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## POLLUTION

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### Q. What is Pollution?

**Ans:** The United Nations considers **Pollution** to be the "presence of substances and heat in environmental media (air, water, land) whose nature, location, or quantity produces undesirable environmental effects."

In other words, **Pollution** is the introduction of contaminants into the natural environment that causes adverse change. Pollution can take the form of any substance (solid, liquid, or gas) or energy (such as radioactivity, heat, sound, or light).

The components of pollution (i.e. the contaminants that causes pollution) are known as **Pollutants**. They can be either foreign substances/energies/naturally occurring contaminants.

### Q. What are pollutants? What are the types?

**Ans:** The components of pollution (i.e. the contaminants that causes pollution) are known as **Pollutants**. They can be either foreign substances/energies/naturally occurring contaminants.

Pollutants are generally classified depending on a number of criteria, as given below:

#### [A] Depending on the source, pollutants are classified into:

- ✦ **Primary Pollutants:** These are the pollutants that are emitted directly from the sources such as volcanic eruptions, combustion of fossil fuel, etc. These include nitrogen oxide, sulphur oxide, etc.
- ✦ **Secondary Pollutants:** These are the pollutants that are not directly emitted from the sources but are formed when primary pollutants react in the atmosphere. For eg., ozone.

#### [B] Depending on the degradability (ecological perspective), pollutants are classified into:

- ✦ **Biodegradable pollutants:** Those pollutants that decompose rapidly under natural conditions are known as biodegradable pollutants. Example– domestic wastes. Their accumulation creates hygienic problems and causes a bad odor.
- ✦ **Non-degradable pollutants:** Those materials that do not degrade (or degrade very slowly) in nature, e.g. aluminum cans, mercuric salts, glass pieces, D.D.T., etc., and cannot be recycled in nature.

#### [C] Depending on the origin, pollutants are classified into:

- ✦ **Natural pollutants:** Those pollutants are formed naturally. Example– minerals or compounds like oil, volcanic eruptions, forest fire etc.
- ✦ **Anthropogenic pollutants:** Those pollutants are formed by human activities. Example– manufactured materials or byproducts, plastics, CFC etc.

### Q. What are the effects of pollution?

#### OR, What are the negative effects of pollution?

**Ans:** Pollution has many adverse effects on not only human, but also other organisms. Some of them are listed as below:

**(1) On human health:** Pollution affects humans in every part of the world. pollution is one of the great existential challenges of the Anthropocene era. Pollution endangers the stability of the Earth's support systems and threatens the continuing survival of human societies.

**(2) On Socio-economy:** The health impacts of pollution have both direct and lasting social consequences. A number of studies show that pollution has an adverse effect on the productivity of both indoor and outdoor workers (Salvo *et. al.*, 2019). In a study it was found that exposure to pollution causes an increase in violent crime (Herrnstadt *et. al.*, 2021). Another paper linked pollution to adverse school outcomes for children (Heissel *et. al.*, 2019).

**(3) On Environment:** Pollution has been found to be present widely in the environment. A 2022 study states that the levels of anthropogenic chemical pollution have exceeded planetary boundaries and now threaten entire ecosystems around the world (Persson *et. al.*, 2022).

There are a number of effects of this:

**(i) Biomagnification** (also known as **bioamplification** or **biological magnification**): It is the increase in concentration of a substance (e.g. a pesticide) in the tissues of organisms at successively higher levels in a food chain.

**(ii) Bioaccumulation:** It is the gradual accumulation of substances (such as pesticides or other chemicals) in an organism. Bioaccumulation occurs when an organism absorbs a substance faster than it can be lost or eliminated by catabolism and excretion. Thus, the longer the biological half-life of a toxic substance, the greater is the risk of it causing chronic poisoning.

**(iii) Invasive species** (or **alien species**): It is an introduced species to an environment that becomes overpopulated and harms its new environment. Invasive species adversely affect habitats, causing ecological, environmental, and/or economic damage. It can outcompete native species and reduce biodiversity.

**(iv) Smog** (or **smoke fog**): It is a type of intense air pollution. The term is derived from the words *smoke* and *fog*, but it is commonly used to describe the pall of automotive or industrial origin. The term was probably first used in 1905 by H.A. Des Voeux.

