Proceedings of the One-Day National Conference on Provision of Potable Drinking Water in Quality-Affected Areas

Government of India
MINISTRY OF JAL SHAKTI
Department of Drinking Water and Sanitation

NATIONAL JAL JEEVAN MISSION
7 February, 2020, New Delhi
Boron affects nervous system.

Mercury affects brain and nervous system.

Chloride, together with sodium, causes increase in blood pressure.

Leak hinders physical and mental growth of children, causes anaemia and damages kidneys in adults.

Nitrate causes blue-baby syndrome in infants (methamoglobinemia).

Pesticides cause cancer, damage to nervous system and reproductive system, severely damages immune system.

Calcium causes constipation and kidney stones.

Fluoride causes discolouration and damage of teeth.

Sodium causes more damage to people who already suffer from diseases of heart, kidney and blood circulation.

Iron causes aggravation in diseases of stomach.

Sulphate, together with Magnesium causes diarrhoea.

Cadmium causes adverse effect on bones.

Arsenic causes skin diseases and cancer.

Fluoride causes fluorosis, deformites in bones and problem in joints.

Figure 1: Adverse effects of drinking water with chemical contamination
(To know if water is potable or not, get it tested in a laboratory)
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on Provision of Potable Drinking Water
in Quality-Affected Areas

NATIONAL JAL JEEVAN MISSION
7 February, 2020, New Delhi
... And so I declare from the Red Fort today that in the days to come, we will take forward the Jal Jeevan Mission. The central and the state governments will jointly work on this Jal Jeevan Mission. We have promised to spend more than Rs. 3.50 lakh crores on this mission in the coming years...

...in the next five years, we have to do more than four times the work that has been done in the last 70 years...

Shri Narendra Modi
Prime Minister of India

(Extract from the Independence day address of Hon'ble Prime Minister from rampart of Red Fort on 15th August, 2019)
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AIRP</td>
<td>Arsenic and Iron Removal Plant</td>
</tr>
<tr>
<td>BOD</td>
<td>Biochemical Oxygen Demand</td>
</tr>
<tr>
<td>CEO</td>
<td>Chief Executive Officer</td>
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<tr>
<td>CI</td>
<td>Cast Iron Pipes</td>
</tr>
<tr>
<td>CWPP</td>
<td>Community Water Purification Plant</td>
</tr>
<tr>
<td>COC</td>
<td>Certificate Of Confirmity</td>
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<tr>
<td>CPVC</td>
<td>Chlorinated Polyvinyl Chloride</td>
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<tr>
<td>DAE</td>
<td>Department of Atomic Energy</td>
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<tr>
<td>DDWS</td>
<td>Department of Drinking Water and Sanitation</td>
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<tr>
<td>DI</td>
<td>Ductile Iron Pipe</td>
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<tr>
<td>DFU</td>
<td>De-Fluoridation Unit</td>
</tr>
<tr>
<td>DPIIT</td>
<td>Department for Promotion of Industry and Internal Trade</td>
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<tr>
<td>EPA</td>
<td>Environmental Protection Agency</td>
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<tr>
<td>FHTC</td>
<td>Functional Household Tap Connection</td>
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<tr>
<td>FTK</td>
<td>Field Test Kit</td>
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<tr>
<td>GI</td>
<td>Galvanized Iron pipes</td>
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<tr>
<td>GoI</td>
<td>Government of India</td>
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<tr>
<td>GC-MS</td>
<td>Gas Chromatography - Mass Spectrometry</td>
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<tr>
<td>HACCP</td>
<td>Hazard Analysis and Critical Control Point</td>
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<tr>
<td>HDPE</td>
<td>High Density Poly Ethylene</td>
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<tr>
<td>HoD</td>
<td>Head of Department</td>
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<tr>
<td>HAIX</td>
<td>Hybrid Anion Exchange</td>
</tr>
<tr>
<td>ICP-OES</td>
<td>Inductively Coupled Plasma Optical Emission Spectrometry</td>
</tr>
<tr>
<td>IEC</td>
<td>Information, Education and Communication</td>
</tr>
<tr>
<td>IFM</td>
<td>Integrated Fluorosis Mitigation</td>
</tr>
<tr>
<td>IMIS</td>
<td>Integrated Management Information System</td>
</tr>
<tr>
<td>ISO</td>
<td>International Organization for Standardization</td>
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<tr>
<td>JJM</td>
<td>Jal Jeevan Mission</td>
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<tr>
<td>LIMS</td>
<td>Laboratory Information Management System</td>
</tr>
<tr>
<td>LPCD</td>
<td>Litres Per Capita Per Day</td>
</tr>
<tr>
<td>MCSRC</td>
<td>Mahavir Cancer Sansthan &amp; Research Centre</td>
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<tr>
<td>MDPE</td>
<td>Medium-Density Polyethylene</td>
</tr>
<tr>
<td>MoEF</td>
<td>Ministry of Environment and Forests</td>
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<td>MoJS</td>
<td>Ministry of Jal Shakti</td>
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<td>NABL</td>
<td>National Accreditation Board for Testing and Calibration Laboratories</td>
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<td>NPPCF</td>
<td>National Programme for Prevention and Control of Fluorosis</td>
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<td>NGT</td>
<td>National Green Tribunal</td>
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<tr>
<td>NGO</td>
<td>Non-Governmental Organization</td>
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<td>Abbreviation</td>
<td>Description</td>
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<tr>
<td>NJJM</td>
<td>National Jal Jeevan Mission</td>
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<tr>
<td>NRDWP</td>
<td>National Rural Drinking Water Programme</td>
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<tr>
<td>NWQSM</td>
<td>National Water Quality Sub-Mission</td>
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<tr>
<td>O&amp;M</td>
<td>Operation and Maintenance</td>
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<tr>
<td>PFMS</td>
<td>Public Financial Management System</td>
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<td>PH</td>
<td>Public Health</td>
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<tr>
<td>PHED</td>
<td>Public Health Engineering Department</td>
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<tr>
<td>PRI</td>
<td>Panchayati Raj Institutions</td>
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<tr>
<td>PSA</td>
<td>Principal Scientific Advisor</td>
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<tr>
<td>PWS</td>
<td>Piped Water Supply</td>
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<tr>
<td>RAWTL</td>
<td>Regional Advance Water Testing Lab</td>
</tr>
<tr>
<td>RCC</td>
<td>Reinforced Cement Concrete</td>
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<tr>
<td>RDW&amp;SD</td>
<td>Rural Drinking Water Supply &amp; Sanitation Department</td>
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<tr>
<td>RO</td>
<td>Reverse Osmosis</td>
</tr>
<tr>
<td>RWS</td>
<td>Rural Water Supply</td>
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<tr>
<td>RWSSP-LIS</td>
<td>Rural Water Supply and Sanitation Programme for Low Income States</td>
</tr>
<tr>
<td>SAR</td>
<td>Subterranean Arsenic Removal</td>
</tr>
<tr>
<td>SOP</td>
<td>Standard Operating Procedure</td>
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<tr>
<td>SPCB</td>
<td>State Pollution Control Board</td>
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<td>SWSM</td>
<td>State Water and Sanitation Mission</td>
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<tr>
<td>TTSP</td>
<td>Tank Type Stand Post</td>
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<tr>
<td>UV</td>
<td>Ultra Violet</td>
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<td>WHO</td>
<td>World Health Organization</td>
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<td>WTP</td>
<td>Water Treatment Plant</td>
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<td>WQAA</td>
<td>Water Quality Assessment Authority</td>
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<tr>
<td>WQ</td>
<td>Water Quality</td>
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<tr>
<td>WQM&amp;S</td>
<td>Water Quality Monitoring &amp; Surveillance</td>
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National Jal Jeevan Mission (NJJM), Department of Drinking Water and Sanitation (DDWS), Ministry of Jal Shakti (M/o JS), Government of India organized a one-day national conference on “Provision of Potable Drinking Water in Quality-Affected Areas” on 7 February, 2020 at India Habitat Centre, New Delhi. The conference was attended by Health and Rural Water Supply/ Public Health Engineering (PHE) Department officials from states affected with water quality issues, civil society, international agencies, community medicine practitioners, public health representatives, etc.

