POLLUTION

Pollution refers to the various ways in which the environment (air, water, and land) is contaminated and made impure and unfit for use by man, animals and other living organisms. It may also be used to mean the destruction and reduction of the chemical and biological value of the environment.

It can be caused by both natural processes such as volcanic eruptions, soil erosion, earth quakes, landslides, accumulation of salt crystals in dry areas and dust particles in the atmosphere as well as due to man's activities.

Pollutants are of two types;

Bio-degradable which are waste materials that can be broken down by biological processes such as sewage, agriculture residues and garbage.

Non bio-degradable which are pollutants that cannot be broken down easily by biological processes hence can take a long period within the environment such as polythene bags, metals, plastic materials and broken bottles.

Pollution is categorized into 4 and that is **land, water, air and noise.**

AIR POLLUTION (ATMOSPHERIC)

This occurs when toxic gases are emitted into the atmosphere either from industries, urban areas or on farmland.

CAUSES OF AIR POLLUTION

Physical causes of air pollution include;

1. Volcanic eruptions also contribute to air pollution as they release a lot of dust and Sulphurous compounds into the atmosphere. These lead to a reduction of sunlight by the accumulated atmospheric dust rising atmospheric temperatures. This was evidenced from eruptions of Mt. Pinatubo in the Philippines, Mt. Etna in Italy as well as Nyamulagira and Nyirangongo in Congo.
2. Strong winds especially in desert and semi-arid areas cause dust storms mixing with the air hence atmospheric pollution. These are common in the Sahara, Namib-Kalahari and Sahel region, in countries like Sudan, Chad, Niger, Egypt and Libya.

Other causes include;

3. Burning of fossil fuels such as coal, petroleum and natural gas in industrial processes releases large quantities of pollutant toxic gases such as sulphur oxides and Chloro-fluoro

hydrocarbons (containing carbon, fluorine and chlorine). This is one of the major causes of smog in major industrial regions of the world such as Japan, Germany, New York and the United States of America.

4. Use of automobiles such as vehicles and motorcycles release unburnt exhaust fumes which is a combination of carbon monoxide and carbon dioxide polluting the atmosphere. It is one of the major causes of atmospheric pollution in large cities like New York, Shanghai, New Delhi, Tokyo, Los Angeles, London, Kampala, Nairobi affecting man and other living organisms.
5. The testing and use of atomic and nuclear weapons in modern warfare by super states such as France, China, Korea, Russia, Japan, and United States of America lead to the release of radioactive waves which affect the atmosphere. In Japan, the bombing of Hiroshima and Nagasaki during World War 2 led to severe air pollution, the effects of which are still being felt with babies being born without some limbs.
6. Burning of vegetation and accidental forest fires release large amounts of smoke and increase the concentration of Carbon dioxide into the atmosphere polluting the air. This is common in pastoral societies such as the Fulani, Karamojongs and among shifting cultivators such as the Azande in Congo forest and Bemba in Zambia. In British Columbia, Mexico and Brazil forest fires are responsible for about 8% of total pollutants in air.
7. The dumping and burning of untreated wastes in large urban centres such as garbage, kitchen refuse, industrial effluents as well as faecal matter results in emission of fowl smells which pollute the air. This is common in slum areas and industrial areas with meat packing plants, fish canaries and paper mills such as Soweto in South Africa, Katanga in Uganda, along the coast of West Africa in Abidjan (Cote D'ivoire).
8. Industries and industrial kilns release toxic gases (sulphur dioxide and Carbon dioxide) into the atmosphere through chimneys that are elected causing smog in most industrialized nations. These not only disrupt the equilibrium of atmospheric gases but also destroy the ozone layer leading to a rise in atmospheric temperatures affecting the environment.
9. The use of chemicals on farm lands to control pests and diseases has also led to air pollution. Such chemicals include Dichlorodiphenyltrichloroethane (D.D.T) used in overhead spraying of locusts leave chemical compounds in the atmosphere. Fertilizers applied in the fields also give off nitrogen oxide, a pollutant gas which leads to decomposition of the ozone layer.
10. Removal of vegetation cover in dry areas gives way for air pollution due to over grazing of pasture lands and over cultivation of arable lands. The ground is left bare and thus vulnerable to wind erosion. This has resulted in dusty air and dirty rain water. This is seen in Oklahoma State, California in United States of America and the sand dunes of the Sahara and Arabia deserts where ''dust bowels'' are common.
11. Accidental leakages of radioactive elements from nuclear power plants due to cooling system failures are responsible for contaminating the air. These were evidenced near Kiev in Ukraine and in the city of Kamenogorsk in Kazakhstan Central Asia.
12. Refrigeration plants and dry cleaners also produce Chlorofluoromethane (Freon 31) which are used as solvents in industries and as aerosol propellants. When these react with ultra violet radiation, they decompose and release a free halogen (set of five chemical elements