At least 2 distinct types of smog are recognized, namely:

**(a) Sulfurous smog** (also called "**London smog**"): It results from a high concentration of sulfur oxides in the air and is caused by the use of sulfur-bearing fossil fuels, particularly coal. This type of smog is aggravated by dampness and a high concentration of suspended particulate matter in the air.

**(b) Photochemical smog** (also known as "**Los Angeles smog**"): It occurs most prominently in urban areas which have large numbers of automobiles. It requires neither smoke nor fog. This type of smog is formed from nitrogen oxides and hydrocarbon vapours emitted by automobiles and other sources, which then undergo photochemical reactions in presence of sunlight, in the lower atmosphere. Such reactions cause formation of highly toxic gas ozone & some nitrogen dioxide. The resulting smog causes a light brownish coloration of the atmosphere, reduced visibility, plant damage, irritation of the eyes, and respiratory distress.

**(v) Acid rain** (or **Acid deposition**): It is a broad term that includes any form of precipitation with acidic components (such as sulfuric or nitric acid) that fall to the ground/water bodies from the atmosphere in wet or dry forms. This can

include rain, snow, fog, hail or even dust that is acidic. This is causing the ongoing decrease in the pH of the Earth.

**(vi) Green house effect:** It is the process by which radiations from the sun are absorbed by the greenhouse gases and not reflected back into space. This insulates the surface of the earth and prevents it from freezing.

During the day the sun heats up the earth's atmosphere. At night, when the earth cools down, the heat is radiated back into the atmosphere. During this process, the heat is absorbed by the greenhouse gases in the earth's atmosphere. This is what makes the surface of the earth warmer, which makes the survival of living beings on earth possible.

However, due to the increased levels of greenhouse gases (because of pollution from factories, automobiles, deforestation, etc.), the temperature of the earth has increased considerably. This has led to several drastic effects, such as:

- Global warming.
- Climate change.
- Depletion of Ozone Layer, which results in the entry of the harmful UV rays to the earth's surface.
- Health problems due to smog formation.
- Acid rain etc.

The major greenhouse gases are:

- Water vapor (H<sub>2</sub>O),
- Carbon dioxide (CO<sub>2</sub>),
- Methane (CH<sub>4</sub>) &
- Ozone (O<sub>3</sub>).

There are other influential gases that contribute to the greenhouse effect, including nitrous oxide (N<sub>2</sub>O), perfluorocarbons (PFCs), chlorofluorocarbons (CFCs), hydrofluorocarbons (HFCs), and sulfur hexafluoride (SF<sub>6</sub>). These gases are mostly produced through human activities, thus they have played important parts in climate change.

### Q. What are the different types of Pollutions?

**Ans:** There are several types of pollution. Some of them are given as below:

Sl. No.	Types of Pollution	Sources (or Causes)	Effects	Prevention
1	<p><b>AIR POLLUTION</b></p> <p>[refers to the contamination of air (out- door/ indoor) due to the presence of substances in the atmosphere that are harmful to the health of humans and other living beings, or cause damage to the climate or to materials.]</p>	<ul style="list-style-type: none"> <li>▪ Burning fossil fuels.</li> <li>▪ Mining operations.</li> <li>▪ Agricultural activities.</li> <li>▪ Exhaust gases from industries and factories etc.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Increased risk of respiratory illness and cardiovascular problems.</li> <li>▪ Increased risk of skin diseases.</li> <li>▪ May increase the risk of cancer.</li> <li>▪ Global warming.</li> <li>▪ Acid rain.</li> <li>▪ Ozone depletion.</li> <li>▪ Hazards to wildlife.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Avoid Using Vehicles.</li> <li>▪ Use of Clean Energy Resources (i.e. using renewable energy, fossil fuel to be replaced by CNG etc).</li> <li>▪ Industrial pollutants can be controlled or treated at the source itself.</li> <li>▪ Tree plantation.</li> </ul>

