

Environmental Pollution

Pollution Definition

- **Pollution** is the introduction of contaminants into the natural environment that cause adverse change
- The presence of or introduction into the environment of a substance which has harmful or poisonous effects
- Pollution can take the form of chemical substances or energy, such as noise, heat or light

History of Pollution

- Pollution started from prehistoric times when man created the first fires - humans burnt wood to cook food, the smoke emitted was pollution
- Metal forging - a key turning point in the creation of significant air pollution levels outside the home
- But level of pollution was low and absorbed by earth's natural systems – main pollution from animal waste, household waste, smoke and ash
- With Industrial Revolution, with the invention of machine from printing press to vehicles, the levels and type of pollution rose sharply

Pollutant - Definition

- A pollutant is a waste material that pollutes air, water or soil
- Any substance introduced into the environment that has undesired effects, or adversely affects the usefulness of a resource
- A pollutant may cause long- or short-term damage by changing the growth rate of plant or animal species, or by interfering with human amenities, comfort, health, or property values

Pollutants may be classified by various criteria:

- (1) By the origin: whether they are natural or man-made (synthetic).
- (2) By the effect: on an organ, species, or an entire ecosystem.
- (3) By the properties: mobility, persistence, toxicity.
- (4) By the controllability: ease or difficulty of removal.

Types of Pollutants

- Three factors determine the severity of a pollutant: its **chemical nature, the concentration and the persistence**
- Pollutants are generally grouped under two types:
- **Biodegradable pollutants** – Biodegradable pollutants are broken down by the activity of micro-organisms and enter into the biogeochemical cycles. Examples of such pollutants are domestic waste products, urine and faecal matter, sewage, agricultural residue, paper, wood and cloth etc.
- **Non- Biodegradable pollutants** – Non-biodegradable pollutants have strong chemical bondage, they do not break down into simpler and harmless products. These includes various insecticides and other pesticides, mercury, lead, arsenic, aluminium, plastics, radioactive waste etc.

Types of Pollutants

- **Stock pollutants** - Pollutants, towards which the environment has little or no absorptive capacity are called *stock pollutants* -e.g. persistent synthetic chemicals (through bioaccumulation), non-biodegradable plastics, and heavy metals. Stock pollutants accumulate in the environment over time
- **Fund pollutants** - Fund pollutants are those for which the environment has some absorptive capacity. Fund pollutants do not cause damage to the environment unless the emission rate exceeds the receiving environment's absorptive capacity (e.g. carbon dioxide, which is absorbed by plants and oceans)

Another classification of pollutants is based on its harmful effects –

- Common Elements
- Toxic Elements
- Radioactive Elements

MAJOR TYPES OF POLLUTION

AIR POLLUTION

WATER POLLUTION

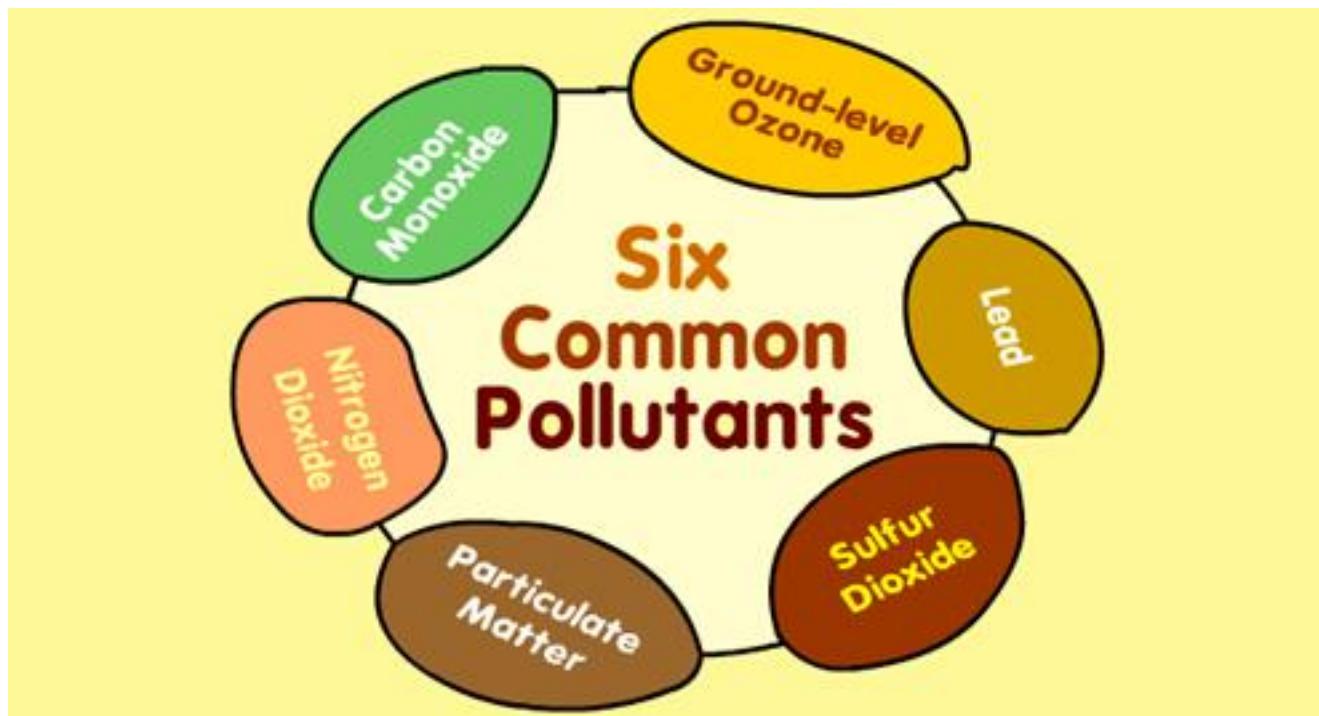
LAND POLLUTION

NOISE POLLUTION

Air Pollution

- Air Pollution is by far the most harmful form of pollution in our environment
- The pollutants for air pollution are divided into two categories
- The first type of pollutants known as **primary pollutants** are those which are produced from a certain process like the smoke emitted from the vehicles
- The second type of pollutants are termed as the **secondary pollutants** and these are the ones which are generated due to the reaction of primary pollutants with natural air

Six Common Pollutants



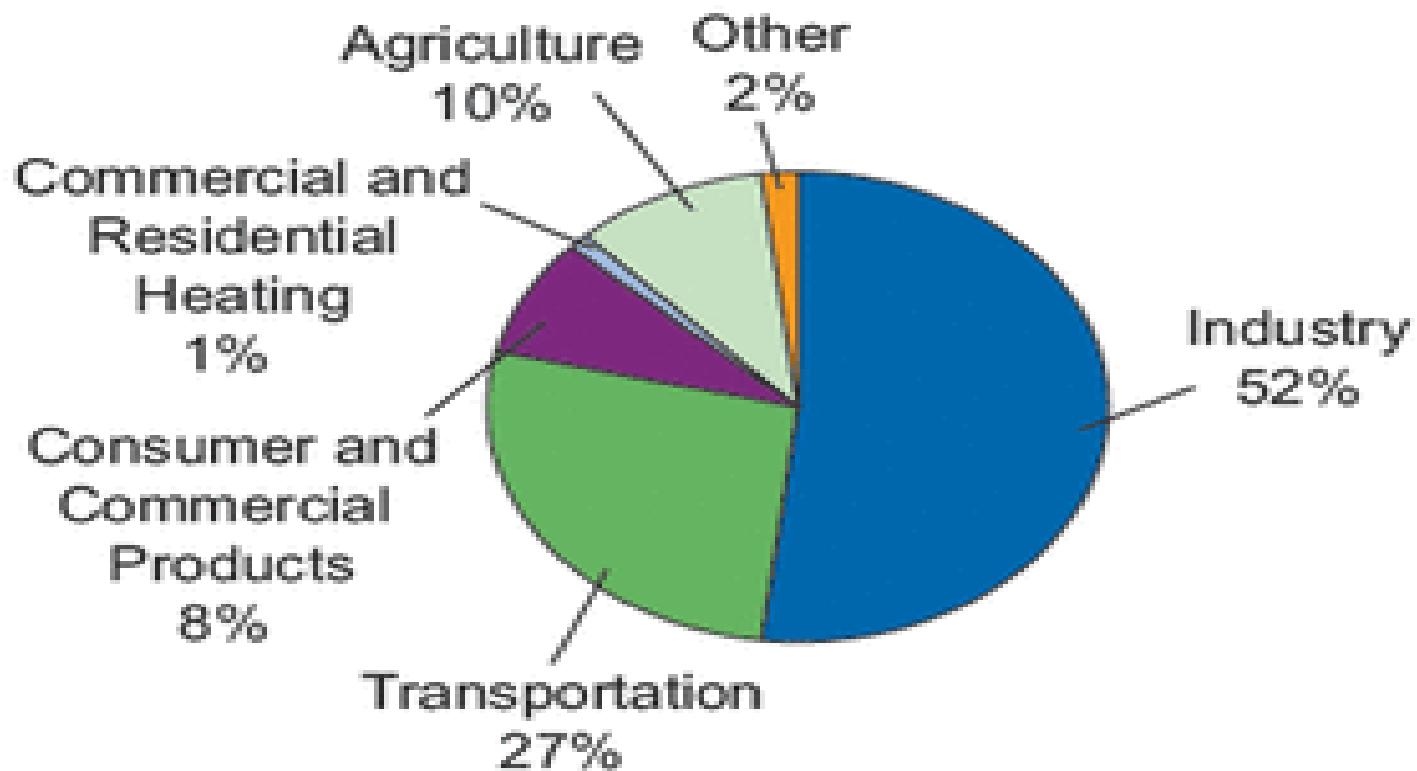
Types of Air Pollutants

- **Primarily air pollutants** can be caused by primary sources or secondary sources. The pollutants that are a direct result of the process can be called primary pollutants
- **Secondary pollutants** are the ones that are caused by the inter mingling and reactions of primary pollutants. Smog created by the interactions of several primary pollutants is known to be as secondary pollutant.

