



Water Resources

TD 603

Lecture 1: Water Quality and Water Treatment

CTARA
Indian Institute of Technology, Bombay

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OVERVIEW OF THE LECTURE

1. Water Distribution Schemes

- ▶ Hand Pump Schemes - Ground Water Based
- ▶ Piped Water Schemes - Ground Water / Surface Water, Single Village/Multi Village

2. Water Quality

- ▶ Drinking Water Standards
- ▶ Indian Water Systems
- ▶ Water Treatment

3. Safe Drinking Water Plans

Case Study

- ▶ North Karjat - Techno-feasibility Study of Piped Water Supply System
- ▶ Karjat Town - Study of Existing Water Supply System

WATER QUALITY CRITERIA/STANDARDS I

- ▶ Primary water quality criteria for designated-best-use-classes (surface water)

A	Drinking Water source without conventional treatment but after disinfections
B	Outdoor bathing (Organised)
C	Drinking water source after conventional treatment and disinfection
D	Propagation of wild life and fisheries
E	Irrigation Industrial Cooling Control Wastes disposal

- ▶ IS 10500:1991- Drinking water - Specification.
- ▶ IS 14543:2004 - Packaged Drinking Water (Other than Packaged Natural Mineral Water) - Specification.

WATER QUALITY CRITERIA/STANDARDS II

- ▶ IS 13428:2005 - Packaged Natural Mineral Water - Specification
- ▶ IS 11624:1986 - Guidelines for the quality of irrigation water
- ▶ Discharge standards

WATER QUALITY MONITORING NETWORK I

- ▶ Central Pollution Control Board (CPCB) has established a network of 1245 monitoring stations: 695 on rivers, 86 on lakes, 19 on drains, 19 on canals, 6 on tank, 12 on creeks/seawater, 26 on pond and 382 groundwater stations
- ▶ Network covers 250 Rivers, 78 Lakes, 6 Tanks, 26 Ponds, 8 Creeks, 19 Canals, 19 Drains & 382 Wells
- ▶ Monitoring is done on monthly or quarterly basis in surface waters & on half yearly basis in case of ground water
- ▶ Inland water quality-monitoring network is operated under a three-tier programme i.e. GEMS, Monitoring of Indian National Aquatic Resources System and Yamuna Action Plan
- ▶ State PCBs have extra monitoring stations under their plans



AGENCIES FOR WATER SECTOR & THEIR RESPONSIBILITIES I

- ▶ Role of the Central government - to guide investments in this sector, encourage the need for training and research, and also to promote water quality monitoring and human resources development programmes
- ▶ Roles of State - plan, design and execute water supply schemes and operate through departments like Public Health Engineering Departments, Panchayati Raj Engineering Departments or Rural Development Engineering Departments and Water Boards.
- ▶ The Central Water Commission (CWC) in the Ministry of Water Resources (MoWR) is responsible for regulating the use of surface water for irrigation, industry and drinking water purposes. It also mediates in inter-state water allocation disputes.

AGENCIES FOR WATER SECTOR & THEIR RESPONSIBILITIES II

- ▶ Central Groundwater Board (CGWB) under the MoWR has an overseeing responsibility for the monitoring of groundwater levels and rates of depletion and the production of water resource inventories and maps.
- ▶ National Rivers Conservation Directorate (NRCD) under the Ministry of Environment and Forests (MoEF) oversees the implementation of Action Plans to improve the quality of the rivers in India
- ▶ Central Pollution Control Board (CPCB) under the Ministry of Environment and Forests (MoEF) promotes basin-wide pollution control strategies. It liaises with State Water Pollution Control Boards for laying down standards for treatment of sewage and effluents. The Board is also

AGENCIES FOR WATER SECTOR & THEIR RESPONSIBILITIES III

responsible for action in the case of non-compliance by agencies.

- ▶ Rajiv Gandhi National Drinking Water Mission (RGNDWM) under the Department of Drinking Water Supply, Ministry of Rural Development (MoRD) formulates policies, sets standards, and provides funds and technical assistance to the states for rural water supply and sanitation activities.
- ▶ Ministry of Agriculture (MoA) is involved in planning, formulation; monitoring and reviewing of various watershed based developmental project activities.

AGENCIES FOR WATER SECTOR & THEIR RESPONSIBILITIES IV

- ▶ Ministry of Urban Development (MoUD) is the nodal ministry for policy formulation and guidance for the urban water supply and sanitation sector. Responsibilities include broad policy formulation, institutional and legal frameworks, setting standards and norms, monitoring, promotion of new strategies, coordination and support to state programmes through institutional expertise and finance.
- ▶ Central Bureau of Health Intelligence (CBHI) under the Ministry of Health and Family Welfare deals with the collection, compilation, analysis and dissemination of the information on health conditions in the country.

