

Energy and Environment Sceince

L-T-P-C: 2-0-0-2

Syllabus:

Unit – 1 [4 Hours]: Present Energy resources in India and its sustainability:

Energy Demand Scenario in India, Different type of **conventional Power Plant**, Advantage and Disadvantage of conventional Power Plants, **Conventional vs Non- conventional power generation**.

Unit – 2 [4 Hours]: Basics of Solar Energy: Solar Thermal Energy; Solar Photovoltaic:
Advantages and Disadvantages, Environmental impacts and safety.

Unit – 3 [4 Hours]: Wind Energy: Power and energy from wind turbines, India's wind energy potential, **Types of wind turbines, Offshore Wind energy**, Environmental benefits and impacts.

Unit – 4 [4 Hours]: Biomass Resources: Biomass conversion Technologies, Feedstock pre-processing and treatment methods, Bioenergy program in India, Environmental benefits and impacts; **Other energy sources: Geothermal Energy resources, Ocean Thermal Energy Conversion, Tidal Energy.**

Unit – 5 [4 Hours]: Air pollution: Sources, effects, control, air quality standards, air pollution act, air pollution measurement; **Water Pollution:** Sources and impacts; **Soil Pollution:** Sources and impacts, disposal of solid waste. **Noise pollution**

Unit – 6 [4 Hours]: Greenhouse gases effect, acid rain; Pollution aspects of various power plants; **Fossil fuels and impacts, Industrial and transport emissions impacts.**

1

Introduction to Water Pollution



Unit-5, Water Pollution, Class 2

Introduction

TYPES OF POLLUTION

There are Five types of Pollution:

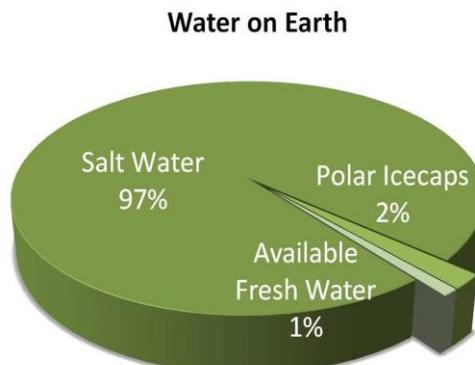
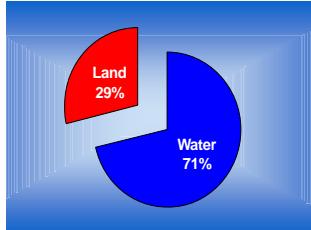
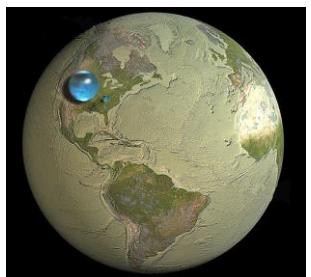
- ❖ Air Pollution
- ❖ Water Pollution
- ❖ Noise Pollution
- ❖ Land Pollution
- ❖ Radio Active Pollution



Pollution is everywhere.....



HOW MUCH FRESH WATER DO WE HAVE ON EARTH?



How much water do we use ?

- Each person requires 100 litres/day !
- Pollution control Board requires only 400 litres/tonne of cane crushed
- If you use more water,
 - more will be your effluent
 - Bigger will be your ETP and so more costs
 - more treatment costs
 - More money to be paid as water tax



What is a Water foot print





[Hoekstra & Chapagain, 2008]

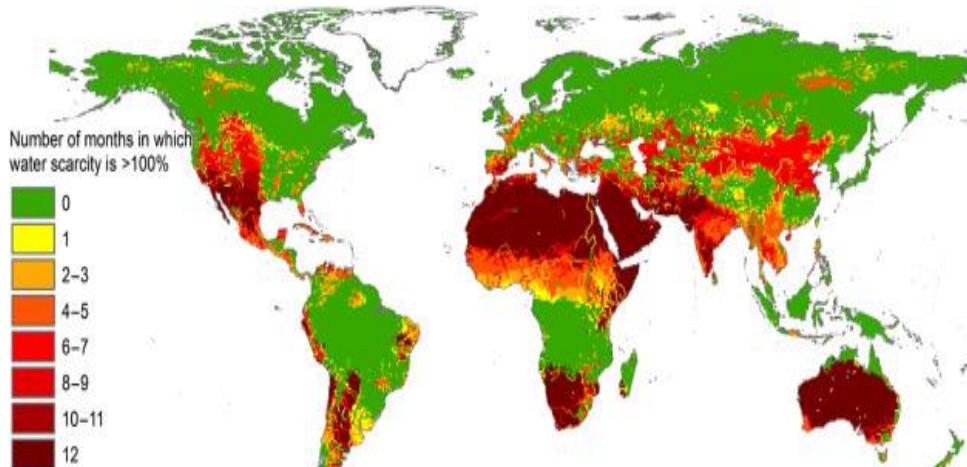


individual water footprint averages 1.385
million liters per year

[Hoekstra & Chapagain, 2008]

Water Scarcity

Is a major GLOABLE PROBLEM?



