

UNIT-5

Air pollution due to Automobiles

→ Automotive Emissions is aggravating the air pollution & various causes of genesis & Exodes of these pollutants have been identified & methods to control them have been outlined.

→ The 3 main types of automotive vehicles being used in our country are;

- a) Passenger cars powered by 4-stroke gasoline engines.
- b) motorcycle scooters & autorikshaws powered mostly by small 2-stroke engines.
- c) Large buses & trucks powered by 4-stroke diesel engines.

→ Emissions from gasoline powered vehicles are generally classified as;

- a) Exhaust Emissions
- b) Crank case Emissions
- c) Evaporative Emissions

→ The amount of pollutants that an automobile emits depends on a no. of factors including design & operation.

→ Diesel powered engines create relatively minor pollution problems compared to gasoline powered ones.

→ The major problems of diesel engines are smoke & odor.

Exhaust Emissions :

→ The IMP Exhaust Emissions from a gasoline engine are CO , NO_x , unburnt HC & particulates.

→ These Emissions varies with the Air-fuel ratio, spark timings & engine operating conditions.

→ Automobile manufacturers have used 2 basic methods to meet the emission standards for CO & HC

a) The first is to inject manifold near the exhaust valves, where Exhaust gas temperature is highest, thus inducing further oxidation of unoxidised / Partially oxidised substances.

b) The second basic method is to design cylinders & adjust fuel-air ratio, spark timing & other variables to reduce the amount of CO & HC.

→ Devices & methods to control HC emissions fall into 3 classes.

a) Devices that modify engine operating conditions such as intake manifold vacuum breakers, carburation mixture improvers, throttle rotators etc.

b) Devices that "treat" Exhaust gases such as after burners catalytic converters, absorbers & filters.

c) use of modified or alternate fuels.

Crank Case Emissions :

→ Crank case Emissions consist of engine blow by which leak past the piston mainly during the compression stroke & of oil vapours generated into the crank case.

→ The gases mainly contain HC & account nearly for 25% of the total HC emission from a passenger car.

→ Emission of HC from the crank case of automobile can be largely eliminated by the positive crank case ventilation (PCCV) system.

→ These systems recycle crank case ventilation air & blowby gases to the engine intake instead of venting them to the atmosphere.

Evaporative Emissions

- An average Indian passenger car would emit about 20 kg of Hydrocarbons (HC) through evaporation only.
- It might also be dealt with by changing the properties of gasoline such as reducing the volatility of fuel and replacing the C_4 & C_5 olefinic hydrocarbon in the fuel with less reactive C_4 & C_5 paraffinic hydrocarbons.
- mechanical methods can also be used to control evaporative emissions.
- The exhaust gas pollutants comprise of HC, CO, NO_x & lead compounds.

Air-Fuel ratio Effect

- A decrease in the AF ratio increases the HC content in the exhausts of passenger cars at idle, but doesn't have any effect at part throttle.
- methane & acetylene are the 2 hydrocarbons most greatly affected by AF ratio.

Spark timing Effect

- The HC emission generally decreases as the spark is retarded @ constant power.

Combined effects of AF ratio & spark timing

- The reduction in HC emission due to leaner AF ratios & due to retarded spark timing are additive.

Control of Exhaust Emission

- There are 2 main approaches to minimize exhaust like
 - a) modifications in the engine design & operating variables
 - b) Treatment of exhaust gases after emission from the engine.

→ The following modifications may help in cleaner exhaust

- use of leaner idle mixture
- use of leaner possible mixture & maximum spark retard compatible with good power output & drivability.
- use of minimum valve-over-lap necessary.
- Pre treatment of the mixture to improve vaporization & mixing of fuel with air.

→ The purpose of Employing methods

- use of narrow venturries to produce higher air speeds & better fuel atomisation.
- Provision of Exhaust heated hot-spots to vaporise the heavier liquid droplets in the air-stream.
- use of Exhaust heat to pre heat the mixture at part loads
- use of automatic transmission.
- special devices for reducing or cutting off fuel supply during deceleration.

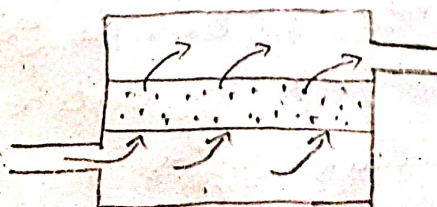
Exhaust treatment devices

→ The basic technique is to promote oxidation of HC & CO after emission from the engine.

→ Exhaust oxidation devices fall into two categories

- Promotion of after burning of the pollutants by Exhaust heat conservation, introduction of additional air & by providing sufficient volume to ensure adequate reaction time.