There were five sessions throughout the day as under:

Contents : Table 1: Session-wise programme details

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<td>Session - III</td>
<td>Effects of poor water quality on health and technologies for removal of contaminants</td>
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<td>Water quality monitoring and surveillance</td>
<td>25</td>
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<tr>
<td>Session - V</td>
<td>Closing session on way forward</td>
<td>32</td>
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1. Director (WQ), Department of Drinking Water and Sanitation, Ministry of Jal Shakti, Government of India welcomed the dignitaries, experts and participants attending the conference and presented an overview of the objectives of the conference as under:
   i.) enable states to present their approach, planning and strategy for providing potable drinking water in quality-affected areas in a time-bound manner;
   ii.) facilitate discussions on water quality related issues;
   iii.) facilitate cross-learning and sharing of best practices from States/ UTs for improving community-based water quality surveillance mechanisms;
   iv.) share overview of available technological interventions for Arsenic and Fluoride removal; and
   v.) enable states to expedite provision of potable drinking water through FHTCs in quality-affected areas.

2. Secretary, Department of Drinking Water and Sanitation, Ministry of Jal Shakti, Government of India addressed the participants mentioning that Hon'ble Prime Minister launched the Jal Jeevan Mission (JJM) on 15 August, 2019 which is to be implemented in mission-mode in order to provide potable water to every household with Functional Household Tap Connection (FHTC) by 2024. The definition of FHTC is important focusing on the 'Functionality' of household tap connection, i.e. water supply on regular basis in adequate quantity and of prescribed quality.

Over the years, Government of India in partnership with States has launched many initiatives. National Water Quality Sub-Mission (NWQSM), as part of the erstwhile National Rural Drinking Water Programme (NRDWP), is being implemented since March, 2017 to provide safe drinking water to identified 27,544 Arsenic/ Fluoride affected rural habitations by March, 2021 as per existing guidelines. NWQSM is now subsumed under JJM.

Also, while allocating funds under JJM, 10% weightage has been given to population residing in habitations affected by water quality and providing potable water to quality affected habitations is topmost priority under JJM. As per National Green Tribunal (NGT) directions, drinking water of prescribed quality is to be supplied in quality-affected areas by 2020.

The Operational Guidelines for JJM emphasize on bottom-up approach rather than top-down approach. Gram Panchayat and/ or its sub-committee is to plan, implement, manage, operate and maintain its in-village water supply infrastructure including water quality surveillance. Community is to be empowered to monitor water quality themselves and this will be an important aspect under JJM. JJM focuses on all aspects of water quality right from testing, technology, management, taking grass root level feedback and communicating results back to them. The role of State Water and Sanitation Mission (SWSM) is very important in implementation of the programme in mission-mode. DDWS at Central level will provide
all kind of technological and financial support to states/UTs.

The Secretary, DDWS informed that out of 2,231 drinking water quality testing laboratories in the country, only 50 laboratories are NABL accredited and that the states/UTs Rural Water Supply Departments should strive for accreditation of remaining laboratories urgently.

It was also conveyed that DDWS has constituted a technical committee under the Chairmanship of Principal Scientific Advisor (PSA) for technical vetting and approval of various technologies. The gathering was requested to share any kind technological intervention/innovation in the field of drinking water for their examination and technical vetting by the Committee.

The Secretary once again urged the participants for active contribution in the conference w.r.t ideas, discussion, planning and road map for way forward.

3. The Hon’ble Minister of State, Jal Shakti in his keynote address emphasized the importance of potable drinking water and its relation with human health and socio-economic development. He explained that most of water supply schemes in rural areas are mainly based on ground water source, which is increasingly under stress due to rapid population growth, urbanization and higher with dwal of ground water. The quality of drinking water is a concern. Even today, people are consuming water with high Arsenic, Fluoride and other contaminants adversely affecting their health and livelihood.

States/ UTs can use up to 2% of the total allocated funds for water quality monitoring and surveillance activities.
Government of India has launched JJM to provide Functional Household Tap Connection at the rate of 55 lpcd with prescribed quality of drinking water to every rural households by 2024 including water quality affected areas. The Ministry has provisioned Rs. 3.60 Lakh Crore under JJM. States/ UTs can use up to 2% of the total allocated funds for water quality monitoring and surveillance activities. The JJM guidelines also gives flexibility to States/ UTs to adopt PPP model. The Hon’ble Minister mentioned that this conference will help in understanding the cross-sectoral issues in the field of water quality.

4. The Hon’ble Union Minister, Jal Shakti, in his inaugural address, mentioned that various State and Central Governments in the past have been working consistently to provide potable water for a long time and currently, around 52,000 habitations are affected with water quality contamination in our country.

He further informed that the different states/ UTs are affected with multiple water quality problems, especially Arsenic, Fluoride and heavy metals, causing severe human health hazards, directly and/or indirectly. Government of India is committed to provide potable drinking water to every household by 2024.

India has achieved 100% success in improving the sanitation facilities on a mission-mode which in-turn has resulted in improving the living standards of our citizens. Similarly, Jal Jeevan Mission (JJM) aims to provide a Functional Household Tap Connection (FHTC) to every rural household by 2024 on a mission-mode. Hon’ble Union Minster requested the public health engineers to create awareness among general public on quality of drinking water being supplied. He also urged the public health engineers to ensure the sustainability and functionality of drinking water purification plants post installation.

The Hon’ble Minister invited all stakeholders to share the best technological interventions with DDWS for technical and functional vetting by technical committee constituted under the Chairmanship of Principal Scientific Adviser (PSA) to Government of India. This will help the States/ UTs to select the best location-specific technological solutions as per need. He wished that the conference will be the platform for all participants in brainstorming on the present challenges and suggest remedial measures in drinking water supply sector.
5. Opening remarks by Shri Bharat Lal, Additional Secretary & Mission Director (JJM), DDWS, MoJS, New Delhi

The Additional Secretary & Mission Director (JJM), Department of Drinking Water and Sanitation, New Delhi enlightened the participants with the objectives and present scenario of water quality-affected habitations in the country. JJM envisages provision of potable drinking water through Functional Household Tap Connection (FHTC) to rural households by 2024.

The Mission Director explained that out of the total 17.87 Crore rural households, presently only 3.28 Crore (18.33%) households have tap water connection. The remaining 14.60 Crore (81.67%) households are to be provided with FHTCs by 2024. The estimated outlay of the mission is Rs.3.60 Lakh

Out of the total 17.87 Crore rural households, presently only 3.28 Crore (18.33%) households have tap water connection. The remaining 14.60 Crore (81.67%) households are to be provided with FHTCs by 2024.