for example Fluorine, Chlorine, Iodine, and Bromine) which pollutes air weakening the ozone layer.

EFFECTS OF AIR POLLUTION

1. It has led to the formation of acid rain. The burning of fossil fuels causes high levels of Sulphur and Nitrogen in the air and when these combine with atmospheric water vapour, they form acids such as sulphuric acid which fall as rainfall. This acid rain destroys buildings, soils and affects man, plants and other living organisms. It is commonly received in India, China, Japan and United States of America.
2. Chlorofluoro Carbons, Carbon dioxide and Carbon monoxide emitted in the atmosphere react with and destroy the ozone layer. This enables dangerous solar radiations reach the surface of the earth as well as trap heat within the lower layers of the atmosphere leading to global warming. This leads to de-glaciation of polar ice and mountain snow caps, loss of vegetation cover, loss of ground water due to prolonged drought.
3. Smog and accumulation of solid particles in air reduce the visibility and natural beauty of the atmosphere accounting for increased air, road and marine accidents in industrial cities such as Tokyo, New York, Washington, New Delhi and Shanghai. It has also discouraged the growth of the tourism industry. Summer tourists to Washington DC cannot see the Washington monument because of the yellowish haze produced by polluted air.
4. The concentration of radioactive substances in air due to the use of nuclear weapons has greatly affected the local communities. Chemical weapons used in Iraq, Vietnam, India, Libya, Japan have affects to date of children born with missing limbs, ears and noses.
5. Air pollution also leads to increased air borne diseases that could cause death. These include asthma, lung cancer, Tuberculosis, bronchitis, pneumonia and skin diseases common in large cities with industrial concentration. In New York, Los Angeles, London and Tokyo, many people were treated of burning throats and smarting eyes while in London, many died of smog.
6. Air pollution reduces availability of fresh air safe enough for human respiration especially in countries like India, China and Japan. This results into health complications especially respiratory diseases.
7. Highly polluted air causes wilting and death in plants due to limited fresh air and increased temperatures. In Japan, trees and shrubs in the gardens of the Imperial palace dried due to polluted air.
8. Limestone emissions and sulphurous gases discharged into the atmosphere react with corrugated iron sheets, corroding them affecting the life span of buildings and machinery. Plastic containers and rubber parts in neighbourhoods are disfigured, discoloured and sometimes cracked.

