CHAPTER-I

Introduction
CHAPTER-1

INTRODUCTION

1.1 Introduction and Motivation:

It is known that all substances are ultimately made up of atoms and molecules. Ordinary fluid like air or water are made up of molecules which are electrically neutral. By heating a gas to very high temperatures or by passing an electric discharge through it, we can break up a large number of molecules into positively charged ions and negatively charged electrons. Such a collection of ions and electrons is known as plasma, provided it satisfies certain conditions. It is intuitively obvious to us that fluids like water and air may be treated as macroscopic continuum systems. But astrophysicists often deal with systems like the solar wind or the interstellar medium having few particles per cm³ but extending over vast regions of space. It is not at once obvious if continuum fluid equations are applicable to such systems. Hence it is useful to have some understanding of the microscopic basis of the continuum equations to know when they are applicable and when they break down. Since neutral fluid equations in a sense can be thought to constitute a special case of plasma equations in which electromagnetic terms are set to zero, there may be some logical appeal in first developing the full plasma equation in complete gory and then considering the neutral fluids as a special case. It is observed that the microscopic theory of neutral fluids is not exactly of
nature of a special case of the microscopic theory of plasmas with electromagnetic forces set to zero. The particles in a neutral fluid interact only when they collide, whereas the particles in a plasma interact through long-range electromagnetic interactions. This difference in the nature of interactions introduces some subtle differences in the microscopic theories. We would like to develop dynamical theories of fluids. By dynamical theory we mean a physical theory with which the time evolution of the system can be studied. Classical mechanics, classical electrodynamics and quantum mechanics are some familiar examples of dynamical theories. The structures of all these dynamical theories have certain common characteristics, which we would expect the dynamical theories of fluids also to have.

The mathematical theories for fluids should have similar structures with these two characteristics:

1. There should be a way to prescribe the state of system with a set of variables.
2. There should be a set of equations giving the time derivatives of these variables.

These two requirements for dynamical theories can be given geometrical representations by introducing having many dimensions such that each of the variables necessary to prescribe the state of the system corresponds to one dimension.
Different levels of theory for neutral fluids

<table>
<thead>
<tr>
<th>Level</th>
<th>Description of State</th>
<th>Dynamical Equations</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>N. quantum particles</td>
<td>$\psi (x_1, \ldots, x_N)$</td>
</tr>
<tr>
<td>1</td>
<td>N classical particles</td>
<td>$(x_1, \ldots, x_N, \mu_1, \ldots, \mu_N)$</td>
</tr>
<tr>
<td>2</td>
<td>Distribution function</td>
<td>$f(x, \mu, t)$</td>
</tr>
<tr>
<td>3</td>
<td>Continuum model</td>
<td>$\rho(x), T(x), v(x)$</td>
</tr>
</tbody>
</table>

Certain condition has to be satisfied in order to pass from level 0 to level 1. Similarly some other conditions have to be satisfied to derive level 2 from level 1 or level 3 from level 2. These conditions will be presented. However, fluids may often have turbulence- a state of random and chaotic motions which appear unpredictable. Developing a proper theory of turbulence has remained one of the unsolved grand problems for over a century.

The air around us (the atmosphere) is the most significant part of our natural environment. The atmosphere has always been polluted to some degree. But a scientific and technical review of history of air pollution could not be commenced prior to 1850 A.D.

The urban atmosphere is a vital part of the physical environment and directly affects the health and well being of the urban population. The biggest and most tragic problem of urban population is the pollution of the environment. The two basic reasons lie behind the worldwide pollution of all kinds that we witness today i.e. the man's reckless reproduction and the technological development combined with lack of awareness and
environmental ethics. In India concern and respect for "Environment" or "Nature" may be traced to the "Vedas"

To have a clear and scientific understanding of the term air pollution knowledge of chemical composition of "clean" or "normal" dry atmospheric air is required. Which is typically present in rural areas or over the oceans far from the landmasses. (Table 1.)

