Component-I (A) - Personal Details

Role	**Name**	**Affiliation**
Principal Investigator	**Prof. Masood Ahsan Siddiqui**	Department of Geography, Jamia Millia Islamia, New Delhi
Paper Coordinator, if any	**Dr. Saleha Jamal**	Department of Geography, Aligarh Muslim University, Aligarh
Content Writer/Author (CW)	**Dr. Shanawaz Ahmad Baba**	Department of Geography and Regional Development, University of Kashmir, Srinagar
Content Reviewer (CR)	**Dr. Saleha Jamal**	Department of Geography, Aligarh Muslim University, Aligarh
Language Editor (LE)		

Component-I (B) - Description of Module

Items	**Description of Module**
Subject Name	**Geography**
Paper Name	**Environmental Geography**
Module Name/Title	**Environmental Pollution**
Module Id	**EG-35**
Pre-requisites	
Objectives	
Keywords	Environment, pollution, air, water, land, noise, thermal,radiation, flora, fauna, sources, pollutant, health, control

STRUCTURE

Objectives of the Study

- Define pollution and pollutants
- List various types of pollution and mention their sources
- Describe effects of air, water and soil pollution on flora and fauna
- Describe methods of control of air, water and soil pollution
- Describe the causes and effects of noise pollution
- Describe thermal and radiation pollutions

1.1 Introduction

Environmental pollution is one of the main threats for our planet. Environmental Pollution is any discharge of material or energy into water, land, or air that causes or may cause acute (short-term) or chronic (long-term) detriment to the earth's ecological balance or that lowers the quality of life. In simple words, Environmental Pollution is a process of contaminating the environment in a way that it becomes unsafe to use. Environmental pollution is the effect of undesirable changes in our surroundings that have harmful effects on plants, animals and human beings. A substance, which causes pollution, is known as pollutant. Pollutants can be solid, liquid or gaseous substances present in greater concentration than in natural abundance and are produced due to human activities or due to natural happenings. Pollutants may cause primary damage, with direct identifiable impact on the environment, or secondary damage in the form of minor perturbations in the delicate balance of the biological food web that are detectable only over long time periods. The industrialization of our society, the introduction of motorized vehicles, rapid urbanization, the explosion of the human population, harnessing of the nartural resources as well as unplanned sewage and waste disposal from industries and cities has been causing a tremendous increase in waste byproducts. Thus, environmental pollution usually occurs as a result of energy conversions and the use of resources which leaves their by-products behind in water, soil or air.

Globally speaking environmental pollution problem is much bigger than we think it is. Environmental pollution is happening in many parts of the world, especially in the form of air and water pollution. The best example for air pollution is some of China's cities, including capital Beijing, and the best example for water pollution is India with its Ganges river pollution problem. But the most severe environmental pollution is happening in developing countries of the Third World because not only to they lack any form of sustainable management but they also lack even the basic sanitation. Air and water pollution can cause death of many organisms in given ecosystem, including humans. Environment pollution has great potential to influence the health of human populations is great (Fereidoun et al, 2007; Progressive Insurance, 2005.). Over the last three decades there has been increasing global concern over the public health impacts attributed to environmental pollution (Kimani, 2007), Human exposure to pollution is believed to be more intense now than at any other time in human existence (Schell et al, 2006). The report of the NGO **Pure Earth** suggests that one of the seven deaths occurs due to pollution. Another comparison shows that pollution kills 60% more people than malaria, HIV/AIDS and tuberculosis combined.

1.2 Environmental Pollution: Definitions

An undesirable change in the physical, chemical and biological characteristics of the environment especially air, water and land that may adversely affect human population and the wild life, industrial processes, cultural assets (building and monuments), is called pollution**.** The term pollution is derived from the Latin word ‘Pollutioneum’ which means to defile or make dirty. The term Pollution has been defined in various ways by various scientists and organisations.

"Environmental pollution may be defined as the unfavourable alterations of our surroundings wholly or largely as a byproduct of man's action through direct or indirect effects of change in energy pattern, radiation levels, chemical and physi cal constitution and abundance of the organisms" (**U.S. President's Science Advisory Committee,1966**).

