
Sources of Pollution: Effects on Health and Its Remedies

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Abstract

Pollution can take the form of chemical substances or energy, such as noise, heat or light. Pollutants, the components of pollution, can be either foreign substances/energies or naturally occurring contaminants. Pollution is often classed as point source or nonpoint source pollution. In 2015, pollution killed 9 million people in the world. Environment pollution is a wide-reaching problem and it is likely to influence the health of human populations is great. Pollution started from prehistoric times when man created the first fires. According to a 1983 article in the journal Science, "soot" found on ceilings of prehistoric caves provides ample evidence of the high levels of pollution that was associated with inadequate ventilation of open fires." Metal forging appears to be a key turning point in the creation of significant air pollution levels outside the home. This paper provides the insight view about the sources of pollution in the perspective of pollution on human health and its remedies.

Keywords: *Environment Pollution; Air Pollution; Global Warming; Acid Rain; Remedies, Health*

1.0 Introduction

Pollution reaches its most serious proportions in the densely settled urban-industrial centers of the more developed countries (Kromm,1973). In poor countries of the world more than 80% polluted water have been used for irrigation with only seventy to eighty percent food and living security in industrial urban and semi urban areas. (Mara & Cairncross, 1989). Industry, clustered in urban and semi-urban areas surrounded by densely populated, low-income localities, continues to pollute the environment with impunity. 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). Pollution can be made by human activity and by natural

forces as well (Fereidoun et al, 2007; Selfish private enterprise and their lack of awareness of public well-being and social costs (Carter, 1985) and natural disasters (Huppert & Sparks, 2006) e.g. volcanic ash from Iceland (World Health Organization [WHO], 2010a) are the one of the main reason of pollution. British Airways (1993) expresses their concern about environment in their general goal 'to be a good neighbor, concerned for the community and the environment. This implies that, businesses now adopted this responsibility as part of their overall business strategy; which should match their broader business goals (Pearce, 1991).

There is no doubt that excessive levels of pollution are causing a lot of damage to human & animal health, plants & trees including tropical rainforests, as well as the wider environment.(Tropical Rainforest Animals, 2008). According to Fereidoun et al (2007), Tehran is one of victim cities in terms of environmental pollution. Gautam et al (2009) nominated Indian cities, among the most polluted cities in the world. Carter (1985) found pollution in formally known Czechoslovakia (now Czech Republic and Slovakia) a serious issue which ultimately affects soils and vegetation. As

Debarleeven (1992) postulates that environmental pollution and degradation are serious problems in Eastern and Central Europe. Kan (2009) originated the fact about China that, it has environmental problems, including outdoor and indoor air pollution, water shortages and pollution, desertification, and soil pollution, have become more pronounced and are subjecting Chinese residents to significant health risks. While many studies have focused on estimating a relationship between pollution and health, they have largely neglected to consider that pollution exposure is endogenously determined if individuals make choices to maximize their well-being. People with high preferences for clean air may choose to live in areas with better air quality. People can respond to a wide range of readily available information on pollution levels by adjusting their exposure. Failing to appropriately account for such actions can yield misleading estimates of the causal effect of pollution on health.

1.1 What is pollution?

Pollution occurs when a substance present in the environment prevents the functioning of natural processes and produces harmful environmental and health effects. In the natural world, many substances

accumulating in the environment are processed through the intricate network of bio-geochemical cycles.

The agent that contaminates the environmental component is called the pollutant. Pollutants can be grouped into two broad categories:

- **Non-biodegradable Pollutants:**

Such substances are not broken down or decomposed by bacteria. Examples are pesticides, heavy metals, rubber, nuclear wastes etc. Plastics also fall in the same category. These pollutants persist for a very long time in nature, get accumulated and often biomagnify to a dangerous level when they move in material cycles in the nature and along with the food chain.

- **Biodegradable Pollutants:**

Pollutants such as garden waste, domestic sewage, agro-based residues, etc. break down into simple products by bacterial decomposition process. These simple products are raw materials of nature that are reutilised in the ecosystem. Decomposition of these non-persistent pollutants occurs naturally as well as through engineered

systems such as sewage treatment plants. Such man made systems enhance nature's capacity to decompose.