**Table 1**

Chemical composition of "Normal" or "Clean" Dry Air over the Sea Level

<table>
<thead>
<tr>
<th>Component</th>
<th>Content (By Volume)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen</td>
<td>78.084 ± 0.0004%</td>
</tr>
<tr>
<td>Oxygen</td>
<td>20.946 ± 0.002%</td>
</tr>
<tr>
<td>Argon</td>
<td>0.934 ± 0.001%</td>
</tr>
<tr>
<td>Carbon dioxide</td>
<td>0.033 ± 0.001%</td>
</tr>
<tr>
<td>Neon</td>
<td>18.180 ± 0.040 ppm</td>
</tr>
<tr>
<td>Helium</td>
<td>5.24 ± 0.004 ppm</td>
</tr>
<tr>
<td>Krypton</td>
<td>1.140 ± 0.010 ppm</td>
</tr>
<tr>
<td>Xenon</td>
<td>0.087 ± 0.001 ppm</td>
</tr>
<tr>
<td>Nitrous-oxide</td>
<td>0.500 ± 0.110 ppm</td>
</tr>
<tr>
<td>Methane</td>
<td>2.000 ppm</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>0.500 ppm</td>
</tr>
<tr>
<td>Carbon monoxide</td>
<td>0.100 ppm</td>
</tr>
<tr>
<td>Ozone</td>
<td>0.110 ppm</td>
</tr>
<tr>
<td>Ammonia</td>
<td>0.110 ppm</td>
</tr>
<tr>
<td>Nitrogen dioxide</td>
<td>0.001 ppm</td>
</tr>
<tr>
<td>Sulfur dioxide</td>
<td>0.002 ppm</td>
</tr>
<tr>
<td>Radon</td>
<td>10-13 ppm</td>
</tr>
</tbody>
</table>

"Air contaminants" or "pollutants" mean any solid, liquid or gaseous substance present in the atmosphere in such concentrations as may be or
tend to be injurious to human beings or other living creatures or plants or property or environment. They include smoke, vapours, soot, carbon fumes, gases, mist, odors, particulate matter, radio active materials, or noxious chemicals, or any other material in the atmosphere.

According to WHO "Air pollution occurs when one or several air pollutants are present in such amounts for such a long period in the outside air that they are harmful to humans, animals, plants, or properties contribute to damage or may impair the well being or use of property to a measurable degree.

Seinfold classified air pollutants into two general classes (1) Primary pollutants, emitted directly from the sources and (2) Secondary pollutants, those formed in the atmosphere by chemical interactions among atmospheric constituents and primary pollutants. Anthony & Hodges classified air pollutants on the basis of state of mater i.e. (1) Gaseous, such as Sulphurdioxide, Nitrogen oxides, Carbon oxides, Ozone, Ammonia etc. and (2) Particulate such as finely divided solids or liquids i.e. aerosol, dust, soot, fumes and smoke. Based upon chemicanature air pollutants may be categorized as (1) Inorganic, such as S02, NOx, CO, HF, HCl, Cl2, O3, NH3 and (2) organics, such as Hydrocarbons (Paraffin's, Olefins, Aromatics), Chlorinated Hydrocarbons (DDT, PCBs), Oxygenated Aliphatics (Aldehydes & Ketones), Nitro-Derivatives of Hydrocarbons (Nitro PAH, Nitrophenols).
According to a Norwegian report the typical levels of air pollutants strongly vary in concentration from the stack or emission sources to the different types of environments i.e. street, urban air, background areas as given in (Table 2.).

### Table 2: Typical levels of Air Pollutants

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Background</th>
<th>Urban Air</th>
<th>Stack Emissions</th>
<th>Auto Emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>0.1 ppm</td>
<td>5-10 ppm</td>
<td>2000-10,000 ppm</td>
<td>1-4%</td>
</tr>
<tr>
<td>SO₂</td>
<td>0.2 ppb</td>
<td>0.0202 ppm</td>
<td>500-3,500 ppm</td>
<td>50-100 ppm</td>
</tr>
<tr>
<td>NOₓ</td>
<td>0.2-5 ppb</td>
<td>0.2-1 ppm</td>
<td>1500-2,500 ppm</td>
<td>1500 ppm</td>
</tr>
<tr>
<td>O₃</td>
<td>10 ppb</td>
<td>0.1-0.5 ppm</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>SPM</td>
<td>10 µg/m³</td>
<td>60-600 µg/m³</td>
<td>35-10⁶ µg/m³</td>
<td>-</td>
</tr>
<tr>
<td>Methane</td>
<td>1.5 ppm</td>
<td>1-10 ppm</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Other</td>
<td>&lt;ppb</td>
<td>1-100 ppb</td>
<td>-</td>
<td>1000 ppm</td>
</tr>
<tr>
<td>Hydrocarbons</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Under chemical effects, oxidation reactions of air pollutants that occur at surfaces are more dangerous i.e. depletion of ozone layer, greenhouse effect, corrosion of metals and degradation of other material surfaces like marble etc.

