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2- BIOTIC AND ABIOTIC ENVIRONMENT

In general the surroundings of an organism living in its natural habitat is termed as environment. These surroundings include all; physical, mental and spiritual conditions. The human beings are so complex in nature that it is a combined effect of everything, which exists, far or near them, affects their life (mental, physical and spiritual). The gravitational forces of distant planets affect each other and these movement or rotation is based on the balance between them. Tides come because of the gravitational attraction

of moon and sun, which move the bodies of water on the earth as well as the water, which is the main constituent of human body (75%). It has been well established that the non-living things and the living beings are totally interrelated and dependent on each other. It is only a matter of time that something is nonliving or somebody is living being.

We consume the food, which becomes part of our body cells and gets changed into living being. After the death of those cells or the whole body it again becomes non-living. So it is a combination or synthesis of various elements with some unknown factor like soul that demarcates the living beings and non-living things. But it is sure that nature is in dynamic equilibrium of both of them. Thus we can classify the environment as

2.2.1 Physical or abiotic environment

It consists of physical factors Land (minerals, toxic elements, nutrients), sky (sink of various things, noise) and air (useful and other gases). Anciently, we have realized this combination as “ Ksiti (Earth), Jal (Water), Pavak (Fire), Gagan (Sky), Sameer (Air):

the five basic elements (Panch Tatva) which influence life.

2.2.2 Living or biotic environment

It consists of plants, animals (including human beings) and micro-organisms. Life in the form of micro-organisms is very strange and subtle (strong). Fungus is available upto 3 Kms. Below the earth. Thus the earth is not made for human beings alone.

All these constituents of environment are referred to as the environmental factors or an ecological factor, which is defined as an ecological condition, which directly or indirectly affects the life of an organism. These biotic and abiotic components are in a dynamic state

i.e. they constantly depend and affect each other and cannot be dealt in isolation with each other. This is the fundamental of Environmental Science or Engineering.

Wherever we have not considered this interdependence and interrelation, knowingly or unknowingly, we have destroyed the very structure of a factor. This unthoughtful

use of a resource, dealt in isolation, pollutes the other environmental factor, which in turn affects the polluting one, as all of them are interrelated and interdependent. This is the fundamental of environmental pollution.

2.3 ADVERSE EFFECTS OF ENVIRONMENTAL POLLUTION

In the nature the niche (role to play) of its every element is fixed; means the role which it has to play is pre-decided and prefixed, be it living or non-living. Every operation cyclic and each and every link of this cycle is important and indispensable. For example

in the hydrological cycle the water gets evaporated from the sea and over the other parts of the earth depending upon the climatic factors; mainly the temperature and the relative humidity. The wind transport it all over the earth and the condensation supplies fresh, sweet water to all places where it is required for supporting life. It goes down the earth by infiltration and percolation. Again it comes to the atmosphere through the leaves of trees and evaporation from the exposed surfaces of water i.e. evapotranspiration. The underground water emerges as springs or extracted by human beings as wells etc. Here

comes the human intervention. Because of the ever-increasing demands of the agriculture (population increase) we have exploited the ground water to such a level that most of the regions have become dark zones. Then to fulfill our ever increasing energy demands in quest of the so called comfort conditions we have burnt such a large amount of fossil fuels that has increased the CO₂ level (from 300 to 350 p.p.m) in the last century.

Actually, glass has the property to allow the short-wave radiation of sun through it and prevent the long wave heat radiation to pass through it. In cold climatic countries houses made up of glass are used to take advantage of this phenomenon i.e. the entry of solar radiation and entrapping the long wave heat radiation inside it. Like this if the outside temperature is -25°C the inside temperature can be raised to 25°C , for example.

Greenery can be easily grown at this suitable temperature and that is why it is known as the greenhouse effect. CO_2 works similar to the glass i.e. it allows the short-wave solar radiation, but prevents the long wave heat radiation, radiated from the earth to the far sky. This helps in maintaining the earth warm, but the increasing concentration of CO_2

is increasing the earth's mean global annual temperature. It was around 14.5°C in the last century but now it is increasing at a rate of 1°C per century. This is known as the global warming and is causing imbalance in the rainfall over the globe. It is also increasing melting of snow on the glaciers and raising the level of sea, endangering the existence of cities near the seas like Mumbai or countries like Mauritius. This is one example of

effect of pollution in which increased concentration of CO_2 generated due to human activities (industrialization, Urbanization) resulted in increase of temperature. So the human activity like burning of fossil fuels is imposing this adverse effect of increasing temperature, on environment.

