

# AIR POLLUTION

Submitted for Environmental Science for the degree of B.Sc Honours (Under CBCS) under the University of Calcutta

## **Submitted By-**

**Name of the Student: RONIT ROY**

**BSc (H) PART III**

**College Roll No.:**

**CU Roll No. : 3115-61-0012**

**Registration No.: 115-1121-0352-16**

**Session: 2020-21**

**College: Surendranath College**

## ACKNOWLEDGEMENT

I would first like to thank our principal Dr. Indranil Kar for giving me the wonderful opportunity in presenting this project which helped me a lot in learning many new aspects on environmental sciences.

The Head of our Department, Dr. Harishankar Biswas has also helped in developing the project report. The other faculty members are also acknowledged.

At last I would like to thank my parents and also my classmates for helping me willingly with their abilities in this project



---

Ronit Roy

# INTRODUCTION

"Air pollution refers to the condition in which the existence of toxic substances in the atmosphere, generated by various human activities and natural phenomena such as volcanic eruptions, results in damaging effects on the welfare of human beings and the living environment" (Omasa 2002). As stated here, this is a very serious problem which is difficult to treat due to the nature of airborne particles.



**FIGURE 1: AIR POLLUTION**

According to the World Health Organization (WHO), outdoor air pollution is classified into four main categories: particulate matter, ozone, nitrogen dioxide, and sulfur dioxide. Additionally, air pollution is further divided into primary and secondary pollutants. Primary pollutants are released directly into the atmosphere from a source, where secondary pollutants occur as a result of complex chemical reactions taking place from two pollutants reacting with each other (Kibble and Harrison 2005).

In the 1970's, the United States government formed the Environmental Protection Agency (EPA) due to growing

concern of our impact on the environment. Ever since then, an entire industry has opened, focusing to remediate what was done before as well as maintain a sense of responsibility for what we do to the environment now. Unfortunately, since this is a relatively new concern, there is very little history of how air pollution has been dealt with in the past. Through current research, we are now making history.

## CAUSES OF AIR POLLUTION

Sources of air pollution can include but are not limited to industrial factories, automobile exhaust, construction, and natural disasters such as forest fires and volcanic eruptions. Particulate matter air pollution is what first comes to mind when considering air pollution because it has an unlimited number of sources.

**Natural Sources:** Whilst man-made pollution and poor air quality is major environmental concern, there are many natural sources of pollution which are often much greater than their man-made counterparts.

**1) Dust and Wildfires:** In large areas of open land that have little to no vegetation, and are particularly dry due to a lack of precipitation, wind can naturally create dust storms. This particulate matter, when added to the air, can have a natural warming effect and can also be a health hazard for living creatures. Particulate matter, when

scattered into regions that have natural vegetation, can also be a natural impediment to photosynthesis.

The smoke and carbon monoxide caused by the wildfires contribute to carbon levels in the atmosphere, which allows for greater warming by causing a Greenhouse Effect.



**FIGURE 2: FORESTFIRES**

**2) Animal and Vegetation:** Animal digestion (particularly by cattle) is another cause of natural air pollution, leading to the release of methane, another greenhouse gas. In some regions of the world, vegetation – such as black gum, poplar, oak, and willow trees – emits significant amounts of volatile organic compounds (VOCs) on warmer days. These react with primary anthropogenic pollutants – specifically nitrogen oxides, sulfur dioxide and carbon compounds – to produce low-lying seasonal hazes that are rich in ozone.

**3) Volcanic Activity:** Volcanic eruptions are a major source of natural air pollution. When an eruption occurs, it produces tremendous amounts of sulfuric, chlorine, and ash products, which are released into the atmosphere and can be picked up by winds to be dispersed over large areas. Additionally, compounds like sulfur dioxide and volcanic ash have been known to have a

natural cooling effect, due to their ability to reflect solar radiation.

**Man-made Sources:** Human activity is responsible for most of the world's air pollution, both indoors and outdoors. Everything from smoking cigarettes to burning fossil fuels tarnishes the air you breathe and causes health problems as minor as a headache to as harmful as respiratory, lung and heart disease.

