

Internal Assessment Test - II

Sub:	AIR POLLUTION AND CONTROL						Code:	10CV765	
Date:	09 / 11 / 2017	Duration:	90 mins	Max Marks:	50	Sem:	VII	Branch:	CIVIL

Answer Any FIVE FULL Questions

	Marks	OBE	
		CO	RBT
1 (a) Describe the phenomenon of indoor air pollution.	[05]	CO5	L2
(b) Explain the harmful effects of indoor air pollution.	[03]	CO5	L2
(c) Discuss the remedial measures of indoor air pollution.	[02]	CO5	L2
2 (a) Describe the phenomenon of greenhouse effect.	[05]	CO5	L2
(b) Explain the harmful effects of greenhouse effect.	[03]	CO5	L2
(c) Discuss the remedial measures of greenhouse effect.	[02]	CO5	L2
3 Explain briefly the principal emissions from gasoline driven and diesel driven vehicles.	[10]	CO5	L2
4 Explain the factors that should be taken into consideration while selecting a site for industry from the point of minimizing air pollution.	[10]	CO3	L2
5 Discuss in brief noise abatement and control.	[10]	CO3	L2
6 Explain the various approaches to minimize exhaust emissions.	[10]	CO5	L2

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6	Explain the various approaches to minimize exhaust emissions.	[10]	CO5	L2

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AIR POLLUTION AND CONTROL- 10CV765

1. INDOOR AIR POLLUTION:

(a)The inside environment of houses often has a higher level of air pollution than the surroundings in cities and towns. Unfortunately, indoor air pollution has not been given much importance, although most people spend as much as 80-90% of their time indoors. The various causes of indoor pollution are use of traditional fuel for cooking, tobacco smoke, temperature, humidity, micro organisms and allergies. The use of formaldehydes in construction materials and poor ventilation due to energy conservation measures in new homes and offices area also responsible for indoor pollution.

(b)Due to burning of traditional fuels:

About 50% of the world's households are using traditional fuels such as fire wood, animal dung, coke etc for cooking. The common pollutants which cause indoor air pollution problems due to combustion of fuel are particulate matter, oxides of sulphur, oxides of nitrogen, carbon monoxide, hydrocarbons and organic and odour causing chemicals. The emission quantity of these pollutants depends upon the type of fuel used, type of stove or furnace used, feed rate amount of additional air and operating conditions.

Due to pollens:

Studies have revealed that pollens, fungal spores and various types of dusts pollute indoor air and cause allergic all gases especially asthma.

Due to artificial building materials and poor ventilation:

Indoor air pollution, especially in new energy efficient homes and offices is making many people around the world sick. The most serious problems so far have been reported in new and remodeled office buildings and homes with energy saving features, and in mobile homes. Most involves formaldehyde in construction materials, such as particle board and indoor plywood and in urea formaldehyde foam insulation.

Formaldehyde vapours leak into the air when the temperature rises and they combine with other contaminants into a mix that can cause headache, respiratory irritations, watery eyes, nausea, diarrhea, skin irritations and heart problems.

(c)Remedy:

The following precautionary measures should be taken to overcome this special problem of indoor pollution.

- i) Cautionary labels should be attached to construction materials that contain formaldehyde resins.
- ii) Municipal health authorities should be authorized to test air within homes when a physician suspects formaldehyde or other vapours might be damaging residents health.
- iii) The air pollution control regulatory should have provision for compulsory testing of products at the point of manufacture to assure that they will not pollute indoor air.
- iv) Architects and construction engineers must make sure that air flow is not reduced to a danger point in the quest for energy efficiency.

2. (a)GREEN HOUSE EFFECT

Man's in advertent activities are increasing the carbon dioxide content of the atmosphere which may probably bring about drastic changes in the world climate in the next 50 years. Increasing global consumption of fossil fuels is steadily increasing the CO₂ level in the atmosphere since the beginning of the twentieth century. It has been estimated that the world's consumption of fossil fuels results in the release of nearly 9×10^9 tonnes of CO₂ per year. The primary source of CO₂ is the consumption of fossil fuels. The secondary source is the oxidation of carbon compounds in marshes and forests by natural degradation. Manufacture of cement is another factor contributing to increasing of CO₂ in the atmosphere.