Pollution may be defined as, "an undesirable change in physical, chemical and biological characteristics of water, air and soil that may harmfully affect human, animal and plant life, industrial progress, living conditions and cultural assets"(**National Academy of Science, USA**,**1966**).

"Pollution is an undesirable change in physical, chemical and biological characteristics of air, water and soil that may harmfully affect the life or create a potential health hazard for living organisms" (**Odum**, **1971)**.

"Pollution is the accumulation of substances in the environment or at rates of flow which exceed the capacity of the ecosystem to either neutralise or disperse them to harmful levels" (**Tiasmann**, 1975).

"Pollution is viewed as the release of substances and energy as waste products of human activities which result in harmful changes within the natural environment" (**National Environmental Research Council**, 1976).

Pollution is thus, direct or indirect change in any component of the environment which is harmful to the living organisms and in particular undesirable for man.

1.3 Pollutant

Any substance present in the environment in such concentration which adversely effects the environment by damaging the growth rate of a species and by interfering with the food chains, and affects the health, comfort and property etc. is considered as a pollutant**.** In other words, Pollutant may be defined as "constituent in the wrong amount at the wrong place or at the wrong time."According to the Indian Environment (Protection) Act, 1986, "A pollutant has been defined as any solid, liquid or gaseous substance present in such concentration as may be or tend to be injurious to the environment". Smoke from industries and automobiles, domestic and commercial sewage, radioactive substances from nuclear plants and discarded household articles (tins, bottles, broken crockery etc.) come under the category of pollutants.

1.3.1 Classification of Pollutants

The classification of pollutants is done from different points of view.

(A) Depending upon their existence in nature pollutants are of two types, namely:

(i) Quantitative and

(ii) Qualitative pollutants.

(i) Quantitative Pollutants: These are those substances normally occurring in the environment, who acquire the status of a pollutant when their concentration gets increased due to the un-mindful activities of man. For example, carbon dioxide, if present in the atmosphere in concentration greater than normal due to anthropogenic activities, then it is classified as a quantitative pollutant.

(ii) Qualitative Pollutant: These are those substances which do not normally occur in nature but are added by man like insecticides. Depending upon the form in which they persist after being released into the environment, the pollutants are categorized into two types, namely (a) primary and (b) secondary pollutants.

(a) Primary Pollutants: These are those which are emitted directly from the source and persist in the form in which they were added to the environment. Like ash, smoke, fumes, nitric oxide, sulphur dioxide, hydrocarbons etc.

(b) Secondary Pollutants: These are those which are formed from the primary pollutants by chemical interaction with some constituent present in the atmosphere. Examples are: sulphur trioxide, nitrogen dioxide, aldehydes, ketones, ozone etc. Primary pollutants like nitrogen oxides and hydrocarbons react in the presence of sunlight to form peroxyacyl nitrate (PAN) and ozone, two secondary pollutants.

(B) In terms of ecosystem i.e. according to their natural disposal, the pollutants can be classified into two basic groups:

(i) Bio-degradable Pollutants: These are the pollutants that are quickly degraded either by natural means like biological/microbial action or by some engineered systems (sewage treatment plants). The degradable pollutants can be further sub-divided into two categories:

(a) Rapidly degradable or non-persistent pollutant: The degradation of these pollutants is very faster process. For example, the decomposition of sewage and wastes of animals and plants is a faster process.

(b) Slowly degradable or persistent pollutant: The degradation of these pollutants is a very slower process. It seems as if the amount of pollutant remains unchanged with time. For example, degradation of synthetic compounds and radio-active elements like Iodine 137, Plutonium 239 takes a longer period of time.

(ii) Non-degradable Pollutants: These are the substances that either do not degrade or degrade very slowly in the natural environment. These include mercury salts, long chain phenolic chemicals, DDT and Aluminium cans etc. Most of these mutants get accumulated in the environment and also get biologically magnified as these move along the food chains in an under composed state. These may also react with other compounds in the environment to produce toxins. These can be further subdivided into two more classes:

(a) Waste: e.g. glass, plastic, phenolic, aluminum cans etc.