Along with this, the increased concentration of other gases like oxides of Nitrogen and Sulphur (NO_x and SO_x), the increased suspended particulate matter (S.P.M) are also causing so many diseases and the problems like acid rain etc. which shall be discussed in the chapter of Air Pollution. The Chlorofluorocarbons used in air conditioning are depleting the useful ozone layer in the stratosphere. The ozone prevents the ultra violet portion of the solar radiation and this reduction in the concentration of ozone, popularly known as ozone hole results in skin cancer. Against human's foul plays, nature has much shock proofing arrangements and rectifying measures. But they have their limits and if the limits are crossed then the natural disasters like tsunami and El-Nino etc. take place.

CONTROL STRATEGIES

After having the primary knowledge of environment, that it is the surroundings that influence the development and growth of mankind and it covers all important facts of our life like physical, chemical, biological, social, economic and spiritual: having

knowledge of pollution and its adverse effects; one has to seriously think about environmental protection. Time has gone when the earth was feeding us, protecting us as the Mother Earth. In the last century we have lost 60% of the forest cover. Forests are the assets of our Mother Earth. A forest is a complete ecosystem i.e., sustainable in itself. Its main part is trees and other vegetation. Trees provide us the fruits, fodder, timber, paper, gum, herbs, medicines, firewood and so many other products. They release oxygen and consume the CO₂ (responsible for global warming). As a recent

estimate one hectare of forest consumes 3 tons of CO₂ and produces 2 tons of O₂ per year approximately. They pump the subsoil water into the atmosphere through transpiration and increase the relative humidity in air, which leads to rainfall. They purify the air by absorbing the gases like SO_x and NO_x and the particulate matter. This way they act like Lord Shiva who consumed the poison produced from the sea when it was explored. This created a sore in his throat and he was called as “Neel-Kantha”. Trees play the same role i.e. they absorb the harmful gases and the particulate

matter and their leaves become sick (blisters). That is why we worship the trees. Trees prevent the soil and water erosion by the confining effect of their roots. They reduce the velocity of wind thus reduce the movement of sand and the expansion of deserts. The canopy of trees detains the raindrops and thus delays the run-off causing floods. They also reduce the velocity of floodwaters and the consequent destruction. Trees absorb the sound waves and thus reduce the noise pollution. They provide shelter to the birds and other animals as a natural habitat. They provide shade to the buildings

and earth and thus reduce the ambient and surface temperatures. The greenery provided by them reduces the atmospheric glare and soothes our eyes and gives us a psychological effect of protection and prosperity. Trees make the forest a complete ecosystem. The ecosystem conserves the

biodiversity and the biodiversity protects the Mother Earth. If earth has enough variety and amount of belongings in its bosom, then only it can distribute them as mother. Time has come when the mother has lost its forest cover, its underground water, its fertile cover of soil (humus). Everything which nature has created in millions of years humans have snatched, consumed, exhausted or destroyed in hundreds of years. In these conditions are we lesser wiser than our ancestors? They prayed to the

God for the peace and harmony to water, sky, soil trees and herbs, natural powers intellectuals and the whole universe in the “Shanti Mantra”. Can’t we control the environmental degradation by striking to the root cause of it? The root cause is the ever-increasing demands and resulting exploitation of the nature. The demand is increasing firstly due to the increasing human population and secondly the increasing level of consumption of resources without thinking about their limited availability and the destruction produced by the adopted processes of utilization and faulty disposal

methods of waste produced. So first of all we have to control the increase of human population, wisely. No prosecution or law can forcibly control the population. It should be controlled through the education and setting of examples by the thinkers and leaders of the society followed by the masses. Incentives should be given to the persons contributing to the birth control

programmers. To have a larger group of persons of same interest it was wiser to increase the human population in the beginning of the civilization. The harsh conditions of nature, fear of unknown wild powers led to bigger and bigger groups. But the time has changed now science has given us powerful tools. So a wise, bold and modern society can uproot this feeling and control its population by itself.