SOURCES OF AIR POLLUTION

- Emissions from Power stations
- Emissions from Industrial Processes
- Vehicular Emissions
- Emissions from Burning of Solid Waste
- Emissions from Natural Sources such as Volcanic Eruptions & Forest Fires

Sources of Emissions of Air Pollutants



Control of air pollution

- Standard for Air
- Laboratory equipment
 - – ambient air monitoring station
 - - portable gas analyser
- Smoke control Action plan

SMOKE CONTROL ACTION PLAN (SCAP)

AIM

**To curb down the number of diesel driven vehicles
emitting black smoke**

- Launched: August 2013
- 2 Main Components:
 - **Enforcement** (road side checks and contraventions of smoky vehicles by Police de L'Environnement)
 - **Sensitization** campaign (TV and radio)

SMOKE CONTROL ACTION PLAN (SCAP)

August 2013 to November 2014

- 198 vehicles contravened
- 104 Prohibition Notices (above 70%)
- 564 PF 71 have been served

SMOKE CONTROL ACTION PLAN (SCAP)



INITIATIVE CONJOINTE:

MINISTÈRE DE L'ENVIRONNEMENT ET DU DÉVELOPPEMENT DURABLE • MINISTÈRE DE L'INFRASTRUCTURE PUBLIQUE,
DE LA NDU, DU TRANSPORT INTÉRIEUR ET DU MARITIME • LA FORCE POLICIERE

Pollutant Standard Index (PSI)

- The **Pollutant Standard Index**, or **PSI**, is a type of air quality index, which is a number used to indicate the level of pollutants in air.
- The **PSI** considers six air **pollutants** - sulphur dioxide , particulate matter (SPM) , fine particulate matter (RSPM) , nitrogen dioxide , carbon monoxide and ozone
- PSI range: 0-50 is good; in Delhi in November 2016 PSI crossed 200 which was very unhealthy; PSI above 300 is hazardous

Air Quality Index		
AQI Category and Color	Index Value	Description of Air Quality
Good Green	0 to 50	Air quality is satisfactory, and air pollution poses little or no risk.
Moderate Yellow	51 to 100	Air quality is acceptable. However, there may be a risk for some people, particularly those who are unusually sensitive to air pollution.
Unhealthy for Sensitive Groups Orange	101 to 150	Members of sensitive groups may experience health effects. The general public is less likely to be affected.
Unhealthy Red	151 to 200	Some members of the general public may experience health effects; members of sensitive groups may experience more serious health effects.
Very Unhealthy Purple	201 to 300	Health alert: The risk of health effects is increased for everyone.
Hazardous Maroon	301 and higher	Health warning of emergency conditions: everyone is more likely to be affected.

Effects of Air Pollution

- Acid rain (formed in the air) destroys fish life in lakes and streams.
- Chlorofluorocarbons (CFC), released from refrigerators, air-conditioners, deodorants and insect repellents cause severe damage to the Earth's environment. This gas has slowly damaged the atmosphere and depleted the ozone layer leading to global warming
- Excessive ultraviolet radiation coming from the sun through the ozone layer in the upper atmosphere which is eroded by some air pollutants, may cause skin cancer in wildlife.

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Water Pollution

- **Water pollution** is the contamination of water bodies e.g. lakes, rivers, oceans, aquifers and groundwater
- This form of environmental degradation occurs when pollutants are directly or indirectly discharged into water bodies without adequate treatment to remove harmful compounds.
- Water pollution affects the entire biosphere

MAJOR WATER POLLUTANTS



- **Organic Contaminants** (Detergents, Herbicides, etc)
- **Inorganic Contaminants** (Heavy Metals, Ammonia, etc)
- **Solid Waste** (Plastics, Paper, Food waste)
- **Thermal Pollution** (Discharge of warm water into water bodies by factories)

SOURCES OF WATER POLLUTION

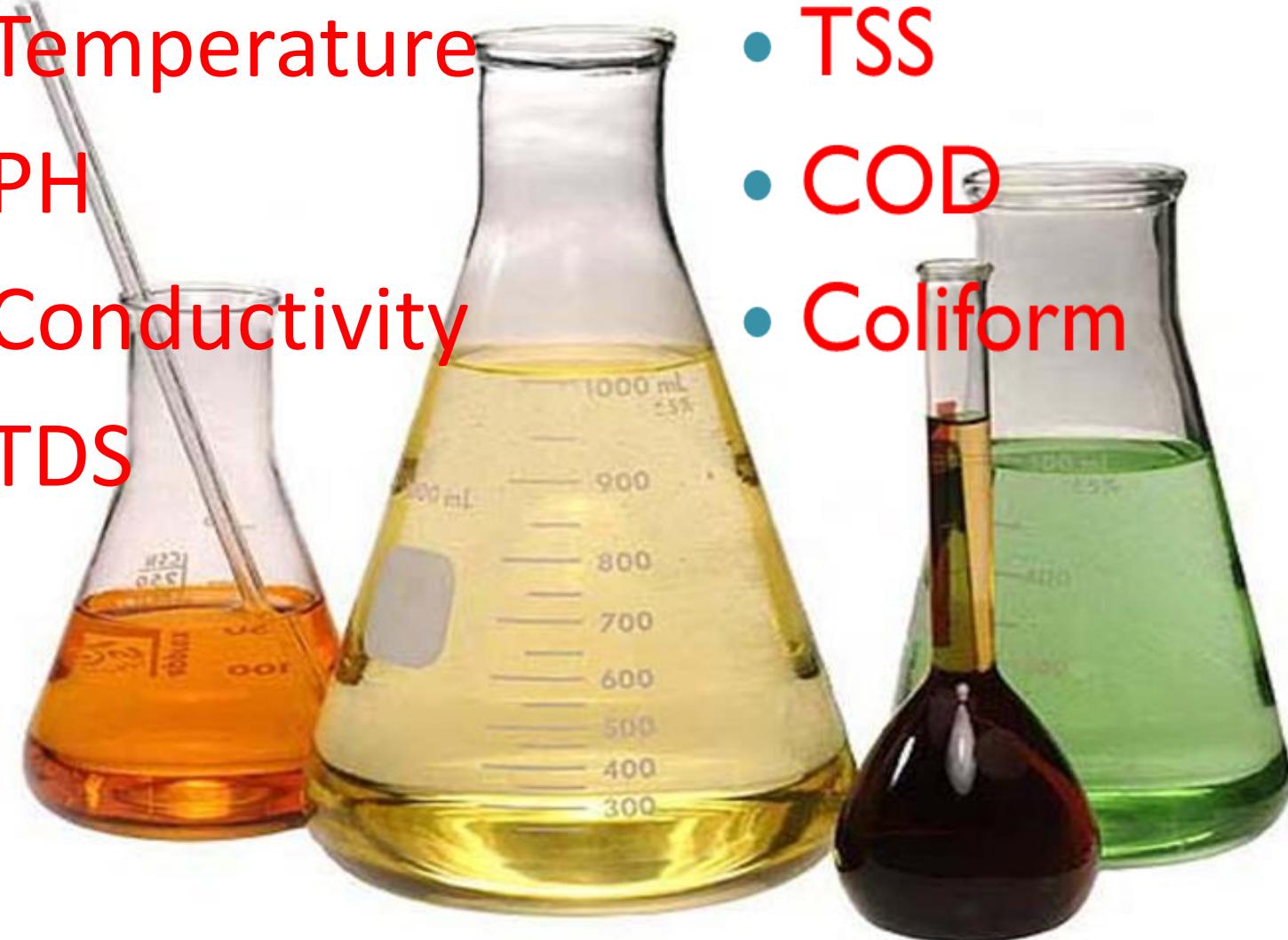
- Sewage
- Runoff of Pesticides & Fertilizers
- Solid Waste Disposal
- Untreated Effluents from Industrial and other activities
- Chemical and Oil Spills

Sampling of Polluted Water By The National Environmental Laboratory



LABORATORY TEST TO DETERMINE WATER QUALITY

- Temperature
- PH
- Conductivity
- TDS
- TSS
- COD
- Coliform





Water Quality Today

- Two Types of Water Pollution
- -Point Source Pollution
 - water pollution that can be traced to a specific origin
 - Discharge via pipes, sewage, and ditches
- -Non-point Source Pollution
 - Pollutants that enter bodies of water over large areas rather than being concentrated at a single point of entry
 - Diffuse, but its cumulative effect is very large
 - Ex: runoff from agricultural fields or parking lots



Types of Water Pollution

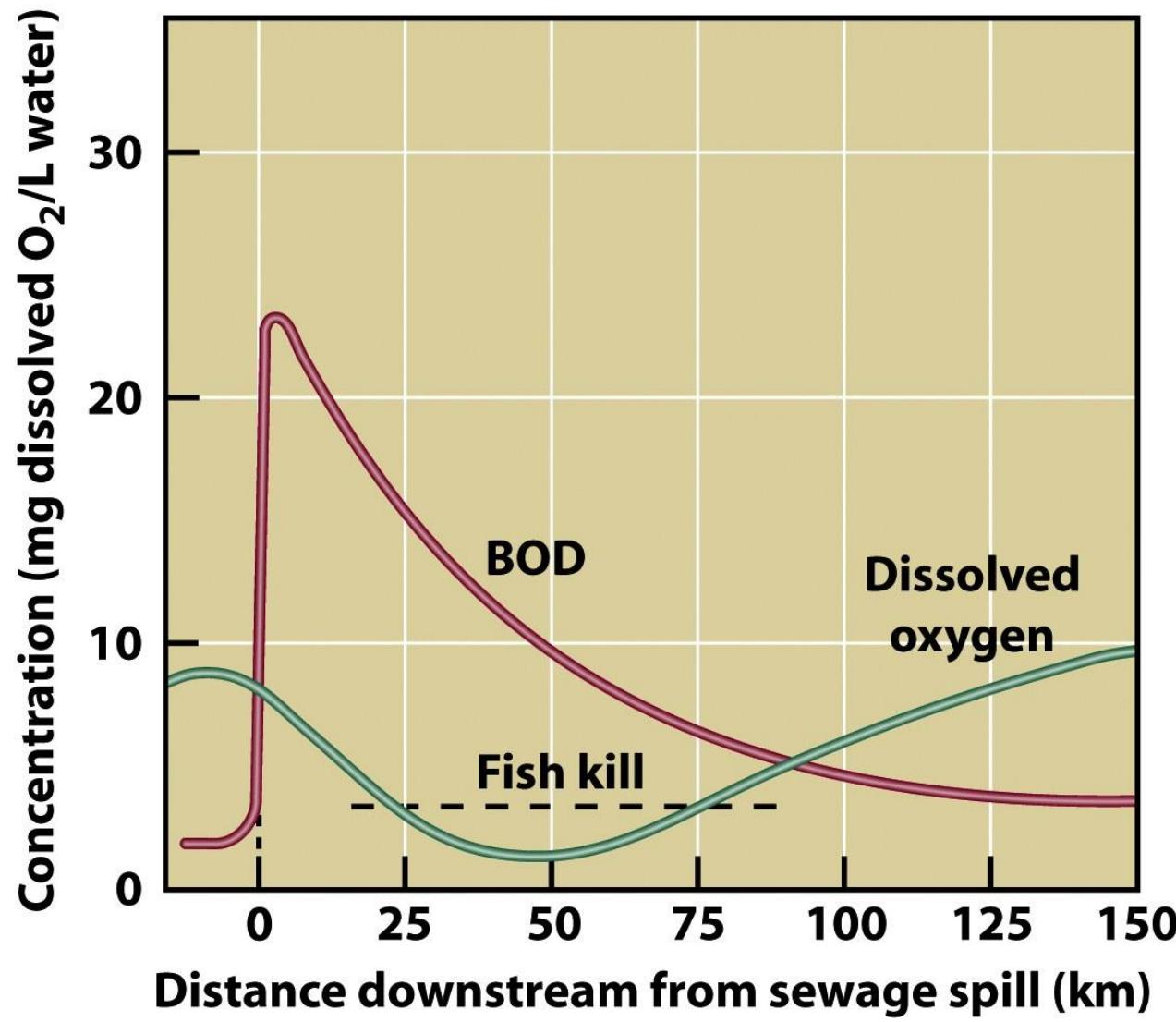
- Water pollution
 - Any physical or chemical change in water that adversely affects the health of humans and other organisms
 - Varies in magnitude and by location
- Major water pollution issue globally
 - Lack of disease-free water
- Eight categories
 - Sewage, disease-causing agents, sediment pollution, inorganic plant and algal nutrients, organic compounds, inorganic chemicals, radioactive substances, and thermal pollution



