Environment and ecology (BOP-355)- UNIT- III

The cause, effects and control measures for air pollution .

Air pollution may be defined as the presence of one or more contaminants like dust, mist, smoke and colour in the atmosphere that are injurious human beings, plants and animals.

1. Rapid industrialization
2. Fast urbanization
3. Rapid growth in population
4. Growth of vehicles on the roads and
5. Activities of human beings have disturbed the natural balance of the atmosphere.

The composition of Air is given below:

Nitrogen 78%
Oxygen 21%
Argon less than 1%
Carbondioxide 0.037%
Water vapour Remaining
Ozone, Helium and ammonia Trace amount

Sources of Air pollution

Sources of air pollution are of two types. Natural sources and artificial sources.

Natural sources of pollution are those that are caused due to natural phenomena. Ex: Volcanic eruptions, Forest fires, Biological decay, Pollengrains, Marshes, Radioactive materials.

Artificial sources are those which are created by man. Ex: Thermal power plants, Vehicular emissions, Fossil fuel burning, agricultural activities etc.

Classification of Air Pollutants Depending on the form of pollutants present in the environment, they are classified as:

1. Primary pollutants and
2. Secondary pollutants

Primary pollutants are those that are directly emitted in the atmosphere in the harmful form Ex: CO, NO, CO2, SO2 etc.

Secondary pollutants are those that are formed by reacting with other components or some basic component of the atmosphere to form new pollutants. Ex: Oxides of Nitrogen (NO2 or NO3) react with moisture in the atmosphere to give Nitric acid.

Indoor air pollutants are primary air pollutants. The most important indoor air pollutant is Radon gas.

Sources of indoor air pollutants are:

1. Radon gas is emitted from building materials like bricks, concrete, tiles, etc that are derived from soil containing radium.
2. Radon is also found in natural gas and ground water and is emitted while being used.
3. Burning fuel in the kitchen and cigarette smoke release pollutants like CO, SO2, HCHO (Formaldehyde) and BAP (Benzo-(A) pyrene).

SOURCES AND COMMON EFFECTS OF COMMON AIR

POLLUTANTS

Carbonmonoxide: It is a colourless, odourless gas that is poisonous for animals. It is formed by incomplete combustion of carbon containing fuels. Source of carbonmonoxide is cigarette smoking and incomplete combustion of fossil fuels (more than 77% comes from motor vehicle exhaust).

Health effects include reduced ability of red blood cells to carry oxygen to body cells and tissues. This leads to headache and anemia. At high levels it causes coma, irreversible brain damage and death.

Nitrogen Dioxide: It is a reddish-brown irritating gas that causes photochemical smog. In the atmosphere, it gets converted into nitric acid (HNO3). It is caused by burning fossil fuels in industries and power plants.

Health effects include lung irritation and damage.

Environmental effects involve acid deposition leading to damage of trees, lakes, soil and ancient monuments. NO2 can damage fabrics.

Sulphur Dioxide: It is a colourless and irritating gas that is formed by combustion of sulphur containing fossil fuels such as coal and oil. In theatmosphere it is converted into Sulphuric acid which is a major component of acid deposition.

Health effects involve breathing problems for healthy people.

Environmental effects involve reduced visibility and acid deposition on trees, lakes, soils and monuments leading to their deterioration and adverse effect on aquatic life.

Suspended Particulate Matter (SPM): Includes a variety of particles and droplets (aerosols) that can be suspended in atmosphere for short to long periods. Human sources for SPM include burning coal in power and industrial units, burning diesel and other fuels in vehicles, agriculture, unpaved roads, construction, etc.

Health effects include nose and throat irritation, lung damage, bronchitis, asthama, reproductive problems and cancer.

Environmental Effects include reduced visibility and acid deposition. Acid deposition may lead to damaged trees, soils and aquatic life in lakes.

Ozone is a highly reactive gas with an unpleasant odour occurring in the stratosphere where it protects mankind fro the harmful ultra-violet rays from the Sun. However on earth, it is a pollutant.It occurs on earth due to reaction between Volatile Organic Compounds (VOCs) and Nitrogen Oxides. It moderates the climate Photochemical smog is a browinsh smoke that frequently forms on clear, sunny days over large cities with significant amounts of automobile traffic.It is mainly due to chemical reactions among nitrogen oxides and hydrocarbons in the presence of sunlight.

Health effects include breathing problems, cough, eye, nose and throat irritation, heart diseases, reduced resistance to colds and pneumonia.

Environmental effects involve damage to plants and trees. Additionally, Smog reduces visibility.

Lead is a solid and highly toxic metal. Its compounds are emitted into the atmosphere as particulate matter.