(b) Poisons: e.g. radio-active substances, pesticides, smog gases, heavy metals.

1.4 Types of Pollution

The natural resources which are freely available as a gift of nature are highly polluted. Depending upon the area or the part of environment affected, pollution may be broadly divided into following types:

1. Air pollution
2. Water pollution
3. Land pollution
4. Noise pollution
5. Radiation Pollution
6. Thermal pollution

1.4.1. Air Pollution

Air pollution is one of the biggest challenges of present humanity. Air pollution means the presence of any abnormal material or property in the air that reduce the usefulness of the air resources. The term pollution may be referred in context with outdoor open atmospheric conditions, localized air condition, and enclosed space conditions. Air pollution occurs due to the presence of undesirable solid, liquid or gaseous particles in the air in quantities that are harmful to human health and the environment. Air may get polluted by natural causes such as volcanoes, which release ash, dust, sulphur and other gases, or by human activities. However, unlike pollutants from human activity, naturally occurring pollutants tend to remain in the atmosphere for a short time and do not lead to permanent atmospheric change.

Sources of Air Pollution

Among the major sources of pollution are power and heat generation, the burning of solid wastes, industrial processes, and, especially, transportation. The common pollutant gases emitted during

the domestic burning of coal, kerosene oil, firewood, cow dung cakes, smoke from cigarettes etc. are carbon monoxide (CO), carbon dioxide (CO2), sulphur dioxide (SO2), etc. About 90% of global air pollution is constituted by the following pollutants.

(i)Carbon dioxide: It is one of the major gases which contributes towards air pollution. It is mainly produced during the combustion of fuel in factories, power stations, household etc.

(ii) Carbon monoxide: It is produced as a result of incomplete combustion of fossil fuels like coal, petroleum and wood charcoal. Automobiles using diesel and petroleum are the major sources of carbon monoxide.

(iii) Sulphur dioxide: It accounts for about 18% of all air pollution. It is produced by chemical industries, metals meltings, pulp and paper mills,oil refineries etc.

(iv) Oxides of nitrogen: A few oxides of nitrogen (NO_x) are produced by natural processes as well as from thermal power stations, factories, automobiles and aircrafts. They account for about 6% of air pollution.

(v) Hydrocarbons: Hydrocarbons are a group of compounds consisting of carbon and hydrogen atoms. They either evaporate from fuel supplies or are remnants of fuel that did not burn completely.

(vi) **Particulate matter**: Particulates are small pieces of solid material (for example, smoke particles from fires, bits of asbestos, dust particles and ash from industries) dispersed into the atmosphere.

Effects of Air Pollution

(i) Effects on Human Health

Exposure to air pollution is associated with numerous effects on human health, including pulmonary, cardiac, vascular, and neurological impairments. The health effects vary greatly from person to person. High-risk groups such as the elderly, infants, pregnant women, and sufferers from chronic heart and lung diseases are more susceptible to air pollution. Children are at greater risk because they are generally more active outdoors and their lungs are still developing. Exposure to air pollution can cause both acute (short-term) and chronic (long-term) health effects.

(ii) Effects on plants

When some gaseous pollutants enter leaf pores they damage the leaves of crop plants. Chronic exposure of the leaves to air pollutants can break down the waxy coating that helps prevent excessive water loss and leads to damage from diseases, pests, drought and frost. Such exposure interferes with photosynthesis and plant growth, reduces nutrient uptake and causes leaves to turn yellow, brown or drop off altogether.

(iii) Effects of air pollution on materials

Every year air pollutants damage materials worth billions of rupees. Air pollutants break down exterior paint on cars and houses. All around the world air pollutants have discoloured irreplaceable monuments, historic buildings, marble statues, etc.

(iv) Effect on climate: Atmospheric changes induced by pollution contribute to global warming, a phenomenon which is caused due to the increase in concentration of certain gases like carbon dioxide, nitrogen oxides, methane and CFCs. There could be several adverse effects of global warming. With a warmer earth the polar ice caps will melt causing a rise in ocean levels and flooding of coastal areas. In countries like Bangladesh or the Maldives this would be catastrophic. If the sea level rises by 3m., Maldives will disappear completely beneath the waves.