CAPE TOWN,
SOUTH AFRICA

India

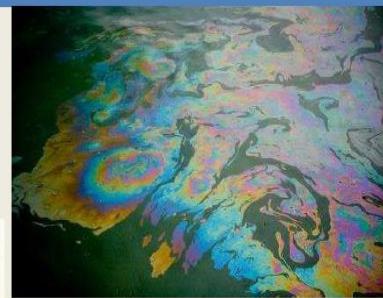
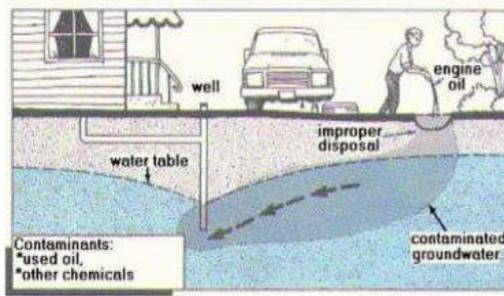


Many countries (BRAZIL)
WAS AFFECTED BY
A SEVERE DROUGHT
& WATER POLLUTION



WATER STRESS DUE TO CONSTRUCTION SECTOR

- Pollute ground water table at times
- Buildings use a huge amount water during construction and operation, which adds to stress on water resources



Water Pollution

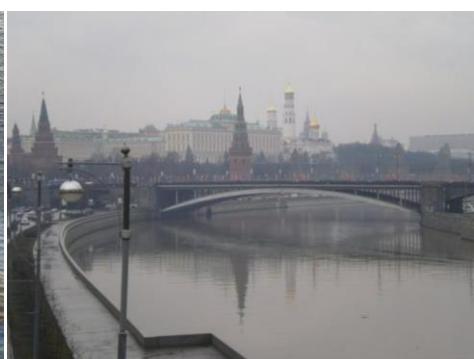
Is a major GLOABLE PROBLEM?



CARIO, EGYPT
WATER POLLUTION OF THE NILE
THEIR MAIN WATER SOURCE



MOSCOW, RUSSIA
THEIR WATER SUPPLY IS VERY
POLLUTED



BANGALORE, INDIA
WATER WASTAGE AND
POLLUTION

BEIJING, CHINIA
THE MOST POPULATED CITY
IN THE WORLD WITH
SEVERE WATER POLLUTION



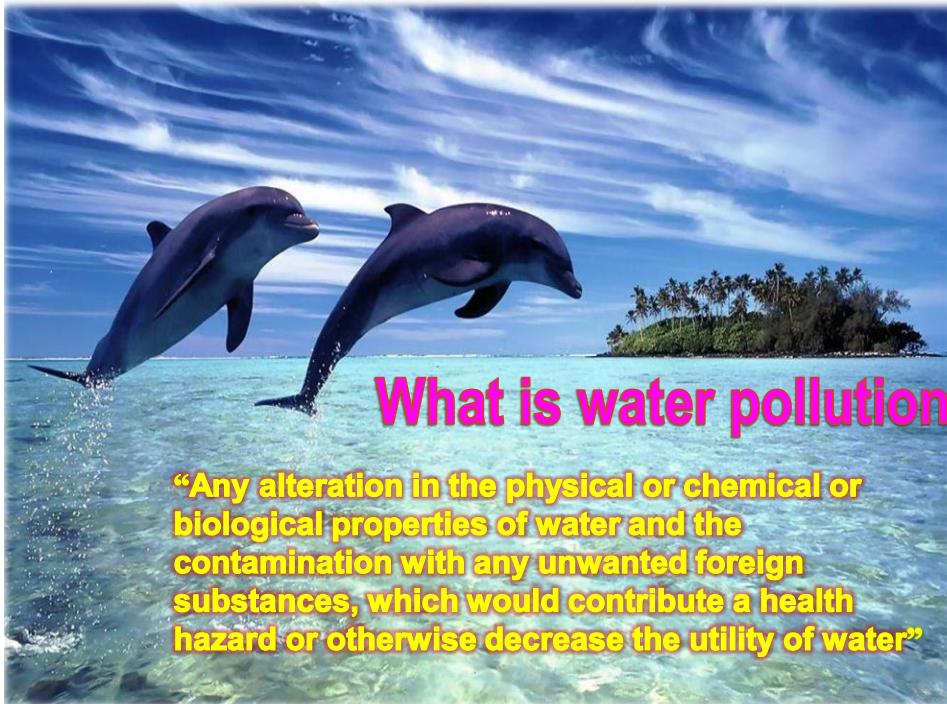
REASONS BEHIND WATER STRESS

- No sense of Ownership
- Over exploitation of ground water
- Contamination of surface/ground water sources
- Mismanagement of water
- Variations in rainfall

Water Pollution: Types, Sources and Effects



- ❑ What is water pollution?
- ❑ Major types of pollutants, sources
- ❑ Point and nonpoint sources
- ❑ water pollution effects
- ❑ Is the water safe to drink?



What is water pollution

“Any alteration in the physical or chemical or biological properties of water and the contamination with any unwanted foreign substances, which would contribute a health hazard or otherwise decrease the utility of water”

Water Pollution

- Is contamination by foreign matter like
 - Microorganisms
 - Chemicals
 - Industrial or other wastes, or sewage.
- **Water pollution**
 - Change in water quality that can harm organisms or make water unfit for human uses
 - Contamination with chemicals
 - Excessive heat
- Deteriorates the quality of the water and renders it **unfit for its intended uses**.



