

Air Pollution and Health Hazards on Human Beings Due to Air Pollution

Abstract

Air pollution is a great concern for today which influences the life of human beings. India is a dusty country and here, PM 2.5 and PM10 is considered more fatal. Air pollution is present from the beginning of life but not so alarming. Both indoor and outdoor pollutants creating health problems. With the increase of air pollution, there is an increase of mortality and morbidity due to the occurrence of various diseases like respiratory, kidney, neurological, cardiovascular etc.

Keywords: Air Pollution, Health Hazards, Diseases, Human Beings, Global Warming, Indoor Pollution, Outdoor Pollution.

Introduction

Pollution is a sacred word. Pollution is an undesirable change in the Physical, Chemical or Biological characteristic of air, water and soil, that creates a potential health hazards for any living beings. Pollution is not a current issue .It started with civilization and discovery of fire. According to an article in Journal Science, "Soot" found on ceiling of prehistoric caves which give evidence of high level of pollution that was associated with improper ventilation and open fire¹. Air pollution is the contamination of air with pollutants which influences the life of human beings as well as distorted the normal functioning of ecosystem. Each and every type of pollution is causing havoc to life but air and water pollution are largely responsible for pollution related problems. According to WHO-World health Organization, air pollution is one of the world's biggest killer Nearly 100 children die due to indoor smoke in every hour. Every day, nearly 1800 people in developing countries dies due to urban air pollution.² Ebi et all conclude that climate change is expected to increase the mortality and morbidity due to the more occurrence of floods, drought fire and extreme heat. ³ A spread in vector born diseases like malaria is also expected. ⁴

Aim of the Study

The main aim of this article is to study about air pollution and its various ill effects on human health.

Review of Literature

Spengler,John D, Sexton, KA discuss on air pollution in the ancient time when there was less pollution in the environmental but due congested homes some pollution was there. Same situation is present today P.D. Sharma cited that quality is determined by SO₂ oxides of nitrogen and particles. If these things increases, then also pollution increases. Times of India's news on chullahs is right but rural population depend on biomass for cooking and heating purposes but today due to Govt. efforts rural people are also using LPG.

Discussion on Air Pollution and Health Hazards

Air pollution means the presence of unwanted materials that makes it unfit for use. Most air pollutants comes from energy use and production ,” says John Walke ,director of Clean air project at NRDC and he also claimed that air pollution in the form CO₂ and methane , also increases the temperature of the earth. Three parameters that judge the quality of air are –carbon dioxide, NO_x and SPM (suspended particulate matter). ⁵ Vehicular emissions and untreated industrial smoke are also sources of air pollution. The materials which causes air pollution are called pollutants, which may be primary or secondary pollutants. These pollutants are as-

Gaseous Pollutants

These are carbon compounds (CO₂,CO),Sulphur compounds (SO₂,SO₃ and H₂S) oxides of nitrogen (NO.NO₂),ozone, halogen and CFC.

Metals

Hg, lead Iron Nickel Zinc Tin Cadmium etc.



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Agricultural Pollutants

Pesticides, herbicides, fungicides and chemical fertilizers.

Complex Organic Pollutants

Benzene, Benzopyrene, acetic acid ether etc

Biotic Compounds

Pollens, spores of various fungi, bacteria and viruses etc.

Solid Waste- Domestic

Municipal and Industrial.

Radioactive Wastes

Plutonium, Krypton, iodine, Cobalt etc.⁶

Any gas can be qualified as a pollutant if its concentration reached to a level which is harmful. Many gases are treated as pollutant but most important are as-

Sulphur Dioxide

It is the second most pollutant of air. Automobiles which use fossil fuels for their functioning which has sulfur as an impurity produce it. Also oil refineries, thermal power plants using coal are the biggest source of SO₂ pollution. It causes acid rain and smog. People exposed to high concentrations of SO₂ continuously and for a longer duration may develop cough, shortness of breath, bronchitis, colds of long duration and fatigue.

Carbon Dioxide

It is essential for plants. In earlier days CO₂ was not a pollutant but today, it has become a havoc. It is produced by fossil fuel combustion, thermal power plants and industries. Naturally volcano eruptions also produce CO₂. It causes global warming and climate change.

