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ENVIRONMENTAL HAZARDS THROUGH POLLUTION: A THREAT TO HUMANKIND

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Abstract:

Pollution is an undesirable change in the physical, chemical or biological characteristics of air, water and soil that may harmfully affect the life or create a potential hazard to any living organisms. This paper provides the insight view about the environmental hazards through pollution in contest of air, water, soil and thermal pollution and their effects on animals, plants or trees and humans due to diseases and other environmental problems. In author's view, still situations are not beyond the reach of the global agencies, governments, local bodies and individual person to used modern technics and resources to balance the environmental conditions for livings and initiate the healthy atmosphere to live friendly with nature. It has observed that mainly human destroying the natural environment through anthropogenic activities and cause many health hazards for himself and other living creatures.

Key Words: Air Pollution, Environment, Health Hazards, Anthropogenic Activities& Undesirable Change

Introduction:

Environmental pollution had been a fact of life for many centuries. Although pollution had been known to exist for a very long time (at least since people started using fire thousands of years ago), but it became a real problem since the start of the industrial revolution, rapid urbanization and men's utilization and exploitation of natural resources. Not only the industrialization but also the exploding population causes the pollution to the environment. Pollution can be made by human activity and by natural sources as well [1]. With the advancement of civilization it was also matured and expanded in proportionate dimensions. It is the by-product of development and infact a price for progress. Environmental pollution is "the contamination of the physical and biological components of the earth/atmosphere system to such an extent that normal environmental processes are adversely affected" [2].

It has been argued that the carrying capacity of the earth is significantly smaller than the demands placed on it by a large numbers of human populations. And overuse of natural resources often results in nature's degradation. Environmental pollution takes place when the environment cannot process and neutralize harmful by-products of human activities (for example, poisonous gas emissions, industrial effluent). Environmental pollution is tangled with the unsustainable anthropogenic activities resulting in substantial public health problems [3]. Pollution disturbs our ecosystem and the balance in the environment with modernization and development in our lives. Pollution reaches its peak, giving rise to global warming and human illness [4].Over the last three decades there has been increasing global concern over the public health impacts attributed environmental pollution [5]. Human exposure to pollution is believed to be more intense now than at other time in human existence [6].

Pollution has become the first enemy of mankind. Today the whole mankind is more afraid of pollution rather than the nuclear holocaust and the entire world is worried about deteriorating and depleting conditions of environment. The Indian cities

are nominated as the most polluted cities in the world [7].The protection and improvement of environment has become a major issue which affects the well-being of the people and economic development. Atmosphere being a common heritage of entire mankind, it is the duty of all to preserve it. Dr. Kurt Waldheim, the Secretary General of United Nations addressing a Conference in 1972, observed that pollution of environment is a problem "no nation, no continent, no hemisphere, no race, no system can handle alone". He further observed that "the quality of our environment can be nothing else but the by-product of the behaviour of the nations". It is crucial to control pollution as the nature, wildlife and human life are precious gift to the mankind. Pollution reaches its most serious proportions in the densely settled urban industrial centres of the more developed countries [8].

Effects of Environmental Pollution:

- **Environmental Degradation:** Environment is the first casualty for increase in pollution whether in air and water. The increase in the amount of CO_2 in the atmosphere leads to smog which can restrict sunlight from reaching the earth. The preventing plants in the process of photosynthesis. Gases like sulphur dioxide and nitrogen oxide can cause acid rain. Water pollution in terms of oil spill may leads to death of several wild species.
- **Global Warming:** The emission of Green House gases particularly CO_2 is leading to Global Warming. The increase CO_2 leads to melting of polar ice caps which increase the sea level and pose danger for the people living in near coastal areas.
- **Ozone Layer Depletion:** Ozone layer is the thin shield high up in the sky that stops ultra violet rays from reaching the earth. As a result of human activities, chemicals such as chlorofluorocarbons (CFCs), were released into the atmosphere which contributed to the depletion of ozone layer.
- **Infertile Land:** Due to constant use of insecticide and pesticide, the soil may become fertile. Plants may not be able to grow properly. Various forms of chemicals produced from industrial waste is released into the flowing water which also affects the quality of the soil.