- Use of Catalytic Converters.



Catalytic burning

- Catalytic converters depend on the action of a catalyst containing certain exotic chemicals to convert HC & CO emissions to their oxidised products
- Extra air is introduced by an engine driven blower
- vanadium pentoxide (V_2O_5) is one of the successful catalysts used so far.
- catalytic converters hold great promise for the future, & their acceptance seems to be around corner.

Limitations of Catalytic converters

- Poisoning of catalyst by lead compounds in fuel
- Deterioration with time
- Pressure loss & noise problems

Other methods:

1) Petrol injection

- The Petrol injection system provides the flexibility needed to meet the engine requirements & eliminates the problem of mixture distribution altogether and hence has lower levels of exhaust emissions & better specific fuel consumptions

2) Stratified charge engine

- It operates with very lean air petrol mixtures depending on a localized rich mixture region near the spark plug to initiate combustion.

Nitrogen oxides in Exhaust Gas

- The concentration of NOx in exhaust gas is found to depend mainly on the peak temperature & pressure & supplied air fuel mixture composition.

→ The NOx concentration rises rapidly as the mixture is made leaner around the stoichiometric ratio of 14.6.

methods to control NOx concentration

① Exhaust Gas recycling

- This system utilise up to 15% of the exhaust stream to recycle into the intake manifold with AF mixture.
- the Exhaust gas dilutes the fresh charge & thus lowers the flame temperature & consequently NOx.
- This system reduces volumetric efficiency & hence max power output available from an engine of given size.

② water injection

- The water injection, by lowering the flame temp. leads to reduction in NOx.
- At the leaner fuel-air ratios, water injection is less effective in reducing NOx than @ the richer AFR.

③ Exhaust manifold reactor with recycling

- Installing a modified recycling system on a vehicle coupled with various Exhaust manifold reactors will result in substantially reduced emissions.

④ Catalytic Reduction

- The laboratory treatment of engine exhaust with a copper-cobalt-alumina catalyst can reduce NO by 80%.

⑤ Lean operation

- This method merely supplies more air as a diluent rather than exhaust gas.

Control of Evaporative Emissions B

- There are 2 sources of Evaporative Emissions like fuel tank & the carburettor.
- The principal factors governing tank Emissions are Fuel volatility, Ambient temp., & Tank Emissions
- Insulation of the fuel tank to reduce temp, sealed & pressurized fuel systems & vapour collection systems have been explored to reduce tank Emissions.
- Carburettor Emission is divided into 2 Categories
 - a) Running losses occurring during Engine operations
 - b) Hot Soak losses occurring when the vehicle is parked.
- On account of internal venting of carburettors the Running losses are insignificant
- Carburettor losses are substantial only during hot Soak following a period of vehicle operation.

Control of Crank Emissions B

- These consist of Engine blowby gases, ventilation air & crank-case lubricant fumes.
- For AP blowby is most imp & the principal constituents in blowby gases are HC
- Designers are shifting crank-case exhaust vents from simple open ending to a feed back
- New engines equipped with this positive crankcase ventilation (PCV) system return crank-case vapours through a vacuum valve, back to the downstream side of the carburettor.

Alternatives

- Electric car, natural gas, wankel engine, Gas turbine & etc.

Noise pollution: Causes, effects and control measures

Sound is main means of communication in many animals, including humans. A low sound is pleasant and harmless. A loud, unpleasant or unwanted sound is called as noise. A given sound can appear music to some and noise to others. It depends upon loudness, duration and mood of a person.

Noise (La. *nausea*=seasickness) is physical form of pollution. It is not harmful to air, soil and water but affects the animals including humans. Noise is unwanted sound, that is unpleasant, loud and disruptive. Humans have a hearing range called as audible range. Audible range depends upon frequency and loudness of sound. For a person with normal hearing, frequency ranges from 20 to 20,000 Hz and loudness ranges from 0 to 120 dB. Sound is measured in decibels (dB). A decibel value above 80 is considered to be noise pollution.

Sources of Noise Pollution

1. Industrialization: Most of the industries use big machines which are capable of producing noise. Apart from that, various equipment's like compressors, generators, exhaust fans, grinding mills also participate in producing noise.

2. Poor Urban Planning: In most of the developing countries, poor urban planning also play a vital role. Congested houses, large families sharing small space, parking lots, street noise, honking, commercial zone leads to noise pollution which disrupts the environment of society.

3. Social Events: Noise is at its peak in most of the social events. Whether it is marriage, parties, pub, disc or place of worship, people normally defy rules set by the local administration and create nuisance in the area. People play songs on full volume and dance till midnight which makes the condition of people living nearby pretty worse.

