CHAPTER 17 Sources of Pollution

Syllabus

Sources of Pollution:

Noise: Traffic, factories, construction sites, loud speakers, airports.

Air: vehicular, industrial, burning of garbage.

Water: domestic and industrial waste.

Soil: chemical fertilisers, biomedical waste and pesticides.

Radiation: X-rays; radioactive fallout from nuclear plants.

Pollution occurs in different forms: noise, air, water, soil and radioactive. Every form of pollution has two sources of occurrence: *point* and *non-point* sources. Point sources are direct sources of pollutants and are easy to identify, monitor and control. Non-point sources are indirect sources and are therefore, difficult to control. The sources of different kinds of pollution are discussed below.

NOISE POLLUTION

Noise Pollution refers to an unwanted sound which produces unpleasant effects and discomfort. Sound becomes unwanted when it interferes with normal activities such as sleeping, conversation or disrupts one's quality of life.

Sources of Noise Pollution

(i) Traffic: The rapidly increasing number of vehicles on the roads are a big source of noise pollution. Increasing traffic jams in congested areas lead to repeated hooting of horns by impatient drivers causing noise pollution.

(ii) Factories: Factories produce a lot of noise pollution. Textile mills, printing presses, engineering establishments and metal works contribute heavily towards noise pollution. In industrial cities, often the industrial zones are located within the residential zones of the city especially in the case of small scale industries. These factories are usually located on the ground floors of the residential areas and cause annoyance, discomfort and irritation to the residents exposed to the noise that is inevitably produced. However, situation is quite different in modern planned cities like Chandigarh where the industrial area is kept away from the residential area and both are separated from each other by a sufficiently wide green belt.

(iii) Noise from Construction Sites : Noise from construction sites is generally far worse than noise originating from factories. This is

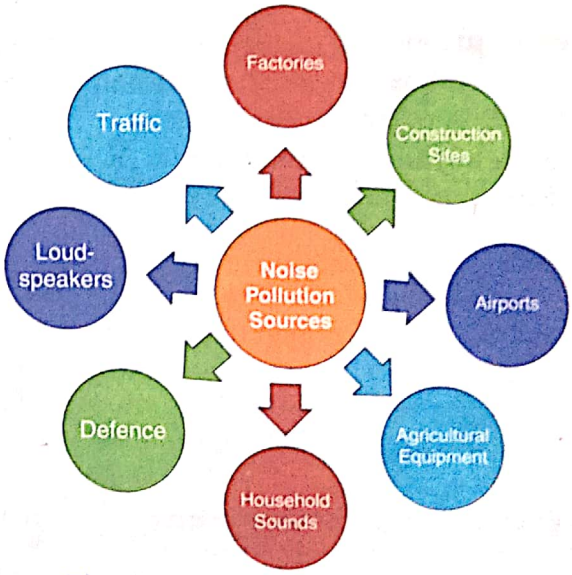

Fig. 17.1. Sources of Noise Pollution

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because construction itself causes high noise emissions and the equipment used is inherently noisy.

In the era of fast urbanisation the demolition and the repair activities along with the huge machines used for the purposes create a great deal of noise to the annoyance of the people living near the sites of construction.

(iv) Loudspeakers: In India we often use loudspeakers during religious functions, birth, marriage, elections, demonstrations, or for commercial advertising. Loudspeakers are therefore, a major source of noise pollution.

(v) Airports: Noise pollution caused by airplanes has been increasing steadily during recent years, especially in the areas close to international airports. This problem has mainly arisen because of the widespread use of heavy long-range jet aircraft. Noise made by jet planes is more disturbing than that of the old propeller driven aircraft because it is of far higher pitch. Jet noise is caused by the violent mixing of the jet of gases from the engine with the surrounding air. It is at maximum level during take-off when the engine delivers maximum thrust, and reduces rapidly as the aircraft climbs. During landing, the main source of high-frequency noise is the sound made by the air compressor and turbine blades. Aircraft pass close to the ground for quite a distance during the landing operation and this noise often constitutes a more sustained environmental nuisance than the intense noise of shorter duration produced during take-off.

Other Sources

Besides the above sources, the other sources of noise pollution are:

- **Household:** A household is a source of many indoor noises such as the banging of doors, noise of playing children, crying of infants, moving of furniture, entertainment equipment like radio, record-players and television sets, domestic gadgets like the mixer-grinders, pressure cookers, desert coolers, air-conditioners, exhaust fans, vacuum cleaners, sewing and washing machines.
- **Agricultural Equipment:** Tractors, thrashers, harvesters, tube wells, powered tillers, all generate noise during usage.