Air pollution causes physical, chemical and biological change or damage. Physical effects may be visual (dirtiness or visibility attenuation), acoustical (noise or blast propagation), molecular energetic (electrical energy of ionization or kinetic energy of heat).
Several workers have studied harmful potential of coal dust, cement dust, fly ash and gaseous pollutants like Ozone, Ammonia, Sulphurdioxide, Nitrogen Oxides and Hydrogen Fluoride on plants.

Among effects on human health gaseous pollutants and fine particulate matter are inhaled and absorbed into the blood stream. The correlation of smoking, air pollution on micro scale, with respiratory disease especially bronchitis and lung cancer, has shown a very strong consistency. Several effects on animals, eating fodder contaminated by air pollutants i.e. Lead, Arsenic, Zinc and Fluoride have been identified.

Concentration of pollutants in the atmosphere is not only the causative factor, local meteorological conditions and weather phenomenon are also responsible for the air pollution episodes. Few examples of important air pollution episodes have been cited in table 3 from the wide spectrum of cities and valleys affected by air pollution.
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### Table 3: Summary of Air Pollution Episodes

<table>
<thead>
<tr>
<th>Episodes</th>
<th>Year</th>
<th>Duration</th>
<th>Reported Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse Valley (Belgium)</td>
<td>1930</td>
<td>October 1-5</td>
<td>60</td>
</tr>
<tr>
<td>Donora Smog, Pennsylvania (USA)</td>
<td>1948</td>
<td>October 26-31</td>
<td>20</td>
</tr>
<tr>
<td>London Smog (U.K.)</td>
<td>1952</td>
<td>December 5-9</td>
<td>4000</td>
</tr>
<tr>
<td>Los Angeles Smog (USA)</td>
<td>1949-54</td>
<td>-</td>
<td>Not available</td>
</tr>
<tr>
<td>Thanks Giving Weekend Episode, New York (USA)</td>
<td>1966</td>
<td>November</td>
<td>200</td>
</tr>
<tr>
<td>Osaka (Japan)</td>
<td>1962</td>
<td>-</td>
<td>60</td>
</tr>
<tr>
<td>Bhopal (India)</td>
<td>1984</td>
<td>December, 3</td>
<td>2500</td>
</tr>
</tbody>
</table>

Conditions, which allow for the accumulation of pollutants denote high pollution potential whereas conditions in which dispersal of pollutants can occur effectively denote low pollution potential. The following have been used as climatologically indices of pollution potential.

(i) Frequency of ground based inversions,

(ii) Strength of surface winds,

(iii) Mixing height

(iv) Transport wind speed

Two factors which tend to increase air pollution concentration are light wind and stability of atmosphere.
1.2 Meaning And Definition Of Air Pollution:

It may be pointed out that air is never pure because of some gases such as sulphur dioxide, hydrogen sulphide, carbon monoxide emission from volcanoes and swamps windblown dusts salt spray pollens from plants etc are continuously added to the air by the natural processes. Thus the air gets polluted when both disturb either by natural or man-made source or its natural composition. H Perkins (1974) has defined air pollution as "the presence in the outdoor atmosphere of one or more contaminants such as dust, fumes gas must, odour, smoke or vapour in quantities of characteristics and the duration such as to be injurious to human, plant or animal life and to property or which unreasonably interfere which the comfortable enjoyment of life and property". According to world health organization (WHO) air pollution is defined as limited to situation in which the outdoor ambient atmosphere contains material in concentration which are harmful to man and his surrounding environment.