WATER (PREVENTION CONTROL OF POLLUTION) ACT, 1974 - I

▶ OBJECTIVE

- ▶ Prevention and Control of Water Pollution
- ▶ Maintaining or Restoring Wholesomeness of Water
- ▶ Establishment of Central & State Boards

▶ APPLICABLE TO

- ▶ Any person, Industry, Operation or Process & Municipal Bodies

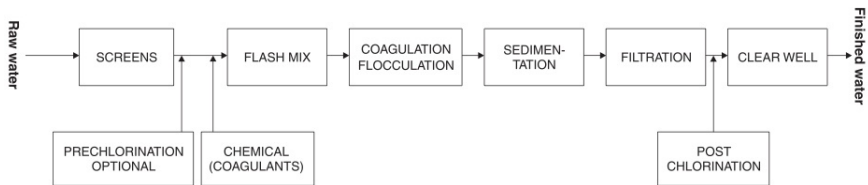
▶ Control of Pollution

- ▶ Prohibition on use of stream or well for disposal of polluting matter, etc.-
 - ▶ No person shall knowingly cause or permit any Poisonous, Noxious or Polluting Matter determined in accordance with such standards as may be laid down by the State Board to enter whether directly or indirectly into any Stream / Well / Sewer / on land

WATER (PREVENTION CONTROL OF POLLUTION) ACT, 1974 - II

- ▶ to enter into any stream any other matter which may tend, either directly or in combination with similar matter, to impede the proper flow of the water of the stream in a manner leading or likely to lead to a substantial aggravation of pollution due to other causes or of its consequences
- ▶ **Restriction**
 - ▶ Consent for discharge - in/on River, Surface Water Body, Land, Sewer, Dry Nallah

WATER TREATMENT PLANTS



WATER TREATMENT PLANTS

Name	Formula	Coagulant Primary/Aid
Ferric Alum	$\text{Fe}_2 \cdot (\text{SO}_4)_3 \cdot \text{Al}_2(\text{SO}_4)_3 \cdot 24\text{H}_2\text{O}$	Primary
Poly Aluminium Chloride	$\{\text{Al}_2(\text{OH})_{2.7} \text{Cl}_{3.3}\}_{15}$	Primary
Ferric Chloride	$\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$	Primary
Calcium Hydroxide	$\text{Ca}(\text{OH})_2$	Primary/Aid
Calcium Oxide	CaO	Primary/Aid

WATER TREATMENT

Parameter	Treatment Methods
<i>Turbidity</i>	<ul style="list-style-type: none"> ✓ Cloth Filtration ✓ Slow Sand Filtration ✓ Coagulation ✓ Candle Filtration
<i>Odour</i>	<ul style="list-style-type: none"> ✓ Aeration ✓ Carbon Filtering using charcoal ✓ Boiling
<i>Colour</i>	<ul style="list-style-type: none"> ✓ Carbon Filtering using charcoal ✓ Slow Sand Filtration
<i>Bacterial Impurities</i>	<ul style="list-style-type: none"> ✓ Boiling ✓ Chlorination ✓ Ultra Violet Radiation - SODIS ✓ Slow Sand Filtration
<i>Fluoride</i>	<ul style="list-style-type: none"> ✓ Activated Alumina Technology ✓ Nalgonda Technique
<i>Ammonia</i>	<ul style="list-style-type: none"> ✓ Chlorination ✓ Boiling
<i>Iron</i>	<ul style="list-style-type: none"> ✓ Oxidation and settling
<i>Hardness</i>	<ul style="list-style-type: none"> ✓ Boiling and Settling/ Filtration ✓ Reverse Osmosis

WATER TREATMENT PLANTS

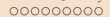


WATER QUALITY ISSUES I

- ▶ Variations in Rainfall resulting in change in quality
- ▶ Different nature of soils and rocks (resulting in e.g. fluoride, iron in ground water)
- ▶ Increased pumping and quick drawal of water
- ▶ Quality deterioration due to pollution from
 - ▶ industrial wastes
 - ▶ domestic wastes (i) liquid wastes (ii) solid wastes
 - ▶ chemicals used in agricultural
- ▶ No control on abstraction of surface water
- ▶ Dilution available in river/stream
- ▶ Maintaining minimum flow in river/stream
- ▶ Presence of micro nutrients and formation of algae in water bodies
- ▶ Water becoming saline due to sea water intrusion

WATER QUALITY ISSUES II

- ▶ Sand quarrying in river beds resulting in damage and pollution to infiltration wells
- ▶ Corrosion and scaling in pipes
- ▶ Inadequacies in water treatment (including inadequate disinfection)
- ▶ Problems in distribution and at consumer end
 - ▶ (a) leakages (b) mixing of sewage (c) poor environmental condition around hand pumps and public fountains (including no/damaged platform) (d) illegal tapping (e) intermittent water supply (f) appearance of algae and worms/larvae at consumer end
- ▶ Lack of sanitation practice



Thank You