- Types of water pollution

1. Surface water pollution
2. Oxygen Depletion
3. Ground water pollution
4. Nutrients
5. Microbiological
6. Suspended matter
7. Chemical pollution

Pollution Sources

- **Point sources** are direct discharges to a single point;
 - examples include discharges from **sewage treatment plants, injection wells** and some **industrial sources**.
- **Non-point sources** are **diffused across a broad area** and their contamination cannot be traced to a single discharge point.
 - Examples include runoff of excess fertilizers, herbicides, and insecticides from agricultural lands and residential areas; oil, grease, and toxic chemicals from urban runoff and energy production; and sediment from improperly managed construction sites, crop and forest lands and eroding stream banks.



Water Pollution Comes from Point and Nonpoint Sources

Point sources

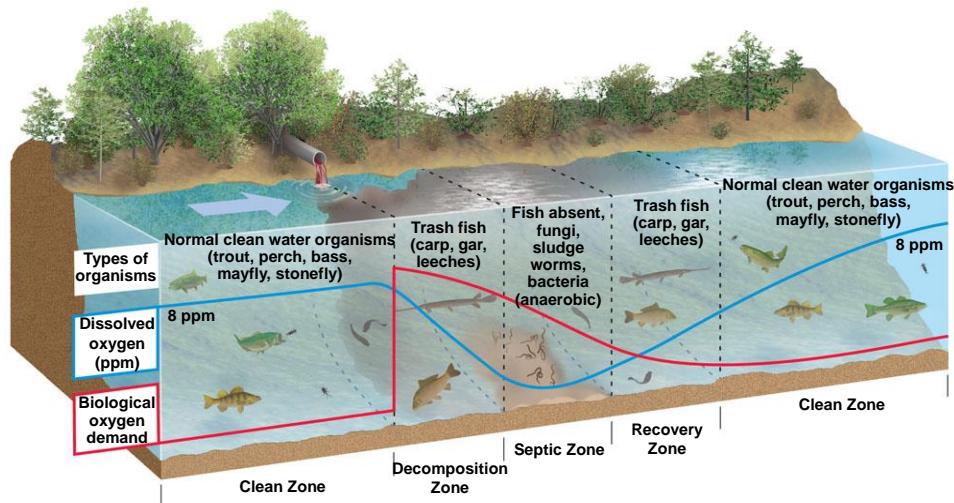
- Located at specific places
- Easy to identify, monitor, and regulate
- Examples : Point Source of Polluted Water in Gargas, France



Nonpoint Sediment from Unprotected Farmland Flows into Streams



Pollution in Streams



Sources of Water Pollution

SOURCES OF WATER POLLUTION

- ❑ Most of Water Pollution is man made It may also occur naturally by addition of soil particles through erosion animal wastes and leaching of minerals from rocks
 - ❑ The sources of water pollution can be classified as
 - + Municipal Waste Water
 - + Industrial Waste
 - + Inorganic Pollutants
 - + Organic Pollutants
 - + Agricultural Wastes
 - + Marine Pollution
 - + Thermal pollution
- | | |
|--|---|
| <p>❑ The sources of water pollution can be classified as</p> <ul style="list-style-type: none">+ Municipal Waste Water+ Industrial Waste+ Inorganic Pollutants+ Organic Pollutants+ Agricultural Wastes+ Marine Pollution+ Thermal pollution | <p>Surface Water Pollution</p> <ul style="list-style-type: none">• Sewage• Industrial effluents• Synthetic detergents• Agrochemicals• Oil• Waste heat |
|--|---|

