

ENVIRONMENTAL POLLUTION AND CONTROL

Air Pollution

Air pollution is the introduction of particulates, biological molecules, or other harmful materials 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 may come from anthropogenic or natural sources.

Causes of Air pollution

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.

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.

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Effects of 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 millions 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.

2. Global warming: Another direct effect is the immediate alterations that the world is witnessing due to Global warming. With increased temperatures world wide, 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 combines 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.

4. Effect on Wildlife: Just like humans, animals also face some devastating affects of air pollution. Toxic chemicals present in the air can force wildlife species to move to new place and change their habitat. The toxic pollutants deposit over the surface of the water and can also affect sea animals.

5. Depletion of Ozone layer: Ozone exists in earth's stratosphere and is responsible for protecting humans from harmful ultraviolet (UV) rays. Earth's ozone layer is depleting due to the presence of chlorofluorocarbons, hydro chlorofluorocarbons in the atmosphere. As ozone layer will go thin, it will emit harmful rays back on earth and can cause skin and eye related problems. UV rays also have the capability to affect crops.

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Solutions for Air Pollution

- 1. Use public mode of transportation:** Encourage people to use more and more public modes of transportation to reduce pollution. Also, try to make use of car pooling. If you and your colleagues come from the same locality and have same timings you can explore this option to save energy and money.
- 2. Conserve energy:** Switch off fans and lights when you are going out. Large amount of fossil fuels are burnt to produce electricity. You can save the environment from degradation by reducing the amount of fossil fuels to be burned.
- 3. Understand the concept of Reduce, Reuse and Recycle:** Do not throw away items that are of no use to you. In-fact reuse them for some other purpose. For e.g. you can use old jars to store cereals or pulses.
- 4. Emphasis on clean energy resources:** Clean energy technologies like solar, wind and geothermal are on high these days. Governments of various countries have been providing grants to consumers who are interested in installing solar panels for their home. This will go a long way to curb air pollution.
- 5. Use energy efficient devices:** CFL lights consume less electricity as against their counterparts. They live longer, consume less electricity, lower electricity bills and also help you to reduce pollution by consuming less energy.

Soil Pollution

Soil pollution is defined as, “contamination of soil by human and natural activities which may cause harmful effect on living organisms”.

Causes and effects

Industrial wastes – Disposal of Industrial wastes is the major problem for soil pollution

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Sources: Industrial pollutants are mainly discharged from various origins such as pulp and paper mills, chemical fertilizers, oil refineries, sugar factories, tanneries, textiles, steel, distilleries, fertilizers, pesticides, coal and mineral mining industries, drugs, glass, cement, petroleum and engineering industries etc.

Effect: These pollutants affect and alter the chemical and biological properties of soil. As a result, hazardous chemicals can enter into human food chain from the soil or water, disturb the biochemical process and finally lead to serious effects on living organisms.

Urban wastes – Urban wastes comprise of both commercial and domestic wastes consisting of dried sludge and sewage. All the urban solid wastes are commonly referred to as refuse.

Constituents of urban refuse: This refuse consists of garbage and rubbish materials like plastics, glasses, metallic cans, fibres, paper, rubbers, street sweepings, fuel residues, leaves, containers, abandoned vehicles and other discarded manufactured products. Urban domestic wastes though disposed off separately from industrial wastes, can still be dangerous. This happens because they are not easily degraded.

Agricultural practices – Modern agricultural practices pollute the soil to a large extent. With the advancing agro-technology, huge quantities of fertilizers, pesticides, herbicides and weedicides are added to increase the crop yield. Apart from these farm wastes, manure, slurry, debris, soil erosion containing mostly inorganic chemicals are reported to cause soil pollution

Radioactive pollutants/ - Radioactive substances resulting from explosions of nuclear testing laboratories and industries giving rise to nuclear dust radioactive wastes, penetrate the soil and accumulate giving rise to land/soil pollution.