SOLUTIONS/ MEASURES OF CONTROLLING AIR POLLUTION

1. Change from traditional sources of energy such as coal, petroleum and firewood that give off large quantities of smoke to environmentally friendly sources such as wind energy, solar, biogas, Hydro Electric Power, natural gas that do not emit smoke.
2. New innovations on motor vehicles, aeroplanes and motorcycles have come out to control pollution. Some vehicles are using Nitrogen gas such as a **CoolN2car**, electricity such as the **Volkswagen ID.4**, **Kia Niro EV** and **Tesla model 3** water such as the **Water car Panther**, motorcycles using batteries such as the **Zembo** and aeroplanes are using solar energy such as the **Solar impulse 2** reducing the amount of exhaust fumes emitted in the atmosphere.
3. Elongated chimneys have been constructed in the higher levels of the atmosphere in a bid to protect surrounding areas from the immediate effects of pollution.
4. International campaigns have spread to various countries calling for inter-regional and international cooperation with the help of the United Nations to fight pollution and global warming in general. A case in point is the Kyoto treaty in Japan.
5. Improvement in the levels of technology with the view of increasing industrial efficiency in combustion in order to minimize incidents of some combustion gases being emitted. Besides car engines can also be redesigned and exhaust systems to ensure further combustion.
6. Encourage treatment of industrial wastes before being released into the atmosphere to control the levels of pollution.
7. Encourage afforestation and re-afforestation in the industrialised cities so that these can absorb the dangerous greenhouse gases such as Carbon dioxide, preventing increase in temperatures.

WATER POLLUTION

Water pollution occurs when toxic substances are released into both surface and underground water sources contaminating them and making them unsafe for human use and other activities.

CAUSES OF WATER POLLUTION

Physical causes include the following;

1. The invasion of water ways by the water weed, the hyacinth and sudd chock them destroying the breeding grounds for fish, reducing the amount of Oxygen for other aquatic organisms, produce foul smell on decomposing in water and also hinders navigation. This is so in Benin, Nigeria and lakes on Lake Victoria, Albert, and Kyoga in Uganda as well as on River Nile.
2. River deposition also causes water pollution through its various stages of erosion by tributaries that deposit sediments usually fine sand and soils causing silting of lakes, rivers, oceans and seas. These destroy breeding grounds for fish, make the water dirty and unfit for human use and also reduce the storage capacity of lake basins. River Niger pollutes the Atlantic Ocean, the Nile, the Mediterranean Sea and Lake Victoria.

3. Natural calamities such as earthquakes, landslides, volcanic eruptions and floods lead to deposition of rock and soil particles as well as flow of magma into water bodies polluting them affecting man and marine life. In 2011 in Japan, an earthquake damaged the Fukushima nuclear plant releasing radioactive substances into the water the effects of which are still being felt to date.

Other causes include;

4. Agricultural fertilizers used to maintain and improve soil fertility in both developed and developing countries have contributed to water pollution in that when these get into contact with rain water, they dissolve into the deeper layers of soil contaminating underground water sources. Besides, where agriculture is done along river banks, lake shores, the chemicals easily find their way in the open surface water bodies contaminating them. Such chemicals include NPK (a combination of Nitrogen, Phosphorous and Potassium) fertilizers and DDT (Dichlorodiphenyltrichloroethane).
5. Dumping of industrial wastes into water bodies is common especially for those industries located near rivers, lakes and coastal areas. Such pollutants include semi-burnt fuels and solid wastes, dyes, salts, acids and bleaches from textile and paper mills, cyanide and chromium. The Great lakes in United States of America, Rhine, Ruhr, Nile, Thanes in Britain, Ganges in India, Niger delta in Nigeria, Lake Victoria in Uganda, and Lake Baikal in Russia are all heavily polluted by industrial effluents.
6. In large urban cities towns and municipalities, dumping of sewage, machinery, plastics and polythene is commonly done in open water surfaces such as lakes, rivers, streams and in fishing communities without permanent toilets, water sources are used. Animal wastes are also dumped in water bodies especially from meat packing plants and fish factories hence contaminating and affecting the quality of water. This is common in United States of America, Netherlands, France, Germany, and Britain where factory farming is common. In the Nile delta in Egypt, Sudan, shores of Lake Victoria and Manila in Philippines.
7. Leakages of petroleum from oil tankers, motor boat engines, sub marines, oil field blow outs and off-shore refineries create floating layers of oil on water bodies making them unfit for use. This also affects aquatic life often leading to its death. This is common on the Atlantic and Pacific oceans. An example is when a Russian tanker raptured near Mikuni town on the Sea of Japan leading to the death of crabs and fish.
8. Testing nuclear weapons in the world's major water bodies such as the Indian ocean, Pacific, Atlantic, Sea of Japan and North Sea done by countries such as North Korea, Japan, China, France, India, Pakistan, United States of America, Russia contaminates water with radioactive substances like the isotopes of Krypton 85 and Uranium 235 & 236 affecting fishing communities.
9. The use of pesticides, insecticides and herbicides to fight weeds, diseases and pests such as tsetse flies, caterpillars, locusts and mosquitoes result in both surface and underground water pollution when it rains. In other circumstances, burnt oil is used on open water as a

