18CEO307T

DISASTER MANAGEMENT AND MITIGATION

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Man Made Disasters

Man Made Disaster

- Anthropogenic hazards or man-made hazards can come to action in the form of a man-made disaster.
- In this case, "anthropogenic" means threats having an element of human intent, negligence, or error; or involving a failure of a man-made system.
- Airplane crashes and terrorist attacks are examples of man-made disasters: they cause pollution, kill people, and damage property.

ANTHROPOGENIC HAZARDS


DANGEROUS GOODS


TRANSPORTATION DISASTERS


GARBAGE DUMP


RIOT


OIL SPILLS


TERRORIST ATTACKS


CRIMINALITY


MINING ACCIDENTS


INDUSTRIAL HAZARDS


ENVIRONMENTAL HAZARDS


MARINE POLLUTION


POWER OUTAGE


NUCLEAR WEAPON


BIOLOGICAL HAZARD


FIRESTORM

Nuclear Disaster

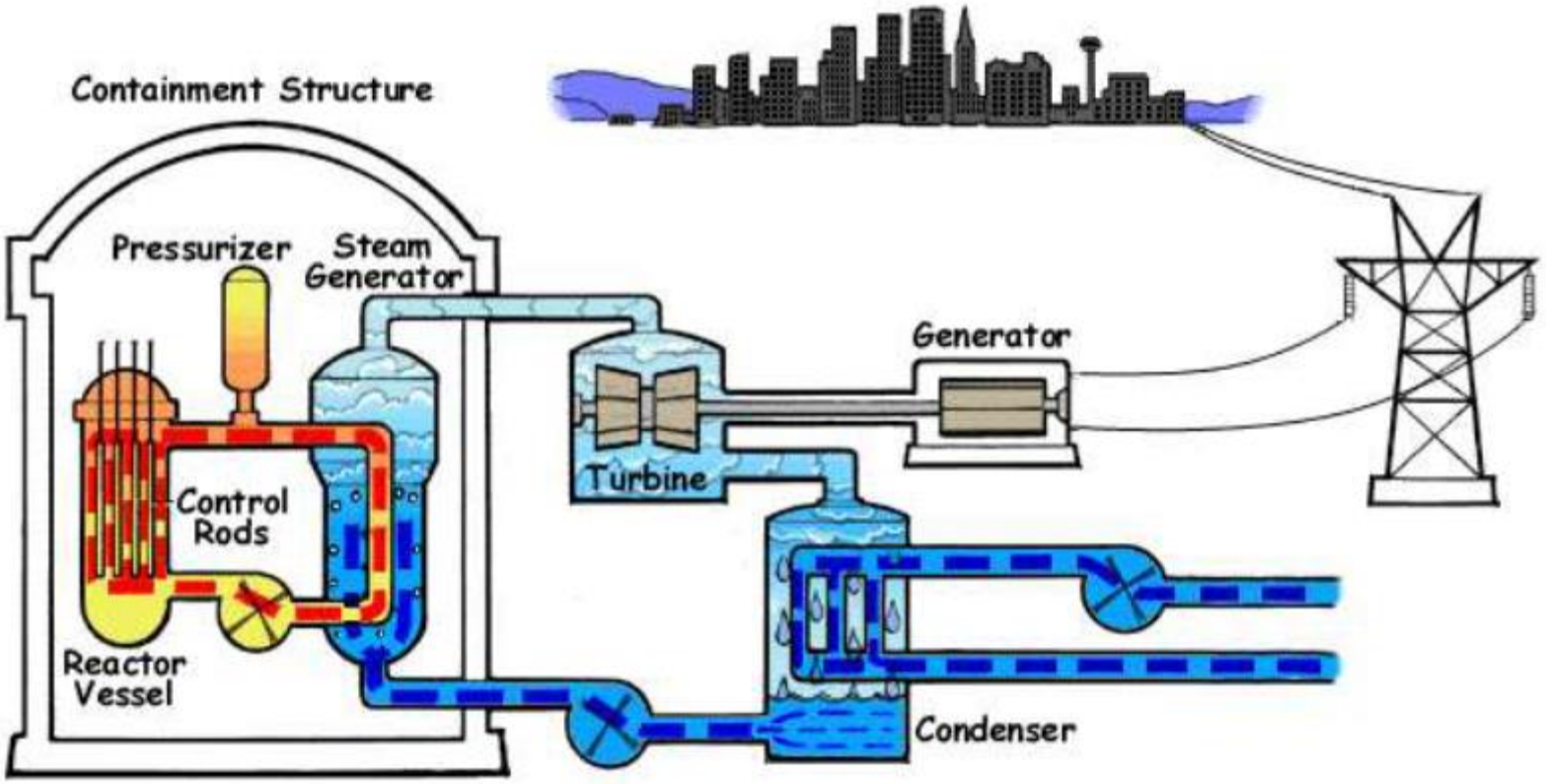
- A nuclear and radiation accident is defined by the International Atomic Energy Agency as "an event that has led to significant consequences to the people, the environment or the facility."
- Examples include lethal effects to individuals, large radioactivity release in to the environment, or reactor core melt.
- Technical measures need to be adopted to reduce the risk of accidents or to minimize the amount of radioactivity released to the environment.

Nuclear Disaster

- A nuclear disaster could take several forms. The most obvious would be a meltdown at a nuclear reactor plant. Though the plant might not explode, the result of such a disaster would very likely be the release of massive amount of radiation and radioactive material into the environment and it would take hundred years to decay to anything near “safe” levels .

Causes of Nuclear Disaster

- Nuclear disasters are usually associated with meltdowns. When a meltdown occurs in a reactor, the reactor "melts". That is, the temperature rises in the core so much that the fuel rods actually turn to liquid, like ice turns into water when heated. If the core continues to heat, the reactor would get so hot that the steel walls of the core would also melt. In a complete reactor meltdown, the extremely hot (about 2700 Celsius) molten uranium fuel rods would melt through the bottom of the reactor and actually sink about 50 feet into the earth beneath the power plant.
- The molten uranium would react with groundwater, producing large explosions of radioactive steam and debris that would affect nearby towns and population centres.



- In a safe nuclear reactor the condenser and the cooling tubes work efficiently and the heat applied on the uranium rods is controlled.

RADIATION INCREASES multifold at each stage!

Uranium Mining

Fuel Enrichment

Power Generation

Waste Disposal

CHEMICAL DISASTERS

Chemical Disaster

- A chemical accident is the unintentional release of one or more hazardous substances which could harm human health or the environment.
- Chemical hazards are systems where chemical accidents could occur under certain circumstances. Such events include fires, explosions, leakages or releases of toxic or hazardous materials that can cause people illness, injury, disability or death.
- While chemical accidents may occur whenever toxic materials are stored, transported or used, the most severe accidents are industrial accidents, involving major chemical manufacturing and storage facilities

Sources of Chemical Disaster

- Manufacturing and formulation installations including during commissioning and process operations; maintenance and disposal.
- Material handling and storage in manufacturing facilities, and isolated storages; warehouses and godowns including tank farms in ports and docks and fuel depots.
- Transportation (road, rail, air, water, and pipelines).

