CHAPTER - 2

ENVIRONMENTAL PROBLEMS IN INDIA AND ISSUES OF POLLUTION IN DELHI

Environment

We know that Environment is the sum total of all surroundings of a living organism, including natural forces and other living things, which provide conditions for development and growth as well as of danger and damage. Living things do not simply exist in their environment. They constantly interact with it. Organisms change in response to conditions in their environment. The environment consists of the interactions among plants, animals, soil, water, temperature, light, and other living and non-living things. The word environment is used to talk about many things. People in different fields of knowledge (like history, geography or biology) use the word differently. An electromagnetic environment is the various radio waves that equipment such as radio and radar can meet. In psychology and medicine a person's environment is the people, physical things, places, and events that the person lives with. The environment affects the growth and development of the person. It affects the person's behavior. It affects the person's body and mind. Discussions on nature versus nurture are sometimes framed as heredity vs environment. The earth is the only planet in the solar system that support life.

Natural environment

In biology and ecology the environment is all of the natural materials and living things, including sunlight. This is also called the *natural environment*. Some people call themselves *environmentalists*. These people think that harmony with the

environment is important. They think we must protect the environment (to keep it safe.) They think people should not put so much pollution (waste) into the environment. The important things in the environment that we value are called natural resources. For example fish, sunlight, and forests. These are *renewable* natural resources because more grow naturally when we use them. *Non-renewable* natural resources are important things in the environment that do not come back naturally, for example coal and natural gas.

Historical environment

Environment is the events and culture that a person lived in. A person's beliefs and actions are dependent on his environment. For example, Thomas Jefferson and Julius Caesa owned slaves. Modern people mostly think it's wrong to own slaves. But in Jefferson's and Caesar's different *environments* slavery was normal. So, their actions did not look as wrong in their societies.

Pollution:

Pollution is the introduction of contaminants into the natural environment that cause adverse change 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. For understanding the pollution we will have to understands the following:

Ancient cultures

Air pollution has always accompanied civilizations. 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. Core samples of glaciers in Greenland indicate increases in pollution associated with Greek, Roman and Chinese metal production, but at that time the pollution was comparatively small and could be handled by nature.

Official Acknowledgement

King Edward I of England banned the burning of sea-coal by proclamation in London in 1272, after its smoke became a problem. But the fuel was so common in England that this earliest of names for it was acquired because it could be carted away from some shores by the wheelbarrow. Air pollution would continue to be a problem in England, especially later during the industrial revolution, and extending into the recent past with the Great Smog of 1952. London also recorded one of the earlier extreme cases of water quality problems with the Great Stink on the Thames of 1858, which led to construction of the London sewerage system soon afterward.

It was the industrial revolution that gave birth to environmental pollution as we know it today. The emergence of great factories and consumption of immense quantities of coal and other fossil fuels gave rise to unprecedented air pollution and the large volume of industrial chemical discharges added to the growing load of untreated human waste. Chicago and Cincinnati were the first two American cities to enact laws ensuring cleaner air in 1881. Other cities followed around the country until early in the 20th century, when the short lived Office of Air Pollution was created under the Department of the Interior. Extreme smog events were experienced by the cities of

Los Angeles and Donora, Pennsylvania in the late 1940s, serving as another public reminder.

Modern Awareness

Pollution became a popular issue after World War II, due to radioactive fallout from atomic warfare and testing. Then a non-nuclear event, The Great Smog of 1952 in London, killed at least 4000 people. This prompted some of the first major modern environmental legislation, The Clean Air Act of 1956. Pollution began to draw major public attention in the United States between the mid-1950s and early 1970s, when Congress passed the Noise Control Act, the Clean Air Act, the Clean Water Act and the National Environmental Policy Act. Severe incidents of pollution helped increase consciousness. PCB dumping in the Hudson River resulted in a ban by the EPA on consumption of its fish in 1974. Long-term dioxin contamination at Love Canal starting in 1947 became a national news story in 1978 and led to the Superfund legislation of 1980. Legal proceedings in the 1990s helped bring to light hexavalent chromium releases in California—the champions of whose victims became famous. The pollution of industrial land gave rise to the name brownfield, a term now common in city planning. The development of nuclear science introduced radioactive contamination, which can remain lethally radioactive for hundreds of thousands of years. Lake Karachay, named by the World watch Institute as the "most polluted spot" on earth, served as a disposal site for the Soviet Union throughout the 1950s and 1960s. Second place may go to the area of Chelyabinsk U.S.S.R. (see reference below) as the "Most polluted place on the planet".

Nuclear weapons continued to be tested in the Cold War, sometimes near inhabited areas, especially in the earlier stages of their development. The toll on the worst-

affected populations and the growth since then in understanding about the critical threat to human health posed by radioactivity has also been a prohibitive complication associated with nuclear power. Though extreme care is practiced in that industry, the potential for disaster suggested by incidents such as those at Three Mile Island and Chernobyl pose a lingering specter of public mistrust. One legacy of nuclear testing before most forms were banned has been significantly raised levels of radiation International catastrophes such as the wreck of the Amoco Cadiz oil tanker off the coast of Brittany in 1978 and the Bhopal disaster in 1984 have demonstrated the universality of such events and the scale on which efforts to address them needed to engage. The borderless nature of atmosphere and oceans inevitably resulted in the implication of pollution on a planetary level with the issue of global warming. Most recently the term persistent organic pollutant (POP) has come to describe a group of chemicals such as PBDEs and PFCs among others. Though their effects remain somewhat less well understood owing to a lack of experimental data, they have been detected in various ecological habitats far removed from industrial activity such as the Arctic, demonstrating diffusion and bioaccumulation after only a relatively brief period of widespread use. A much more recently discovered problem is the Great Pacific Garbage Patch, a huge concentration of plastics, chemical sludge and other debris which has been collected into a large area of the Pacific Ocean by the North Pacific Gyre. This is a less well known pollution problem than the others described above, but nonetheless has multiple and serious consequences such as increasing wildlife mortality, the spread of invasive species and human ingestion of toxic chemicals. Organizations such as 5 Gyres have researched the pollution and, along with artists like Marina De Bris, are working toward publicizing the issue. Growing evidence of local and global pollution and an increasingly informed public over time

have given rise to environmentalism and the environmental movement, which generally seek to limit human impact on the environment.

Forms of pollution

The major forms of pollution are listed below along with the particular contaminant relevant to each of them:

Air 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 micro metre size PM_{10} to $PM_{2.5}$. Light pollution: - includes light trespass, over-illumination and astronomical interference. Littering:- the criminal throwing of inappropriate man-made objects, unremoved, onto public and private properties.