Human Health:

The decrease in the quality of air leads to several respiratory problems including asthma or lungs cancer, chest pain, congestion, throat inflammation, cardiovascular diseases, respiratory diseases are some diseases that can be causes by air pollution. McGeehin reported that U.S. population suffering from many infectious diseases such as cancer, birth defects asthma, many of which may be associated with environmental exposure [9].Water pollution occurs due to contamination of water and nay pose skin related problems including skin irritation and rashes. Similarly, noise pollution leads to hearing loss, stress and sleep disturbance. Pollutants can enter into the human body either directly or indirectly through food chain. Thus every kind of pollution adverse effects human body as shown in fig. 1.Metals even in small amounts can cause severe physiological and neurological damage to the human body. Therefore, pollutants mainly heavy metals should be prevented from reaching the natural environment [10]. The excess quantities of heavy metals are detrimental as these destabilize the ecosystems because of their bioaccumulation in organisms, and elicit toxic effects on biota and even death in most living organisms [11].

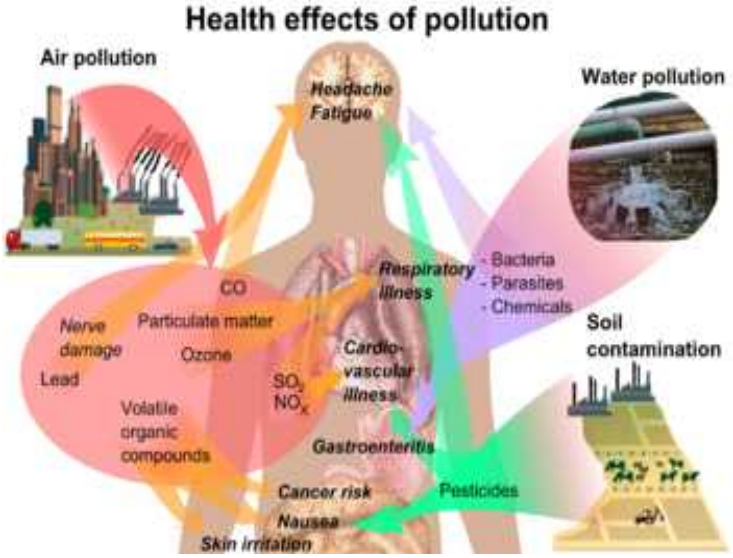

Figure 1: Effects of Environmental pollution on human health (Source: Google Images)

Environmental Pollutants:

Environmental pollutants are constituent parts of the pollution process. They are the actual "executing agents" of environmental pollution. It has been found that in 1990, there were around 65,000 different chemicals in the marketplace, i.e. potential environmental pollutants that were to be released into air, water and land on a regular basis [12].

Miguel A. Santos identifies at least three general characteristics of environmental pollutants

- Pollutants don't recognize boundaries, i.e. they are trans boundary;
- Many of them can't be degraded by living organisms and therefore stay in the ecosphere for many years; and
- They destroy biota and habitat [12]

Effects of some pollutants on human body are shown in fig. 2.

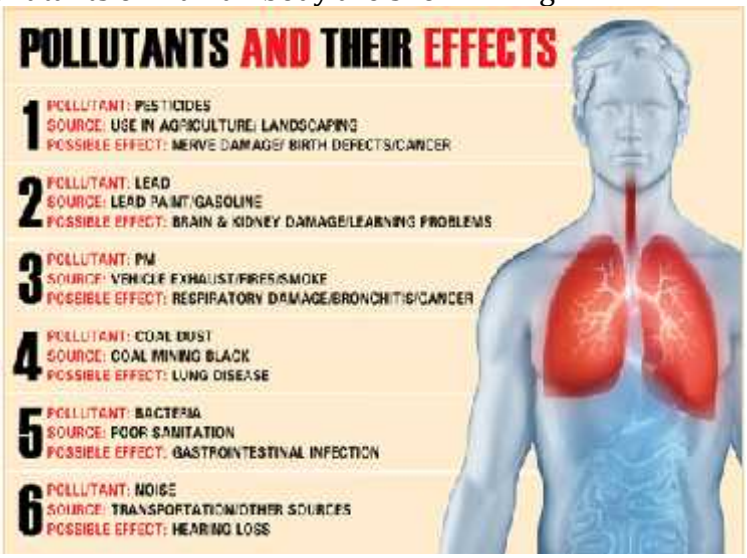

Figure 2: Effects of water pollutants on human body(Source: Google Images)

