Surveillance of Drinking Water Quality - Safe Water Initiative

Dr. Madan Nanoti  
Dy. Director & Head  
Geo-Environment Management Division  
National Environmental Engineering Research Institute,  
Nagpur.  

mv_nanoti@neeri.res.in
External assessment of the water supply system

• Quite a few managers of urban water supply tend to hold the contentions
  ➢ Their water supply system is unique
  ➢ Problems are also unique
  ➢ No scope to change
  ➢ Affairs must be continued as they are

• Attempt is essential to change this mind set

• Mind set may be changed by external assessment of the water supply system
Urban Water Supply – Problems of Common Nature
Resources Constraints & Demand Pressure

• Rapid pace of urbanization
• Deteriorating environmental conditions
• Dwindling availability of water sources
• Sizeable investment needs
• Community culture of considering water supply as a social virtuous deed
Design and O & M

• Source selection, design and protection
• Treatment plant commensurate with site specific need
• Quality of service
• Adequacy of service coverage
• Reliability of service provision
• Post planning extension of service connections
Management and Revenues

- Consorted decision and long term policy
- Institutional and fiscal reforms
- Appropriate pricing policies
- Private sector participation
- Community involvement
- Motivation of human resources
- Reliable information system and data base
Adverse impact of the problems

- Large urban poor population lacking access to water and sanitation services
- Rest of the population remains dissatisfied with the facilities
- Health risk potential through water supply continues
Surveillance of Drinking Water Quality
SDWQ
AIMS & OBJECTIVES

- Assessment of the present status of surveillance of drinking water quality programme
- Identification of deficiencies, if any, in the existing system and suggest remedial measures
- Action plan for improving the surveillance of drinking water quality programme
- Preparation of guidelines for initiating suitable measures for surveillance programme, where it is non-existent
- Improvement of water supply system
SDWQ – Basis

• Assessment of
  ➢ water quality from source to consumer end
  ➢ Sanitary conditions
  ➢ Leak detection
  ➢ Infrastructure
  ➢ Performance of manpower
  ➢ Role of the water supply agencies
  ➢ Financial aspects

• Action against health problems
• Remedial actions
• Institutional and organizational reforms
• Community participation
• Support for surveillance
• Legal framework
• Drinking water quality standards
<table>
<thead>
<tr>
<th>Region</th>
<th>Cities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern Region</td>
<td>Allahabad, Bhopal, Chandigarh, Dehradun, Faridabad, Indore, Patiala, Shimla, Srinagar, Udaipur &amp; Varanasi</td>
</tr>
<tr>
<td>Eastern Region</td>
<td>Bhubaneshwar, Durgapur, Gangtok, Guwahati, Patna, Puri, Ranchi, Raipur &amp; Shillong</td>
</tr>
<tr>
<td>Southern Region</td>
<td>Bangalore, Coimbatore, Kochi &amp; Vishakhapatnam</td>
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<tr>
<td>Western Region</td>
<td>Surat</td>
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<tr>
<td>Region</td>
<td>Cities</td>
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<td>------------------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>Northern Region</td>
<td>Agra, Delhi &amp; Jammu</td>
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<tr>
<td>Eastern Region</td>
<td>Kolkata</td>
</tr>
<tr>
<td>Southern Region</td>
<td>Chennai, Hyderabad &amp; Thiruvananthapuram</td>
</tr>
<tr>
<td>Western Region</td>
<td>Ahmedabad, Jaipur, Mumbai &amp; Nagpur</td>
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</tbody>
</table>
METHODOLOGY

Reconnaissance Visit(s) & Interaction with Water Supply Agencies

Secondary Information
- Source(s)
  - Quality & Quantity
- Water Treatment Plant(s)
  - Design aspects
  - Treatment
  - O & M facilities
- Distribution System
  - No. of distribution zones
  - Population served
- Municipal Solid & liquid wastes
  - Collection & transport facilities
  - Treatment & disposal