**1) The burning of fossil fuels:** Sulfur dioxide emitted from the combustion of fossil fuels like coal, petroleum and other factory combustibles are one the major cause of air pollution. Pollution emitting from vehicles cause an immense amount of pollution. Their overuse is killing our environment as dangerous gases are polluting the environment. Carbon Monoxide (CO) caused by improper or incomplete combustion and generally emitted from vehicles is another major pollutant along with Nitrogen Oxides (NO<sub>x</sub>), that is produced from both natural and man-made processes



**FIGURE 3: VEHICLE EMISSION**

**2) Agricultural activities:** Ammonia is a very common byproduct 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 a large amount of carbon monoxide, hydrocarbons, organic compounds (VOC), and chemicals into the air thereby depleting the quality of air. Petroleum refineries also release hydrocarbons and various other chemicals that pollute the air and also cause land pollution.

**4) Mining operations:** Mining is a process wherein minerals below the earth are extracted using large equipment. During the process dust and chemicals are released in the air causing massive air pollution. This is one of the reasons

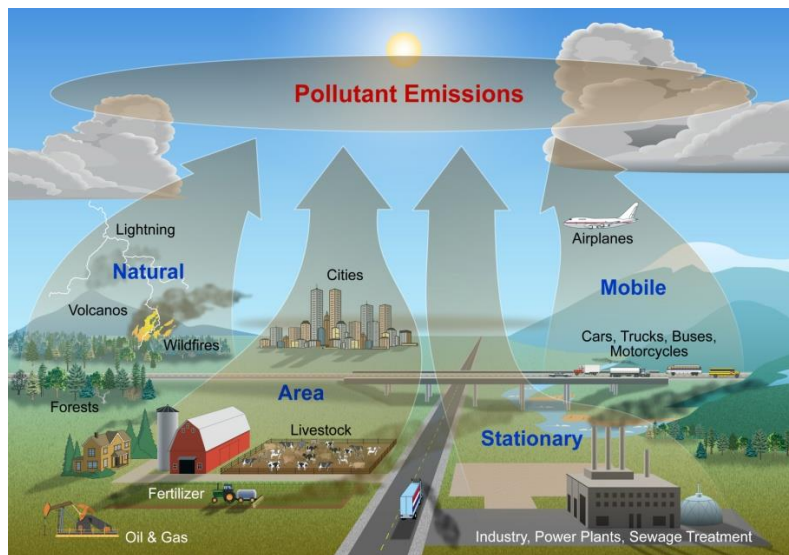
which is responsible for the deteriorating health conditions of workers and nearby residents.



**FIGURE 4: AIR POLLUTION DUE TO MINING**

**5) Indoor air pollution:** Household cleaning products, painting supplies emit toxic chemicals in the air and cause air pollution.

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



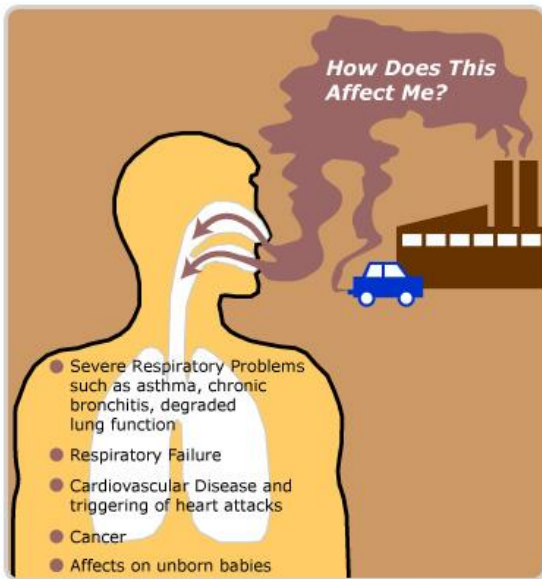
**FIGURE 5: THE SOURCES OF AIR POLLUTION**



# EFFECTS OF AIR POLLUTION

Air pollution is a significant risk factor for a number of pollution-related diseases, including respiratory infections, heart disease, COPD, stroke and lung cancer. Productivity losses and degraded quality of life are also caused by air pollution.

**1. Respiratory and heart problems:** The effects of air pollution are alarming. They are known to create several respiratory and heart conditions along with Cancer, among other threats to the body. Several million are known to have died due to direct or indirect effects of Air pollution. Children in areas exposed to air pollutants are said to commonly suffer from pneumonia and asthma.