4. Transportation: Large number of vehicles on roads, aero planes, trains produce heavy noise. The high noise leads to a situation wherein a normal person lose the ability to hear properly.

5. Construction Activities: Construction activities like mining, construction of bridges, dams, buildings, stations, roads, flyovers take place in almost every part of the world. These construction activities have to be continued to meet the demand of ever increasing Population. It also creates noise pollution.

- 6. Household Chores:** We people are surrounded by gadgets and use them extensively in our daily life. Gadgets like TV, mobile, mixer grinder, pressure cooker, vacuum cleaners, washing machine and dryer, cooler, air conditioners are also contributors to the amount of noise that is produced and but many times it affects the quality of life of our neighborhood.
- 7. Fireworks:** Firework is a common thing during various fairs, festivals and cultural ceremonies. Apart from air pollution, the intensity of their sound creates noise pollution.
- 8. Agricultural Machines:** Tractors, thrashers, harvesters, tube wells, powered tillers etc. have all made agriculture highly mechanical but at the same time highly noisy.
- 9. Defence Equipment and launching of satellites:** A lot of noise pollution is added to the atmosphere by artillery, tanks, launching of rockets, explosions, exercising of military airplanes and shooting practices. Screams of jet engines and launching of satellite, sonic booms have a deafening impact on the ears.
- 10. Miscellaneous Sources:** The automobile repair shops, market places, schools, colleges, bus stands, and railway stations etc. are other sources of noise pollution.

Effects of noise pollution

Human response to noise varies from man to man according to age and temperament. It may vary even in the same individual from time to time because of change in health, fatigue and other conditions (Fig). The effects of noise on human beings are as under:-

1) Auditory effects: It includes deafness or auditory fatigue.

Deafness or impaired hearing: Prolonged exposures to noise lead to gradual deterioration of internal ear and subsequently hearing loss or deafness. It may occur due to continuous exposure to noise level of more than 90 dB. It may be temporary or permanent. Explosions or other high intensity sounds can also cause immediate deafness by rupturing the ear drums or damaging the cochlea. Many time hearing loss is attributed to occupation.

Auditory fatigue: It is defined as a temporary loss of hearing after exposure to sound. Continuous humming sound such as whistling and buzzing in the ears.

2) Non auditory effects: These are:-

Irritation and annoyance: Noise, sometimes, leads to emotional disturbances and makes people loose their temper. It can interfere with proper rest and sleep. Annoyance seems to increase with the loudness of the sound.

Work efficiency: It has been observed that noise reduces the efficiency of work.

Physiological effects: It includes dilation of the pupils, paling of skin, tensing of voluntary muscles, diminishing of gastric secretions, increase in diastolic blood pressure and the sudden injection of adrenals

into blood stream which increases neuromuscular tension, nervousness, irritability and anxieties. It can adversely affect the development of unborn babies.

Other health effects: Noise is also associated with headache, giddiness, sweating, nausea, fatigue, difficulty in breathing, disturbed sleep pattern, psychological stress.

Trouble Communicating: High decibel noise can put trouble and may not allow people to communicate freely. Constant sharp noise can give you severe headache and disturb your emotional balance.

Effect on Animals: Animals rely heavily on sounds to communicate, to find food, avoid predators etc. Pets react more aggressively due to exposure to constant noise. They become disoriented more easily and face many behavioral problems. Overexposure to high intensity of noise affects the hearing ability of many animals. Man-made noise affects mating calls and echolocation. This leads to reduction in survival and reproduction rates. At an ecosystem level, noise pollution could lead to migration of animals. Their migration can affect the crop production. Because many animals such as bats pollinate bananas, peaches, agave and other cash crops.

Effect on non-living things: The noise booms cause cracks in walls of buildings as well as in hills. Sonic boom can break window panes and buildings.

Steps to Control Noise pollution

Noise pollution can be effectively controlled by taking the following measures:

(1) Control at receiver's end: For people working in noisy installations, ear-protection aids like ear-plugs, ear-muffs, noise helmets, headphones etc. must be provided to reduce occupational exposure.

(2) Suppression of noise at source: It can be achieved by following methods:

- (a) Designing, fabricating and using quieter machines to replace the noisy ones.
- (b) Proper lubrication and better maintenance of machines.
- (c) Installing noisy machines in sound proof chambers.
- (d) Covering noise-producing machine parts with sound-absorbing materials to check noise production.
- (e) Reducing the noise produced from a vibrating machine by vibration damping i.e. making a layer of damping material (rubber, neoprene, cork or plastic) beneath the machine.

(f) Using silencers to control noise from automobiles, ducts, exhausts etc.