Sewage

- The release of wastewater from drains or sewers
 - Includes human wastes, soaps, and detergents
- Causes 2 serious environmental problems:
 - Enrichment
 - Fertilization of a body of water by high levels of plant and algal nutrients (nitrogen and phosphorus)
 - Increase in Biological Oxygen Demand (BOD)
 - Amount of oxygen needed by microorganisms to decompose biological wastes
 - As BOD increases Dissolve Oxygen (DO) decreases

Sewage





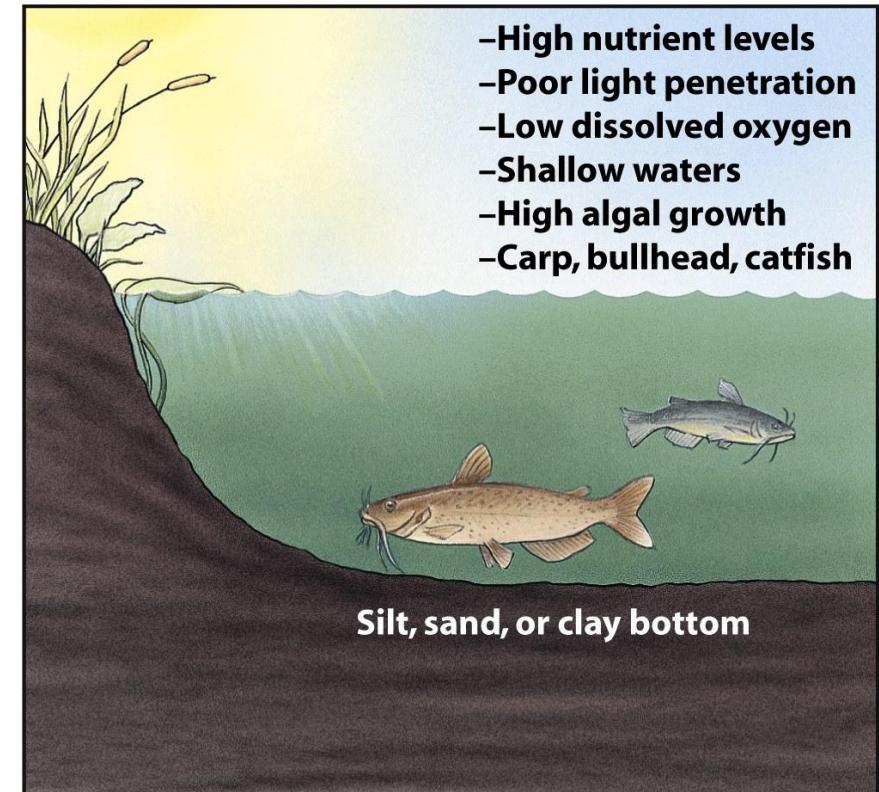
Sewage- Eutrophication

- **Eutrophic-**

- Slow-flowing stream, lake or estuary enriched by inorganic plant and algal nutrients such as phosphorus
- Often due to fertilizer or sewage runoff



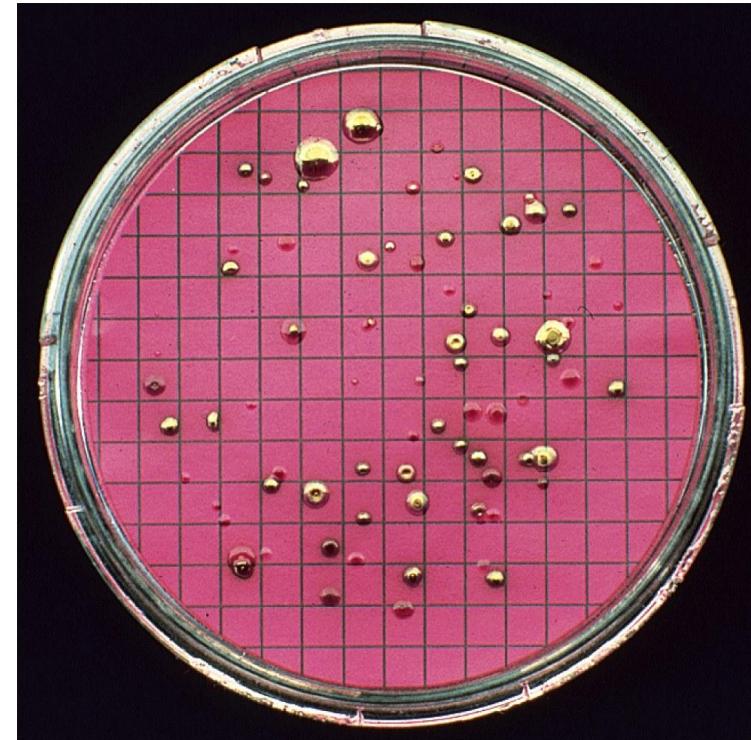
Eutrophic lake





Disease-causing Agents

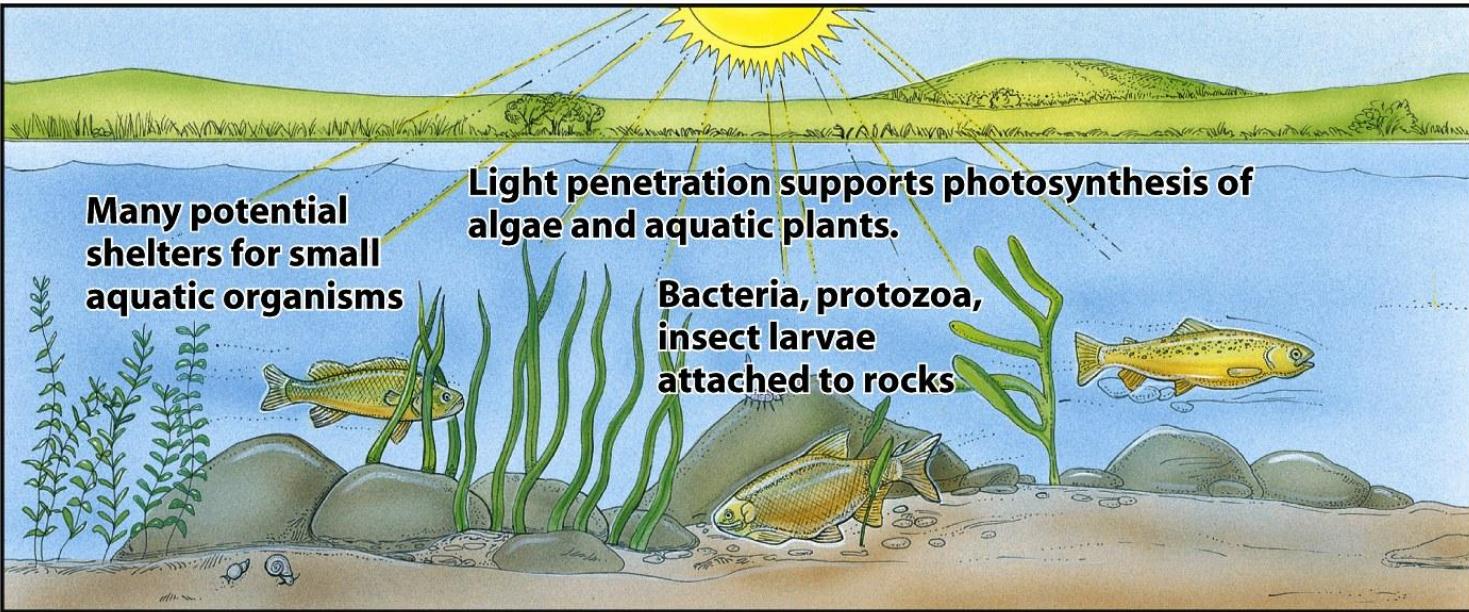
- Monitored by testing for presence of E. coli in the water via a fecal coliform test
 - Indicates the presence of pathogenic organisms



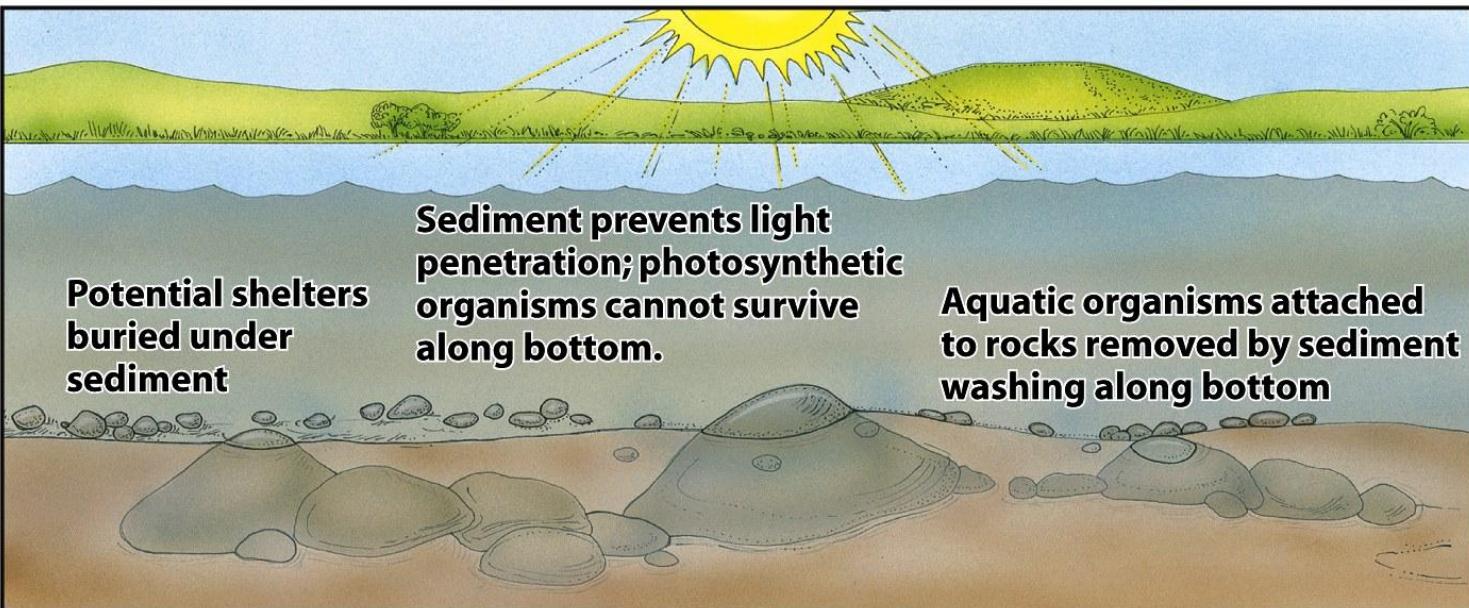


Sediment Pollution

- Excessive amounts of suspended soil particles
 - Originates from erosion of agricultural lands, forest soils exposed by logging, degraded stream banks, overgrazed rangelands, strip mines, and construction
- Problems
 - Limits light penetration
 - Covers aquatic animals and plants
 - Brings insoluble toxins into waterways