Types of Environmental Pollution:

There are many types of environmental pollution but the most important ones are:

- Air pollution

- Soil pollution
- Thermal pollution
- Radioactive pollution
- Water pollution

Air Pollution:

The origin of air pollution on the earth can be traced from the times when man started using firewood as means of cooking and heating. With the discovery and increasing use of coal, air pollution became more pronounced especially in urban areas. It was recognized as a problem 700 years ago in London in the form smoke pollution, which prompted the King Edward-I to make the first antipollution Law to restrict people from using coal for domestic heating in the year 1273. In the year 1300 another Act banning the use of coal was passed. Defying the law led to imposition of capital punishment. The earliest recorded major disaster was the 'London Smog' that occurred in 1952 that resulted in more than 4000 deaths due to the accumulation of air pollutants over the city for five days. Air pollution problem have caused a colossal loss of human life [13] animal and plant life.

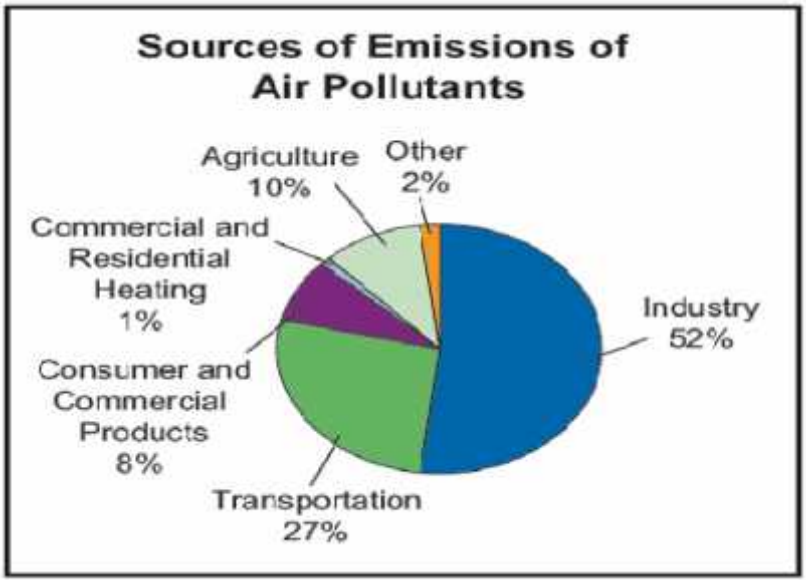

Figure 3: Percentage contribution of different air pollutants to air pollution (Source: Google Images)

Air pollution is the introduction of chemicals, particulate matter, or biological materials that cause or discomfort to human or other living organisms, or cause damage to the natural environment into the atmosphere. Air may get polluted by natural sources such as volcanoes, forest fire etc. or by human activities such as combustion of fuels for cooking and heating purposes, emission from industries, automobiles, power generation, smelting, mining etc. as shown in fig. 3. The main pollutants found in air include particulate matter, lead, ground level ozone, heavy metals, sulphur dioxide, benzene, carbon monoxide and nitrogen dioxide [14]. Other factors, such as poor environmental regulation, rapid growth in urban population, increasing industrialization, less efficient technology of production, congested roads and poor maintenance of vehicles, also empowering the problems of air pollution [15].

Air pollution began to increase in the beginning of the twentieth century with the development of the transportation systems and large scale use of petrol and diesel. The severe air quality problems dye to the formation of photochemical smog from the combustion residues of petrol and diesel engines were felt for the first time in Los

Angeles. Pollution due to auto exhaust remains a serious environmental issue in many developed and developing countries including India. Air pollution in cities causes a shorter lifespan for city dwellers [16]. The Air Pollution Control Act in India was passed on 1981 and The Motor Vehicle Act for controlling the air pollution, very recently. These Laws are intended to prevent air from being polluted.

The greatest industrial disaster leading to serious air pollution took place in Bhopal where extremely poisonous Methyl Isocyanide gas was accidently released from the Union carbide pesticide manufacturing plant on the night of December 3rd 1984. The effects of this disaster on the human health and on the soil are felt even today [17].