(3) Acoustic Zoning: There should be silence zones near the residential areas, educational institutions and above all, near hospitals. Zoning of noisy industrial areas, bus terminals and railway stations, aerodromes etc. away from the residential areas i.e. increasing the distance between source and receiver.

(4) Sound Insulation at Construction Stages: It reduces the chances of noise nuisance in future. Some of these measures could be:

a) The space/cracks that get left between the door and the wall should be packed with sound absorbing material.

(b) Sound insulation can be done by constructing windows with double or triple panes of glass and filling the gaps with sound absorbing materials.

(c) Acoustical tiles, perforated plywood etc. can be fixed on walls, ceilings, floors etc. to reduce noise (especially for sound proof recording rooms etc.)

(5) Planting of Trees: Green muffler scheme involves planting green trees and shrubs along roads, hospitals, educational institutions etc. to reduce noise to a considerable extent. Trees like Ashoka, Neem, Tamarind are good for this purpose.

(6) White noise:- It is a special type of sound signal which is used to mask background sounds. White noise helps to mask out sounds which might otherwise prevent one from either falling asleep or waking up whilst asleep.

(7) Legislative Measures: Strict legislative measures need to be enforced to curb the menace of noise pollution. Noise standards (Table) should be strictly followed. Minimum use of loudspeakers and amplifiers especially near silence zones. Banning pressure horns in automobiles. Albeit, noise has been considered as

pollutant under Air act and The noise pollution (regulation and control) rules(2000) have been framed under Environment protection act. But still **people need to be educated about harmful effects of noise.**

Table :Ambient air quality standards in respect of noise

Area Code	Category of Area/Zone	Limits in dB(A) Leq*	
		Day Time	Night Time
(A)	Industrial area	75	70
(B)	Commercial area	65	55
(C)	Residential area	55	45
(D)	Silence Zone	50	40

Source: CPCB

Note:

1. Day time shall mean from 6.00 a.m. to 10.00 p.m.
2. Night time shall mean from 10.00 p.m. to 6.00 a.m.
3. Silence zone is defined as an area comprising not less than 100 meters around hospitals, educational institutions and courts. The silence zones are zones, which are declared as such by the competent authority.
4. Mixed categories of areas may be declared as one of the four-abovementioned categories by the competent authority.

*dB (A) Leq denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing. A”decibel” is a unit in which noise is measured. “A” in dB (A) Leq, denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear.

Leq: It is an energy mean of the noise level over a specified period.

Effects of Air Pollution

The damage caused by air pollution is enormous. It can damage our health in many ways. The pollutants in the air have a negative impact on humans, animals and plants and on the environment as a whole.

Environmental Effects of Air Pollution

1. Acid Deposition

During the combustion of fossil fuels, the emission of sulfur dioxide and nitrogen oxides react with water to form sulfuric acid and nitric acid. High acidity causes metals to dissolve in water, thus polluting the surface water. This has serious health effects on aquatic plants and animals. For example, high aluminum concentration hampers the nutrient uptake by plants leading to decay of plants in the long run.

Air pollution threatens to destroy the statues and other objects. One of the seven wonders of the world, the Taj Mahal, located in Agra city is getting destroyed due to the sulfur dioxide polluted air hovering over it. The sulfur dioxide in the air reacts with calcium carbonate (limestone) leading to absorption of water by limestone during rainfall causing it to fragment. Air pollution can cause the rubber tyres of automobiles to crack and become porous. In addition to this, the automobiles lose their finish and outdoor statues begin to rust.

2. Eutrophication

The main contributors to this phenomenon are the nitrogen pollutants such as, nitrogen oxides and ammonia. The increased plant nutrients in water cause some water plants such as algae and duckweed, to grow extensively. This extensive growth blocks the supply of sunlight to water. The oxygen supplies are exhausted by these plants which are not renewed because the

heterotrophic plants and bacteria need light to carry out the process of photosynthesis, thus leading to the disruption of the ecosystem.

3. Smog

The word smog is a combination of the words smoke and fog. a term coined by a Glasgow public health official. Des Voeux. It causes a smoky dark atmosphere over the cities causing poor visibility and creating a haze throughout the area. The smog in the atmosphere comprises over 100 chemicals from different sources like automobiles, fires, waste treatment. oil production industrial solvents, paints and coatings and car engines. The particulates that are present in smog are carbon monoxide, dirt. soot, dust and ozone. Smog has harmful effects on agriculture. Many crop plants like soybeans, wheat, tomatoes, peanuts, lettuce and cotton are subject to infection by exposure to smog.

