Unit 5: Environmental Pollution

POINTS TO BE DISCUSSED

- Environmental pollution: concepts and types.
- Air, water, soil, noise and marine pollution- causes effects and controls.
- Concept of hazardous waste and human health risks.

• Solid waste management: Control measures of Municipal, biomedical and e-waste.

5.1 INTRODUCTION :

Environment involves the biotic and abiotic components and their interaction making them to coexist. Natural or anthropogenic activities influence the balance which is manifested through changes occurring in air, water and land. Any disturbance in air, water and land is reflected in the deviation from natural balance in living beings. This undesirable change in the composition of air, water and land and the disturbed inter-relation (ecology) is called Environmental Pollution. Pollution can be defined as any undesirable change in the surroundings that may adversely affect human life, other living species and the environment. Environmental pollution is one the most significant challenges that the world is facing in our day. Pollutants include solid, liquid and gaseous substances present in excess than natural quantity causing detrimental effect on the environment. A pollutant can be classified as:

- a) Biodegradable: Pollutants which can be rapidly broken down into simpler, harmless, substances and decompose in nature in due course of time
- b) Non biodegradable: Pollutants which cannot be degraded by natural processes easily or do not decompose very easily. They are difficult to eradicate from the environment; for example, toxic elements like lead or mercury, plastic, synthetic fibers.

5.1.1 Sources of pollution:

- a. Industrial activities and mining processes.
- b. Transportation and automobile exhaust.
- c. Agricultural activities.
- d. Disposal of solid wastes.
- e. Construction activities.
- f. Runoff from the land.

5.2 AIR POLLUTION:

It is any undesirable change in the quality of air that affects the environment and human beings. It occurs when any harmful gases, dust, smoke enters into the atmosphere and makes it difficult for living organisms to survive. Air pollution kills an estimated seven million people worldwide every year. The presence of high concentration of pollutants in air affects the natural cleansing mechanism of the atmosphere causing air pollution. Air pollution may be caused by both natural and anthropogenic causes. However, naturally occurring pollutants tend to remain in atmosphere for a shorter period of time. 5.2.1 Classification of Air Pollutants:

a. Primary air pollutants: Pollutants that are directly emitted directly into air from identifiable sources. For example: carbon monoxide (CO), carbon dioxide (CO₂), nitrogen oxides (NO_x) etc.

b. Secondary air pollutants: Pollutants produced in the environment due to interaction among the primary pollutants. They are caused by the intermingling and reactions of primary pollutants. For example: sulphuric acid (H_2SO_4), nitric acid (HNO_3), PAN, O3.

5.2.2 Types of air pollution:

a. Indoor air pollution: Indoor air pollution is the degradation of indoor air quality by harmful chemicals and other materials. Indoor air pollution has a far greater impact because fuel, such as wood, charcoal and animal dung, is burned inside homes for cooking and heating within closed walls.

b. Outdoor air pollution: Outdoor air pollution is caused mainly by industrial activities and combustion processes from automobiles. Increasing industrialization and urbanization has lead to high concentration of outdoor air pollution in modern cities.

5.2.3 Sources of air pollution:

- a) Anthropogenic sources:
 - Motor vehicles: The automobile industry plays an important role in air pollution. In the cities, by far, the largest amount of pollutants is

emitted by the motor vehicles. It is due to the continuous increase in the number of motor vehicles. Combustion of carbon constituted fuels (coal, fuel oil, wood, natural gas) is never complete, and it produces carbon monoxide (CO) and hydrocarbons. Automobiles emit large amount of CO, hydrocarbons and nitrogen oxides.