Control measures for air pollution

Air pollution can be controlled by two fundamental approaches: preventive techniques and effluent control. One of the effective means of controlling air pollution is to have proper equipment in place. This includes devices for removal of pollutants from the flue gases though scrubbers, closed collection recovery systems through which it is possible to collect the pollutants before they escape, use of dry and wet collectors, filters, electrostatic precipitators, etc. Providing a greater height to the stacks can help in facilitating the discharge of pollutants as far away from

the ground as possible. Industries should be located in places so as to minimize the effects of pollution after considering the topography and the wind directions. Substitution of raw material that causes more pollution with those that cause less pollution can be done.

Table 1: Sources, Health and Welfare Effects for Criteria Pollutants.

Pollutant	Description	Sources	Health Effects	Welfare Effects
Carbon Monoxide (CO)	Colorless, odorless gas	Motor vehicle exhaust, indoor sources include kerosene or wood burning stoves.	Headaches, reduced mental alertness, heart attack, cardiovascular diseases, impaired fetal development, death.	Contribute to the formation of smog.
Sulfur Dioxide (SO_2)	Colorless gas that dissolves in water vapor to form acid, and interact with other gases and particles in the air.	Coal-fired power plants, petroleum refineries, manufacture of sulfuric acid and smelting of ores containing sulfur.	Eye irritation, wheezing, chest tightness, shortness of breath, lung damage.	Contribute to the formation of acid rain, visibility impairment, plant and water damage, aesthetic damage.
Nitrogen Dioxide (NO_2)	Reddish brown, highly reactive gas.	Motor vehicles, electric utilities, and other industrial, commercial, and residential sources that burn fuels.	Susceptibility to respiratory infections, irritation of the lung and respiratory symptoms (e.g., cough, chest pain, difficulty breathing).	Contribute to the formation of smog, acid rain, water quality deterioration, global warming, and visibility impairment.
Ozone (O_3)	Gaseous pollutant when it is formed in the troposphere.	Vehicle exhaust and certain other fumes. Formed from other air pollutants in the presence of sunlight.	Eye and throat irritation, coughing, respiratory tract problems, asthma, lung damage.	Plant and ecosystem damage.
Lead (Pb)	Metallic element	Metal refineries, lead smelters, battery manufacturers, iron and steel producers.	Anemia, high blood pressure, brain and kidney damage, neurological disorders, cancer, lowered IQ.	Affects animals and plants, affects aquatic ecosystems.
Particulate Matter (PM)	Very small particles of soot, dust, or other matter, including tiny droplets of liquids.	Diesel engines, power plants, industries, windblown dust, wood stoves.	Eye irritation, asthma, bronchitis, lung damage, cancer, heavy metal poisoning, cardiovascular effects.	Visibility impairment, atmospheric deposition, aesthetic damage.

1.4.2. Water Pollution

Water is one of the most important biological components that sustain life. However, nowadays water is highly polluted and is one of the pivotal issues in the world. The water is said to be polluted when it has more "negative" qualities than "positive" ones. Water quality refers to the physical, chemical and biological characteristics of water. Thus, in simple words, we can that polluted water is that water which has been abused, defiled in some way, so that it is no longer fit for use.Water pollution can be defined as "the presence of too much of undesirable substances in water which tend to degrade the quality of water's physical, chemical and biological characteristics, making it unsuitable for beneficial use".

Sources of Water Pollution

Water pollution is one of the most serious environmental problems. Water pollution is caused by a variety of human activities such as,

- Domestic sewage discharged into rivers from areas located on its banks.
- Excretory wastes of humans and animals in water bodies.
- Disposal of urban and industrial waste matter into water bodies.
- Industrial wastes effluents from urban areas containing high concentration of oil, heavy metals and detergents.
- Minerals, organic wastes and crop dusting from agricultural fields with phosphate and nitrogen fertilizers that reach lakes, rivers and sea (water becomes deoxygenated and poisonous, thus, cannot support aquatic life).
- Chemical fertilizers, pesticides, insecticides, herbicides and plant remains.
- Industrial waste water containing several chemical pollutants, such as calcium, magnesium, chlorides, sulphide, carbonates, nitrates, nitrites, heavy metals and radioactive waste from nuclear reactor.
- Natural sources of pollution of water are soil erosion, leaching of minerals from rocks and decaying of organic matter.