way of controlling mosquito breeding places hence polluting them affecting other aquatic organisms.

10. The use of proper methods of fishing such as fish poisoning in an attempt to catch more fish is commonly used in developing countries such as India. These chemicals pollute the water affecting its quality, man and marine animals.
11. Leakages from sewage systems especially clogged sewers (sewage pipes) and pit latrines located near swamps and water systems lead to water pollution. When sewage water leaks into the surrounding soil, it contaminates wells and water springs.

EFFECTS OF WATER POLLUTION

1. Water pollution causes several water borne diseases such as cholera, typhoid, meningitis, hepatitis A and E, dysentery, bilharzia that if not treated early can cause deaths. This has caused deaths in Uganda, Congo, Sudan, Jamaica and Haiti.
2. Pollution reduces the quality and quantity of water from springs, boreholes, rivers and lakes for both domestic use for drinking, bathing, and cooking, washing and industrial purposes. In the Great lakes region of North America 44% of all surface water is unfit for domestic use. The River Rhine in Europe is equally not safe, so is Lake Victoria, New Delhi, New York and London.
3. Pollution raises the cost of water treatment especially in urban and industrial settings as it requires the use of expensive chemicals and modern technology to purify the polluted water. It is expensive to eliminate toxic chemicals, bad odours and tastes. This has risen the cost of using safe piped water and has also affected the development of other sectors such as agriculture and industries. Countries like India, China, United States of America and Germany incur high costs of water treatment.
4. Water pollution through oil spills and industrial chemicals destroy breeding grounds for fish, reduce oxygen supply and interfere with plankton growth, poison fish and other marine animals causing their death and migration to safer water bodies. This has been evidenced in River Rhine, Thanes, River St. Lawrence and the Great Lakes, Niger, Atlantic Ocean and River Nile. This has affected the development of fishing industries.
5. It contributed to unemployment especially for fishing communities near lakes and rivers sides due to reduced number of fish stock. This affects the income earned hence poor standards of living of the people. This was seen in Columbia on River Magdalena, River Rhine and in the Great Lakes in United States of America.
6. Constant accumulation of garbage, plastic materials and tins in streams, lakes, rivers as well as water weeds destroy the scenic beauty reducing tourist activities such as swimming, sun bathing, sport fishing due to bad odours and chemicals that may disfigure the skin and respiratory problems if used for recreation. This further leads to loss of foreign exchange.
7. Pollution of water bodies by sediment water weeds like hyacinth, dumping of old metals and plastics hinders navigation since they become shallow and unsuitable for large ocean vessels that require deep waters. This interferes with port activities requiring constant

dredging which is expensive. Nigerian Western waterways and some landing sites on Lake Victoria have been chocked by the water hyacinth.

8. Heavy pollutants deposited in rivers pollute basins and soils with metals such as lead making them unfit for agricultural use. Silt sediments may also be saturated with toxic pollutants from industrial chemicals which poison the areas where they are deposited making them barren and unsuitable to support agriculture.
9. Water that is heavily polluted gives off foul smells which pollute the local atmosphere denying the inhabitant's fresh air especially in the coastal areas.
10. There are high government costs incurred in maintaining river systems that are highly polluted by silt accumulation in drainage canals of irrigation systems as well as behind dams which require constant costly dredging. This involves the use of advanced technology such as floatation dredgers.

