

# **Sources of Water Pollution and their Effects on Environment**

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# Sources of Water Pollution

## ➤ The Main Sources of General Pollution affecting Water for Human Consumption are :

1. Wastewater of animal origin (Manure heaps, cattle sheds or human origin)
2. Industrial Process waters or liquid effluents
3. Run off Water
4. Accidental Contamination

## ➤ Water Quality Considerations for Human Consumption

1. Free from disease causing organisms
2. A aesthetically acceptable, clear, odourless, palatable
3. Free from toxic dissolved metals
4. Does not contain inorganic and organic constituents in such concentrations as to cause health hazards when consumed over a longer period of time or life time

# Point and Non-point Sources of Pollution

- **Point source pollution involves wastes flushed into city's sewers or discharged directly by an industry and is measurable accurately**
- **Non-point source pollution occurs due to runoff from different areas**
  - **Causes extensive pollution of surface and groundwater sources**
  - **Affects drinking water, fishing, recreational streams and lakes**
  - **Accurate measurement is a complex problem due to extreme difficulty in determining specific contribution of each source at any one location**
- **Potential sources of non-point pollution include :**
  - **Fertilizers : Herbicides**
  - **Insecticides : Animal wastes**
  - **Dustfall ppth : Bacteria in Soil**
- **Does not contain inorganic and organic constituents in such concentrations as to cause health hazards when consumed over a longer period of time or life time**

# Water Quality Management

## ➤ What is Water Quality ?

- Related to its potability for drinking purposes especially for Bacteriological point of view
- Related to its uses for beneficial purposes, i.e. Domestic, irrigation and industrial

## ➤ What is Quality Criteria ?

- Health (Human health related factors)
- Aesthetic
- Organoleptic etc.

## ➤ Damage Caused by Water Pollution

- Health
- Cost Investment
- Destruction of Natural Resources
- Navigational interfaces
- Corrosion etc.

# Quantity and Quality of Waste Resources

- **Availability of Water is highly uneven in both space and time**
  - Precipitation of water confined to only 3-4 months in a year
  - Varies from 10 CM in western parts of Rajasthan to over 1000 cm in Meghalaya
  - Total precipitation in India is estimated to be 400 million hectare meters, but
    - **Surface water availability** : **178 MHM**
    - **Groundwater availability** : **42 MHM**
- **Substantial increase in the demand for water resource envisaged in near future in sectors :**
  - Drinking
  - Irrigation
  - Industrial purposes
- **Transportation of these pollutants into surface and groundwater through natural forces viz. wind and precipitation**
- **In India, 100,000 tonnes of pesticides and fertilizers are being used annually causing extensive pollutions of water and land**
- **Thus, pesticide residues at levels higher than permissible limits in surface and groundwater supplies posing problems of taste, odour and hazards to human health**
- **In India, an alarming rise in levels of nitrates and phosphates in drinking waters of several states is observed :**
  - **Due to excessive use of chemical fertilizers viz. Ammonium, calcium, potassium and sodium, nitrates and phosphates**
  - **Urea also gets quickly converted to nitrates through microbial activities, contributing to excessive nitrates in drinking water**

# **Hence to Avoid the Damage to Public Health/Property/ Uncontrolled Exploitation of Natural Resources (Water) Management of Water Quality is Essential**