The atmosphere is a gaseous sheath which surrounds the earth from all the sides. The air is a mechanical mixture of several gases mainly Nitrogen (78%) Oxygen (20.95%) Argon (0.93%) and Carbon dioxide (0.03%) besides other trace gases like neon, krypton, helium, hydrogen, xenon, and ozone. Air is very important for all types of life in the biosphere, human life is not possible without air because man can live for few days without water or for a few weeks without food but cannot
survive even for a few minutes without air. It constitutes about 80% of the total intake of all things by a person every day as a person breathes 22,000 times a day inhaling gallons or 16 kilograms of air, which he obtains from the oxygen rich atmosphere surrounding the earth.

In a general sense air pollution may be defined as the disequilibrium condition of the air caused due to introduction of foreign form natural as well as anthropogenic source of to the air so that the air become injurious to biological communities in general and human community in particular.

Air pollution is generally accomplished through the pollutants of gases and solid and liquid particles of both organic and inorganic chemical classification important being CO₂, Fluorocarbon, NOx, sulphur compounds, waste heat water vapour, ammonia, hydrocarbons, methane, proximately nitrates, methyl bromide, krypton, aerosol etc, it is significant that air pollution through natural source including volcanic dusts, wind blown dust, vapour form plant lives rating malarias in the natural environment, pollens form plants flowers etc. The natural dimension and magnitude of air pollution depend on a variety of factors such as residence time of pollutants in the atmosphere sources of pollution, nature of pollutants amount of pollutants etc.

According to D.M. Dixon (1972) pollution includes all those activities conscious or unconscious of human being and their domestic cattle and the result there of which detract in any way in the long term or short term form enjoyment of his environment and his ability to derive full benefit therefore-
Pollution is defined as "the percentage at large of substance or energy patterns which have been involuntarily produced, have outlived their purpose have escaped by accident or have unforeseen effect in quantities which harm his (man) health or do effect him". (Lord Kenett).

Pollution is viewed as "the release of substances and energy as waste products of human activities which result in changes usually harmful weather the natural environment. "(Natural Environmental Research Council 1976).

Environmental pollution is assuming global dimensions and its frontiers are no more confined to any particular part of our planet. The first UN conference held in Stockholm on 5th and 6th June 1972 and now United Nations conference on environment and development (UNCED) called the Earth summit at Rio De Janeiro (Brazil) on 3rd to 14th June 1992 had focussed attention of more that 170 nations on the growing worldwide menace of environmental pollution.

The World Health Organization (WHO) diffuse as are pollution as limited to situations in which the other ambient atmosphere contains malarial in concentrations which are harmful to man and his environment.

The clear air is defined as the air occurring in areas sufficiently distance from place of human activities and other abnormal influence.

In India main problem of air pollution arises from the fact that 80% of its industrial production and motorization are concentrated in some
large industrial centers. This has created severe environmental pollution problems in isolated pocket with demand of clean air resource.

Air pollution is generally a disequilibrium condition of air caused due to the introduction of foreign element from natural and man made sources to the air so that it becomes injurious to biological communities.

H. Perkins (1974) defined air pollution as "The presence in the outdoor atmosphere of are or more contaminants such as fumes, dust, gases, mist, grit odour, smoke smog or vapour in considerable quantities and of duration which is injurious to human animal or plant life or which unreasonably interferes which the comfortable enjoyment of life and property."

1.3 Source of air pollution:

Air pollution is caused by discharge of contaminants such as dust, fumes, gas, mist, odour, smoke or vapour in the atmosphere mainly SO₂, oxides of nitrogen, pesticides. Fumigants fluoride, phosphate, carbon monoxide etc are destroying the plants, animal, human beings, buildings soils and water.

Air is never absolutely clear in nature, pollution of air started from the very moment when the primitive man knew to make fire, since then it has increased and still increasing every moment. Atmosphere i.e. air sector is continuous which diffuse and disperse the air pollutant at a great rate with factor action. Air pollutants are substrate causing damage to target or receptor.
**Industrial Source Of Odour Pollution:**

Often we smell is the most strident kind of pollution and its reduction involve not only chemical, physical and engineering problems but also solid physiological and psychological.