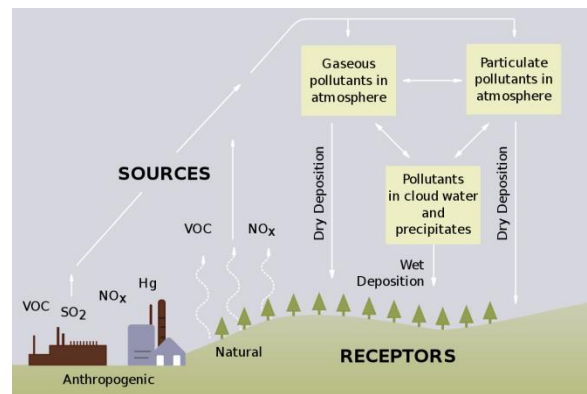


**FIGURE 6: EFFECT OF AIR POLLUTION ON HUMAN HEALTH**

**2. Global warming:** Another direct effect is the immediate alterations that the world is witnessing due to global

warming. With increased temperatures worldwide, increase in sea levels and melting of ice from colder regions and icebergs, displacement and loss of habitat have already signaled an impending disaster if actions for preservation and normalization aren't undertaken soon.

**3. Acid rain:** Harmful gases like nitrogen oxides and sulfur oxides are released into the atmosphere during the burning of fossil fuels. When it rains, the water droplets combine with these air pollutants, becomes acidic and then falls on the ground in the form of acid rain. Acid rain can cause great damage to human, animals, and crops.



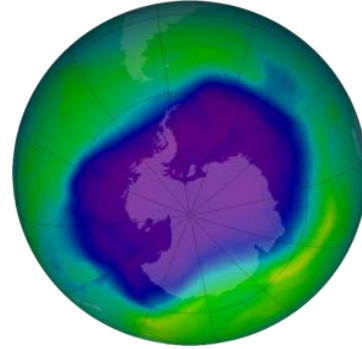
**FIGURE 7: ACID RAIN**

**4. Eutrophication:** Eutrophication is a condition where a high amount of nitrogen present in some pollutants gets developed on sea's surface and turns itself into algae and adversely affect fish, plants and animal species. The green colored algae that are present on lakes and ponds is due to the presence of this chemical only.

**5. Effect on wildlife:** Just like humans, animals also face some devastating

effects of air pollution. Toxic chemicals present in the air can force wildlife species to move to a new place and change their habitat. The toxic pollutants deposit over the surface of the water and can also affect sea animals.

**6. Depletion of the ozone layer:** The presence of ozone in the atmosphere serves as a shield to protect living organisms on earth from the harmful effects of the solar ultraviolet radiation. At higher altitudes of the stratosphere, ozone concentration is high and this belt of the atmosphere is called the ozone layer or ozone umbrella. The ultraviolet radiations are known to cause skin cancer particularly in white males.



**FIGURE 8: OZONE HOLE IN ANTARCTICA**

**Ozone depletion** refers to the gradual thinning of Earth’s ozone layer in the upper atmosphere caused by the release of chemical compounds containing gaseous chlorine or bromine from industry and other human activities.

Pollutants	Sources	Health Effects
O <sub>3</sub>	Electric arcing, electronic air cleaners, some copiers, and printers	At lower concentration can cause chest pain, coughing, shortness of breath (asthma) and throat irritation
VOC	Air fresheners, furniture, office equipment, cleaning agents	Nausea, damage to the liver, mucous membrane annoyance and asthma
CO	Combustion equipment, engines, faulty heating systems	Fatigues in healthy, chest pain and sore eyes (low concentration) Impaired vision and headaches
NO <sub>2</sub>	Combustion, gas stoves, water heaters, gas-fired dryers, cigarettes, engines	Cause a variety of pathological changes including the destruction of cilia lining respiratory airways
CO <sub>2</sub>	Combustion appliances, humans present in room	Cause occupants to grow drowsy and get headaches, shortness of breath
PM <sub>10</sub>	Stoves, fireplaces, cigarettes, aerosol sprays, cooking	Eye irritation effects and respiratory illness like lung cancer
O <sub>2</sub>	Photosynthesis from organisms like plants	Nausea, vomiting and lethargic movements
Temperature	Air conditioning, fire, outdoor air temperature	Hyperthermia, skin pain and can cause serious cardiac arrhythmia
Humidity	Unsanitary conditions and water damage	Cold and dry will cause skin itchiness. Moisture cause cough, eye irritation