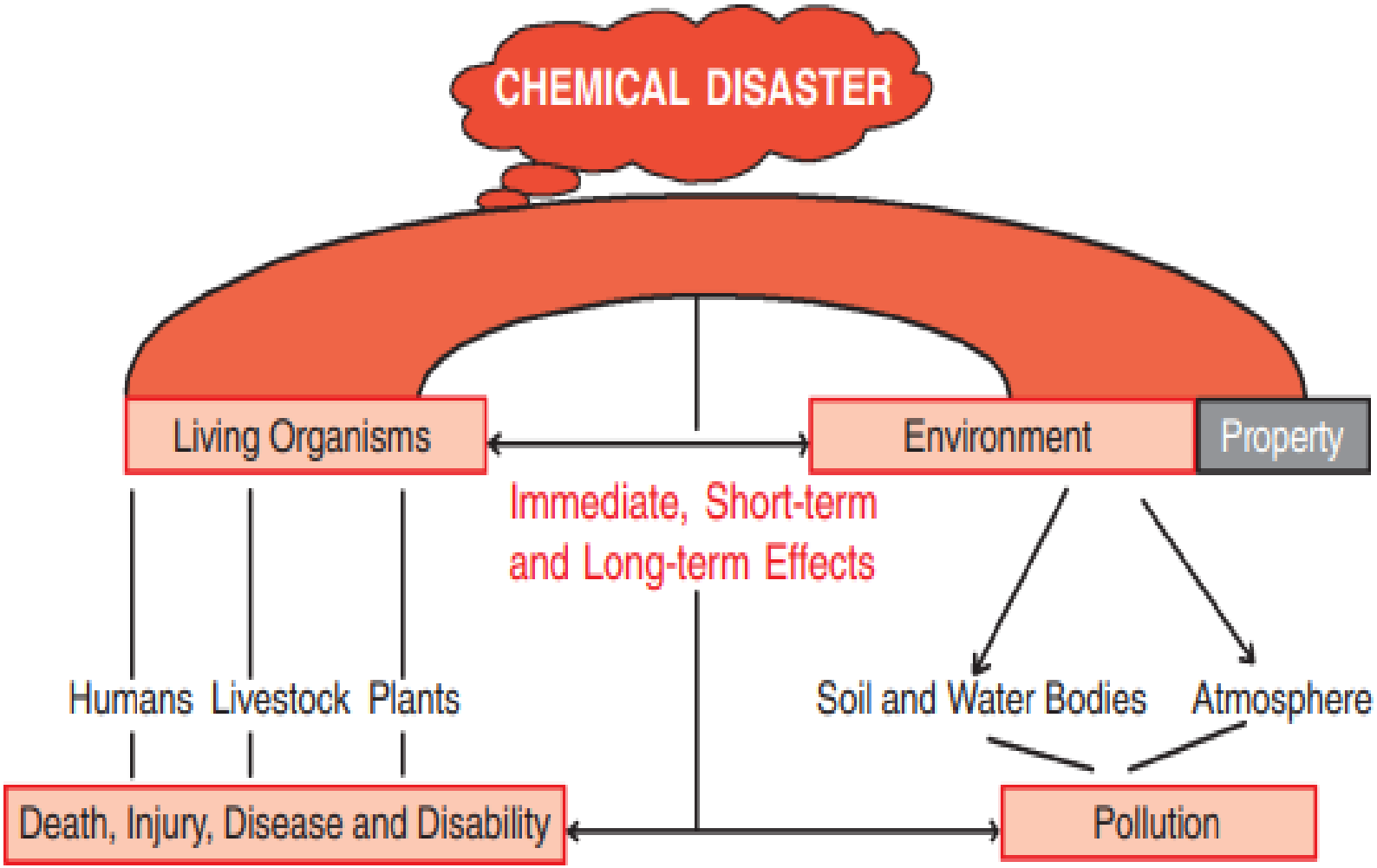
Factors Leading to Chemical Disasters

- Fire
- Explosion
- Toxic release
- Poisoning
- Combinations of the above.

Initiators of Chemical Accidents

- Process and Safety System Failures
  - Technical errors
  - Human errors
  - Lack of information
  - Organisational errors
- Natural Calamities
- Terrorist Attacks

Impact of Chemical Disaster



Effects of Chemical Disaster

- Breathing difficulties
- Eye irritation
- Skin abnormalities
- Deaths
- Internal organ failure

Bhopal Disaster

- The Bhopal disaster, also referred to as the Bhopal gas tragedy, was a gas leak incident on the night of 2–3 December 1984 at the Union Carbide India Limited (UCIL) pesticide plant in Bhopal, Madhya Pradesh, India.
- Over 500,000 people were exposed to methyl isocyanate (MIC) gas. The highly toxic substance made its way into and around the towns located near the plant.

Precautions

- Industries using harmful and powerful chemicals should be located far away from residential areas
- There should be surveys to keep a check on their activity
- The govt. should formulate an emergency plan to in case of an accident
- Pollution levels should be checked and maintained
- Deal with the causes of the accident and implement the safety measures which will minimise its consequences.
- Immediately inform the relevant local authorities of the accident.

Precautions

- The local or regional authorities of the area in which the installation is located are responsible for informing the public, sounding the alarm if need be, and deciding upon the instructions to be followed by the population.
- The local or regional governing body ensures the coordinated use of the civil and military means required to deal with the disaster.
- In the case of radioactivity, the technical co-ordination of the implementation of protective and rescue measures is assured by specialists who should be present at all political levels and in all the intervening squads, and work in collaboration with the personnel in charge of security at the installation affected.


Black Death
biological
sickness
area
healthcare
medication
large
flu
Spanish flu
h1n1
sick
swine
vaccine
vaccination
needle
pandemic
virulence
contagion
pharmacology
plague
prevention
death
pneumonia
global outbreak
H1N1
professional
safety
infected
virus
global pandemic
HIV
deadly
smallpox
microscopic
AIDS
medical
medicine
contagious
microscope
infection
hemorrhagic
emergency
region
laboratory
influenza
widespread
large region
epidemic
protection
flu pandemic
transmission
global
quarantine
care
continent
infectious
viral
research
health
science
disease
danger
illness
symptoms
injection
pharmaceutical
mortality
tuberculosis
outbreak
worldwide
Spanish
drug
shot
treatment
Earth
mask
globe
syringe
hospital
international
ebola

Biological Disasters

- Biological disasters are scenarios involving disease, disability or death on a large scale among humans, animals and plants due to toxins or disease caused by live organisms or their products.
- Such disasters may be natural in the form of epidemics or pandemics of existing, emerging or re-emerging diseases and pestilences or man-made by the intentional use of disease causing agents in Biological Warfare (BW) operations or incidents of Bioterrorism (BT).
- Anthrax - spore dispersal in the air

  Small pox - aerosols

  Typhus & plague - lice, fleas, rodents, etc.

Bio-Terrorism

- A bioterrorism attack is the deliberate release of viruses, bacteria, or other germs (agents) used to cause illness or death in people, animals, or plants

Eg- Japan used plauge bacilli in china during 1932-1945 causing 260000 death.

Trends Favoring Biological Weapons

- ✓ Low cost and widespread availability
- ✓ More efficient in terms of coverage/Kg of payload
- ✓ Advances in biotechnology have made production easy
- ✓ Agents are largely natural pathogens and simulate existing diseases.
- ✓ Have an unmatched destructive potential
- ✓ Technology for dispersing biological agents sophisticated.
- ✓ The lag time between infection and appearance of symptoms is longer than with chemical exposures.
- ✓ Lethal biological agents can be produced easily and cheaply
- ✓ Difficult to detect

Methods Of Dissemination/Delivery

- Aerosols - biological agents are dispersed into the air, forming a fine mist that may drift for miles.
- Animals – fleas, mice, flies, mosquitoes, and livestock.
- Food and water contamination - some pathogenic organisms and toxins may persist in food and water supplies.
- Person-to-person : Smallpox, Plague, and the Lassa

Prevention of Biological Disasters

- Vulnerability Analysis and Risk Assessment
- Environmental Management
  - Water supply
  - Personal hygiene
  - Vector control
  - Burial/disposal of the dead
- Prevention of Post-disaster Epidemics
- Integrated Disease Surveillance Systems
- Pharmaceutical Interventions: Chemoprophylaxis, Immunisation and Other Preventive Measures
- Non-pharmaceutical Interventions
  - Social Distancing Measures
  - Disease Containment by Isolation and Quarantine Methodologies
- Biosafety and Biosecurity Measures

Before a Biological Disaster

- ✓ Children and older adults are particularly vulnerable to biological agents.
- ✓ Ensure from a doctor/the nearest hospital that all the required or suggested immunizations are up to date.

During a Biological Disaster

- ✓ In the event of a biological attack, Close the doors and windows when a biological attack is imminent.
- ✓ Watch television, listen to radio, or check the Internet for official news and information ,you should seek medical attention if you become ill.
- ✓ The first evidence of an attack may be when you notice symptoms of the disease caused by exposure to an agent.
- ✓ Be suspicious of any symptoms you notice, but do not assume that any illness is a result of the attack.
- ✓ Use common sense and practice good hygiene.