Stream ecosystem with low level of sediment



Same stream with high level of sediment



Inorganic Plant and Algal Nutrients



- Chemicals such as nitrogen and phosphorus that stimulate the growth of plants and algae
 - Harmful in large concentrations
- Sources:
 - Human and animal wastes, plant residues, atmospheric deposition, and fertilizer runoff
- Causes:
 - Enrichment, bad odors, and a high BOD



Organic Compounds

- Chemicals that contain carbon atoms
 - Natural examples: sugars, amino acids, and oils
 - Human-made examples: pesticides, solvents, industrial chemicals, and plastics

Table 22.2 Some Synthetic Organic Compounds Found in Polluted Water

<i>Compound</i>	<i>Some Reported Health Effects</i>
Aldicarb (pesticide)	Attacks nervous system
Benzene (solvent)	Associated with blood disorders (bone marrow suppression); leukemia
Carbon tetrachloride (solvent)	Possibly causes cancer; liver damage; may also attack kidneys and vision
Chloroform (solvent)	Possibly causes cancer
Dioxins (TCDD) (chemical contaminants)	Some cause cancer; may harm reproductive, immune, and nervous systems
Ethylene dibromide (EDB) (fumigant)	Probably causes cancer; attacks liver and kidneys
Polychlorinated biphenyls (PCBs) (industrial chemicals)	Attack liver and kidneys; possibly cause cancer
Trichloroethylene (TCE) (solvent)	Probably causes cancer; induces liver cancer in mice
Vinyl chloride (plastics industry)	Causes cancer



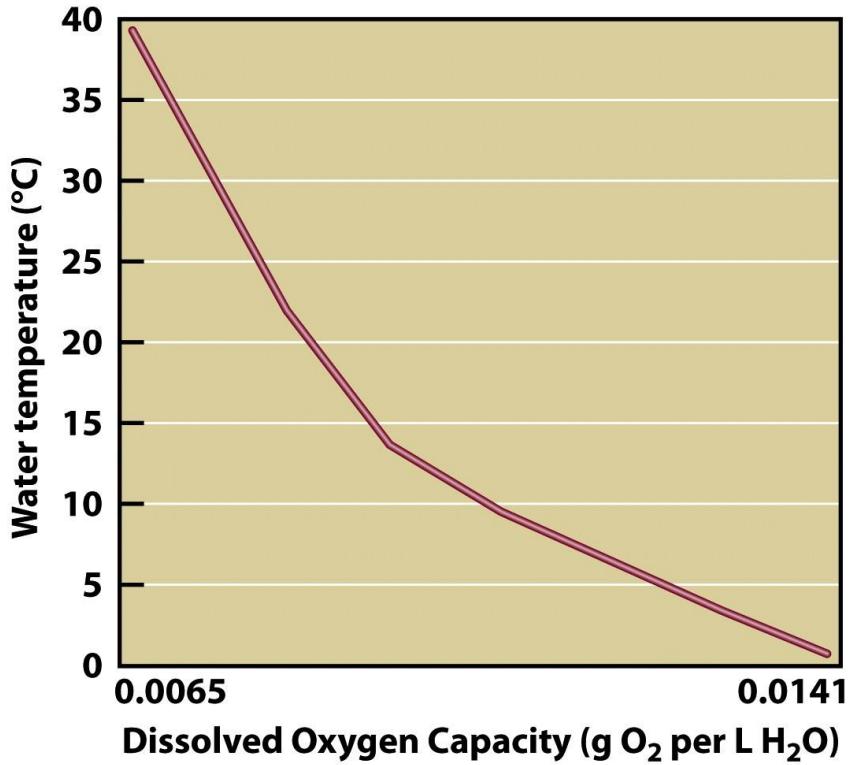
Inorganic Chemicals

- Contaminants that contain elements other than carbon
 - Examples: acids, salts, and heavy metals
- Do not degrade easily
- Lead
 - Found in old paint, industrial pollutants, leaded gasoline
- Mercury
 - Mercury bioaccumulates in the muscles of top predators of the open ocean



Thermal Pollution

- Occurs when heated water produced during industrial processes is released into waterways
- Organisms affected
 - Temperature affects reproductive cycles, digestion rates, and respiration rates
 - Warm water holds less DO than cold water



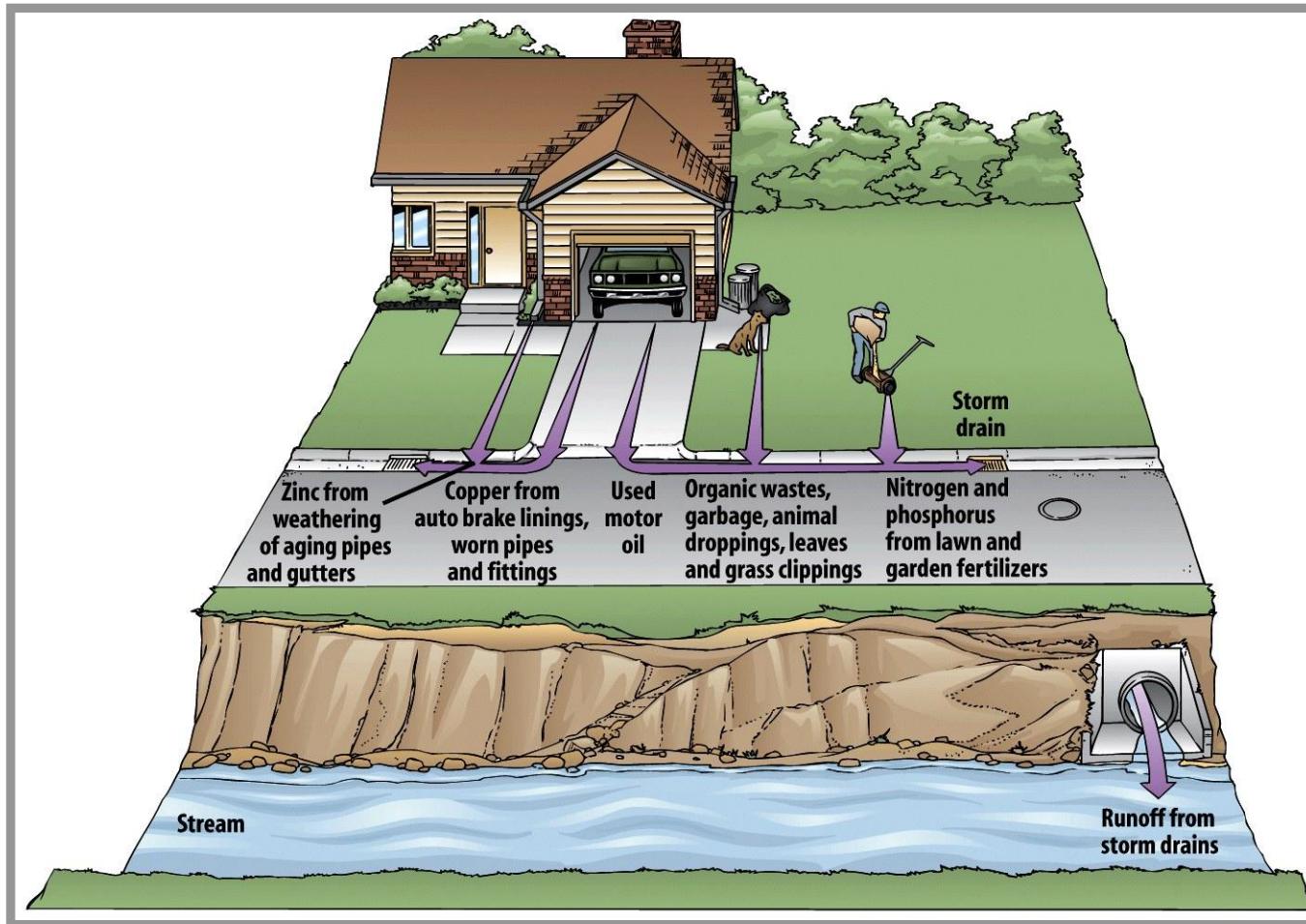


Water Pollution from Agriculture

- Agriculture is leading source of water pollution
 - Animal wastes and plants residues have high BOD
 - Chemical pesticides can leach into groundwater
- Almost all streams and rivers are polluted with agricultural pesticides



Municipal Water Pollution



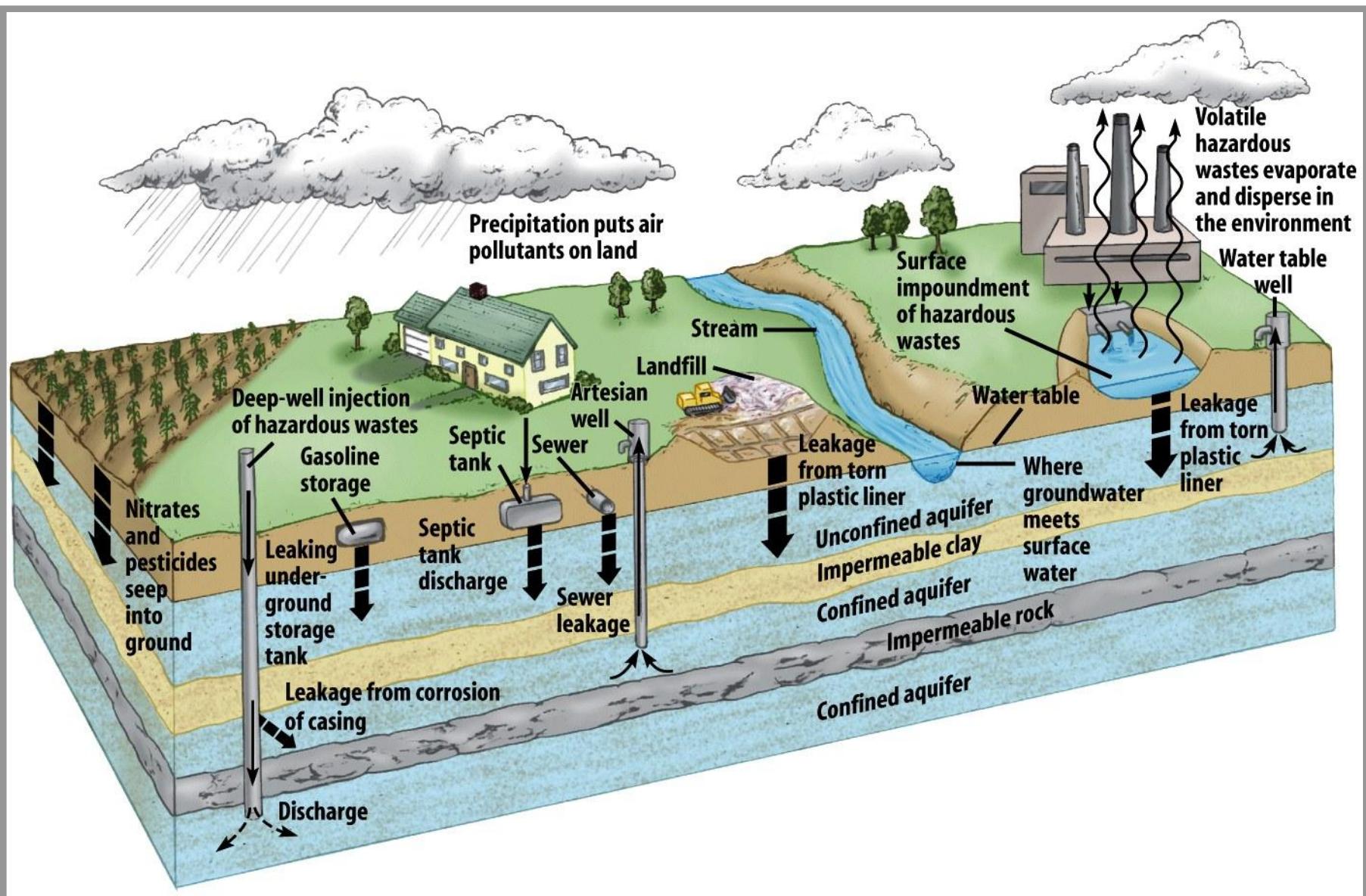


Industrial Wastes in Water



- Different industries generate different pollutants
 - Food processing plants- high BOD
 - Paper mills- High BOD and toxic compounds
- Many industries recover toxins before they go into the waste stream