MUNICIPAL WASTE WATER

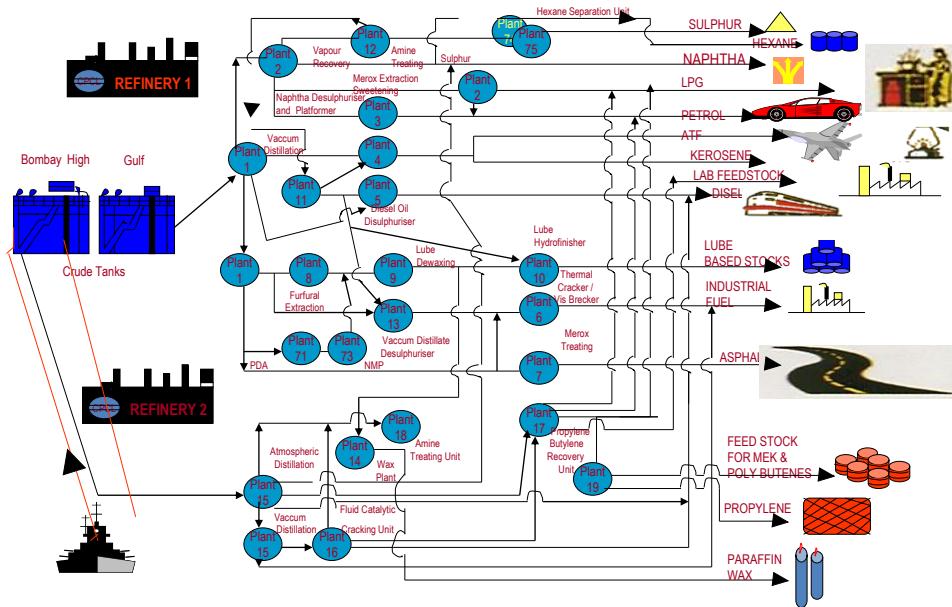


Industrial waste/ Effluents

- The major source of water pollution is the waste water discharged from industries and commercial bodies.
- These industries are chemical, metallurgical, food processing industries, textile, paper industries.
- Industrial waste water usually contains specific and readily identifiable chemical compounds .They discharge several organic and inorganic pollutants. That prove highly toxic to living beings. (toxic wastes Chromium, mercury, lead, copper, cadmium etc)



CRUDE-OIL PROCESSING



ORGANIC POLLUTANTS

- ✖ They Include **oils, fats, phenols, organic acids grease** and several other organic compounds



INORGANIC POLLUTANTS

- They include fine particles of different metals, chlorides, sulphates, oxides of iron, cadmium, acids and alkalies.



AGRICULTURAL WASTES

- Chemical fertilizers and pesticides have become essential for present day high yielding crops.
- Consequently, they have become a potential source of water pollution
- These fertilizers contain major plant nutrients mainly nitrogen, phosphorous, and potassium.
- Excess fertilizers may reach the ground water by leaching or may be mixed with surface water of rivers, lakes and ponds by runoff and drainage.



- Adds Nitrogen and Phosphorus to water Causes Eutrophication and algal blooms



MARINE POLLUTION

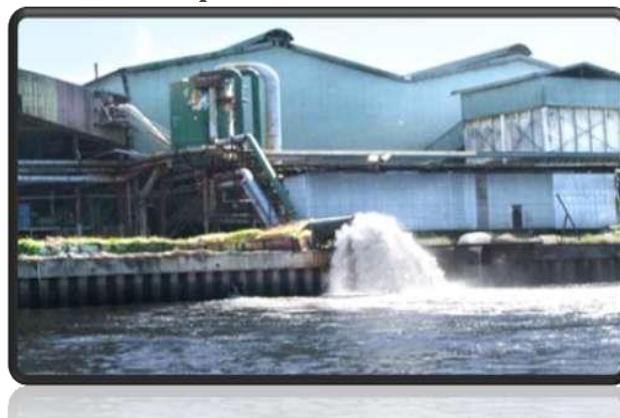
- * Ocean are the final sink of all natural and manmade pollutants. Rivers discharge their pollutants into the sea. The sewage and garbage of costal cities are also dumped into the sea. The other sources include, discharge of oils, grease, detergents, and radioactive wastes from ships.



Chronicle / Kurt Rogers

THERMAL POLLUTION

- * Thermal Pollution of water is caused by the rise in temperature of water. The main source of thermal pollution are the thermal and nuclear power plants. The power generating plants use water as coolants and release hot water into the original source. Sudden rise in temperature kills fish and other aquatic animals.



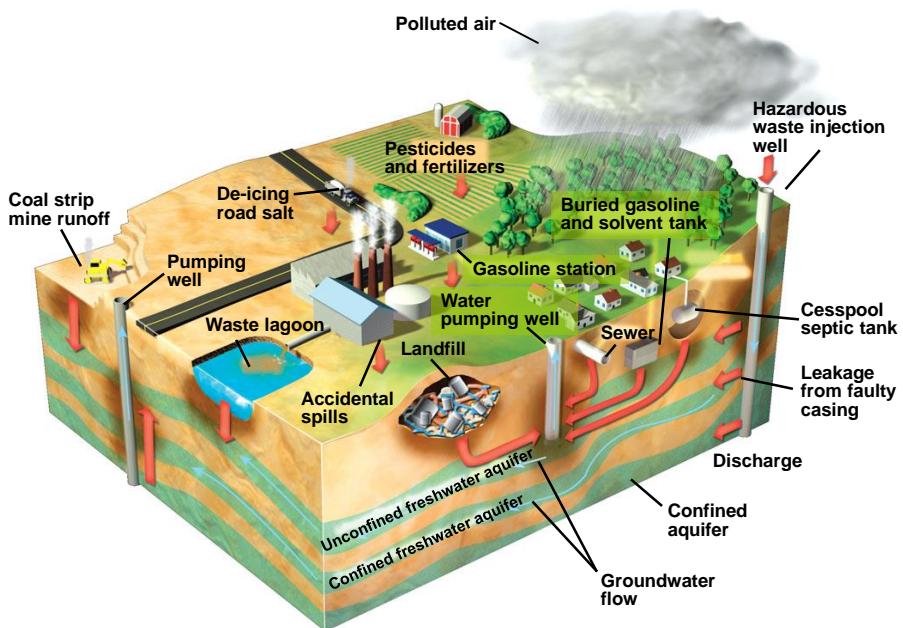
Domestic Sewage

- Refers to waste water that is discarded from households. Also referred to as sanitary sewage, such water contains a wide variety of dissolved and suspended impurities.
- The main organic materials are food and vegetable waste, plant nutrient come from chemical soaps, washing powders, etc.
- Domestic sewage is also very likely to contain disease-causing microbes.