			<p><b>NOTE:</b></p> <p><b>Black lung disease:</b> This is coal workers' pneumoconiosis (CWP), &amp; is considered as an occupational disease of lung. It occurs when coal dust is inhaled. continuously, over time, resulting in scarring within the lungs, impairing the ability to breathe.</p> <p><b>Asbestosis:</b> It is a chronic lung condition that is caused by prolonged exposure to high concentrations of asbestos fibers in the air. Though asbestosis is believed to be mostly an occupational disease, there are reports of secondhand exposure to asbestos containing dust.</p> <p>The major symptoms includes:</p> <ul style="list-style-type: none"> <li>→ Shortness of breath.</li> <li>→ Persistent dry cough.</li> <li>→ Chest tightness or chest pain.</li> <li>→ Weight loss from loss of appetite.</li> <li>→ A dry, crackling sound in the lungs while breathing in.</li> <li>→ Wider and rounder than normal fingertips and toes (clubbing).</li> </ul> <p><b>Silicosis:</b> It is a long-term lung disease caused by inhaling large amounts of crystalline silica dust, usually over many years. Silica is a substance naturally found in certain types of stone, rock, sand and clay. Over time, exposure to silica particles causes permanent lung scarring, called pulmonary fibrosis.</p>	
2	<p><b>WATER POLLUTION</b></p> <p>[refers to the contamination of water sources by substances which make the water unusable for drinking, cooking, cleaning, swimming, and other activities.</p> <p>Pollutants include chemicals, trash, bacteria, parasites, fertilizers, pesticides, pharmaceutical products etc. All forms of pollution eventually make their way to water.]</p>	<ul style="list-style-type: none"> <li>▪ <b>Global warming:</b> Rising global temperatures caused by CO<sub>2</sub> emissions heat the water, reducing its oxygen content.)</li> <li>▪ <b>Deforestation:</b> Felling forests can exhaust water resources and generate organic residue which becomes a breeding ground for harmful bacteria.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Destruction of biodiversity.</li> <li>▪ Contamination of the food chain.</li> <li>▪ Lack of potable water.</li> <li>▪ Cause of several diseases (such as cholera, hepatitis A and dysentery).</li> <li>▪ Infant mortality (according to the UN, diarrhoeal diseases linked to lack of hygiene cause the death of about 1,000 children a day worldwide).</li> </ul>	<ul style="list-style-type: none"> <li>▪ Reduce CO<sub>2</sub> emissions to prevent global warming and acidification of the oceans.</li> <li>▪ Reduce the use of chemical pesticides and nutrients on crops.</li> <li>▪ Reduce and safely treat waste water so that, as well as not polluting, it can be reused for irrigation and energy production.</li> </ul>

		<ul style="list-style-type: none"> <li>▪ <i>Industry, agriculture and livestock farming:</i></li> <li>▪ Chemical dumping from these sectors is one of the main causes of eutrophication of water.</li> <li>▪ <i>Rubbish and faecal water dumping:</i> The UN says that more than 80% of the world's sewage finds its way into seas and rivers untreated.</li> <li>▪ <i>Maritime traffic:</i> Much of the plastic pollution in the ocean comes from fishing boats, tankers and cargo shipping.</li> <li>▪ <i>Fuel spillages:</i> The transportation and storage of oil and its derivatives is subject to leakage that pollutes our water resources.</li> </ul>		<ul style="list-style-type: none"> <li>▪ Restrict the use of single-use plastics that end up floating in rivers, lakes and oceans, many as microplastics.</li> <li>▪ Encourage sustainable fishing to ensure the survival of species and avoid depletion of the seas.</li> </ul>
<p>3</p>	<p style="text-align: center;"><b>NOISE POLLUTION (or SOUND POLLUTION)</b></p> <p>[refers to the propagation of noise or sound with ranging impacts on the activity of human or animal life, most of which are harmful to a degree.</p> <p>The World Health Organization (WHO) defines noise above 65 decibels (dB) as noise pollution. To be precise, noise becomes harmful when it exceeds 75 decibels (dB) and is painful above 120 dB.]</p>	<ul style="list-style-type: none"> <li>▪ <b>Traffic noise:</b> Traffic noise accounts for most polluting noise in cities. For example, a car horn produces 90 dB and a bus produces 100 dB.</li> <li>▪ <b>Air traffic noise:</b> There are fewer aircraft flying over cities than there are cars on the roads, but the impact is greater: a single aircraft produces 130 dB.</li> <li>▪ <b>Construction sites:</b> Building and car park construction and road and pavement resurfacing works are very noisy. For example, a pneumatic drill produces 110 dB.</li> <li>▪ <b>Catering and night life:</b> Bars, restaurants and terraces that spill</li> </ul>	<p><b>Physical:</b> Respiratory agitation, racing pulse, high blood pressure, headaches and, in case of extremely loud, constant noise, gastritis, colitis and even heart attacks.</p> <p><b>Psychological:</b> Noise can cause attacks of stress, fatigue, depression, anxiety and hysteria in both humans and animals.</p> <p><b>Sleep and behavioural disorders:</b> Noise above 45 dB stops you from falling asleep or sleeping properly. Remember that according to the World Health Organization it should be no more than 30 dB. Loud noise can have latent effects on our behaviour, causing aggressive behaviour and irritability.</p> <p><b>Memory and concentration:</b> Noise may affect people's ability to focus, which can lead to low performance over time. It is also bad for the memory, making it</p>	<p>International bodies like the WHO agree that awareness of noise pollution is essential to beat this invisible enemy.</p> <p>Governments can also take measures to ensure correct noise management and reduce noise pollution.</p> <p>In recent years, the European Union has been promoting the use of new barriers that allow changes in sound waves, mainly for motorways and other forms of transport such as trains.</p> <p>Aircraft noise can be reduced by using quieter jet engines. Altering flight paths</p>