Noise pollution

Noise pollution which encompasses roadway noise, aircraft noise, industrial noise as well as high-intensity sonar. oil contamination 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, 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.

Pollutant

A pollutant is a waste material that pollutes air, water or soil. Three factors determine the severity of a pollutant: its chemical nature, the concentration and the persistence.

Fig. 2.1:Air pollution produced by ships may alter clouds, affecting global temperatures.

Sources and causes

Air pollution comes from both natural and human-made (anthropogenic) sources. However, globally human-made pollutants from combustion, construction, mining, agriculture and warfare are increasingly significant in the air pollution equation.

Motor vehicle emissions are one of the leading causes of air pollution. China, United States, Russia, India Mexico, and Japan are the world leaders in air pollution emissions. Principal stationary pollution sources include chemical plants, coal-fired power plants, oil refineries, petrochemical plants, nuclear waste disposal activity, incinerators, large livestock farms (dairy cows, pigs, poultry, etc.), PVC factories, metals production factories, plastics factories, and other heavy industry. Agricultural air pollution comes from contemporary practices which include clear felling and burning of natural vegetation as well as spraying of pesticides and herbicides. About 400 million metric tons of hazardous wastes are generated each year. The United States alone produces about 250 million metric tons. Americans constitute less than 5% of the world's population, but produce roughly 25% of the world's CO_2, and generate approximately 30% of world's waste. In 2007, China has overtaken the United States as the world's biggest producer of CO_2, while still far behind based on per capita pollution - ranked 78th among the world's nations. In February 2007, a report by the Intergovernmental Panel on Climate Change (IPCC), representing the work of 2,500 scientists, economists, and policymakers from more than 120 countries, said that humans have been the primary cause of global warming since 1950. Humans have ways to cut greenhouse gas emissions and avoid the consequences of global warming, a major climate report concluded. But to change the climate, the transition from fossil fuels like coal and oil needs to occur within decades, according to the final report this year from the UN's Intergovernmental Panel on Climate Change (IPCC).

Some of the more common soil contaminants are chlorinated hydrocarbons (CFH), heavy metals (such as chromium, cadmium–found in rechargeable batteries, and lead–found in lead paint, aviation fuel and still in some countries, gasoline), MTBE, zinc, arsenic and benzene. In 2001 a series of press reports culminating in a book called

Fateful Harvest unveiled a widespread practice of recycling industrial byproducts into fertilizer, resulting in the contamination of the soil with various metals. Ordinary municipal landfills are the source of many chemical substances entering the soil environment (and often groundwater), emanating from the wide variety of refuse accepted, especially substances illegally discarded there, or from pre-1970 landfills that may have been subject to little control in the U.S. or EU. There have also been some unusual releases of polychlorinated dibenzodioxins, commonly called *dioxins* for simplicity, such as TCDD. Pollution can also be the consequence of a natural disaster. For example, hurricanes often involve water contamination from sewage, and petrochemical spills from ruptured boats or automobiles. Larger scale and environmental damage is not uncommon when coastal oil rigs or refineries are involved. Some sources of pollution, such as nuclear power plants or oil tankers, can produce widespread and potentially hazardous releases when accidents occur. In the case of noise pollution the dominant source class is the motor vehicle, producing about ninety percent of all unwanted noise worldwide.

Overview of main health effects on humans from some common types of pollution. Adverse air quality can kill many organisms including humans. Ozone pollution can cause respiratory disease, cardiovascular disease, throat inflammation, chest pain, and congestion. Water pollution causes approximately 14,000 deaths per day, mostly due to contamination of drinking water by untreated sewage in developing countries. An estimated 500 million Indians have no access to a proper toilet, and 580 Indians die of water-related pollution every day. Nearly 500 million Chinese lack access to safe drinking water. A 2010 analysis estimated that 1.2 million people died prematurely in a year in China because of air pollution. In 2007 it was estimated that in India, air pollution is believed to cause 527,700 fatalities. Studies have estimated that the

number of people killed annually in the US could be over 50,000.Oil spills can cause skin irritations and rashes. Noise pollution induces hearing loss, high blood pressure, stress, and sleep disturbance. Mercury has been linked to developmental deficits in children and neurologic symptoms. Older people are majorly exposed to diseases induced by air pollution. Those with heart or lung disorders are at additional risk. Children and infants are also at serious risk. Lead and other heavy metals have been shown to cause neurological problems. Chemical and radioactive substances can cause cancer and as well as birth defects.

Environment

Pollution has been found to be present widely in the environment. There are a number of effects of this: Biomagnification 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 CO_2 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.

Environmental health information

The Toxicology and Environmental Health Information Program (TEHIP) at the United States National Library of Medicine (NLM) maintains a comprehensive toxicology and environmental health web site that includes access to resources produced by TEHIP and by other government agencies and organizations. This web site includes links to databases, bibliographies, tutorials, and other scientific and consumer-oriented resources. TEHIP also is responsible for the Toxicology Data Network (TOXNET) an integrated system of toxicology and environmental health databases that are available free of charge on the web.

TOXMAP is a Geographic Information System (GIS) that is part of TOXNET. TOXMAP uses maps of the United States to help users visually explore data from the United States Environmental Protection Agency's (EPA) Toxics Release Inventory and Superfund Basic Research Programs.

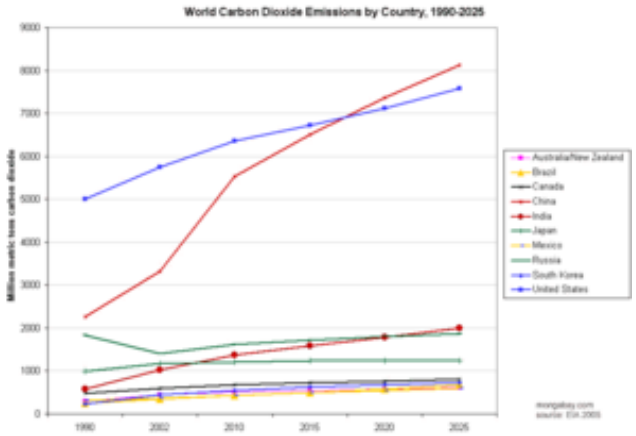
Perspectives

The earliest precursor of pollution generated by life forms would have been a natural function of their existence. The attendant consequences on viability and population levels fell within the sphere of natural selection. These would have included the demise of a population locally or ultimately, species extinction. Processes that were untenable would have resulted in a new balance brought about by changes and adaptations. At the extremes, for any form of life, consideration of pollution is superseded by that of survival. For humankind, the factor of technology is a