Ex:

1. Radio nuclides of Radium, Thorium, Uranium, isotopes of Potassium (K-40) and Carbon (C-14) are commonly found in soil, rock, water and air.
2. Explosion of hydrogen weapons and cosmic radiations include neutron, proton reactions by which Nitrogen (N-15) produces C-14. This C-14 participates in Carbon metabolism of plants which is then into animals and human beings.
3. Radioactive waste contains several radio nuclides such as Strontium90, Iodine-129, Cesium-137 and isotopes of Iron which are most injurious. Strontium get deposited in bones and tissues instead of calcium.
4. Nuclear reactors produce waste containing Ruthenium-106, Iodine-131, Barium-140, Cesium-144 and Lanthanum-140 along with primary nuclides Sr-90 with a half life 28 years and Cs-137 with a half life 30 years. Rain water carries Sr-90 and Cs-137 to be deposited on the soil where they are held firmly with the soil particles by electrostatic forces. All the radio nuclides deposited on the soil emit gamma radiations.
5. **Biological agents** – Soil gets a large amount of human, animal and bird excreta which constitute a major source of land pollution by biological agents.

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Ex: 1. Heavy application of manures and digested sludge can cause serious damage to plants within a few years

Control measures of soil pollution

1. Soil erosion can be controlled by a variety of forestry and farm practices.

Ex: Planting trees on barren slopes, Contour cultivation and strip cropping may be practiced instead of shifting cultivation, Terracing and building diversion channels may be undertaken. Reducing deforestation and substituting chemical manures by animal wastes also helps arrest soil erosion in the long term.

2. Proper dumping of unwanted materials: Excess wastes by man and animals pose a disposal problem. Open dumping is the most commonly practiced technique. Nowadays, controlled tipping is followed for solid waste disposal. The surface so obtained is used for housing or sports field.

3. Production of natural fertilizers: Bio-pesticides should be used in place of toxic chemical pesticides. Organic fertilizers should be used in place of synthesized chemical fertilizers. Ex: Organic wastes in animal dung may be used to prepare compost manure instead of throwing them wastefully and polluting the soil.

4. Proper hygienic condition: People should be trained regarding sanitary habits.

Ex: Lavatories should be equipped with quick and effective disposal methods.

5. Public awareness: Informal and formal public awareness programs should be imparted to educate people on health hazards by environmental education.

Ex: Mass media, Educational institutions and voluntary agencies can achieve this.

6. Recycling and Reuse of wastes: To minimize soil pollution, the wastes such as paper, plastics, metals, glasses, organics, petroleum products and industrial effluents etc should be recycled and reused.

Ex: Industrial wastes should be properly treated at source. Integrated waste treatment methods should be adopted.

7. Ban on Toxic chemicals: Ban should be imposed on chemicals and pesticides like DDT, BHC, etc which are fatal to plants and animals. Nuclear explosions and improper disposal of radioactive wastes should be banned.

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MINAS - Minimum National Standards for polluting industries helps state pollution control board and other industries in implementing standards in a phased manner. These standards are evolved after consultation with experts and experienced people.

Air Quality Standards

Ambient air quality refers to the condition or quality of air surrounding us in the outdoors. National Ambient Air Quality Standards are the standards for ambient air quality set by the Central Pollution Control Board (CPCB) that is applicable nationwide. The CPCB has been conferred this power by the Air (Prevention and Control of Pollution) Act, 1981.

Ambient Air Quality Standards in India

The Air (Prevention and Control of Pollution) Act 1981 was enacted by the Central Government with the objective of arresting the deterioration of air quality. The Air (Prevention and Control of Pollution) Act 1981 describes the main functions of the Central Pollution Control Board (CPCB) as follows:

- To advise the Central Government on any matter concerning the improvement of the quality the air and the prevention, control and abatement of air pollution.
- To plan and cause to be executed a nation-wide programme for the prevention, control and abatement of air pollution.
- To provide technical assistance and guidance to the State Pollution Control Board.
- To carry out and sponsor investigations and research related to prevention, control and abatement of air pollution.
- To collect, compile and publish technical and statistical data related to air pollution; and
- To lay down and annul standards for the quality of air

National Ambient Air Quality Standards (NAAQS)

POLLUTANTS	Time Weighted Average	Concentration of Ambient Air			Method of Measurement
		Industrial Area	Residential Rural and other area	Sensitive area	
Sulphur Dioxide (SO ₂)	Annual Average	80µg/m ³	60µg/m ³	15µg/m ³	Improved west and Gacke Method
	24 hours	120µg/m ³	80µg/m ³	30µg/m ³	Ultraviolet fluorescence
Oxides of Nitrogen (NO ₂)	Annual Average	80µg/m ³	60µg/m ³	15µg/m ³	Jacob Hochheister