- Industrial wastes: It is a major source of air pollution which includes metallurgical plants, chemical plants, petroleum refineries, fertilizer plants, steel plants and food processing. Various industrial processes may emit both organic and inorganic contaminants through accidental spills and leaks of stored chemicals or the handling and storage of chemicals – especially of volatile inorganic chemicals. Heavier machinery located inside big factories and industrial plants also emit pollutants into the air. Industry has a right to produce and make profit, but it has no right to ruin the public environment.
- Power plants: Fossil fuels also present a wider scale problem when they are burned for energy in power plants. Chemicals like sulfur dioxide are released during the burning process, which travel straight into the atmosphere. These types of pollutants react with water molecules to yield something known as acid rain. Pollutants like fly ash and soot are released from these power plants.
- Agricultural activities: **Agricultural sources** arise from activities that raise animals and grow crops, which can generate emissions of gases and particulate matter. For example, animals confined to a barn or restricted area produce large amounts of manure. Manure emits various gases, particularly ammonia into the air. This ammonia can be emitted from the animal houses, manure storage areas, or from the land after the manure is applied. In crop production, the misapplication of fertilizers, herbicides, and pesticides can potentially result in aerial drift of these materials and harm may be caused.

5.2.4 Effects of air pollution:

- Acid rain: Acid rain is precipitation containing harmful amounts of nitric and sulfuric acids. These acids are formed primarily by nitrogen oxides and sulfur oxides released into the atmosphere when fossil fuels are burned. These acids fall to the Earth either as wet precipitation (rain, snow, or fog) or dry precipitation (gas and particulates). Some are carried by the wind, sometimes hundreds of miles. Acid rain affects the amount of chemicals in soils and freshwater, affecting food chains. In the environment, acid rain damages trees and causes soils and water bodies to acidify, making the water unsuitable for some fish and other wildlife. It also speeds the decay of buildings, statues, and sculptures that are part of our national heritage.
- Global warming: Global warming is one of the most worrying effects for scientists and environmentalists. Global warming is a direct consequence of the greenhouse effect, which is produced by the high emission of CO₂ and methane into the atmosphere. Most of these emissions are produced by the industry, so this can be remedied by social responsibility and action by companies and factories. The Earth's atmosphere contains a delicate balance of naturally occurring gases that trap some of the sun's heat near the Earth's surface. This "greenhouse effect" keeps the Earth's temperature stable. Unfortunately, evidence is mounting that humans have disturbed this natural balance by producing large amounts of some of these greenhouse gases, including carbon dioxide and methane.
- Crop and Forest Damage: Ground level ozone affects the yields of agricultural crops and commercial forests. This also stuns the growth and sustainability of tree seedlings. Crop and forest damage can also result from acid rain and from increased UV radiation caused by ozone depletion. The plants are also susceptible to diseases, pests, and environmental stresses.
- Eutrophication is a condition in a water body where high concentrations of nutrients (such as nitrogen) stimulate blooms of

algae, which in turn can cause fish kills and loss of plant and animal diversity. Although eutrophication is a natural process in the aging of lakes and some estuaries, human activities can greatly accelerate eutrophication by increasing the rate at which nutrients enter aquatic ecosystems. Air emissions of nitrogen oxides from power plants, cars, trucks, and other sources contribute to the amount of nitrogen entering aquatic ecosystems.

- Ozone depletion: Ozone gas occurs both on the ground level and • Earth's upper atmosphere (stratosphere). Ground level ozone harms human health. Ozone is a gas that occurs both at groundlevel and in the Earth's upper atmosphere, known as the stratosphere. At ground level, ozone is a pollutant that can harm human health. In the stratosphere, however, ozone forms a layer that protects life on earth from the sun's harmful ultraviolet (UV) rays. The ozone layer is gradually being destroyed by man-made chemicals referred to as ozone-depleting substances, including chlorofluorocarbons, hydro chlorofluorocarbons, and halons. Thinning of the protective ozone layer can cause increased amounts of UV radiation to reach the Earth, which can lead to more cases of skin cancer, cataracts, and impaired immune systems. UV can also damage sensitive crops, such as soybeans, and reduce crop yields.
- 5.2.5 Control of air pollution:
 - Industries make a major contribution towards causing air pollution. Formation of pollutants can be prevented and their emission can be minimized at the source itself.
 - Usage of air pollution control devices such as scrubbers, electrostatic precipitators, cyclones play an important role in controlling of pollution.
 - The use of clean energy sources like solar, wind and geothermal energies reduce air pollution at a larger level.
 - Making a vehicle more fuel efficient. Lighter more streamlined vehicles need less energy. Old and technologically obsolete

vehicles must be discarded. Vehicular emission check should also be implemented.