- **However, if you notice of an unusual and suspicious substance nearby:**
  - ✓ Move away quickly.
  - ✓Cover your head and nose.
  - ✓Listen to the media for official instructions.
  - ✓ Seek medical attention if you become sick.
- **If you are exposed to a biological agent:**
  - ✓ Ultra efficient filter masks can be used.
  - ✓ Follow official instructions for disposal of contaminated items such as bag and cloths.
  - ✓Take bath with soap and put on clean clothes.
  - ✓Seek medical assistance.
  - ✓ If required and advised, stay away from others or even quarantined.

After a Biological Disaster

- ✓ Pay close attention to all official warnings and instructions on how to proceed.
- ✓ The delivery of medical services for a biological event may be handled differently to respond to increased demand.
- ✓ The basic public health procedures and medical protocols for handling exposure to biological agents are the same as for any infectious disease.


FIRE
HAZARDS

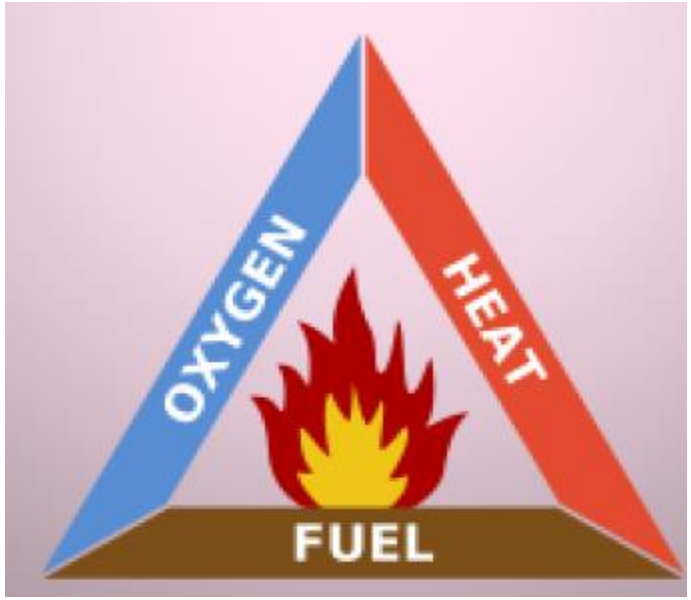
Fire Hazard

- Fire hazards are conditions that favor fire development or growth.
- Three elements are required to start and sustain fire:

  (1) oxygen, (2) fuel, and (3) heat
- Because oxygen is naturally present in most earth environments, **fire hazards usually involve them is handling of fuel or heat**
- Fire or combustion is a chemical reaction between oxygen and a combustible fuel.
- To start a fire, source of ignition such as a spark, flame and high temperature are needed.
- The ignition temperature or combustion point is the temperature at which a given fuel can burst into flame

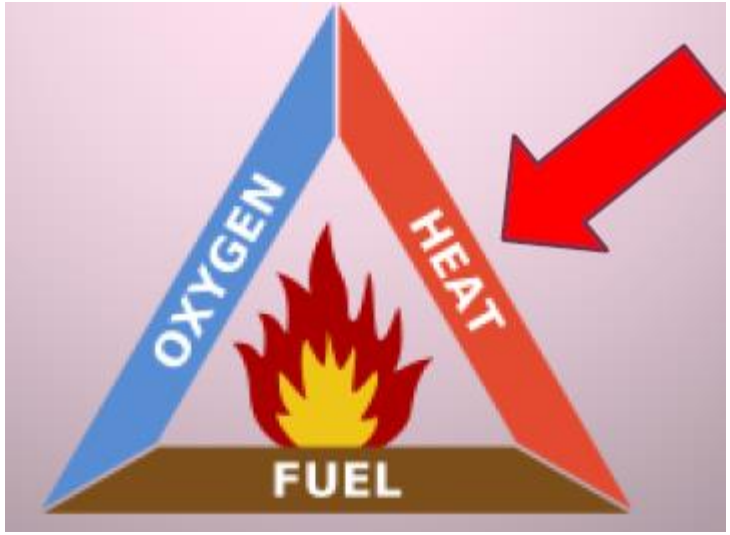
Fire Triangle

- Diagram for understanding the necessary ingredients for most fires.
- The triangle illustrates the three elements a fire needs to ignite: heat, fuel, and an oxygen.
- A fire naturally occurs when the elements are present and combined in the right mixture.
- The fire extinguishes by removing anyone of the elements in the fire triangle



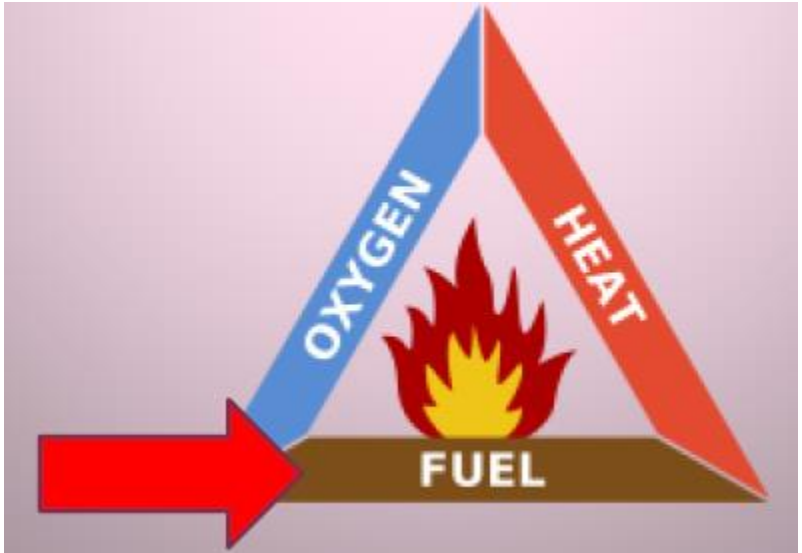
Fire Triangle

- Without sufficient heat, a fire cannot begin, and it cannot continue. Heat can be removed by the application of a substance which reduces the amount of heat available to the fire reaction. This is often water, which requires heat for phase change from water to steam. Introducing sufficient quantities and types of powder or gas in the flame reduces the amount of heat available for the fire reaction in the same manner. Turning off the electricity in an electrical fire removes the ignition source.



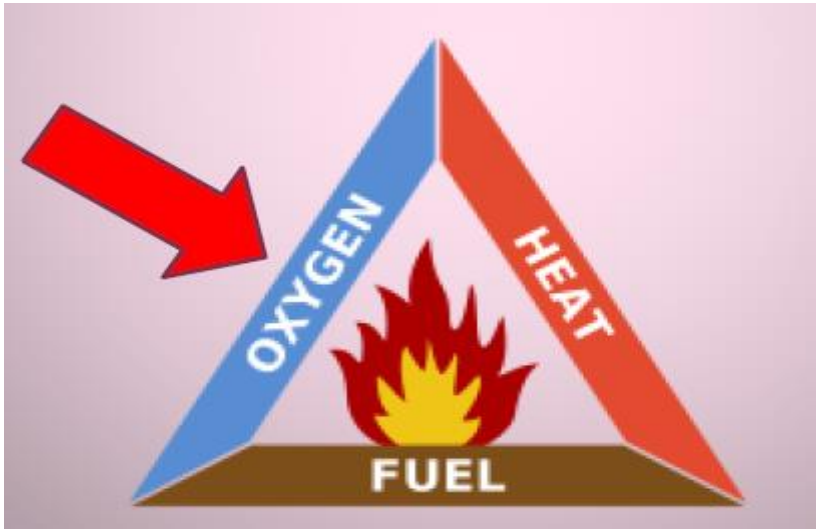
Fire Triangle

- Without fuel, a fire will stop. Fuel can be removed naturally, as where the fire has consumed all the burn able fuel, or manually, by mechanically or chemically removing the fuel from the fire. Fuel separation is an important factor in fire suppression, and is the basis for most major tactics, such as controlled burn. The fire stops because a lower concentration of fuel vapour in the flame leads to a decrease in energy release and a lower temperature. Removing the fuel there by decreases the heat.



Fire Triangle

- Without sufficient oxygen, a fire cannot begin, and it cannot continue. With a decreased oxygen concentration, the combustion processs lows. In most cases, there is plenty of air left when the fire goes out so this is commonly not a major factor.