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	24 hours	120 $\mu\text{g}/\text{m}^3$	80 $\mu\text{g}/\text{m}^3$	30 $\mu\text{g}/\text{m}^3$	modified (Na-Arsentire method Gas Phase Chemilumine Scene
Suspended Particulate Matter (SPM)	Annual Average	360 $\mu\text{g}/\text{m}^3$	140 $\mu\text{g}/\text{m}^3$	70 $\mu\text{g}/\text{m}^3$	High Volume sampling (average flow rate not less than 1.1 m^3/minute)
	24 hours	500 $\mu\text{g}/\text{m}^3$	200 $\mu\text{g}/\text{m}^3$	100 $\mu\text{g}/\text{m}^3$	
Respirable Particulate Matter (size Less than 10μm) RPM	Annual Average	120 $\mu\text{g}/\text{m}^3$	60 $\mu\text{g}/\text{m}^3$	50 $\mu\text{g}/\text{m}^3$	Respirable particulate matter sampler
	24 hours	150 $\mu\text{g}/\text{m}^3$	100 $\mu\text{g}/\text{m}^3$	75 $\mu\text{g}/\text{m}^3$	
Lead as Pb	Annual Average	1.0 $\mu\text{g}/\text{m}^3$	0.75 $\mu\text{g}/\text{m}^3$	0.50 $\mu\text{g}/\text{m}^3$	AAS method after sampling using EPM 2000 or equivalent filter paper
	24 hours	1.5 $\mu\text{g}/\text{m}^3$	1.0 $\mu\text{g}/\text{m}^3$	0.75 $\mu\text{g}/\text{m}^3$	
Carbon Monoxide	8 hours	5.0 mg/m^3	2.0 mg/m^3	1.0 mg/m^3	Non disbersive infrared spectroscopy
	1 hour	10.0 mg/m^3	4.0 mg/m^3	2.0 mg/m^3	
<p>Annual Average : Annual Arithmetic Mean of minimum 104 measurements in a year taken twice a week 24-hourly at uniform interval</p> <p>24 Hours Average : 24-hourly/8-hourly values should be met 98% of the time in a year. However 2% of the time, it may exceeded but not two consecutive days.</p>					
<ol style="list-style-type: none"> 1. The levels of air quality necessary with an adequate margin of safety, to protect the public health, vegetation and property. 2. Whenever and wherever two consecutives values exceeds the limit specified above for the respective category, it shall be considered adequate, reason to institute regular/continuous monitoring and further investigations. 					

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Acid rain is a result of air pollution. When any type of fuel is burnt, lots of different chemicals are produced. The smoke that comes from a fire or the fumes that come out of a car exhaust don't just contain the sooty grey particles that you can see - they also contains lots of invisible gases that can be even more harmful to our environment. Some of these gases (especially nitrogen oxides and sulphur dioxide) react with the tiny droplets of water in clouds to form sulphuric and nitric acids. The rain from these clouds then falls as very weak acid - which is why it is known as "acid rain".

Acid rain can be carried great distances in the atmosphere, not just between countries but also from continent to continent. The acid can also take the form of snow, mists and dry dusts. The rain sometimes falls many miles from the source of pollution but wherever it falls it can have a serious effect on soil, trees, buildings and water.

Control measures

Reduce emissions:

- Burning fossil fuels is still one of the cheapest ways to produce electricity so people are now researching new ways to burn fuel which don't produce so much pollution.
- Governments need to spend more money on pollution control even if it does mean an increase in the price of electricity.
- Sulphur can also be 'washed' out of smoke by spraying a mixture of water and powdered limestone into the smokestack.
- Cars are now fitted with catalytic converters which remove three dangerous chemicals from exhaust gases.

Find alternative sources of energy

- Governments need to invest in researching different ways to produce energy.
- Two other sources that are currently used are hydroelectric and nuclear power. These are 'clean' as far as acid rain goes but what other impact do they have on our environment?
- Other sources could be solar energy or windmills but how reliable would these be in places where it is not very windy or sunny?
- All energy sources have different benefits and costs and all theses have to be weighed up before any government decides which of them it is going to use.