**Major Source Of Air Pollution:**

Natural source of air pollution are volcanic eruptions releasing poisonous gases (such as S02 and CO, H2S) forest fires, natural organic and inorganic decays or vegetative decay, marsh gases, deflection sands and dust extra terrestrial bodies, cosmic dust, pollen grams of flowers, soil debris all these are produced naturally and released in the air.

**Increase In Population:**

The rapid explosion of population is one of the most important factors of air pollution. Only India is reaching population near bout 1.25 billion. In Faizabad population is approaching 14 lacks. Which generates several serious problems including the worsening of condition of the environment.

**Man Made Source:**

Man made sources such as increases in population, deforestation, burning of fuels and fires, emission from vehicles, rapid industrialization etc.
Other Sources Of Air Pollutants And Particulate Matter

Airborne pollutants arise mainly from emission of certain gases that condense as particle or transform the particulate. Thus the major source of air pollutants are the gaseous matter and particulate which get released by burning of fossil fuels such as coal, wood, petroleum etc. The primary particulate matter consists of dust or smoke particles emitted from factors-

Atmospheric particulate matter range in size from 0.001 micrometer to several hundred micrometer, particulate matter in the air is produce by natural source such as dust.

Industrial fugitive process - These include loading material, handling and transfer operations.

Fuel Combustion And Industrial - This consists of smelting and polishing furnaces, fertilizers, pesticides, fungicides textiles and chemical production.

Transportation Sources - These include source vehicle exhaust and particles nom clutch and break wear.

Non-Industrial Fugitive Process - These are dust agricultural operations fir etc:

Emission Of Industrial Air Pollutants

Industries are by far the largest single emission source for polluting the environment. Some of the major pollutants emitting sources are as follows:
(i) Sulphuric acid industry - H₂SO₄ acid industry and other industries discharge large quantities of S0₂ and S0₃ in the air.

(ii) Fluoride industry - It emits offensive fluoride HF and cryolite.

(iii) Hydrochloric industry - The industry releases toxic chlorine vapors, chlorine monoxide HCl, and unrecalled hydrocarbons.

(iv) Iron and steal industry- The emission from iron and steel industry include metal oxide, SOₓ, CO, CO₂, etc.

1.4 Classification of And Effect Of Air Pollutants:

Pollutants are the main source of pollution, which cause damage to the largest, or receptor. Target is always adversely affected by pollutant. It may be man, animal, plant, tree, building or malarial etc.

I. Aerosol pollutants -

Are pollutants that remain suspended in air and consist of fine particles of different organic or inorganic compounds having diameter less than 100 micron.

Pesticides - Today damage from pesticides is increasing enormously.

II. Gaseous pollutant -

These pollutants are gaseous in nature and normal temperature and pressure. These also include vapour of compounds whose boiling points are below zero degree. These pollutants include a variety of inorganic and organic gaseous materials.
**Metallic contaminants** - A number of toxic and non-toxic metals occur in the atmosphere and rain releases metals to the soils and rocks of earth's crust which passes to rivers and seas. Industrial activities discharge many of metals into air, water sail various metals creating environmental hazard are essential destroy trace element required for growth and development of plants, animals and human beings. These elements are Ca, Al, Ba, Co, Pb, Ag, Te, Zn, and Mo etc.

Inorganic gases these include noxious gaseous pollutants like oxides of nitrogen (NOx) oxides of sulphur, oxides of carbon, hydrogen sulphide, ammonia, chlorine, hydrogen fluoride, hydrogen chloride etc.

Organic gases pollutants include hydrocarbon (CxHx) such as CH₄, C₃H₈, C₂H₂ etc, and other compounds such as formaldehyde, acetone, vapour alcohol, organic acid methyl isocyanides etc.