Synthetic Detergents And Oils

- Added because of washing clothes, cleaning utensils.
- In industries for washing
- Add surfactants and soaps to water
- Toxic to fish, aquatic life.
- Oceans are polluted by oil on a daily basis from oil spills, routine shipping, run-offs and dumping.

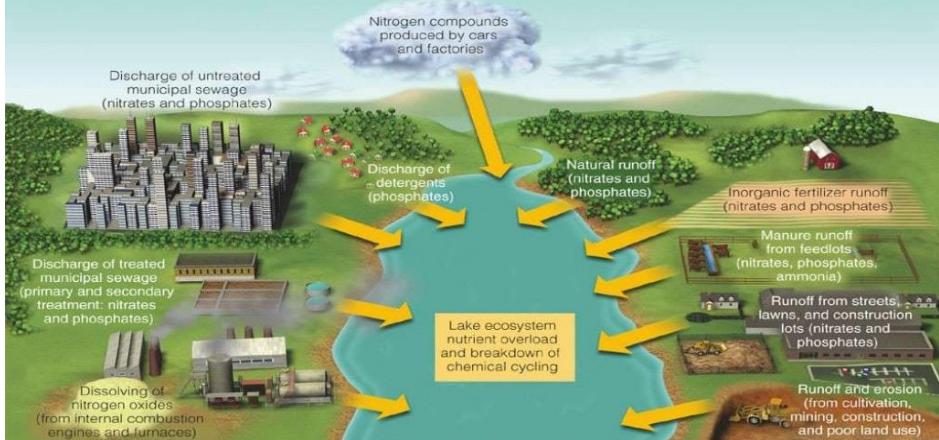
Groundwater Pollution



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Pollution of Lakes

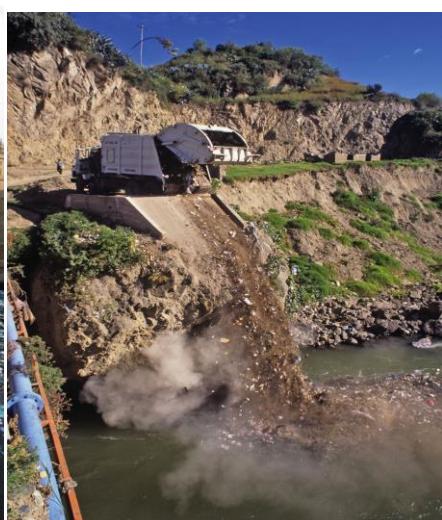
Eutrophication



Highly Polluted River in China



Trash Truck Disposing of Garbage into a River in Peru



Effects of Water Pollution

Effects of Water Pollution

**One type of pollution can lead to other types of pollution
= as the physical environment is INTERCONNECTED**



- Depletion of dissolved oxygen
- Eutrophication
- Pathogen....spreading diseases
- Bio-magnification
- Genetic deformities
- Blue baby Syndrome
- Minamata disease

According to the World Health Organisation, about **5 million people die every year from drinking polluted water.**

Effects of water pollution

<p>Human lives (poisoning)</p>	<p>Economic Loss (fisherman, tourist)</p>
<p>Plants and Animals</p>	<p>Algae Growth (Chemical fertilizers, affects aqua life)</p>

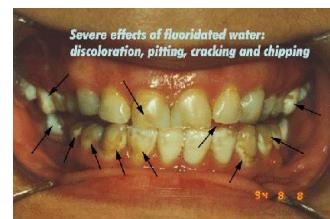
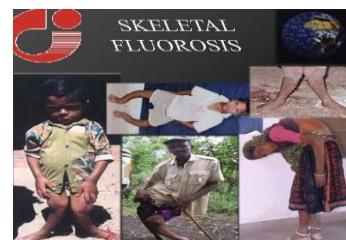
Lake Fish Killed by Water Pollution



Fig. 20-10, p. 536

Fluoride Poisoning

- The incidence of fluoride above permissible levels of 1.5ppm occur in 14 Indian states, namely: Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra,
- Some Estimates find that 65 per cent of India's villages are exposed to fluoride risk.
- Fluoride had been reported to cause depressions in DNA and RNA synthesis in cultured cells.
- Another study on the effects of fluorides in mice showed significant reductions in DNA and RNA levels.
- Conditions including ageing, cancer, and arteriosclerosis are associated with DNA damage and its disrepair.



Arsenic Poisoning

- High levels of arsenic above the permissible levels of 50 parts per billion (ppb) are found in the alluvial plains of Ganges covering six districts of West Bengal.
- Arsenic contamination of drinking water causes a disease called arsenicosis, for which there is no effective treatment.
- Arsenic contamination is by far the biggest mass poisoning case in the world putting 20 million people from West Bengal and Bangladesh at risk though some other estimates put the figure at 36 million people.