The production of CO₂ is very fast and has an influence on climate and that phenomenon is called the GREEN HOUSE EFFECT. The layer of CO₂ act like the glass in a green house because while the sun's radiation can pass through it and heat up the earth, it stops that same heat being required by the earth. In other words CO₂ is transparent to short wave radiation from the sun but absorbs the longer wave radiation from the earth. The net result of all this is that there is a danger of the earth gradually being heated up.

(b)Harmful Effects: If the CO₂ content of the atmosphere is doubled which can occur by the middle of the next century then it will result in increase in the present world temperature by about 3.6 °C. It is estimated that if the earth continues to warm up, all the ice caps in the Antarctic and Arctic will begin to melt. Consequently the sea level will rise by a few meters and most of the cities on the sea shore will be submerged. The warming of the atmosphere will reduce the amount of incoming solar radiation.

(c)Remedial Measures: Agricultural and industrial operations as well as deforestation may generate a large quantity of dust which in turn can reduce the effective radiation and thus maintain the atmospheric temperature more or less at the same level.

To overcome the ecological crises due to CO₂ community based forestry schemes should be undertaken.

3. EMISSIONS FROM GASOLINE POWERED VEHICLES are generally classified as

- a) Exhaust emissions
- b) Crank case emissions and
- c) Evaporative emissions

EXHAUST EMISSIONS: The important exhaust emissions from a gasoline engine are carbon oxide, unburnt hydro carbons, nitrogen oxides and particulates containing lead compounds. These emissions vary with the air fuel ratio spark timings and the engine operating conditions.

CRANK CASE EMISSIONS: It consist of engine blow by which leaks past the piston mainly during the compression stroke, and of all vapors generated into the crank case. The quality of blow by depends on engine design and operating conditions. Worn out piston rings and cylinder liner may greatly increase blow by. Those gases mainly contain hydro carbons and account nearly for 25% of the total hydro carbon emissions from a passenger car.

EVAPORATIVE EMISSIONS: Through a short term experimental determination it has been estimated that an average Indian passenger car would emit about 20 kg of hydro carbons through evaporation annually.

Evaporative emissions essentially constitute the fuel evaporation from the fuel tank and

carburetors and consists of hydro carbons alone. The amount of pollutants, that an automobile emits depends on a number of factors including the design and operation (idle, acceleration etc) of the hydro carbons emitted by a car with no controls, the exhaust gases account for roughly 65%, evaporation from the fuel tank and carburetors for roughly 15% and blow by crank emission gases that escape around the piston rings for about 20%

DIESEL POWERED ENGINES: Diesel powered vehicles create relatively minor pollution problems compared to gasoline powered ones. The diesel engine exhausts only about a tenth of the amount of carbon monoxide exhausted by a gasoline engine. Blow by is negligible in the diesel powered ones, since the cylinders contain only air on the compression stroke. Evaporative emissions are also low because the diesel engine uses a closed injection fuel system and because the fuel is less volatile than gasoline. The major problems of diesel engines are smoke and odour.

4. FACTORS TO BE CONSIDERED FOR INDUSTRIAL PLANT LOCATION FROM THE POINT OF AIR POLLUTION CONTROL

While selecting a site from the point of air pollution and control, the following factors should be taken into consideration to avoid costly control measures, improve public relations and prevent litigation, there are 6 factors to be considered.

- i) Existing levels of air contaminants
- ii) Potential effects on the surrounding area.
- iii) Meteorological factors and climate
- iv) Topographical features
- v) Clean air available
- vi) Planning and zoning

Existing levels of air contaminants

If the new plant is to be located in an area which is already industrialised, it is a good practice to undertake a pre operational survey to know the existing levels of contaminants under prevailing meteorological conditions. This type of survey gives an idea regarding the nature of pollution due to existing industries i.e whether the existing level of pollution is high, medium or low. The results of such a survey with respect to known operational data on the

magnitude of emissions from the new sources, would provide information on the extent to which waste products could be safely discharged into the atmosphere without resulting in too much contamination.