1.2 Different forms of pollution

- **Air pollution:** the release of chemicals and particulates into the atmosphere. Common gaseous pollutants include carbon monoxide, sulfur dioxide, chlorofluorocarbons (CFCs) and nitrogen oxides produced by industry and motor vehicles. Photochemical ozone and smog are created as nitrogen oxides and hydrocarbons react to sunlight. Particulate matter or fine dust is characterized by their micrometre size PM_{10} to $PM_{2.5}$.
- **Light pollution:** includes light trespass, over-illumination and astronomical interference.
- **Noise pollution:** This encompasses roadways noise, aircraft noise, industrial noise as well as high-intensity sonar.
- **Soil contamination:** This occurs when chemicals are released by spill or underground leakage. Among the most significant soil contaminants are hydrocarbons, heavy metals,

MTBE, herbicides, pesticides and chlorinated hydrocarbons.

- **Radioactive contamination**, resulting from 20th century activities in atomic physics, such as nuclear power generation and nuclear weapons research, manufacture and deployment.
- **Thermal pollution**: This is a temperature change in natural water bodies caused by human influence, such as use of water as coolant in a power plant.
- **Visual pollution**, which can refer to the presence of overhead power lines, motorway billboards, scarred landforms (as from strip mining), open storage of trash, municipal solid waste or space debris.
- **Water pollution**, by the discharge of wastewater from commercial and industrial waste (intentionally or through spills) into surface waters; discharges of untreated domestic sewage, and chemical contaminants, such as chlorine, from treated sewage; release of waste and contaminants into surface runoff flowing to surface waters (including urban runoff and agricultural runoff,

which may contain chemical fertilizers and pesticides); waste disposal and leaching into groundwater; eutrophication and littering.

- **Plastic pollution**: involves the accumulation of plastic products in the environment that adversely affects wildlife, wildlife habitat, or humans.

2.0 Air pollution

Air is essential for us to live. We can live without food and water for days but only a few minutes without oxygen. An average human adult uses six times more amounts of gases per day as compared to water and food. That is why maintaining air quality is important for us.

Types of Air Pollutants and their Sources

When clean air moves in the troposphere, it collects products from natural events as well as human activities. Some list of the common air pollutants resulting from human activities are,

Suspended Particulate Matter (SPM): Bio particles (organisms, spores, pollen grains), dust particles, smoke, mist, fumes, spray, asbestos, pesticides, metallic dust (arsenic, barium, boron, selenium, beryllium,

cadmium, chromium, iron, manganese, nickel, zinc).

Gases: Nitric oxide (NO), nitrogen dioxide (NO₂), sulphur dioxide (SO₂), carbon monoxide (CO), carbon dioxide (CO₂), ozone (O₃), peroxy acetyl nitrate (PAN), hydrogen fluoride (HF), ammonia (NH₃), chlorine (Cl), hydrogen sulphide (H₂S), hydrocarbons (methane, ethane, propane, acetylene, ethylene, butane, iso pentane), aldehydes, alcohols.

Air pollutants can be grouped into two categories: Primary pollutants and secondary pollutants.

2.1 Primary Pollutants are emitted directly into the air as a result of natural or human activity. Examples include **particulates, sulphur dioxide, nitrogen oxides, carbon dioxide, carbon monoxide, ozone** and **hydrocarbons** released from fuel burning. We now discuss some of these in brief.

2.2 Particulate matter

The smaller particles such as dust, soil, sulphate salts, heavy metal salts, fire particles of carbon (soot), silica, asbestos, liquid sprays, mist, etc. remain suspended in the air for long periods and pollute it.

2.3 Sulphur Dioxide

It is emitted from burning fossil fuels like coal and petrol and from processing of

sulphide ores like pyrite. At concentrations above 1 ppm (Parts per million (ppm) is the unit of concentration often used to measure the level of pollutants in air, water, body fluids, etc. One ppm is 1 part in 1,000,000. The common unit mg/litre is equal to one ppm for water solutions.), it affects human beings.

2.4 Nitrogen oxides

Nitrogen oxide (NO), Nitrogen dioxide (NO₂), Nitrous oxide (N₂O) and Nitrate (NO₃) are generated in the burning of fuels and biomass. These oxides play an important role in the formation of photochemical smog.