Water pollutants are categorized as point source pollution and non-point source pollution.

1. Point source pollution

When pollutants are discharged from a specific location such as a drain pipe carrying industrial effluents discharged directly into water body it represents point source pollution. In other words, point source pollution is defined as any single identifiable source of pollution from which pollutants are discharged.

2. Non Point source pollution

Those sources which do not have any specific location for discharging pollutants, in the water body are known as non-point sources of water pollution. For example, run off from agricultural fields, grazing lands, construction sites, abandoned mines and pits etc.

Effects of Water Pollution

Water pollution is the second major source of waterborne diseases and health problems after air pollution.

(i) Effects on humans

On consuming polluted water, humans can suffer from diseases like amoebic dysentery, skin cancers, cholera, typhoid fever, damage of nervous system, genetic mutations/ birth defects, hepatitis, malaria. Metals like lead, zinc, arsenic, copper, mercury and cadmium in industrial waste waters adversely affect humans and other animals. Consumption of arsenic polluted water leads to skin lesions, rough skin, dry and thickening of skin and ultimately skin cancer. Pollution of water bodies by mercury causes minamata disease in humans and dropsy in fishes. Lead causes displexia, cadmium poisoning causes Itai – Itai disease etc.

(ii) Effects on plants and animals

Water pollution results in lower crop yields, excess growth of algae can kill aquatic life, reduce photosynthesis, disrupts food chain and food web. Oil spills are a major problem in near-coastal waters and can kill or adversely affect fish, other aquatic organisms and birds and mammals. Spills can kill or reduce populations of organisms living in coastal sands and rocks, and may kill the worms and insects that serve as food to birds and other animals.

Control measures for preventing water pollution

1. Setting up effluent treatment plans to treat waste.
2. Industrial wastes must be treated before discharge.
3. Educate Public for preventing water pollution and the consequences of water pollution
4. Strict enforcement of Water Pollution Control Act.
5. Continuous monitoring of water pollution at different places.
6. Developing economical method of water treatment.

1.4.3. Land Pollution

Land pollution is the degradation of the earth's land surface through misuse of the soil by poor agricultural practices, mineral exploitation, industrial waste dumping, and indiscriminate disposal of urban and toxic wastes. In simple terms, land pollution is the degradation of the earth's surface caused by a misuse of resources and improper disposal of waste.

Land pollution is responsible for damage done to natural habitat of animals, deforestation and damage done to natural resources, and the general uglying up of our communities. Polluting the land by harmful chemicals can lead to entry of pollutants into food chain. This is commonly caused by excess use of fertilizers in agriculture, irresponsible disposable of industrial wastes etc. Even defecating in the open spaces also causes pollution.

Sources of Land Pollution

The major sources of land pollution are highlighted below:

(i) Soil erosion: Soil erosion can be defined as the movement of topsoil from one place to another. Soil erosion removes rich humus topsoil developed over many years through vegetative decay and microbial degradation and thus strips the land of valuable nutrients for crop growth. Strip mining for minerals and coal lays waste thousands of acres of land each year, denuding the earth and subjecting the mined area to widespread erosion problems. The increase in urbanization due to population pressure presents additional soil-erosion problems; sediment loads in nearby streams may increase as much as 500 to 1,000 times.

(ii) Industrial Waste: Large number of industrial chemicals, dyes, acids, fertilizer companies, pharmaceutical companies etc. find their way into the soil and are known to create many health hazards including cancer.

(iii) Urban Wastes: Because of modem life style and eating habits the urban wastes are becoming very dangerous to the human beings. Urban wastes include both which is a non-degradable material and harmful to the society in long run.

(iv) Agricultural sources: Agricultural chemicals especially fertilizers and pesticides pollute the soil. Fertilizers in the run off water from these fields can cause eutrophication in water bodies. Pesticides are highly toxic chemicals which affect humans and other animals adversely causing respiratory problems, cancer and death.