Source of Fire Hazard

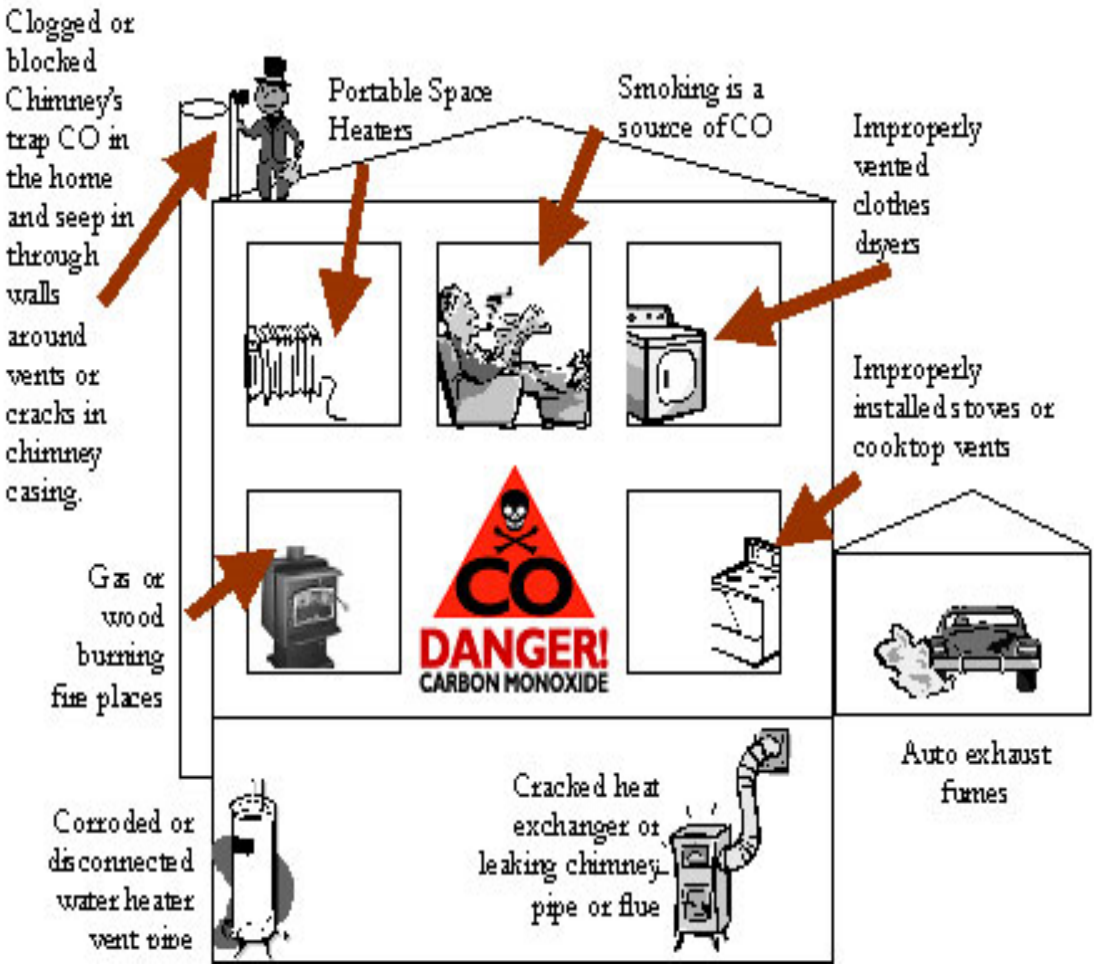
Types of Fire	Sources/Materials
Class A Fire	Solid materials: wood, plastics, textiles, paper, clothing.
Class B Fire	Flammable liquids and gasses
Class C Fire	Electrical (live electricity situations, exclude fires in other materials started by electricity)
Class D Fire	Combustible, easily oxidized metals such as aluminium, magnesium, titanium and zirconium
Special Categories	Extremely active oxidizers or mixtures, flammables containing oxygen, nitric acid, hydrogen peroxide, and solid missile propellant

Source of Fire Hazard

SRM INSTITUTE OF SCIENCE & TECHNOLOGY
—Deemed to be University—

Fuels can be SOLIDS, LIQUIDS, VAPORS or GASES.

Fuels	Sources/Materials
Solids	Wood, plastics, textiles, paper, clothing, fabric curtain, etc.
Liquids	Petrol, diesel, kerosene, etc.
Gases	Ammonia, Carbon monoxide

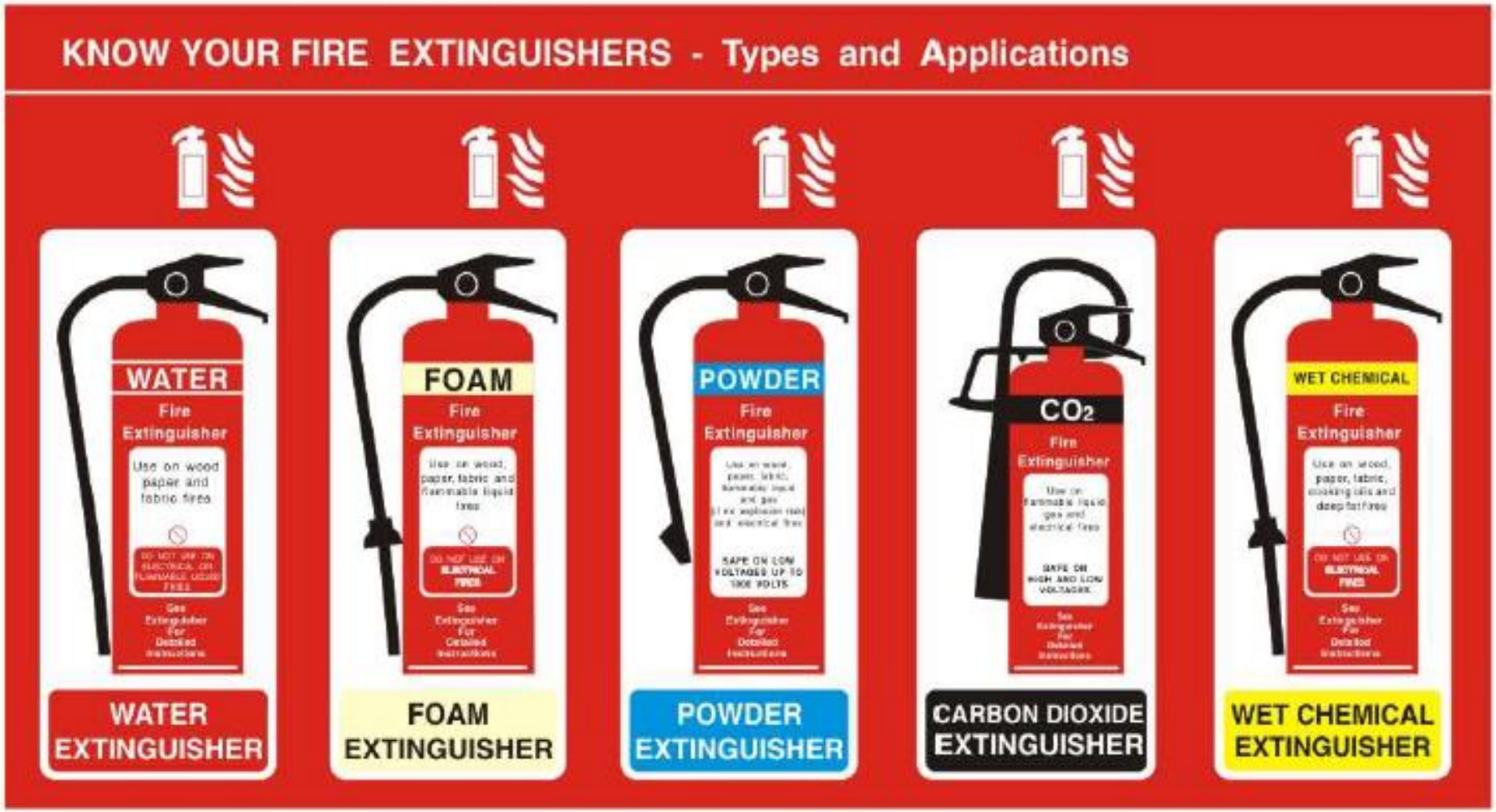


Sources of Fire Hazard

- Failure of electrical systems and equipments
- Lightning strikes
- Presence of a flammable gas or liquid mixture
- Hot surfaces; e.g: furnaces, chimneys
- Hot engines
- Heated surfaces

Fire Extinguisher

Types of Fire Extinguisher



Solid Red	Cream	Blue	Black	Yellow
Can be used on: Class A	Can be used on: Class A Class B	Can be used on: Class A Class B Class C Class D Electrical	Can be used on: Class B Electrical	Can be used on: Class A Class F

Class A

Combustible materials. These include paper, textiles, wood and similar materials.