Pathogen Spread

- **Stagnant water and other untreated water** provide a habitat for the mosquito and a host of other parasites and insects that cause a large number of diseases especially in the tropical regions.
- Among these, **malaria is undoubtedly** the most widely distributed and causes most damage to human health.

- **Pesticides.** The organophosphates and the carbonates present in pesticides affect and damage the nervous system and can cause cancer.
- Some of the pesticides contain carcinogens that exceed recommended levels. They contain chlorides that cause reproductive and endocrinial damage.
- **Lead.** Lead is hazardous to health as it accumulates in the body and affects the central nervous system. Children and pregnant women are most at risk.
- **Petrochemicals.** Benzene and other petrochemicals can cause cancer even at low exposure levels.
- **Chlorinated solvents.** These are linked to reproduction disorders and to some cancers.
- **Other heavy metals.** –Heavy metals cause damage to the nervous system and the kidney, and other metabolic disruptions.

Control of Water Pollution

Control of Water Pollution

- Treatment of water before leaving in water bodies.
- Restoration of polluted water bodies.
- Ganga Action Plan
- River Water Monitoring



Global Environmental Monitoring Stations/ Monitoring of Indian National Aquatic Resource

- CPCB in collaboration with concerned SPCBs/PCCs established a nationwide network of water quality monitoring comprising 2500 stations in 28 States and 6 Union Territories.
- The monitoring is done on monthly or quarterly basis in surface waters and on half yearly basis in case of ground water.
- The monitoring network covers 445 Rivers, 154 Lakes, 12 Tanks, 78 Ponds, 41 Creeks/Seawater, 25 Canals, 45 Drains, 10 Water Treatment Plant (Raw Water) and 807 Wells.
- Among the 2500 stations, 1275 are on rivers, 190 on lakes,
- Water samples are being analysed for 28 parameters consisting of 9 core parameters, 19 other physico-chemical and bacteriological parameters apart from the field observations.

Major Water Pollutants and Their Sources

Table 20-1 Major Water Pollutants and Their Sources

Type/Effects	Examples	Major Sources
Infectious agents (pathogens) <i>Cause diseases</i>	Bacteria, viruses, protozoa, parasites	Human and animal wastes
Oxygen-demanding wastes <i>Deplete dissolved oxygen needed by aquatic species</i>	Biodegradable animal wastes and plant debris	Sewage, animal feedlots, food-processing facilities, paper mills
Plant nutrients <i>Cause excessive growth of algae and other species</i>	Nitrates (NO_3^-) and phosphates (PO_4^{3-})	Sewage, animal wastes, inorganic fertilizers
Organic chemicals <i>Add toxins to aquatic systems</i>	Oil, gasoline, plastics, pesticides, fertilizers, cleaning solvents	Industry, farms, households, mining sites, runoff from streets and parking lots
Inorganic chemicals <i>Add toxins to aquatic systems</i>	Acids, bases, salts, metal compounds	Industry, households, mining sites, runoff from streets and parking lots
Sediments <i>Disrupt photosynthesis, food webs, other processes</i>	Soil, silt	Land erosion from farms and construction and mining sites
Heavy metals <i>Cause cancer, disrupt immune and endocrine systems</i>	Lead, mercury, arsenic	Unlined landfills, household chemicals, mining refuse, industrial discharges
Thermal <i>Make some species vulnerable to disease</i>	Heat	Electric power and industrial plants