Groundwater Pollution



- Ganges River, India
 - Used for bathing and washing clothing
 - Sewage and industrial waste discharged into river
 - Ganga Action Plan initiated by government
 - Construction of 29 sewage treatment plants



Effects of Water Pollution

- Disease causing agents are transmitted through polluted water. Eg- Hepatitis. Poliomyelitis, etc.
- Heavy metals cause adverse impacts on vital body organs such as kidney, liver etc.
- Heavy metals and toxic elements undergoes bioaccumulation through food chain.
- Nutrients such as nitrites and phosphates from domestic sewage and agricultural runoff cause nutrient enrichment of water body, thus Eutrophication.

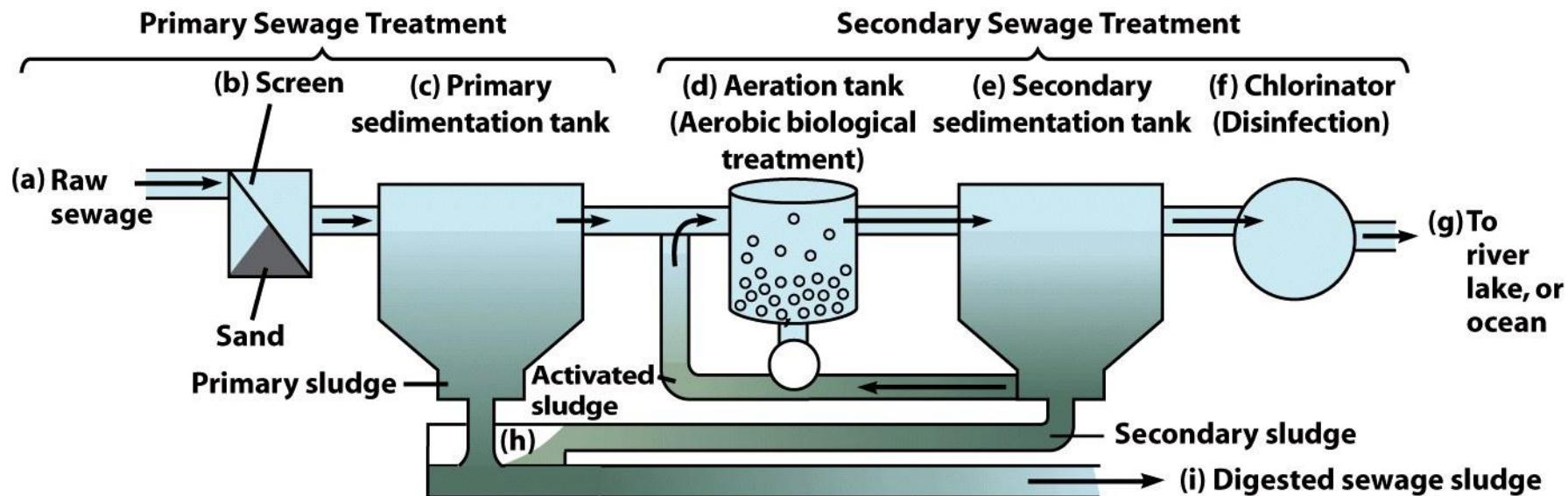
- Oil spills in water adversely affect the aquatic life, birds, fishes etc.
- Radioactive waste accumulates in plants, animals and human body and leads to genetic damages, mutation and mortality.
- Hot water from thermal power plans and cooling tower increases temperature of water body.

Water Pollution – Control Measures

- 1) Sewage Treatment - In urban areas of developed countries, domestic sewage is typically treated by centralized sewage treatment plants
- 2) Industrial Wastewater treatment – Effluent treatment plants

Municipal Sewage Treatment

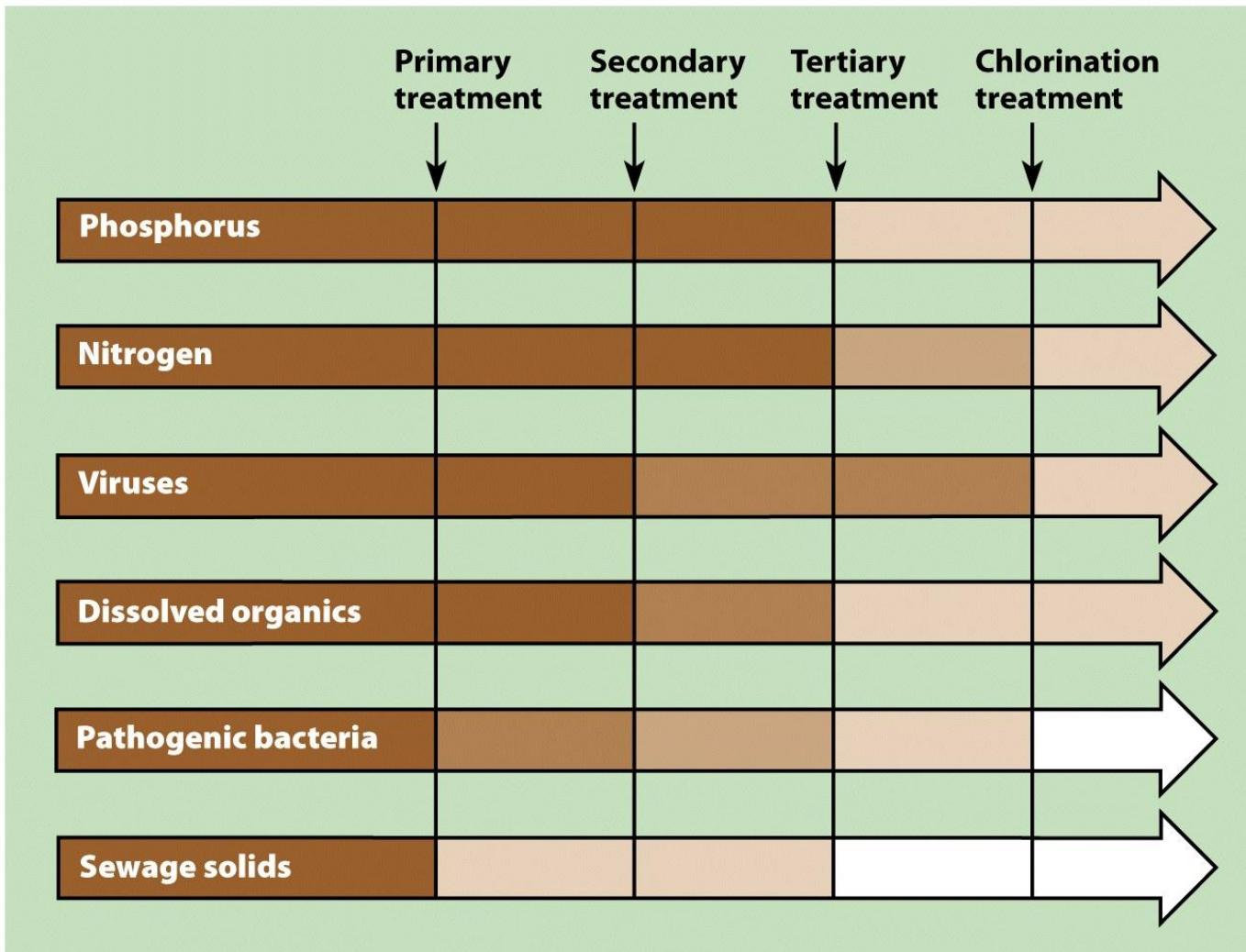
- Primary treatment
 - Removing suspended and floating particles by mechanical processes
- Secondary treatment
 - Treating wastewater biologically to decompose suspended organic material; reduces BOD



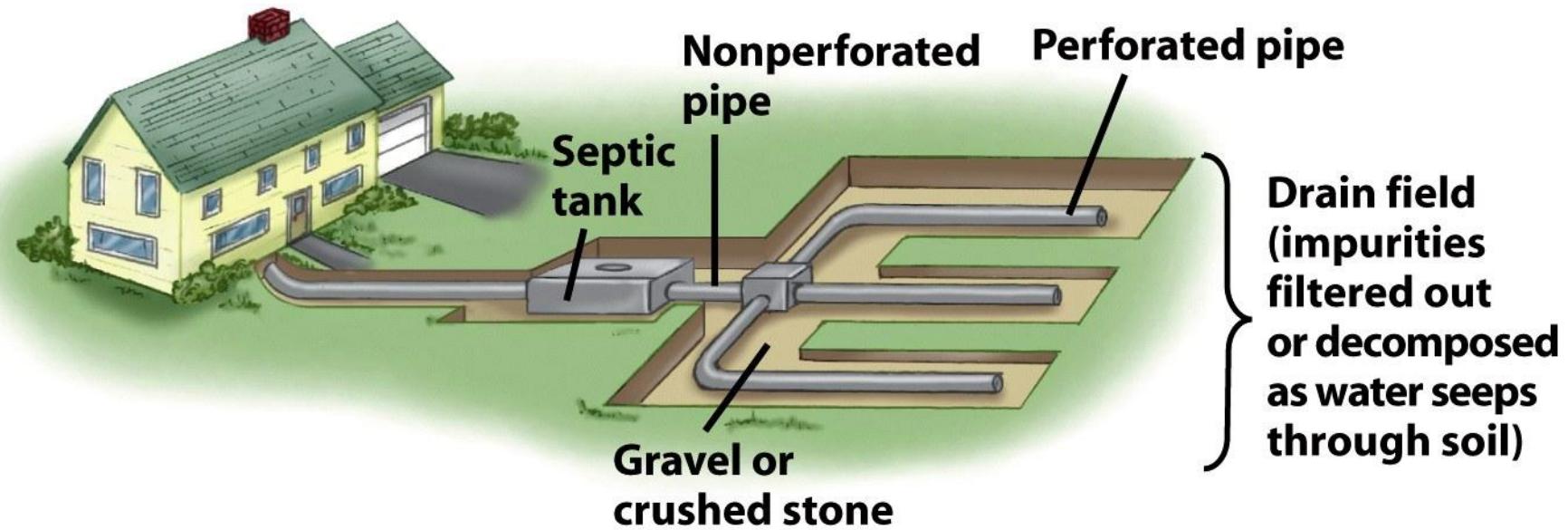
Municipal Sewage Treatment

- Sewage Sludge
 - Solids remaining after primary and secondary sewage treatment has been completed
- Tertiary treatment
 - Advanced wastewater treatment methods that are sometimes employed after primary and secondary treatments
 - Reduce phosphorus and nitrogen