Carbon Monoxide

It is highly poisonous because it has a greater (240 times greater than oxygen) and permanent binding capacity with Haemoglobin and form Carboxyhaemoglobin. It is produced due to incomplete combustion when too little oxygen is available. If you burn fossil fuels in homes then CO detector must be fitted in homes. 80% of carbon dioxide is produced by automobiles. High dose exposure to CO may affect lung tissues and reduced the functioning of lungs. CO at 5% causes cardiovascular effects. Increased concentrations of CO leads to stroke, head injury, atherosclerosis, hypertension, acute poisoning of CO may also have effects on functioning of liver, kidney, bone, immune capacity and spleen.⁷ It can cause visual impairment, reduced cognitive functioning and ability, headaches. At higher concentrations it may cause even death or unconsciousness

Nitrogen Oxide

These are produced by automobiles, aircraft, thermal power plants and factories. Nitrogen oxide are indirect greenhouse gases i.e. they produced ozone which is a greenhouse gas. Nitrogen oxide is mainly produced in nitrogen rich water bodies and soil. It's global warming potential (when calculated over 100 years) is 298 times more than that of same mass of CO₂. As clarified in the four Assessment Report (AR4) of the IPCC, the average life time of N₂O is 120 years. The concentration of N₂O is increases 0.3% every year since 1980 and now its concentration is 18%

higher than that present in preindustrial period. The oxides of nitrogen are toxic gases which enter the human body via breathing. High doses of nitrogen oxides makes our system more prone to respiratory pathogens and increases risk of acute respiratory diseases like bronchitis, chronic fibrosis, emphysema and pneumonia. It has been studied that continuous exposure to even little dose of NO₂ (0.1ppm) over a period of one to three years increases the chances of bronchitis, emphysema, oedema and also affect the functioning of lungs.

CFCs

Earlier these chemicals were considered safe and stable. But they do not decompose easily. These chemicals have severely destroyed the Earth's protecting layer of ozone. CFC's are produced by air conditioners, refrigerators, foam plastics cosmetic goods etc.⁹

OZONE

It has both good and bad effects. When present in the stratosphere it behaves as a life saving blanket but in troposphere it is a pollutant which has ill effects on both human and plants. It is an unstable and highly reactive gas. It damages the respiratory tract covering which causes shortness of breath, coughing, lung inflammation, chest pain and renders more prone to respiratory problems such as asthma and pneumonia.¹⁰

Particulate Matter

Particles of different sizes are referred as PM followed by a number. For example PM10 means particulate matter of less than 10 microns. PM10 and PM2.5 are considered more potent pollutants as they enter in our lungs. In cities most particulates come from traffic fumes. Indian Air Quality Standard allow the exposure of PM2.5 up to 40ug/m³ and a current study reported that 50% population in 45% districts of India is exposed to greater concentrations of PM2.5. Particulates are carcinogenic and also causes permanent DNA mutations, heart attacks and premature deaths. The European Study of Cohorts for Air Pollution Effects (ESCAPE) published in 2013 cited that for every 10ug/m³ increase concentration of PM2.5, then chances of lung cancer increases by 36%.¹⁰ Larger particles settle on body and causes skin problems. But finer particles by inhalation enter our circulatory system. More fine the particle more deeply they enter into body. As the concentrations of particles increase in surroundings the frequency of cough and phlegm increases. The particulates effect the upper and lower respiratory tract differently. Upper respiratory symptoms are running nose, sinusitis, sore throat, wet cough, hay fever and red eyes. The lower respiratory problems are dry cough, phlegm, shortness of breath and chest pain. Particles loaded with viral, bacterial and fungal pathogens also work as a vector of various infectious diseases.⁷

Lead and Other Heavy Metals

Lead particles enter in our body either by inhalation or by indigestion. Vehicles are the main producers of lead of which 50-70% is released in the environment and the rest deposited

The pollutants emission in main metropolitan cities in 2001 is given below to understand their release in these cities.

Vehicle Emission Load (In Metropolitan Cities in Tones/day)

City/pollutant	SPM	SO ₂	NO _x	HC	CO
Delhi	10.30	08.96	126.46	249.57	651.01
Mumbai	05.59	04.03	70.82	108.21	469.92
Banaglore	02.62	01.76	26.22	78.51	195.36
Calcutta	03.25	03.65	54.69	43.83	163.24
Ahemdabad	02.95	03.89	40	67.75	179.14

(Source Agarwal-2001)