distinguishing and critical consideration, both as an enabler and an additional source of byproducts. Short of survival, human concerns include the range from quality of life to health hazards. 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_{50}), and medicine (e.g. medication and radiation doses). "The solution to pollution is dilution", is a dictum which summarizes a traditional approach to pollution management whereby sufficiently diluted pollution is not harmful. It is well-suited to some other modern, locally scoped applications such as laboratory safety procedure and hazardous material release emergency management. But it assumes that the dilutant is in virtually unlimited supply for the application or that resulting dilutions are acceptable in all cases. Such simple treatment for environmental pollution on a wider scale might have had greater merit in earlier centuries when physical survival was often the highest imperative, human population and densities were lower, technologies were simpler and their byproducts more benign. But these are often no longer the case. Furthermore, advances have enabled measurement of concentrations not possible before. The use of statistical methods in evaluating outcomes has given currency to the principle of probable harm in cases where assessment is warranted but resorting to deterministic models is impractical or infeasible. In addition, consideration of the environment beyond direct impact on human beings has gained prominence. Yet in the absence of a superseding principle, this older approach predominates practices throughout the world. It is the basis by which to gauge concentrations of effluent for legal release, exceeding which penalties are assessed or

restrictions applied. One such superseding principle is contained in modern hazardous waste laws in developed countries, as the process of diluting hazardous waste to make it non-hazardous is usually a regulated treatment process. Migration from pollution dilution to elimination in many cases can be confronted by challenging economical and technological barriers. Greenhouse gases and global warming

Fig 2.2: Historical and projected CO_2 emissions by country.



Source: Energy Information Administration.

Global Warming

Carbon dioxide, while vital for photosynthesis, is sometimes referred to as pollution, because raised levels of the gas in the atmosphere are affecting the Earth's climate. Disruption of the environment can also highlight the connection between areas of pollution that would normally be classified separately, such as those of water and air. Recent studies have investigated the potential for long-term rising levels of atmospheric carbon dioxide to cause slight but critical increases in the acidity of ocean waters, and the possible effects of this on marine ecosystems.

Most polluted places in the developing world

The Blacksmith Institute, an international non-for-profit organization dedicated to

eliminating life-threatening pollution in the developing world, issues an annual list of some of the world's worst polluted places. In the 2007 issues the ten top nominees, already industrialized countries excluded, are located in Azerbaijan, China, India, Peru, Russia, Ukraine and Zambia.

Fig. 2.3: Satellite picture, taken in 2004, shows thick haze and smoke along the Ganges Basin in northern India.

Environmental issues in India

A satellite picture, taken in 2004, shows thick haze and smoke along the Ganges Basin in northern India. Major sources of aerosols in this area are believed to be smoke from biomass burning in the northwest part of India, and air pollution from large cities in northern India. Dust from deserts in Pakistan and the Middle East may also contribute to the mix of aerosols.

Fig. 2.4: Solid waste adds to water pollution in India, a 2005 image

There are many environmental issues in India. Air pollution, water pollution, garbage, and pollution of the natural environment are all challenges for India. The situation was worse between 1947 through 1995. According to data collection and environment assessment studies of World Bank experts, between 1995 through 2010, India has made one of the fastest progress in the world, in addressing its environmental issues and improving its environmental quality. Still, India has a long way to go to reach environmental quality similar to those enjoyed in developed economies. Pollution remains a major challenge and opportunity for India. Environmental issues are one of the primary causes of disease, health issues and long term livelihood impact for India. British rule of India saw several laws related to environment. Amongst the earliest ones were Shore Nuisance (Bombay and Kolaba) Act of 1853 and the Oriental Gas Company Act of 1857. The Indian Penal Code of 1860, imposed a fine on anyone who voluntarily fouls the water of any public spring or reservoir. In addition, the Code penalised negligent acts. British India also enacted laws aimed at controlling air pollution. Prominent amongst these were the Bengal Smoke Nuisance Act of 1905 and the Bombay Smoke Nuisance Act of 1912. Whilst these laws failed in having the intended effect, British-enacted legislations pioneered the growth of environmental regulations in India. Upon independence from Britain, India adopted a constitution and numerous British-enacted laws, without any specific constitutional provision on protecting environment. India amended its constitution in 1976. Article 48(A) of Part IV of the amended constitution, read: The State shall endeavour to protect and improve the environment and to safeguard the forests and wildlife of the country. Article 51 A(g) imposed additional environmental mandates on the Indian state. Other Indian laws from recent history include the Water (Prevention and Control of Pollution) Act of 1974, the Forest (Conservation) Act of 1980, and the Air

(Prevention and Control of Pollution) Act of 1981. The Air Act was inspired by the decisions made at Stockholm Conference. The Bhopal gas tragedy triggered the Government of India to enact the Environment (Protection) Act of 1986. India has also enacted a set of Noise Pollution (Regulation & Control) Rules in 2000. In 1985, Indian government created the Ministry of Environment and Forests. This ministry is the central administrative organisation in India for regulating and ensuring environmental protection. Despite active passage of laws by the central government of India, the reality of environmental quality mostly worsened between 1947 to 1990. Most of Indian economy was nationalised and owned by India, and regulations were mostly ignored by state run enterprises. Rural poor had no choice, but to sustain life in whatever way possible. The state governments of India often regarded environmental laws enacted by the central government as a mere paperwork formality. Air emissions increased, water pollution worsened, forest cover decreased. Starting in 1990s, reforms were introduced. Since then, for the first time in Indian history, major air pollutant concentrations have dropped in every 5 year period. Between 1992 to 2010, satellite data confirms India's forest coverage has increased for the first time by over 4 million hectares, a 7% increase.

Causes

Some have cited economic development as the cause regarding the environmental issues. Others believe economic development is key to improving India's environmental management and preventing pollution of the country. It is also suggested that India's growing population is the primary cause of India's environmental degradation. Systematic studies challenge this theory. Empirical evidence from countries such as Japan, England and Singapore, each with population

density similar or higher than India, yet each enjoying environmental quality vastly superior than India, suggests population density may not be the only factor affecting India's issues.

Fig. 2.5: Floods are a significant environmental issue for India

Major issues

Floods are a significant environmental issue for India. It causes soil erosion, destruction of wetlands and wide migration of solid wastes. Major environmental issues are forest and agricultural degradation of land, resource depletion (water, mineral, forest, sand, rocks etc.), environmental degradation, public health, loss of biodiversity, loss of resilience in ecosystems, livelihood security for the poor. The major sources of pollution in India include the rampant burning of fuel wood and biomass such as dried waste from livestock as the primary source of energy, lack of organised garbage and waste removal services, lack of sewage treatment operations, lack of flood control and monsoon water drainage system, diversion of consumer waste into rivers, cremation practices near major rivers, government mandated protection of highly polluting old public transport, and continued operation by Indian government of government owned, high emission plants built between 1950 to 1980.Air pollution, poor management of waste, growing water scarcity, falling

groundwater tables, water pollution, preservation and quality of forests, biodiversity loss, and land/soil degradation are some of the major environmental issues India faces today. India's population growth adds pressure to environmental issues and its resources.

