

Environmental Pollution

- **Environmental pollution (Air, water, soil, thermal, and noise): causes, effects, and Controls; Primary and secondary air pollutants; Air and water quality standards**
 - **Nuclear hazards and human health risks**
 - **Solid waste management: Control measures for various types of urban, industrial waste, Hazardous waste, E-waste, etc; Waste segregation and disposal**
 - **Pollution case studies: Ganga Action plan (GAP), Delhi air pollution and public health issues, Plastic waste management rules, Bhopal gas tragedy,**
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Environmental pollution:

Pollution is the introduction of contaminants into the natural environment that causes adverse change. Pollution can take the form of chemical substances or energy, such as noise, heat or light. Pollutants, the components of pollution, can be either foreign substances/energies or naturally occurring contaminants.

Environmental pollution is one of the most serious problems facing humanity and other life forms on our planet today. “Environmental pollution is defined as “the contamination of the physical and biological components of the earth/atmosphere system to such an extent that normal environmental processes are adversely affected.” Pollutants can be naturally occurring substances or energies, but they are considered contaminants when in excess of natural levels. Any use of natural resources at a rate higher than nature’s capacity to restore itself can result in pollution of air, water, and land.

Environmental pollution is of different types namely air, water, soil, noise and light-weight. These cause damage to the living system. How pollution interacts with public health, environmental medicine and the environment has undergone dramatic change.

Air pollution:

Air pollution is a mixture of solid particles and gases in the air. Car emissions, chemicals from factories, dust, and pollen and mold spores may be suspended as particles. Ozone, a gas, is a major part of air pollution in cities. When ozone forms air pollution, it's also called smog. Some air pollutants are poisonous.

“Air pollution occurs when harmful or excessive quantities of substances are introduced into Earth's atmosphere. Sources of air pollution include gases, particulates, and biological molecules.”

“Air pollution refers to the release of pollutants into the air that are detrimental to human health and the planet as a whole.”

Primary and secondary air pollutants:

A primary pollutant is an air pollutant emitted directly from a source. A secondary pollutant is not directly emitted as such, but forms when other pollutants (primary pollutants) react in the atmosphere.

Primary air pollutants:

The primary pollutants are “directly” emitted from the processes such as fossil fuel consumption, volcanic eruption and factories.

The major primary pollutants are Oxides of Sulphur, Oxides of Nitrogen, Oxides of Carbon, Particulate Matter, Methane, Ammonia, Chlorofluorocarbons, Toxic metals etc.

Examples of Primary Pollutants:

1. Car exhaust, smokestacks (CO, SO₂, NO)
2. Particulate material (soot, ash)
3. Toxic metals (lead, mercury)
4. Volatile organic compounds (VOCs) (methane, propane, CFCs, etc.)

Secondary air pollutants:

The secondary pollutants are not emitted directly. The secondary pollutants form when the primary pollutants react with themselves or other components of the atmosphere. Most important secondary level Air Pollutants are Ground Level Ozone, Smog and POPs (Persistent Organic Pollutants).

Causes of air pollution:

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. But, their overuse is killing our environment as dangerous gases are polluting the environment

➤ **Burning of Fossil Fuels:**

The combustion of fossil fuels emits a large amount of sulphur dioxide. Carbon monoxide released by incomplete combustion of fossil fuels also results in air pollution.

➤ **Automobiles:**

The gases emitted from vehicles such as jeeps, trucks, cars, buses, etc. pollute the environment. These are the major sources of greenhouse gases and also result in diseases among individuals.

➤ **Agricultural Activities:**

Ammonia is one of the most hazardous gases emitted during agricultural activities. The insecticides, pesticides and fertilizers emit harmful chemicals in the atmosphere and contaminate it.

➤ **Factories and Industries:**

Factories and industries are the main source of carbon monoxide, organic compounds, hydrocarbons, and chemicals. These are released into the air degrading its quality.

➤ **Mining Activities:**

In the mining process, the minerals below the earth are extracted using large pieces of equipment. The dust and chemicals released during the process not only pollute the air but also deteriorate the health of the workers and people living in the nearby areas.