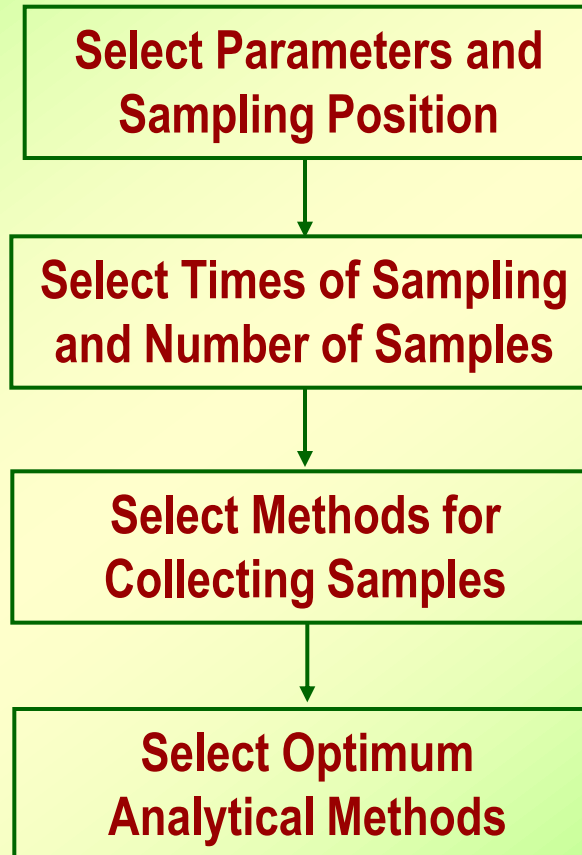
## **How to Manage Water Quality ?**

- **By Monitoring baseline (back ground) or intrinsic water quality**
- **Identification of point and non-point sources of pollution**
- **Pollution abatement through investigating measures (Using Environmental Pollution Laws)**
- **Post-Mitigation Monitoring for continuous vigilance of water quality**
- **Control of soil erosion from the river banks**
- **Control of seawater/saline water intrusion into water bodies**
- **Control of acidic/alkaline waste due to mining activities**
- **Control of leachates from mining residues, solid refuse or chemical slag/sludges etc.**
- **Evaluating performance of ETP/STP before their effluents join the receiving water bodies**
- **Discharge pattern in Surface Water (Rivers/Sea)**

# Water Quality Monitoring

- **Sampling** { Groundwater  
Surface Water  
Sea Water
- **Analysis**
- **Interpretation of results, preparation of report**

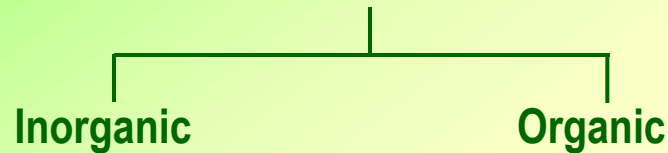
# Factors Involved in Design of Sampling Positions





# Indicators of Water Pollution

- Hydrological or Meteorological Parameters
- Physical Parameters
- Chemical Parameters



- Nutrient Parameters
- Biological Parameters
- Bacteriological Parameters

## Criteria for the Selection of Water Quality Parameters

- Basic Parameters : Determine the general quality of waters
- Optional Parameters : Selected according to the location and water use for particular purpose
- Globally Significant Parameters : Selected as per the facilities available in the laboratory

# Selection of Parameters

## ➤ Physical Parameters

- Colour
- Turbidity
- Total Solids
- Conductivity
- pH

## ➤ Chemical Parameters

### Inorganic

- a. Alkalinity
- b. Chlorides
- c. Sulfates
- d. Hardness
- e. Silicates
- f. Fluoride
- g. Sodium
- h. Potassium
- i. Iron
- j. Management
- k. Heavy metals

### Organic

- a. Dissolved Oxygen
- b. Chemical Oxygen Demand
- c. Bio-chemical Oxygen Demand
- d. Oil and Grease
- e. Phenols
- f. Hydrocarbons