4. Loss of Ozone Layer

The ozone layer is present in the stratospheric layer of the atmosphere. It helps to shield the UV rays from reaching the surface of the earth. Ozone formation takes place by a photochemical reaction. wherein the energy of radiation from the sun dissociates the oxygen molecule to form atomic oxygen. The formation and decomposition of ozone is a natural Ozone process. However, ample evidence suggests that human activities have caused a large amount of ozone depleting chemicals to enter the atmosphere, thus disrupting the natural ecosystem.

The ozone destroyers/ozone depleting substances are as follows,

- (a) Chlorofluorocarbons
- (b) Methyl chloroform
- (c) Carbon tetrachloride
- (d) Halons - Fire extinguishing agents

(e) Methyl bromide - Soil fumigant (used as a pesticide).

The depletion of the ozone layer has a negative impact on the environment. Extensive research has shown that depletion of ozone layer increases the rates of incidence of malaria and other infectious diseases in addition to cancer. The increased UV radiation penetrating the earth's surface have undesirable effects on the growth and photo-synthetic activity in a number of plants including rice, corn and sunflower. These radiations can penetrate about twenty meters under the surface of water causing damage to species such as plankton, fish larvae, shrimps, crabs and sea weeds, thus leading to the disruption of the entire ecosystem. A decrease in the number of phytoplankton affects the entire ecosystem.

5. Greenhouse Effect

As a result of human activities, a number of gasses are being put into the atmosphere which trap the energy that comes to the earth as sunlight. The combustion of fossil fuels produces carbon dioxide, which contributes to the "greenhouse effect" warming the earth. It is estimated that humans generate approximately 24 billion tonnes of carbon dioxide each year, by burning fossil fuels in rich countries.

Most scientists and environmentalists are of the view that global warming would lead to the melting of polar ice caps leading to the rise in the global sea-levels. In such a case, most of the islands would disappear and flooding would occur along coastlines all over the world. This would lead to destruction of cropland and relocation of millions of inhabitants to safer places.

Ambient Air Quality Levels

The ambient air quality levels can be described as the quality of air in the environment in which humans and other organisms live and breathe. Anthropogenic activities have a considerable impact on the content and quality of ambient air. The ambient air quality affects the public health, animals, crops and Earth's ecosystems.

Air is a colorless, odorless, tasteless mixture of gasses (78% nitrogen, 21% oxygen, 0.93% argon, 0.03% carbon dioxide, 0.4% other gasses). Human activities such as burning of fuel to power the motor vehicles, chlorofluorocarbons (CFCs) used in air conditioners and refrigerators, smoke and heavy metals (like lead and mercury) discharged by burning of rubbish, the greenhouse gasses emitted as vehicular exhaust, power plants, industries, homes, cause changes in the chemical composition of ambient air through the release of chemical and industrial pollutants into the atmosphere.

The air pollutants adversely affect certain populations that include infants, children and the elderly with increased risk of respiratory tract infections, cardiovascular diseases to name a few. The effects on the environment are - development of acid rain and greenhouse gasses, depletion of ozone layer, eutrophication, smog, climate change, loss of biodiversity, land degradation, destruction of habitats, etc.

The Government of India has enacted the Air (Prevention and Control of Pollution) Act in 1981 with the aim to stop the deterioration in air quality. The Environment Protection Act, 1986 was created to further emphasize protection of the environment. The Central Pollution Control Board started a nation-wide programme called National Ambient Air Quality Monitoring (NAAQM) programme in the year 1984. This programme was later renamed as National Air Monitoring Programmer (NAMP).

National Ambient Air Quality Standards (NAAQS)

NAAQS refers to the level of air pollutants with a sufficient margin of safety to protect the public health, vegetation property. The aim of NAAQS are,

- (i) Effective management of the air quality.
- (ii) To control or prevent the damage caused by air pollution.
- (iii) To assess the status of ambient air quality in India with respect to 12 pollutants. These pollutants include sulfur dioxide (SO₂), oxides of nitrogen (NO_x), suspended particulate matter (SPM) of PM₁₀ (particulate matter having size less than 10 microns) and PM_{2.5} (particulate matter having size less than 2.5 microns), respirable particulate matter (RPM), lead, carbon monoxide (CO), ammonia, ozone, benzene, benzopyrene, arsenic, nickel.

According to the Ministry of Environment and Forests, Government of India notification 2009, the ambient air quality data is presented in tabular form.