➤ **Domestic Sources:**

The household cleaning products and paints contain toxic chemicals that are released in the air. The smell from the newly painted walls is the smell of the chemicals present in the paints. It not only pollutes the air but also affects breathing.

Effects of Air Pollution:

The hazardous effects of air pollution on the environment include:

➤ **Diseases:**

Air pollution has resulted in several respiratory disorders and heart diseases among humans. The cases of lung cancer have increased in the last few decades. Children living near polluted areas are more prone to pneumonia and asthma.

➤ **Global Warming:**

Due to the emission of greenhouse gases, there is an imbalance in the gaseous composition of the air. This has led to an increase in the temperature of the earth. This increase in earth's temperature is known as global warming.

➤ **Acid Rain:**

The burning of fossil fuels releases harmful gases such as nitrogen oxides and sulphur oxides in the air. The water droplets combine with these pollutants, become acidic, and fall as acid rain which damages human, animal and plant life.

➤ **Ozone Layer Depletion:**

The release of chlorofluorocarbons (CFC), halons, and hydrochlorofluorocarbons in the atmosphere is the major cause of depletion of the ozone layer. The depleting ozone layer does not prevent the harmful ultraviolet rays coming from the sun and causes skin diseases and eye problems among individuals.

➤ **Effect on Animals:**

The air pollutants suspend on the water bodies and affect the aquatic life. Pollution also compels the animals to leave their habitat and shift to a new place.

Air Pollution Control:

Following are the measures one should adopt to control air pollution:

➤ **Avoid Using Vehicles:**

People should avoid using vehicles for shorter distances. Rather they should prefer public modes of transport to travel from one place to another. This not only prevents pollution but also conserves energy.

➤ **Energy Conservation:**

A large number of fossil fuels are burnt to generate electricity. Therefore, do not forget to switch off the electrical appliances when not in use. Thus, you can save the environment at the individual level. Use of energy-efficient devices such CFLs also controls pollution to a greater level.

➤ **Use of Energy efficient appliances:**

Whether at the domestic level or at the industrial level, we must push for appliances that use energy efficiently, which result in complete combustion of fuel, as incomplete combustion causes air pollution.

➤ **Shifting industries:**

Another possible solution to reduce the harmful effects of air pollution is to shift the manufacturing plants, factories and industries to remote areas with a low level of population.

➤ **Using Modern Techniques:**

With technology making great advancements, there are now technologies available that can help reduce the release of pollutants in the air. Air filters, scrubbers, precipitators are just a few examples.

➤ **Shifting to Natural Gasses:**

Instead of using and exhausting fossil fuels, shifting to greener options is a no-brainer. For example, using CNG (compressed natural gas) instead of petrol or diesel is a great option.

Water pollution:

Water pollution is the contamination of water bodies, usually as a result of human activities. Water bodies include for example lakes, rivers, oceans, aquifers and groundwater. Water pollution results when contaminants are introduced into the natural environment.

“Water is essential to life. It need not be spelt out exactly how important it is. Yet water pollution is one of the most serious ecological threats we face today.”

Water pollution happens when toxic substances enter water bodies such as lakes, rivers, oceans and so on, getting dissolved in them, lying suspended in the water or depositing on the bed. This degrades the quality of water. Not only does this spell disaster for aquatic ecosystems, the pollutants also seep through and reach the groundwater, which might end up in our households as contaminated water we use in our daily activities, including drinking.

Sources of Water Pollution:

Point and non-point sources:

1. When pollutants are discharged from a specific location such as a drain pipe carrying industrial effluents discharged directly into a water body it represents point source pollution
2. In contrast, non-point sources include discharge of pollutants from diffused sources or from a larger area such as runoff from agricultural fields, grazing lands, construction site, abandoned mines and pits, etc.

Causes of Water Pollution:

The causes of water pollution vary and may be both natural and anthropogenic. However, the most common causes of water pollution are the anthropogenic ones, including:

Agrochemicals:

Agrochemicals like fertilizers (containing nitrates and phosphates) and pesticides (insecticides, fungicides, herbicides etc.) washed by rain-water and surface runoff pollute water.

Storm water runoff:

Carrying various oils, petroleum products, and other contaminants from urban and rural areas (ditches). These usually forms sheens on the water surface.