## ➤ Nutrient Parameters : Phosphates, Organic Nitrogen, Nitrate-Nitrogen and Nitrite-Nitrogen

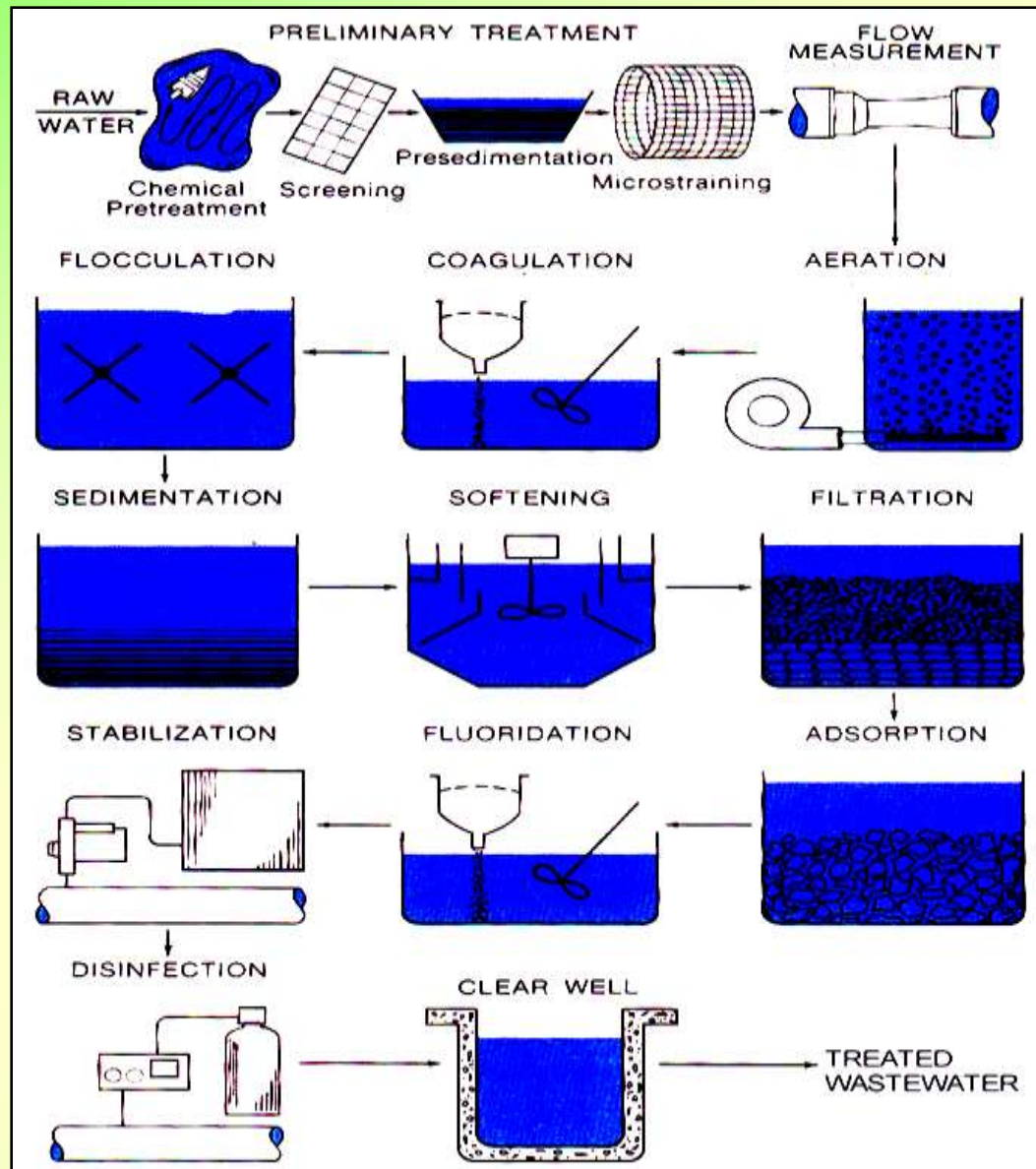
- **Biological Parameters** :
  - a. Phytoplankton
  - b. Zooplankton
  - c. Water fowl
  - d. fish Kill

- **Bacteriological** :
  - a. Total count
  - b. Strepto coccai
  - c. Coliform

There is another method suggested by EPA under environmental monitoring system :