Human Sources: Paint, Smelters (metal refineries), lead manufacture, storage batteries, leaded petrol, etc

Health effects: Lead accumulates in the body and brain leading to nervous system damage and mental retardation (especially in children), digestive and other health problems. Lead containing chemicals are known to cause cancer in test animals.

Environmental Effects: It can harm wildlife.
Hydrocarbons Lower hydrocarbons accumulate due to decay of vegetable matter.
Human effects: They are carcinogenic
Chromium: It is a solid toxic metal emitted into the atmosphere as particulate matter.
Human sources: Paint, Smelters, Chromium manufacture, Chromium plating.
Health Effects: Perforation of nasal septum, chrome holes, etc.

CONTROL MEASURES

The atmosphere has several built-in self cleaning processes such as dispersion, gravitational settling, flocculation, absorption, rain-washout, etc to cleanse the atmosphere. However, control of contaminants at their source level is a desirable and effective method through preventive or control technologies.

Source control: Some measures that can be adopted in this direction are:

1. Using unleaded petrol
2. Using fuels with low sulphur and ash content
3. Encouraging people to use public transport, walk or use a cycle as opposed to private vehicles
4. Ensure that houses, schools, restaurants and playgrounds are not located on busy streets
5. Plant trees along busy streets as they remove particulates, carbon dioxide and absorb noise
6. Industries and waste disposal sites should be situated outsdide the city preferably on the downwind of the city.
7. Catalytic converters should be used to help control emissions of carbon monoxide and hydrocarbons

Control measures in industrial centers

1. Emission rates should be restricted to permissible levels by each and every industry
2. Incorporation of air pollution control equipment in design of plant layout must be made mandatory
3. Continuous monitoring of the atmosphere for pollutants should be carried out to know the emission levels.

EQUIPMENT USED TO CONTROL AIR POLLUTION

Air pollution can be reduced by adopting the following approaches.

1. Ensuring sufficient supply of oxygen to the combustion chamber and adequate temperature so that the combustion is complete there by eliminating much of the smoke consisting of partly burnt ashes and dust.
2. To use mechanical devices such as scrubbers, cyclones, bag houses and electro-static precipitators in manufacturing processes. The equipment used to remove particulates from the exhaust gases of electric power and industrial plants are shown below. All methods retain hazardous materials that must be disposed safely. Wet scrubber can additionally reduce sulphur dioxide emissions.
3. The air pollutants collected must be carefully disposed. The factory fumes are dealt with chemical treatment.

The cause,effects and control measures for water pollution.

Water pollution can be defined in many ways. Usually, it means one or more substances have built up in water to such an extent that they cause problems for animals or people. Oceans, lakes, rivers, and other inland waters can naturally clean up a certain amount of pollution by dispersing it harmlessly. If you poured a cup of black ink into a river, the ink would quickly disappear into the river's much larger volume of clean water. The ink would still be there in the river, but in

such a low concentration that you would not be able to see it. At such low levels, the chemicals in the ink probably would not present any real problem. However, if you poured gallons of ink into a river every few seconds through a pipe, the river would quickly turn black. The chemicals in the ink could very quickly have an effect on the quality of the water. This, in turn, could affect the health of all the plants, animals, and humans whose lives depend on the river. Thus, water pollution is all about quantities: how much of a polluting substance is released and how big a volume of water it is released into. A small quantity of a toxic chemical may have little impact if it is spilled into the ocean from a ship. But the same amount of the same chemical can have a much bigger impact pumped into a lake or river, where there is less clean water to disperse it. Water pollution almost always means that some damage has been done to an ocean, river, lake, or other water source. A 1971 United Nations report defined ocean pollution as:"The introduction by man, directly or indirectly, of substances or energy into the marine environment (including estuaries) resulting in such deleterious effects as harm to living resources, hazards to human health, hindrance to marine activities, including fishing, impairment of quality for use of sea water and reduction of amenities." Fortunately, Earth is forgiving and damage from water pollution is often reversible.

The main types of water pollution

When we think of Earth's water resources, we think of huge oceans, lakes, and rivers. Water resources like these are called surface waters. The most obvious type of water pollution affects surface waters. For example, a spill from an oil tanker creates an oil slick that can affect a vast area of the ocean. Not all of Earth's water sits on its surface, however. A great deal of water is held in underground rock structures known as aquifers, which we cannot see and seldom think about. Water stored underground in aquifers is known as groundwater. Aquifers feed our rivers and supply much of our drinking water. They too can become polluted, for example, when weed killers used in people's gardens drain into the ground. Groundwater pollution is much less obvious than surface-water pollution, but is no less of a problem. In 1996, a study in Iowa in the United States found that over half the state's groundwater wells were contaminated with weed killers. Surface waters and groundwater are the two types of water resources that pollution affects. There are also two different ways in which pollution can occur. If pollution comes from a single location, such as a discharge pipe attached to a factory, it is known as point-source pollution. Other examples of point source pollution include an oil spill from a tanker, a discharge from a smoke stack (factory chimney), or someone pouring oil from their car down a drain. A great deal of water pollution happens not from one single source but from many different scattered sources. This is called nonpoint-source pollution.