Sewage:

Emptying the drains and sewers in fresh water bodies causes water pollution. The problem is severe in cities.

Mining activities:

Mining activities involve crushing rocks that usually contain many trace metals and sulfides. The leftover material from mining activities may easily generate sulfuric acid in the presence of precipitation water.

Industrial Effluents:

Industrial wastes containing toxic chemicals, acids, alkalis, metallic salts, phenols, cyanides, ammonia, radioactive substances, etc., are sources of water pollution. They also cause thermal (heat) pollution of water.

Burning of fossil fuels:

the emitted ash particles usually contain toxic metals (such as As or Pb). Burning will also add a series of oxides including carbon dioxide to air and, respectively, water bodies.

Leaking landfills:

May pollute the groundwater below the landfill with a large variety of contaminants (whatever is stored by the landfill).

Animal waste:

Contribute to the biological pollution of water streams. Think of it this way: anything that can cause air pollution or soil pollution may also affect water bodies and cause innumerable ecological and human health issues

Effects of water pollution:

The effects of water pollution are varied. They include poisonous drinking water, poisonous food animals (due to these organisms having bioaccumulated toxins from the environment over their life spans), unbalanced river and lake ecosystems that can no longer support full biological diversity, deforestation from acid rain, and many other effects. These effects are, of course, specific to the various contaminants.

1. Water bodies in the vicinity of urban areas are extremely polluted. This is the result of dumping garbage and toxic chemicals by industrial and commercial establishments.
2. Water pollution drastically affects aquatic life. It affects their metabolism, behavior, causes illness and eventual death. Dioxin is a chemical that causes a lot of problems from reproduction to uncontrolled cell growth or cancer. This chemical is bioaccumulated in fish, chicken and meat. Chemicals such as this travel up the food chain before entering the human body.
3. The effect of water pollution can have a huge impact on the food chain. It disrupts the food-chain. Cadmium and lead are some toxic substances, these pollutants upon entering the food chain through animals (fish when consumed by animals, humans) can continue to disrupt at higher levels.
4. Humans are affected by pollution and can contract diseases such as hepatitis through faecal matter in water sources. Poor drinking water treatment and unfit water can always cause an outbreak of infectious diseases such as cholera etc.
5. The ecosystem can be critically affected, modified and destructured because of water pollution.

Control of Water Pollution:

Water pollution, to a larger extent, can be controlled by a variety of methods. Rather than releasing sewage waste into water bodies, it is better to treat them before discharge. Practicing this can reduce the initial toxicity and the remaining substances can be degraded and rendered harmless by the water body itself. If the secondary treatment of water has been carried out, then this can be reused in sanitary systems and agricultural fields.

A very special plant, the Water Hyacinth can absorb dissolved toxic chemicals such as cadmium and other such elements. Establishing these in regions prone to such kinds of pollutants will reduce the adverse effects to a large extent. Some chemical methods that help in the control of water pollution are precipitation, the ion exchange process, reverse, and coagulation. As an individual, reusing, reducing, and recycling wherever possible will advance a long way in overcoming the effects of water pollution.

Soil Pollution:

Soil contamination or soil pollution as part of land degradation is caused by the presence of xenon biotic chemicals or other alteration in the natural soil environment. It is typically caused by industrial activity, agricultural chemicals or improper disposal of waste.

Definition of Soil pollution:

“Soil pollution refers to the contamination of soil with anomalous concentrations of toxic substances. It is a serious environmental concern since it harbors many health hazards.”

“Soil pollution refers to anything that causes contamination of soil and degrades the soil quality. It occurs when the pollutants causing the pollution reduce the quality of the soil and convert the soil inhabitable for microorganisms and macro organisms living in the soil.”

Causes of Soil Pollution:

Soil pollution can be natural or due to human activity. However, it mostly boils down to the activities of the human that causes the majority of soil pollution such as heavy industries, or pesticides in agriculture.

Industrial activities including mining, smelting and manufacturing; domestic, livestock and municipal wastes; pesticides, herbicides, fertilizers used in agriculture; petroleum-derived products that are released into or break-down in the environment; fumes generated by transportation all contribute to the problem. These include pharmaceuticals, endocrine disruptors, hormones and biological pollutants; "e-waste" from old electronics; and the plastics that are nowadays used in almost every human endeavor.