- Scientists agree that climate change is a global problem that must be attacked by a unified world with a single goal. All nations must come together to reduce greenhouse gas emissions.
- The use of clean fuels such as CNG and developing technologies that minimize the usage of fossil fuels should be encouraged.
- Proper legislative measures should be taken to reduce the impact of air pollution. Air pollution legislation should be enacted to enable legal measures to be taken against avoidable emissions both from the old and new industries.

5.3 WATER POLLUTION:

Water is the essential element that makes life on earth possible. The water found in streams, lakes, rivers, wetlands and reservoirs is called surface water. Water that is stored in underground in aquifers and percolates into the ground is called groundwater. Oceans, lakes, rivers, and other inland waters can naturally clean up a certain amount of pollution by dispersing it harmlessly.

According to the Water (Prevention and Control of Pollution) Act, 1974, —water pollution means such contamination of water or such alteration of the physical, chemical or biological properties of water or such discharge of any sewage or trade effluent or of any other liquid, gaseous or solid substance into water (whether directly or indirectly) as may or is likely to, create a nuisance or render such water harmful or injurious to public health or safety or to domestic, commercial, industrial, agricultural or other legitimate uses, or the life and health of animals or plants or of aquatic organisms.

• Point source of pollution: In this type pollutants are discharged from one definite source where it enters the water. E.g.: effluent pipe, oil spillage.

- Non-point source of pollution: Nonpoint source pollution generally results from land runoff, precipitation, atmospheric deposition, drainage, seepage or hydrologic modification. Nonpoint source (NPS) pollution, unlike pollution from industrial and sewage treatment plants, comes from many diffuse sources.
- 5.3.1 Sources of water pollution:
 - Domestic sewage: Wastes from residential homes, sewage etc. constitutes nearly 70 percent of the water pollution. The residential buildings do have connected sewage treatment system but it is either inadequate or misused. The garbage and sewage discharged from it is flown in drains or sewage lines thereby blocking the free flow of water. The primary source of pathogens (disease-causing microorganisms) and organic substances. The water discharged from untreated or inadequately treated sewage which goes into rivers, lakes, wells etc. causes serious infectious diseases like typhoid, cholera, dysentery and other skin diseases.
 - Eutrophication: The increased level of nutrients in water bodies is known as Eutrophication. It results in the bloom of algae in the water. It also depletes the amount of oxygen in the water that negatively affects fish and other aquatic animal populations.
 - Industrialization: Rapid industrialization is another cause of concern as far as water pollution is concerned. Immediately after the independence, major steps were taken in our country in its stride for development in order to give its economy a big push. Industrialization was then considered the most important factor that can put the country in the path of progress. However industrialization along with

development brought with it a danger to the human civilization- the problem of environmental pollution. Industries produce a tremendous amount of waste, which contains toxic chemicals and pollutants, causing damage to our environment and us. They contain harmful chemicals, including lead, mercury, sulfur, nitrates, asbestos, and many others.