The causes of water pollution

Most water pollution doesn't begin in the water itself. Take the oceans: around 80 percent of ocean pollution enters our seas from the land. Virtually any human activity can have an effect on the quality of our water environment. When farmers fertilize the fields, the chemicals they use are gradually washed by rain into the groundwater or surface waters nearby. Sometimes the causes of water pollution are quite surprising. Chemicals released by smokestacks (chimneys) can enter the atmosphere and then fall back to earth as rain, entering seas, rivers, and lakes and causing water pollution. That's called atmospheric deposition. Water pollution has many different causes and this is one of the reasons why it is such a difficult problem to solve.

Sewage :With billions of people on the planet, disposing of sewage waste is a major problem. According to 2004 figures from the World Health Organization, some 1.1 billion people (16

percent of the world's population) don't have access to safe drinking water, while 2.6 billion (40 percent of the world's population) don't have proper sanitation (hygienic toilet facilities); the position hasn't improved much since. Sewage disposal affects people's immediate environments and leads to water-related illnesses such as diarrhea that kills 3-4 million children each year. (According to the World Health Organization, water-related diseases could kill 135 million people by 2020.) In developed countries, most people have flush toilets that take sewage waste quickly and hygienically away from their homes.

Yet the problem of sewage disposal does not end there. When you flush the toilet, the waste has to go somewhere and, even after it leaves the sewage treatment works, there is still waste to dispose of. Sometimes sewage waste is pumped untreated into the sea. Until the early 1990s, around 5 million tons of sewage was dumped by barge from New York City each year. The population of Britain produces around 300 million gallons of sewage every day, some of it still pumped untreated into the sea through long pipes. The New River that crosses the border from Mexico into California carries with it 20-25 million gallons (76-95 million liters) of raw sewage each day. Even in rich nations, the practice of dumping sewage into the sea continues. In early 2012, it was reported that the tiny island of Guernsey (between Britain and France) has decided to continue dumping 16,000 tons of raw sewage into the sea each day. In theory, sewage is a completely natural substance that should be broken down harmlessly in the environment: 90 percent of sewage is water. In practice, sewage contains all kinds of other chemicals, from the pharmaceutical drugs people take to the paper, plastic, and other wastes they flush down their toilets. When people are sick with viruses, the sewage they produce carries those viruses into the environment. It is possible to catch illnesses such as hepatitis, typhoid, and cholera from river and sea water.

Nutrients Suitably treated and used in moderate quantities, sewage can be a fertilizer: it returns important nutrients to the environment, such as nitrogen and phosphorus, which plants and animals need for growth. The trouble is, sewage is often released in much greater quantities than the natural environment can cope with. Chemical fertilizers used by farmers also add nutrients to the soil, which drain into rivers and seas and add to the fertilizing effect of the sewage. Together, sewage and fertilizers can cause a massive increase in the growth of algae or plankton that overwhelms huge areas of oceans, lakes, or rivers. This is known as a harmful algal bloom (also known as an HAB or red tide, because it can turn the water red). It is harmful because it removes oxygen from the water that kills other forms of life, leading to what is known as a dead zone.

The effects of water pollution

Some people believe pollution is an inescapable result of human activity: they argue that if we want to have factories, cities, ships, cars, oil, and coastal resorts, some degree of pollution is almost certain to result. In other words, pollution is a necessary evil that people must put up with if they want to make progress. Fortunately, not everyone agrees with this view. One reason people have woken up to the problem of pollution is that it brings costs of its own that undermine any economic benefits that come about by polluting. Take oil spills, for example. They can happen if tankers are too poorly built to survive accidents at sea. But the economic benefit of compromising on tanker quality brings an economic cost when an oil spill occurs. The oil can wash up on nearby beaches, devastate the ecosystem, and severely affect tourism. The main problem is that the people who bear the cost of the spill (typically a small coastal community) are not the people who caused the problem in the first place (the people who operate the tanker). Yet, arguably, everyone who puts gasoline (petrol) into their car—or uses almost any kind of

petroleum-fueled transport—contributes to the problem in some way. So oil spills are a problem for everyone, not just people who live by the coast and tanker operates. Sewage is another good example of how pollution can affect us all. Sewage discharged into coastal waters can wash up on beaches and cause a health hazard. People who bathe or surf in the water can fall ill if they swallow polluted water—yet sewage can have other harmful effects too: it can poison shellfish (such as cockles and mussels) that grow near the shore. People who eat poisoned shellfish risk suffering from an acute—and sometimes fatal—illness called paralytic shellfish poisoning. Shellfish is no longer caught along many shores because it is simply too polluted with sewage or toxic chemical wastes that have discharged from the land nearby.

