CHAPTER 1

Introduction

Environmental pollution is one of the most serious problems facing humanity and other life forms on our planet today. Environmental pollution is defined as "the contamination of the physical and biological components of the earth/atmosphere system to such an extent that normal environmental processes are adversely affected". Pollutants can be naturally occurring substances or energies, but are considered contaminants when in excess of natural levels. Any use of natural resources at a rate higher than nature's capacity to restore itself can result in pollution of air, water and land.

Generally, environmental pollution takes place when the environment cannot process and neutralize harmful by-products of human activities in due course without any structural or functional damage to its system. Although pollution had been known to exist since life began, it had seen the growth of truly global proportions only since the onset of the industrial revolution during the 19th century. Environmental pollution is a problem not only in the developed country but also in developing countries. Factors such as population growth, technological advancement and urbanization invariably place greater demands on the planet and stretch the use of natural resources to the maximum.

Pollution is something that we face on an everyday basis; probably this is something we may even be immune in our fast paced lives. There are three major types of environmental pollution: air, water and land pollution. Air pollution and noise pollution are increasing at an alarming rate today. Air pollution occurs with the addition of harmful chemicals into the earth's atmosphere. The main pollutants that cause air pollution are carbon monoxide, CFCs, nitrogen oxides and sulfur dioxide. Water pollution is caused when wastes are released into the water that contaminates it. Soil can even be contaminated due to various domestic and industrial activities. Noise pollution is also a current environmental issue that causes harm in various ways.

1.1 Water Pollution

Water pollutants include contamination due to domestic wastes, insecticides and herbicides, food processing waste, pollutants from livestock operations, volatile organic compounds (VOCs), heavy metals, chemical waste and others. Waterborne diseases caused by polluted drinking water include Typhoid, Amoebiasis, Giardiasis, Ascariasis, Hookworm etc. Waterborne diseases caused by polluted beach water are rashes, ear ache, pink eye, respiratory infections, hepatitis, encephalitis, gastroenteritis, diarrhoea, vomiting, and stomach aches etc.

When water is contaminated with chemicals such as pesticides, hydrocarbons, persistent organic pollutants, heavy metals etc it could lead to cancer, including prostate cancer and non-Hodgkin's lymphoma, hormonal problems that can disrupt reproductive and developmental processes, damage to the nervous system, liver and kidney damage, and damage to the DNA. Specifically mercury in water can cause abnormal behavior, slower growth and development, reduced reproduction, and death.

Nutrient pollution (nitrogen, phosphates etc) causes overgrowth of toxic algae eaten by other aquatic animals, and may cause death; it can also cause outbreaks of fish diseases. Chemical contamination is known to cause decline in frog biodiversity and tadpole mass. Oil pollution can negatively affect development of marine organisms, increase susceptibility to disease and affect reproductive processes; can also cause gastrointestinal irritation, liver and kidney damage, and damage to the nervous system.

Water Pollution may disrupt photosynthesis in aquatic plants and thus affecting ecosystems that depend on these plants. Terrestrial and aquatic plants may absorb pollutants from water (as their main nutrient source) and pass them up the food chain to consumer animals and humans. Plants may be affected due to large concentrations of sodium chloride in water. They may also be affected by herbicides in water.

Wastewater from domestic sector is another major contributor to water contamination and subsequent related water borne diseases. The methodologies for treating potable water are discussed in Chapter 11 and those for treatment of domestic and industrial waste waters are discussed in Chapters 12 and 13.

1.2 Air Pollution

Some of the most important air pollutants are sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone, Volatile Organic Compounds (VOCs) and airborne particles, with radioactive pollutants. Combustion of fossil fuels produces extremely high levels of air pollution and is one of the main areas, which is now in focus for control.

The general impacts or effects of air pollution on humans include reduced lung functioning, irritation of eyes, nose, mouth and throat, asthma attacks, respiratory symptoms such as coughing and wheezing, increased respiratory disease such as bronchitis, reduced energy levels, headaches and dizziness, disruption of endocrine,

reproductive and immune systems neurobehavioral disorders, cardiovascular problems and can sometimes even lead to cancer and premature death.

Impact of acid rain destroys fish life in lakes and streams. Acid rain can kill trees, destroy the leaves of plants, can infiltrate soil by making it unsuitable for purposes of nutrition and habitation.