Natural Pollution of Soil:

In some extremely rare processes, some pollutants are naturally accumulated in soils. This can occur due to the differential deposition of soil by the atmosphere. Another manner in which this type of soil pollution can occur is via the transportation of soil pollutants with precipitation water.

Anthropogenic Soil Pollution:

Almost all cases of soil pollution are anthropogenic in nature. A variety of human activities can lead to the contamination of soil.

Pesticides:

Before World War II, the chemical nicotine chemical present in the tobacco plants was used as the pest controlling substance in agricultural practices. However, DDT was found to be extremely useful for malaria control and as pest control of many insects during World War II.

Inorganic Fertilizers:

Excessive use of inorganic nitrogen fertilizers leads to acidification of soil and contaminate the agricultural soil.

Industrial Pollution:

The incorrect way of chemical waste disposal from different types of industries can cause contamination of soil. Human activities like this have led to acidification of soil and contamination due to the disposal of industrial waste, heavy metals, toxic chemicals, dumping oil and fuel, etc.

Heavy Metals:

The presence of heavy metals (such as lead and mercury, in abnormally high concentrations) in soils can cause it to become highly toxic to human beings.

Effects of Soil Pollution:

Soil pollution affects plants, animals and humans alike. While anyone is susceptible to soil pollution, soil pollution effects may vary based on age, general health status and other factors, such as the type of pollutant or contaminant inhaled or ingested. However, children are usually more susceptible to exposure to contaminants, because they come in close contact with the soil by playing in the ground; combined with lower thresholds for disease, (headaches, nausea, and vomiting, coughing, pain in the chest, and wheezing) this triggers higher risks than for adults. Therefore, it is always important to test the soil before allowing your kids to play there, especially if you live in a highly industrialized area.

Control of Soil Pollution:

Several technologies have been developed to tackle soil remediation. Some important strategies followed for the decontamination of polluted soil are listed below.

1. Excavation and subsequent transportation of polluted soils to remote, uninhabited locations.
2. Extraction of pollutants via thermal remediation – the temperature is raised in order to force the contaminants into the vapor phase, after which they can be collected through vapors extraction.
3. Bioremediation or phytoremediation involves the use of microorganisms and plants for the decontamination of soil.
4. Mycoremediation involves the use of fungi for the accumulation of heavy metal contaminants.

Thermal pollution:

Thermal pollution, sometimes called "thermal enrichment," is the degradation of water quality by any process that changes ambient water temperature. A common cause of thermal pollution is the use of water as a coolant by power plants and industrial manufacturers. Other causes of thermal pollution include soil erosion.

Cause of Thermal Pollution:

Many human and natural factors contribute to the problem of thermal pollution. The single biggest cause of thermal pollution is probably cooling for industrial machinery and power plants. Water is an excellent, and free, cooling agent. This is why many industrial operations pull in relatively cool water to cool their machinery and let the relatively warm water flow back into the river or lake or sea.

Thermal pollution also has some natural causes. Geothermal vents and hot springs introduce excess heat into bodies of water. Soil erosion, deforestation, and runoff from paved areas are other artificial sources of hot water. Deforestation eliminates shade, which exposes the water to sunlight. Water on hot paved surfaces gets hot, then runs off into nearby bodies of water, raising the water temperature. Retention ponds can also be a source of thermal shock because the relatively small and shallow bodies of water can absorb quite a bit of heat energy from the sun. Pumping that water directly into a river, lake, or bay causes a significant temperature increase, just like pouring a hot pitcher of water into a bathtub full of water causes the water to jump a few degrees Fahrenheit.

Effects of Thermal Pollution:

The effects of thermal pollution are diverse, but in short, thermal pollution damages water ecosystems and reduces animal populations. Plant species, algae, bacteria, and multi-celled animals all respond differently to significant temperature changes. Organisms that cannot adapt can die of various causes or can be forced out of the area. Reproductive problems can further reduce the diversity of life in the polluted area.