**TABLE 1: COMMON AIR POLLUTANTS, THEIR SOURCES AND THEIR EFFECT ON HUMAN BODY**

# RECENT IMPROVEMENTS IN AIR QUALITY IN INDIA

The COVID-19 pandemic has caused industrial activity to shut down and cancelled flights and other journeys, slashing greenhouse gas emissions and air pollution around the world. If there is something positive to take from this terrible crisis, it could be that it's offered a taste of the air we might breathe in a low-carbon future. The World Health Organisation (WHO) estimates that about 3 million people die each year from ailments caused by air pollution, and that more than 80% of people living in urban areas are exposed to air quality levels that exceed safe limits. The situation is worse in low-income countries, where 98% of cities fail to meet WHO air quality standards. When India shut down last month and suspended all transport to contain the spread of coronavirus, the skies over its polluted cities quickly turned an azure blue, and the air, unusually fresh. Power generation in India during the two weeks before March 24 (the day of the lockdown) and two weeks after and found a 19% overall reduction in power generation in India. Coal-based power generation in particular reduced by 26% during the same period. All coal-based power plants in 300 kilometres radius of Delhi (Haryana, Punjab, and Uttar Pradesh) except two units at Dadri Power Plant have been shut down due to low demand. It emphasised that there has been a reduction in overall power demand and associated coal consumption by the power generation facilities across the country. Most of this reduction came after the lockdown resulting in a drastic drop in NO<sub>2</sub> (nitrogen dioxide)/pollution emissions/levels in urban areas

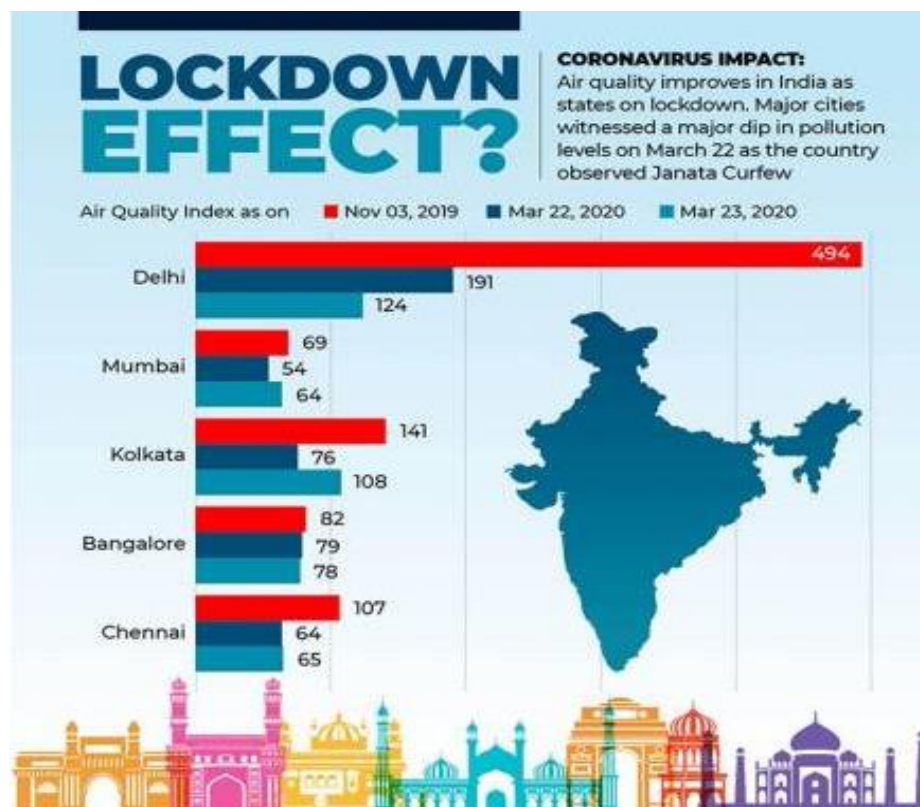


FIGURE 8: RECENT IMPROVEMENTS IN AIR QUALITY IN INDIA



## REFERENCE

- <https://sites.biology.colostate.edu/>
- <https://www.conserve-energy-future.com>
- <http://www.enviropedia.org.uk/>
- <https://www.nationalgeographic.org>
- <https://www.moneycontrol.com>
- <https://www.ecowatch.com>