Class B

Flammable liquids. These include petrol, oil and paint.

Class C

Flammable gases. These include butane and methane.

Class D

Flammable metals. These include potassium and uranium.

Electrical

Electrical goods. These include appliances in kitchens as well as computers, phones etc.

Class F

Cooking oils. These include chip pan fires and deep fat fryers.

Type (Fire / Extinguisher)	CLASS A Combustible materials (e.g. paper & wood)	CLASS B Flammable liquids (e.g. paint & petrol)	CLASS C Flammable gases (e.g. butane and methane)	CLASS D Flammable metals (e.g. lithium & potassium)	Electrical Electrical equipment (e.g. computers & generators)	CLASS F Deep fat fryers (e.g. chip pans)	Comments
Water	✓	✗	✗	✗	✗	✗	Do not use on liquid or electric fires
Foam	✓	✓	✗	✗	✗	✗	Not suited to domestic use
Dry Powder	✓	✓	✓	✓	✓	✗	Can be used safely up to 1000 volts
CO2	✗	✓	✗	✗	✓	✗	Safe on both high and low voltage
Wet Chemical	✓	✗	✗	✗	✗	✓	Use on extremely high temperatures

Fire Detection Devices

- ***Smoke detectors***

  require a flow of air in order to work well

- ***Heat detectors***

  detect fires where there is no smoke

  activated by the significant increase of temperature associated with fire

- ***Flame detectors***

  react to the movement of flames.

Before a Fire

- Regularly check electrical equipment
- Maintain proper fire safety equipment
- Follow correct steps to put out fires and evacuate the building

During a Fire

- Call the fire department.
- Begin evacuating others.
- Turn off the gas valve to prevent escalation
- Meet at the pre-assigned meeting place.
- Make sure that all persons have safely escaped.
- When the fire department arrives, inform a
- Fire fighter if anyone is missing; do not re-enter the building yourself.