Fig. 2.6: Public dumping of rubbish alongside a road in Kolkata

Population growth and environmental quality

There is a long history of study and debate about the interactions between population growth and the environment. According to a British thinker Malthus, for example, a growing population exerts pressure on agricultural land, causing environmental degradation, and forcing the cultivation of land of poorer as well as poorer quality. This environmental degradation ultimately reduces agricultural yields and food availability, causes famines and diseases and death, thereby reducing the rate of population growth. Population growth, because it can place increased pressure on the assimilative capacity of the environment, is also seen as a major cause of air, water, and solid-waste pollution. The result, Malthus theorised, is an equilibrium population that enjoys low levels of both income and environmental quality. Malthus suggested positive and preventative forced control of human population, along with abolition of poor laws. Malthus theory, published between 1798 and 1826, has been analysed and

criticised ever since. The American thinker Henry George, for example, observed with his characteristic piquancy in dismissing Malthus: "Both the jayhawk and the man eat chickens; but the more jayhawks, the fewer chickens, while the more men, the more chickens." Similarly, the American economist Julian Lincoln Simoncriticised Malthus's theory. He noted that the facts of human history have proven the predictions of Malthus and of the Neo-Malthusians to be flawed. Massive geometric population growth in the 20th century did not result in a Malthusian catastrophe. The possible reasons include: increase in human knowledge, rapid increases in productivity, innovation and application of knowledge, general improvements in farming methods (industrial agriculture), mechanisation of work (tractors), the introduction of high-yield varieties of wheat and other plants (Green Revolution), the use of pesticides to control crop pests.More recent scholarly articles concede that whilst there is no question that population growth may contribute to environmental degradation, its effects can be modified by economic growth and modern technology. Research in environmental economics has uncovered a relationship between environmental quality, measured by ambient concentrations of air pollutants and per capita income. This so-called environmental Kuznets curve shows environmental quality worsening up until about $5,000 of per capita income on purchasing parity basis, and improving thereafter. The key requirement, for this to be true, is continued adoption of technology and scientific management of resources, continued increases in productivity in every economic sector, entrepreneurial innovation and economic expansion. Other data suggests that population density has little correlation to environmental quality and human quality of life. India's population density, in 2011, was about 368 human beings per square kilometre. Many countries with population density similar or higher than India enjoy environmental quality as

well as human quality of life far superior than India. For example: Singapore (7148 /km^2), Hong Kong (6349 /km^2), South Korea (487 /km^2), Netherlands (403 /km^2), Belgium (355 / km^2), England (395 /km^2) and Japan (337/ km^2).

Fig. 2.7: The TajMahal next to the Yamuna river.

Water pollution

Water pollution in India

India is recognised as has having major issues with water pollution, predominately due to untreated sewerage. Rivers such as the Ganges, the Yamuna and Mithi Rivers, all flowing through highly populated areas, thus polluted. Discharge of untreated sewage is the single most important cause for pollution of surface and ground water in the India. There is a large gap between generation and treatment of domestic waste water in the India. The problem is not only that India lacks sufficient treatment capacity but also that the sewage treatment plants that exist do not operate and are not maintained. The majority of the government-owned sewage treatment plants remain closed most of the time due to improper design or poor maintenance or lack of reliable electricity supply to operate the plants, together with absentee employees and poor management. The waste water generated in these areas normally percolates in

the soil or evaporates. The uncollected wastes accumulate in the urban areas cause unhygienic conditions and release pollutants that leaches to surface and groundwater.

According to a World Health Organization study, out of the India's 3,119 towns and cities, just 209 have partial sewage treatment facilities, and only 8 have full wastewater treatment facilities. Over 100 Indian cities dump untreated sewage directly into the Ganges River. Investment is needed to bridge the gap between 29000 million litre per day of sewage India generates, and a treatment capacity of mere 6000 million litre per day. Other sources of water pollution include agriculture run off and small scale factories along the rivers and lakes of India. Fertilizers and pesticides used in agriculture in northwest have been found in rivers, lakes and ground water. Flooding during monsoons worsens India's water pollution problem, as it washes and moves all sorts of solid garbage and contaminated soils into its rivers and wetlands.

Fig. 2.8: Air pollution in India

Air pollution

A rural stove using biomass cakes, fuel wood and trash as cooking fuel. Surveys suggest over 100 million households in India use such stoves (chullahs) every day, 2–3 times a day. It is a major source of air pollution in India, and produces smoke and numerous indoor air pollutants at concentrations 5 times higher than coal. Clean

burning fuels and electricity are unavailable in rural parts and small towns of India because of poor rural highways and limited energy generation infrastructure. Air pollution in India is a serious issue with the major sources being fuel wood and biomass burning, fuel adulteration, vehicle emission and traffic congestion. Air pollution is also the main cause of the Asian brown cloud, which is causing the monsoon to be delayed. India is the world's largest consumer of fuel wood, agricultural waste and biomass for energy purposes. Traditional fuel (fuel wood, crop residue and dung cake) dominates domestic energy use in rural India and accounts for about 90% of the total. In urban areas, this traditional fuel constitutes about 24% of the total. Fuel wood, agri waste and biomass cake burning releases over 165 million tonnes of combustion products into India's indoor and outdoor air every year. These biomass-based household stoves in India are also a leading source of greenhouse emissions contributing to climate change. The annual crop burning practice in northwest India, north India and eastern Pakistan, after monsoons, from October to December, are a major seasonal source of air pollution. Approximately 500 million tons of crop residue is burnt in open, releasing smoke, soot, NOx, SOx, PAHs and particulate matter into the air. This burning has been found to be a leading cause of smog and haze problems through the winter over Punjab, cities such as Delhi, and major population centers along the rivers through West Bengal. In other states of India, rice straw and other crop residue burning in open is a major source of air pollution. Vehicle emissions are another source of air pollution. Vehicle emissions are worsened by fuel adulteration and poor fuel combustion efficiencies from traffic congestion and low density of quality, high speed road network per 1000 people. On per capita basis, India is a small emitter of carbon dioxide greenhouse. In 2009, IEA estimates that it emitted about 1.4 tons of gas per person, in comparison to the United

States' 17 tons per person, and a world average of 5.3 tons per person. However, India was the third largest emitter of total carbon dioxide in 2009 at 1.65 Gt per year, after China (6.9 Gt per year) and the United States (5.2 Gt per year). With 17 percent of world population, India contributed some 5 percent of human-sourced carbon dioxide emission; compared to China's 24 percent share. The Air (Prevention and Control of Pollution) Act was passed in 1981 to regulate air pollution and there have been some measurable improvements. However, the 2012 Environmental Performance Index ranked India as having the poorest relative air quality out of 132 countries.