Excessive ultraviolet radiation coming from the sun through the ozone layer in the upper atmosphere which is eroded by some air pollutants may cause skin cancer in wildlife. Ozone in the lower atmosphere may damage lung tissues of animals. Ozone holes in the upper atmosphere can allow excessive ultraviolet radiation from the sun to enter the Earth causing damage to trees and plants. Ozone in the lower atmosphere can prevent plant respiration by blocking stomata (openings in leaves) and negatively affecting plants' photosynthesis rates which will stunt plant growth; ozone can also decay plant cells directly by entering stomata. The details of the technologies that are used to control air pollution in discussed in Chapter 14 of this book.

1.3 Land Pollution

Soil pollution is due to contamination from industrial and domestic pollutants. Some common soil pollutants are hydrocarbons, solvents and heavy metals. Fossil fuels also contribute to soil contamination and water pollution. Common sources of fossil fuel pollution include power-generating plants, petroleum refineries, petrochemical plants, production and distribution of fossil fuels, road transport (motor vehicles), shipping and aircraft industry.

Heavy metal contamination in soil is being frequently observed in both developed and developing countries. Lead in soil is especially hazardous for young children causing developmental damage to the brain, high levels of mercury can increase the risk of kidney damage; cyclodienes can lead to liver toxicity and cause problems related to depression of the central nervous system, and also cause headaches, nausea, fatigue, eye irritation and skin rash etc.

Domestic sector is another significant source of pollution generating municipal solid waste that may end up in landfills or incinerators leading to soil contamination and air pollution. Soil contamination may alter plant metabolism and reduce crop yields. Trees and plants may absorb soil contaminants and pass them up the food chain.

Environmental Problems in India

The environmental problems in India are growing rapidly. The increasing economic development and a rapidly growing population that has taken the country from 300 million people in 1947 to more than one billion people today is putting a strain on the environment, infrastructure, and the country's natural resources. Industrial pollution, soil erosion, deforestation, rapid industrialization, urbanization, and land degradation are all worsening problems. Overexploitation of the country's natural resources (land or water)

and the industrialization process has resulted in environmental degradation of these resources.

India's per capita carbon dioxide emissions were roughly 3,000 pounds (1,360 kilograms) in 2007. That's small compared to China and the U.S., with 10,500 pounds (4,763 kilograms) and 42,500 pounds (19,278 kilograms) respectively that year. To address the issues related to pollution, Central Pollution Control Board has done a nation- wide environmental assessment of Industrial Clusters based on CEPI and 43 such industrial clusters having CEPI greater than 70, on a scale of 0 to 100, has been identified as critically polluted.

The World Health Organization (WHO) estimates that about two million people die prematurely every year as a result of air pollution, while many more suffer from breathing ailments, heart disease, lung infections and even cancer. Fine particles or microscopic dust from coal or wood fires and unfiltered diesel engines are rated as one of the most lethal forms of air pollution caused by industry, transport, household heating, cooking and ageing coal or oil-fired power stations. There are four reasons of air pollution are - emissions from vehicles, thermal power plants, industries and refineries. The problem of indoor air pollution in rural areas and urban slums has increased.

Bhopal gas tragedy was the greatest industrial disaster in the world that took place at a Union Carbide pesticide plant in the Indian city of Bhopal, Madhya Pradesh. At midnight on 3 December 1984, the plant accidentally released methyl isocyanate (MIC) gas, exposing more than 500,000 people to MIC and other chemicals. The first official immediate death toll was 2,259. The government of Madhya Pradesh has confirmed a total of 3,787 deaths related to the gas release. Others estimate 8,000-10,000 died within 72 hours and 25,000 have since died from gas-related diseases, making it the deadliest man-made environmental disaster in history. Another important decision was when the impact of air pollution from neighboring industries on the monument of Taj Mahal was evident. In the "Taj Mahal Case" Supreme Court ordered closure of more than 200 industries. Another latest example of industrial pollution is the leak of chlorine gas in Mumbai. On July 14, 2010 nearly 76 people were treated in hospital on after chlorine gas leak from an industrial area in Mumbai.

Vehicle emissions are responsible for 70% of the country's air pollution. The major problem with government efforts to safeguard the environment has been enforcement at the local level, not with a lack of laws. Exhaust from vehicles has increased eight-fold over levels of twenty years ago; industrial pollution has risen four times over the same period. Recent studies estimate that 10 per cent of Bangalore's 60 lakh population and over 50 per cent of its children below 18 years suffer from air pollution-related ailments. In Chennai a study in 2009, has shown that exhaust from vehicles, dust from construction debris, industrial waste, burning of municipal and garden waste are all on the rise in the city. So are respiratory diseases, including asthma. At least six of the 10 top causes of death are related to respiratory disease.

