



IMPACT OF THE ENVIRONMENTAL POLLUTION ON HUMAN HEALTH

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Abstract:

This paper discusses various types of environmental pollution—air, water, soil, noise, radioactive, thermal, and marine—and their harmful impacts on human health. It highlights the sources and consequences of pollution, while emphasizing the need for strict regulations, public awareness, and sustainable practices to safeguard the environment and public health.

Index Terms - Environmental pollution, human health, air pollution, water pollution, climate impact

Introduction: The Environment is defined as the surroundings around us, which includes physical and non-physical systems that interact with each other. Environmental Pollution is increasing gradually and causing a serious impact on living organisms, including humans. It can be reduced by microorganisms or plants that have biosynthetic pathways for the degradation or accumulation of environmental pollutants from soil and water. The lack of genetic components in natural macroorganisms or plants reduces their ability to degrade or accumulate pollutants, and hence, they are currently released at high rates.

Pollution is the addition of any substance (solid, liquid, gas) or any form of energy (such as heat, sound, or radioactivity) to the environment at a rate faster than it can be dispersed, diluted, decomposed, recycled, or stored in some harmless form. The major kinds of pollution are usually classified as air pollution, water pollution, and land pollution. Modern society is also concerned about specific types of pollutants such as noise pollution, light pollution and plastic pollution. Pollution of all kinds can have negative effects on the environment and wildlife, and after impacting human health, Environmental pollution is one of the greatest problems that human society is facing today. Air, water and soil form the three basic areas of environmental pollution. Environmental pollution is unwarranted disposal of mass or energy into

earth's natural resource pool such as water, land or air that results in long or short term detriment to the atmosphere and its ecological health to negatively impact the living being and their life both quantitatively and qualitatively (Hussein 1998) Environmental pollution reflects a measure of contamination of the living and nonliving constituents of the earth, in a manner and to an extent, to adversely affect the normal optimum environmental process. The relative presence of pollutants such as suspended particulate matter (PM2.5 and PM10) gases such as No₂, So₂, Co₂; Co and CH₄, Volatile organic compounds; polyaromatic hydrocarbon; and heavy metals(Ni, Cd, As, Pb etc.) determines the quality of the air which is not only a critical determinant of human health but also a key regulator of plant growth and development, Environmental pollution is a significant factor for several health conditions including respiratory infections, heart diseases and stroke and lung cancer. It also includes difficulty in breathing, wheezing, coughing, asthma, and Cardiac Conditions.

Concept of Environmental Pollution: Air is an integral component of the environment responsible for various life processes and hence our persistence on this planet. The rapid pace of global industrialisation and urbanisation has perturbed the pristine environment and, hence, global air quality. The air quality degraded over time. The recent data from the Central Pollution Control Board in the different regions show a high level of pollution.

The particulate matter increases in the atmosphere due to the presence of vehicles and industrial waste. Toxic air pollutants are a class of chemicals that may potentially cause health problems in a significant way.

Component of Environment Pollution: - The environment is composed of four basic components

1. Atmosphere
2. Hydrosphere
3. Lithosphere
4. Biosphere

Component of Environmental Pollution

1. Air Pollution

Air pollution refers to the presence of harmful or excessive quantities of substances—including gases, particulates, and biological molecules—in the Earth's atmosphere. This pollution can be natural or human-made and poses severe health risks, environmental degradation, and climate change challenges.

One primary contributor to air pollution is the combustion of fossil fuels in vehicles, industries, and power plants. These activities emit various pollutants, such as carbon monoxide, Nitrogen oxides, Sulphur dioxide, and volatile organic compounds. These gases contribute to the formation of smog, which has detrimental effects on human health, particularly on the respiratory system, and can lead to diseases like asthma, bronchitis, and even lung cancer.

Particulate matter, tiny solid or liquid particles suspended in the air, is another critical component of air pollution. These particles come from various sources, including vehicle emissions, industrial processes, and natural events like wildfires and dust storms. Inhalation of particulate matter can penetrate deep into the lungs and even enter the bloodstream, causing cardiovascular problems, respiratory diseases, and premature death.

Moreover, air pollution isn't confined to cities or industrial areas. Agricultural activities also contribute significantly. Ammonia from livestock waste and fertilisers, along with pesticides and other chemicals, can degrade air quality, affecting both human health and ecosystems.

The adverse effects of air pollution extend beyond health concerns. Acid rain, a consequence of Sulphur dioxide and nitrogen oxides reacting with atmospheric moisture, damages forests, soils, and aquatic ecosystems, affecting biodiversity and water quality. Additionally, pollutants like black carbon can accelerate the melting of ice and snow, contributing to global warming and altering weather patterns.