Municipal Sewage Treatment



Individual Septic System- Drain Field



Laws Controlling Water Pollution

- Citizen Watchdogs to Monitor Pollution
- Safe Drinking Water Act (1974)
 - Set uniform federal standards for drinking water
 - Maximum contaminant level
- Clean Water Act (1972)
 - EPA sets up and monitors National Emissions Limitations
 - Effectively improved water quality from point sources

Laws that Protect Groundwater

- Safe Drinking Water Act
- Resource, Conservation and Recovery Act

Marine Pollution

- **Marine pollution** occurs when harmful, or potentially harmful, effects result from the entry into the ocean of chemicals, particles, industrial, agricultural and residential waste, noise, or the spread of invasive organisms
- Marine pollution includes a range of threats including from land-based sources, oil spills, untreated sewage, heavy siltation, eutrophication (nutrient enrichment), invasive species, persistent organic pollutants (POP's), heavy metals from mine tailings and other sources, acidification, radioactive substances, marine litter, overfishing and destruction of coastal and marine habitats

Marine Pollution Causes

- **3 main types of inputs of pollution into the ocean:** direct discharge of waste into the oceans, runoff into the waters due to rain, and pollutants that are released from the atmosphere
- When pesticides , toxic metals are incorporated into the marine ecosystem, they quickly become absorbed into marine food webs
- Oil spills can have devastating effects. While being toxic to marine life, polycyclic aromatic hydrocarbons (PAHs) found in crude oil, are very difficult to clean up, and last for years in the sediment and marine environment
- Deep sea mining

Marine Eutrophication

- Effect of Eutrophication on marine life
- Eutrophication is an increase in chemical nutrients, typically compounds containing nitrogen or phosphorus, in an ecosystem
- It can result in an increase in excessive plant growth and decay of the ecosystem due to lack of oxygen
- Results in severe reductions in water quality, fish, and other animal populations

Marine Pollution : Acidification

- The oceans are normally a natural carbon sink, absorbing carbon dioxide from the atmosphere
- Because the levels of atmospheric carbon dioxide are increasing, the oceans are becoming more acidic
- Oceans and coastal ecosystems play an important role in the global carbon cycle and have removed about 25% of the carbon dioxide emitted by human activities
- Rising ocean temperatures and ocean acidification means that the capacity of the ocean carbon sink will gradually get weaker

Land Pollution

- **Land pollution** is any type of destruction of the Earth
- It can either occur naturally or as a result of human activities, such as industrial development, agricultural development, coal mining, deforestation and overcrowded landfills
- Natural factors: The natural factors that **cause soil** erosion includes volcanic eruptions, changes in rainfall pattern, earthquakes, topographic changes, wind and glacier movements.

SOURCES OF LAND POLLUTION

- Domestic Solid Waste (Garbage, Rubbish, Trash)
- Construction and Demolition Waste
- Agricultural Waste
- Industrial Waste

Land Pollution

Humans produce vast quantities of waste

- Domestic waste
- Toxic Waste
- Radioactive waste
- Industrial waste - mining
- Agricultural waste

Effects of Land Pollution

- Soil Erosion
- Low yields
- Desertification
- Less land for cultivation

Noise Pollution

- **Noise pollution** or **noise disturbance** is the disturbing or excessive noise that may harm the activity or balance of human or animal life
- Noise pollution is a major problem in India. The government of India has rules & regulations against firecrackers and loudspeakers, but enforcement is extremely lax
- It is measured in the units of decibels and is denoted by the dB. The noise which is more than 115 dB is intolerant
- The industrial limit of sound in the industries must be 75 dB according to the world health organization. A type writer can produce a sound of 60 dB

Causes of Noise Pollution

- Industrial activity
- Poor Urban Planning
- Transportation and Construction
- Social Events
- Household Gadgets

SOURCES OF NOISE POLLUTION

- Industrial (power plants, stone crushing, metal workshops, cabinet making);
- Multipurpose halls including wedding halls;
- Bungalows along the coast;
- Places of entertainment, including night clubs;
- Road traffic e.g. moving trucks, automobiles, buses, especially those with modified silencer system;
- Community noise e.g. radio/TV, loudspeakers, pool houses and alarms;
- Animals e.g. dogs, cats, crows;
- Use of loud speaker, amplifier, musical instrument, electrical or mechanical device for religious activities;
- Aircrafts and speed boats;
- Neighbourhood;
- Machinery (generator sets, compressors, air conditioning units, boilers, pumps, motors);
- Others, including construction works, road infrastructural works, public gathering, vibration, ice cream sellers, vendor shouts.



too much noise

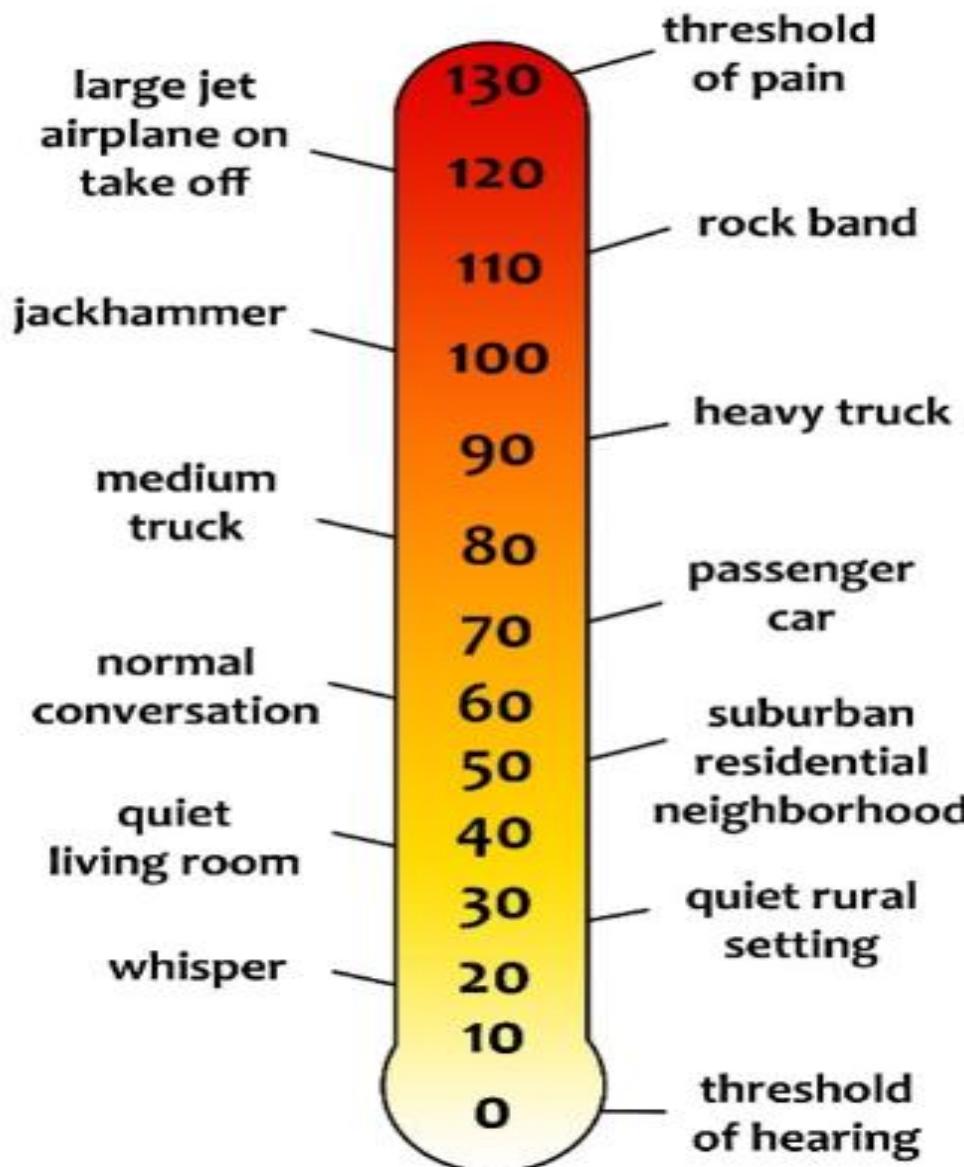
Effects of Noise Pollution

- Hearing Problems
- Sleeping Disorders
- Cardiac problems
- Effect on Wild life

HEALTH EFFECTS OF NOISE POLLUTION

- ◆ Hearing Loss (including occupational hearing loss)
- ◆ Stress
- ◆ High Blood pressure
- ◆ Sleep Loss
- ◆ Distraction
- ◆ Productivity Loss
- ◆ Cause Irritability,
- ◆ headache
- ◆ Annoying and interfere with communications.

Decibel Scale (dBA)



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

NOISE CONTROL MEASURES

An integrated approach is adopted towards noise pollution control through:

- Mass sensitization;
- Enforcement of the existing Noise Regulations;
- Use of Noise Abatement Technologies;
- Research in Novel Technologies;

A Sound Level Meter (SLM) is used to measure Noise levels



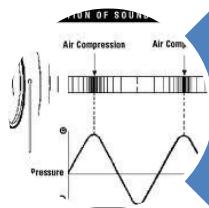
NOISE ABATEMENT TECHNOLOGIES



Installation of barriers between the noise source and the receiver



Use of acoustics in the design of building such as double glazing



Installation of panels or enclosures



Green belt development such as the attenuation of sound levels by plantation of trees and shrubs can

Soil Pollution



- Soil contamination or soil pollution is caused by the presence of xenobiotic (human-made) chemicals or other alteration in the natural soil environment.
- Contamination is correlated with the degree of industrialization and intensity of chemical usage
- Developing countries tend to be less tightly regulated

Causes of Soil Pollution

- Corrosion of underground storage tanks.
- Application of pesticides and fertilizers.
- Mining
- Oil and fuel dumping
- Disposal of coal ash
- Leaching from landfills
- Direct discharge of industrial wastes to the soil
- Drainage of contaminated surface water into the soil

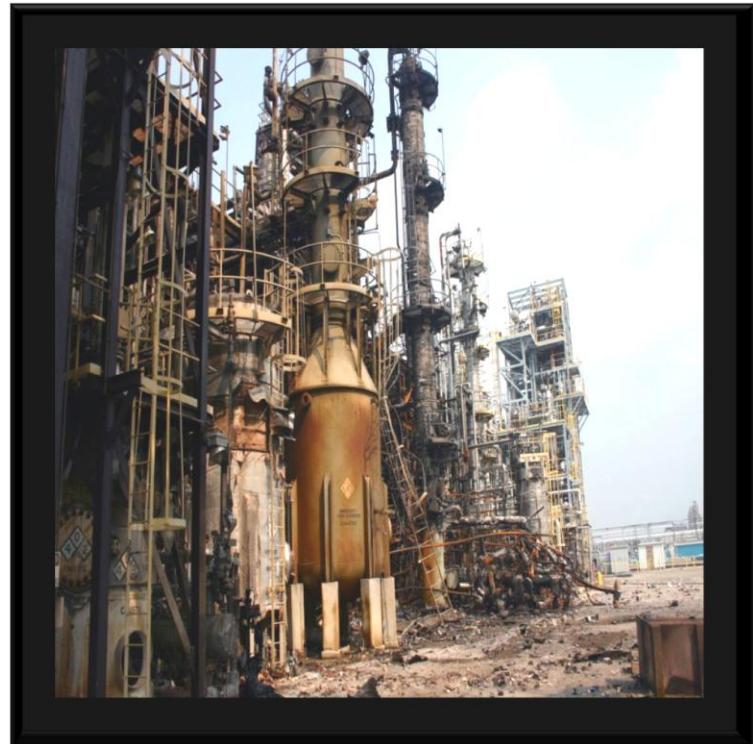
Human Influence



- Soil pollution starts with the flawed concept of throwing trash on the side of a road and throwing out your dustbin on the road.
- Besides the tons household plastic, industrial dumping of man-made chemicals is also done.
- not just restricted to developing countries, but highly developed and advanced countries as well.
- Agricultural advancement has also played a part in laying many a green pastures barren.