2.5 Oxides of carbon

Incomplete combustion of coal, oil and other fuels for energy production, manufacturing and transport; biomass burning, exhausts from aircrafts and space rocket engines, etc. give rise to carbon dioxide (CO₂) and carbon monoxide (CO). Carbon monoxide is deadly poisonous in concentration higher than 100 ppm, which is quite common at the time of traffic jams on the busy roads of a city. Human activities result in the production of nearly 250 million tonnes of CO annually and it accounts for 50 % of the total atmospheric pollutants.

2.6 Secondary Pollutants are produced as a result of chemical reactions between primary pollutants and normal atmospheric compounds under the influence of solar radiations. Some examples are ozone, smog and acid rain.

2.7 Ozone

Ozone is both a protector and a problem for us. In the stratosphere, the ozone layer protects us from harmful UV radiations. In the lower atmosphere it acts as a powerful oxidizing agent and causes damage to crops, vegetations, fabrics etc. and harm to human beings. Some people are affected even at a low concentration of 0.001 ppm.

2.8 Smog

Smog is a mixture of smoke and fog or moisture in the air. Smog is basically of two types: Photochemical smog or brown air smog and the industrial smog or grey air smog. The hydrocarbons and nitrogen oxides from automobiles and power plants react in the presence of sunlight producing a number of secondary pollutants such as ozone, formaldehyde and Peroxy Acyl Nitrate (PAN). The resulting brown orange shroud is known as photochemical smog. Mainly sulphur oxides, particulate and droplets (aerosol) combine with atmospheric

moisture and form a greyish haze known as grey smog or industrial smog.

2.9 Acid rain

The primary pollutant sulphur dioxide (SO_2) reacts with oxygen (O_2) in the atmosphere to form sulphur trioxide (SO_3), a secondary pollutant. Sulphur trioxide further reacts with water vapour to form another secondary pollutant sulphuric acid (H_2SO_4), which is a component of acid rain. Acid rain or acid precipitation includes wet acidic depositions like rain, snow, fog, moist or dew and deposition of dry acidic particulates from the air. It occurs in and around the areas where major emissions of sulphur dioxide (SO_2) and nitrogen oxides (NO_x) occur as a result of anthropogenic activities. Hydrochloric acid emitted from coal fired power plants also adds to acid rain problems. Acid depositions have disastrous effects on both the life forms as well as the materials. The pH of aquatic bodies is lowered which may harm or kill their biota. Soil fertility is also affected adversely.

3.0 Effects of Pollution

3.1 Air Pollution on Human Health

Air pollutants mainly act on the respiratory system of humans and their health effects can be basically divided into two categories:

Acute health effects and chronic health effects.

3.2 Acute Effects

When the level of air pollutants rises suddenly, there are adverse effects on health such as headaches, colds, irritated throats and coughs, irritation to nose and mucous lining, itching, swelling of eyes, tissue fluid accumulation and bronchial spasm. When the air becomes sufficiently clean these acute effects disappear. For example, in Delhi, the use of CNG as fuel in public transport has significantly lowered air pollution and the air has become cleaner in the last few years.

3.3 Chronic health effects

Long term exposure to air pollutants mainly sulphur dioxide, nitrogen dioxide and ozone and smoking breaks down the natural defences of our body causing respiratory diseases such as lung cancer, shortness of breath, asthma, chronic bronchitis (cells lining the bronchi and bronchioles get inflamed or damaged resulting in mucus build up, coughing and shortness of breath) and emphysema (irreversible damage to alveoli causing abnormal dilation of air spaces, loss of lung elasticity and shortness of breath).

3.4 Controlling Air Pollution

The main sources of air pollution are industries like thermal power plants, sugar mills, distilleries, paper mills etc. Vehicular emissions are another source of air pollution. The Environment (Protection) Act, 1986 has classified the industries as red, orange and green depending on the degree of pollution caused by them. It further specifies the various pollution control measures to be adopted by these industries. The following important measures have been taken by the government to control air pollution:

- The ambient air quality of various cities and towns is monitored regularly through a network of 290 monitoring stations under the National Ambient Air Quality Monitoring Programme.
- Ambient air quality standards and emission standards for industrial units have been notified.
- Emissions from highly polluting industrial units and thermal power plants are regularly monitored and action is taken against the defaulting units.
- Unleaded petrol is now being supplied to the entire country with effect from February 2000. Sulphur

is being progressively reduced in diesel. Fuel quality standards for petrol and diesel have been notified.