- Oil spills: Poses a huge threat to marine life when a large amount of oil spills into the sea and does not dissolve in water. It causes problems for local marine wildlife, including fish, birds, and other sea organisms.
- Sediment pollution: Sedimentation due to runoff effects water quality. It decreases the capacity of streams, ditches, navigation channels and rivers. It decreases the penetration of light into water due to which due to under water flora is disturbed. So the fishes and other fauna feeding on that flora are also disturbed and whole food chain is disturbed. Pollutants like pesticides and phosphorus are transported and accumulated due to sedimentation. Sediment particles also attach to fish gills so fishes feel difficulty to respire in this way they causes fish death. Similarly sediments carry dangerous chemicals like pesticides and petroleum products to water bodies thus polluting them

5.3.2 Effects of air pollution:

• Water pollution leads to damage to human health. Disease carrying agents such as bacteria and viruses are carried into the surface and ground water. Drinking water is affected and health hazards result. Direct damage to plants and animals nutrition also affects human

health. Diseases spread by unsafe water include cholera, giardia, and typhoid

- When water pollution causes an algal bloom in a lake or marine environment, the proliferation of newly introduced nutrients stimulates plant and algae growth, which in turn reduces oxygen levels in the water. This dearth of oxygen, known as eutrophication, suffocates plants and animals.
- Chemicals and heavy metals from industrial and municipal wastewater contaminate waterways as well. These contaminants are toxic to aquatic life—most often reducing an organism's life span and ability to reproduce—and make their way up the food chain as predator eats prey. That's how tuna and other big fish accumulate high quantities of toxins, such as mercury.
- Disruption in food chains happens when toxins and pollutants in the water are consumed by aquatic animals (fish, shellfish etc) which are then consumed by humans.

5.3.3 Control of water pollution:

- The sewage pollutants are required to be treated in sewage treatment plants before their discharge in natural water bodies.
- Radioactive materials enter human body through water and food, and may be accumulated in blood and certain vital organs. They cause tumors and cancer.
- Pollution disrupts the food chain by moving the toxins from one level in the chain to higher levels. In some cases, pollution can wipe out an entire part of the food chain. Such affect the other organisms by either causing excessive growth, in case the predator dies or death.

- Hot water should not be disposed off directly into the river, as it adversely affects the life of aquatic organisms. Thermal pollution can be reduced by employing techniques such as cooling, cooling ponds, evaporative or wet cooling towers and dry cooling towers.
- Water pollution due to organic insecticides and pesticides can be reduced by the use of very specific stable chemicals in the manufacture of insecticides and pesticides. Moreover, use of bio-fertilizers needs to be promoted.
- Oil slicks should be skimmed off from the surface with suction device. Sawdust may be spread over oil slicks to absorb the oil components.

5.4 SOIL POLLUTION:

Soil pollution is defined as the presence of toxic chemicals (pollutants or contaminants) in soil, in high enough concentrations to pose a risk to human health and/or the ecosystem. In the case of contaminants which occur naturally in soil, even when their levels are not high enough to pose a risk, soil pollution is still said to occur if the levels of the contaminants in soil exceed the levels that should naturally be present. 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. The main reason why the soil becomes contaminated is due to the presence of man-made waste.

5.4.1 Causes of soil pollution:

• Industrial activity: The discharge of industrial waste into soils can result in soil 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.

- Agricultural activities involving the diffusion of herbicides, pesticides and/or insecticides and fertilizers. The utilization of chemicals has gone up tremendously since technology provided us with modern pesticides and fertilizers. They are full of chemicals that are not produced in nature and cannot be broken down by it. As a result, they seep into the ground after they mix with water and slowly reduce the fertility of the soil.
- Urban Activities: Lack of proper waste disposal, regular constructions can cause excessive damage to the soil due to lack of proper drainage and surface run-off. These waste disposed of by humans contain chemical waste from residential areas. Moreover leaking of sewerage system can also affect soil quality and cause soil pollution by changing the chemical composition of the soil.
- Acid Rain: is caused when pollutants present in the air mix up with the rain and fall back on the ground. The polluted water could dissolve away some of the essential nutrients found in soil and change the structure of the soil.
- Improper disposal of highly toxic industrial/chemical waste can severely pollute the soil. For example, the storage of toxic wastes in landfills can result in the seepage of the waste into the soil. This waste can go on to pollute groundwater.
- 5.4.2 Effects of soil pollution:

- Industrial effluents when discharged through sewage system poison the biological purification mechanism of sewage treatment causing several soil and water borne diseases.
- When soils are repeatedly contaminated and accumulate large amounts of poisonous materials and chemicals, the soil reaches a point where it cannot support plant life.
- Soil pollution allows emission of relatively large quantities of nitrogen, volatilization of ammonia, and the decomposition of organic materials in the soil. As a result, this releases sulfur compounds and sulfur dioxides into the atmosphere, causing acid rain. Acidic soils are inhospitable to several microorganisms that improve soil texture and help in the decomposition of organic matter.
- Soil pollution is often accompanied by a decrease in the availability of nutrients; plant life ceases to thrive in such soils. Soils contaminated with inorganic aluminum can prove toxic to plants.

5.4.3 Control of soil pollution:

- Control of land loss and soil erosion can be attempted through restoring forest and grass cover to check wastelands, soil erosion and floods. Crop rotation or mixed cropping can improve the fertility of the land.
- Materials such as glass containers, plastic bags, paper, cloth etc. can be reused at domestic levels rather than being disposed, reducing solid waste pollution.
- It is important to dispose of solid waste properly by treated it before it's released into the environment. Acidic and alkaline

waste, for example, can be neutralized before they are disposed of to avoid soil contamination.

- The best way to control soil pollution is to strictly control the mining and industrial pollutants. The government should also put in place measures to ensure electronic wastes and heavy metals do not contaminate the soil.
- The government should make an effort to improve the quality of soil through pollution treatment and remediation.

5.5 Noise pollution:

Noise is considered to be any unwanted sound that may negatively affect the well-being of individuals. 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. Although noise constantly surrounds us, noise pollution generally receives less attention than water quality and air quality issues because it cannot be seen, tasted, or smelled. Noise pollution has a negative impact on wildlife species by reducing habitat quality, increasing stress levels, and masking other sounds.

5.5.1 Sources of noise pollution:

- Factories that use heavy machinery emit large amounts of sound that are damaging to the people that work for the company and those living in the neighborhood. Apart from that, various equipment like compressors, generators, exhaust fans, grinding mills also participates in producing big noise.
- Increased number of vehicles on the roads is the second reason for noise pollution. In the city, the main sources of traffic noise are the motors and exhaust system of autos, smaller trucks, buses, and motorcycles. This type of noise can be augmented by narrow streets and tall buildings, which produce a canyon in

which traffic noise reverberates. Increasing traffic has given rise to traffic jams in congested areas where the repeated hooting of horns by impatient drivers pierces the ears of all road users.

- Tractors, thrashers, harvesters, tube wells, powered tillers etc. have all made agriculture highly mechanical but at the same time highly noisy. Noise level 90 dB to 98 dB due to running of farm machines have been recorded in the state of Punjab.
- The noise from locomotive engines, horns and whistles, and switching and shunting operation in rail yards can impact neighboring communities and railroad workers. For example, rail car retarders can produce a high frequency, high level screech that can reach peak levels of 120 dB at a distance of 100 feet, which translates to levels as high as 138, or 140 dB at the railroad worker's ear.
- Apartment dwellers are often annoyed by noise in their homes, especially when the building is not well designed and constructed. In this case, internal building noise from plumbing, boilers, generators, air conditioners, and fans, can be audible and annoying. Improperly insulated walls and ceilings can reveal the sound of-amplified music, voices, footfalls and noisy activities from neighboring units. External noise from emergency vehicles, traffic, refuse collection, and other city noises can be a problem for urban residents, especially when windows are open or insufficiently glazed.
- The problem of low flying military aircraft has added a new dimension to community annoyance, as the nation seeks to improve its nap-of the- earth aircraft operations over national parks, wilderness areas , and other areas previously unaffected by aircraft noise has claimed national attention over recent years.
- We are surrounded by gadgets and use them extensively in our daily life. Gadgets like TV, mobile, mixer grinder, pressure cooker, vacuum cleaners, washing machine and dryer, cooler, air conditioners are minor contributors to the amount of noise

that is produced. Still, it affects the quality of life of your neighborhood in a bad way.