2. Water Pollution

Water pollution refers to the contamination of water bodies such as rivers, lakes, oceans, groundwater, and even drinking water sources by harmful substances. These contaminants can be of various types, including chemicals, pathogens, heavy metals, and physical or biological agents, and they pose serious threats to human health, aquatic life, and the environment.

The sources of water pollution are diverse and include industrial activities, agricultural runoff containing pesticides and fertilisers, untreated sewage and wastewater discharge, oil spills, improper disposal of hazardous waste, and even atmospheric deposition of pollutants.

The impact of water pollution is far-reaching. Contaminated water can lead to various health problems when used for drinking, bathing, or cooking. It can also harm aquatic ecosystems by killing marine life, disrupting food chains, and causing algal blooms or dead zones. Additionally, pollutants in water can accumulate in the food chain, affecting human health through the consumption of contaminated fish or other seafood.

3. Soil/Land Degradation

Soil or land pollution refers to the degradation of the Earth's surface due to the introduction of harmful chemicals, waste materials, or other pollutants, leading to adverse effects on soil quality and overall land health.

There are several causes of soil pollution:

1. **Industrial Activities:** Chemical spills, improper disposal of industrial waste, and the release of heavy metals or toxic substances from manufacturing processes can contaminate soil.
2. **Agricultural Practices:** Overuse of pesticides, herbicides, and fertilizers, as well as improper disposal of animal waste, can introduce harmful chemicals and nutrients into the soil, affecting its fertility and ecosystem balance.
3. **Mining Activities:** Extractive industries can leave behind contaminated soil and mine tailings, often containing heavy metals and other hazardous materials that persist in the environment.
4. **Improper Waste Disposal:** Dumping household waste, construction debris, and landfill leachate can introduce pollutants into the soil, impacting its quality and posing risks to groundwater.
5. **Oil Spills and Transportation Activities:** Accidental oil spills, leaks from transportation, or improper handling of petroleum products can lead to soil contamination, affecting vegetation and groundwater quality.

The consequences of soil pollution:

Reduced Soil Fertility: Contaminants can alter soil pH, decrease nutrient levels, and disrupt microbial activity, affecting the soil's ability to support plant growth.

Impact on Human Health: Contaminated soil can lead to the accumulation of toxic substances in crops, posing risks to human health through the food chain or direct exposure.

Ecological Imbalance: Soil pollution can disrupt ecosystems, harm beneficial organisms, and reduce biodiversity, impacting the overall health of plants, animals, and microorganisms that depend on healthy soil.

4. Noise Pollution

Noise pollution refers to the presence of excessive or disruptive noise that can have harmful effects on human health, wildlife, and the environment. It is commonly caused by various sources such as industrial activities, transportation, construction, urbanization, and recreational events.

There are several key sources of noise pollution:

1. **Transportation:** Road traffic, aircraft, trains, and maritime vessels contribute significantly to noise pollution, especially in densely populated areas close to transportation routes.
2. **Industrial Activities:** Factories, manufacturing plants, construction sites, and machinery generate high levels of noise, impacting workers' health and nearby residents.
3. **Urbanization:** Urban areas with increased population density, commercial activities, and infrastructure development often experience higher levels of noise pollution due to constant human activities.
4. **Recreational and Entertainment Events:** Concerts, sporting events, fireworks, and other leisure activities can produce loud and prolonged noise, affecting nearby communities.

The effects of noise pollution on human health can be extensive:

1. **Hearing Damage:** Prolonged exposure to high noise levels can lead to hearing impairment or permanent hearing loss.
2. **Sleep Disturbance:** Noise can disrupt sleep patterns, leading to insomnia, fatigue, and increased stress levels.
3. **Cardiovascular Issues:** Chronic exposure to noise pollution has been linked to increased risks of hypertension, heart disease, and strokes.
4. **Cognitive Impairment:** Continuous exposure to high levels of noise can impair concentration, hinder learning, and decrease productivity.
5. **Noise pollution also affects wildlife,** disrupting communication, migration patterns, and breeding behaviors in various animal species.

Mitigating noise pollution:

1. Regulations and Urban Planning: Implementing noise ordinances, zoning regulations, and urban planning strategies to minimize noise in residential and sensitive areas.
2. Technological Solutions: Advancements in soundproofing, noise-reducing materials, and quieter machinery help lower noise emissions from various sources.
3. Public Awareness: Educating the public about the health impacts of noise pollution and promoting responsible behavior and noise-reducing practices.
4. Efforts to reduce noise pollution aim to create healthier and more peaceful environments, ensuring that communities can thrive without the detrimental effects of excessive noise on human well-being and the natural world.

5. Radioactive Pollution

Radioactive pollution occurs when there is an introduction of harmful radioactive substances into the environment, posing risks to human health, ecosystems, and the environment. Radioactive elements emit ionizing radiation, which can cause damage to living organisms' cells and genetic material.