How can we stop water pollution?

There is no easy way to solve water pollution; if there were, it wouldn't be so much of a problem. Broadly speaking, there are three different things that can help to tackle the problem—education, laws, and economics—and they work together as a team.

Education

Making people aware of the problem is the first step to solving it. In the early 1990s, when surfers in Britain grew tired of catching illnesses from water polluted with sewage, they formed a group called Surfers Against Sewage to force governments and water companies to clean up their act. People who've grown tired of walking the world's polluted beaches often band together to organize community beach-cleaning sessions. Anglers who no longer catch so many fish have campaigned for tougher penalties against factories that pour pollution into our rivers. Greater public awareness can make a positive difference.

Laws

One of the biggest problems with water pollution is its transboundary nature. Many rivers cross countries, while seas span whole continents. Pollution discharged by factories in one country with poor environmental standards can cause problems in neighboring nations, even when they have tougher laws and higher standards. Environmental laws can make it tougher for people to pollute, but to be really effective they have to operate across national and international borders. This is why we have international laws governing the oceans, such as the 1982 UN Convention on the Law of the Sea (signed by over 120 nations), the 1972 London (Dumping) Convention, the 1978 MARPOL International Convention for the Prevention of Pollution from Ships.

The cause, effects and control measures for soil pollution.

When we talk about air or water pollution, the reactions garnered are stronger. This is because we can see the effects caused by the pollutants and their extent very clearly. It is normal human psychology to believe in what you see first hand. Our land on the other hand is living a nightmare too. We may not be able to see the effects with clarity, but land is being polluted and abused constantly and we are unable to calculate the damages incurred. Land Pollution has come to become one of the serious concerns that we collectively battle. Land pollution, in other words, means degradation or destruction of earth’s surface and soil, directly or indirectly as a result of human activities. Anthropogenic activities are conducted citing development, and the same affects the land drastically, we witness land pollution; by drastic we are referring to any activity that lessens the quality and/or productivity of the land as an ideal place for agriculture, forestation, construction etc. The degradation of land that could be used constructively in other words is land pollution. Land Pollution has led to a series of issues that we have come to

realize in recent times, after decades of neglect. The increasing numbers of barren land plots and the decreasing numbers of forest cover is at an alarming ratio. Moreover the extension of cities and towns due to increasing population is leading to further exploitation of the land. Land fills and reclamations are being planned and executed to meet the increased demand of lands. This leads to further deterioration of land, and pollution caused by the land fill contents. Also due to the lack of green cover, the land gets affected in several ways like soil erosion occurs washing away the fertile portions of the land. Or even a landslide can be seen as an example.

Causes of Land Pollution

Below are the sources of land pollution:

1. Deforestation and soil erosion: Deforestation carried out to create dry lands is one of the major concerns. Land that is once converted into a dry or barren land, can never be made fertile again, whatever the magnitude of measures to redeem it are. Land conversion, meaning the alteration or modification of the original properties of the land to make it use-worthy for a specific purpose is another major cause. This hampers the land immensely. Also there is a constant waste of land. Unused available landover the years turns barren; this land then cannot be used. So in search of more land, potent land is hunted and its indigenous state is compromised with.
2. Agricultural activities: With growing human population, demand for food has increased considerably. Farmers often use highly toxic fertilizers and pesticides to get rid off insects, fungi and bacteria from their crops. However with the overuse of these chemicals, they result in contamination and poisoning of soil.
3. Mining activities: During extraction and mining activities, several land spaces are created beneath the surface. We constant hear about land caving in; this is nothing but nature's way of filling the spaces left out after mining or extraction activity.
4. Overcrowded landfills: Each household produces tonnes of garbage each year. Garbage like aluminum, plastic, paper, cloth, wood is collected and sent to the local recycling unit. Items that can not be recycled become a part of the landfills that hampers the beauty of the city and cause land pollution.
5. Industrialization: Due to increase in demand for food, shelter and house, more goods are produced. This resulted in creation of more waste that needs to be disposed of. To meet the demand of the growing population, more industries were developed which led to deforestation. Research and development paved the way for modern fertilizers and chemicals that were highly toxic and led to soil contamination.
6. Construction activities: Due to urbanization, large amount of construction activities are taking place which has resulted in large waste articles like wood, metal, bricks, plastic that can be seen by naked eyes outside any building or office which is under construction.
7. Nuclear waste: Nuclear plants can produce huge amount of energy through nuclear fission and fusion. The left over radioactive material contains harmful and toxic chemicals that can affect human health. They are dumped beneath the earth to avoid any casualty.
8. Sewage treatment: Large amount of solid waste is leftover once the sewage has been treated. The leftover material is sent to landfill site which end up in polluting the environment.

