

# ENVIRONMENTAL SCIENCE

## Question no. 2

### Environmental Management Methods

Unchecked human activities and over-exploitation of resources can lead to environment degradation, which can ultimately cause catastrophic damage.

Therefore, environmental management is crucial for ensuring safe future for humanity.

Environmental management is carried out in following steps:

- 1) Identification of pollutants
- 2) Identification of methods for controlling those pollutants
- 3) Forming policy to implement those methods
- 4) Public participation.

Environmental Management methods can be divided into three categories based on their working: Physical, Chemical and Biological.

#### Methods

##### Physical

- Absorption and wet scrubbing
- Fabric Filter
- Cyclone Method
- Shog Towers

##### Chemical

- Catalytic Reactors

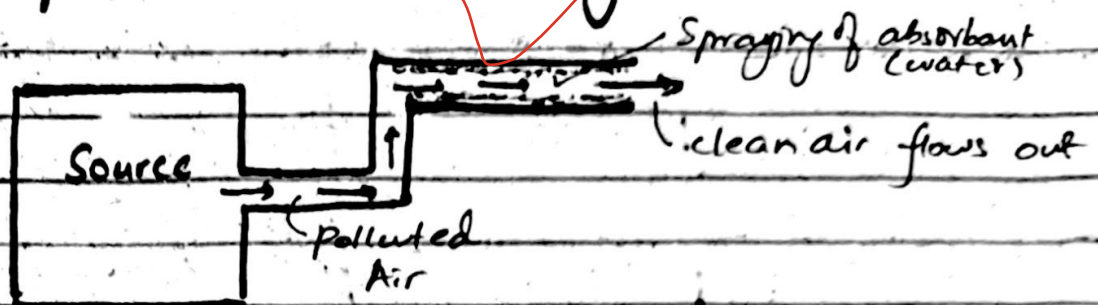
##### Biological

- Bio-fillers
- Composting

##### Physico-chemicals

- incineration
- Adsorption

## (1) Absorption and Wet Scrubbing Method

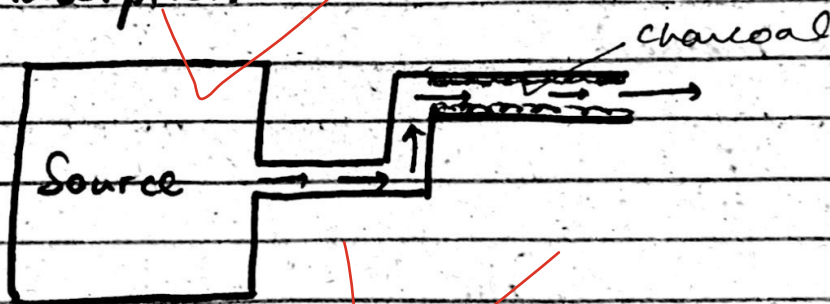


The filter is sprayed with water. Polluted air flows into the filter and pollutants such as sulphur oxides and hydrogen sulphides absorb into the water. Filter can be cleaned using hot steam.

It is effective for textile, cement, paper, thermal power industries, etc.

Efficiency: 98%

## (2) Adsorption



These filters consist of a layer of charcoal. Pollutants stick to the charcoal and as a result clean air flows out. These filters are effective in filtering volatile organic compounds.

Factories: fertilizer, cement, paper, etc.

