in the world. This is attributed to the burning of coal that is done regularly in order to overcome the cold weather. These carbon emissions go a long way to

polluting the air.

### 9.8 United Arab Emirates (U.A.E):

This is one of the richest countries in the world. With a small population of about 9 million people, this Middle East country has a GDP (PPP) per capita of \$30,984. With an average concentration of PM 2.5 of 61ug/m<sup>3</sup>, it is the 8th most

polluted country. The heightened level of air pollution in UAE is due to the excavation of oil, which leads to subsequent release of harmful gases such as nitrogen oxide. Also, the country is home to many automobiles thus more carbon emissions. The country has made strides in order to reduce pollution, for instance, the annual car free days.



**Figure 3: Air Pollution in Egypt**

### 9.10 India:

The average concentration of PM 2.5 in India is 59ug/m<sup>3</sup>. This is the second biggest country in terms of population with a population of over one billion, just behind China.

The GDP (PPP) per capita of the country is a bit low (\$5,777) owing to the large population. The large population is the source of the problem because it puts a strain in the use of resources. The pressure on industries, water sources, and food

companies warrants for more industrial activities, which leads to more releases of waste products into the environment as well as rivers such Ganges. Moreover, the large population translates to more automobiles which mean more carbon emissions into the atmosphere. Worth noting is that Indian cities occupy six slots in the top ten most polluted cities in the world with its capital city, New Delhi, taking first position. Air pollution in Delhi is shown in figure 4 while figure 5 shows schools shut as toxic smog hits Delhi.



**Figure 4: Air pollution in Delhi.**



**Figure 5: Schools shut as toxic smog hits Delhi.**

It may be interesting to note that Noida's air is more polluted than Delhi, becomes India's second most polluted city after Faridabad as reflected in figure 6 while Ghaziabad vide figure 7. The pollution levels in Ghaziabad, Noida and Greater Noida were found in the 'severe' category in some days. According to the Central Pollution Control Board (CPCB) data, the air quality index (AQI) values of the three cities stood at 440, 445 and 436, respectively, with Noida emerging as the most polluted city in the country after Faridabad. The severe conditions have prevailed for long now. These conditions could be due to biomass burning and local pollutants, which are not getting dispersed due to very low wind speed. Steps were even taken for closing down industrial units, halting the construction activities, water sprinkling and even removal of road dust with the help of mechanized road sweeping when the air pollution levels were very high.

#### **9.11 Bahrain:**

This is a small country with a meager population of 1.3 million. It is the 10th most polluted country with an average concentration of PM 2.5 of 57ug/m<sup>3</sup>. It may be a small country but it has a powerful GDP (PPP) per capita of \$28,559. The country is highly oriented towards massive industrialization. Consequently, there is very high carbon emissions and

energy loss to the atmosphere, which causes air pollution.

#### **9.12 Nepal:**

With an average concentration of PM 2.5 of 51ug/m<sup>3</sup>, Nepal makes it to number 11 on this list of highly air polluting country. With an approximate population of 29 million, it is fairly a small country. The country, which is closest to the Himalaya, is feared to negate the glaciers or the beauty of the Himalayas due to increased levels of air pollution. The pollution has led to respiratory diseases. Car emissions have also intensified with the increased use of outdated vehicles.

#### **9.13 Beijing:**

Beijing is highly polluted due to vehicular emissions and industries. It has forced to take emergency measures in a bid to tackle the problem of air pollution, including mandatory factory closures and bans on cars entering the city on days when pollution levels are particularly high. While Beijing is not alone when it comes to smoke-filled skies, this city of more than 20 million people has come to symbolize the environmental cost of China's break-neck economic growth.

#### **9.14 South Korea:**

Pollution in Asia's fourth-largest economy has been driven up by factors including coal fired power generation and high vehicle emissions. South Korea designated the issue of air pollution as a 'disaster' which allows the government to use parts of its reserve funds for emergency caused by polluted air. Several bills were passed

included mandating that every school classroom should have an air purifier and removing a limit on sales of liquefied petroleum gas (LPG)

vehicles, which typically produce less emissions than gasoline and diesel. Air pollution in South Korea is depicted vide figure 8.



**Figure 6: Air pollution in Noida.**



**Figure 7: Ghaziabad engulfed in smog after Diwali festival.**



**Figure 8: A man wearing a mask rides a bicycle along the Han river in Seoul, South Korea, Wednesday, March 6, 2019 (Lee Jin-man / AP).**

## Conclusions:

Air pollution, particularly in urban areas is quite alarming and expose human population to great risk. Such an emerging urban air pollution problem need to be addressed through well defined economical tools coupled with technological front. Cause-effect relationship with cost-benefit studies need to be undertaken by researchers alongwith data base to be developed in respect of air quality, all related research, sources, effects, mitigating findings etc for the general public, researchers , decision makers, urban authorities etc. Environmental policy parameters as reflected in the present paper should be considered and infused into urban development process and sustainable planning.

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