Effects of Land Pollution

1. Soil pollution: Soil pollution is another form of land pollution, where the upper layer of the soil is damaged. This is caused by the overuse of chemical fertilizers, soil erosion caused by running water and other pest control measures; this leads to loss of fertile land for agriculture, forest cover, fodder patches for grazing etc.

2. Change in climate patterns: The effects of land pollution are very hazardous and can lead to the loss of ecosystems. When land is polluted, it directly or indirectly affects the climate patterns.
3. Environmental Impact: When deforestation is committed, the tree cover is compromised on. This leads to a steep imbalance in the rain cycle. A disturbed rain cycle affects a lot of factors. To begin with, the green cover is reduced. Trees and plants help balance the atmosphere, without them we are subjected to various concerns like Global warming, the green house effect, irregular rainfall and flash floods among other imbalances.
4. Effect on human health: The land when contaminated with toxic chemicals and pesticides lead to problem of skin cancer and human respiratory system. The toxic chemicals can reach our body through foods and vegetables that we eat as they are grown in polluted soil.
5. Cause Air pollution: Landfills across the city keep on growing due to increase in waste and are later burned which leads to air pollution. They become home for rodents, mice etc which in turn transmit diseases.
6. Distraction for Tourist: The city looses its attraction as tourist destination as landfills do not look good when you move around the city. It leads to loss of revenue for the state government.
7. Effect on wildlife: The animal kingdom has suffered mostly in the past decades. They face a serious threat with regards to loss of habitat and natural environment. The constant human activity on land, is leaving it polluted; forcing these species to move further away and adapt to new regions or die trying to adjust. Several species are pushed to the verge of extinction, due to no homeland. Other issues that we face include increased temperature, unseasonal weather activity, acid rains etc. The discharge of chemicals on land, makes it dangerous for the ecosystem too. These chemicals are consumed by the animals and plants and thereby make their way in the ecosystem. This process is called bio magnification and is a serious threat to the ecology.

Solutions for Land Pollution

1. Make people aware about the concept of Reduce, Recycle and Reuse.
2. Reduce the use of pesticides and fertilizers in agricultural activities.
3. Avoid buying packages items as they will lead to garbage and end up in landfill site.
4. Ensure that you do not litter on the ground and do proper disposal of garbage.
5. Buy biodegradable products.
6. Do Organic gardening and eat organic food that will be grown without the use of pesticides.
7. Create dumping ground away from residential areas.

The cause, effects and control measures for marine pollution

Marine pollution is defined as the introduction of substances to the marine environment directly or indirectly by man resulting in adverse effects such as hazardous to human health, obstruction of marine activities and lowering the quality of sea water.

Sources of Marine Pollution:

a. Municipal waste and sewage from residences and hotels in coastal towns are directly discharged into sea.
b. Pesticides and fertilizers from agriculture which are washed off by rain enter water courses and finally to sea. India is estimated to use 55,000 tons of pesticides annually and about 25 percent of it is carried to-ocean.
c. Petroleum and oil washed off from roads normally enter sewage system and finally into seas.
d. Ship accidents and accidental spillage at sea can therefore be very damaging to the marine environment.
e. Off shore oil exploration also pollute the sea water to a large extent,

f. Dry docking: All ships periodic dry docking servicing; cleaning the hulls etc. During this period when cargo compartments are emptied, residual oil goes into sea.
g. Pollution due to organic wastes: When O2 concentration falls 1.5 mg/L, the rate of aerobic oxidants reduced and replaced by the anaerobic bacteria that can oxidize the organic molecules without the use of oxygen.
h. Pollution due to oil: Crude oil is transported by sea after a tanker has unloaded its cargo of oil; it has to take on sea water ballast for return journey. This ballast water is stored in cargo compartments that previously contained oil. During unloading of cargo certain amount of oil remains clinging to the walls of container and this may amount to 800t in a 200,000t tankers. The ballast water thus contaminated with oil. When fresh crag of oil is to be loaded these compartments are clean with water which discharges the dirty ballast along with oil into sea.
i. Tanker accidents: In the natural process, a large no. of oil tanker accidents happens every year. Sometimes this can results in major disasters.
j. Volcanic eruptions in the sea.
k. Deep sea mining is a relatively new mineral retrieval process that takes place on the ocean floor. Ocean mining sites are usually done at about1,400 – 3,700 meters below the ocean's surface. The vents create sulfide deposits, which contain precious metals such as silver, gold, copper, manganese, cobalt, and zinc. These raise questions about environment damage to surrounding areas. Removal of parts of the sea floor will result in disturbances to the benthic layer, and habitat of benthic organisms.
Beside from direct impact of mining the area, leakage, spills and corrosion would alter the mining area's chemical makeup.