Table 20-1, p. 532

Water Quality as Measured by Dissolved Oxygen Content in Parts per Million

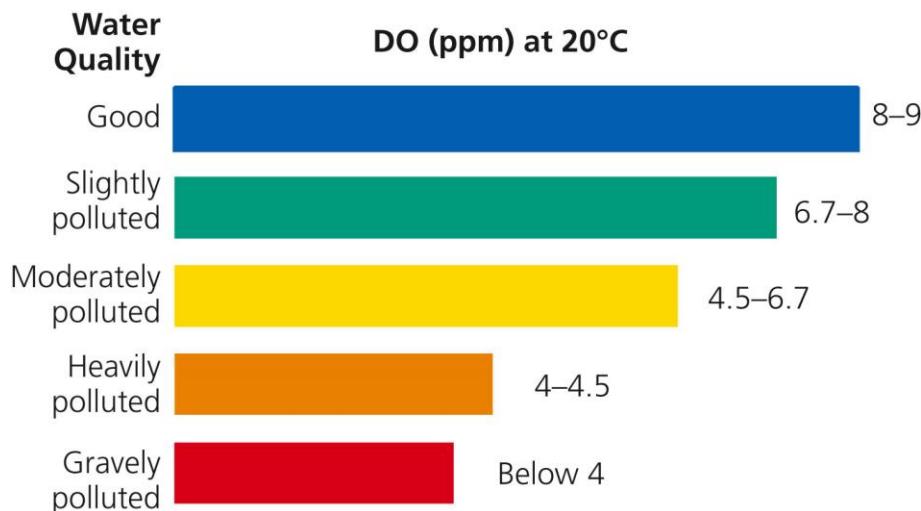


Fig. 20-A, p. 533

Solutions: Septic Tank System

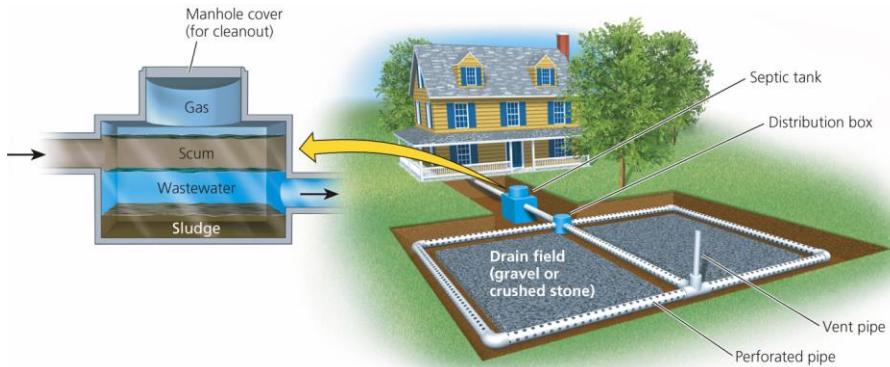


Fig. 20-19, p. 550

Solutions: Primary and Secondary Sewage Treatment

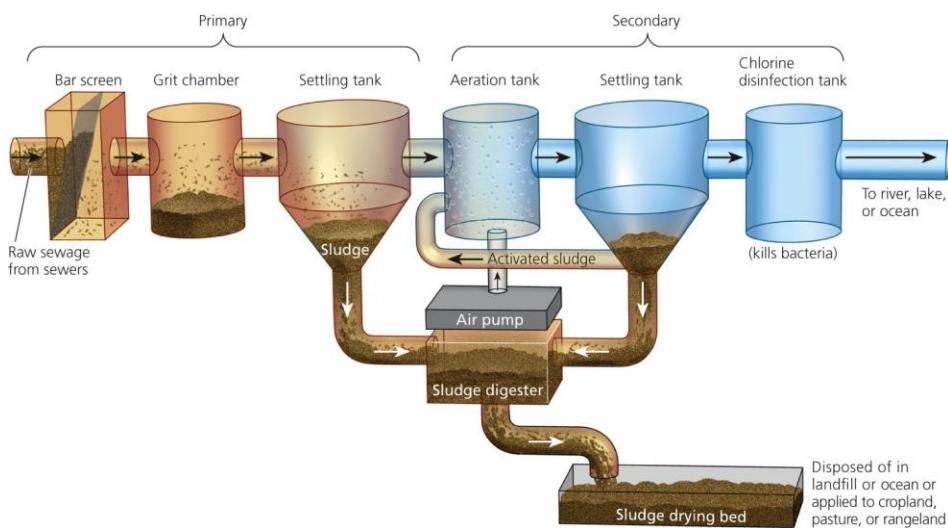
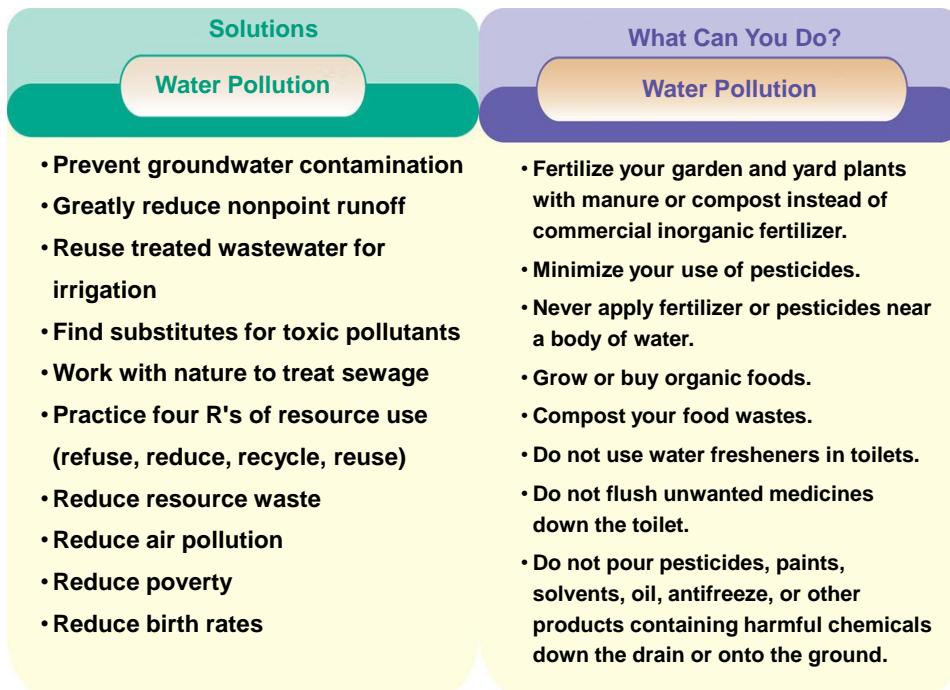


Fig. 20-20, p. 551



WHAT HAVE WE LEARNT?