SOLUTIONS

1. The water hyacinth and other water weeds that not only destroy the scenic beauty but also affect marine life and choke industrial pipes could be eradicated either mechanically by use of excavation or by use of biological methods using beetles to feed on the vegetation.
2. Use of manure to improve agricultural productivity instead of using fertilizers which percolate to underground water sources.
3. Encourage the treatment of domestic and industrial wastes before dumping to reduce the toxic levels and harm that they can have on the water bodies.
4. Encourage protection of any source of water especially for domestic and industrial use. Pit latrines should be located away from water points making the water safe enough for consumption.
5. Encourage proper sewage and garbage disposal mechanisms through discouraging indiscriminate disposal in wetlands and open water surfaces. It should be done in restricted areas only after treatment.
6. Signing nuclear non-proliferation treaties and abiding by them would reduce the emission of nuclear wastes into water bodies.
7. Improvement in technology such that computerised systems in production are used to improve efficiency reducing on the waste products as well as designing properly ocean going oil tankers where having double coating in compartments storing oil would prevent any leakages in water bodies.
8. Encourage constant river dredging to remove accumulations of silt sediments in water bodies by using floatation dredgers to increase the depth of water bodies for other uses such as navigation.
9. Put in place a water management index such that a control policy on the level of pollution is adhered to where no country is expected to exceed it and if so should meet all the costs of purification.
10. Carry out mass sensitization on the dangers of water pollution and control measures through media such as televisions, radios and newspapers.

LAND/SOIL POLLUTION

It refers to all those processes that add materials onto or into the soil making it unsuitable for either agricultural use, human, animal and plant habitation.

CAUSES OF SOIL POLLUTION

1. Excessive use of agricultural chemicals such as NPK (Nitrogen, Phosphorous and Potassium) fertilizers to improve soil fertility, pesticides such as Dichlorodiphenyltrichloroethane (D.D.T), fungicides, insecticides and herbicides may increase the acidity or basicity in the soils affecting soil micro-organisms. This interferes with their contribution to soil formation processes rendering the soils infertile. They are commonly used on irrigated fields and on plantation farms such as on the Gezira in Sudan, Richards Toll in Senegal, Polders in Netherlands and fruit ranches in California.
2. The discharge of industrial affluent such as waste fuels, oils, dyes and radioactive compounds on land increases the toxicity of land making it barren. This is especially in the industrial centres such as the Great Lakes region in North America, Shanghai in China and the Niger delta in Nigeria while Italy and France dump nuclear wastes and other lethal poisons in Nigeria, Benin and Togo.
3. The poor garbage disposal especially of the non-biodegradable pollutants from hospitals, urban centres and homes such as syringes and drugs, polythene bags, broken bottles, plastics, farm machinery, old iron sheets, automobiles and electrical equipment in which Poly Chlorinated biphenyls (PCBs) are used as coolants in refrigerators leak lethal poisons into the soils. Besides contaminating the soils, they reduce water percolation and circulation of Oxygen into the soil as well as physical space on land surface.
4. Minerals and mining centres expose some mineral ores into land especially in oil drilling areas where wastes are also deposited. This adds metallic elements in the soil killing soil living organisms affecting their fertility.
5. The establishment of irrigation farming has contributed to the accumulation of bases such as Magnesium, Manganese, Potassium iron and salts through irrigation water increasing salinity of the soils. This contaminates the soils rendering them less productive. This is especially experienced in semi-arid areas with high rates of evaporation such as in Sudan on the Gezira, the Richard's Toll in Senegal, California and the Doho scheme in Uganda.
6. The pouring on the surface of land of human and animal wastes increases the concentration Urea, Uric acids and Ammonia whose accumulation leads to scourging of plant life and barrenness of land over time.
7. The formation of acid rains in the heavily polluted areas reach the ground in solution form contaminating the soils with sulphurous substances destroying them.
8. Nuclear testing and leakages as in Japan and Chernobyl in Russia have led to contamination of soils. Nuclear disarmaments also lead the ground at nuclear sites polluted with radioactive substances.