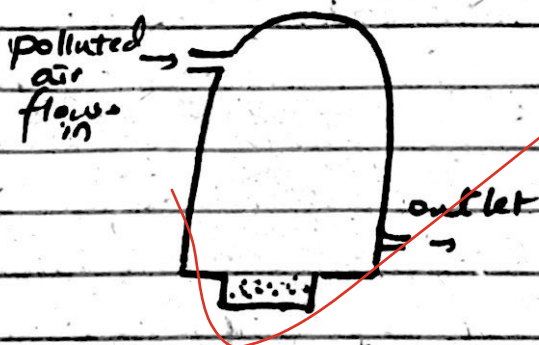
Efficiency: 98%

### (3) Fabric filter Method / Bag House



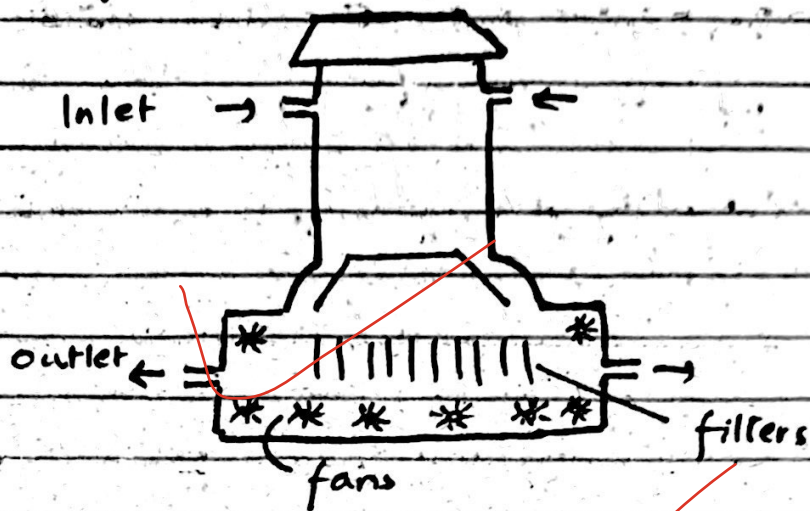
This filter uses fabric such as cotton for filtration. It is effective in filtering small pollutants which settle to the bottom of the filter and can be removed by detaching it. It works on the principle of vacuum cleaner.  
Factories: Textile, paper, cement, etc  
Efficiency: 98%.

### (4) Cyclone Method



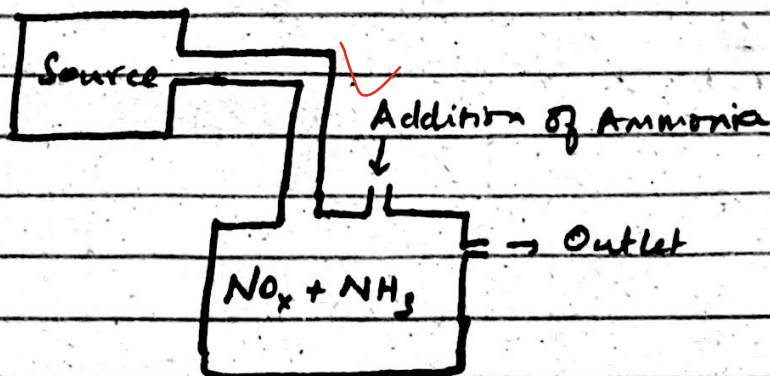
Cyclone method is effective in filtering large particles which settle to the bottom of the container.  
Factories: Ceramics, Cement, etc  
Efficiency: 98%.

## (5) Smog Towers



Smog towers are effective in managing smog. They suck polluted air inside which travels down. After passing through the filters, clean air moves out.

## (6) Catalytic Reactors

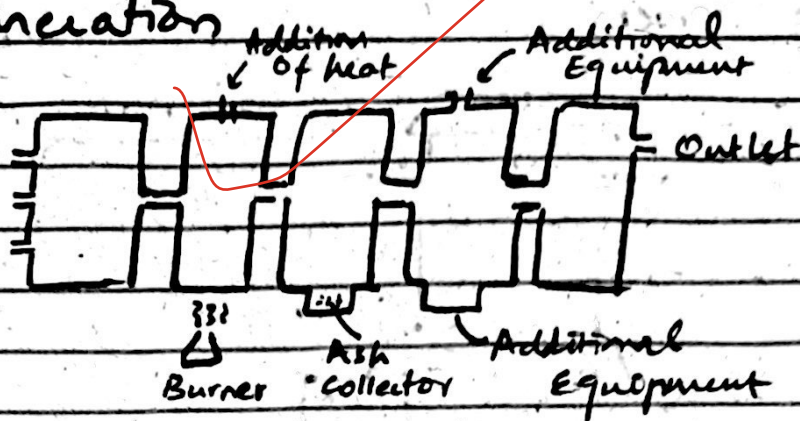


Catalytic reactors are used for filtration of nitrogen oxides. Ammonia reacts with nitrogen oxides, neutralizing its effects.