1. KEEP WATER CLEAN FROM ALL KINDS OF POLLUTION.
2. MAKE SURE ALL LEAKING TAPS AND OLD PLUMBING FITTINGS ARE FIXED REGULARLY.
3. COLLECT RAINWATER IN TANKS FROM THE ROOF.
4. USE GREY WATER TO FLUSH TOILETS AND WATER TREES
5. LOOK AFTER OUR WETLANDS TO PROTECT THE WATER TABLE AND AQUIFERS.
6. REGULATE THE DRILLING OF WELLS.



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Water Conservation Options

Operational and Housekeeping Measures

- Monitor water consumption and establish baseline.
- Optimise blowdown from evaporative cooling towers.
- Adopt reuse practices such as final rinses from tank cleaning, refrigeration equipment defrost, equipment cleaning, soak water (electroplating plant), filter backwash etc.
- Segregate waste process streams (low- and high-strength) at their potential reuse.
- Inspect nozzles regularly for clogging and clean them.

Low-cost Measures

- Adopt **pressure reduction valves** where applicable: Potential savings: up to 25%.
- Increase COC through chemical treatment of circulating water. This will reduce blowdown.
- Adopt low-flush and ultra-low-flush toilets (commercial buildings).
- Install efficient drift eliminators to improve cooling tower efficiency.
- Adopt rainwater harvesting.
- Uses drift irrigation for landscaping or garden.

Retrofit Measures

- Adopt electronic hand wash(saves 70% water), water less urinals (100% water) for buildings.
- Adopt ozonation (use of ozone) to treat cooling water which can reduce blowdown by 80% when compared to traditional treatment.
- Install meters on individual water consuming equipment.
- Replace old equipment with water saving models.

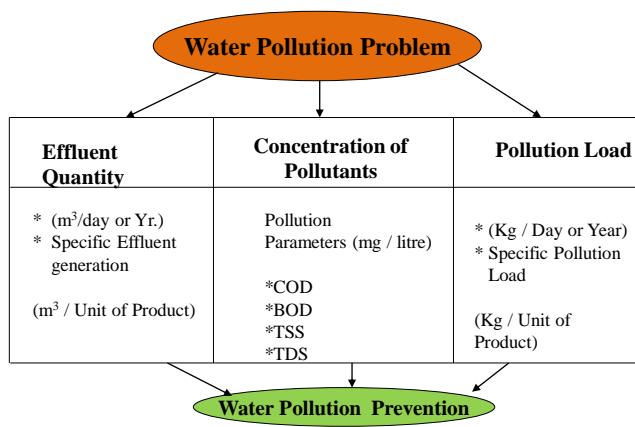
Sustainable Development Goals
**ENSURE AVAILABILITY AND SUSTAINABLE
MANAGEMENT OF WATER AND SANITATION FOR ALL**

By 2030, **improve water quality** by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally

By 2030, substantially **increase water-use efficiency** across all sectors and ensure sustainable withdrawals and supply of freshwater **to address water scarcity**

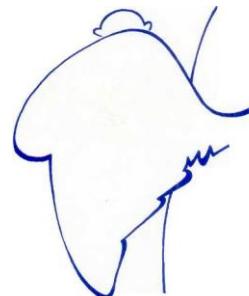
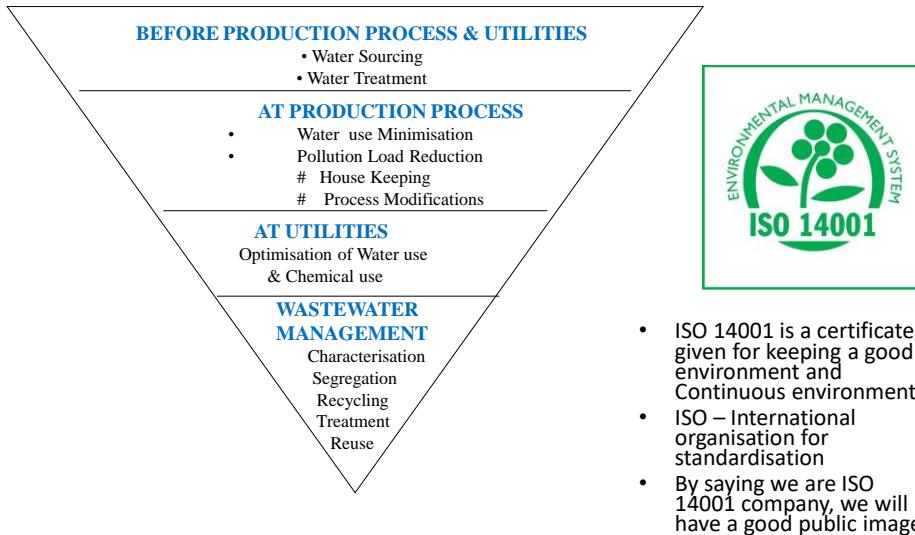
By 2020, **protect and restore water-related ecosystems**, including mountains, forests, wetlands, rivers, aquifers and lakes

WATER POLLUTION PROBLEM AND ITS PREVENTION



MINIMISATION OF ONE OR TWO OR ALL OF THE ABOVE

WATER POLLUTION PREVENTION HIERARCHY



SAVE *the Nature to --*
YOU !!!

Thank You