<table>
<thead>
<tr>
<th>State</th>
<th>As on 25.03.2019</th>
<th>As on 26.01.2020</th>
<th>Progress</th>
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<tbody>
<tr>
<td></td>
<td>No. of habitations</td>
<td>Population</td>
<td>No. of habitations</td>
</tr>
<tr>
<td>Assam</td>
<td>4,301</td>
<td>16.08</td>
<td>3,309</td>
</tr>
<tr>
<td>Bihar</td>
<td>807</td>
<td>12.06</td>
<td>335</td>
</tr>
<tr>
<td>Jharkhand</td>
<td>19</td>
<td>0.13</td>
<td>3</td>
</tr>
<tr>
<td>Karnataka</td>
<td>3</td>
<td>0.03</td>
<td>0</td>
</tr>
<tr>
<td>Punjab</td>
<td>652</td>
<td>8.28</td>
<td>644</td>
</tr>
<tr>
<td>Uttar Pradesh</td>
<td>707</td>
<td>5.33</td>
<td>606</td>
</tr>
<tr>
<td>West Bengal</td>
<td>9,126</td>
<td>93.20</td>
<td>5,304</td>
</tr>
<tr>
<td>Total</td>
<td>15,615</td>
<td>135.10</td>
<td>10,201</td>
</tr>
</tbody>
</table>

Table 2: Number of Arsenic-affected habitations with population (in Lakh)
Crore with Central and state share of Rs.2.08 Lakh Crore and Rs. 1.52 Lakh Crore, respectively.

It was explained that National Water Quality Sub-Mission (NWQSM) is being implemented since March, 2017 to provide safe drinking water to identified 27,544 Arsenic/ Fluoride affected rural habitations by March, 2021 as per existing guidelines. All the quality-affected habitations identified under NWQSM have to be provided with FHTCs by 31 March, 2021.

The Mission Director also sensitized the states/ UTs on the directions given by National Green Tribunal (NGT) with regard to Arsenic-affected habitations that potable water is to be ensured by 2020. He explained that the progress reported in states of Punjab, Uttar Pradesh, Bihar and Assam is not satisfactory and that the situation in West Bengal is acute. These states were advised to take the matter seriously and take urgent steps to advance the timeline of providing potable water to 31 December, 2020 in view of serious health consequences for those consuming contaminated water and make immediate alternate arrangements for the supply of potable drinking water to inhabitants in the interim period.

Over the years, efforts have been taken by states to provide potable water supply in quality-affected habitations. Figure 2 indicates the number of quality-affected habitations that are yet to be provided with potable water supply.

It was conveyed that the newly emerged quality-affected habitations, if any, have to be prioritized and schemes planned accordingly. Since commissioning of piped water supply schemes takes 2-3 years, states/ UTs have been advised to take up Community Water Purification Plants over the years.努力

The states/ UTs were requested to monitor hotspots, evaluate triggers identified by Health Department w.r.t water-borne diseases and carry out mass water quality monitoring activities and generate a pre-monsoon report within three months.
(CWPPs) in Arsenic and Fluoride affected habitations as an immediate (short-term) measure.

The states/ UTs were requested to monitor hotspots, evaluate triggers identified by Health Department w.r.t water-borne diseases and carry out mass water quality monitoring activities and generate a pre-monsoon report within three months. As per JJM guidelines, states/UTs are to identify and train 5 women from every village. The states/UTs were advised to partner with NGOs/ Trusts/ Foundations, etc. as Implementation Support Agencies (ISAs) which can be allotted 40-60 villages at a time. The states/UTs may also identify sector partners at state level, viz. UNICEF/ international development agencies, etc.

It was discussed that states/UTs are encouraged to promote innovative technologies and research. Identify convergence, especially with Health Department and plan for rehabilitation of those affected with diseases such as Fluorosis, Arsenicosis, etc. It was requested to plan and implement awareness campaigns on adverse health impacts of drinking contaminated water and its impact on cattle, food chain, productivity & economy, and thus overall life.

6. Presentation by PHED, West Bengal
The Chief Engineer, PHED, West Bengal highlighted the status of ground water contamination and initiatives taken so far to address the water quality issues in the State. The State has multiple water quality problems comprising of Arsenic, Fluoride, Iron and Salinity.

The State has adapted multi-pronged approach for ensuring potable water supply in quality-affected areas comprising of short-term, medium-term and long-term measures as under. Under short-term measures, state installed handpump attached Arsenic removal units, Community
Water Purification Plants and Water ATMs. Under medium and long-term measures, the following are implemented:

i.) Groundwater based piped water supply schemes fitted with Arsenic and Iron removal plants;

ii.) Groundwater based piped water supply schemes;

iii.) Surface water based Piped Water Supply Schemes;

iv.) Sub-Surface water based piped water supply schemes.

The technologies/ media adopted in State for Fluoride removal are as under:

i.) Electro-coagulation followed by Activated Alumina Adsorption;

ii.) Hybrid Anion Exchange Resin;


The technologies/ media adopted for Arsenic removal are as under:

i.) Granular Ferric Hydroxide;

ii.) Hybrid Anion Exchange (HAIX-Nano-Fe) Resin;

iii.) Laterite based Media;

iv.) Nanomaterial – Metal Oxyhydroxide Nanocomposites;

v.) Arsenic removal using Ceramic Membrane;

vi.) Gobardanga model with Activated Alumina Adsorption;

vii.) Modified Sujapur Sadipur model with Activated Alumina Adsorption.

The state in partnership with academic institutes has been undertaking regular performance evaluation of Arsenic and Iron removal plants. The Chief Engineer also mentioned that the State has good network of water quality testing laboratories with advanced instruments like ICP-OES and GC-MS. Three laboratories are accredited as per ISO/ IEC 17025: 2017. The Department has recently received SKOCH Award Silver under 'Governance' category for 'Smart Rural Drinking Water Quality Monitoring and Surveillance' involving the community.

Further, he also elaborated the challenges faced in implementation of JJM as under:

i.) Coverage of the entire water quality-affected area by 2024 through FHTC;

ii.) Restructuring of the organization;

iii.) Non availability of credible agencies for execution of projects;

iv.) Operation & maintenance of the assets;

v.) Transfer of assets to the community/ PRIs;

vi.) Non-availability of trained operators;

vii.) Testing of private drinking water sources;

viii.) Scaling up of new technologies.

7. Presentation by PHED, Assam

The Chief Engineer, PHED, Assam highlighted the status of Arsenic and Flouride contamination in the State. Presently, there are 2,992 Arsenic affected habitations and 71 Flouride affected habitations in the State. The State have informed the action taken/planned for providing safe drinking water to quality affected habitations.
Rajasthan adopted short-term and long-term measures for potable water supply in quality-affected areas. Under short-term measures, State constructed ring wells and installed CWPPs. Under long-term measures, State is implementing piped water supply schemes.

The technologies adopted in State are as under:

i.) Adsorption technology;
ii.) Nano-based technology;
iii.) Electric de-fluoridation Plant;
iv.) New indigenous technology invented in Assam.

The Chief Engineer conveyed that the state has a network of over 78 water quality testing laboratories.

For FHTCs in quality-affected areas, the following is being adopted:

i.) Surface water based multi village piped water supply schemes;
ii.) Ground water based mini piped water supply schemes;
iii.) Single village schemes proper technology in habitations covered with CWPPs.