The second control strategy is the reduction in consumption of the limited resources. Fresh water is only 0.1% of the total water on the earth and if we misuse it and convert it into waste water to be again mixed in the fresh body of water (river) it is not less than a sin. Using water of a quality in a work where inferior quality water could have

been used is also an unwise act. The present sanitation system in which one part of human excreta is carried away by 99 parts of potable (drinking) water is not a wise option. Sanitation and cleanliness is a must but it should be obtained in an overall wise manner. Actually the soil has soil bacteria, which can easily decompose the waste organic matter (biodegradable) without deteriorating the environment and can convert it to useful manure. Water also has aerobic bacteria for the decomposition of the same organic matter but these bacteria consumes the oxygen, which is present in the fresh body of water as dissolved oxygen. The depletion of this D.O. causes all types of

problems like the damage to the aquatic life and the development of foul conditions to the fresh body of water, which requires more and more treatment of raw water to make it potable. After spending a lot of money (Resources, energy) we make it fit for drinking and then use it for all purposes like flushing and gardening. Only 5-10 liters of water is required per person per day for drinking/cooking; that is oral consumption but we are using 200 liters pure, bacteria free potable water, which is costing not less

than 15 Rs. per thousand litre. Here the main concern is about the wasteful expenditure and the consequent pollution caused due to the disposal of sewage/wastewater into the rivers and other streams. This type of sanitation system needs an immediate change. Some N.G.O. at MGIRI (Mahatma Gandhi Institute of Rural Industrialization) at Wareham near Nagpur has invented an Indian type W.C. Pan in which only one liter of water is sufficient for flushing the human excreta in one operation. That small amount of water + excreta goes inside the earth and there is no requirement of sewer line, treatment and disposal of sewage. Another N.G.O in Nagpur has demonstrated the commercially viable conversion of human excreta into biogas and its utilization within the same premises. This is a two fold solution that the amount of waste is reduced and its consumption reduces the subsequent pollution.

Sometimes the solution may not be easy as the subsoil may not be porous and sewerage system may be a must, but in that case also the nonfoul wastewater from kitchens and bathrooms can be reused in flushing and gardening without any problem. This can reduce the consumption of treated potable water by 40% and reduce the quantity of sewage also. The other main important point of consideration is use of fossil fuels for

production of electricity, and transportation etc. Coal, petroleum and gas all are limited and exhaustible in nature. We have consumed most of them and in coming century we will not find any petroleum. Alongwith the scarcity the main problem of concern is the environmental pollution. They produce harmful gases like oxides of sulphur (Sox and oxides of Nitrogen (NOx), unburnt hydrocarbon, CO and suspended particulate matter etc. This is the major manmade cause of air pollution. The flyash (residual of coal burning) is another hazard. In place of these fossil fuels renewable sources of energy like sun, wind, biomass and hydropower can be beneficially used. The presently available technology is not sufficient as the cost of electricity production by renewable is higher than the thermal means except for the hydropower which is available at limited places only.

Sun is the ultimate source of energy and its radiations are freely available at all places. There is a necessity of harnessing the solar energy directly or after converting it into electricity. The present technologies like photovoltaic conversion are not fully environment friendly as the manufacturing of PV cells itself is too much energy intensive. The solar thermal route is a better option, which can be further improved. The harnessing of wind power, tidal power are very good options. India is the only country having

separate ministry of non-conventional energy resources, emerging as a prominent power in the field of electricity generation with wind power (6300 MW). Still there is a need of optimum utilization of these resources, which are comparatively more ecofriendly as producing lesser pollution.

2.5 ENVIRONMENTAL ACTS AND REGULATIONS

Various Acts and regulations: - After knowing something about the various elements of environment, their dynamic interrelationship and the adverse effects of environmental pollution, one should work in the direction of adopting the pollution control strategies. For this, provision of Acts and regulations is a must in the present setup of the society. In the ancient system the environmental management was a part of life when consideration of animals like cows, dogs, cats etc., birds like sparrows, flamingo (KURAJA) peacocks etc. was there in daytoday life and they were treated as part of family. A small share of meals was contributed by

every person/family and a voluntary adjustment existed Sun was considered to be the prime source of energy and happiness and the daily routine was so adjusted to cater more and more energy through its radiations and using least amount of other means, like the valuable natural resources, coal, petroleum etc.

Human and animal energy was used for transportation and the buildings were designed for natural day lighting, natural ventilation and least heating/cooling demands. This prevented the environment from being polluted but the present trend of living in nucleus families with self-centeredness, living away from nature, desire of more and more comforts has led the society to such an extent of consumerism that there is no scope of environment protection. In this era it can be obtained only by imposing rules, regulations, acts, penalties and such other measures. There are so many regulations to be fulfilled by the individuals, entrepreneurs, industrialists, producers, consumers, society, nations and internationals

WATER RESOURCES

The various sources of water, which can be harnessed economically, can be divided into the following two categories:-

(A) Surface sources such as

- (i) Ponds and lakes**
- (ii) Streams and rivers**
- (iii) Storage resources (dams)**

(B) Subsurface or underground sources such as

- (i) Springs**
- (ii) Wells (open and tube-wells)**