Potential effects on the surrounding

Another important factor from the point of site selection is to have a knowledge of the specific effects of the major pollutants likely to be discharged into the atmosphere in relation to the population and land use of the area surrounding the site. For example, whether the pollutants will have any effect on the health of people, whether it causes damage to vegetation, whether it effects the farm animals in that area is to be considered. A rural and predominantly agricultural area is more affected by fluorides and SO₂ than in urban population. This is because certain pollutants are more toxic and harmful to vegetation and animals than to people. H₂S has little effect on vegetation but is obnoxious and even dangerous to human life in comparatively low concentration.

Meteorological factors and climate

The prime factors which have to be considered in order to minimise air pollution problems are the climate and meteorology of the location under consideration. It is important to know the prevailing wind direction, wind speed and factors favourable for stable atmosphere is inversion conditions. The dispersive ability of the air at each possible site has to be determined. This can be done on the basis of the average values for wind movement and inversion conditions. Wind roses for each possible site have to be constructed and studied. Meteorological factors should be favourable for the air to dilute the pollutional load down to acceptable levels of contamination.

Topographical features

Air movement is greatly influenced by the topography in the neighbourhood of the site under consideration, like valleys, mountains, sea, oceans. In fact more attention has to be given for air pollution control in valleys than in level terrain. Especially when the average wind velocity is less than 16km/hr.

The location of industries in valleys, mountainous areas and undulating terrain present difficult problem from the point of air pollution control. Air pollution disasters in Meuse valley (Belgium) and at Donora, Pennsylvania are good examples. If an industrial plant is

located at the bottom of a narrow valley with mountains rising fairly steeply on either side the situation become very critical probably one of the worst site conditions one can think off.

Clean air available

The requirement if many industrial processes for supplies of clean air produces another important aspect of air pollution into the problem of site selection. For example, Industries requiring clean air for manufacture are factories dealing with manufacture of anti biotic electronic components and life saving vaccines, also clean air is required for cooling the reactors of atomic energy plants since if polluted air were used, the impurities present would become radioactive above and their escape would create a hazard in those cases, location of industries in areas of heavy air pollution will add maternally to the cost of cleansing the air.

Planning and zoning

Proper planning and zoning of industrial areas and residential areas can play an important role in the control of Air pollution. Residential areas and heavy industries should not be located too close to each other. It is always better to have green belt between industrial areas and residential areas. If there are any municipal laws and regulations regarding this aspect, they should be strictly enforced.

Recently scientists have identified a dozen species of trees which have a capacity to absorb industrial pollutants from the air. Many of these trees grow in our county for example, tamarind and margosa trees.

5. Noise abatement and control

Control of Noise Pollution

Noise generation is associated with most of our daily activities. A healthy human ear responds to a very wide range of SPL from - the threshold of hearing at zero dB, uncomfortable at 100-120 dB and painful at 130-140 dB. Due to the various adverse impacts of noise on humans and environment, noise should be controlled. The technique or the combination of techniques to be employed for noise control depend upon the extent of the noise reduction required, nature of the equipment used and the economic aspects of the available techniques. Reduction in the noise exposure, time or isolation of species from the sources and form part of the noise control techniques besides providing personal ear protection and

engineered control for noise reduction at source.

The techniques employed for noise control can be broadly classified as

- Control at source
- **Control in the transmission path**
- **Using protective equipment.**

Noise Control at Source

The noise pollution can be controlled at the source of generation itself by employing techniques like-