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1. Decreased Dissolved Oxygen:

Warm water holds less oxygen than cool water. If the oxygen level drops animals that cannot move to another area may begin to die. In deeper bodies of water, the injection of warm water can keep oxygen from dispersing into deep water, which is potentially good for bacteria but dangerous for aquatic animals. The decreased oxygen can cause algae blooms that pose a threat to aquatic plants and animals. This algae bloom problem is probably the most common and best-known side effect of thermal pollution.

2. Loss of Biodiversity:

The sudden heating can kill off vulnerable organisms or drive them away. This is one of many serious issues for threatened and endangered animal species. This loss can come from organisms dying from the hot water, being unable to reproduce as effectively as before, or simply leaving the area. We usually think of animals as casualties of water pollution, but multi-celled aquatic plants are also at risk when thermal pollution changes the local aquatic ecosystem.

3. Ecological Impacts:

The local aquatic ecosystem can be damaged by thermal pollution, especially if it is dramatic, as in copious amounts of warm water being dumped into a chilly pond or bay or river. “Thermal shock” can kill off insects, fish, and amphibians.

4. Migration:

Fish and amphibians may move away from the warm water to a more-suitable location, disrupting the ecosystem for animals that remain. Birds may also be forced to leave in search of areas with more food.

5. Increased Toxins:

Toxins in the water are more a side effect of dumping waste water than a direct effect of thermal pollution. Chemical pollution is an almost inevitable side effect of using water for cooling. Solvents, fuel oil, and dissolved heavy metals end up in the lake or river where the cooling water gets dumped.

Noise pollution:

Noise pollution, also known as environmental noise or sound pollution, is the propagation of noise with harmful impact on the activity of human or animal life. The source of outdoor noise worldwide is mainly caused by machines, transport, and propagation systems.

Noise pollution is generally defined as regular exposure to elevated sound levels that may lead to adverse effects in humans or other living organisms. According to the World Health Organization, sound levels less than 70 dB are not damaging to living organisms, regardless of how long or consistent the exposure is. Exposure for more than 8 hours to constant noise beyond 85 dB may be hazardous. If you work for 8 hours daily in close proximity to a busy road or highway, you are very likely exposed to traffic noise pollution around 85dB.

Effects of Noise Pollution:

Hypertension:

Hypertension is, in this case, a direct result of noise pollution caused elevated blood levels for a longer period of time.

Hearing loss:

Hearing loss can be directly caused by noise pollution, whether listening to loud music in your headphones or being exposed to loud drilling noises at work, heavy air or land traffic or separate incidents in which noise levels reach dangerous intervals, such as around 140 dB for adult or 120 dB for children.

Sleep disturbances:

Sleep disturbances are usually caused by constant air or land traffic at night, and they are a serious condition in that they can affect everyday performance and lead to serious diseases.

Child development:

Children appear to be more sensitive to noise pollution, and a number of noise-pollution-related diseases and dysfunctions are known to affect children, from hearing impairment to psychological and physical effects. Also, children who regularly use music players at high volumes are at risk of developing hearing dysfunctions. In 2001, it was estimated that 12.5% of American children between the ages of 6 to 19 years had impaired hearing in one or both ears.

Psychological dysfunctions :

Psychological dysfunction and noise annoyance. Noise annoyance is, in fact, a recognized name for an emotional reaction that can have an immediate impact.

We can reduce Noise Pollution:

We can Reduce Noise pollution by turning off appliances when not in use, use of earplugs, lowering the volume, planting more trees, regular maintenance of vehicles and machines etc. By controlling noise we can control negative health effects that noise pollution has on everyone.

- Turn off Appliances at Home and offices.
- Shut the Door when using noisy Machines.
- Use Earplugs.
- Lower the volume.
- Stay away from Noisy area.
- Follow the Limits of Noise level.
- Control Noise level near sensitive areas.
- Go Green by planting trees.

Nuclear hazards and human health risks:

These can be both beneficial and harmful, depending on the way in which they are used. We routinely use X-rays to examine bones for fractures, treat cancer with radiation and diagnose diseases with the help of radioactive isotopes. About 17% of the electrical energy generated in the world comes from nuclear power plants.