- Gross emission standards for on-road vehicles and mass emission standards for all categories of new vehicles have been notified under the Central Motor Vehicles Rules, 1989.
- Fiscal incentives are provided for installation of pollution control equipment.
- Thus, limiting the emission of pollutants and preventing their generation are the main strategies for air pollution control. The industrial emissions can be limited by the use of scrubbers. Vehicular emissions are being controlled through the use of good quality petrol, better engine technology and pollution control devices.

3.5 Effects of Pollution on Environment

Pollution has been found to be present widely in the environment. There are a number of effects of this:

- Bio magnification describes situations where toxins (such as heavy metals) may pass through trophic levels, becoming

exponentially more concentrated in the process.

- Carbon dioxide emissions cause ocean acidification, the ongoing decrease in the pH of the Earth's oceans as CO₂ becomes dissolved.
- The emission of greenhouse gases leads to global warming which affects ecosystems in many ways.
- Invasive species can out compete native species and reduce biodiversity. Invasive plants can contribute debris and biomolecules (allelopathy) that can alter soil and chemical compositions of an environment, often reducing native species competitiveness.
- Nitrogen oxides are removed from the air by rain and fertilise land which can change the species composition of ecosystems.
- Smog and haze can reduce the amount of sunlight received by plants to carry out photosynthesis and leads to the production of tropospheric ozone which damages plants.
- Soil can become infertile and unsuitable for plants. This will affect other organisms in the food web.

- Sulfur dioxide and nitrogen oxides can cause acid rain which lowers the pH value of soil.

4.0 Pollution control

Pollution control is a term used in environmental management. It means the control of emissions and effluents into air, water or soil. Without pollution control, the waste products from overconsumption, heating, agriculture, mining, manufacturing, transportation and other human activities, whether they accumulate or disperse, will degrade the environment. In the hierarchy of controls, pollution prevention and waste minimization are more desirable than pollution control. In the field of land development, low impact development is a similar technique for the prevention of urban runoff.

4.1 Practices on Pollution control

Recycling: Recycling is the process of converting waste materials into new materials and objects. It is an alternative to "conventional" waste disposal that can save material and help lower greenhouse gas emissions

Reusing: Reuse is the action or practice of using something again, whether for its original purpose (conventional reuse) or to fulfil a different function

Waste minimisation: Waste minimisation is a process of elimination that involves reducing the amount of waste produced in society and helps to eliminate the generation of harmful and persistent wastes, supporting the efforts to promote a more sustainable society

Mitigating: Environmental mitigation, compensatory mitigation, or mitigation banking, are terms used primarily by the United States government and the related environmental industry to describe projects or programs intended to offset known impacts to an existing historic or natural resource such as a stream, wetland, endangered species, archaeological site or historic structure.

Preventing: Pollution prevention reduces the amount of pollution generated by industry, agriculture, or consumers. In contrast to most pollution control strategies, which seek to manage a pollutant after it is emitted and reduce its impact upon the environment, the pollution prevention approach seeks to increase the efficiency of a process, the reducing the amount of pollution generated at its source

Compost: Compost is organic matter that has been decomposed and recycled as a

fertilizer and soil amendment. Compost is a key ingredient in organic farming.

5.0 Conclusion

This research paper explores the sources, effects, reactions and suggestions for controlling the different sources of pollution. As effective response to pollution is largely based on human appraisal of the problem (Kromm, 1973) and pollution control program evolves as a nationwide fixed cost-sharing effort relying upon voluntary participation (Sharp & Bromley, 1979). Policymakers in developing countries need to design programs, set standards, and take action to mitigate adverse health effects of air pollution. People in the poorest countries tend to be most at risk from household-related environmental quality problems, which impose the largest environmental disease burden on humanity. "The solution to pollution is dilution", is a dictum which summarizes a traditional approach to pollution management whereby sufficiently diluted pollution is not harmful. Since science holds experimental demonstration to be definitive, modern treatment of toxicity or environmental harm involves defining a level at which an effect is observable. Common examples of fields where practical measurement is crucial include automobile

emissions control, industrial exposure (e.g. Occupational Safety and Health Administration (OSHA) PELs), toxicology (e.g. LD), and medicine (e.g. medication and radiation doses).

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