Factories: Paper, cement, fertilizers, etc

Efficiency: 98%

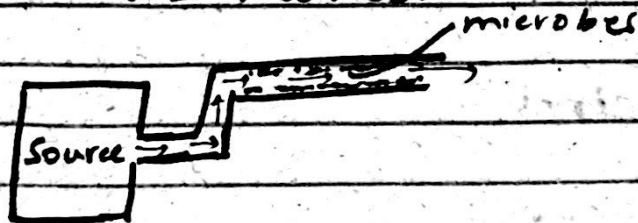
## (7) Incineration



Incinerators are used for filtration of toxic pollutants such as hospital waste. The ash can be utilized in construction material such as bricks.

Efficiency: 98%

## (8) Bio Filters Method



In this method, micro-organisms (bacteria and microbes) are used to clean the air. They consume the pollutants making the air safe for the environment.

These filters are useful for filtering volatile organic compounds.

Factors: cement, paper, etc

Efficiency: 98%

## (9) Composting

Composting is a method of turning organic waste into useful compost which can be used for soil fertilization.

Some of the methods of composting are:

- a) Indore Method
- b) Bangalore Method
- c) Vermi Method.

## (10) Electric Vehicles

Promoting electric vehicles is an effective way of reducing air pollution as these vehicles do not release harmful pollutants into the atmosphere.

### Question no. 3

Environmental Pollution has become one of the most pressing challenges for Pakistan. It has resulted into food shortages, health problems, bio-diversity loss, etc. To counter these issues, a multi-faceted approach is necessary. As an administrator, I would suggest following measures to manage environmental pollution:

## (i) Proper Waste Disposal

In Pakistan, open-dumping is a common

practice. It causes release of toxic pollutants into the air, exacerbating the air quality. There is a dire need of adopting better ~~solutions~~ techniques for waste disposal in the country which may include:

(a) Recycling

Materials such as plastics and metallic items should be separated from waste and ~~recycled~~ recycled.

(b) Composting

Organic waste should be utilized for making compost which can further be used in agricultural practices for enhancing soil fertility.

(c) Incineration

Toxic waste such as that from a hospital should be treated in incinerators. The ash can further be used in construction material.

Adopting these techniques would significantly reduce waste and ensure healthier environment.

## (2) Smog Towers

Cities such as Lahore are facing significant health hazards due to smog. If left unaddressed, it can lead to similar

conditions as during the Great Smog of London which led to deaths of 4000 individuals. Installing smog towers can help reduce smog and maintain healthy environment. Recently, Pakistan's first smog tower was installed in Lahore in December, 2024. According to the Ministry of Environment, Air Quality Index dropped from 1600 to 250 in that locality which proves the effectiveness of smog towers. According to an analysis, around 200 smog towers are required to completely free the city from smog.

### (3) Afforestation and Reforestation

Forests are known to be massive carbon sinks. Planting trees in the country would help reduce pollution significantly. Reforestation is a process of planting trees where there once were a forest while afforestation refers to tree plantation in barren areas.

### (4) Green Infrastructure

The country should invest in green infrastructure which provides sustainable construction practices and helps reduce pollution. China's Sponge City Project



is a step in this direction. It involves penetrable pathways, green construction materials, increased tree coverage and streams. Such initiatives help reduce pollution and ensure healthy environment.

### (5) Promotion of Renewable Energy

Burning of fossil fuels release massive amounts of carbon dioxide, leading to environmental degradation. Therefore, transition towards clean renewable energy resources - solar, wind, biomass and hydropower - is essential for ensuring clean environment. Government should give initiatives to encourage people to shift towards renewable energy resources.

### (6) Imposing Carbon Tax

Carbon taxes should be imposed to discourage the <sup>sales</sup> of hydrocarbons. It would compel people to resort to sustainable renewable energy resources for meeting their needs.

### (7) Modern Agricultural Techniques

Prevalent agricultural methods include overexploitation of resources and improper

management of waste, which leads towards environment pollution. Techniques such as verticle farming and precision farming should be adopted by using Artificial Intelligence. This will ensure optimal use of resources and prevent wastage.