Effects of Marine Pollution:

a. 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.
b. Commercially important marine species are also killed due to clogging of gills and other structures.
c. When oil is spilled on the sea, it spreads over the surface of the water to form a thin film called as oil slick. This damages marine life to a large extent. Commercial damage to fish by tainting which gives unpleasant flavor to fish and sea food reduces market values of sea food and causes death of birds through its effect on feathers. Birds often clean their plumage by pruning and in the process consume oil which can lead to intestinal, renal and liver failure.
d. For salt marshy plants oil slick can affect the flowering, fruiting and germination.
e. 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.
f. The coral reefs are the productive ecosystems offer many benefits to people.
g. Drill cuttings dumped on the seabed result in the production of toxic sulphides in the bottom sediment thus eliminating the benthic fauna.

Control Measures of Marine Pollution:

a. Introduction of sewage treatment plants to reduce BOD of final product before discharging into sea.

b. Cleaning oil from surface waters and contaminated beaches can be accelerated through the use of chemical dispersants which can be sprayed on the oil.
c. Load on top system reduce oil pollution cleaned with high pressures jets of water.
d. Crude oil washing: The clingage is removed by jets of crude oil while the cargo is being unloaded.
e. Skimming off the oil surface with a section device.
f. Spreading a high density powder over the oil spill, so that oil can I be sunk to the bottom.

Noise pollution - Causes, types, effects and control of noise pollution
Noise pollution
Noise is defined as, "the unwanted, unpleasant or disagreeable sound that causes discomfort to all living beings". Sound intensity is measured in decibels (dB), that is the tenth part of the longest unit Bel. One dB is the faintest sound that a human ear can hear.

TYPES OF NOISE: Environmental noise has been doubling every ten years. Noise is classified as:
1. Industrial Noise
2. Transport Noise and
3. Neighbourhood noise

Industrial Noise: It is sound with a high intensity sound caused by industry machines. Sources of such noise pollution is caused by machines from machines in various factories, industries and mills. Noise from mechanical saws and pneumatic drills is unbearable and a nuisance to the public.
The Indian Institute of Oto-Rino Laryngology, Chennai reported that increasing industrial pollution damages the hearing ability by atleast 20%.
Workers in steel industry, who work close to heavy industrial blowers are exposed to 112dB for eight hours suffer from occupational pollution.

Transport Noise: Transport noise mainly consists of traffic noise from road, rail and aircraft. The number of automobiles on roads like motors, scooters, cars, motor cycles, buses, trucks and diesel engine vehicles have increased enormously in the recent past further aggravating the problem of transport noise.
Noise levels in most residential areas in metropolitan cities is hovering around the border line due to increased vehicular noise pollution. This high level of noise pollution leads to deafening in the elderly.

Neighbourhood noise: This type of noise includes disturbance from household gadgets and community. Common sources being musical instruments, TV, VCR, Radios, Transistors, Telephones, and loudspeakers etc. Statistically, ever since the industrial revolution, noise in the environment has been doubling every ten years.

Effects of Noise pollution
1. Noise pollution affects both human and animal health. It leads to:
1. contraction of blood vessels
2. making skin pale

3. excessive adrenalin in the blood stream which is responsible for high blood pressure.
4. Blaring sounds are known to cause mental distress
5. Heart attacks, neurological problems, birth defects and abortion
2. Muscle contraction leading to nervous breakdown, tension, etc
3. The adverse reactions are coupled with a change in hormone content of blood, which in-turn increases heart beat, constriction of blood vessels, digestive spams and dilation of the pupil of the eye.
4. Adverse affects health, work efficiency and behaviour. Noise pollution may cause damage to the heart, brain, kidneys, liver and may produce emotional disturbance.
5. The most immediate and acute effect of noise is impairment of hearing that diminishes some part of the auditory system. Prolonged exposure to noise of certain frequency pattern leads to chronic damage to the inner ear.
6. Impulsive noise may cause psychological and pathological disorders
7. Ultrasonic sound can affect the digestive, respiratory, cardiovascular system and semicircular canals of the internal ear.
8. The brain is adversely affected by loud and sudden noise by jets and airplanes. People are subjected to psychiatric illness.
9. Recent reports suggest that blood is thickened by excessive noise.
10. The optical system of human beings is also affected by noise pollution. Severe noise pollution causes:
1. Pupullary dilation
2. Impairment of night vision and
3. Decrease in rate of colour perception

Control measures:

1. SOURCE CONTROL: This includes source modification such as acoustic treatment to machine surface, design changes, limiting operational timings, etc
2. TRANSMISSION PATH INTERVENTION: This includes containing the source inside a sound insulating enclosure, constructing a noise barrier or provision of sound absorbing materials along the path.
3. RECEPTOR CONTROL: This includes protection of the receiver by altering the work schedule or provision of personal protection devices such as ear plugs for operating noisy machinery. The measure may include dissipation and deflection methods.
4. OILING: Proper oiling will reduce noise from the machine.