Soil Pollution:

Soil is the medium which sustain all life forms on the earth. Soil is one of the most important resource of the nature [18].Soil pollution occurs due to incorporation of unwanted chemicals in the soil due to human activities. Use of pesticides and insecticides absorbs the nitrogen compounds from the soil making it unfit for plants to derive nutrition from. Domestic, municipal and agricultural wastes are the main sources of soil pollution. Addition of excessive chemical fertilizers to the soil in order to increase the crop yield, irrigation of agricultural field with polluted water. Dumping of toxic waste, deforestation, discharge of industrial effluent etc., all these activities contaminate the soil to a greater extent [19]. Some soil pollutants are hydrocarbons, solvents and heavy metals. Among these heavy metals have specific ecological and biological effects on the environment of organisms living on the earth. Resistance and reliability of heavy metals in the soil is very long than other pollutants and soil pollution by heavy metals is relatively permanent [20]. Soil pollution results when waste are not disposed in a regulated and proper manner. Rubbish should be placed in disposal containers for collection and dumped in landfills that are covered with soil. Toxic chemicals must be disposed off in sealed containers that are buried in special cemented landfills.

Soil pollution closely associated to air water pollution, so its numerous effects come out as similar as caused by water and air contamination such as cancer, headache, fatigue, skin rashes etc. [21]

Soil pollution can alter metabolism of plants' metabolism and reduce crop yields and the same process with microorganisms and arthropods in a given soil environment. Small life forms may consume harmful chemicals which may then be passed up to the food chain of larger animals; this may lead to increased mortality rates and even animal extinction. [22]

Thermal Pollution:

Thermal pollution is the warming up of natural environment/aquatic ecosystem to the point where the desirable organisms are adversely affected. Thermal pollution is caused due to the excess of heat in the environment creating unwanted changes over long time; due to huge number of industrial processes such as generation of electricity from thermal power plants, deforestation and air pollution. It increases the earth's temperature causing drastic changes in the environment and aquatic system and results in the extinction of many life forms. In addition to this air toxics from thermal plants also contributes to the phenomenon of "Global Warming [23]. The accelerated pace of development, rapid industrialization and extensive population density have increased demand of thermal power plants which are the main cause of thermal pollution.

Effects of Thermal Pollution:

- Direct thermal shock (The effects of sharp changes in temperature when new thermal power plants open up or when plants shut down for repairing is known

as thermal shock). Fishes and other organisms adapted to a particular temperature range may also die due to thermal shock.

- Thermal pollution reduces dissolved oxygen as warmer effluents from thermal power plants reduces the solubility of oxygen and increase in temperature enhances the rate of respiration in aquatic organisms thus forcing them to consume more oxygen. Decrease in the level of dissolved oxygen causes breathing problems in aquatic organisms which may prove to be fetal.
- It also increases the susceptibility to diseases, parasites and toxic chemicals.
- Change in water properties, increase water toxicity.
- Interfere with biological activities, increase vulnerability to diseases and cause undesirable changes in algae production.
- Thermal pollution may also increase the enzyme activity of aquatic animals [24]

Radioactive Pollution:

Radioactive elements enter into water bodies due to various activities such as mining and processing of ores, increasing use of radioactive isotopes, radioactive materials from nuclear reactor and nuclear power plants. Various sources of radioactive pollutants are shown in fig. 4. When these radio-nucleoids are taken up by aquatic organisms, exchange takes place with chemically similar elements present in aquatic organisms for example, ex-radioactive strontium-90 and radium-226 replaces calcium, and phosphorus-32 absorbed by bones in aquatic animals causes hazardous effects on organisms. The biological damage resulting from ionizing radiations is generally termed as radiation damage.