EFFECTS OF SOIL POLLUTION

1. Pollution of land with non-biodegradable pollutants such as polythene bags, plastics, broken bottles reduces the circulation of air and water in soils making them more acidic affecting agricultural production and soil living organisms hence famine such as in India.
2. Excessive pollution of land especially from industrial and mining fields leads to barrenness of land which can only be redeemed after a long time of rest by use of soil additives such as lime and fertilizers.
3. The disposal of human wastes on the surface of the earth offers good breeding habitats for disease causing vectors thus increasing incidences of diseases such as cholera, diarrhoea and cancer affecting the health and productivity of people.
4. The pollution of land through accumulation of bases and metals such as iron, manganese, potassium, lead, mercury leads to pollution of both surface and underground water through percolation and surface run off. This in turn affects marine life, the quality and quantity of water for both domestic and industrial use.
5. It leads to high government expenditure to detox the soils since it requires modern technology to remove industrial toxins and nuclear leakages. This affects investment in other sectors of the economy.
6. Soil pollution leads to destruction of organic elements in soil affecting the soil structure making them loose and prone to erosion by wind and water. This is so in areas where there is heavy application of fertilizers such as on the Polders in Netherlands. It therefore affects production of crops.
7. Heavily polluted surfaces have also led to the destruction of wild animals, birds and man such as Sea fish eaters in Peru, coastal waters. Vegetation is also affected leading to wilting due to accumulation of Uric acids and Ammonia in the soils.

SOLUTIONS

1. Use of organic manures such as mulches, farm yard and green manure help reduce pollution levels while increasing soil fertility and productivity. This has been largely encouraged in India, China and Uganda.
2. Putting in place policies and laws such as separating collection centres of degradable and non-biodegradable pollutants. Besides, garbage can also be collected in special areas for treatment or incineration. In Uganda, Kitezi is used as a garbage collection centre.
3. Lime can be added to polluted soils by irrigation water to reduce the salt content in the soils.
4. Use of environmentally friendly techniques of pest and weed control such as grazing among tree crops like coffee, rubber, cocoa to control weeds while through research, biological pest killers can be developed to contain the problem of pest outbreak.
5. Recycling of non-biodegradable pollutants such as plastic bottles and polythene bags into other products in order to reduce their impact on the environment.
6. Treatment of wastes before disposal.

NOISE POLLUTION

Noise pollution occurs when there is disturbing noise in the environment. This is normally caused by heavy traffic movement, construction works, mining explosions, use of weapons during wars such as bombs and guns from industries, musical instruments in night clubs and volcanic eruptions.

Noise pollution has had direct effects such as loss of hearing, weight loss due to stress, hypertension, shocks, disturbance of sleep and mental concentration as well as caused physical damage to buildings, bridges and roads due to vibrations.

NB: Whereas pollution is largely negative, dust in the atmosphere induces condensation and the formation of precipitation.

REVISION QUESTIONS

1a) Examine the causes of environmental pollution.

b) With reference to a specific region, outline the problems caused by environmental pollution.

2a) Explain the term environmental pollution.

b) With reference to one developed or developing country, assess the effects of pollution on the environment.

3. Giving specific examples, assess the extent of environmental pollution.

4. ‘‘Man more than any other organism in an attempt to meet his day to day needs has ended up destabilising the eco system of which he is a component’’. Examine this statement with reference to environmental pollution.

5a) Distinguish between environmental degradation and environmental pollution.

b) Account for the increasing levels of atmospheric pollution.

6. Examine measures being taken to combat environmental pollution in the world.

7. ‘‘Rural farmers pollute the environment as much as urban dwellers and industrialists do’’. Examine the validity of the above statement with reference to both the industrialised and developing countries.

END