### (B) Sustainable Industrial Practices

Factories are the biggest source of pollution. Toxic pollutants from <sup>industries</sup> such as sulphur dioxide and nitrogen oxides pollute the air, leading to environmental degradation. Techniques such as Direct Air Capture (DAC) and Carbon Mineralization should be adopted to clean the toxic air from factories before releasing it into the environment.

### Question no. 5

#### (1) Irresponsible Behavior of US

US has displayed a very irresponsible behavior in withdrawing from Green Deals. This action will have far-reaching consequences in the international arena. US, being a superpower, has once again

failed to look beyond its interests.

## (2) Lack of Climate Justice

US is among the major emitters of carbon dioxide but has still withdrawn from green deals. The actions of major emitters are threatening the survival of ~~developed~~ developing nations as climate change adversely affects already vulnerable countries. This depicts the bleak picture of lack of climate justice displayed by international community.

## (3) Consequences of Withdrawal

### (A) Bad Precedent for the World

By withdrawing from Green deals, US has set a bad precedent for the world. This step would encourage other countries to withdraw from the deals as well.

### (B) Aggravated Effects of Climate Change

As the threats of climate change demand swift action, this irresponsible behavior would aggravate the global warming. As a result, the

world would witness aggravated effects of climate change.

### (c) Existential threat to Island and coastal countries

The Island and Coastal countries face existential threat due to climate change.

Bangladesh with an average elevation of 1.5 meters above sea level, face persistent threats. According to UN, more than half of its population would be displaced by 2050. Maldives, an archipelago, with much of its land barely above sea level risk complete submergence by 2100. Similarly, the nations of Kiribati, Tuvalu and Marshall Islands face similar existential threat. Inaction by US and other countries would further exacerbate the situation.

### (d) Trade War

US views mitigation measures akin to economic regression. Withdrawal from Green deals is a step toward reviving its economy to counter and contain the growing influence of China. This has increased the possibility of trade war in the future where countries would engage in economic pursuit without giving much thought to climate change.

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## Question no. 6

### (A) Climate Change

It refers to the rapid <sup>change</sup> ~~increase~~ in the climate of the Earth due to human activities. Climate change has led to adverse consequences including increase in frequency and intensity of natural disasters, rising sea levels, ~~loss~~ of bio-diversity, etc. It has caused mass food insecurity, health problems and an existential threat to island and coastal nations.

#### (1) Pollutants

The main pollutants that have led to climate change and environment degradation include  $CO_2$ ,  $SO_2$ ,  $NO_x$ ,  $CO$ , etc. These pollutants are released from A.C., refrigerators, industries and agricultural activities.

#### (2) Ozone Depletion

Ozone acts as a protective layer that prevents harmful ultraviolet rays from the sun from entering into the Earth's atmosphere. Excessive amount of ~~carbon dioxide~~ <sup>chloride radical</sup> reacts with ozone and turns it into oxygen, leading to

depletion of ozone layer.



### (3) Global Warming

Global warming refers to increase in global temperature. The pollutants in the air act as a greenhouse effect by trapping heat waves from the sun, warming the Earth. According to IPCC, the global temperature has risen by  $1.1^\circ\text{C}$  post industrial era. Without adequate measures, this temperature is likely to rise beyond  $1.5^\circ\text{C}$  and  $2^\circ\text{C}$ , causing catastrophic damage.

## (B) Adaptation Measures for Pakistan

### (1) Disaster Management

The government should invest in equipping the country with adequate facilities for managing a disaster. Techniques such as building barriers for protection against flood should be adopted. In areas prone to wildfires, fire resistant houses should be built. Moreover, disaster management agencies should be facilitated to ensure their proper training.

## (2) Disaster Predictions

Adequate steps should be taken towards disaster prediction to ensure timely evacuation. This proactive approach is essential for minimizing damage.

## (3) High Yield Seeds

Climate change has reduced the yield of crops, leading to food scarcity. For this purpose, genetically engineered high yield seeds should be used.

## (4) Investment in R&D

Investment in Research and Development is crucial in adapting to climate change.

## (5) Raising Awareness

Awareness campaigns should be held to educate the public about the threats of climate change to better prepare them for the future.