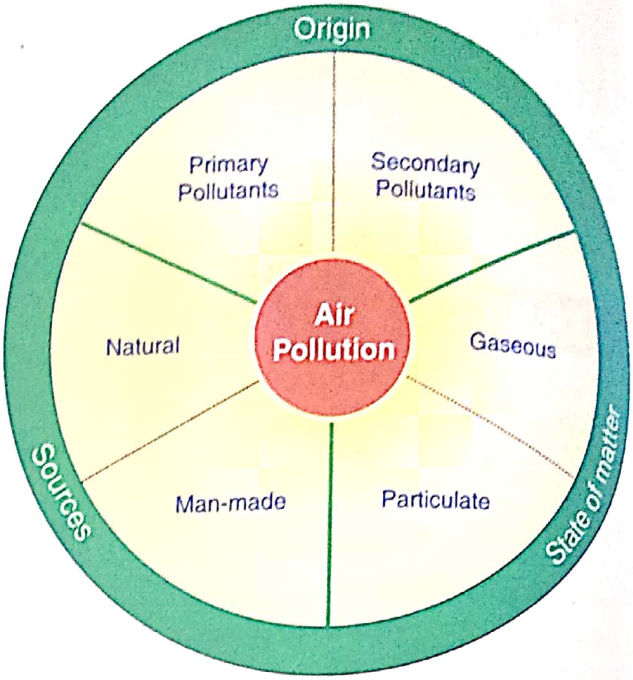

Fig. 17.2. Classification of Air Pollution

- **Defence:** A lot of noise pollution is added to the atmosphere by artillery, tanks, launching of rockets, explosions, exercising of military airplanes and shooting practices. Screams of jet engines and sonic booms have a deafening impact on the ears and in extreme cases have been known to shatter window panes and old dilapidated buildings.
- **Miscellaneous:** Noise from the automobile repair shops, blasting, bulldozing and stone crushing.

AIR POLLUTION

The contamination of air by pollutants like dust, smoke and harmful gases which cause adverse effects on human beings, plants, animals and the environment is known as *air pollution.*

The air pollutants can be classified in many ways as shown below:

1. According to Origin: The air pollutants are classified into:

(a) *Primary Pollutants*: The pollutants that are emitted directly from the sources and are found in the atmosphere in the form in which they are emitted are known as primary pollutants, such as: ash, smoke, dust, radioactive compounds, oxides of sulphur and nitrogen, etc.

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(b) ***Secondary Pollutants:*** The pollutants that are formed in the atmosphere by chemical interactions between primary pollutants and atmospheric constituents are known as secondary pollutants. Examples of secondary pollutants are Sulphur trioxide, Ozone, Peroxyacetyl Nitrate (PAN), ketones, etc.

2. **According to State of Matter:** The air pollutants are classified into:

(a) ***Gaseous air pollutants:*** These pollutants exist in a gaseous state at normal temperature and pressure. They are Carbon dioxide (CO_2), Nitrogen oxides (NO_x), Sulphur Oxides (SO_x), etc.

(b) ***Particulate air pollutants:*** These are not gaseous substances. They are suspended droplets, solid particles or mixtures of the two. They include dust, fumes, smoke, soot and fly ash.

3. **According to Sources:** Pollutants originate from:

(a) ***Natural Sources:*** These include volcanic eruptions, deflation of sand and dust as well as forest, or wild fires of natural vegetation, etc.

(b) ***Man-made Sources:*** These include human activities, related with industries, urban centres, aircraft, nuclear experiments, automobiles, agriculture and power plants.

SOURCES OF AIR POLLUTION

Many types of pollutants are released into the air from various sources. The major man-made sources of air pollution are automobiles, industries, burning of garbage and brick kilns. These sources release pollutants such as oxides of carbon, oxides of sulphur, oxides of nitrogen, and hydrocarbons, ozone, chlorofluoromethanes, etc.

