Indo-UK Water Quality Scoping workshop

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Water Quality Monitoring of Aquatic Resources

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Legal Framework and Mandate

- Water (Prevention & Control of Pollution) Act, 1974.
- Restoration of wholesomeness of Water Quality.
- Lay down and modify standards.
- Collect, compile & publish data.
## Water Quality Monitoring & Management

- **Static Stations**: 2500 locations*
- **Real Time Stations**: 10
- **Laboratories**: 165
- **Real Time Station Expansion**: 113
- **Data Dissemination**: Web Based & Hand outs

* CWC, CGWB, Local Bodies and State Govt. also monitor water quality

### Polluted River Stretches
- 302 on 275 rivers

### Polluted Lakes/Tanks/Ponds
- 151

#### Yearwise Growth of Monitoring Network

![Yearwise Growth of Monitoring Network Diagram](chart.png)

- **NO. OF MONITORING STATIONS**
- **YEAR**

### Water Quality Monitoring Network

<table>
<thead>
<tr>
<th>Water Body</th>
<th>Number of Stations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rivers (445)</td>
<td>1275</td>
</tr>
<tr>
<td>Lakes (154)</td>
<td>190</td>
</tr>
<tr>
<td>Ponds (78)</td>
<td>79</td>
</tr>
<tr>
<td>Creeks/Sea Water</td>
<td>41</td>
</tr>
<tr>
<td>Canals</td>
<td>41</td>
</tr>
<tr>
<td>Drains</td>
<td>45</td>
</tr>
<tr>
<td>Tanks</td>
<td>12</td>
</tr>
<tr>
<td>Wells</td>
<td>807</td>
</tr>
</tbody>
</table>
Water Quality Monitoring - Frequency and Parameters

- Surface water - Monthly
- Ground water - Half yearly
- Parameters: 28 Physico-chemical and Bacteriological
  - 9 Trace Metals
  - 28 Pesticides
- Water Analysis - APHA - Examination of Water & Wastewater
- Laboratory Accreditation - ISO 17025 (85 chemical and 6 biological parameters)

(National Accreditation Board for Testing and Calibration Laboratories (NABL), Department of Science and Technology)
## Use Based Classification of Surface Water

<table>
<thead>
<tr>
<th>DESIGNATED-BEST-USE</th>
<th>CLASS OF WATER</th>
<th>CRITERIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drinking Water Source without conventional treatment but after disinfection</td>
<td>A</td>
<td>1. Total Coliforms Organism MPN/100ml shall be 50 or less&lt;br&gt;2. pH between 6.5 and 8.5&lt;br&gt;3. Dissolved Oxygen 6mg/l or more&lt;br&gt;4. Biochemical Oxygen Demand 3 days 27°C 2mg/l or less</td>
</tr>
<tr>
<td>Outdoor bathing (Organised)</td>
<td>B</td>
<td>1. Total Coliforms Organism MPN/100ml shall be 500 or less&lt;br&gt;2. pH between 6.5 and 8.5&lt;br&gt;3. Dissolved Oxygen 5mg/l or more&lt;br&gt;4. Biochemical Oxygen Demand 3 days 27°C 3mg/l or less</td>
</tr>
<tr>
<td>Drinking water source after conventional treatment and disinfection</td>
<td>C</td>
<td>1. Total Coliforms Organism MPN/100ml shall be 5000 or less&lt;br&gt;2. pH between 6 to 9&lt;br&gt;3. Dissolved Oxygen 4mg/l or more&lt;br&gt;4. Biochemical Oxygen Demand 3 days 27°C 3mg/l or less</td>
</tr>
<tr>
<td>Propagation of Wild life and Fisheries</td>
<td>D</td>
<td>1. pH between 6.5 to 8.5&lt;br&gt;2. Dissolved Oxygen 4mg/l or more&lt;br&gt;3. Free Ammonia (as N) 1.2 mg/l or less</td>
</tr>
<tr>
<td>Irrigation, Industrial Cooling, Controlled Waste disposal</td>
<td>E</td>
<td>1. pH between 6.0 to 8.5&lt;br&gt;2. Electrical Conductivity at 25°C micro mhos/cm Max. 2250&lt;br&gt;3. Sodium absorption Ratio Max. 26&lt;br&gt;4. Boron Max. 2mg/l</td>
</tr>
<tr>
<td>CRITERIA</td>
<td>RATIONALE</td>
<td></td>
</tr>
<tr>
<td>-----------------</td>
<td>-----------------</td>
<td></td>
</tr>
<tr>
<td>1. Faecal Coliform MPN/100ml : 500 (desirable)</td>
<td>To ensure low sewage contamination. Faecal coliform and faecal streptococci are considered as they reflect the bacterial pathogenicity. The desirable and permissible limits are suggested to allow for fluctuation in environmental conditions such as seasonal changes, changes in flow conditions etc.</td>
<td></td>
</tr>
<tr>
<td>MPN/100ml : 2500 (Maximum Permissible)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Faecal Streptococci MPN/100ml : 100 (desirable)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MPN/100ml : 500 (Maximum Permissible)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. pH:</td>
<td>The range provides protection of the skin and delicate organs like eyes, nose, ears etc. which are directly exposed during outdoor bathing.</td>
<td></td>
</tr>
<tr>
<td>Between 6.5-8.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Dissolved Oxygen: 5 mg/l or more</td>
<td>The minimum dissolved oxygen concentration of 5 mg/l ensures reasonable freedom from oxygen consuming organic pollution immediately U/s which is necessary for preventing production of anaerobic gases (obnoxious gases) from sediments</td>
<td></td>
</tr>
<tr>
<td>5. Biochemical Oxygen Demand 3 day, 27°C: 3 mg/l or less</td>
<td>The Biochemical Oxygen Demand of 3 mg/l or less of the water ensures reasonable freedom from oxygen demanding pollutants and prevent production of obnoxious gases.</td>
<td></td>
</tr>
</tbody>
</table>
## Water Quality of Rivers at a Glance (2015)