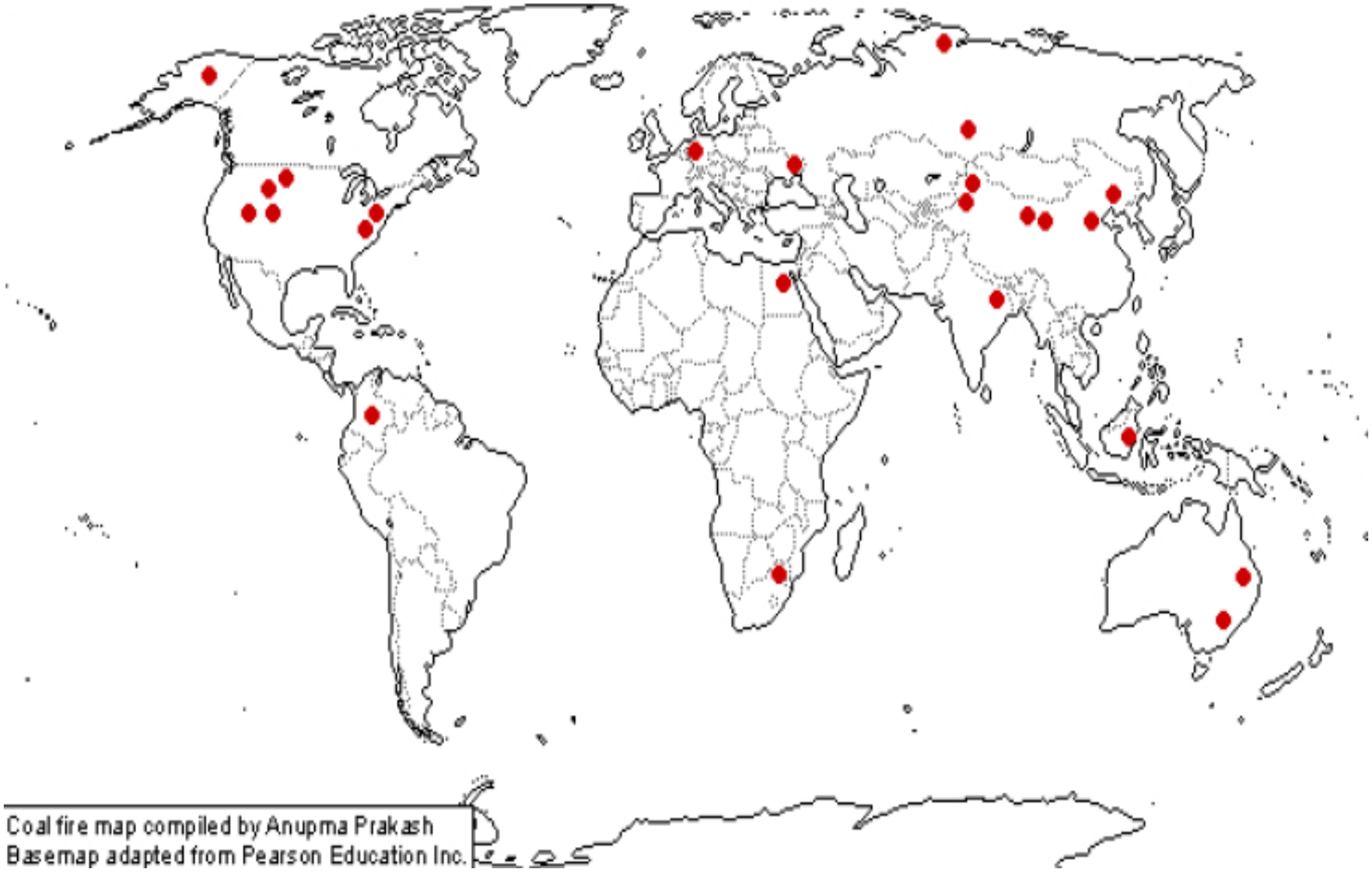
Coal Fire

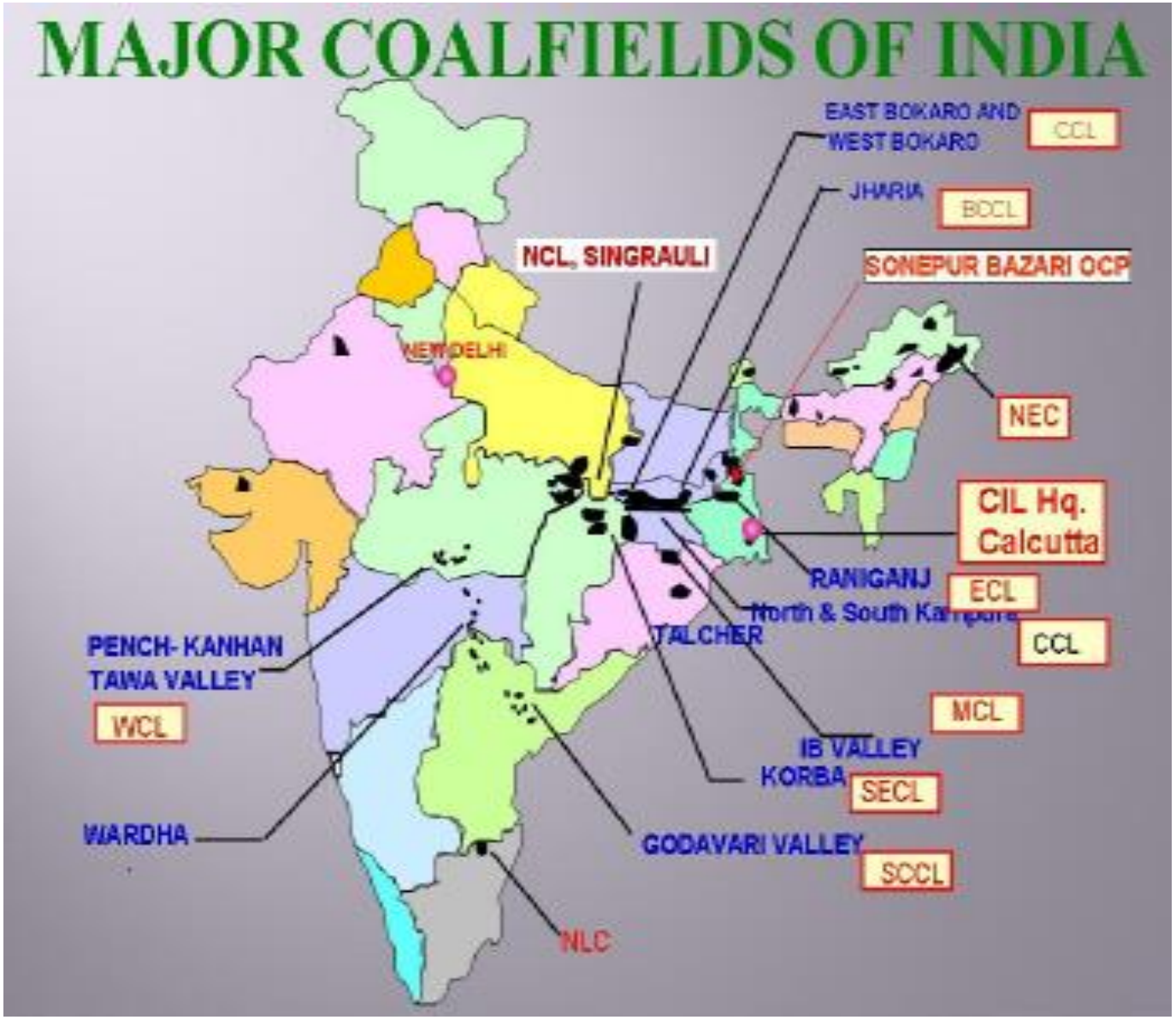
Coal Fire

- The term "Coal fire" refers to a burning or smoldering coal seam, coal storage pile or coal waste pile. Two major causes have been identified for coal fires:
- **Natural causes:**

  coal seam or dust can be exposed by the erosion or a subsidence event, strike by lightning or ignite by a wildfire.
- **Human causes:**

  friction, electricity or oxygen can ignite coal peat or dust during regular extraction, illegal mining, transportation.


Coal fire map compiled by Anupma Prakash
Basemap adapted from Pearson Education Inc.


MAJOR COALFIELDS OF INDIA
EAST BOKARO AND
WEST BOKARO
CCL
JHARIA
BCCL
NCL, SINGRAULI
SONEPUR BAZARI OCP
NEW DELHI
NEC
CIL Hq.
Calcutta
RANIGANJ
ECL
North & South Karanpura
CCL
TALCHER
PENCH- KANHAN
TAWA VALLEY
WCL
MCL
IB VALLEY
KORBA
SECL
WARDHA
GODAVARI VALLEY
SCCL
NLC

Spontaneous Combustion

- Spontaneous combustion means that coal can start to burn without any recognizable outer influence.
- Spontaneous combustion depends, amongst others:
  - ✓ coal type
  - ✓ Temperature
  - ✓ availability of oxygen
  - ✓ exposure to surface
  - ✓ thickness of coal seam

Control of Spontaneous Combustion

- Three types of gases which have already been used to fight mine fires.

  a) Carbon dioxide b) inert gases c)Nitrogen

- Inorganic Inhibitors

  magnesium chloride, cadmium chloride & trisodium

- Sealant

  Mica, rubber, bitumen

- High Pressure Foam

Causes of Disaster in Coal Mines

- ✓ Explosion
  - presence of explosive mixture
  - suitable source of ignition
- ✓ Rock Fall
- ✓ Fire
  - accidental fire
  - spontaneous heating

Spontaneous Heating

- Coal undergoes slow oxidation on exposure to air at ambient temperatures with the evolution of heat, gases and moisture.
- The heat generated, if not dissipated, gives rise to an increase the temperature of the coal which in turn increases the rate of oxidation.
- The higher the inherent moisture, the higher the heating tendency.
- The lower the ash content, the higher the heating tendency.
- The higher the oxygen content in the coal, the higher the heating tendency.

Impact of Atmospheric Environment

- Release of carbon dioxide, a greenhouse gas, is one of the major cause to climate change and global warming, according to the IPCC.
- Coal is the largest contributor to the human-made increase of CO_2 in the atmosphere.
- According to Guan et al., coal fires in northern China discharge into the atmosphere each year:

  490,200 t of carbon monoxide (CO),

  514,700 t of sulfur dioxide (SO_2),

  300,000 t of nitrogen dioxide (NO_2),

  112,000 t of dust, as well as other harmful gases such as carbon dioxide (CO_2) and hydrogen sulfide (H_2S).

Impact on Soil Environment

- Soil moisture and air have a great impact on plant growth.
- Coal fires change the physico-chemical properties of soil. Yellow burned soil is omnipresent in coal fire areas
- Soil becomes fragile and prone to crumbling, with very low organic matter content and only small numbers of microorganisms

Impact on Human Health

- Coal tar is a respiratory carcinogen identified by the International Cancer Research Institution of the World Health Organization.
- Arsenic contained in coal fire discharge can cause chronic intoxication with after-effects such as pigment deficiency, over-pigmentation, and skin cancer.

Coal Fire Mitigation

- Trench cutting and filling with incombustible materials
- Surface sealing with soil (soil with high water retaining capacity)
- Creation of water pools on the surface, water circulation under pressure, flooding of fire areas
- Inert gas and/or foam infusion
- Cementing and grouting, flushing with bentonite and/or fly ash
- It was found that a 10 cm layer of bentonite can reduce air permeation by up to 90 %.


FOREST
FIRE

Forest Fire

- The most common hazard in forests is forests fire.
- They pose a threat not only to the forest wealth but also to the entire regime to fauna and flora seriously disturbing the bio-diversity and the ecology and environment of a region.
- During summer, when there is no rain for months, the forests become littered with dry senescent leaves and twinges, which could burst into flames ignited by the slightest spark

Forest Fire

- Forest fire causes imbalances in nature and endangers biodiversity by reducing faunal and floral wealth.
- Traditional methods of fire prevention are not proving effective and it is now essential to raise public awareness on the matter, particularly among those people who live close to or in forested areas.

Causes of Forest Fire

- Causes of forest fires can be divided into two broad categories:
  - ✓*environmental (which are beyond control)*
  - ✓*human related (which are controllable)*

Environmental Causes

- Many forest fires start from natural causes such as lightning which set trees on fire. However, rain extinguishes such fires without causing much damage.
- High atmospheric temperatures and dryness (low humidity) offer favorable circumstance for a fire to start.
- Environmental causes are largely related to climatic conditions such as temperature, wind speed and direction, level of moisture in soil and atmosphere and duration of dry spells.

Human Causes

- Fire is caused when a source of fire like naked flame, cigarette, electric spark or any source of ignition comes into contact with inflammable material
- Graziers and gatherers of various forest products starting small fires to obtain good grazing grass as well as to facilitate gathering of minor forest produce
- The use of fires by villagers to ward off wild animals fires lit intentionally by people living around forests for recreation

Human Causes

- The causes of forest fire have been increasing rapidly. The problem has been accentuated by the growing human and cattle population.
- People enter forests ever more frequently to graze cattle, collect fuelwood, timber and other minorforest produce. **It has been estimated that 90% of forest fires in India are man-made**

Effects of Forest Fire

- loss of valuable timber resources
- degradation of catchment areas
- loss of biodiversity and extinction of plants and animals
- loss of wildlife habitat and
- depletion of wildlife
- loss of natural regeneration and
- reduction in forest cover
- global warming
- loss of carbon sink resource and
- increase in percentage of CO2 in atmosphere
- change in the microclimate of the area with unhealthy living conditions

Effects of Forest Fire

- soil erosion affecting productivity of soils and production
- ozone layer depletion
- health problems leading to diseases
- loss of livelihood for tribal people and the rural poor, as approximately 300 million people are directly dependent upon collection of non-timber forest products from forest areas for their livelihood.