1. Vehicular

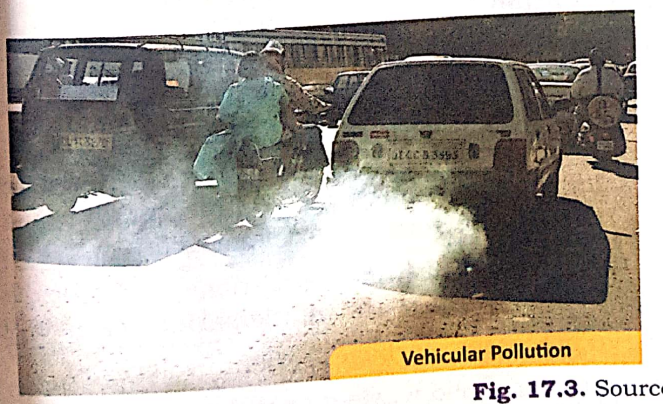
Vehicles are mainly responsible for more than 80 per cent of total air pollution. The major pollutants released from automobiles, locomotives, aircraft, etc., include carbon monoxide (CO), unburnt hydrocarbons and nitrogen monoxide. In the major metropolitan cities like Delhi, Mumbai and Kolkata, vehicular exhaust accounts for 75 per cent of all CO, 45 per cent of all hydrocarbons, 40 per cent of all oxides and 30 per cent of all suspended particulate matter.

Air pollution is also caused by the gaseous and volatile hydrocarbons such as, methane, acetylene and ethylene. Some hydrocarbons like ethylene, which undergo chemical reactions in the presence of sunlight and nitrogen oxide form photochemical oxidants (like ozone) that are harmful. Fuel combustion in automobiles also produces nitrogen dioxide.

2. Industrial Air Pollution

Industries such as chemical industries, paper and pulp mills, cotton mills and petroleum refineries produce most air pollution. The cement factories emit dust, which is potential health hazard. The smoke coming out from the factories has small particles of dust, carbon, metals, other solids, liquids and radioactive materials which get mixed in smoke and pollute the air.

The burning of sulphur in coal or heavy oil in thermal power plants release SO_2 in the air. Sulphur dioxide (SO_2) combines with oxygen and water to form sulphuric acid (H_2SO_4) in the


Vehicular Pollution

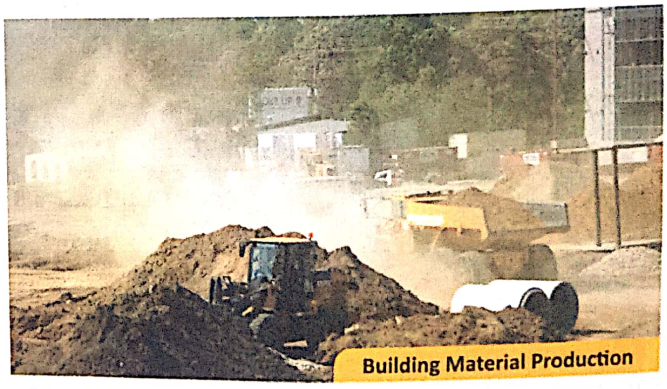

Building Material Production

Fig. 17.3. Sources of Air Pollution

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Fig. 17.4. Effects of SO_2 on Leaves

atmosphere which is a health hazard. Besides, it produces acid rain.

Kanpur has the heaviest air pollution due to dust and smoke of the factories. In winter, smog, a combination of smoke and fog envelopes many cities creating health hazards and traffic problems. During the winter months, due to severe cold, the use of coal and fossil fuels to heat homes and for other purposes increases. These lead to the formation of smog. In some cities like Delhi, smog severity is aggravated by stubble burning in neighbouring agricultural areas. Smog is harmful for health as it causes asthma, bronchitis, shortness of breath, eye and nose irritation, etc. Smog also reduces visibility and leads to problems in traffic movement.

3. Burning of Garbage

Burning of garbage pollutes the atmosphere by emitting such gases as carbon dioxide, sulphur dioxide, nitrogen oxides and particulate matter such as dust and smoke.

The open burning of refuse and in municipal incinerators are also responsible for air pollution.

Biomass burning like forest fires produces Nitrogen dioxide (NO_2) into the atmosphere. NO_2 is readily soluble in water and forms nitric acid, which falls out in the rain.

SOURCES OF WATER POLLUTION

Sources of water pollution can be divided into the following two categories:

(i) Domestic

Man uses water for drinking, preparation of food, bathing, for cleaning the house, etc. Most of the used water is drained out through municipal drains and poured into a river or lake. Domestic wastewater that is mixed with other wastes such as plastic, detergents, animal dung and human faecal material, is known as *municipal waste.*

Many detergents and fertilisers contain phosphates. When phosphates are discharged into waterways, their remnants promote rapid growth of algae. Such enrichment process is known as '*eutrophication*'. Aquatic weeds multiply rapidly in many water bodies. They interfere with fishing, navigation and irrigation.

(ii) Industrial

Industries dealing with chemicals, pulp and paper, food processing, etc., produce waste material such as heavy metals or synthetic organic compounds. These reach water bodies either through direct discharge or by leaching from waste dumps.