Health Status
- Prevalence of water borne diseases

Status of SDWQ Programme
- Infrastructural facilities
- Institutional setup with work norms
- Financial resources
- Lab facilities
- Human resources

Planning
- Sampling Locations
- Number of Samples
- Team formation
- Time schedule

Field Visits
- Sample Collection
- Sample Analysis
- Sanitary and KAP Survey

Interpretation of Results and Report Preparation
# Physico-chemical and Bacteriological Parameters

<table>
<thead>
<tr>
<th>Physico-Chemical Parameters</th>
<th>Bacteriological Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature (°C)</td>
<td>Total Coliforms (CFU/100 ml)</td>
</tr>
<tr>
<td>pH</td>
<td>Faecal Coliforms (CFU/100 ml)</td>
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<tr>
<td>Total Dissolved Solids (mg/L)</td>
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<tr>
<td>Total Hardness (mg/L, CaCO₃)</td>
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<tr>
<td>Magnesium (mg/L, Mg)</td>
<td></td>
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<tr>
<td>Sulphate (mg/L, SO₄)</td>
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<tr>
<td>Phenolic Compounds (mg/L)</td>
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<tr>
<td>Potassium (mg/L, K)</td>
<td></td>
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<tr>
<td>Manganese (mg/L, Mn)</td>
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<tr>
<td>Zinc (mg/L, Zn)</td>
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<tr>
<td>Chromium (mg/L, Cr)</td>
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<tr>
<td>Arsenic (mg/L, As)</td>
<td></td>
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<tr>
<td>Conductivity (micro mhos/cm)</td>
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<tr>
<td>Total Alkalinity (mg/L, CaCO₃)</td>
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<tr>
<td>Calcium (mg/L, Ca)</td>
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<tr>
<td>Chloride (mg/L, Cl)</td>
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<tr>
<td>Fluoride (mg/L, F)</td>
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<tr>
<td>Sodium (mg/L, Na)</td>
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<tr>
<td>Iron (mg/L, Fe)</td>
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<tr>
<td>Copper (mg/L, Cu)</td>
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<tr>
<td>Cadmium (mg/L, Cd)</td>
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<tr>
<td>Lead (mg/L, Pb)</td>
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<tr>
<td>Temperature (°C)</td>
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<tr>
<td>pH</td>
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<tr>
<td>Turbidity (NTU)</td>
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<tr>
<td>Conductivity (micro mhos/cm)</td>
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<tr>
<td>Total Alkalinity (mg/L, CaCO₃)</td>
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<tr>
<td>Lead (mg/L, Pb)</td>
<td></td>
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</tbody>
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Sampling Locations and Number of Samples

**Raw Water Source**
- All Parameters
  - Each Raw Water Source

**Treatment Plant**
- Settled Water
  - Turbidity + Sulphate
    - Each Clarifier
    - Combined Settled Water
- Filtered Water
  - Turbidity + Sulphate
    - Each Filter
    - Combined Filtered Water
- Clear Water
  - All Parameters
    - Clear Water Sump