Radioactive substances when released into the environment are either dispersed or become concentrated in living organisms through the food chain. Other than naturally occurring radioisotopes, significant amounts are generated by human activity, including the operation of nuclear power plants, the manufacture of nuclear weapons, and atomic bomb testing. For example, strontium 90 behaves like calcium and is easily deposited and replaces calcium in the bone tissues. It could be passed to human beings through ingestion of strontium-contaminated milk. Again another example is tritium, which is radioactive hydrogen. The amount of tritium released from nuclear power plants to the atmosphere have reached as high as tens of thousands of curies in one year, and releases to bodies of water have measured as high as tens of millions of picocuries per litre.

Nuclear accidents impact health:

Apart from the damage caused by fires and explosions, accidents also release radioactive materials which can cause radiation sickness. Radiation exposure above a certain threshold, usually only received by workers and emergency teams in a stricken plant, causes acute radiation syndrome within hours of exposure. Depending on the dose of radiation this ranges from skin rashes, vomiting and diarrhoea, to coma and death.

Radiation damages DNA, especially as it assembles in dividing cells. That means tissues which contain many dividing cells, such as the gut lining, skin and bone marrow, are most at risk of damage. High enough doses also damage brain cells and such doses are invariably fatal.

Solid Waste Management:

Waste management includes the activities and actions required to manage waste from its inception to its final disposal. This includes the collection, transport, treatment and disposal of waste, together with monitoring and regulation of the waste management process.

Waste (also known as rubbish, trash, refuse, garbage, junk, and litter) is unwanted or useless materials. Waste is linked to people development. Litter refers to waste disposed of improperly.

According to the Basel Convention, United Nations Environment Programme "Wastes are materials that are not prime products (that is products produced for the market) for which the initial user has no further use in terms of his/her own purposes of production, transformation or consumption, and of which he/she wants to dispose. Wastes may be generated during the extraction of raw materials, the processing of raw materials into intermediate and final products, the consumption of final products, and other human activities. Residuals recycled or reused at the place of generation are excluded."

Industrial Waste:

Industrial waste is the waste produced by industrial activity which includes any material that is rendered useless during a manufacturing process such as that of factories, industries, mills, and mining operations.

Industrial waste is defined as waste generated by manufacturing or industrial processes. The types of industrial waste generated include cafeteria garbage, dirt and gravel, masonry and concrete, scrap metals, trash, oil, solvents, chemicals, weed grass and trees, wood and scrap lumber, and similar wastes.

Hazardous waste:

A solid waste is a hazardous waste if it is specifically listed as a known hazardous waste or meets the characteristics of a hazardous waste. Listed wastes are wastes from common manufacturing and industrial processes, specific industries and can be generated from discarded commercial products. Characteristic wastes are wastes that exhibit any one or more of the following characteristic properties: ignitability, corrosively, reactivity or toxicity.

A substance is chemically reactive when it is unstable or could react when exposed to another compound. Hazardous waste that is considered chemically reactive is likely to explode or produce harmful fumes when exposed to other compounds. A flammable substance is anything that is likely to catch on fire, and a corrosive substance is something that can corrode, or break down, metals.

E-waste:

Electronic waste or e-waste describes discarded electrical or electronic devices. Used electronics which are destined for refurbishment, reuse, resale, salvage recycling through material recovery, or disposal are also considered e-waste.

This term applies to consumer and business electronic equipment that is near or at the end of its useful life. There is no clear definition for electronic waste (e-waste) at this time, but if you can plug it in to an electrical outlet or it contains circuit boards or chips, it is most likely e-waste. These products can contain heavy metals like cadmium, lead, copper, and chromium that can

contaminate the environment. DO NOT dispose of these items in the trash or your recycling bins.

Examples of electronic waste include, but not limited to:

- TVs, computer monitors, printers, scanners, keyboards, mice, cables, circuit boards, lamps, clocks, flashlight, calculators, phones, answering machines, digital/video cameras, radios, VCRs, DVD players, MP3 and CD players
- Kitchen equipment (toasters, coffee makers, microwave ovens)
- Laboratory equipment** (hot plates, microscopes, calorimeters)
- Broken computer monitors, television tubes (CRTs)

Causes for Solid Waste Generation:

1. Population increase
2. Growing Urbanization
3. Industry
4. Mining
5. Transport

Waste management is the collection, transport, processing, recycling or disposal, and monitoring of waste materials. The term usually relates to materials produced by human activity, and is generally undertaken to reduce their effect on health, the environment or aesthetics. Waste management is also carried out to recover resources from it. Waste management can involve solid, liquid, gaseous or radioactive substances, with different methods and fields of expertise for each.