Preventive measures:

1. Prescribing noise limits for vehicular traffic
2. Ban on honking (usage of horns) in certain areas
3. Creation of silence zones near schools and hospitals
4. Redesigning buildings to make them noise proof
5. Reduction of traffic density in residential areas
6. Giving preference to mass public transport system.

Thermal pollution - causes, effects and control measures of thermal pollution

Thermal pollution

Thermal pollution is defined as the addition of excess of undesirable heat to water thereby making it harmful to man, animal or aquatic life. Thermal pollution may also cause significant departures from nor activities of aquatic communities.

Sources of Thermal Pollution:
The following sources contribute to thermal pollution.

1. Nuclear power plants
2. Coal fired plants
3. Industrial effluents
4. Domestic sewage
5. Hydro-electric power

1. Nuclear power plants: Nuclear power plants including drainage from hospitals, research institutions, nuclear experiments and explosions, discharge a lot of heat that is not utilized along with traces of toxic radio nuclides into nearby water streams. Emissions from nuclear reactors and processing installations are also responsible for increasing the temperatures of water bodies. The operations of power reactors and nuclear fuel processing units constitutes the major contributor of heat in the aquatic environment. Heated effluents from power plants are discharged at 10 C higher than the receiving waters that affects the aquatic flora and fauna.
2. Coal-fired power plants: Coal fired power plants constitute a major source of thermal pollution. The condenser coils in such plants are cooled with water from nearby lakes or rivers. The resulting heated water is discharged into streams thereby raising the water temperature by 15C. Heated effluent decreases the dissolved content of water resulting in death of fish and other aquatic organisms. The sudden fluctuation of temperature also leads to "thermal shock" killing aquatic life that have become acclimatized to living in a steady temperature.
3. Industrial effluents: Industries like textile, paper, pulp and sugar manufacturing release huge amounts of cooling water along with effluents into nearby natural water bodies. The waters polluted by sudden and heavy organic loads result in severe drop in levels of dissolved oxygen leading to death of several aquatic organisms.
4. Domestic Sewage: Domestic sewage is discharged into rivers, lakes, canals or streams with minimal treatment or without any treatment. These wastes have a higher organic temperature and organic load. This leads to decrease in dissolved oxygen content in the receiving waters resulting in the set-up of anaerobic conditions causing release of foul and offensive gases in water. Eventually, this leads to development of anoxic conditions resulting in rapid death of aquatic organisms.
5. Hydro-electric power: Generation of hydroelectric power sometimes leads to negative thermal loading in water systems. Apart from electric power industries, various factories with cooling requirement contribute to thermal loading.

Thermal pollution in streams by human activities

1. Industries and power plants use water to cool machinery and discharge the warm water into a stream
2. Stream temperature rises when trees and tall vegetation providing shade are cut.
3. Soil erosion caused due to construction also leads to thermal pollution
4. Removal of stream side vegetation
5. Poor farming Practices also lead to thermal polloution

Effects of Thermal pollution

1. Reduction in dissolved oxygen: Concentration of Dissolved Oxygen (DO) decreases with increase in temperature.

2. Increase in toxicity: The rising temperature increases the toxicity of the poison present in water. A 10C increase in temperature of water doubles the toxicity effect of potassium cyanide, while 80C rise in temperature triples the toxic effects of o-xylene causing massive mortality to fish.
3. Interference in biological activity: Temperature is considered to be of vital significance to physiology, metabolism and biochemical processes that control respiratory rates, digestion, excretion, and overall development of aquatic organisms. Temperature changes cause total disruption to the entire ecosystem.
4. Interference in reproduction: In fishes, several activities like nest building, spawning,hatching, migration and reproduction depend on optimum temperature.
5. Direct mortality: Thermal pollution is directly responsible for mortality of aquatic organisms. Increase in temperature of water leads to exhaustion of microorganisms thereby shortening the life span of fish. Above a certain temperature, fish die due to failure of respiratory system and nervous system failure.
6. Food storage for fish: Abrupt changes in temperature alters the seasonal variation in the type and abundance of lower organisms leading to shortage of right food for fish at the right time.