Studies conducted by the high altitude zoology field station of the Zoological Survey of India (ZSI) based in Solan town of Himachal Pradesh have recorded a drastic fall in butterfly numbers in the western Himalayas. The population of 50 percent of the 288 species recorded in the western Himalayas, comprising areas of Himachal Pradesh and Jammu and Kashmir, has declined more than half in just 10 years. With pollution level rising across the country, in 2009 the Ministry of environment and forests has revised the national ambient air quality standards after 15 years.

80 percent of urban waste in India ends up in the country's rivers due to unchecked urban growth across the country. A growing number of bodies of water in India are unfit for human use, and the River Ganga, is dying slowly due to unchecked pollution. Studies have shown that three billion liters of waste are pumped into Delhi's Yamuna River each day. Only 55 percent of the 15 million Delhi residents are connected to the city's sewage system. The remainder of the population flushes their bath water, waste water and just about everything else down pipes and into drains, most of them empty into the Yamuna. This is true of all major cities and towns across the country. Groundwater exploitation is a serious matter of concern today. Studies have shown that consumption of groundwater containing alarming levels of arsenic during pregnancy can lead to blindness among newborn infants. Cases have been reported of loss of sight when consumption of ground waters having high arsenic concentrations.

India’s urban population slated to increase from the current 330 million to about 600 million by 2030, the challenge of managing municipal solid waste (MSW) in an environmentally and economically sustainable manner is bound to assume gigantic proportions. The country has over 5,000 cities and towns, which generate about 40 million tonnes of MSW per year today. Plastic bags, plastic thin sheets and plastic waste are also a major source of pollution. New regulations are being proposed to handle the plastic wastes generated in the country. Cities in India spend approximately 20% of the city budget on solid waste services.

E-waste produced in India includes over 100,000 tonnes from refrigerators, 275,000 tonnes from TVs, 56,300 tonnes from personal computers, 4,700 tonnes from printers and 1,700 tonnes from mobile phones. About 3,80,000 tonnes of E-waste was produced in 2007, which includes only the waste generated out of television sets, mobile phones and PCs, a major chunk of which comes from organizations. The un-organized recycling sector, which fails to practice eco-friendly E-waste recycling methods release large amount of toxic chemicals. In addition India imports almost 50,000 tonnes of e-waste yearly.

Pollution due to biomedical waste is likely to spread disease dangerous to life and making atmosphere noxious to health. In early April, 2010 a machine from Delhi University containing cobalt-60, a radioactive metal used for radiotherapy in hospitals, ended up in a scrap yard in the city. The death from radiation poisoning of a scrap yard worker in Delhi has highlighted the lax enforcement of waste disposal laws in India.

Two merchant vessels MSC Chitra and Khalijia-III collided off the Mumbai coast on August 7, 2010 causing an oil spill. Several containers from one of the vessels fell into the sea. Nearly 100 containers that fell into the waters following the collision between two merchant vessels off the Mumbai coast are still missing and are carrying hazardous chemicals.

Green House Gas Emissions

India emits the fifth most carbon of any country in the world. At 253 million metric tons, only the U.S., China, Russia, and Japan surpassed its level of carbon emissions in 1998. Carbon emissions have grown nine-fold over the past forty years. In this industrial age, with the ever-expanding consumption of hydrocarbon fuels and the resultant increase in carbon dioxide emissions, that greenhouse gas concentration have reached levels causing climate change. Going forward, carbon emissions are forecast to grow 3.2% per annum until 2020. To put this in perspective, carbon emissions levels are estimated to increase by 3.9% for China and by 1.3% for the United States. India is a non-Annex I country under the United Nations Framework Convention on Green house gases and Climate Change, and as such, is not required to reduce its carbon emissions. An historical summary of carbon dioxide (CO_2) emissions from fossil fuel use in India is increasing rapidly and causes global warming. A dedicated satellite is to be launched by Indian Space Research Organisation (ISRO) by 2012 to monitor India's greenhouse gas emission. The objective is to study the impact of climate change, fallout of greenhouse gas emissions on the environment by monitoring it through satellite technology.

Environmental Management

In view of the above it is necessary to adopt methods to conserve the environment and reduce pollution to the natural systems. Environmental planning and management are strategic challenges confronting businesses in the 21st century. The focus of this book is on Environmental Management to address the issues related to pollution, discuss the legal position across the globe and in the country, to help the reader plan and manage the environmental pollution related problems in a more efficient manner. The book also discusses the technological solutions available for air, water and hazardous waste management.