Waste segregation and disposal:

Segregation is one of the most important activities that we need to promote and enforce for effective waste management in urban area and to make landfills reduce in size gradually and finally come to no landfills in four-five decades from now. Even in Western Europe where they have been working on developing a scientific waste management systems for the last 30 years or so, nearly one-third of waste is still going to the engineered landfill. In India, too, we cannot have “zero” landfill or “no” ..

Control measures of urban and industrial wastes:

An integrated waste management strategy includes three main components

1. Source reduction
2. Recycling
3. Disposal

Source reduction is one of the fundamental ways to reduce waste. This can be done by using less material when making a product, reuse of products on site, designing products or packaging to reduce their quantity. On an individual level we can reduce the use of unnecessary items while shopping, buy items with minimal packaging, avoid buying disposable items and also avoid asking for plastic carry bags.

Recycling is reusing some components of the waste that may have some economic value. Recycling has readily visible benefits such as conservation of resources reduction in energy used during manufacture and reducing pollution levels. Some materials such as aluminum and steel can be recycled many times. Metal, paper, glass and plastics are recyclable. Mining of

new aluminum is expensive and hence recycled aluminum has a strong market and plays a significant role in the aluminum industry. Paper recycling can also help preserve forests as it takes about 17 trees to make one ton of paper. Crushed glass (cullet) reduces the energy required to manufacture new glass by 50 percent. Cullet lowers the temperature requirement of the glassmaking process thus conserving energy and reducing air pollution.

Ganga Action plan (GAP):

The Ganga action plan was, launched by Shri Rajeev Gandhi, the then Prime Minister of India on 14 Jan. 1986 with the main objective of pollution abatement, to improve the water quality by Interception, Diversion and treatment of domestic sewage and present toxic and industrial chemical wastes from identified grossly polluting units entering in to the river.

The Ganga rises in the Garhwal Himalaya from the Gangotri Glacier, some 4100 meters above the sea level under the name of Bhagirathi. The river flows through the Himalayas till another two streams, the Mandakani and the Alakhnanda join it at Devprayag. It is below this confluence that the river is known as the Ganga proper. The Ganga Basin which is the largest river basin of the country houses about 40% population of India. The river after traversing a distance of 2525 kms. from its source, meets the Bay of Bengal at Ganga Sagar in West Bengal. During the course of its journey from the hills to the sea, municipal sewage from large urban centres, trade effluents from industries and polluting waste from several other non-point sources are discharged into the river resulting in its pollution.

At the time of launching, the main objective of GAP was to improve the water quality of Ganga to acceptable standards by preventing the pollution load reaching the river. However, as decided in a meeting of the Monitoring Committee in June, 1987 under the Chairmanship of Prof. M. G. K. Menon, then Member, Planning Commission, the objective of GAP was recast as restoring the river water quality

The other objectives of the Ganga Action Plan are as under:

- Control of non-point pollution from agricultural run off, human defecation, cattle wallowing and throwing of unburnt and half burnt bodies into the river.
- Research and Development to conserve the biotic, diversity of the river to augment its productivity.
- New technology of sewage treatment like Up-flow Anaerobic Sludge Blanket (UASB) and sewage treatment through afforestation has been successfully developed.
- Rehabilitation of soft-shelled turtles for pollution abatement of river have been demonstrated and found useful.
- Resource recovery options like production of methane for energy generation and use of aquaculture for revenue generation have been demonstrated.
- To act as trend setter for taking up similar action plans in other grossly polluted stretches in other rivers.

Delhi air pollution and public health:

Delhi is in pollution's ever tightening chokehold, causing catastrophic health harms. India ranks as the second most populated country in the world, and the first in air pollution. Of the World Health Organization's (WHO's) top 10 most polluted cities, all but one (Bamenda, Cameroon) are in India. Consider the sheer number of people breathing toxic air.