- **Reducing the noise levels from domestic sectors:** The domestic noise coming from radio, tape recorders, television sets, mixers, washing machines, cooking operations can be minimised by their selective and judicious operation. By usage of carpets or any absorbing material, the noise generated from felling of items in house can be minimised.
- **Maintenance of automobiles:** Regular servicing and tuning of vehicles will reduce the noise levels. Fixing of silencers to automobiles, two wheelers etc., will reduce the noise levels.
- **Control over vibrations:** The vibrations of materials may be controlled using proper foundations, rubber padding etc. to reduce the noise levels caused by vibrations.
- **Low voice speaking:** Speaking at low voices enough for communication reduces the excess noise levels.
- **Prohibition on usage of loud speakers:** By not permitting the usage of loudspeakers in the habitant zones except for important meetings or functions. Now-a-days, the urban Administration of the metro cities in India, is becoming stringent on usage of loudspeakers.
- **Selection of machinery:** Optimum selection of machinery tools or equipment reduces excess noise levels. For example selection of chairs, or selection of certain machinery or equipment which generate less noise (sound) due to its superior technology etc. is also an important factor in noise minimisation strategy.
- **Maintenance of machines:** Proper lubrication and maintenance of machines, vehicles etc. will reduce noise levels. For example, it is a common experience that, many parts of a

vehicle will become loose while on a rugged path of journey. If these loose parts are not properly fitted, they will generate noise and cause annoyance to the passenger. Similarly is the case of machines. Proper handling and regular maintenance is essential not only for noise control but also to improve the life of machine.

Control in the transmission path

The change in the transmission path will increase the length of travel for the wave and get absorbed or refracted or radiated in the surrounding environment.

Installation of barriers: Installation of barriers between noise source and receiver can attenuate the noise levels.

Design of building: The design of the building incorporating the use of suitable noise absorbing material for wall/door/window/ceiling will reduce the noise levels. Installation of panels or enclosures: A sound source may be enclosed within a paneled structure such as room as a means of reducing the noise levels at the receiver. The actual difference between the sound pressure levels inside and outside an enclosure depends not only on the transmission loss of the enclosure

panels but also on the acoustic absorption within the enclosure and the details of the panel penetrations which may include windows or doors.

Green belt development: Green belt development can attenuate the sound levels. The degree of attenuation varies with species of greenbelt.

Using protection equipment

Protective equipment usage is the ultimate step in noise control technology, i.e. after noise reduction at source and/or after the diversion or engineered control of transmission path of noise. The first step in the technique of using protective equipment is to gauge the intensity of the problem, identification of the sufferer and his exposure to the noise levels.

The usage of protective equipment and the worker's exposure to the high noise levels can be minimized by -

- **Job rotation:** By rotating the job between the workers working at a particular noise source or isolating a person, the adverse impacts can be reduced.
- **Exposure reduction:** Regulations prescribe that, noise level of 90 dB for more than 8

hour continuous exposure is prohibited. Persons who are working under such conditions will be exposed to occupational health hazards. The schedule of the workers should be planned in such a way that, they should not be over exposed to the high noise levels.

• **Hearing protection:** Equipment like earmuffs, ear plugs etc. are the commonly used devices for hearing protection. Attenuation provided by ear-muffs vary widely in respect to their size, shape, seal material etc. Literature survey shows that, an average noise attenuation up to 32 dB can be achieved using earmuffs

6. CONTROL OF EXHAUST EMISSIONS IN VEHICLES:

Two main approaches to minimize exhaust emissions are

1. Modifications in the engine design and operating variables.
 2. Treatment of exhaust gases after emission from the engine.
1. The following modifications may help in cleaner exhaust.
 - a. Use of cleaner idle mixtures.
 - b. Use of cleanest possible mixture and maximum spark retard compatible with good power output and drivability
 - c. Use of minimum valve over lap necessary.
 - d. Pre treatment of the mixture to improve vaporization and mixing of fuel with air.
 - e. Low quench combustion chambers
 - f. Piston and ring variables

2. Exhaust treatment devices

The basic techniques is to promote oxidation of HC and CO after emission from the engine. Exhaust oxidation devices fall into two categories

- a. Promotion of after burning of the pollutants by exhaust heat conservation and introduction of additional air and by providing sufficient volume to ensure adequate reaction time
- b. Use of catalytic converters. In after burners air from an engine driven blower is injected into the exhaust stream just after the exhaust valve. Sometimes an additional source of ignition is provided in the exhaust passage to initiate the after burning under certain engine conditions.

Other methods

- 1) Petrol injection
- 2) Stratified charge engine