Fig.2.9: Solid waste policy in India

Solid waste pollution

Trash and garbage disposal services, responsibility of local government workers in India, are ineffective. Solid waste is routinely seen along India's streets and shopping plazas. Image shows solid waste pollution along a Jaipur street, a 2011 image. Trash and garbage is a common sight in urban and rural areas of India. It is a major source of pollution. Indian cities alone generate more than 100 million tons of solid waste a year. Street corners are piled with trash. Public places and sidewalks are despoiled with filth and litter, rivers and canals act as garbage dumps. In part, India's garbage crisis is from rising consumption. India's waste problem also points to a stunning

failure of governance. In 2000, India's Supreme Court directed all Indian cities to implement a comprehensive waste-management programme that would include household collection of segregated waste, recycling and composting. These directions have simply been ignored. No major city runs a comprehensive programme of the kind envisioned by the Supreme Court. Indeed, forget waste segregation and recycling directive of the India's Supreme Court, the Organisation for Economic Cooperation and Development estimates that up to 40 percent of municipal waste in India remains simply uncollected. Even medical waste, theoretically controlled by stringent rules that require hospitals to operate incinerators, is routinely dumped with regular municipal garbage. A recent study found that about half of India's medical waste is improperly disposed of Municipalities in Indian cities and towns have waste collection employees. However, these are unionised government workers and their work performance is neither measured nor monitored. Some of the few solid waste landfills India has, near its major cities, are overflowing and poorly managed. They have become significant sources of greenhouse emissions and breeding sites for disease vectors such as flies, mosquitoes, cockroaches, rats, and other pests. In 2011, several Indian cities embarked on waste-to-energy projects of the type in use in Germany, Switzerland and Japan. For example, New Delhi is implementing two incinerator projects aimed at turning the city’s trash problem into electricity resource. These plants are being welcomed for addressing the city’s chronic problems of excess untreated waste and a shortage of electric power. They are also being welcomed by those who seek to prevent water pollution, hygiene problems, and eliminate rotting trash that produces potent greenhouse gas methane. The projects are being opposed by waste collection workers and local unions who fear changing technology may deprive them of their livelihood and way of life. Along with waste-to-energy projects, some

cities and towns such as Pune, Maharashtra are introducing competition and the privatisation of solid waste collection, street cleaning operations and bio-mining to dispose the waste. A scientific study suggests public private partnership is, in Indian context, more useful in solid waste management. According to this study, government and municipal corporations must encourage PPP-based local management through collection, transport and segregation and disposal of solid waste.

Noise pollution

The Supreme Court of India which is in New Delhi gave a significant verdict on noise pollution in 2005. Unnecessary honking of vehicles makes for a high decibel level of noise in cities. The use of loudspeakers for political purposes and for sermons by temples and mosques makes noise pollution in residential areas worse. In January 2010, Government of India published norms of permissible noise levels in urban and rural areas.

Land or Soil pollution

In March 2009, the issue of Uranium poisoning in Punjab attracted press coverage. It was alleged to be caused by fly ash ponds of thermal power stations, which reportedly lead to severe birth defects in children in the Faridkot and Bhatinda districts of Punjab. The news reports claimed the uranium levels were more than 60 times the maximum safe limit. In 2012, the Government of India confirmed that the ground water in Malwa belt of Punjab has uranium metal that is 50% above the trace limits set by the United Nations' World Health Organization. Scientific studies, based on over 1000 samples from various sampling points, could not trace the source to fly ash and any sources from thermal power plants or industry as originally alleged. The

study also revealed that the uranium concentration in ground water of Malwa district is not 60 times the WHO limits, but only 50% above the WHO limit in 3 locations. This highest concentration found in samples was less than those found naturally in ground waters currently used for human purposes elsewhere, such as Finland. Research is underway to identify natural or other sources for the uranium.

Greenhouse gas emissions

India was the third largest emitter of carbon dioxide in 2009 at 1.65 Gt per year, after China (6.9 Gt per year) and the United States (5.2 Gt per year). With 17 percent of world population, India contributed some 5 percent of human-sourced carbon dioxide emission; compared to China's 24 percent share. On per capita basis, India emitted about 1.4 tons of carbon dioxide per person, in comparison to the United States' 17 tons per person, and a world average of 5.3 tons per person.

Fig. 2.10: Monsoons scrub India's air, bringing its natural diversity in better view.

Fig. 2.11: Himalayan peaks in eastern India on a day without haze.

Environmental issues and Indian law

Since about the late 1980s, the Supreme Court of India has been pro-actively engaged in India's environmental issues. In most countries, it is the executive and the legislative branches of the government that plan, implement and address environmental issues; the Indian experience is different. The Supreme Court of India has been engaged in interpreting and introducing new changes in the environmental jurisprudence directly. The Court has laid down new principles to protect the environment, re-interpreted environmental laws, created new institutions and structures, and conferred additional powers on the existing ones through a series of directions and judgments. The Court's directions on environmental issues goes beyond the general questions of law, as is usually expected from the highest Court of a democratic country. The Supreme Court of India, in its order, includes executive actions and technical details of environmental actions to be implemented. Indeed, some critics of India's Supreme Court describe the Court as the *Lords of Green Bench* or *Garbage Supervisor*. Supporters of India's Supreme Court term these orders and the Indian bench as pioneering, both in terms of laying down new principles of law, and in delivering environmental justice. The reasons for the increasing interjection of India's Supreme Court in governance arenas are, experts claim, complex. A key factor

has been the failure of government agencies and the state owned enterprises in discharging their Constitutional and Statutory duties. This has prompted civil society groups to file public interest complaints with the Courts, particularly the Supreme Court, for suitable remedies. Public interest litigation and judicial activism on environmental issues extends beyond India's Supreme Court. It includes the High Courts of individual states. India's judicial activism on environmental issues has, some suggest, delivered positive effects to the Indian experience. Proponents claim that the Supreme Court has, through intense judicial activism, become a symbol of hope for the people of India. As a result of judicial activism, India's Supreme Court has delivered a new normative regime of rights and insisted that the Indian state cannot act arbitrarily but must act reasonably and in public interest on pain of its action being invalidated by judicial intervention. India's judicial activism on environmental issues has, others suggest, had adverse consequences. Public interest cases are repeatedly filed to block infrastructure projects aimed at solving environmental issues in India, such as but not limiting to water works, expressways, land acquisition for projects, and electricity power generation projects. The litigation routinely delays such projects, often for years, whilst rampant pollution continues in India, and tens of thousands die from the unintended effects of pollution. Even after a stay related to an infrastructure project is vacated, or a court order gives a green light to certain project, new issues become grounds for court notices and new public interest litigation. Judicial activism in India has, in several key cases, found state-directed economic development ineffective and a failure, then interpreted laws and issued directives that encourage greater competition and free market to reduce environmental pollution. In other cases, the interpretations and directives have

preserved industry protection, labour practices and highly polluting state-owned companies detrimental to environmental quality of India. Proactive measures should be taken to conserve the depleting environment.