Among the heavy metals cadmium, lead, mercury, copper, chromium, etc., get into water.

Sources of Air Pollution

Pollutant	Sources
1. *Carbon Monoxide (CO)*	Gasoline fuel, motor vehicles fuel, burning of wood and coal, solid waste disposal, Industrial processes.
2. *Nitrogen Oxides (NO_x)*	Primary sources are motor vehicles and power generation stations, combustion of organic matters, furnace stacks, incinerators.
3. *Sulphur Oxides (SO_x)*	Mainly due to burning of coal, smelting operations, refineries, chemical plants, open burning of garbage and municipal incinerators.
4. *Hydrocarbons (HC)*	Motor vehicles, industrial processes, garbage, agricultural waste.
5. *Particulates*	Motor vehicles, fuel combustion, solid waste disposal.

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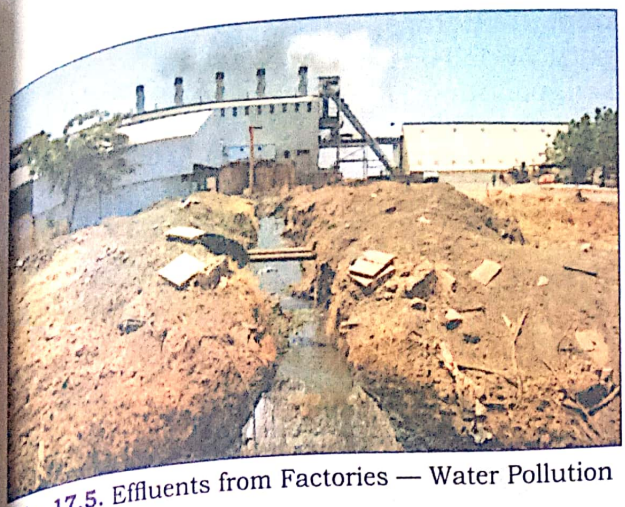

Fig. 17.5. Effluents from Factories — Water Pollution

(a) ***Lead:*** Lead is used in many industries and may accumulate in biological system. Lead can enter water from many sources like the mining and smelting of lead-bearing ores and metals, lead plumbing, paints and ceramic glazes and the disposal of lead-zinc batteries in the garbage.

(b) ***Manganese:*** Manganese has been found widely in nature and used in manufacturing steel.

(c) ***Mercury:*** Mercury is used in plastic and chemical industries. Methyl mercury is the most common form of mercury found in aquatic environment. It has been reported that accumulation of mercury is as high as 5000 times the amount in fish and is passed on to man.

SOURCES OF SOIL POLLUTION

The soil pollution is the result of several sources, which can be categorised under the following heads:

(i) chemical fertilisers,
(ii) biomedical waste,
(iii) pesticides.

(i) Chemical fertilisers: Agricultural practices today use chemical fertilisers, which contain such plant nutrients as *nitrogen, phosphorous* and *potassium*. The excessive use of chemical fertilisers creates pollution. The fertilisers are used to enrich the soil, but they also contaminate the soil with their impurities. When the fertilisers are contaminated with other synthetic organic pollutants, the water in the soil gets polluted.

(ii) Biomedical waste: Hospital wastes contain organic materials, chemicals, metal, needles, plastic, etc. Dumping of domestic sewage and hospital organic wastes contaminate the soil with pathogens that affect human health. The excreta of humans and animals pollute the soil. Intestinal parasites constitute the most serious soil pollution problems in the third world countries.

(iii) Pesticides: Pesticides and weedicides are used to control pests and weeds on the farm. They contaminate the soil. Pesticide residues change the chemical properties of soil and accumulate on the soil permanently and introduce these toxic materials into plant products.

SOURCES OF RADIOACTIVE POLLUTION

The two main sources of radioactive pollution are:

(a) Natural Sources: These sources are cosmic rays with energetic radiations reaching the earth from outer space. Though they are a major hazard in space, they are not dangerous for organisms on earth.

(b) Man-made Sources: The following sources cause radioactive pollution:

(i) ***X-rays waste:*** The use of X-rays is common for detecting skeletal disorders. Cancer patients undergo radium and other isotope radiations. The X-rays pass through genetic cells and affect the chromosomes, resulting in mutations.

(ii) ***Radioactive fallout from nuclear plants:*** In a nuclear power establishment, both fuel elements and coolants are sources of radiation pollution. Radioactive wastes from atomic reactors

Fig. 17.6 Nuclear Reactors

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are hazardous to living organisms. Even if radioactive wastes are buried underground they may escape into the surroundings. Inert gases escape as vapours and pollute the environment.