Large amounts of radioactive radiation can kill cells that can dramatically affect the exposed organism as well as possibly its offspring. Affected cells can mutate and result in cancer. Alarge enough dose of radiation can kill the organism [25].Radiation damage can be divided into two types: (a) Somatic damage (also called radiation sickness) and (b) Genetic damage. Somatic damage refers to damage to cells that are not associated with reproduction. Effects of somatic radiation damage include reddening of the skin, loss of hair, ulceration, fibrosis of the lungs, the formation of holes in tissue, a reduction of white blood cells, and the induction of cataract in the eyes. This damage can also result in cancer and death. Genetic damage refers to damage to cells associated with reproduction. This damage can subsequently cause genetic damage from gene mutation resulting in abnormalities. Genetic damages are passed on to next generation. [26]

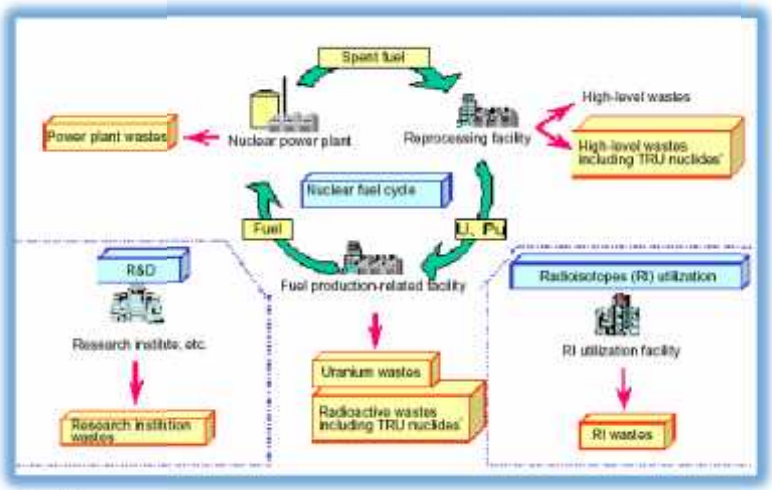

Figure 4: Sources of Radioactive Pollutants (source: Google images)

Radioactive pollution is highly dangerous when it occurs. It can cause due to nuclear plant malfunctions, improper nuclear waste disposal accidents etc. It causes cancer, infertility, blindness at the time of birth, can sterilized soil and affected air and water.

Water Pollution:

Water is the essential element that makes life on the earth possible. Without water there would be no life. Water is not only one of the essential commodities of our day-today life, but development of this natural resource also plays a crucial role in economic and social development processes [27]. Although 71% of the earth's surface is covered with water but only a tiny fraction of this water is available to us as fresh water. About 97% of the total water available is found in the oceans and is too salty for drinking and irrigation. The remaining 3% is fresh water. Of this 2.997% is locked in ice caps and glaciers. Thus only 0.003% of the earth total volume of water is easily available to us as soil moisture, ground water, water vapour and water in lakes, streams, rivers and wetlands. In short if the world's water supply were only 100 litres our usable supply of fresh water would be only about 0.003 litres (one-half teaspoon). This makes the water a very precious resource. The future wars in our world may well be fought over water. The WHO states that one sixth of the world's population; approximately 1.1 billion people do not have access to safe water and 2.4 billion lack basic sanitation.[28]

When the quality or composition of water changes directly or indirectly as a result of man's activities such that it becomes unfit for any purpose it is said to be polluted. Water perhaps the oldest from of environment pollution of which the humans have been aware. Direct and indirect references to pollution of water are found even in ancient literature. Water pollution is a major problem which requires ongoing evaluation and revision of water resource policy at all levels. It has been suggested that it is the worldwide leading cause of deaths and diseases and accounts for more than 14,000 deaths daily. [29]

The quantity and quality of clean water are of vital significance for the welfare of mankind. But there is a continuous increase in demand for pure and quality water for man's use. According to 1982 survey, 70% of all the available water is polluted in our country. So, we must examine the quality of water, it results in the development existing water re-use technology. Water pollution has many sources. The most polluting of them are the city sewage and industrial waste discharge into the rivers. The facilities to treat waste water are not adequate in any city in India. Presently only about 10% of the wastewater generated is treated; rest is discharged as it is into our water bodies. Due to this pollution enters into ground water, rivers and other water bodies. Such water which ultimately ends up in our households is often highly contaminated and carries disease causing microbes. Agricultural run-off, or the water from the fields that drains into rivers, is another major water pollutants as it contains fertilizers and pesticides. Polluted water causes various health hazards, threatened aquatic life and also disturbed the production of different crops [30], [31].