8. Presentation by PHED, Rajasthan

The Chief Engineer, PHED, Rajasthan highlighted that the state has multiple water quality problems comprising of Fluoride, Nitrate, Salinity etc. 78% of drinking water supply schemes in the state are based on ground water source. In Rajasthan, FHTCs are provided only in habitations having population more than 4,000.

The main focus is on Fluoride. The habitations affected with Salinity and Fluoride are covered through RO plants and those affected with only Fluoride are covered through De-fluoridation units. The CWPPs are provided for minimum need of drinking and cooking purposes only. The state is aiming to cover Fluoride affected habitations to provide FHTCs by March 2021 as per guidelines of NWQSM.

The state has adapted short-term and long-term measures for potable water supply in quality-affected areas. Under short/medium-term measures, state has installed Reverse Osmosis (RO) plants and solar energy-based de-fluoridation units. State is planning to increase its coverage through major projects based on surface water sources and drinking water grid under long-term measures.

The technologies adopted in state are as under:

i.) Reverse Osmosis (RO) plants;
ii.) De-fluoridation units;
iii.) Solar energy-based water pumping system attached with de-fluoridation unit.

The Chief Engineer mentioned that 6 out of the 33 laboratories in state are NABL accredited. Accreditation process of 13 laboratories is under active progress. Further, 343 laboratories are to be set up at block-level with NABL accreditation.

Rajasthan also adopted some innovative initiatives as under:

i.) Integrated Fluorosis Mitigation (IFM) approach which includes focus on health and nutrition along with safe drinking water;
ii.) Constitution of state water quality task force. This task force is working as per the national model (Assam and West Bengal) and international experiences (Joint Monitoring Program – WHO & UNICEF) and WINSICOSIN;
iii.) M-ColiPAT kit for microbiological water quality testing;
iv.) Evaluation study of 200 community RO plants across Rajasthan;
v.) Water disinfection technology by M/s Hydro-Dis, Australia.

9. Presentation by Uttar Pradesh Jal Nigam

The Principal Secretary, Rural Water Supply Department, UP explained that the state has multiple water quality problems comprising of Arsenic, Fluoride, Iron, Nitrate, Salinity, etc. For immediate relief, CWPP is being proposed in all the habitations which may not be covered by 31 March, 2020. The state has 3,089 JE/ AES affected villages and all the affected villages/ habitations have been covered by PWS, mini PWS (TTSP) and extra deep India Mark–II hand pump.

The state has adapted short-term and long-term measures for potable water supply in quality-affected areas. Under short/ medium-term measures, Reverse Osmosis (RO) Plants and solar energy-based de-fluoridation units are being installed. Under long-term measures, state is increasing coverage through major projects based on surface water and drinking water grid.

The technologies adopted in state are as under:

i.) Adsorption;
ii.) Nano-technology;
iii.) Chlorination;
iv.) Silver Ionization;
v.) AMRIT.

The state has 1 state-level, 75 Regional/ district-level and 5 Mobile water quality testing laboratories. Only the state laboratory is NABL accredited.

Further, he also elaborated the challenges faced in implementation of JJM as under:

i.) Source sustainability;
ii.) Community consensus for land acquisition for suitable site;
iii.) Collection of community contribution for JJM;
iv.) Lack of public awareness;
v.) Lack of feasible technical energy-based options for continuous functioning of scheme;
vi.) Non-willingness to pay for safe drinking water;
vii.) Requirement of huge resources (technical/skilled human resource) to provide safe drinking water to all households by 2024;
viii.) Depleting ground water level.

10. Presentation by DWSS, Punjab

The Principal Secretary, DWSS, Punjab highlighted that the state has multiple water quality problems comprising of Arsenic, Fluoride, Uranium and Heavy Metals. The state has taken following initiatives to address water quality issues:

i.) 6 mega projects worth Rs. 952 Crore approved under NWQSM;

ii.) 85 Uranium-affected villages of Moga District (Population 3.63 lakh) covered with surface water supply scheme worth Rs. 225 Crore under World Bank project likely to be commissioned by 31 March, 2020;
iii.) 48 Iron-affected villages (Population 49,000) of Roopnagar district shifted to surface water supply at a cost of Rs. 26.27 Crore;

iv.) Stand alone Ion Exchange Technology based (INDION Uranium Selective Resin) (1000 LPH) pilot plant commissioned in November, 2019 in a village in Hoshiarpur district;

v.) 22 CWPPs installed on Hand Pumps;

vi.) 86 retrofitted Iron-cum-Arsenic removal plants based on Adsorption by nano materials (IIT Chennai technology) @ 70 LPCD.

The technologies adopted in state are as under:

i.) Adsorption;

ii.) RO;

iii.) Ion Exchange Technology;

iv.) Online Domestic UV Treatment Units by Stanley Electric, Japan have been implemented as Pilot Project.

Integrated three-tier water quality testing laboratory infrastructure notified. Upgradation of buildings and equipment in progress and will be completed by year end. LIMS software for management of laboratories being implemented. 2 NABL accredited laboratories namely Regional Advance Water Testing Lab (RAWTL) at SAS Nagar and TWERU, Patiala.

Further, she also elaborated the challenges faced in implementation of JJM as under:

i.) Sustainability of treatment technologies;

ii.) High media cost;

iii.) Disposal of media;

iv.) Special permission required from Department of Atomic Energy (DAE) for extraction of Uranium.

11. Presentation by Drinking Water and Sanitation Wing, PWD, Tripura

There are 2,357 habitations affected with Iron contamination in the state, out of which 1,423 habitations have been fully covered and 928 are partially covered habitations. There are 8,59,052 number of rural households in the state, out of which 67,729 have been covered with Functional Household Tap Connection (FHTC).

The Chief Engineer explained about the model of Iron removal plant in Tripura as under:

i.) Package type iron removal plant;

ii.) Modified iron removal plant;

iii.) Tripura make carbon filter.

At present, State has one state-level laboratory, 8 district-level laboratories, 12 Sub-Divisional laboratories and 3 Laboratories attached to SWTP which are all functional for day to day water testing. The state-level water testing laboratory is NABL accredited.

The state faces the challenge of land availability during implementation of Iron removal plants and backwash during Operation & Maintenance.

12. Presentation by RDW&SD, Karnataka

The Consultant, RDW&SD, Karnataka explained that the state has multiple water quality problems comprising of Fluoride, Iron, Nitrate, Heavy metals, Salinity, etc. There are 446 habitations/villages affected with water quality contamination, out of which 342 habitations/villages have been covered with piped water supply. The State is aiming to cover left out habitations under NWQSM by March, 2021.
13. Presentation by PHED, Bihar

The Chief Engineer, PHED, Bihar explained about ground water quality scenario in the state mentioning that 33 districts of the state are affected with water quality contamination comprising of Fluoride, Arsenic and Iron.