On November 1, 2019, Delhi's Environment Pollution (Prevention and Control) Authority (EPCA) declared air pollution a public health emergency. The declaration acknowledged the severe impact of pollution on health. Although it provided for specific measures to ameliorate pollutant levels and to prevent undue human exposure, it did not specifically define "public health emergency," specify duration, or provide for long-term systemic changes.

While the ongoing crisis in Delhi was born of the externalities of rapid urban and economic development in the context of a shifting climate, it has been abetted by profound failure in political will and coordination within a federal system of divided responsibilities ill-suited to regulating air pollutants. Against this murky backdrop of failed public health and environmental governance, the EPCA has proven to be a bright beacon shining amidst the fog.

Air Pollution and Human Health:

Ambient air pollution is a key risk factor for preventable non-communicable diseases (NCDs): It kills more than four million people every year globally. Worldwide, air pollution is responsible for 29 percent of all deaths and disease from lung cancer, 17 percent from acute lower respiratory infection, 25 percent from ischemic heart disease, 43 percent from chronic obstructive pulmonary disease, and 24 percent of all deaths from stroke.

In addition to these direct impacts on individual health outcomes, air pollution causes indirect health harms on other key determinants of individual health. For example, with dangerously high levels of air pollution, people cannot go outside to exercise or cannot perform work during business hours. Every aspect of an individual's health is affected.

Plastic Waste Management rules:

The Government has notified the Plastic Waste Management Rules, 2016, in suppression of the earlier Plastic Waste (Management and Handling) Rules, 2011. The Minister of State for Environment, Forest and Climate Change, the minimum thickness of plastic carry bags has been increased from 40 microns to 50 microns. 15, 000 tones of plastic waste is generated every day, out of which 9, 000 tones is collected and processed, but 6, 000 tones of plastic waste is not being collected. Shri Javadekar also said that the rules, which were admissible up to municipal areas, have now been extended to all villages. The Minister said that notifying the new Plastic Waste Management Rules is a part of the revamping of all Waste Management Rules.

And whereas, to implement these rules more effectively and to give thrust on plastic waste minimization, source segregation, recycling, involving waste pickers, recyclers and waste processors in collection of plastic waste fraction either from households or any other source of its generation or intermediate material recovery facility and adopt polluter's pay principle for the sustainability of the waste management system, the Central Government reviewed the existing rules;

Bhopal Gas Tragedy:

The Bhopal disaster, also referred to as the Bhopal gas tragedy, was a gas leak incident on the night of 2–3 December 1984 at the Union Carbide India Limited (UCIL) pesticide plant in Bhopal, Madhya Pradesh, India. It is considered to be the world's worst industrial disaster.

On December 3, 1984, about 45 tons of the dangerous gas methyl isocyanate escaped from an insecticide plant that was owned by the Indian subsidiary of the American firm Union Carbide Corporation. The gas drifted over the densely populated neighbourhoods around the plant, killing thousands of people immediately and creating a panic as tens of thousands of others attempted to flee Bhopal. The final death toll was estimated to be between 15,000 and 20,000. Some half a million survivors suffered respiratory problems, eye irritation or blindness, and other maladies resulting from exposure to the toxic gas; many were awarded compensation of a few hundred dollars. Investigations later established that substandard operating and safety procedures at the understaffed plant had led to the catastrophe. In 1998 the former factory site was turned over to the state of Madhya Pradesh.

In the early 21st century more than 400 tons of industrial waste was still present on the site. Neither the Dow Chemical Company, which bought out the Union Carbide Corporation in 2001, nor the Indian government had properly cleaned the site. Soil and water contamination in the area was blamed for chronic health problems and high instances of birth defects in the area's inhabitants. In 2004 the Indian Supreme Court ordered the state to supply clean drinking water to the residents of Bhopal because of groundwater contamination. In 2010 several former executives of Union Carbide's India subsidiary—all Indian citizens—were convicted by a Bhopal court of negligence in the disaster. Continued corporate and government mishandling of the disaster sparked decades of protests by victims and others.