Pollutant	Time Weighted Average	Concentration in Ambient Air	
		Industrial, Residential and Rural Area	Ecologically Sensitive Area
Sulphurdioxide (SO ₂) µg/m ³	Annual	50	20
	24 hours	80	80
Oxides of nitrogen (NO ₂)	Annual	40	30
	24 hours	80	80
Suspended Particulate Matter (PM ₁₀)	Annual	60	60
	24 hours	100	100
PM _{2.5}	Annual	40	40
	24 hours	60	60
Ozone	8 hours	100	100
	1 hour	180	180
Lead (Pb)	Annual	0.50	0.50
	24 hours	1.0	1.0
Carbonmonoxide (CO)	8 hours	2.0	2.0
	1 hour	4.0	4.0
Ammonia (NH ₃)	Annual	100	100
	24 hours	400	400
Benzene	Annual	5	5
Benzopyrene	Annual	1	1
Arsenic (As)	Annual	6	6
Nickel (Ni)	Annual	20	20

The Air (Prevention and Control of Pollution) Act was enacted by the Parliament in the 32nd year of the Republic of India under Article 253 of the constitution.

The main provisions of the Act are,

- (a) To prevent, control and mitigate air pollution.
- (b) Setting up of Central and State Pollution Control Boards.
- (c) Authorize the boards to effectively implement the Act.

The different types of air pollutants such as carbon dioxide, carbon monoxide, sulfur dioxide, nitrogen oxides, lead, smoke, volatile organic compounds generated from different sources such as industries, power plants and automobiles are considered under this Act. Any industrial plant can be put to operation only with the prior consent of the State Pollution Control Board. The State Board can lay down standards for emission of air pollutants into the atmosphere after consultation with the Central Pollution Control Board.

Important Definitions used in the Act

(a) Air Pollution

According to the Act "Air pollution is the presence in the atmosphere of any air pollutant".

(b) Air Pollutant

According to the Act "Air pollutant is any solid, liquid or gaseous substance (including noise) present in the atmosphere in such concentrations as may be or tend to be injurious to human beings or other living creatures or property or environment.

(c)Control Equipment

According to the Act "Control equipment is an apparatus, device, equipment or system to control the quality and manner of emission of any air pollutant and includes any device used for securing the efficient operation of any industrial plant".

Powers of the Boards

The Central Pollution Control Board was established and constituted in 1981 by the Government of India. It has an important role in abatement and control of pollution in the country.

Some of the functions of the Central Pollution Control Board include the following,

- (i) To improve the air quality of the surrounding environment and prevent, control or lessen the air pollution in the country.
- (ii) Advise the Central Government regarding pollution prevention and control and in the improvement of air quality.
- (iii) Raising awareness nationwide for prevention, control or abatement of environmental pollution
- (iv) To coordinate the activities of various State Boards and settle their disputes, if any.
- (v) Provide technical support and advise the State Pollution Control Boards, conduct and sponsor research programmes relating to pollution problems, their prevention and control.
- (vi) Provide training to personnel involved in pollution prevention, control and abatement programmes.
- (vii) Organize mass awareness programmes through mass media to disseminate and educate the public regarding pollution prevention, control and abatement.
- (viii) Collect, compile and publish technical and statistical data regarding environmental pollutants and work out various activities for prevention, control and abatement of pollutants.
- (ix) Prepare manuals, codes and guidelines regarding treatment and disposal of sewage.

- (x) Lay down standards for quality of air or water in consultation with the respective State Government,
- (xi) Set up research laboratories.
- (xii) The CPCB is empowered to issue consent to industry, local bodies and other authority for violation of rules regarding general emission, effluent standards, hazardous chemicals and waste, bio-medical waste, industrial solid waste, municipal solid waste under the Environment Protection Act, 1986.

Functions of the State Board

The functions of the State Board under the Air Act are to,

1. Organize a detailed proposal for the prevention, control or abatement of air pollution.
2. Counsel the state government on matters relating to prevention, control or abatement of pollution.
3. Gather and communicate the information regarding prohibition, control or abatement of air pollution.
4. Motivate research activities pertaining to the problems of water pollution, prevention and control of pollutants discharged into the atmosphere.
5. Work with the Central Board in arranging training programmes to individuals participating in pollution control activities
6. Organize a large-scale education programme on control of air pollution.
7. To test the control equipment used in industrial plants or manufacturing processes and give instructions to take necessary steps for the prevention, control or abatement of air pollution.
8. To put down the standards for emission of air pollutants, its quantity and composition, discharged into the atmosphere from the industrial plants and automobiles, with the exception of ships and aircrafts.
9. To advise the State Government regarding suitable location for setting up of any industry.
10. Perform other functions as laid down by the Central Board or the State Government.

Penalties for Violation of Provisions of the Act

The companies, government departments or individuals not complying with the standard conditions or found violating the Act are penalized with imprisonment up to three months or with a fine of 10,000/- or both. Serious violations of law can lead to stiffer penalties of seven years of imprisonment or fine of 5000/- per day.