(v) Plastic bags: Plastic bags made from low density polyethylene, is virtually indestructible, create colossal environmental hazard like land pollution. The discarded bags block drains and sewage systems.

Causes of land pollution

1. Toxic compounds affect plant growth and human life also.
2. Water logging and salinity makes soil infertile.

3. Hazardous chemicals enter into food chain from soil disturbing the biochemical process.
4. Nervous disorders, gastrointestinal disorder, joint pain, respiratory problems are the effects seen on human beings.

Control measures for preventing soil pollution

1. Soil erosion must be prevented or controlled by proper tree plantation.
2. All the wastes from industry, domestic, must be dumped with proper treatment.
3. Use of synthetic fertilizers must be avoided instead natural fertilizers must be preferred.
4. Educate people regarding consequences of soil pollution and to prevent soil pollution.
5. Toxic and non-degradable materials must be totally banned.
6. Recycling and reuse of industrial and domestic wastes can minimize soil pollution considerably.

1.4.4. Noise Pollution

Noise pollution has a relatively recent origin and is one of the least discussed problems. Noise is one of the most pervasive pollutant.People tends to underestimate this problem because it is not possible to smell, see or touch it. Noise Pollution is any loud sounds that are either harmful or annoying to humans and animals. To be more precise, noise by definition is "sound without value" or "any noise that is unwanted by the recipient". Noise like other pollutants is a by product of industrialization, urbanization and modern civilization. Noise level is measured in terms of decibels (dB). W.H.O.has prescribed optimum noise level as 45 dB by day and 35 dB by night. Anything above 80 dB is hazardous.

Sources of Noise Pollution

Noise pollution is a growing problem. It is a composite of sounds generated by human activities ranging from blasting stereo systems to the roar of supersonic transport jets. All human activities contribute to noise pollution to varying extent. Noise pollution is more intense in the work environment than in the general environment. Sources of noise pollution are many and may be located indoors or outdoors.

(a) Indoor sources include noise produced by household gadgets like radio, television, generators, electric fans, washing machine, vacuum cleaners, air coolers, air conditioners and family conflict. The average background noise in a typical home today is between 40 and 50 decibels. Noise pollution is more in cities due to a higher concentration of population and industries and activities such as transportation.

(b) Outdoor sources of noise pollution include indiscriminate use of loudspeakers, industrial activities, automobiles, rail traffic, aeroplanes and activities such as those at market place, religious, social, and cultural functions, sports and political rallies. During festivals, marriage and many other occasions, use of fire crackers contribute to noise pollution.

Effects of Noise Pollution

The research shows that many illnesses are connected to noise pollution, such as hearing loss, high blood pressure, coronary heart diseases, loss of temper, decrease in work efficiency, sleeplessness, anxiety and speech interference. The effect is variable, depending upon individual susceptibility, duration of exposure, nature of noise, and time distribution of exposure. On the average an individual will experience a threshold shift (a shift in an individual's upper limit of sound detectability) when exposed to noise levels of 75 to 80 dB for several hours. This shift will last only several hours once the source of noise pollution is removed. A second physiologically important level is the threshold of pain, at which even short-term exposure will cause physical pain (130 to 140 dB). Any noise sustained at this level will cause a permanent threshold shift or permanent partial hearing loss. At the uppermost level of noise (greater than 150 dB), even a single short-term blast may cause traumatic hearing loss and physical damage inside the ear. The

industrial noises also affect the lives of animals. For example, whales' navigation system breaks down due to the sounds of ships.

Preventive Measures

Noise is everywhere, it is not as easy to control as other pollutions. Reducing noise pollution by muffling the sounds at the source is one of the best methods in industry and for urban living. Using earplugs where abnormal noise is produced. Banning noise polluting vehicles, controlling vibration of machines by proper lubricating machine, plantation of trees on road sides and near building can absorb noise, constructing sound proof rooms, enforcing noise pollution control act and educating people about noise pollution and its consequences. Creation of green cover adjacent to municipal roads and in mines is the way to mitigate noise pollution. It has been observed that noise level reduces by 10 decibels per every 10m wide green belt development.