Soil pollution facts

- Soil is a non-renewable resource with more potential to degrade.
- Most countries have very little control over soil pollutant dumping.
- Developed and developing countries have now put a major legal framework and clean-up program in place, to deal with soil pollution.



Soil Pollution Solutions

- Reduction of Acid Rain

Sulfur dioxide emissions can cause acid rain and forest destruction.

- Reduce Waste

Consider the amount of needlessly generated waste.

- Improve Agricultural practices

- Wetland Restoration

Help restore polluted wetlands.

- Reduction of Human Impact

Finally, simply reduce your negative impact on the environment.



What is Thermal Pollution?

- Increase in the normal temperatures of natural waters caused by intervention of human activities.

Major Causes

- Nuclear power plants
- Hydro-electric power
- Coal fired power plants
- Industrial waste
- Deforestation
- Soil erosion
- Burning of fossil fuels

Coal Fired power plants

- Coal used as fuel
- Condenser coils cooled with water from nearby lake/ river
- Heated effluents decrease DO of water
- Damages marine organisms

Industrial Waste

- Discharged water from steam electric power industry using turbo generators
- Temperature of receiving water increases by 6-9°C

Deforestation

- The decrease in vegetation increases the amount of light that hits the water, which increases the temperature of the water
- Deforestation also increases erosion

Soil Erosion

- Erosion makes the water muddy, which increases the light absorbed

Effects of Increased Water Temperature

- Thermal shock

Aquatic life adapted to a certain water temperature can go into shock when the temp. is changed even 1 or 2 degrees.

- Oxygen dissolved in water decreases
- Increases the rate of photosynthesis, which increases the amount of plant growth
- Increases the metabolic rate of fish, which increases their need for oxygen

Possible Solutions

- Energy chips that converts excess heat into electricity
- Desalination plants
- Less nuclear power
- End shoreline deforestation
- Prevent soil erosion

Control measures

- Cooling towers: A tower like device in which atmospheric air circulates and cools warm water, generally by direct contact (evaporation).
- Cooling ponds: The pond receives thermal energy in the water from the plant's condensers and the energy is dissipated mainly through evaporation. Once the water has cooled in the pond, it is reused by the plant. New water is added to the system ("make-up" water) to replace the water lost through evaporation.

Control measures

- Spray ponds: An arrangement for cooling large quantities of water in open reservoirs or ponds; nozzles spray a portion of the water into the air for the evaporative cooling effect.
- Artificial lakes as reservoirs
- Cogeneration: a process where waste heat is recycled for domestic and/or industrial heating purposes.

Pollution Control

- Pollution control is a term used in environmental management
- It means the control of emissions and effluents into air, water or soil
- Pollution prevention and waste minimization are more desirable than pollution control

Pollution Control Practices :

- Recycling
- Reusing
- Waste minimisation
- Mitigating
- Preventing
- Composting

Polluter Pays Principle

- Around 300 BC, **Kautiliya** in his *Arthashastra* prescribed different levels of financial penalties for causing harm to the environment
- *If anyone intentionally spoils the water of another ... let him not only pay damages, but purify the stream or cistern which contains the water.* **Plato, Greek Philosopher**
- The polluter pays principle underpins environmental policy such as an **ecotax**, which, if enacted by government, deters and essentially reduces greenhouse gas emissions

Central Pollution Control Board

- The **Central Pollution Control Board (CPCB)** of India is a statutory organisation under the Ministry of Environment, Forest and Climate Change;
- Established in 1974
- CPCB conducts environmental assessments and research. It is responsible for maintaining national standards under a variety of environmental laws, in consultation with zonal offices, tribal, and local governments
- It has responsibilities to conduct monitoring of water and air quality, and maintains monitoring data

Some Facts & Figures

Table 6.34 - No. of complaints received at the Pollution Prevention and Control Division by category, 2004 - 2013

Category	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Noise	444	342	178	135	157	123	160	170	131	150
Solid waste	177	201	137	88	49	136	118	127	100	93
Air pollution	129	154	61	62	57	57	76	96	105	120
Waste water	180	289	92	76	84	72	77	84	71	82
Odour	328	272	121	88	102	88	128	77	79	79
Other ¹	447	215	224	119	147	46	63	177	176	163
Total	1,705	1,473	813	568	596	522	622	731	662	687

Source: Ministry of Environment & Sustainable Development

¹ includes backfilling, erosion, illegal construction, objections to projects, law and order, land conversion, land reclamations, landslides etc

Some Facts & Figures

Distribution of Pollution-Related Complaints Received at the Ministry of Environment in 2014



ROLE OF THE POLLUTION PREVENTION & CONTROL (PPC) DIVISION

The PPC Division attends all environmental complaints received at the Ministry and works in close coordination with the Post-EIA Division, the ICZM Division and the Police.

Major types of environmental complaints addressed includes pollution issues related to **air, noise, water, solid waste and odour**.

Complaints are usually handled via a mechanism called the **Complaint-Handling Protocol**.

Enforcing Agencies

Enforcing Agency	Sphere of Responsibility / Pollution medium
Ministry of Health	Noise, Sanitary, Quality Control Of Drinking Water And Odour Nuisances
Ministry of Agro Industry	Pesticide Residue, Soil And Compost
Ministry of Fisheries	Waters In The Coastal Zone, Other Than Waters In The Port
Port Master	Waters In The Port
Wastewater Management Authority	Effluents
Water Resources Unit	inland waters (rivers, rivulets, dams etc..)

Enforcing Agencies

Enforcing Agency	Sphere of Responsibility / Pollution medium
Ministry of Local Government	solid wastes and hazardous wastes
Local Authority	<p>Cleaning of barelands</p> <p>Removal of bulky wastes</p> <p>Cleaning of drains & canals</p> <p>Issue of building and land use permit, trade license etc</p>

Enforcement tools

- Programme Notice
- Enforcement Notice
- Prohibition Notice
- Stop Order
- Eyesore abatement Notice
- Fixed penalty



Waste Management

What are Wastes?

- **Waste** (also known as **rubbish, trash, refuse, garbage, junk, litter**) is unwanted or useless materials. In biology, waste is any of the many unwanted substances or toxins that are expelled from living organisms, metabolic waste; such as urea and sweat.

Basel Convention Definition of Wastes

“Substances or objects which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of the law”

Disposal means

“Any operation which may lead to resource recovery, recycling, reclamation, direct re-use or alternative uses”

According to EPA regulations, SOLID WASTE is

- Any garbage or refuse (Municipal Solid Waste)
- Sludge from a wastewater treatment plant, water supply treatment plant, or air pollution control facility
- Other discarded material
- Solid, liquid, semi-solid, or contained gaseous material from industrial, commercial, mining, and agricultural operations, and from community activities

Types of Wastes

- **Solid wastes:** Wastes in solid forms, domestic, commercial and industrial wastes

Examples: Plastics, containers, bottles, cans, papers, scrap iron, and other trash

- **Liquid Wastes:** Wastes in liquid form

Examples: domestic washings, chemicals, oils, waste water from ponds, manufacturing industries and other sources

Classification of Wastes according to their Properties

- **Bio-degradable**
can be degraded (paper, wood, fruits and others)
- **Non-biodegradable**
cannot be degraded (plastics, bottles, old machines,cans, styrofoam containers and others)

Classification of Wastes according to their Effects on Human Health and the Environment

- Hazardous Wastes**

Substances unsafe to use commercially, industrially, agriculturally, or economically and have any of the following properties- ignitability, corrosivity, reactivity & toxicity.

- Non-hazardous Wastes**

Substances safe to use commercially, industrially, agriculturally, or economically and do not have any of those properties mentioned above.

Classification of wastes according to their origin and type

- **Municipal Solid wastes:** Solid wastes that include household garbage, rubbish, construction & demolition debris, sanitation residues, packaging materials, trade refuges etc. are managed by any municipality.
- **Bio-medical wastes:** Solid or liquid wastes including containers, intermediate or end products generated during diagnosis, treatment & research activities of medical sciences.
- **Industrial wastes:** Liquid and solid wastes that are generated by manufacturing & processing units of various industries like chemical, petroleum, coal, metal gas , paper etc.
- **Agricultural wastes:** Wastes generated from farming activities. These substances are mostly biodegradable.

- **Fishery wastes:** Wastes generated due to fishery activities. These are extensively found in coastal & estuarine areas.
- **Radioactive wastes:** Waste containing radioactive materials. Usually these are byproducts of nuclear processes. Sometimes industries that are not directly involved in nuclear activities, may also produce some radioactive wastes, e.g. radio-isotopes, chemical sludge etc.
- **E-wastes:** Electronic wastes generated from any modern establishments. They may be described as discarded electrical or electronic devices.

MAGNITUDE OF PROBLEM: Indian scenario

- Per capita waste generation increasing by 1.3% per annum
- With urban population increasing between 3 – 3.5% per annum
- Yearly increase in waste generation is around 5% annually
- India produces more than 42.0 million tons of municipal solid waste annually.
- Per capita generation of waste varies from 200 gm to 600 gm per capita / day.