5.5.2 Effect of noise pollution:

- High-intensity sound waves cause unnecessary ripples in the ear canal, disturbing the fluid that aid communications between the ear and the brain. This disturbance destroys the tiny, very delicate, hair follicles that send signals to the brain whenever sounds enter the ear. Hearing loss is very probable after 50% of these hairs are gone, necessitating hearing devices, particularly for children. Research has also shown that uncontrolled exposure to high-intensity noises can seriously jeopardize a kid's memory and reading power.
- Noise can lead to serious psychological disorders and, sadly, you may not even realize it because it becomes a part of you. Research shows that too much noise makes people easily irritable, nervousness, irrational in decision making, and constant unease throughout the day.
- Man-made noises such as jackhammers, horns, machinery, airplanes, and even vehicles can be too loud for our hearing range.
- Constant exposure to loud levels of noise can easily result in the damage of our eardrums and loss of hearing, causing tinnitus or deafness. It also reduces our sensitivity to sounds that our ears pick up unconsciously to regulate our body's rhythm.
- Noise affects brain responses and people's ability to focus, which can lead to low-performance levels over time. Like other sound waves, too much noise

when it goes to the brain leads to lower response rates as well as making the mind dull.

- Cardiovascular diseases are another adverse effect of noise pollution. In our daily life, we are exposed to many different impressions. If we get to many impressions, our brain is unable to handle all of them properly which leads to stress. This stress can come from work, from our social life or from strokes of fate.
- It is quite obvious that an excessive amount of noise prevents us from communicating to each other since we simply are not able to hear what the other person says. This can often be seen in daily life when people walk on main streets.

5.5.3 Control of noise pollution:

- Making noise mounds, walls for noise attenuation and well-maintained roads and smooth surfacing of it are some of the noise abatement measures.
- Air traffic noise can be tackled by the appropriate introduction of noise regulations for takeoff and landing of aircraft at the airport.
- Use of soundproofing equipment like generators in areas producing a lot of noise can reduce industrial noise.
- Reducing noise level from domestic sectors, maintenance of automobiles, and prohibition of uses of loudspeakers for certain time.
- Controlling human activities like minimum use of loudspeakers or amplifiers and repeated honing in traffic-prone areas.

5.6 Marine pollution:

Oceans are the largest water bodies on the planet Earth. Excessive human activities have drastically affected marine life on the Earth's oceans. Ocean pollution, also known as marine pollution, is the spreading of harmful substances such as oil, plastic, industrial and agricultural waste and chemicals into the ocean.

Marine Pollution (UN definition) – "The introduction by man, directly, or indirectly, of substances or energy to the marine environment resulting in deleterious effects such as: hazards to human health, hindrance to marine activities, impairment of the quality of seawater for various uses and reduction of amenities.

• Types of marine pollution:

• Acidification: Oceans of our planet act as a natural carbon sink. The carbon-dioxide present in the atmosphere dissolves in the oceans. This lowers the atmospheric CO2 concentration which, in turn, reduces the effects of global warming on the planet. However, as the atmospheric concentration of the gas is increasing, the oceans are becoming more acidic. This change in the pH of the ocean water can have harmful effects on marine life. Structures made of calcium carbonate might become vulnerable to dissolution in the acidic environment. This will negatively impact the corals and shellfish living in the oceans.