The primary sources of radioactive pollution include:

1. Nuclear Accidents: Catastrophic events like the Chernobyl disaster in 1986 and the Fukushima Daiichi nuclear disaster in 2011 released significant amounts of radioactive materials into the environment, causing widespread contamination.
2. Nuclear Power Plants: Normal operations, accidents, or improper disposal of radioactive waste from nuclear power plants can lead to the release of radioactive substances into the air, water, and soil.
3. Industrial and Medical Uses: Activities involving the use of radioactive materials in industries, research facilities, and medical procedures can result in accidental leaks, spills, or improper disposal, contributing to radioactive pollution.

The impacts of radioactive pollution can be severe:

Health Risks: Exposure to high levels of ionizing radiation can cause acute radiation sickness and increase the risk of developing cancer, genetic mutations, and reproductive issues in humans and other organisms.

Environmental Contamination: Radioactive substances can persist in the environment for long periods, contaminating soil, water, and air, and bioaccumulating in the food chain, affecting ecosystems and wildlife.

6. Thermal Pollution

Thermal pollution refers to the generation of energy by burning coal. This phenomenon disrupts aquatic ecosystems and poses numerous environmental hazards.

Industries and power plants utilize water for cooling purposes, withdrawing colossal amounts from rivers, lakes, or oceans, then discharging the heated water back into these sources. This discharge, often significantly warmer than the natural temperature, elevates the water body's overall heat level, causing various adverse effects.

One of the most critical impacts of thermal pollution is its effect on aquatic life. Sudden temperature changes disrupt the balance of ecosystems, affecting the metabolism, reproduction, and behavior of aquatic organisms. Many species have specific temperature requirements for survival, and even a slight increase can disturb their life cycle, leading to migration, reduced reproduction, or death. Fish are highly sensitive to temperature changes, which affect their spawning patterns and overall population.

Additionally, thermal pollution reduces the oxygen-carrying capacity of water. Warm water holds less dissolved oxygen than colder water, affecting the survival of aquatic organisms, especially those reliant on oxygen-rich environments. This decline in oxygen levels can lead to the formation of hypoxic (low oxygen) or anoxic (no oxygen) zones, further endangering aquatic life.

Furthermore, altered water temperatures can disrupt nutrient cycles and promote the growth of invasive species, upsetting the natural balance of the ecosystem. Increased temperatures can encourage the growth of algae, leading to algal blooms, which not only block sunlight from reaching other aquatic plants but also consume large amounts of oxygen upon decomposition, exacerbating oxygen depletion.

Efforts to mitigate thermal pollution involve various strategies, including implementing cooling technologies to reduce the temperature of discharged water, utilizing alternative cooling methods such as dry cooling systems, and stricter regulations on thermal discharge limits.

7. Marine Pollution

Marine pollution refers to the introduction of harmful or potentially harmful substances into the ocean and other bodies of water, leading to adverse effects on marine life, ecosystems, and even human health. It's caused by various sources, including industrial discharges, agricultural runoff, oil spills, plastic debris, and improper waste disposal.

One of the major contributors to marine pollution is plastic waste. Millions of tons of plastic end up in the ocean each year, harming marine animals through ingestion or entanglement. Microplastics, tiny plastic particles, further exacerbate the issue, entering the food chain and potentially affecting entire ecosystems.

Chemical pollution from industrial and agricultural activities introduces toxins and pollutants into the water, impacting marine organisms' health and disrupting ecosystems. Oil spills, whether from natural seepage or human activities like tanker accidents, pose a severe threat, coating marine life, disrupting habitats, and causing long-term ecological damage.

Nutrient pollution, often from agricultural runoff containing excess fertilizers, leads to harmful algal blooms. These blooms deplete oxygen

in the water, creating dead zones where marine life cannot survive. Additionally, heavy metals, pesticides, and other pollutants can accumulate in marine organisms, eventually making their way up the food chain and potentially affecting human health.

Overfishing and destructive fishing practices also contribute to marine pollution by disrupting the balance of marine ecosystems. Bycatch, where non-target species are caught unintentionally, leads to the unnecessary loss of marine life.

Efforts to combat marine pollution involve international agreements, local regulations, and community-driven initiatives. These include the implementation of stricter waste management practices, promoting recycling, reducing single-use plastics, enforcing regulations on industrial waste disposal, creating marine protected areas, and raising awareness about the importance of preserving marine environments.

Addressing marine pollution is crucial for the health of our oceans, as they play a vital role in regulating the Earth's climate, providing food and livelihoods for millions, and supporting diverse ecosystems. Collaboration on a global scale is necessary to mitigate the impact of human activities and ensure the preservation of our oceans for future generations.

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