		<p>outside when the weather is good can produce more than 100 dB. This includes noise from pubs and clubs.</p> <p><b>Animals:</b> Noise made by animals can go unnoticed, but a howling or barking dog, for example, can produce around 60-80 dB.</p>	<p>hard to study.</p> <p>Interestingly, our ears need more than 16 hours' rest to make up for two hours of exposure to 100 dB.</p>	<p>and time of day runway has benefited residents near airports.</p> <p>Noise from roadways and other urban factors can be mitigated by urban planning and better design of roads.</p> <p>The government of India has rules and regulations against firecrackers and loudspeakers. Awaaz Foundation is a non-governmental organization in India working to control noise pollution from various sources through advocacy, public interest litigation, awareness, and educational campaigns since 2003.</p>
<p style="text-align: center;">4</p>	<p style="text-align: center;"><b>SOIL POLLUTION (or SOIL CONTAMINATION or LAND POLLUTION)</b></p> <p>[refers to as a part of land degradation caused by the presence of xenobiotic (human-made) chemicals or other alteration in the natural soil environment.]</p>	<p>Soil pollution can be caused by the following:</p> <ul style="list-style-type: none"> <li>→ Microplastics</li> <li>→ Oil spills</li> <li>→ Mining</li> <li>→ Acid rain</li> <li>→ Agrochemicals</li> <li>→ Construction activity</li> <li>→ Waste disposal</li> <li>→ Hydrocarbons etc</li> </ul>	<ul style="list-style-type: none"> <li>▪ <b>Damage to health:</b> Soil pollutants enter our body through the food chain, causing illnesses to appear. Moreover, the spread of antibiotics in the environment increases the pathogens' resistance to these drugs.</li> <li>▪ <b>Poorer harvests:</b> Soil pollution agents jeopardize world food security by reducing the amount and quality of harvests.</li> <li>▪ <b>Climate change:</b> From 2015 to 2050, 69 gigatonnes of CO<sub>2</sub> will be emitted as a result of land use change and land degradation, a figure that represents 17% of current greenhouse gas emissions each year.</li> <li>▪ <b>Water and air pollution:</b> Soil degradation affects the quality of air and water, particularly in developing countries.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Eating sustainable foodstuffs, properly recycle batteries, produce homemade compost and dispose of drugs in the places authorized for this purpose.</li> <li>▪ Encourage a more eco-friendly model for industry, farming and stock breeding, among other economic activities.</li> <li>▪ Improve urban planning and transport planning and waste water treatment.</li> <li>▪ Improve the management of mining waste, restore the landscape and conserve topsoil.</li> <li>▪ Involve local communities and indigenous peoples in the design, implementation and assessment of sustainable land and soil management.</li> </ul>

			<ul style="list-style-type: none"><li>▪ <b>Population displacement.</b></li><li>▪ <b>Species extinction.</b></li><li>▪ <b>Desertification.</b></li><li>▪ <b>Economic impact:</b> Global economic losses caused by soil degradation are expected to be more than half of the world's annual Gross Domestic Product (GDP).</li></ul>	
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