Sources of Water Pollution:

Sources of water pollution are categorized into two groups-

- Point sources
- Non-Point sources

Point Sources:

The identifiable single source which discharges harmful substances directly into a water body is called a point source (shown in fig. 5). Examples of some point sources are;

- Leaking septic tank systems.
- Unlined landfills.
- Polluted water from abandoned and active mines.
- Water discharged by industries.
- Public and industrial waste water treatment plants.
- Leaking storage lagoons for polluted waste.
- Effluent discharges from sewage treatment works and industrial sites, power stations.
- Leaking underground storage tanks that contain chemicals or fuels such as gasoline.

Non-Point Source or Diffused Source:

When pollutants enter indirectly into a water body from many sources which are often difficult to identify, such sources are known as non-point sources (shown in fig. 5). For example a river can be polluted by runoff from any of the land and industries in its watershed. If a farm, a road, or any other land surface in a watershed is polluted, run off from a rainstorm can carry the pollution into a nearby river, stream, or lake. Some additional causes of non-point sources are;

- Pesticides, herbicides and fertilizers from residential lawns, farmland etc.
- Feces and agricultural chemicals from livestock feedlots.
- Oil and gasoline from personal watercraft.
- Chemicals added to road surfaces.
- Precipitation containing air pollutants.
- Soil runoff from farms and construction sites.
- Water runoff from city and suburban streets that may contain oil, gasoline, animal feces and litter.

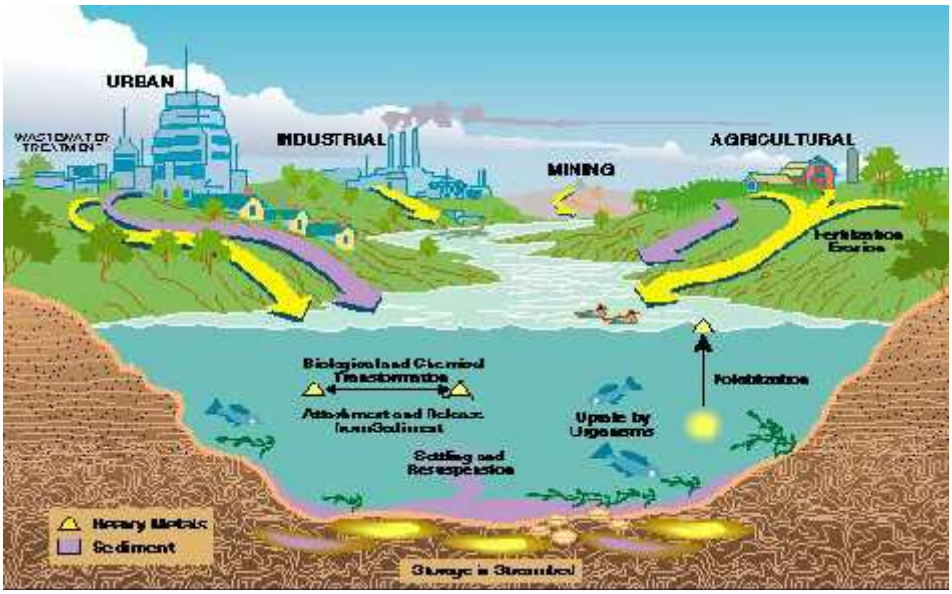

Figure 5: Point and non-point sources of water pollution (Source: Google Images)

Water Pollutants:

Water pollutants are the agents which alter the physical and chemical properties of water and makes its unfit for drinking and other useful purposes. Major categories of water pollutants and their sources are listed in table 1. Depending upon the chemical nature water pollutants there are various types of pollutants such as organic, inorganic, agricultural run-off, radioactive materials and heat produced by industries and public

oriented places. Waste water containing these pollutants polluted the natural sources of water and enters into human metabolic systems and as result produces unwanted changes in the physical, chemical and biological characteristics of air water and land. These changes cause toxicity to many, aquatic systems, plants and other living beings. The minamata disaster has made the awareness and seriousness of hazards of environment pollution. This disaster happened in japan due to the mercury poisoning [32]. The incidence of Ita-Itai Byo disease, which also happened in Japan, has further developed the environmental awareness. [33]