Fig. 2.12: Greater adjutant perched on a pile of trash and solid waste in Assam.

Fig. 2.13: The world's rarest monkey, the golden langur.

Fig. 2.14: Forests of India's Western Ghats

Fig. 2.15: Forests of Kerala. Western part of the Indian peninsula is one of the 32 ecological hotspots of the world.

Fig. 2.16: Great hornbill in the forests of eastern Himalayas (Arunachal Pradesh). Eastern Himalayas are another of the 32 ecological hotspots of the world.

Wildlife in India

Forests and conservation

Ecological issues are an integral and important part of environmental issues challenging India. Poor air quality, water pollution and garbage pollution – all affect the food and environment quality necessary for ecosystems. India is a large and diverse country. Its land area includes regions with some of the world's highest rainfall to very dry deserts, coast line to alpine regions, river deltas to tropical islands. The variety and distribution of forest vegetation is large. India is one of the 12 mega biodiverse regions of the world. Indian forests types include tropical evergreens, tropical deciduous, swamps, mangroves, sub-tropical, montane, scrub, sub-alpine and alpine forests. These forests support a variety of ecosystems with diverse flora and fauna. Until recently, India lacked an objective way to determine the quantity of forests it had, and the quality of forests it had.

Forest cover measurement methods

Prior to 1980s, India deployed a bureaucratic method to estimate forest coverage. A land was notified as covered under Indian Forest Act, and then officials deemed this land area as *recorded forest* even if it was devoid of vegetation. By this forest-in-name-only method, the total amount of recorded forest, per official Indian records, was 71.8 million hectares. Any comparison of forest coverage number of a year before 1987 for India, to current forest coverage in India, is thus meaningless; it is just bureaucratic record keeping, with no relation to reality or meaningful comparison. In the 1980s, space satellites were deployed for remote sensing of real forest cover. Standards were introduced to classify India's forests into the following categories: Forest Cover: defined as all lands, more than one hectare in area, with a tree canopy

density of more than 10 percent. (Such lands may or may not be statutorily notified as forest area). Very Dense Forest: All lands, with a forest cover with canopy density of 70 percent and above Moderately Dense Forest: All lands, with a forest cover with canopy density of 40–70 percent Open Forest: All lands, with forest cover with canopy density of ten to forty percent Mangrove Cover: Mangrove forest is salt tolerant forest ecosystem found mainly in tropical and sub-tropical coastal and/or inter-tidal regions. Mangrove cover is the area covered under mangrove vegetation as interpreted digitally from remote sensing data. It is a part of forest cover and also classified into three classes viz. very dense, moderately dense and open.

Non Forest Land: defined as lands without any forest cover

Scrub Cover: All lands, generally in and around forest areas, having bushes and or poor tree growth, chiefly small or stunted trees with canopy density less than 10 percent

Tree Cover: Land with tree patches (blocks and linear) outside the recorded forest area exclusive of forest cover and less than the minimum mapable area of one hectare

Trees Outside Forests: Trees growing outside Recorded Forest Areas

The first satellite recorded forest coverage data for India became available in 1987. India and the United States cooperated in 2001, using Landsat MSS with spatial resolution of 80 metres, to get accurate Indian forest distribution data. India thereafter switched to digital image and advanced satellites with 23 metres resolution and software processing of images to get more refined data on forest quantity and forest quality. India now assesses its forest distribution data biennially. The 2007 forest

census data thus obtained and published by the Government of India suggests the five states with largest area under forest cover as the following:

Madhya Pradesh: 7.64 million hectares

Arunachal Pradesh: 6.8 million hectares

Chhattisgarh: 5.6 million hectares

Orissa: 4.83 million hectares

Maharashtra: 4.68 million hectares

India hosts significant biodiversity; it is home to 7.6% of all mammalian, 12.6% of avian, 6.2% of reptilian, and 6.0% of flowering plant species. In recent decades, human encroachment has posed a threat to India's wildlife; in response, a system of national parks and protected areas, first established in 1935, was substantially expanded. In 1972, India enacted the Wildlife Protection Act and Project Tiger to safeguard crucial habitat; further federal protections were promulgated in the 1980s. Along with over 500 wildlife sanctuaries, India now hosts 14 biosphere reserves, four of which are part of the World Network of Biosphere Reserves; 25 wetlands are registered under the Ramsar Convention. These laws did not have the effect they intended. In 1985, India created the Ministry of Environment and Forests. This was followed by a National Forest Policy and the major government reforms of early 1990s. Over the last 20 years, India has reversed the deforestation trend. Specialists of the United Nations report India's forest as well as woodland cover has increased. A 2010 study by the Food and Agriculture Organisation ranks India amongst the 10 countries with the largest forest area coverage in the world (the other nine being Russian Federation, Brazil, Canada, United States of America, China, Democratic Republic of the Congo, Australia, Indonesia and Sudan). India is also one the top 10 countries with the largest primary forest coverage in the world, according to this

study. From 1990 to 2000, FAO finds India was the fifth largest gainer in forest coverage in the world; whilst from 2000 to 2010, FAO considers India as the third largest gainer in forest coverage.

National Forest Commission and India's afforestation programme

In 2003, India set up a National Forest Commission to review and assess India's policy and law, its effect on India's forests, its impact of local forest communities, and to make recommendations to achieve sustainable forest and ecological security in India. The report made over 300 recommendations including the following: India must pursue rural development and animal husbandry policies to address local communities need to find affordable cattle fodder and grazing. To avoid destruction of local forest cover, fodder must reach these communities on reliable roads and other infrastructure, in all seasons year round. The Forest Rights Bill is likely to be harmful to forest conservation and ecological security. The Forest Rights Bill became a law since 2007. The government should work closely with mining companies. Revenue generated from lease of mines must be pooled into a dedicated fund to conserve and improve the quality of forests in the region where the mines are located. Power to declare ecologically sensitive areas must be with each Indian state. The mandate of State Forest Corporations and government owned monopolies must be changed. Government should reform regulations and laws that ban felling of trees and transit of wood within India. Sustainable agro-forestry and farm forestry must be encouraged through financial and regulatory reforms, particularly on privately owned lands. India's national forest policy expects to invest US$ 26.7 billion by 2020, to pursue nationwide afforestation coupled with forest conservation, with the goal of increasing India's forest cover from 20% to 33%.