The Government of Bihar has taken a resolution of “Har Ghar Nal Ka Jal” in rural areas which is being implemented jointly by:

i.) Public Health Engineering Department
   a. Mukhyamantri Gramin Peyjal Nishchay Yojana (Quality affected area)
   b. Mukhyamantri Gramin Peyjal Nishchay Yojana (Non-quality affected area)
   c. Jal Jeevan Mission (NRDWP/NWQSM/RWSSP-LIS)

ii.) Panchayati Raj Department
   a. Mukhyamantri Gramin Peyjal Nishchay Yojana

Key strategy adopted for achieving the target of safe drinking water supply is as under:

i.) Ward of Gram Panchayats would be the implementation unit;

ii.) One Tap in one house (in place of water supply through stand-post);

iii.) 70 lpcd water supply;

iv.) Inclusion of 5 years O&M cost in the capital cost of the scheme;

v.) Shift from metallic pipes (CI/ GI/ DI) to non-metallic pipes (HDPE/ MDPE/ CPVC);

vi.) Pre-fabricated structure in place of RCC structures;

vii.) Social certification of work implementation.
33 districts of Bihar are affected with water quality contamination comprising of Fluoride, Arsenic and Iron. The Government of Bihar has taken a resolution of “Har Ghar Nal Ka Jal” in rural areas.

It was explained that the state will achieve the NWQSM targets by March, 2021. The state has adapted short-term and long-term measures for potable water supply in quality-affected areas. Short/medium-term measures include Reverse Osmosis (RO) plants and solar energy-based DFUs. Under long-term measures, state is increasing coverage through major projects based on surface water and drinking water grid.

The technologies adopted in state are as under:

i.) Arsenic treatment technologies
   a. Adsorption/ nano-technology based adsorption
   b. Adsorption with Resin technology
   c. Oxidation & adsorption catalytic oxidation-based treatment (type-I)
   d. Oxidation & adsorption catalytic oxidation-based treatment (type-II)

ii.) Fluoride treatment technologies
   a. Ion exchange method
   b. Adsorption

iii.) Iron treatment technologies
   a. Nano-technology based Adsorption
   b. Oxidation & filtration with natural MnO2 based media
   c. Oxidation & filtration with resin technology
   d. Oxidation & adsorption catalytic oxidation-based treatment (type-I)
   e. Oxidation & adsorption catalytic oxidation-based treatment (type-II)

State has issued protocol on operation & maintenance and reject management for Arsenic, Fluoride and Iron treatment units. The Chief Engineer also conveyed that the state has 123 laboratories, out of which only state-level laboratory is NABL accredited.

State undertook some innovative initiatives as under:

i.) Relaxed eligibility criteria & decentralized tendering;

ii.) Devolution of review, approval and sanctioning power among field functionaries;

iii.) Establishment of quality monitoring cell and introduction of third-party quality check;

iv.) Strengthening the quality testing at consignee end by establishing testing equipments at site. Time & motion tracking at state and PH Division level;

v.) Detailed diagnostic study carried out on various parameters of services delivery & finalized WTP;

vi.) Protocol developed for O&M of WTP and reject management.
Dr. P. Saxena, MD, Additional Deputy Director General, M/o HFW, GoI

Dr. P. Saxena delivered a brief talk on National Programme on Prevention and Control of Fluorosis (NPPCF) by GoI. The following activities are undertaken as per National Programme for Prevention and Control of Fluorosis (NPPCF):

i.) Surveillance of fluorosis in the community;
ii.) Capacity building (Human Resource) in the form of training and HR support;
iii.) Establishment of diagnostic facilities in the medical hospitals;
iv.) Management of fluorosis cases including treatment surgery, rehabilitation;
v.) Health education for prevention and control of fluorosis cases.

Dr. P. Saxena stressed on the need for convergence and collaboration between Health departments and RWS/ PHE departments, especially in the districts identified as hotspots under NPPCF.

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<td>Fluorosis mitigation efforts of GoI</td>
<td>Dr. P. Saxena, MD, Additional Deputy Director General, M/o HFW, GoI</td>
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<td>Health impacts of Arsenicosis</td>
<td>Dr. Ashok Ghosh, Chairman, State Pollution Control Board, Bihar and Professor &amp; HoD Research, Mahavir Cancer Sansthan &amp; Research Centre (MCSRC), Patna</td>
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<tr>
<td>Health Impacts of Fluorosis</td>
<td>Dr. Pravin Khobragade, Health Specialist, UNICEF</td>
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<tr>
<td>Overview of available technologies for Arsenic removal from water</td>
<td>Prof. Arunabha Majumdar, Jadavpur University</td>
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<td>Overview of available technologies for Fluoride removal from water</td>
<td>Dr. Pawan Labhasetwar, NEERI, Nagpur</td>
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<tr>
<td>Water Safety Planning</td>
<td>Ms. Payden, Deputy Representative, WHO India</td>
</tr>
</tbody>
</table>

Table 3: Details of session-III
Dr. Ashok Ghosh made a presentation on health impacts of Arsenicosis. During the presentation he stressed on how Arsenic acts as a slow poison to human body. The inorganic Arsenic, naturally present at high levels in the groundwater of many countries is creating an important public health issue affecting millions of people. Severe health effects have been observed in population consuming Arsenic contaminated water over long periods. Research has established that drinking Arsenic contaminated water causes mental retardness, lung cancer, indigestion, hyperkeratosis, irritations, pterygium, peripheral neuropathy, liver cancer, kidney & urinary bladder cancer and even reduces sperm count leading to infertility.

He explained that the Indian subcontinent traditionally used surface water until 1970s, post which due to rising pollution levels tube wells became the trend and over millions of tube wells exist now. However, although the use of ground water reduced infant and child mortality rates, it brought Arsenic contamination issues. He further explained the routes of Arsenic ingestion, viz. drinking Arsenic contaminated water, food chain, burning cowdung cake, etc. He also briefed on Arsenic distribution in the environment and its transfer pathways to human body.

Research findings by his Institute in Bihar are as under:

i.) 12,218 of 41,061 hand pumps had Arsenic contaminated water of >10 ppb (29.75%);

ii.) Highest Arsenic value recorded is 1,906 against WHO permissible limit of 10 ppb;

iii.) A total of 18 districts (61 blocks) are affected by high level of Arsenic;

iv.) Trivalent Arsenic is found in 87 % of tested ground water sources;

v.) Worst-affected districts are Bhojpur, Bhagalpur, Buxar, Patna, Vaishali, Khagaria and Samastipur;

vi.) Many areas with persons showing symptoms of Arsenic poisoning and confirmed cancer are detected as Arsenic hotspots of Bihar.

Challenges faced are as under:

i.) Research into Arsenic speciation, mobilization are largely fragmented and repetitive;

ii.) Lack of comprehensive data base for Arsenic contaminated aquifers and exposed population;

iii.) Lack of knowledge and medical infrastructure relating to diagnosis and treatment of Arsenicosis;

iv.) Very limited epidemiological studies/research conducted till date;

v.) Lack of maintenance and monitoring of mitigation structures;

vi.) No medicine to treat patients with Arsenicosis.
16. Health Impacts of Fluorosis by Dr. Pravin Khobragade, Health Specialist, UNICEF

Dr. Pravin Khobragade made a presentation on Health Impacts of Fluorosis. During the presentation he explained how consuming Fluoride contaminated water leads to deposition of fluoride in hard and soft issues in the body leading to fluorosis. This can be identified easily by discoloration of teeth and crippling disorder. He also told excessive Fluoride intake leads to loss of Calcium from the tooth matrix, aggravating cavity formation throughout life rather than remedying it, and thus causing dental fluorosis. Severe chronic and cumulative overexposure can cause the incurable crippling of skeletal fluorosis.