1.4.5. Radiation Pollution

Radiation pollution is one of the serious types of pollution and also neglected one. This is the pollution due to abnormal radiation in the environment. Radiation pollution is any form of ionizing or non-ionizing radiation that results from human activities. The radiations emanating from the decay of radioactive nuclides are major sources of radiation pollution. The most well-known radiation results from the detonation of nuclear devices and the controlled release of energy by nuclear-power generating plants, from cell and mobile towers, by use of wireless Internet access modems etc. Other sources of radiation include spent-fuel reprocessing plants, by-products of mining operations, and experimental research laboratories. Increased exposure to medical X-rays and to radiation emissions from microwave ovens and other household appliances, although of considerably less magnitude, all constitute sources of environmental radiation.

Effects of Radiation Pollution

Public concern over the release of radiation into the environment greatly increased following the disclosure of possible harmful effects to the public from nuclear weapons testing, the accident (1979) at the Three Mile Island nuclear-power generating plant near Harrisburg, and the catastrophic 1986 explosion at Chernobyl, A Soviet nuclear power plant. In the late 1980s, revelations of major pollution problems at U.S. nuclear weapons reactors raised apprehensions even higher.The environmental effects of exposure to high-level ionizing radiation have been extensively documented through post-war studies on individuals who were exposed to nuclear radiation in Japan. Some forms of cancer show up immediately.

Preventive Measures

Radioactive nuclear wastes cannot be treated by conventional chemical methods and must be stored in heavily shielded containers in areas remote from biological habitats. The safest of storage sites currently used are impervious deep caves or abandoned salt mines. Most radioactive wastes, however, have half-lives of hundreds to thousands of years, and to date no storage method has been found that is absolutely infallible.

1.4.6. Thermal Pollution

Thermal pollution is the discharge of waste heat via energy dissipation into cooling water and subsequently into nearby waterways. In simple words, this pollution arises due to release of excess heat from thermal power plants, industries involved in metals molding etc. The heat is released into the surrounding air rising the temperature of the locality drastically. The major sources of thermal pollution are fossil-fuel and nuclear electric-power generating facilities and, to a lesser degree, cooling operations associated with industrial manufacturing, such as steel foundries, other primary metal manufacturers, and chemical and petrochemical producers.

Power plants- thermal and nuclear, chemical and other industries use lot of water (about 30 % of all abstracted water and 90 % of all water consumption excluding agricutural uses) for cooling purposes and the used hot water is discharged into rivers, streams or oceans. Discharge of hot water may increase the temperature of the receiving water by 5 to 11 °C above the ambient water temperature. The discharge of heated water into a waterway often causes ecological imbalance, sometimes resulting in major fish kills near the discharge source. The increased temperature accelerates chemical-biological processes and decreases the ability of the water to hold dissolved oxygen. Unlike terrestrial ecosystems, the temperature of water bodies remain steady and does not change very much. Accordingly, aquatic organisms are adopted to a uniform steady temperature of environment and any fluctuation in water temperature severely affects aquatic plants and animals. Hence discharge of hot water from power plants adversely affects aquatic organisms. Aquatic plants and animals in the warm tropical water live dangerously close to their upper limit of temperature, particularly during the warm summer months. It requires only a slight deviation from this limit to cause a thermal stress to these organisms. Discharge of hot water in water body affects feeding in fishes, increases their metabolism and affects their growth. Their swimming efficiency declines. Running away from predators or chasing prey becomes difficult. Their resistance to diseases and parasites decreases. Due to thermal pollution biological diversity is reduced. Thus rapid and dramatic changes in biologic communities often occur in the vicinity of heated discharges. One of the best methods of reducing thermal pollution is to store the hot water in cooling ponds, allow the water to cool before releasing into any receiving water body.

1.5 Conclusion

Environmental pollution is a challenge in most developed societies of the world; contemporary societies of developing countries in particular also grapple with the problems of environmental pollution and are seeking ways to tackle it. This contemporary issue has a negative ripple effect on the health and socio-economic well-being. The environmental pollution calls for radical actions for environment protection and rehabilitation. More than that, the problem should be resolved on a global level by the united efforts of the global community.