Control measures for thermal pollution

The following methods can be adapted to control high temperature caused by thermal discharges:
1. Cooling towers: Use of water from water systems for cooling systems for cooling purposes, with subsequent return to the water way after passage through a condenser, is called cooling process. Cooling towers transfer heat from hot water to the atmosphere by evaporation. Cooling towers are of two types:
(i) Wet cooling tower: Hot water coming out from the condenser (reactor) is allowed to spray over baffles. Cool air, with high velocity, is passed from sides, which takes away the heat and cools the water.
(ii) Dry cooling tower: Here, hot water is allowed to flow in long spiral pipes. Cool air with the help of a fan is passed over these hot pipes, which cools down hot water. This cool water can be recycled.
2. Cooling ponds: Cooling ponds are the best way to cool thermal discharges. Heated effluents on the surface of the water in cooling ponds maximise dissipation of heat to the atmosphere and minimise the water area and volume. The warm water wedhe acts like a cooling pond.
3. Spray ponds: The water coming out from condensers is allowed to pass into the ponds through sprayers. Here water is sprayed through nozzles as fine droplets. Heat from the fine droplets gets dissipated to the atmosphere.
4. Artificial lakes: Artificial lakes are man made water bodies that offer once-through cooling. The heated effluents can be discharged into the lake at one end and water for cooling purposes may be withdrawn from the other end. The heat is eventually dissipated through evaporation.

Nuclear Pollution: Sources, Effects and Control

Radionuclides are elements (uranium 235, uranium 283, thorium 232, potassium 40, radium 226, carbon 14 etc.) with unstable atomic nuclei and on decomposition release ionizing radiations in the form of alpha, beta and gamma rays.

Out of the known 450 radioisotopes only some are of environmental concern like strontium 90, tritium, plutonium 239, argon 41, cobalt 60, cesium 137, iodine 131, krypton 85 etc. 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. The U.S. Environmental Protection Agency standard for permissible levels of tritium in drinking water is 20,000 picocuries per litre.

Nuclear power plants routinely and accidentally release tritium into the air and water. Tritium has a half-life of 12.3 years and emits radioactive beta particles. Once tritium is inhaled or swallowed, its beta particles can bombard cells causing a mutation.

Few occupations that involve radioactive exposures are uranium mineworkers, radium watch dial painters, technical staff at nuclear power plants, etc. Exposure to radioactive and nuclear hazards has been clinically proven to cause cancer, mutations and teratogenesis (Teratogenesis is a prenatal toxicity characterized by structural or functional defects in the developing embryo or fetus).

Nuclear hazard effects can be either initial or residual. Initial effects occur in the immediate area of explosion and are hazardous immediately after the explosion where as the residual effects can last for days or years and cause death. The principal initial effects are blast and radiation.

Blast causes damage to lungs, ruptures eardrums, collapses structures and causes immediate death or injury. Thermal Radiation is the heat and light radiation, which a nuclear explosion's fireball emits producing extensive fires, skin burns, and flash blindness. Nuclear radiation consists of intense gamma rays and neutrons produced during the first minute after the explosion.

This radiation causes extensive damage to cells throughout the body. Radiation damage may cause headaches, nausea, vomiting, diarrhea, and even death, depending on the radiation dose received.

Sources of Nuclear Pollution:

The sources of radioactivity include both natural and manmade.

Effects of Nuclear Pollution:

Studies have shown that the health effects due to radiation are dependent on the level of dose, kind of radiation, duration of exposure and types of cells irradiated. Radiation effects can be somatic or genetic.

1. Somatic effects:
Somatic effects the function of cells and organs. It causes damages to cell membranes, mitochondria and cell nuclei resulting in abnormal cell functions, cell division, growth and death.
2. Genetic effects:
Genetic effects the future generations. Radiations can cause mutations, which are changes in genetic makeup of cells. These effects are mainly due to the damages to DNA molecules. People suffer from blood cancer and bone cancer if exposed to doses around 100 to 1000 roentgens. Instantaneous deaths on exposure in the event if disasters are many.
Management of Radioactive Waste:
a. The radioactive waste which comes out from industry, nuclear reactors should be stored and allowed to decay either naturally in closed drums or in very large underground air tight cemented tanks (Delay and Decay).
b. The intermediate radioactive waste should be disposed off into the environment after diluting it with some inert materials (Dilute and Disperse)
c. Now-a-days small quantities of high activity wastes are converted into solids such as concrete and then it is buried underground or sea. (Concentrate and contain)
Control Measures:
a. Laboratory generated nuclear wastes should be disposed off safely and scientifically.
b. Nuclear power plants should be located in areas after careful study of the geology of the area, tectonic activity and meeting other established conditions.
c. Appropriate protection against occupational exposure.
d. Leakage of radioactive elements from nuclear reactors, careless use of radioactive elements as fuel and careless handling of radioactive isotopes must be prevented.
e. Safety measure against accidental release of radioactive elements must be ensured in nuclear plants.
f. Unless absolutely necessary, one should not frequently go for diagnosis by x-rays.
g. Regular monitoring of the presence of radioactive substance in high risk area should be ensured.
Among the many options for waste disposal, the scientists prefer to bury the waste in hundreds of meters deep in the earth's crust is considered to be the best safety long term option.