Environmental issues in Delhi

During the autumn and winter months, some 500 million tons of crop residue are burnt, and winds blow from India's north and northwest towards east. This aerial view shows India's annual crop burning, resulting in smoke and air pollution over Delhi and adjoining areas. Environmental problems in Delhi, India, are a threat to the well-being of the city's and area's inhabitants as well as the flora and fauna. Delhi, the eighth-most populated metropolis in the world, is one of the most heavily polluted cities in India, having for instance one of the country's highest volumes of particulate matter pollution. Overpopulation and the ensuing overuse of scarce resources such as water put heavy pressure on the environment. The city suffers from air pollution caused by road dust and industry, with comparatively smaller contributions from unclean engines in transportation, especially diesel-powered city buses and trucks, and 2-wheelers and 3-wheelers with two-stroke engines. Noise pollution comes mainly from motorcycle and automobile traffic. Water pollution and a lack of solid waste treatment facilities have caused serious damage to the river on whose banks Delhi grew, the Yamuna. Besides human and environmental damage, pollution has caused economic damage as well; Delhi may have lost the competition to host the 2014 Asian Games because of its poor environment.

Water pollution

The river Yamuna, the reason for Delhi's existence, has suffered heavily from pollution. At its point of entry into Delhi, at Wazirabad, its dissolved oxygen (DO) content is 7.5 milligrammes per litre. At its point of exit from city limits, the DO level is only 1.3 mg/l. Similarly, coliform counts jump from 8,500 per 100 ml at entry to 329,312/100ml at exit (for DO 5 mg/litre is the norm and for coliforms 500/100ml). In 2007, roughly half of all the city's raw sewage went straight into the river. 55% of the

city's 15 million people are connected to the city's sewer system and its treatment plants, but because of corrosion and clogging in the system many of the treatment plants do not run at full capacity. Waste from 1,500 unplanned neighborhoods runs straight into the river. The Supreme Court of India took up the issue in 1994 after reports in the press, and since 2001 is actively monitoring the river and the city's efforts to clean it; in 2011, the national government announced a Rs 1,357 crore drain interceptor plan (all waste water is to be cleaned before it reaches the river) that would clean up the river by 2014.

Water sources

Underground hydrological resources are a substantial supplemental source of water in Delhi, especially in the affluent sections of the city. In the residential plots called ‘farmhouses’ almost every household draws from this resource. Though water-storing rocks, i.e. aquifers, are renewed as surface rain-water percolates down, they are not inexhaustible. Delhi’s aquifers stand in danger of depletion on account of excessive use. Furthermore, rampant construction activity has contaminated them with cement, paints, varnishes and other construction materials; leaky, poorly constructed and maintained sewage lines have added to the contamination. This is an irremediable loss, as aquifers, once polluted, cannot be decontaminated; they have no exposure to air and sunlight or to micro-organisms which clear-up chemical or biological pollutants. Contributing further to underground water degradation are Delhi’s mushrooming landfill sites. Waste material leeches underground, contaminating aquifers. Besides, land-fill sites degrade land. Delhi has twenty-five landfill sites, and more are planned.

Loss of flora and fauna

There is significant dispute over the extent of the city's green cover. City authorities claimed in 2008 that the green cover had increased from 26 km^2 to 300 km^2; moreover, the Delhi Forest Act stipulated that for every felled tree ten saplings need to be planted. Critics point out that the data as well as the meaning of "green cover" are unclear. The actual increase may be only half of what was claimed, and there are estimates that some 100,000 trees had been cut in Delhi, due in part to the construction of the Delhi Metro and the Delhi Bus Rapid Transit System.

Air pollution

Air pollution in Delhi is caused mainly by industry and vehicular traffic. As many as 10,000 people a year may die prematurely in Delhi as a result of air pollution. The 1997 White Paper sponsored by the Ministry of Environment and Forests already proposed various measures to bring down pollution caused by traffic, including smoothing the flow of traffic with parking regulations and bringing down total traffic by mandatory limits on driving. City authorities claim to have had some success in bringing down air pollution; for instance, during the bidding process for the 2014 Asian Games, the city's organizing committee had claimed that "pollution levels had come down drastically in Delhi with the arrival of Metro rail as well as all public transport vehicle being run compulsorily on compressed natural gas." For traffic related sources, growth in vehicle numbers and mileage seems to outpace efforts to reduce emissions. Contrary to popular belief, most of the air pollution in Delhi is not due to vehicular traffic. Main contributors to particulate matter in the PM10 range, as a recent study shows, are road dust (50%) and industry (23%)--vehicles accounted for

only 7%. Among industrial contributors, power plants within Delhi city limits were the main culprits.

Proposed solutions

The Delhi Development Authority (DDA) is charged with providing "lung spaces." Of the city's 44777 hectares, 8422 hectares are reserved for "the Greens", of which the DDA manages more than 5050 hectares. There is a policy for afforestation, atmospheric pollution, bio-medical waste, domestic refuse, and water and sewage treatment. Additionally, there are action plans to encourage public participation in environmental problems. Given the continued growth of the city and its population, problems are tackled only with difficulty—for instance, the Yamuna clean-up projects spent $500 million between 1993 and 2005, yet the river's pollution actually doubled during this same period.

Industrial Pollution in Delhi

The major sources of industrial pollution in Delhi include thermal power plants, brick kilns, hot mix plants and industrial units. The thermal power plants in Delhi are at Indraprastha, Badarpur and Rajghat. Industries in Non-conforming Areas: According to a survey by the Delhi Government, out of a total of 1,25,000 industries, there are 98,000 industries in non- conforming areas as per the Master Plan of Delhi. Non-conforming industries are located in unauthorised colonies, "laldora" villages, resettlement colonies, the walled city and other residential pockets. In accordance with directives of the Supreme Court the Delhi Government has constituted a high powered Committee headed by Principal Secretary-cum-Commissioner of Industries for ensuring that the provisions of the Master Plan are complied with. All industries in

the National Capital Territory of Delhi were required to approach the Committee for grant of permission to operate their industries in the industrial areas. The Supreme Court has ordered closure of industries as per the details given below.