Impacts of Forest Fire

- Forest ecosystem
- Change in landscape
- Effect on photosynthesis
- Effect on food web
- Effect on seed capacity
- Effect on new recruits
- Loss of valuable timber resources.
- Degradation of catchment areas.
- Loss of biodiversity and extinction of plants and animals.
- Loss of wild-life, habitat and depletion of wild-life.
- Loss of natural regeneration and reduction in forest cover.

Impacts of Forest Fire

- Global warming.
- Loss of carbon sink resource and increase in percentage of $C0_2$ in the atmosphere.
- Change in the microclimate of the area with unhealthy living conditions.
- Soil erosion affecting productivity of soils and production.
- Ozone layer depletion.
- Health problems leading to disease.
- Loss of livelihood for the tribal and rural poor, as approximately 300 million people (including 70 million tribal) are dependent upon collection of non-timber forest products from the forest areas for their livelihood.

Pollution

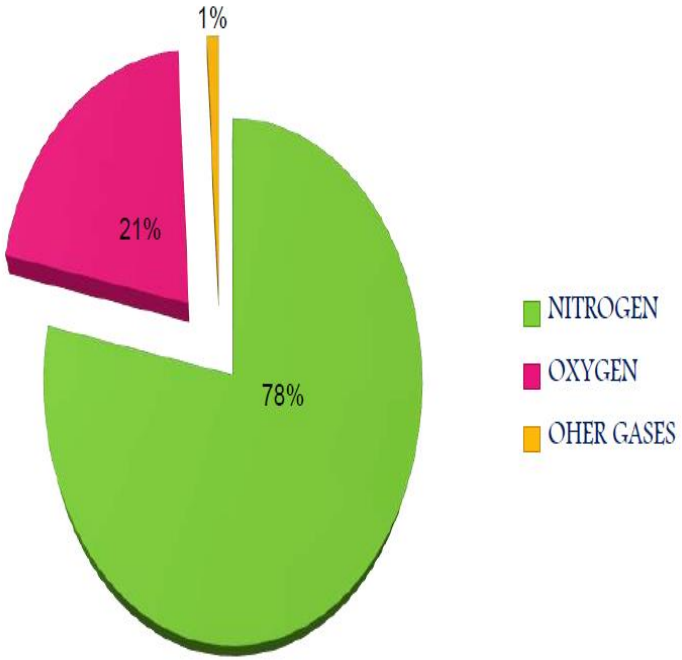
- The presence of unusually high concentrations of harmful or poisonous substances in the environment is called POLLUTION.
- Pollution contaminates the air and water with poisonous substances and makes them impure to such an extent that they become harmful to the human beings, other animals, plants as well as to the non-living things. Pollution are of three types.

POLLUTION ,
WHAT DOES IT LOOK LIKE ?

Air

- Air is mixture of gases. The two main gases present in air are Nitrogen & Oxygen.

- Nitrogen makes up to 78% of the air whereas oxygen makes 21% of the air and the remaining 01% is occupied by co22, water vapor, argon and other gases.
- In addition to the normal constituents polluted air may also contain some harmful gases such as carbon monoxide, sulphur dioxide, nitrogen oxides, dust, smoke, etc.



Air Pollution

- The air over large cities is contaminated with harmful gases like sulphur dioxide, nitrogen oxides, carbon monoxides, smoke & dust etc. The contamination of air with harmful gases, smoke and dust etc is called as Air Pollution .
- The substance whose presence in the air makes it impure or contaminated is called an Air Pollutant.
- The major pollutants which causes air pollution are sulphur dioxide, nitrogen oxides , carbon monoxides, excess of carbon dioxide, chlorofluorocarbons, and suspended particles.

Causes of Air Pollution

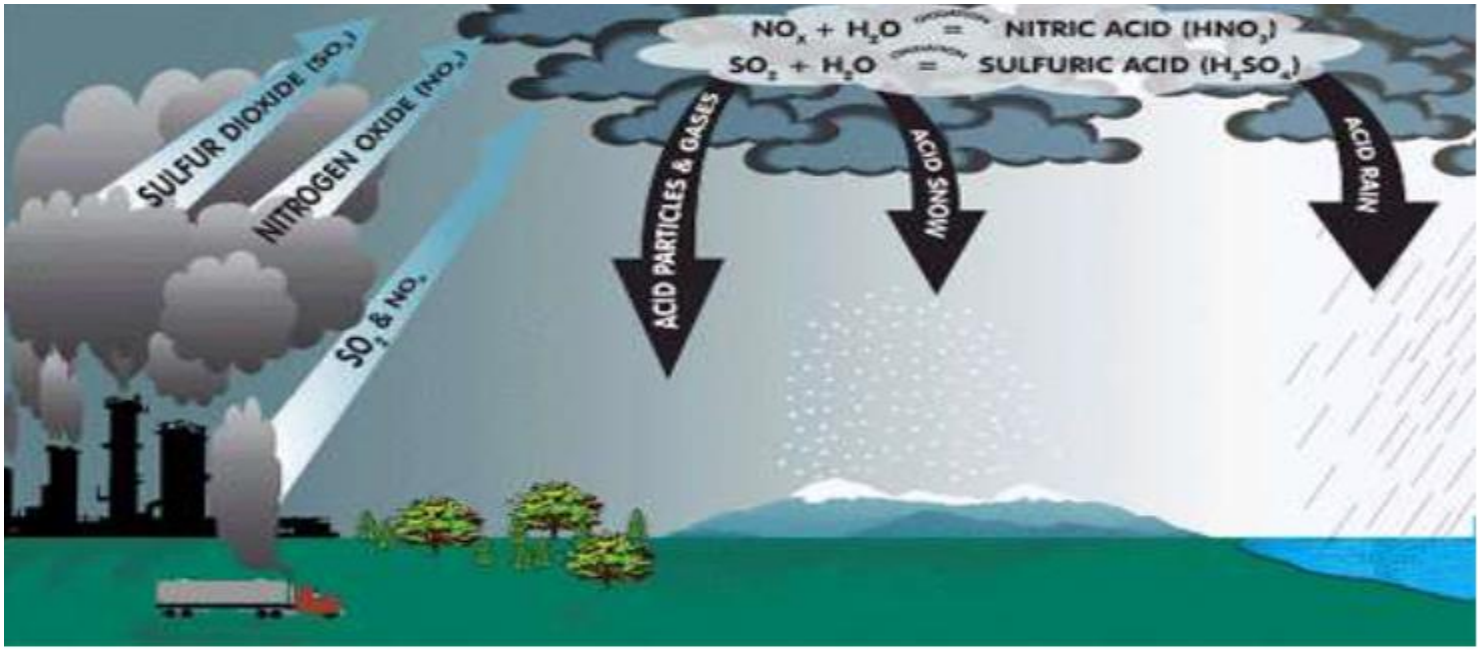
- A cloud of smoke from the exhaust of a vehicle
- Smoke from a factory chimney – Industrial facilities
- Eruption of a volcano
- Cigarette smoke
- Burning Leaves – Forest Fire
- Household combustion devices.

Effects of Air Pollution

- Health problems
- Damage to the environment
- Damage to property
- Thinning of the protective ozone layer of the atmosphere which is leading to climate changes.