He explained the three adverse impacts of fluorosis in detail as under:

i.) **Dental Fluorosis in children:** Dental fluorosis is the appearance of faint white lines or streaks on the teeth that only occurs when younger children consume too much Fluoride over long periods when teeth are developing under the gums. Most dental fluorosis cases are either mild or moderate. Mild forms of fluorosis appear as white, lacy markings on the tooth's enamel and are difficult to see with the untrained eye. Moderate fluorosis looks just like mild but covers more of the tooth. When fluorosis is severe, the enamel may have pitting and brown spots.

ii.) **Skeletal Fluorosis:** Skeletal fluorosis is a serious condition, resulting from chronic ingestion of large amounts of Fluoride over many years during periods of bone modeling (growth) and/or remodeling. In skeletal fluorosis the bones are generally weaker than normal with stiffness and pain in the joints as the early symptoms.

iii.) **Non-Skeletal Fluorosis:** Fluoride when consumed in excess can cause several ailments, besides skeletal and dental fluorosis, which fall under non-skeletal fluorosis. The sign of non-skeletal fluorosis symptoms are nervousness, depression, muscle weakness, stiffness, allergy, gastro-intestinal issues, urinary tract & headache issues, etc. It affects men, women and children of all age groups.

Detection of fluorosis is made through:

i.) **Physical examination:** Dental changes, pain and stiffness of peripheral joints, skeletal deformities, coin test, chin test, stretch test, etc.;

ii.) **Laboratory tests:** Urine tests and drinking water analysis for Fluoride level;

iii.) **Radiological examination** (where ever possible): X-ray forearm (AP view), X-ray of most affected part (AP and lateral).

Management of fluorosis is to be done as under:

i.) **Drinking Safe drinking water**

ii.) **Changing dietary habits**

   a.) avoid use of fluoride rich foods, Black rock salt;

   b.) use of food rich in calcium, vitamin 'C', anti-oxidants, etc.

iii.) **Rehabilitation:** Physiotherapy, Corrective plasters, Orthoses & Surgery if required.
17. Overview of available technologies for Arsenic removal from water by Prof. Arunabha Majumdar, Jadavpur University

Prof. Arunabha Majumdar made a presentation on available technologies for removal of Arsenic from Water. He explained that the feasibility of Arsenic Removal Unit (ARU) depends on existing basic water supply system, amount of Arsenic in water and percentage that needs to be removed, level of managerial & technical capacity to install & maintain ARU, community participation in managing ARU, their willingness & level of income to contribute towards O&M, etc. Arsenic can be removed from ground water by Oxidation & Co-precipitation techniques. Arsenic is present in groundwater in As (III) and As (V) forms in different proportion and most treatment methods are effective in removing Arsenic in pentavalent form and hence include an oxidation step as pre-treatment to convert Arsenite to Arsenate.

Some of the technological options available for removal of Arsenic are as under:

i.) **Oxidation and Co-precipitation:** The oxidation agents like Oxygen, powdered active Carbon and dissolved Oxygen, UV-Irradiation & chemicals (free Chlorine, Hypochlorite, bleaching powder, Ozone, Permanganate, Hydrogen peroxide, etc.) may be used for oxidation process and Co-Precipitation process.

ii.) **Adsorption:** Activated Alumina / Ferric Hydroxide/ Laterite/ Iron Nail/ haematite, etc. are used as media in adsorption technology. Activated Alumina having good absorptive surface is an effective media for Arsenic removal. After adsorption capacity exhausted, Activated Alumina may be regenerated by washing the column with 4% caustic soda followed by 2% solution of Sulphuric acid. Activated Alumina column may be replaced after four regenerations.

iii.) **Ion-exchange:** Synthetic ion exchange resins are a special kind of sorption media. They are used in water treatment to remove undesirable ions by replacing ions attached to the resins. Ion exchange is very effective when the form of Arsenic in water is predominantly As (V), otherwise pre-oxidation step is necessary.

iv.) In **Subterranean Arsenic Removal (SAR) Technology,** aerated groundwater is recharged back into the aquifer to create an oxidation zone which can trap Iron and Arsenic on the soil particles through adsorption process. The oxidation zone created by aerated water boosts the activity of the Arsenic-oxidizing microorganisms which can oxidize Arsenite to Arsenate state. The process is not chemical based and almost no sludge is produced during operational stage since Iron and Arsenic compounds are rendered inactive at the aquifer itself.

v.) **Reverse Osmosis (RO):** RO is very effective in removing dissolved Arsenic. Arsenic removal efficiency of greater than 95% can be achieved when operating pressure is ideal. States have to take necessary steps for reject management.

vi.) **Arsenic and Iron Removal Plant (AIRP):** When groundwater contains an excessive amount of Iron (and/ or Manganese), plants designed for Iron removal can at the same time remove Arsenic can be removed from ground water by Oxidation & Co-precipitation techniques. Arsenic is present in groundwater... most treatment methods are effective in removing Arsenic in pentavalent form and hence include an oxidation step as pre-treatment to convert Arsenite to Arsenate.
Arsenic. Depending on the proportion of As (III) in the water, a chemical oxidation step may be required. Many Iron removal plants do not use flocculation and sedimentation; the flocs formed as a result of the presence of natural coagulants or added coagulants are removed in the direct filtration step. Other methods that can be used in small communities are Arsenic-specific filter units (like activated Alumina filters) and ion exchange resin beds. These units may need a coarse sand pre-filter unit to remove excessive iron so that iron hydroxide flocs formed do not clog the subsequent filter units. Again a chemical oxidation step may be necessary depending on the proportion of As (III).

The sludge may be disposed in on-site sanitation pit (anaerobic reactor), may be mixed with cement concreting or may be mixed with clay and burning for brick manufacturing.

Critical Issues Relating To Arsenic Removal Plants are as under:

i.) AIRP design must be done on the basis of actual water quality of bore-well;

ii.) Treatment process preferably is to be developed on the basis of treatability study;

iii.) Dosage of chemicals is to be derived through field study;

iv.) Backwashing interval is to be determined as per field condition;

v.) Reject (sludge/ exhausted media) management must be scientific and without any risk;

vi.) On-site Arsenic detection kit must be available;

vii.) Regeneration/ replacement of media must be done at appropriate time;

viii.) AIRP operators must be trained;

ix.) Pressure gauge and flow meters must be functional at the plant;

x.) Plant-wise O&M manual (incorporating SOP) must be prepared and available at site;

xi.) Third-party monitoring and plant performance evaluation may be carried out.

