CHAPTER 1

Introduction of Air Pollution

1.1 INTRODUCTION

Air is one of the five essentials (air, water, food, heat, and light) for the human beings. Man breaths nearly 22,000 times in a day and inhales approximately 15kg of air per day. Generally human beings can live for 5 weeks without any food, 5 days without any water but not even 5 minutes without air. Even though the air is abundantly available over the surface of the earth, but it contains lot of impurities. All the impurities in the inhaled air do not cause injury to health and it depends on several factors. The chemical composition of clean atmospheric dry air is given in Table 1.1(a) and comparison of clean air and polluted air in Table 1.1(b). Due to industrialisation in a region, the purity of air has been reducing in that locality to a level which endanger the health of the community.

Table 1.1(a). Chemical composition of clean dry atmospheric air

Substance	Concentration	
	% by volume	by ppm
Nitrogen	78.09	780,900
Oxygen	20:95	209,500
Argon	0.93	9,300
Carbon dioxide	0.032	320
Neon	0.0018	18
Helium	0.00052	5.2
Methane		1.2
Krypton		0.5
Hydrogen		0.5
Xenon		0.08
Nitrogendioxide		0.02
Ozone, etc.		0.01 to 0.04

Table 1.1(b). Comparison of clean air and polluted air

Pollutant	Clean air (ppm)	Polluted air (ppm)
SO_2	0.001–0.01	0.02–2.0
CO_2	310–330	350–700
CO	<1.0	5–200
NO_x	0.001–0.01	0.01–0.5
HC	1.0	1–20
Particulates ($\mu g/m^3$)	10–20	70–700

Various types of contaminants are entering into the atmosphere, by natural and man-made activities which are taking place on the earth. So, in general, air pollution means the presence of a foreign matter in air. Various authors defined 'air pollution' which are as follows.

Dean. E.Painter defined 'air pollution' as the presence in the outdoor atmosphere of one or more contaminants in a sufficient quantity and duration to cause them to be injurious to human health and welfare and animal and plant life and to interfere with the enjoyment of life and property.

The American Medical Association, Council of Industrial Health (WHO) defined 'air pollution' as the excessive concentration of foreign matter in the air which adversely affects the well being of the individual or causes damage to property.

The Bureau of Indian Standards (IS:4167) states that the pollution is the presence in ambient atmosphere of substances generally resulting from the activities of man, in sufficient concentration present for a sufficient time and under circumstances which interfere significantly with the comfort health or welfare of persons or with the full use of enjoyment of property.

A typical legal definition of air pollution is the presence in the outdoor atmosphere of substances or contaminants put there by man, in quantities or concentrations and of a duration as to cause any; discomfort to a substantial number of inhabitants of a district of which are injurious to public health or to human, plant or animal life or property or which interfere with the reasonable comfortable enjoyment of life and property throughout the state or throughout such territories or areas of the state as shall be affected thereby (WHO).

From the above definition, air pollution definition may be simplified as the presence of pollutants in air in sufficient quantity and duration which adversely affect the health and enjoyment of property of human beings, animals and plants.

1.2 EPISODES OF AIR POLLUTION DISASTERS

Episode is an event in the chain of events.

Disaster is a sudden misfortune or a terrible accident.

Air pollution is not a recent phenomenon and the problem of air pollution has existed for centuries. Smoke, ash, sulphurdioxide and other products of combustion have been recognized as nuisance. In 1272, smoke was considered as first air pollutants and King Edward I of England banned the use of sea coal since it released lot of smoke during burning. Henry V (1413–1422) of England regulated the use of coal as fuel. In the year 1800 hydrochloric acid was recognised as atmospheric pollutant (the strong emission of hydrochloric acid was resulted in the production of soda ash from common salt).

In 1961, Royal Command of Charles II published a pamphlet on 'air pollution' and it was recognised that coal was responsible for the unpleasant smell and irritation to the throat and nose.

Air Pollution Disasters

Air pollution disasters occurred in various places in the world. Some of them are severe and a few of them are given below.

1. *Meuse Valley (Belgium)*

In December, 1930 a heavily industrialised area of Meuse Valley experienced a severe 3-day fog and temperature inversion. In 24 km long Meuse Valley consists of hills on either side with a height of 80 to 120 m, which are occupied by steel and power plants, sulphuric acid plants, and zinc plants. Pollutants got trapped on the valley over a period of three days due to temperature inversion. Due to severe fog 60 people died and several hundred became ill and suffered with eye and nosal irritation. Cattle became sick.

2. *Donora (U.S.A.)*

Donora, Pennsylvania is located at 45 km south of Pittsburgh in a horse shoe shaped valley on the Monongahela river. In the last week of October 1948, anticyclone weather condition characterised by little or no air movement occured over a period of 4 days. Temperature inversion and fog resulted the death of 20 people and 6000 out of 14,000 population became ill due to respiratory tract diseases and irritation of eyes.

3. *London (England)*

From 5th to 9th of December 1952, an anticyclone weather created a subsidence inversion and fog formed over the London area. Due to low temperature inversion, stagnant air, smoke and sulphurdioxide 4000 people died and several thousands hospitalised for respiratory troubles. Similarly in January, 1956 and December, 1962 air pollution disasters took place in London and hundreds of people died.

4. *Los Angeles (U.S.A.)*

The city of Los Angeles is located along the narrow pacific coastal plain in the southern portion of State of California. The land rises gradually from the coast line to eastward mountains which are at a height of 600 m over a distance of 50 km. The obnoxious gases released from thousands of automobiles were trapped due to stable atmosphere. The temperature inversion increased the concentration of exhaust gases of automobiles, which resulted the formation of photochemical smog and peroxyl acetyl nitrate (PAN), and experienced a severe smog problem in 1945. It resulted the reduction of visibility, irritation to eyes and damage to vegetation.

5. *Tokyo (Japan)*

In the early morning of June 18th, 1970, a thick fog was formed over the Tokyo city, due to increased levels of oxidants in the atmosphere. 6000 people suffered with eye irritation, sore throat and difficulty in breathing. Photochemical oxidant reacted with sulphur dioxide resulted acid mist which caused eye irritation.

6. *Bhopal (India)*

In the early morning hours of 3rd December, 1984, 30 tonnes of deadly methyl iso cynate (MIC) gas was released from storage tank due to alleged failure of vent scrubber system. More than 2500 deaths occured and one lakh people severely affected with coughing, conjunctivities, suffocation and cardiac failure.

It is observed the following points from the above air pollution disasters.

(i) Majority of air pollution disasters were occured during late night or early hours of winter months, because the dispersion of pollutants is low.

(ii) The situations were triggered due to heavy accumulation of air pollutants, which were released from huge processed industries, where they were located in a centralised area.

(iii) The worst conditions occured in a U-shaped vallies or hilly terrains.

(iv) In some occasion even the industries were located in the plain areas, the disasters took place due to failure of necessary checks for leakages and safety measures.

Hence, to avoid the disasters or atleast to minimise them, proper attention is necessary by the authorities to consider topographical, meteorological, man and environment, and safety maintenance aspects while locating the industries. In this regard, it is always desirable to remember and remind the slogan of "PREVENTION IS ALWAYS BETTER THAN CURE".