- **Basic Parameters** : Determines the general quality of water parameters are Temperature, pH, EC, DO, Cl, Alkalinity, Suspended solids, Nitrogen-NH<sub>3</sub>, NO<sub>3</sub> and NO<sub>2</sub>, BOD, Fluoride and Phosphate
- **Optional Parameters** : Selected according to the location and water use for particular purpose, TOC, COD, Cr(IV), Total Cr, Ni, Zn, Cu, As, B, Si, Fe, K, Na, Phosphates, Organic nitrogen, Se, H<sub>2</sub>S, Ba, Ca & Mg
- **Globally Significant Parameters** : Selected according to the site and the facilities available in the lab : Heavy metal, Cd, Hg, Pb, Organochlorine Compounds like DDT, Aldrin, Dieldrin Hexachlorocyclohexane etc.

# Wastewater Treatment Processes



# Wastewater Treatment Processes

Process	Purpose
<b>Preliminary Treatment</b>	
Screening	Removes large debris that can foul or damage plant equipment
Chemical Pretreatment	Conditions the water for the eventual removal of algae and other aquatic nuisances that cause taste, odour and colour
Presedimentation	Removes gravel, sand, silt and other gritty material that can foul or damage plant equipment
Microstraining	Removes algae, aquatic plants, and small debris that can clog or foul other process
<b>Flow Measurements</b>	Measures the amount of water being treated
<b>Main Plant Processes</b>	
Aeration	Removes odour and dissolved gases, adds oxygen to improve taste
Coagulation/ Flocculation	Converts nonsettleable particles to settleable particles
Sedimentation	Removes settleable particles
Softening	Removes hardness causing materials from water
Filtration	Removes finely divided particles, suspended flocs, and most microorganisms
Adsorption	Removes Organics and colour
Stabilization	Prevents scaling and corrosion
Fluoridation	Adds Fluoride in order to harden tooth enamel
Disinfection	Kills disease-causing organisms

# Control of Pollution or to Improve the Quality of Water

- **If natural quality of water is unsatisfactory like high fluoride, high nitrate and excess iron**  
Then - special treatment be followed (Coagulation, reverse osmosis, flotation)  
High turbidity - conventional treatment  
Bacterial Contamination - Chlorination
- **If pollution due to domestic sewage and/or Industrial effluents or outfalls**  
Then - Segregate the waste channels, construct STP/ETP following chemical/biological methods. Treat the waste to the desired level of effluent quality before discharge to the receiving water bodies (for wastewater disposal follow the ISI/CPCB/State Pollution Control Board standards depending on the disposal site)
- **If pollution is due to improper disposal of solid waste nearby the waste body**  
Then – segregate the waste (Solid/Hazardous) and dispose off at the sites properly lined or by any other suitable methods to avoid leachates
- **The best alternative is to reduce the pollution at site by modifying the process, changing the raw material or entirely adopting the cleaner technology if available**
- **Pollution control is not a one stock job to install treatment plants etc. but-need to monitor STP/ETP, various outfalls and overall quality of water even for the nutrient load like nitrogen and phosphorus which helps for eutrophication**

# Backlog in Water Pollution Control

- Ties recently, water quality management practices in India have adhered to strict regulatory measures viz. water Act 1974
- Only 50% of large/medium scale Industries have provided complete/partial emission/effluent control systems stipulated by CPCB/SPCBS
- Small scale industries have not yet been subjected to rigorous pollution control measures
- Only few cities have municipal wastewater treatment facilities
- Efforts have been directed only towards control of pollution from point sources while non-point sources pollution has been overlooked
- No comprehensive document on sources of pollution available
- Over 400 water quality monitoring stations operating under GEMS and MINAS have not been provided appropriate inputs to river action plans
- Hence, there is a need to develop site-specific effluent standards fully exploiting assimilative capacity of the water-bodies with respect to designated use

**Thank You**