18. Overview of available technologies for Fluoride removal from water by Dr. Pawan Labhasetwar, NEERI, Nagpur

Dr. Pawan Labhasetwar made a presentation on De-fluoridation technologies as under:

i.) Nalgonda Technique: This is based on combined use of alum and lime in two-step process and has been claimed as most effective technique for Fluoride removal. Nalgonda Technique involves addition of aluminium salts, lime and bleaching powder followed by rapid mixing, flocculation sedimentation, filtration, disinfection and sludge concentration for recovery of water and Aluminium salt. Aluminium salt may be added as Aluminium Sulphate or Aluminium Chloride or combination of these two. Aluminium salt is only responsible for removal of Fluoride from water.

ii.) Electrolytic-Defluoridation Technique: An electrolytic defluoridation unit basically consists of an electrolyte reactor having Aluminium anode and cathode. When DC source is applied across the electrodes, the anode dissolves and Hydrogen gas is released at the cathode. During the dissolution of anode, various aqueous metallic species are produced, which depend on the solution
chemistry. These metallic species act as a coagulant by combing with Fluoride ions present in the water to form large size flocs which can be removed by sedimentation or filtration.

iii.) **Chemo-Defluoridation Unit:** The salt of Calcium and Phosphorous are used to reduce the raw water Fluoride concentration. The chemicals react with each other to form the chemical complex which absorbs Fluoride and precipitates out. Then, water is allowed to flow by gravity into the sand filter. Filtered water free from Fluoride is used for cooking & drinking purpose.

iv.) **Membrane Techniques (Reverse Osmosis, Nano Filtration, dialysis & electro-dialysis):** RO is very effective in removing Fluoride. The membranes used in nano-filtration will have slightly larger pores than those used in reverse osmosis and offer less resistance to passage both of solvent and of solutes. Dialysis separates solutes by transport of the solutes through a membrane rather than using a membrane to retain the solutes while water passes through it as in reverse osmosis and nano-filtration. Electro-dialysis is the removal of ionic components from aqueous solutions through ion exchange membranes under the driving force of an electric field.

Mr. Pawan stressed on the need for benchmarking of technologies which may be done as under:

i.) Operating conditions;
ii.) Economic parameters;
iii.) Reject management;
iv.) Technology readiness level;
v.) Resilience to failure;
vi.) Other miscellaneous parameters.

Some other solutions for reducing fluorosis are as under:

1.) Implementing water quality-based treatment system;
2.) Improving monitoring mechanism;
3.) Harnessing citizen science for awareness building for informed choices by consumers;
4.) Treat proportion of water needed for drinking (alternate distribution system).

19. **Water Safety Planning by Ms. Payden, Deputy Representative, WHO India**

Ms. Payden made a presentation on Water Safety Planning (WSP). WSP is a comprehensive risk assessment and risk management approach that includes all steps in the water supply from catchment to consumer. Till now, 93 counties have implemented Water Safety Plans.
The conventional system of water quality monitoring has following drawbacks:

i.) By the time test results come in, people would have become sick;

ii.) Limitations of end product testing, particularly microbiological contaminants, but also chemicals. Samples are small and infrequent in relation to quantity of water supplied;

iii.) E.coli (or alternatively thermotolerant coliforms) is good faecal indicator and appropriate for surveillance, but it is not a good indicator of specific pathogens and absence of E.coli does not necessarily mean water safe;

iv.) Not a management tool because of delay in results;

v.) Compliance monitoring results may alert you to a problem but does not tell you what caused it, what to fix and how to prioritize improvements.

Benefits of Water Safety Planning are as under:

i.) More effective co-ordination and improved efficiency;

ii.) Encourages other stakeholders to take increased responsibility;

iii.) Water safety due diligence in place;

iv.) Better targeting of investments and enhanced preparedness for emergencies;

v.) Clearer identification of responsibility for those outside supplier control;

vi.) Strong basis for gaining and retaining confidence of consumers;

vii.) Financial benefits in the long-term;

viii.) Increased customer confidence in water supply;

ix.) Reliability;

x.) Safety;

xi.) Better health outcomes;

xii.) Saving costs due to availability of safe water at tap.

WSP is a tool to achieve JJM objectives because of the following:

i.) Addresses quality and quantity of water supply;

ii.) Focuses on multi-sectoral action and stakeholder engagement;

iii.) Proactive risk management tool from catchment to consumer;

iv.) WSP can be used in any system;

v.) WSP has been pilot tested and replicated in many countries;

vi.) WSP to be backed by water quality surveillance to achieve health outcomes.
The Head (FAD), BIS, New Delhi enlightened the participants in Indian Standards on Drinking Water-Specification IS 10500:2012 and its amendments from time to time. This standard prescribes the requirements and the methods of sampling and testing for drinking water. He explained that IS 10500 was originally published in 1983 with the objective of assessing the quality of water resources and to check the effectiveness of water treatment and supply by the concerned authorities.

It was informed that this standard specifies the acceptable limits and the permissible limits in the absence of alternate source. Acceptable limits

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### Table 4: Details of session-IV

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<td>Sh. P. Ramesh, Head (FAD), Bureau of Indian Standards, New Delhi</td>
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<tr>
<td>'Public Health' role and responsibility vis-à-vis water supply - some legal concerns</td>
<td>Sh. Sanjay Upadhyay, advocate, Supreme Court of India and Managing Partner, Enviro Legal Defense firm</td>
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<tr>
<td>NABL accreditation, policy and procedure</td>
<td>Sh. N. Venkateswaran, Chief Executive Officer, NABL, Gurugram</td>
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<tr>
<td>WQM&amp;S activities by Govt of Gujarat</td>
<td>Sh. M.C. Acharya, CSO &amp; N.K. Chauhan, EE, Gujarat Water Supply &amp; Sewerage Board, Gandhinagar, Gujarat</td>
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<tr>
<td>Water quality management and community involvement</td>
<td>Smt. Gayatri Minj, community member supported by Gram Vikas, Odisha</td>
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</table>
are the values in excess of which the water is not suitable for drinking purposes. Such a value may, however, be tolerated in the absence of an alternative source. However, if the value exceeds the limits indicated under 'permissible limit in the absence of alternate source', the sources will have to be rejected.

This standard covers specifications for the following group of parameters as under:

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<th>S.No.</th>
<th>Requirement</th>
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<tr>
<td>1.</td>
<td>Organoleptic &amp; physical requirements (6 test parameters)</td>
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<tr>
<td>2.</td>
<td>Chemical requirements affecting acceptability (24 test parameters)</td>
</tr>
<tr>
<td>3.</td>
<td>Toxic metals and anions (15 test parameters)</td>
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<tr>
<td>4.</td>
<td>Pesticide residues (20 residues)</td>
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<tr>
<td>5.</td>
<td>Radioactive residues (2 tests for alpha &amp; beta emitters)</td>
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</table>
| 6.    | Biological requirements  
i.) bacteria (2 requirements for E.coli & Total coliforms)  
ii.) virus (MS 2 virus)  
iii.) protozoans (2 requirements for Cryptosporidium & Giardia) |

Table 5: BIS standard group specifications

A comparative overview of WHO guidelines for drinking water quality and IS 10500: 2012 and its amendments ... prescribes the requirements and the methods of sampling and testing for drinking water. ... assessing the quality of water resources and to check the effectiveness of water treatment and supply by the concerned authorities.

As per Scheme III of BIS Conformity Assessment Regulations 2018, certification for management system as per Indian Standard – Scheme III (Hazard Analysis and Critical Control Point (HACCP) as per IS 15000:2013) and as per Scheme IV of BIS Conformity Assessment Regulations 2018, certification as per requirements of IS 10500:2012;

i.) BIS to conduct testing and verification of processing and testing facilities, competency of personnel and implementation of HACCP system by Water Treatment Plants;
iii.) Subsequently, Certificate Of Confirmity (COC) to be granted to the water treatment plant from where drinking water is treated and/or supplied.

iv.) Each plant to adhere to a HACCP manual as per requirements of IS 15000:2013.

v.) An Inspection and testing plan to define the levels of control (frequency) of tests. It will also define which tests may be conducted in-house and which tests which may be subcontracted to labs.

vi.) Each plant to adhere to a defined Inspection and testing plan for requirements of IS 10500.

vii.) Test Certificate shall be issued by the BIS certified water treatment plant for supply of water declaring that the water supplied meets the requirements of IS 10500. This certificate and test results to be displayed on water supply body website.

viii.) Surveillance visits to be paid to each BIS certified water treatment plant and samples to be drawn on random basis for each season during the year from consumers' premises or public drinking water supply point, or both for testing as per the requirements of IS 10500.