**Distribution System**
- Main Service Reservoirs
  - All Parameters
    - One Sample
- Distribution Zones
- Service Reservoirs
  - Residual Chlorine / Bacteriological (daily)
    - Each Reservoir
- Consumer Ends
  - Residual Chlorine / Bacteriological (daily)
    - Population Served
<table>
<thead>
<tr>
<th>Cities/Towns</th>
<th>Population</th>
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<tbody>
<tr>
<td>Bhubaneswar</td>
<td>48%</td>
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<tr>
<td>Coimbatore</td>
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<tr>
<td>Dehradun</td>
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<tr>
<td>Durgapur</td>
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<td>Kochi</td>
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<tr>
<td>Raipur</td>
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<tr>
<td>Ranchi</td>
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<tr>
<td>Shillong</td>
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<td>Shimla</td>
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<tr>
<td>Puri</td>
<td></td>
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<tr>
<td>Udaipur</td>
<td></td>
</tr>
<tr>
<td>Bangalore</td>
<td>9%</td>
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<tr>
<td>Surat</td>
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<tr>
<td>Allahabad</td>
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<tr>
<td>Bhopal</td>
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<tr>
<td>Chandigarh</td>
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<td>Faridabad</td>
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<tr>
<td>Guwahati</td>
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<tr>
<td>Indore</td>
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<tr>
<td>Patna</td>
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<td>Patiala</td>
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<td>Varanasi</td>
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<tr>
<td>Visakhapatnam</td>
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<table>
<thead>
<tr>
<th>Population Range</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 - 60 Lakhs</td>
<td>43%</td>
</tr>
<tr>
<td>10 - 20 Lakhs</td>
<td></td>
</tr>
<tr>
<td>1 - 10 Lakhs</td>
<td></td>
</tr>
</tbody>
</table>

Categorisation of the Cities/Towns Based on Population
Percentage of Cities with Level of Population Served

- 100%: 41%
- 80 - 100: 33%
- 60 - 80: 19%
- 40 - 60: 7%
Total Design and Present Capacity of Water Treatment Plants in the Cities
Number and Type of Ground and Surface Water Sources for Organised Supply in the Cities
Daily Extraction of Ground Water

Cities

Water Extracted (MLD)

- Allahabad: 130
- Chandigarh: 68
- Dehradun: 66
- Faridabad: 176
- Guwahati: 97.51
- Patiala: 190
- Patna: 20.4
- Puri: 4
- Raipur: 2.87
- Shillong: 40
- Surat: 11.5
- Udaipur: 19
- Varanasi: 145
- Visakhapatnam: 19
Quantity of Water Supply Based on 100% Population Coverage
Laboratory Facilities Available at Treatment Plant and Central Level in the Cities

- Allahabad: CL - Adequate, PL - Adequate
- Bangalore: CL - Inadequate, PL - Adequate
- Coimbatore: CL - Adequate, PL - Inadequate
- Indore: CL - Not Available, PL - Not Applicable
- Shillong: CL - Not Available, PL - Inadequate
- Surat: CL - Adequate, PL - Not Available
- Bhopal: CL - Inadequate, PL - Not Applicable
- Kochi: CL - Adequate, PL - Not Available
- Ranchi: CL - Inadequate, PL - Inadequate
- Guwahati: CL - Adequate, PL - Not Applicable
- Faridabad: CL - Not Available, PL - Adequate
- Bhubaneshwar: CL - Inadequate, PL - Not Applicable
- Chandigarh: CL - Adequate, PL - Not Applicable
- Durgapur: CL - Inadequate, PL - Inadequate
- Shimla: CL - Adequate, PL - Not Available
Average Hours of Organised Water Supply Per Day in the Cities
Surveillance of Drinking Water Quality Programme in the Cities
Leak Detection Programme in the Cities

Cities: Chandigarh, Dehradun, Indore, Kochi, Patna, Patna, Shillong, Surat, Varanasi, Visakhapatnam

Yes: 35% Cities

No: 65% Cities

Cities: Allhabad, Bangalore, Bhopal, Bhubaneswar, Coimbatore, Durgapur, Faridabad, Guwahati, Patiala, Puri, Raipur, Ranchi, Shimla, Udaipur
Present Status of Surveillance

- **Leak Detection**
  - Yes: 44.1%
  - No: 29.4%
  - NA: 26.5%

- **SDWQ**
  - Adequate: 47.7%
  - Inadequate: 17.0%
  - NA: 11.8%

- **Lab facilities**
  - Yes: 67.6%
  - No: 14.7%
  - NA: 17.6%
Annual Financial Aspects in the Cities
Single point addition of coagulants
- Not conducive to effective mixing
Chemical dosing through perforated pipe – Simple and effective
Maintenance of Flash Mixers and Clariflooculators
Clarifier - Flooded due to overloading
A Sand filter without filter sand
Filter bed full of mud balls.
Cracks in filter bed
Silted sedimentation tank & aquatic weed growth
Pump house