Acid Rain

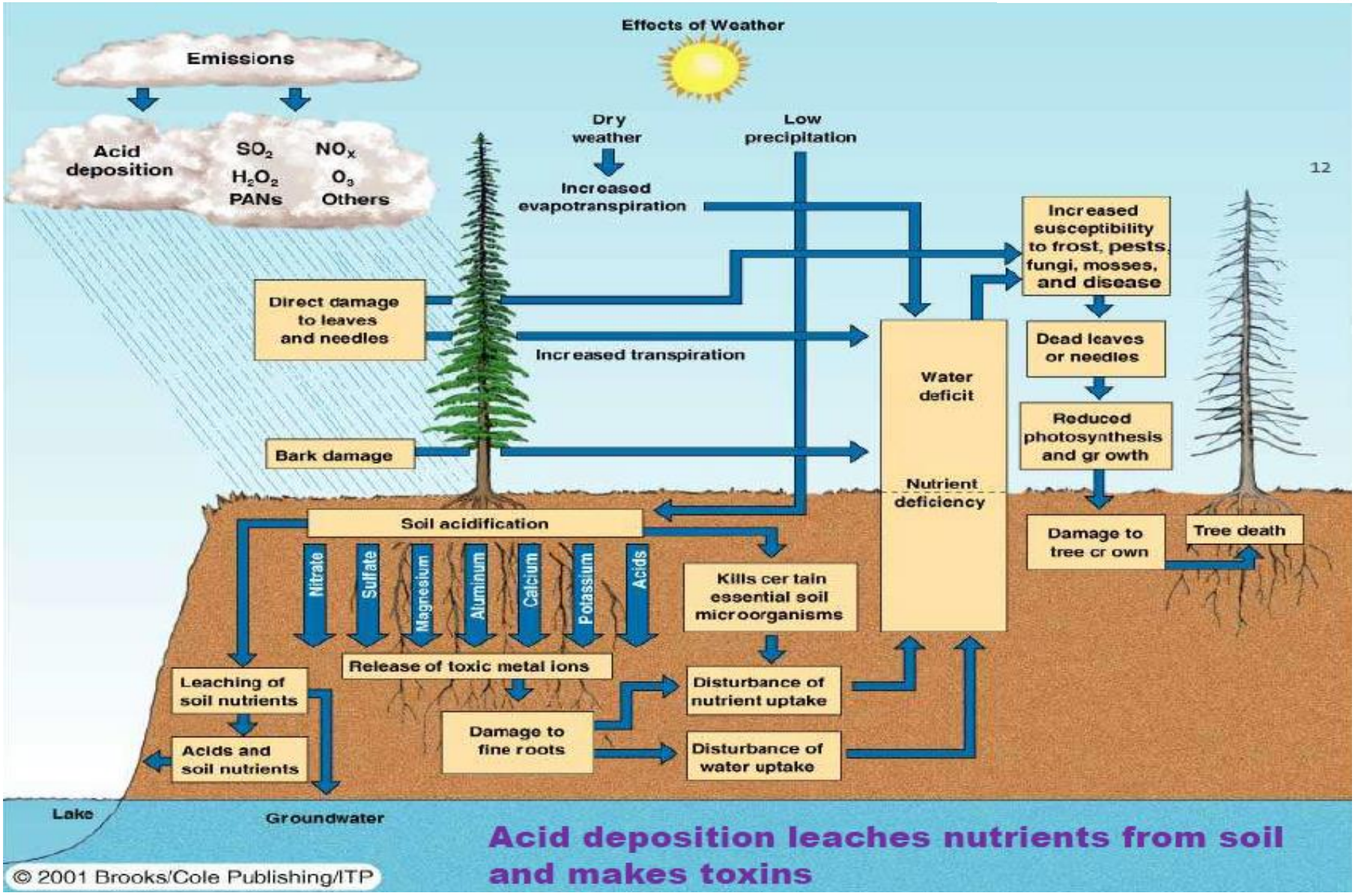
- The poisonous gases like sulphur dioxide and nitrogen oxide that is released by the industries, by burning fossil fuels, by the vehicles, etc go to the atmosphere and pollute it. The sulphur dioxide reacts with the water vapour to form sulphuric acid and the nitrogen oxide reacts with the water vapour to form nitric acid. These acids get dissolved with the rain water and fall to earth in the form of acid rain.



EFFECTS OF ACID RAIN

DIRECT DAMAGES TO LEAVES AND ROOTS

TREES GET WEEKENED AND EATEN BY INSECTS


Effects of Weather
Emissions
Acid deposition
SO_2
H_2O_2
PANs
NO_x
O_3
Others
Dry weather
Low precipitation
Increased evapotranspiration
12
Increased susceptibility to frost, pests, fungi, mosses, and disease
Direct damage to leaves and needles
Increased transpiration
Water deficit
Dead leaves or needles
Reduced photosynthesis and gr owth
Bark damage
Nutrient deficiency
Soil acidification
Damage to tree cr own
Tree death
Nitrate
Sulfate
Magnesium
Aluminum
Calcium
Potassium
Acids
Kills cer tain essential soil micr oorganisms
Release of toxic metal ions
Leaching of soil nutrients
Disturbance of nutrient uptake
Damage to fine roots
Acids and soil nutrients
Disturbance of water uptake
Lake
Groundwater
Acid deposition leaches nutrients from soil and makes toxins
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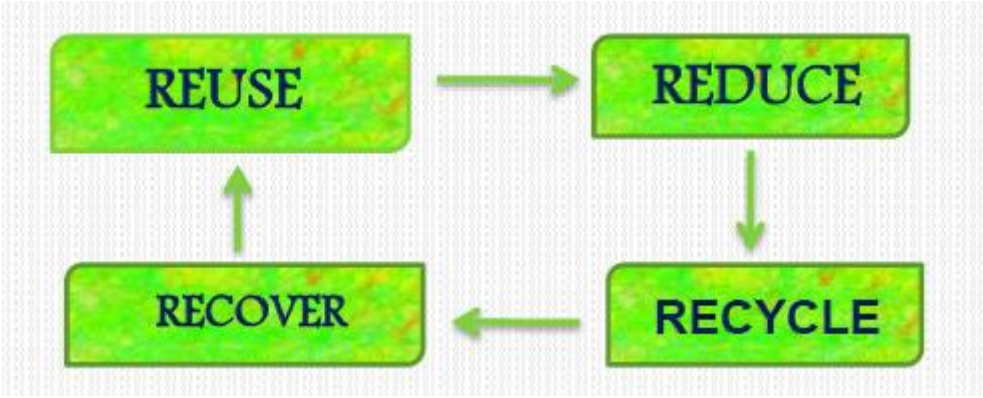
Controlling Air Pollution

- The air pollution can be controlled by using smokeless fuels like LPG, PNG (Piped Natural Gas).
- Solar water heaters should be installed to obtain hot water.
- The air pollution from motor vehicles can be reduced by using CNG (Compressed Natural Gas).
- The air pollution from factories, industries, thermal power stations, oil refineries, etc can be controlled by washing their smoke and waste gases with jets of water.
- The air pollution can be controlled by using non-polluting sources of energy like solar energy, wind energy and hydro energy for generating electricity.

Controlling Air Pollution

- We should not burn dry leaves, papers and garbage in the open.
- We should save electricity.
- We should grow more trees.
- We should use utilize the plastic waste materials in making useful materials.
- We should use bicycle for covering short distances.
- We should use 4R's.




Water Pollution

Water Pollution

- Water pollution is the contamination of water bodies (e.g. lakes, rivers, oceans, aquifers and groundwater).
- Water pollution occurs when pollutants are discharged directly or indirectly into water bodies without adequate treatment to remove harmful compounds.
- Water pollution affects plants and organisms living in these bodies of water.
- In almost all cases the effect is damaging not only to individual species and populations, but also to the natural biological communities

Water Pollutants

- Petroleum hydrocarbons
- Plastics
- Pesticides
- Heavy metals
- Sewage
- Radioactive waste
- Thermal effluents

Water Pollutants

- Detergents
- Chloroform
- Food processing waste, (fats and grease)
- Insecticides and herbicides.
- Petroleum hydrocarbons, (gasoline, diesel fuel, jet fuels, and fuel oil).
- Lubricants (motor oil).
- From stormwater runoff

Preventing Water Pollution

- Conserve water by turning off the tap.
- Mind what you throw down your sink or toilet.
- Don’t throw paints and oils in water channels.
- Use environment friendly household products, such as washing powder, household cleaning agents etc.
- Take great care not to overuse pesticides and fertilizers.
- Don’t throw litter into rivers, lakes or oceans. Help clean up any litter you see on beaches or in rivers and lakes, make sure it is safe to collect the litter and put it in a nearby dustbin.

Treating Polluted Water

- Suspended, solid particles and inorganic material can be removed by the use of filters.
- Use of biological filters and processes can naturally degrade the organic waste material.
- After above two steps chemical additives are supplied to get rid of any left-over impurities.