Table 2.1:Industries as per detail

Date of Order	Type of Industry	Date of Closure
08-07-1996	168 (hazardous industries)	30-11-1996
06-09-1996	513 (ordered to relocate outside Delhi)	31-01-1997
10-10-1996	46 (Hot mix plant)	28-02-1997
26-11-1996	243 (Brick kilns-to stop functioning and relocate outside Delhi)	30-06-1997
26-11-1996	21 (Arc/induction furnaces)	31-03-1997

The Delhi Government under directions from the Supreme Court has identified 102 acres of developed land in the existing industrial estates and seven other locations with an area of approximately 4,800 acres for relocation of the industries. 1,300 acres have been notified for acquisition and development of new industrial estates for relocation of industrial units. The government has invited applications from industrial units operating in non-conforming areas for allotment of industrial plots.

Common Effluent Treatment Plants

Efforts to control pollution from industries include the setting up of 15 Common Effluent Treatment Plants (CETPs) in industrial areas. The funding pattern is in accordance with a World Bank scheme. The State government and the MoEF have each deposited 25% (Rs.22.5 crores) of the total cost of Rs.90 crores of the CETPs with the Delhi State Industrial Development Corporation as the executing agency. The Industrial Development Bank of India (IDBI) is yet to make available the requisite

credit to the entrepreneurs. The entrepreneurs are in the process of constituting associations and approaching the IDBI for credit. The 15 CETPs are being set up under directions of the Supreme Court. Necessary steps need to be taken by the Delhi Government for expediting the construction and commissioning of the CETPs.

Air Pollution from Thermal Power Plants

There are three coal based thermal power plants in Delhi, at Indraprastha, Rajghat and Badarpur. The air pollutants emitted by the thermal power plants are: sulphur dioxide, oxides of nitrogen and particulates. Electrostatic precipitators have been installed at the three power plants to control particulate emissions. Sulphur dioxide and oxides of nitrogen are emitted through stacks of specified height to facilitate wider dispersal so that the ground level concentrations of these gaseous pollutants are kept controlled. Stack monitoring is being done on a regular basis.

Fly Ash from Thermal Power Plants

The total quantity of fly ash from the three power plants is about 6,000 tonnes per day (Badarpur 3,500-4,000 TPD, Indraprastha 1,200-1,500 and Rajghat - 600-800 TPD). While Badarpur and Rajghat have dry fly ash collection facilities, they do not have adequate storage facilities. By and large the fly ash generated is disposed of in ash ponds. The ash ponds are located close to the river Yamuna in case of Rajghat and Indraprastha power plants. The river Yamuna is vulnerable to overflows from the ash ponds, particularly during the monsoon. Besides, ground water contamination may take place due to leaching of heavy metals present in the fly ash.

None of the thermal power plants in Delhi has an action programme for mass scale utilisation of fly ash. The Central Pollution Control Board has issued directions to the

plants under Section 5 of the Environment (Protection) Act to submit detailed Action Plans for committed utilisation of fly ash to achieve a minimum 20% utilisation by December, 1997. The Action Plans were to have been submitted in October, 1996. The power plants were also advised to set up facilities for fly ash utilisation within the premises as ancillary units. This has not been done so far. Necessary assistance will need to be made available to the entrepreneurs, accompanied by necessary financing, for establishing units manufacturing fly ash products. For new thermal power plants, as in the case of the Rajghat plant, the Ministry has prescribed that at least 20% fly ash should be utilised in the first year of the commissioning of the unit, with an increase of 10% every year, thereafter so that by the end of the ninth year 100% of the fly ash comes to be utilised. The terms of supply of fly ash would be settled mutually between the power plants and the concerned entrepreneurs. For providing the necessary impetus to the utilisation of fly ash, the Ministry of Environment and Forests proposes to prohibit the use of top soil in brick/block manufacturing and in use on roads and embankments within a specified radius from the location of thermal power plants. Simultaneously, appropriate technology dissemination is required for fly ash utilisation and other institutional support. Directives for mandatory utilisation of fly ash bricks will have to be given to the construction agencies. Fly ash can also be used in Portland Pozzolona cement, cement concrete, cement mortar, building components, landfill embankments and in pavements.

Hazardous Wastes:

The State Government and the Delhi Pollution Control Committee is still to inventorise the industrial units in Delhi generating hazardous wastes as defined in the Hazardous Wastes (Management and Handling) Rules. The hazardous waste also has

to be characterised. Most of the hazardous waste generating units in Delhi are functioning without authorisation required under Rules. Such authorisation is granted by the Committee on satisfaction that the unit is disposing off the wastes in an environmentally sound manner. The large number of hazardous wastes generating units working unauthorisedly is a cause of concern. In January, 1997 the Ministry of Environment and Forests has delegated powers to the Delhi Pollution Control Committee to close down units handling hazardous wastes operating in violation of the Rules. The implication of industrial units functioning without authorisation is that hazardous waste is not being handled in an environmentally sound manner. Apart from the environment being affected adversely, there is danger of groundwater becoming contaminated. Those units which have been granted authorisation are disposing of the hazardous waste on-site. Quite possibly, the hazardous waste is just being disposed of in storage pits without pre-treatment. Whether the pits are properly lined to prevent leaching and run-offs is an important question which has not been addressed adequately as yet by the Delhi Pollution Control Committee. There is no common facility for the collective treatment, storage and disposal of hazardous wastes generated by various industrial units in Delhi. The facility should also have arrangements for incineration. Delhi needs such a facility urgently.

The salient activities for controlling industrial pollution in Delhi are:

Table 2.2:Industrial Pollution in Delhi

S.No.	Activity	Responsibility	Timeframe
1.	The three coal based power plants should switch over to beneficiated coal.	DVB/NTPC/MoC/MoP	31.12.98
2.	Till availability of beneficiated coal, superior quality of coal (D Grade) should be used.	NTPC/DVB/MoP/MoC	31-12-97
3.	Strict enforcement of pollution control measures applicable to industrial boilers.	DPCC/Factory Inspectorate	
4.	Shifting of polluting industries from non-conforming to conforming areas	Delhi Admn./DPCC	According to Court directive.
5.	Construction and commissioning of 15 CETPs	Indl. Associations (CETP Companies) DPCC/DSIDC	31-12-98
6.	Inventorisation of hazardous waste units: characterisation of wastes.	GNCTD/Indl. Asso./DPCC	Immediate
7.	Common facilities for treat-ment, storage disposal and incineration of hazardous waste.	GNCTD/DPCC	31-12-98
8.	Notification for mandating fly ash utilisation	MoEF	31-12-97
9.	Provision for dry collection and storage facilities for fly-ash should be made in three power plants	DVB/NTPC/MoP	31-12-98
10.	Cleaner production cell should be set up for SSIs in the Deptt. of Industry, Govt. of Delhi for promoting clean technologies/waste minimisation.	DSIDC	31-12-97
11.	To ensure installation of pollution control devices by all air polluting industries.	DPCC	31-12-97

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