Drawbacks of the Air Act

Some of the major drawbacks of the Act are,

- (a) The offenders or defaulters of the Act are given a 60 days notice period before taking them to the court. The time given is sufficient enough to destroy the evidence of the offense.
- (b) An industry can be set up outside the Air Pollution Control Area without prior permission of the State Pollution Control Board.
- (c) The air pollutants discharged by the aircraft or ship are excluded from the Act.

AIR POLLUTION EPISODES

Since time immemorial, air pollution is a matter of serious concern for the city dwellers. Our planet has witnessed numerous disasters, both natural and man-made, which have devastating impact on lives, property and surrounding environment.

Great London Smog:

During earlier times, the smoke produced by burning poor quality coal for heating and cooking in northern Europe led to increased levels of sulphur dioxide and combustion particles (smoke) in air. The industrial revolution in the 19th century further added pollutants into air from various processes. Smoke particles trapped in the fog formed in smog in stagnant weather conditions. A smoky dark atmosphere settled over cities for many days that caused poor visibility and haze all through with serious impact on human health. The smog related deaths first occurred in London in 1873 which killed 500 people, 1000 deaths in 1880 and about 4000 deaths in December 1952.

Meuse Valley (1930):

The Meuse Valley in Belgium witnessed air pollution episode in the first week of December 1930. The cause of disaster was poisonous products in the waste gas of the many factories in the valley along with the prevailing weather conditions that resulted in 60 days in three days. The main symptoms of effected were dyspnea, acute circulatory insufficiency, poor pulse rate, bronchitics, hoarseness in voice, nausea, vomiting and lachrymation.

Donora Fog, Pennsylvania (1948):

In the year of 1948, the U.S steel company town of Donora witnessed a horrific incident. The Donora Zinc Works smelting operation released fluoride gases, sulphur, carbon monoxide and heavy metal dusts trapped in the stagnant weather conditions caused 20 deaths within 24 hours. About 14000 people became ill on the following days with symptoms of lung infections, particularly upper respiratory symptoms such as nasal discharge and sore throat.

Mexico, Poza Rica (1960):

The residents of Poza Rica, Mexico, woke up to clouds of large quantities of unburned hydrogen sulphide released into the atmosphere in November, 1950 from an oil field installation. The pollutants in the air killed 22 people and as many as 320 persons fell ill within a matter of three hours. The chief symptoms of the effected were respiratory tract infection, eye irritation, pulmonary oedema and neurological problems.

Bhopal Disaster (1984):

The Bhopal gas tragedy at the Union Carbide pesticide plant located in a densely populated region in the city of Bhopal, on the night of 2nd and 3rd December, 1984 is one of the greatest chemical disaster in history. The poisonous and highly toxic clouds of suffocating methyl isocyanate (MIC) gas engulfed the residents of the city, killing 2000 people immediately and injuring about 3 lakhs people. In addition, about 1000 animals were killed and about 7000 were injured. Among the survivors of the tragedy, many of them continue to suffer from one or several health problems from the disastrous effects of the massive poisoning.

Vizag Gas leak (2020):

The Visakhapatnam gas leak, also referred to as the Vizag gas leak, was an industrial accident that occurred at the LG Polymers chemical plant in the R. R. Venkatapuram village of the Gopalapatnam neighbourhood, located at the outskirts of Visakhapatnam, Andhra Pradesh, India, during the early morning of 7 May 2020. The resulting vapour cloud spread over a radius of around 3km, affecting the nearby areas and villages. As per the National Disaster Response Force (NDRF), the death toll was 11, and more than 1,000 people became sick after being exposed to the gas. Preliminary investigations concluded that the accident was likely the result of insufficient maintenance of units storing the styrene monomer, improper storage, and operation errors.

Environment Acts, Rules and Regulations

Contents:

- Environmental Rules and Regulation.
- The Water(Prevention and control of pollution)Act,1974.
- The Air(Prevention and control of pollution)Act,1981.
- The Environment (Protection)Act,1986.

Necessity of Environmental Legislation:

An independent department of environment was established by the government of India in 1980 to impart environmental awareness by encouraging research on environmental problems. The following protection for environmental are made by India are as...

India makes provision for Environmental protection:

1. Fundamental Rights
2. Directive principals of state policy
3. Fundamental Duties

- Constitution was amended in the year 1976 and Article 48-A was added which states that:

“The state shall endeavour to protect and improve the environment and to safeguard the forest and wild life of the country.”

- As a fundamental duty to be observed by every citizen in the Article 51-A(g):

“To protect and improve the natural environment including forest, lacks, rivers and wild life and to have compassion for living creatures.”