SOURCES OF HUMAN EXPOSURES

Exposures occurs through

- Ingestion of contaminated water or food
- Contact with disease vectors
- Inhalation
- Dermal

Waste hierarchy

Waste hierarchy refers to 3 R's

Reduce, Reuse, Recycle

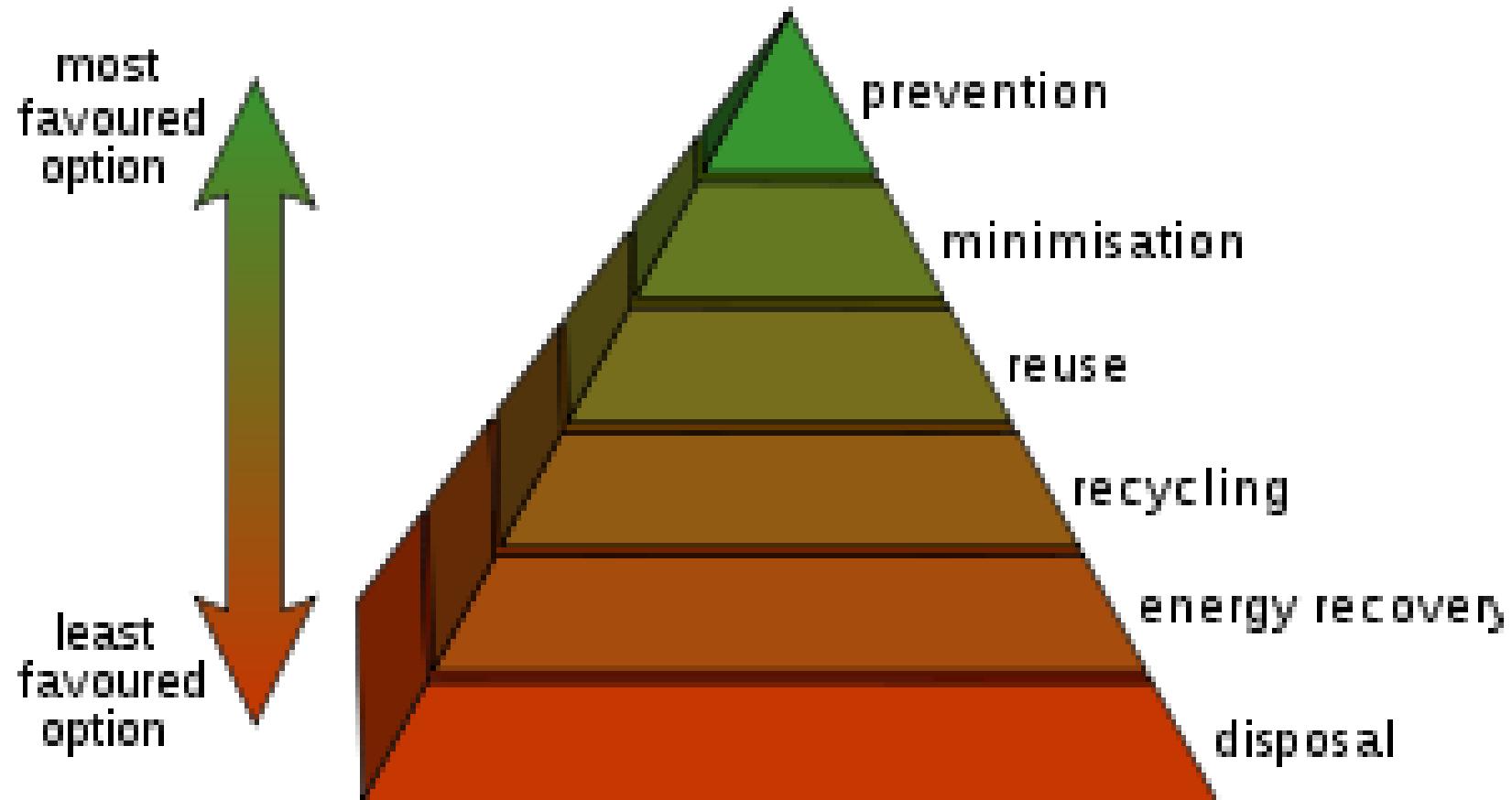
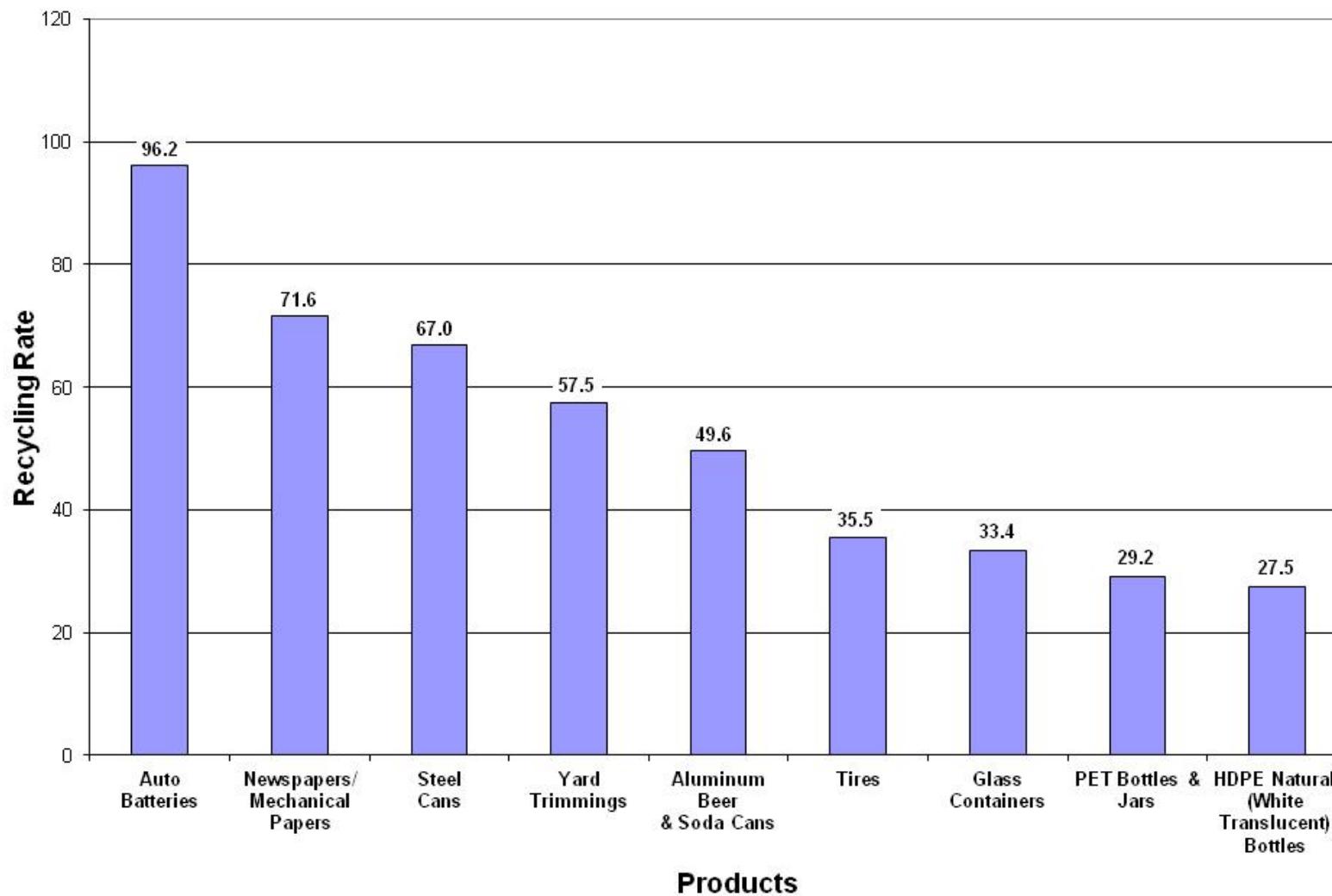


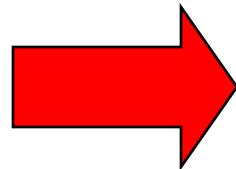
Figure 3. Recycling Rates of Selected Products, 2010*



"By recycling almost 8 million tons of metals (which includes aluminum, steel, and mixed metals), we eliminated greenhouse gas (GHG) emissions totaling more than 26 million metric tons of carbon dioxide equivalent (MMT CO_2E). This is equivalent to removing more than 5 million cars from the road for one year."

CATEGORIES OF WASTE DISPOSAL

1. DILUTE AND DISPERSE

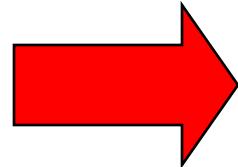


Throw it in the river / lake
/ Sea/ Burn it

Basically this involves spreading trash thinly over a large area to minimize its impact

Works for sewage, some waste chemicals, when land-disposal is not available

**2. CONCENTRATE AND
CONTAIN
(ISOLATION)**



**Waste dumps,
landfills**

Historically, that's how most of the solid waste gets treated

Useful options

- Resource recovery
- Composting
- Vermicomposting
- Energy recovery
- Incineration
- Pyrolysis
- Gasification
- Bio-methanation or anaerobic digestion

Impacts of Waste on health

- Chemical poisoning through chemical inhalation
- Uncollected waste can obstruct the storm water runoff resulting in flood
- Low birth weight
- Cancer
- Congenital malformations
- Neurological disease
- Mercury toxicity from eating fish with high levels of mercury.

Effects of waste on animals and aquatic life

- Increase in mercury level in fish due to disposal of mercury in the rivers.
- Plastic found in oceans ingested by birds.
- High algal population in rivers and sea.
- Degrades water and soil quality.

Impacts of waste on Environment

- Waste breaks down in landfills to form methane, a potent greenhouse gas
- Littering, due to waste pollutions, illegal dumping, Leaching: is a process by which solid waste enter soil and ground water and contaminating them.

WHAT SHOULD BE DONE

- Reduce Waste
 - Reduce office paper waste by implementing a formal policy to duplex all draft reports and by making training manuals and personnel information available electronically.
 - Improve product design to use less materials.
 - Redesign packaging to eliminate excess material while maintaining strength.
 - Work with customers to design and implement a packaging return program.
 - Switch to reusable transport containers.
 - Purchase products in bulk.

WHAT SHOULD BE DONE

Reuse

- Reuse corrugated moving boxes internally.
- Reuse office furniture and supplies, such as interoffice envelopes, file folders, and paper.
- Use durable towels, tablecloths, napkins, dishes, cups, and glasses.
- Use incoming packaging materials for outgoing shipments.
- Encourage employees to reuse office materials rather than purchasing new ones.

WHAT SHOULD BE DONE

Donate/Exchange

- old books
- old clothes
- old computers
- excess building materials
- old equipment to local organizations

WHAT SHOULD BE DONE

Employee Education

- Develop an “office recycling procedures” packet.
- Send out recycling reminders to all employees including environmental articles.
- Train employees on recycling practices prior to implementing recycling programs.
- Conduct an ongoing training process as new technologies are introduced and new employees join the institution.

WHAT SHOULD BE DONE

Conduct outreach program adopting an ecologically sound waste management system which includes:

- waste reduction
- segregation at source
- composting
- recycling and re-use
- more efficient collection
- more environmentally sound disposal

Residents may be organized into small groups to carry out the following:

1. Construction of backyard compost pit
2. Construction of storage bins where recyclable and reusable materials are stored by each household
3. Construction of storage centers where recyclable and reusable materials collected by the street sweepers are stored prior to selling to junk dealers
4. Maintenance of cleanliness in yards and streets
5. Greening of their respective areas
6. Encouraging others to join