**Radioactive Pollutants** - These include particulate and electromagnetic radiations which causes chronic cellular damage in man and animal. Naturally occurring radiation like cosmic and terrestrial radiation enter into biosphere and effect the whole Jaunpur. Cosmic rays which enter the atmosphere from outer space, there quantum depend upon altitude and latitude of location. The earth's crust also contains some radioactive which continuously emit radiation for example-U-238, Th-234, Ea-226 are present in soul rocks and natural building. X -rays used in medicine penetrate the human body. X-rays exposure has cumulative effect on the body.
Industrial emission from nuclear reactors and processing installations are also responsible for atmospheric radiation. The increasing use of radioisotopes in research industry and medicine and in nuclear reactors use for power generation are the major source - the operation of nuclear reactor and nuclear fuel processing units make the largest contribution. The gaseous wastes containing Ar-41, Xe-113, I-131, Kr-85, H-3 and C-14 are discharged during the operation of reactors.

**Gaseous Pollutants** -

These pollutants are emitted by man made sources like transportation fuel combustion, industrial operations, soil waste disposal and various other activities. About 80.5 million tones of total pollutants are produced per year by transportation, alone carbon monoxide is the major individual primary pollutants atmosphere the larger the value of relative toxicity assigned by weakling factor which is based on proposed for standard air quality.

Among the various gaseous pollutants the major primary pollutants which are most significant are-oxides of Nitrogen (N0x), oxides of sulphur, oxides of carbon and hydrocarbons CxHx and particles.
### Table 4

<table>
<thead>
<tr>
<th>Gaseous Pollutants</th>
<th>Pollutions Sources</th>
<th>Natural Sources</th>
<th>Annul emission</th>
<th>Atmospheric Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pollution Source</td>
<td>Natural Source</td>
</tr>
<tr>
<td>CO₂</td>
<td>Combustion</td>
<td>Release from plants biology</td>
<td>1.4x10¹⁰</td>
<td>1012</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO</td>
<td>Auto exhaust industrial process and others</td>
<td>Forest fire</td>
<td>2.75x10⁸</td>
<td>7.5x10¹</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SO₂</td>
<td>Combustion of coal and oil</td>
<td>Volcanic eruption</td>
<td>1.45x10⁶</td>
<td>1.5x10⁻¹</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H₂S</td>
<td>Sewage treatment charcoal process</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NO</td>
<td>Combustion</td>
<td>Lightning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydrocarbons</td>
<td>Combustion exhaust</td>
<td>Biological form</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Emission From Vehicles** - The automobiles exhaust are responsible for more than 75% of total air pollution. The automobiles such as car, scooters, motors, taxies, trucks etc release huge amount of poisonous gases such as carbon mono oxide (about 78%), Nitrogen oxides about (8.5%) and hydrocarbons (about 15%) in addition to leaded gas and particulate lead etc as result of incomplete combustion of petrol and diesel which react with oxides of nitrogen in presence of sunlight to form photochemical smog in the atmosphere. Thus smog is very toxic in nature.

**Transportation** - There are several fuel burning sources, which pour pollutants in the air. Automobiles which have internal combustion engines
(primary transportation source) are of the prime valence as air pollutants. Automobile exhausts release smoke and to a little extent lead particles. Thus smoke is produced primarily from the incomplete combustion of carbonaceous matters. It contains gaseous pollutants nearly two third of CO and one half of the hydrocarbons and nitrous oxide. The toxic vehicular exhausts coming from increasing vehicular traffic growth due to population explosion pushed continued heat to the ambient air quality.

There are about 350 million automobiles all over the globe and their number is still increasing vigorously. By 2001 India will have near 4 million vehicles and 70% operating on petrol.

**Rapid Industrialization** - A large number of industries such as chemical industries, paper and pulp mills, leather mills, etc.

1.5 **Transport And The Environment:**

Environmental concerns include the whole situation of, noise, water economic and social effects, land values and dislocation etc. They include all forms of pollution and disruption of the natural water economic and social effects, land values and dislocation etc. They include all forms of pollution and disruption of the natural ecological processes by human and related activities. The growth of human population, the goods and services consumed pose serious environmental problems. It must be recognized that many economic, national, social and tribal goals and objectives are in direct conflict with many environmental concerns. A classic example is
the economic benefits to petroleum producing areas as compared with the
detrimental effects resulting from petroleum from petroleum consumption.