Environmental Rules And Regulation:

Major environmental act in India:

1. The water (prevention and control of pollution) Act,1974.
2. The air (prevention and control of pollution) Act,198.
3. The environment (protection) Act,1986.
4. Wildlife protection Act,1972.
5. The forest (conservation) Act,1980.
6. The motor vehicles Act,1988.

1. THE WATER (PREVENTION AND CONTROL OF POLLUTION) ACT,1974.

Objectives:

- Prevention and control of water pollution.
- Maintaining or restoring wholesomeness of water.
- Establishment of Boards for prevention and control of water pollution.

Role of central board:

- To advise the central Govt. on issues related to water pollution.
- To organise training of persons engaged in pollution control.
- To set up laboratories for analysis of water samples from any stream, well or trade effluents.
- To provide technical assistance and guidance to the state board to carry out research in prevention and control of water pollution.
- To promote cleanliness of streams and wells in different area of the state.

Role of state board:

- To advice the state govt. On issues related to the water pollution.
- To inspect the trade effluents and waste water treatment plants.
- To find out recent methods for disposal, treatment and reuse of waste water.
- To make , vary or revoke any order for the prevention , control or abatement of waste in to streams or wells.

Power to state and central board:

- Power to obtain information.
- Power to give direction.
- Power to take sample of effluents.
- Power of entry and inspection.
- Prohibition of polluting matter.

Penalties for violation of the provisions of the acts:

- In case of failure to give information by a person discharging effluents into stream or well , the penalty is Imprisonment up to 3 months or fine up to Rs.10000 or both.
- In case of permitting polluting material into stream or well or on land, the penalty is imprisonment for 1.5 to 6 years or fine or both.
- In case of obstructing the performance of the board's functions, destroying or damaging the property of the board, giving wrong information , making false statements. The penalty is imprisonment up to 3 months , or fine up to Rs.10000 or both.
- In case of violation of order prohibiting discharge of polluted matter into stream, well or land, violation of board order of closure of industry or stoppage of water supply or electricity supply, the penalty is imprisonment of 1.5 to 6 years.

2. THE AIR (PREVENTION AND CONTROL OF POLLUTION) ACT,1981

Objectives:

- Prevention, control and abatement of air pollution.
- Maintaining the quality of air.
- Establishment of Boards for the prevention and control of air-pollution.

Role of central Board:

- To improve the quality of air.
- To establish or recognise testing laboratories.
- To co-ordinate the activities of the state boards, provide technical assistance and carry out research relating to the prevention and control of air pollution.

Role of state board:

- To plan a comprehensive program for prevention and control of air pollution and implement the same.
- To inspect air pollution control areas assess the quality of air therein and take appropriate measure to control air pollution in such areas.
- To organise training programs and mass education programs to prevent air pollution.

Power of Board:

- Power to declare air pollution control areas.
- Power to entry and inspection.
- Power to take samples of air emission.
- Restriction on use of certain industrial plants.
- Power to give instruction for ensuring standards for emission from automobiles.
- Establishments of state air laboratory.

Penalties for violation of the provisions of the acts:

- Except for the fact that there is no provision for publication of names of offenders under this act, the penalties for defaults or violations of the provisions under the act are the same as under the water act.
- The main drawback of these act lies in the fact that defaulter is given 60 Days notice before taking him to court as by the time the case is field in the court offender may destroy the evidence.

Some industries are under Air Act,1981:

- Fertiliser industries
- Engineering industries
- Food and agricultural products industries
- Mining industries
- Paper and pulp industries
- Petroleum refineries
- Power plants

3. THE ENVIRONMENT (PROTECTION) ACT,1986.

Objectives:

- Protection and improvement of environment(air, water, land).
- Prevention of hazards to all living creatures(humans, animals, plants).
- Maintenance of harmonious relationship between human being and their environment.

Power of central Government:

- Laying down standards of quality for air, water and land.
- Planning and execution of a nationwide program to prevent, control and abate environmental pollution.
- Establishment of environmental laboratories and institutions.
- Carrying out and sponsoring investigations and research in environmental pollution problems.
- Restricting areas in which industries , operations or processes shall not be carried out.
- Coordination of the actions by the state govt.,officers and other authorities under this act.

ENVIRONMENTAL LEGISLATION SERVES THE FOLLOWING PURPOSES

- It protects environment by punishing offenders.
- It protects the resources from opuses.
- Encourages the restoration of the environment.
- It restricts emission or discharge pollutants in excess of the standards.
- It ensures smooth solution of conflicts.
- It serves as guidelines for industries.