- Eutrophication: When the concentration of chemical nutrients increases in a water body, the process is called eutrophication. The change can lead to an excessive growth of plants and their subsequent decay. When the highly polluted rivers drain into the ocean, it might result in the formation of dead zones where the water is highly depleted of oxygen. Eutrophication decreases the level of oxygen, reduces the quality of water, makes the water inhabitable for fish, affects the breeding process within the marine life and increases the primary productivity of the marine ecosystem.
- **Toxins:** Toxins such as pesticides, DDT, PCBs, furans, TBT, radioactive waste, phenols, and dioxins get accumulated in the tissue cells of the marine organisms and lead to bioaccumulation hampering the life underwater and sometimes leads to a mutation in aquatic life forms. The toxins pass from prey to predator through the food chain and start biomagnifying at each higher level in the food chain. Humans are often at the top of many marine food chains and thus are the receivers of large quantities of biomagnified toxins from seafood.
- 5.6.1 Sources of marine pollution:
 - Municipal waste and sewage from residences and hotels in coastal towns are directly discharged into sea. Runoff from the land comes from both urban and agricultural areas. Often referred to as non-point source pollution, runoff can originate from sources such as cars and trucks, septic tanks, farms, and timber harvesting operations.
 - Chemicals that end up on roads and highways flow over and under the ground with rainwater, as do pesticides; fertilizers; and carbon-, nitrogen-, and phosphorous-rich particulates, eventually reaching the ocean. Inland mining can cause an

influx of mineral and soil deposits. These travel through rivers and estuaries, making soil a real threat to marine ecosystems. Runoff can even smother marine plants and coral reefs.

- Toxic waste, including mercury, released by manufacturing plants enters the sea and the food chain, making its way up to larger species consumed by humans. Agricultural toxins can be direct biological hazards and raise ocean temperatures, which can be deadly for some animals and plants.
- Ship accidents and accidental spillage at sea can therefore be very damaging to the marine environment. Ships and platforms release large amounts of oil every year. However, oil isn't the only pollutant that comes from ships, which may also discharge fuel, plastic, and human waste. Crude oil is difficult to clean up.
- The ocean floor is a valuable source of gold, silver, copper, and zinc, but mining under the sea is a major source of pollution. Sulfide deposits created when these substances are drilled can have environmental impacts that aren't fully understood. Deep sea mining is a relatively new mineral retrieval process that takes place on the ocean floor. Ocean mining sites are usually done at about 1,400 3,700 meters below the ocean's surface.

5.6.2 Effects of marine pollution:

- Apart from causing Eutrophication, a large amount of organic wastes can also result in the development of 'red tides'. These are phytoplankton blooms because of which the whole area is discolored. Once these organisms start to sink and decompose, oxygen is depleted and the area becomes a dead zone because marine life cannot survive in that environment.
- Debris in the water, whether chemically harmful or not, can be hazardous. It can kill all kinds of marine life. Discarded metal cans and plastic, broken glass, fishing gear, and parts of ships can harm people who come into contact with them.

- Organic waste addition results in end products such as hydrogen sulphide, ammonia and methane which are toxic to many organisms. This process results in the formation of an anoxic zone which is low in its oxygen content; from which most life disappears except for anaerobic microorganisms and renders the water foul smelling.
- Consumption of toxic substances stored in the fatty tissues of fish
- Toxic materials are a side effect of modern life. Toxic pollution often ends up in the ocean, sediment, and the sea surface micro-layer.

5.6.3 Control of marine pollution:

- To control marine pollution, wastewater from our thermal power stations is discharged only after being purified in our wastewater treatment facility.
- Plastic bags, bottles etc. have become one of the big reasons for marine pollution. We need to stop using plastic made material to save marine life and our environment.
- We all need to make sure that only rainwater goes into the drainage because most of the drain water goes into oceans. If we allow sewage and waste material to get into the drainage, it will eventually affect the marine life.
- Climate change and marine pollution are both results of excess human interference in the natural world. If we choose eco-friendly household cleaners and take measures to reduce the fumes we release into the air we can reduce the impact of our lives on the oceans.