<table>
<thead>
<tr>
<th>River (Locations)</th>
<th>TEMP. ºC</th>
<th>D.O. (mg/l)</th>
<th>pH</th>
<th>CONDUCTIVITY (µmhos/cm)</th>
<th>B.O.D. (mg/l)</th>
<th>FECAL COLIFORM (MPN/100ml)</th>
<th>TOTAL COLIFORM (MPN/100ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ganga (63)</td>
<td>12-40</td>
<td>2.9-11.6</td>
<td>6.7-9.3</td>
<td>153-6250</td>
<td>1-16</td>
<td>370-70×10⁴</td>
<td>2-14×10⁵</td>
</tr>
<tr>
<td>Yamuna (25)</td>
<td>16-38</td>
<td>0.9-15.5</td>
<td>7.1-9.2</td>
<td>147-2150</td>
<td>01-97</td>
<td>7-13 ×10⁶</td>
<td>17-17×10⁶</td>
</tr>
<tr>
<td>Brahmaputra (10)</td>
<td>16-38</td>
<td>4.4-9.8</td>
<td>6.4-8.3</td>
<td>68-406</td>
<td>1-3.5</td>
<td>2-24×10⁴</td>
<td>2-24×10⁴</td>
</tr>
<tr>
<td>Mahi (6)</td>
<td>20-34</td>
<td>4.7-8.9</td>
<td>7.1-9.4</td>
<td>234-773</td>
<td>1-3.1</td>
<td>4-58</td>
<td>4-300</td>
</tr>
<tr>
<td>Narmada (18)</td>
<td>18-32.8</td>
<td>6.4-9.4</td>
<td>6.0-8.6</td>
<td>96-817</td>
<td>1-9</td>
<td>2-28</td>
<td>7-240</td>
</tr>
<tr>
<td>Tapi (12)</td>
<td>19-36</td>
<td>2.1-7.7</td>
<td>4.7-8.6</td>
<td>153-42880</td>
<td>1-23</td>
<td>2-170</td>
<td>2-24×10²</td>
</tr>
<tr>
<td>Mahanadi (22)</td>
<td>18-37.5</td>
<td>5.4-9.8</td>
<td>6.7-8.5</td>
<td>140-33410</td>
<td>1-4.1</td>
<td>20-16×10⁴</td>
<td>22-16×10⁴</td>
</tr>
<tr>
<td>Godavari (35)</td>
<td>14-41</td>
<td>2.2-8.4</td>
<td>6.9-8.9</td>
<td>140.7-1632</td>
<td>1-25</td>
<td>2-500</td>
<td>7-24×10²</td>
</tr>
</tbody>
</table>
Water Quality Issues and Impacts

- Lotic and Lentic water resources
  - Eutrophication
  - Pathogenic Pollution
  - Environmental flows inadequate

- Groundwater resources
  - Fluoride
  - Nitrate
  - Arsenic
  - Salinity
  - Contaminated soils
Sources of Pollution

- **Point- Municipal Sewage/Solid Waste and Industrial effluent**
  - 7935 Urban Centres
  - 420 million habitants
  - 62000 MLD Sewage Generation
  - 141064 Tonnes/Day Municipal Solid Waste
    - **Industrial Effluent**
      - 83000 MLD (Assessment Year 2005)
        (Cooling Water 72000 MLD, Process Waste water -11000MLD)

- **Non Point- Agriculture return water and Animal Dung**
  - 6,40,867 Villages
  - 916 million Rural Human habitants
  - 512 million Cattle Population
  - 25 million tonnes Fertiliser consumption
  - 45 Thousand Tonnes Pesticides Consumption
Sewage Generation v/s Treatment Capacity State specific

- Urban Sewage Generation (MLD)
- Installed Treatment Capacity (MLD)
Sewage Generation and Treatment Capacity

- Urban Population (x Ten Thousands)
- Gross Wastewater Generation (MLD)
- Sewage Treatment (MLD)
Mean discharge seasonal

- Summer (Mar-May)
- Winter (Dec-Feb)
- Post-monsoon (Oct-Nov)

Gauging Stations:
- Rishikesh
- Balawali
- Garhmukteshwar
- Fatehgarh
- Kanpur
- Allahabad
- Mirzapur
- Varanasi
- Buxar
- Patna
- Azamabad

Mean flow (m³/s)
Potential Areas of Partnership

- Benchmarking water quality
- Ecological monitoring and understanding environmental flow
- Retrofitting Sewerage networks in urban settlements
- In-situ sewage treatment for drains and application of bacterio-phages
- Cost effective and energy efficient treatment Technologies
- Waste Minimization/Utilization strategies for Small Scale Industries
- R&D on Instrumentation for continuous monitoring
- Institutional networking
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Thank You