	CO ₂	CH ₄	N ₂ O	CFC-12	CF4
Pre-industrial concentration mid-1700	280ppmv	700ppbv	275ppbv	00	00
Concentration in1992	355ppmv	17.4ppbv	311ppbv	503pptv	70pptv
Recent rate of concentration	1.5ppmv	13ppbv	0.75ppbv	18-20pptv/year	1.1-1.3pptv/year
Changes per year	0.4%/year	0.8%/year	0.25/year	7% per year	2%
Atmospheric life time (years)	50-200	12-17	120	13.3	50000

(source- IPCC WGI Report,1994 (cited in compendium of environment Statistics, Govt. of India,1997)

The severity of the pollutant can be ascertained from this table. We observed that CF4 have life time of fifty thousand years .thus they are highly stable and toxic. Similarly N₂O have the life time of 120 years. The pollutants are produced and present not only outdoor but also be present indoor in our homes. The agarbati sticks, paints and polishes, synthetic fibers, indoor dry cleaning produced indoor pollutants. Some indoor pollutants are as-

1. Allergens –Dust, spores and pollen grains
2. Formaldehyde-insulation, tobacco, smoke,
3. Mercury-spills in dental care facilities thermometer breakage
4. Aerosol-consumer products, varnish, paints
5. Asbestos and synthetic fibers-Thermal /electrical insulation
6. Ammonia- metabolic product.

But some pollutants are categorized both as indoor and outdoor pollutants as- particulate matter, CO₂, CO, organic compounds, O₃, SO₂, lead, spore and pollen grain.¹¹

Dry Cleaning

It also emits small amount of chlorinated solvents such as PCE/ perchloroethylene or petroleum solvents that have been used by the dry cleaners. This could health risk if dry cleaned clothes are stored in enclosed indoor spaces.¹²

Indoor Air Pollution

Indians spent more than 90% of time indoors like sleeping hours, offices hours, shopping hours etc. Indoor air is about 3-5 times more polluted than outdoor air. So this has more adverse effect on our health. Indoor air is the air present in a building for at least an hour.80% of the rural people and 20% of urban livelihood use biomass for cooking and heating which increases the respiratory and pulmonary illnesses. Also 30% of rural population use kerosene for lightning-which is also a health risk. ¹³ Prime Minister's special envoy, SH. Shyam Saran declared

WHO's estimate of 30,000 to 40,000 people death due indoor pollution in India. The black carbon or soot from the chullahs is a great concern for the rural people health. In India 135-140 million people still depend on traditional fuel i.e. the burning of wood, twigs, leaves and agricultural residues for heating and cooking purposes which approximately contribute to 80% energy needs of the people.¹⁴ IPCC observe that the mean temperature of the world would increase by three tenths if one degree Celsius in the second half the 20th century. IPCC also announce that the world average surface temperature increases by 1.4 to 5-8 degree Celsius over the period of 1990 to 2100.¹⁵ These changes in temperature are due to global warming due to green house effect. This effect is due to green house gases whose contribution is tabulated as –

Gases/year	2001	2005
CO ₂	61%	58%
CH ₄	15%	16%
CFC	11%	20%
N ₂ O	4%	6%
Other Co,NO,SO ₂ ,NO ₂	9%	8%

The greater the concentration of green house gases in the atmosphere, the less infrared energy that can escape. Therefore increasing the amount of green house gases would increase the planet's surface temperature by increasing the amount of heat trapped in the lowest part of the atmosphere. ¹⁶ Due to the global warming tropical diseases like malaria and dengue may increase in poor tropical and sub tropical countries. But not so much in western countries because they can counter effectively with disease causing insects and vectors. Also diseases like diarrhea, stomach ache, vomiting, headache, fever and body pain also increases. It also causes skin itching and scalding. ¹⁷

Air quality index and health

Air quality index is a good indicator of prevailing environmental conditions and their impact on health. Air quality is a tool for making aware of

people of air quality. There are six Air quality categories namely Good, Satisfactory, Moderately polluted, Poor, Very poor and Severe

Range/AQI	PM ₁₀ 24 hours	PM _{2.5} 24 hours	NO ₂ 24 hours	O ₃ 24 hours	CO 8 hours mg/m ³	SO ₂ 24 hours	NH ₃ 24 hours	Pb 24 hours
Good (0-50)	0-50	0-30	0-40	0-50	0-1.0	0-40	0-200	0-0.5
Satisfactory (51-100)	51-100	31-60	41-80	51-100	1.1-2.0	41-80	201-400	.5-1
Moderately pollution(101-200)	101-250	61-90	81-180	101-168	2.1-10	81-380	401-800	1.1-2.0
Poor (201-300)	251-350	91-120	181-280	169-208	10-17	381-800	801-1200	2.1-3.0
Very poor(301-400)	351-430	121-250	281-400	209-748	17-34	801-1600	1200-1800	3.1-3.5
Severe (401-500)	430+	250+	400+	748+	84+	1600+	1800+	3.5+