Organic pollutants are the most common pollutants found in water. It is caused by naturally occurring compounds like protein fats, carbohydrates etc. as well as synthetic like dyes pesticides etc. they are originated mainly from domestic sewage, urban runoff, industrial effluents (soaps, detergents, pesticides herbicides), farm waste, Petroleum hydrocarbon including fuels, lubricating fuel, and fuel combustion by-products from storm water run-off[34]. These pollutants discharged into water bodies are degraded into simpler compounds by aerobic bacteria, making them harmful. But they required a large amount of O_2 and thus increases BOD level leading to exhaustion of dissolved oxygen making aerobic bacteria die and thus entire ecosystem get disturbed [35]. Inorganic pollutants includes nitrates, sulphate, phosphate, heavy metals, etc. which are obtained from mines, industrial discharge, fertilizers found in water run-off, heavy metals from motor vehicles, industries and acid mine drainage [36]. Inorganic acids and alkalis can do extensive damage to water bodies by breaking down into natural buffer system and altering its normal pH values. Under more acidic and alkaline conditions, the aquatic population tends to fall as they destroy aerobic bacteria with no supply of oxygen**.**

Radioactive elements enter into water bodies due to various activities such as mining and processing of ores, increasing use of radioactive isotopes, radioactive materials from nuclear reactor and nuclear power plants. When these radionucleoides are taken up by aquatic organisms, exchange takes place with chemically similar elements present in aquatic organisms for example, ex-radioactive strontium-90 and radium-226 replaces calcium, phosphorus-32 absorbed by bones in aquatic animals causes hazardous effects on organisms.

Table 1: Major Categories of water pollutants

Category	Examples	Sources
Causeshealthproblems		
1. Infectious agents	Bacteria, viruses, parasites	Human and animal excreta
2. Organic chemicals	Pesticides, plastics, oil, gas, Detergents	Industrial, household, and farm use
3. Inorganic chemicals	Acids, caustics, salts, metals	Industrial effluents, household cleansers, surface runoff
4. Radioactive materials	Uranium, thorium, Cesium, iodine, radon	Mining/processing ores, power plants, weapons, natural sources
Causesecosystemdisruption		
1. Sediment	Soil, silt	Land erosion
2. O^2-demanding wastes	Animal manure and plant Residues	Sewage, agricultural runoff, paper mills, food processing

3. Thermal	Heat	Power plants, industrial

Effects of Water Pollution on Human and Aquatic Life:

Water pollution has taken toll of all the surviving species on the earth. Almost 60% of the species live in water bodies. It occurs due to several factors; the industrial waste dumped into the rivers and other water bodies cause an imbalance in the water leading to its severe contamination and death of aquatic species[37]. Contaminated drinking water is also a major source of hepatitis, typhoid and opportunistic infections that attack the immuno-compromised, especially persons living with HIV/AIDS.[38]

Spraying of insecticide, pesticides like DTT on plants pollutes the ground water system and oil spills in the oceans have caused irreparable damage to the water bodies. Various diseases spreads by consumption of polluted water include typhoid, amoebiasis, diardiasis, ascariasis, hookworm, respiratory infections, hepatitis, encephalitis, gasterointeritis, diarrhea, vomiting and stomach ache. It has been estimated that 50,000 people die daily worldwide as a result of water related diseases.[39]Water pollution apart from causing hazards to human health, also diminishes the aesthetic quality of lakes and rivers. More seriously, contaminated water destroys aquatic life and reduces its reproductive ability. In short nobody can escape the adverse effects of water pollution. An estimated 260 million people are infected with schistosomiasis [WHO 2004]. 1.3 million People die of malaria each year, 90% of whom are children under 5 [40].

Conclusions:

The study undertaken in this paper offers conclusive evidences for the Environmental pollution and its life threatening impact on every living organism. Author's studies also observed that, since last few decades the quality of almost all the natural resources even the life supporting component air, water and soil have deteriorates upto such extent that instead of supporting life supporting phenomena these are altering the their mechanism and making the survival of life forms difficult. The pollution not only degrading the natural environment but also reducing the life span of humans. In author's view although hazards through environmental pollution are life threatening but still conditions are in the hands of global agencies, government and local bodies, and individual person that can balance the environment conditions by using modern techniques to initiates healthy atmosphere for human to live friendly with the nature.

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