We all should be concerned about the human and natural
environment. There are those who feel that we must be concerned some of
the action that we have taken that have adverse effects. Since this is a
global human problem it is difficult to capture the problem definition and
therefore propose optional solutions. One of the efforts is the idea of
sustainable Transportation. This notion fits with Sustainable Development
the idea that current actions and activities should not impede future
activities.

Any major proposal today requires more than just an engineering
and economic approval. Consideration must also be given to the
environmental issues that are associated with that project. The scope of the
considerations related to an action is often determined by the policies and
regulations currently in effect at the time of undertaking. It is difficult for
a professional to go beyond currently defined constraints. It will also be
probably illegal to ignore or slight the established constraints.

Probably the best-publicized environmental problem in North
America is Smog in the Los Angeles area. It should be noted that greater
Los Angeles covers and area almost twice the size of Switzerland. It is
also high earthquake risk area and one that was highly rich in petroleum
resources. The earthquake risk and other factors have contributed to very
low urban densities, heavy use of automobiles and other motor vehicles. It
has been estimated that over fifty percent of the developed land area in L.A. is paved roadways or parking lots.

Transportation raises many environmentally sensitive issues. Transport activities and projects; cause a considerable change in an area. The projects themselves are visible consumers of land, and encourage other activities that may produce harmful effects. The environmental effects may accumulate from many sources and scrutiny of individual action and projects may not be effective or sufficient.

The Smog problem has many causes, the principal one being the heavy use of internal combustion engines. Much of the pollution control efforts of the automotive industry have been instituted because of the Los Angeles experience. Other major cities such as Mexico, Tokyo etc, also have SMOG problems.

Environmental concerns currently are stated legally by the local and regional environmental regulations and review processes. A project must comply with these. Problems arise when the current regulations appear to be or are applied retroactively. Extensive and costly litigation can follow apparent non-compliance.

Efforts continue to reduce harmful emissions from engines. The use of electric propulsion has long been considered a solution. The latest efforts are hybrid drives using small engines along with electric drives. These schemes store energy in batteries when it is not demanded by
vehicle motion. Another option is the use of fuel cell to convert petroleum products to electricity.

The change in the content of the earth's atmosphere causes major concerns. The Kyoto Protocol attempts to set forth policies that each county should follow to reduce its contribution to the effluents of contemporary mankind. The main concern is about the so called Green House Gases, include among the most serious Green House Gases is CO₂, Carbon Dioxide, the major product of complete combustion of carbon based fuels. Reducing CO₂ essentially means reducing consumption of carbon based fuels, which currently power most transport vehicles. Reducing green house gases presents a major dilemma because so much of our current way of life depends on transport and other activities fueled with coal and petroleum products.

Smog:

The most sever air pollution ever occurred was due to sulphurous smog caused in London in 1952. The mixture of smog fog and sulphur dioxide (SO₂). Fog formation, the most widespread disaster due to SOx occur it is accomplished by smoke the combination occur during temperature inversion. It generally worst in early hours of morning and appears to worsen shortly after sunrise perhaps because of photo chemically induced oxidation of S0₂ into sulphur trioxide (S0₃) follow by combination with moisture to give acidic aerosol particulates of smoke from coal combustion provide the condensation nucleation cells on which
fog droplets condense, their surface area help in catalytic oxidation of $\text{SO}_2$.

The following reactions take place-

$$\text{S} + \text{O}_2 \rightarrow \text{SO}_2 \quad \text{(i)}$$

$$\text{SO}_2 + \frac{1}{2}\text{O}_2 \rightarrow \text{SO}_3 \quad \text{(ii)}$$

The smog is derived from an elision of smoke and fog. First coined by HA Voeux (1905) the oldest smog, which consists of a mixture of coal smoke and fog, has played human beings since the 14th century. The indication of deadly 'smoky fog, called carbon smog (occurs mainly over industrial areas). The other kind of predominant smog is known as photochemical or Los Angeles smog whose first clue came in 1950. Los Angeles consisting mainly mixture of oxidizing pollutants is known as oxidizing smog.