Source CPCB, Ministry of Environment and Forestry and Climate Change-¹⁸

When people are exposed to toxic air pollutants for a particular concentration and time, they may have increased chances of cancer occurrence as well as neurological, reproductive, developmental, respiratory and other system abnormality also. The air pollutants cause diseases that are in the direct exposure of air in one way or the other way like lung and skin .Minor disorders like eye allergy, nasal allergy, sinusitis, throat infection to chronic respiratory and heart diseases, lung cancer in developing children. WHO reported total 7 million people die prematurely every year from air pollution-both from household and outdoor. Among these death

1. 21% due to pneumonia,
2. 20% from stroke,
3. 34% from ischaemic heart disease
4. 19% from chronic obstructive pulmonary diseases
5. 7% from lung cancer

Recent data states 9 out of 10 people are exposed to very high level of pollutants in the World are at the risk of cancer and cardiovascular diseases.

¹⁹ The data for outdoor and indoor diseases separately are given as-

Outdoor air pollution caused deaths-breakdown of disease-

1. 40% ischaemic heart disease
2. 40% stroke
3. 11% COPD - chronic obstructive pulmonary diseases
4. 6% lung cancer
5. 3% acute lower respiratory infections in children

Indoor air pollution –caused deaths-breakdown diseases-

1. 26% ischaemic heart disease
2. 34% stroke
3. 22% COPD - chronic obstructive pulmonary diseases
4. 6% lung cancer
5. 12% acute lower respiratory infections in children²⁰

Disorders due to Air Pollution

I have already explained various ill effects or diseases due to air pollution. Due to air pollution global warming occur which increases the average temperature of earth. Also particulate and other gases concentration increases. Acid rain occurs. Various abnormalities in the functioning of human body take place which causes diseases. Let them explain –

Respiratory and Lung diseases

COPD- chronic obstructive pulmonary disease which include disease like chronic bronchitis and emphysema. Lung disease increases due to air pollution especially in children. A study shows that about 2.2 million school children in Delhi are growing up with irreversible lung damage of which they will never recover. The number of bronchitis is projected to increase- going from 12 to 36 million new cases per year for children aged 6 to 12 and from 3.5 to 10million cases for Adults.¹⁰ There is a relationship between air pollution and lung cancer. Although smoking is the main cause of lung cancer but pollutants also contribute to it a lot. People dwelling in congested and small houses which have little or no access to sunlight and air or go to the area which is filled with particles of dust, smoke, cotton fibers or various metals, are more sensitive to lung cancer .CFC which damage the ozone layer, also increases the risk of melanoma (skin cancer)

Cardiovascular Diseases

Exposure for a longer period to nitrogen dioxide, CO and sulphur dioxide enhances the risk of heart attack. Cardiovascular diseases is caused by weakening of cardiac muscles and their inability to transmit blood in the body.PM_{2.5} also causes heart diseases

Brain Disorder

Particles of air pollutants in brain cause long term damage to brain. Most of the magnetite, the compound of magnetic iron oxide found in human brain is produced due to polluted air coming out of industries in high quantity. These particles may cause Alzheimer's disease.

Remarking An Analisation

Kidney Disorders

Due to air pollution, the kidney develop a abnormality called membranous nephropathy i.e. a kidney disease that can occur by itself or in conjunction with several other disease) which is a major cause of kidney failure.²¹

If pregnant woman live in a polluted area continuously, then chances of various diseases like brain deformity, asthma and improper growth of brain may develop in their unborn child.

Conclusion

WHO recent data released in Geneva about most polluted cities in the world, which blow an alarming signal for the Govt. of India as 14 out of 15 most polluted states belong to India. These cities behave like a gas chamber. These cities pollutant level is so high that the inhabitants when inhaled, then they suck smoke equal to two or three cigarettes. The situation is going to worsen in the future if the Governments give priority to development but not to the environment. Air pollution in cities causes a shorter life span for city dwellers .Environmental pollution is due to the unsustainable anthropogenic activities, resulting in substantial public health problems (khan,2004).Life of man and animals is precious .So environment should be protected .If no pollution or less pollution then life would be longer and safer.

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