(iii) *Nuclear Weapons*: Testing of nuclear weapons involves using radioactive substances like Uranium 235 and Plutonium 239 for fission. The radioactive waste emitted during these tests makes the surrounding materials radioactive.

Radioactive particles are carried away to distant places by wind. They are brought down by rain. Raindrops containing these radioactive particles fall on earth, and affect the soil causing soil pollution. From the soil, the radioactive materials reach water sources, where the aquatic organisms absorb and accumulate them through the food chains and pass them on to human beings.

(iv) *Radioactive Isotopes*: Radioactive isotopes are used in research laboratories. When the wastewater from these laboratories reaches the rivers, streams, lakes, etc., through the sewers they cause water pollution.

EXERCISES

I. Choose the correct option:

1. Direct sources of pollutants that are easy to identify, monitor and control:
   (a) Direct sources (b) Primary sources (c) Point sources (d) Secondary sources
2. Which amongst the following is not a source of Noise Pollution?
   (a) Traffic (b) Factories (c) Defence (d) Burning of Garbage
3. Ozone, ketones and sulphur oxides are examples of which amongst the following:
   (a) Primary Pollutants (b) Direct Pollutants
   (c) Secondary Pollutants (d) Natural Sources
4. Suspended droplets, solid particles or mixtures of the two in the air:
   (a) Gaseous air pollutants (b) Natural air pollutants
   (c) Primary pollutants (d) Particulate air pollutants
5. Which amongst the following is NOT a source of Air Pollution?
   (a) Vehicular exhaust (b) Biomedical Waste
   (c) Industrial exhaust (d) Burning of garbage
6. Motor vehicles fuel, burning of wood, coal and solid waste disposal are major sources of which pollutant?
   (a) Carbon monoxide (b) Nitrogen oxides
   (c) Particulates (d) Sulphur oxides
7. Rapid growth of algae when phosphates are discharged into waterways.
   (a) Algae-Discharge (b) Eutrophication
   (c) Algae-Enrichment (d) Phosphatic Algae
8. Which amongst the following is not a source of Radioactive Pollution?
   (a) Nuclear weapons (b) X-rays waste
   (c) Pesticides (d) Radioactive fallout from nuclear plants
9. Construction sites are of source of which pollution?
   (a) Noise due to construction equipment.
   (b) Air due to the particulate matter released.
   (c) Soil due to the excavation for the site.
   (d) Only (a) and (b).

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II. Short Answer Questions

1. Name any three air pollutants and the sources of each of them.
2. What are natural sources of air pollution? Name one industry which pollutes the atmosphere with gaseous as well as with particulate matter.
3. What is known as smog? What harm is done by smog especially in winter?
4. Name three gases emitted during burning of garbage.
5. Mention any two sources of water pollution.
6. Name two heavy metals from industries that pollute water.
7. Mention any two sources of soil pollution.
8. Why radioactive pollutants are very dangerous?
9. In cities flyovers are constructed with large sheets of fibre glass on the outer side of the flyovers. Give reason.
10. How does lighting of crackers cause pollution?

III. Structured Questions

1. With reference to noise pollution, answer the following:
   (a) When does sound become a source of noise pollution?
   (b) How does traffic contribute to noise pollution?
   (c) Why are the construction sites considered as worse than factories in their contribution to noise pollution?
   (d) How do the airplanes cause noise pollution? Why is there more noise pollution during landing as compared to during take-off?
2. Air pollution is the contamination of air by pollutants. In this context answer the following:
   (a) Based on their origin, how can air pollutants be classified?
   (b) How does the use of automobiles cause air pollution?
   (c) How do industries pollute the air?
   (d) Mention any three air pollutants and two sources of each.
3. With reference to the sources of water pollutants answer the following questions:
   (a) What are the domestic sources of water pollution?
   (b) Why is it harmful to dispose of household detergents in water bodies?
   (c) In what way does the industrial waste pollute water?
   (d) What are the sources of radioactive pollution? Describe each of them.

IV. Thinking Skills

1. Of all the different types of pollution, noise pollution is the most subtle but with many harmful effects. Do you agree with this statement? Give reasons to support your answer.
2. Pollution in the cities is the price of growing affluence. Give your views on the above statement with examples.

V. Practical Work

Find out the percentage of pollutants released into the air by automobiles in your city. Do you think introduction of CNG in some of the cities has been helpful in reducing pollution levels?

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