5.7 Concept of hazardous waste:

Hazardous wastes are those that may contain toxic substances generated from industrial, hospital, some types of household wastes. These wastes could be corrosive, inflammable, explosive, or react when exposed to other materials. Some hazardous wastes are highly toxic to environment including humans, animals, and plants. Due largely to economic development, industrialization, and changing lifestyles, quantity of hazardous waste in India is rising significantly.

Hazardous waste is a waste with properties that make it dangerous or potentially harmful to human health or the environment. Hazardous waste in India is defined as "any substance, excluding domestic and radioactive wastes, which because of its quantity and/or corrosive, reactive, ignitable, toxic and infectious characteristics causes significant hazards to human health or environment when improperly treated, stored, transported and disposed ". Much of this hazardous material is stored in landfills or other containment areas. If these hazardous waste sites are not properly designed or managed, their contents can be released into the surrounding environment, posing a threat to public health. Households generate small quantities of hazardous waste, such as oil-based paints, paint thinners, wood preservatives, pesticides, household cleaners, used motor oil, antifreeze, and batteries.

Four defining characteristics of hazardous waste are:

- Ignitability: Ignitable waste can create fires under certain conditions or is spontaneously combustible. Examples include waste oils and used solvents.
- Corrosivity: Corrosive waste includes acids or bases capable of corroding metal, like storage tanks, containers, drums, and barrels. Battery acid is a good example.
- Reactivity: Reactive waste is unstable under "normal" conditions. It can cause explosions, toxic fumes, gases or vapors when mixed with water. Examples include lithium-sulphur batteries and explosives.
- Toxicity: Toxic waste is harmful or fatal when ingested or absorbed. When toxic waste is disposed on land, contaminated liquid may drain

(leach) from the waste and pollute groundwater. Certain chemical waste and heavy metals are examples of potential toxic waste.

5.8 Solid waste management:

Solid waste refers to the range of garbage materials—arising from animal and human activities—that are discarded as unwanted and useless. Waste can be categorized based on material, such as plastic, paper, glass, metal, and organic waste. Categorization may also be based on hazard potential, including radioactive, flammable, infectious, toxic, or non-toxic wastes. Solid waste disposal management is usually referred to the process of collecting and treating solid wastes. It provides solutions for recycling items that do not belong to garbage or trash. Solid waste management can be described as how solid waste can be changed and used as a valuable resource.

Improper disposal of municipal solid waste can create unsanitary conditions, and these conditions in turn lead to pollution of the environment. Diseases can be spread by rodents and insects. The tasks of solid waste disposal management are complex technical challenges. They can also pose a wide variety of economic, administrative and social problems that must be changed and solved.

The term municipal solid waste refers to solid waste from houses, streets and public places, shops, offices, and hospitals. Management of these types of waste is most often the responsibility of municipal or other governmental authorities. Although solid waste from industrial processes is generally not considered municipal waste, it nevertheless needs to be taken into account when dealing with solid waste because it often ends up in the MSW stream.

Solid waste management can be divided into five components:

- a. Generation
- b. Storage
- c. Collection

- d. Transportation
- e. Disposal

An integrated waste management strategy includes three main components:

- 1. Source reduction
- 2. Recycling
- 3. Disposal

Disposal of solid waste is done most commonly through a sanitary landfill or through incineration. A modern sanitary landfill is a depression in an impermeable soil layer that is lined with an impermeable membrane. Even though land filling is an economic alternative for solid waste disposal, it has become increasingly difficult to find suitable land filling sites that are within economic hauling distance and very often citizens do not want landfills in their vicinity. Incineration is the process of burning municipal solid waste in a properly designed furnace under suitable temperature and operating conditions. Incineration is a chemical process in which the combustible portion of the waste is combined with oxygen forming carbon dioxide and water, which are released into the atmosphere. Incineration can reduce the municipal solid waste by about 90 percent in volume and 75 percent in weight. The risks of incineration however involve air quality problems and toxicity and disposal of the fly and bottom ash produced during the incineration process.