Treated water sump not covered
Hazard of storm water entry
Leakage from Distribution System
Public Stand Posts

The Public Stand Posts (PSPs) in urban and rural water supplies are the potential sources of recontamination of drinking water supply. A large number of PSPs are in horrible state.
Hand Pumps

Hand-pumps installation should be carefully supervised to avoid possible contamination of groundwater.
The different installation stations of the Greater Shillong Water supply Scheme at Mawphlang
The different installation stations of the Greater Shillong Water supply Scheme at Mawphlang
Well maintained chemical dosing system
Uniform distribution of backwash water

- Good design and operation
Reliable flow measuring system
- Prerequisite for plant control
Good housekeeping
Well equipped laboratory
– Vital for effective plant control
Recommendations

Source
Treatment
Storage and Reservoir
Distribution
Leak Detection
Quality Control
Administration and Financial Structure
Staff
Public Awareness
# Committee for Surveillance of Drinking Water Quality

<table>
<thead>
<tr>
<th>No.</th>
<th>Position Description</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chairman of city Water Supply and Sewerage Board or Municipal Commissioner or Revenue / Divisional Commissioner (In case of cities / towns not having Water Supply Boards or City Corporation)</td>
<td>Chairman</td>
</tr>
<tr>
<td>2</td>
<td>A Nominee of the Mayor, preferably from the corporators</td>
<td>Member</td>
</tr>
<tr>
<td>3</td>
<td>Officers of the relevant water supply agency</td>
<td>Members (2)</td>
</tr>
<tr>
<td>4</td>
<td>Senior Officer of the Health Department of the city</td>
<td>Member</td>
</tr>
<tr>
<td>5</td>
<td>Senior Officer of the Health Department of the State</td>
<td>Member</td>
</tr>
<tr>
<td>6</td>
<td>Representative of Chamber of Commerce</td>
<td>Member</td>
</tr>
<tr>
<td>7</td>
<td>Representative of the University or Education Department or Education Institute</td>
<td>Member</td>
</tr>
<tr>
<td>8</td>
<td>Representative of the Local Chapter of the Indian Medical Association</td>
<td>Member</td>
</tr>
<tr>
<td>9</td>
<td>Representative of the Geology Department or Water Resources Department or Pollution Control Board or CGWB</td>
<td>Member</td>
</tr>
<tr>
<td>10</td>
<td>Representative of registered NGO in the jurisdiction of the local water supply agency</td>
<td>Member</td>
</tr>
<tr>
<td>11</td>
<td>Superintending Analyst of Laboratory for Surveillance of Drinking Water Quality</td>
<td>Member</td>
</tr>
<tr>
<td>12</td>
<td>One of the Executive Engineers of the relevant water supply agency</td>
<td>Member</td>
</tr>
</tbody>
</table>
Urgent needs

- Consorted decision and long term policy
- Institutional and fiscal reforms
- Appropriate pricing policies
- Private sector participation
- Community involvement
- Motivation of human resources
- Reliable information system and data base
Surveillance of Drinking Water Quality

- Expected Results

  • Technical Solutions / options
  • Monitoring & surveillance of drinking water quality
  • Mechanism to implement the SDWQ considering Institutional Capacity Building
Legal framework & participation

- Enactment implies enforcement
- Participation implies trust and empowerment
- Empowerment does not mean anarchy
METROPOLITAN WATERWORKS AUTHORITY
400 Prachachuen Laksi, Bangkok 10210

Tel. 504-0123 Fax : 503-9456
E-mail: mwa 125@water.mwa.or.th,
http://www.mwa.or.th