**Main Component Of Photochemical Smog:**

In cities with many industries and automobile traffic the atmosphere is polluted by the smoke coming out from the chimneys of factories and power plant and also from the exhaust of automobiles. The main components of smog are unsaturated hydrocarbons nitrogen oxides (NOx) and some sulphur compounds. The various components of photochemical smog are-

**Inorganic Gases**- Such as ozone Nitrogen oxide (NOX), hydrogen peroxide and carbon monoxide.

**Organic**- Peroxide organic hydro peroxides proxy acetyl nitrate (PAN) Peroxybenzoyl nitrate (PBN).
The components of typical smog along with their optimum level are-

Table: 5 Components of smog and their levels

<table>
<thead>
<tr>
<th>Components</th>
<th>Optimum level ppm</th>
<th>Component</th>
<th>Optimum level ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>I Carbon mono oxide</td>
<td>2.0</td>
<td>Aromatic compound</td>
<td>0.20</td>
</tr>
<tr>
<td>II Nitric oxide</td>
<td>0.15</td>
<td>Ozone</td>
<td>0.10</td>
</tr>
<tr>
<td>III Nitrogen oxide</td>
<td>0.20</td>
<td>Aldehyde</td>
<td>0.20</td>
</tr>
<tr>
<td>IV Unsaturated hydrocarbon</td>
<td>0.50</td>
<td>Organic peroxide</td>
<td>0.30</td>
</tr>
</tbody>
</table>

1.6 Vehicular Pollution:

India cities quality as some of the most polluted in the world. The most important factor responsible for the deterioration of air quality in cities is the exponential increase in petrol and diesel fuelled vehicles. Between 1986 and 1991 the number of vehicles on India road increased from 11 million to 21 million of these 70% are two and three wheeler with inefficient and highly polluting two stork engines. The situation of vehicular pollution is continued to worsen.

The vehicular pollution in India is has ever relatively low as compared to several European countries. The pollution has became a serious problem in urban areas. Apart from a concentration of vehicles in urban area the other factor are-
The type of Engines used
The age of vehicle
The congested traffic
The poor road condition
The outdate automative termology etc.

The principal pollutants emitted by vehicles are-

(a) Carbon monoxide (CO)
(b) Hydrocarbons (HC)
(c) Oxides of Nitrogen (NOx)
(d) Particulate matter.

The last two decades the urban pollution in India has increased from 200 million in 1971 to 2170 million in 1991 and it had reached 4 million to 2001. With an increases in urbanization and industrialization and commercial activities in the urban areas demanded for transport has also increased considerably. The use of personal vehicles has been increasing steadily because public transport system in most of the cities is inadequate.

Petroleum based vehicles also emit Polly nuclear hydrocarbon (PHC) and aldehydes in traces. Depending upon sulphur content in the fuel-varying amount of S02 is also emitted.

The exhaust pipe of the vehicles is there for the major source of air pollution and accounts for 65-70% pollution, 20% pollution of air is caused though below by from the crank case breather and the remaining evaporation emission from the fuel tank breather carburetor and spillage losses.
In addition the exhaust gases from the petrol based fuel vehicles also contain lead compounds because of addition of Tetra ethyl lead in motor spirit.

The air pollutant concentration in the atmosphere because of vehicles is not only a simple function of the emission but it depends on the height of the emission meteorology and several other factors.

Heavy-duty diesel (HSD) powered vehicles contributes more NOx and PM emission and light duty gasoline powered vehicles and motorcycles are the major source of CO and Fe.

The impact of vehicular pollutants is comparatively more because of the fact that these are ground level emission. In metropolitan cities high rise building close to the road effects disperse of pollutants.

Air quality modeling studies carried out by Central Pollution Control Board (CPCB).

The pollution load nom vehicular depends on the characteristics of fuel and efficiency of combustion. The main pollutants nom gasoline are lead carbon monoxide, hydrocarbon and sulphur dioxide. The quantum of which varies which the quality of fuel. A high aromatic content result in increased emission of hydrocarbons while a high sulphur content increases the sulphur dioxide emission. The exhaust nom diesel driven vehicles contains a significant amount of unburnt hydrocarbon oxidize of nitrogen carbon monoxide and sulphur dioxide etc.