The stages of Integrated drinking water certification are as under:

i.) **Grant of conformity**
   a.) Submission of applications for grant of conformity along with requisite fees;
   b.) Scrutiny of applications;
   c.) Conducting of combined audit;
   d.) Grant of license and Certificate of Conformity.

ii.) **Operation of schemes**
   a.) Critical control points to be identified from source up to consumer's end by certified plant;
   b.) Documents / test records to be maintained by certified plant;
   c.) One surveillance visit per year for each certified plant;
   d.) One sample to be drawn on random basis for each season during the year from consumers' premises or public drinking water supply point or both for testing as per the requirements of IS 10500.

iii.) **Renewal**: Renewal / recertification shall be done for a period of 3 years.

iv.) **Complaints**: Considering the importance of drinking water and health aspects involved, investigation of the complaint to be done on priority by Water Treatment Plant. Records to be maintained for complaints received and action taken by the plant.

"Considering the importance of drinking water and health aspects involved, investigation of the complaint to be done on priority by Water Treatment Plant."

21. 'Public Health' role and responsibility vis-à-vis water supply - some legal concerns by Shri Sanjay Upadhyay, advocate, Supreme Court of India and Managing Partner, Enviro Legal Defense firm

Mr. Sanjay Upadhyay highlighted the Constitutional scheme, **legal mandate for quality control of drinking water, policy environment and judicial decisions by Hon'ble Courts and National Green Tribunal.**

He explained the Constitutional scheme on Safe and Potable Drinking Water as under:
i.) Article 21 - Right to safe drinking water (Subhash Kumar vs. state of Bihar & Ors.);

ii.) Article 47 - While it does mandate the state to improve public health there is no link to Drinking Water per se;

iii.) Article 243 (G) and 243 (W) r/w Schedule XI (Item 11) and XII (Item 5) - directly relate to the mandate of Panchayats and ULBs respectively to ensure Drinking water.

Water supply laws as per the International Environmental Law Research Centre (IELRC) are as under:

i.) Laws establishing water boards for urban water supply;

ii.) Laws enacted for water supply in metropolitan cities;

iii.) Laws for water supply in the state as a whole;

iv.) Laws on regulation of groundwater extraction, use and transportation laws on protection of water sources;

v.) Laws for supply of water to specific industrial areas.

Legal mandate for quality control of drinking water are as under:

i.) Water (Prevention and Control of Pollution) Act, 1974 - Largely related to prevention of pollution of sources of drinking water such as wells and streams (Section 24, 25). Central Water Laboratory established under Section 51 for examining samples of water including potable water;

ii.) Water (Prevention and Control of Pollution) Rules, 1975 - Such tests carried out by central water laboratory or designated state water laboratory include those for water quality (bacteriological analysis of potable water and distilled water);


iv.) Environment (Protection) Rules, 1986 - BIS independently has no legal sanction but it assumes legality when linked with EP Rules, 1986. It provides that if any industrial effluent is discharged in a water body that is used for drinking water, then the BOD cannot exceed 30 mg/litre. It also links certain industries to the BIS - drinking water specifications.

The national policy environment on drinking water is as under:

i.) National Water Policy, 1987; National Water Policy, 2002 - state that adequate safe drinking water facilities should be provided to the entire population both in urban and rural areas;

ii.) National Water Policy, 2012 - mentions access to safe drinking water and differential pricing for equitable access to drinking water in all areas;


Mr. Upadhyay suggested key takeaways as under:

i.) While Missions and Schemes aim at providing drinking water supply to a huge target in urban and rural areas, ensuring potable quality as per BIS specifications is must;

ii.) This cannot be seen as an aspirational goal alone. Legal and judicial mandate needs to be
adhered to in absence of which legal consequences may follow;

iii.) By not providing potable standards of drinking water, it would entail legal consequences both individually and institutionally;

iv.) Overlapping jurisdictions and mandates need to be ironed out by delineating clear responsibilities and duties.

Key judicial decisions by NGT are as under:

i.) Mrs. Sunita Pandey & Anr. vs. Union of India & Ors. (OA No. 384/2019) - In the context of contamination of groundwater due to Arsenic and availability of clean drinking water in several states, held that 'issue of making available potable drinking water to the said population is an inalienable constitutional duty for which the Central Government as well as the States have to make all possible efforts. The problem being in several States, the Central Government should take lead in the matter in the interest of health and safety of large population of the Country';

ii.) M.C. Mehta vs. Union of India & Ors. (OA 200/2014) - Uttarakhand SPCB to disseminate water quality of river Ganga at all strategic locations at least on monthly basis and indicate fitness of water quality for bathing/drinking purpose. Failure to do so may call for coercive action against the State Board.

22. NABL accreditation, policy and procedure by Shri. N. Venkateswaran, Chief Executive Officer, NABL, Gurugram

NABL is presently a constituent Board of Quality Council of India (QCI). QCI has been set up as an autonomous non-profit organization under the Department for Promotion of Industry and Internal Trade (DPIIT), Ministry of Commerce and Industry. NABL operates accreditation program in accordance with the requirements of ISO/IEC 17011 and offers accreditation services in areas as under:

i.) Testing laboratories as per ISO/ IEC 17025 - 'General requirements for the competence of Testing and calibration laboratories';

ii.) Calibration laboratories as per ISO/ IEC 17025 - 'General requirements for the competence of Testing and calibration laboratories';

iii.) Medical testing laboratories as per ISO 5189 - 'Medical laboratories requirements for quality and competence';

iv.) Proficiency testing providers as per ISO/ IEC 17043 - 'Conformity assessment general requirements for proficiency testing';

v.) Reference material producers as per ISO 17034 'General requirements for the competence of reference material producers'.

He highlighted on accreditation procedure for testing laboratories as per ISO/ IEC/ 17025 is online right from application to awarding certificate except some field review by the NABL assessors. The entire process takes minimum 90 days with support of laboratory authorities.

The CEO, NABL elaborated the online registration & application process in detail and requested the interested authorities to visit official website of NABL at https://nabl-india.org.
The Executive Engineer explained the various activities being undertaken by Water Supply & Sewerage Board, Gujarat to build the capacity and to create awareness on safe drinking water in the State. He also explained about State drinking water supply grid.

It was informed that Government of Gujarat has conceptualized to provide Water Health Card with the objectives as under:

i.) WHC provides on hand water quality details at each Village about their drinking water source and its quality;

ii.) WHC will ensure safety and security of water resources;

iii.) WHC will provide sharing of information about drinking water quality to panchayati raj

Figure 4: Step-wise process of NABL accreditation
institution by providing Water Health Card (WHC);

iv.) WHC will maintain portability and reliability of drinking water quality standards both at the production at source level as well as at the consumption points (household level);

v.) Every year village level water quality details updated in WHC.

24. Water quality management and community involvement by Smt. Gayatri Minj, community member supported by Gram Vikas, Odisha

Ms. Gayatri Minj enlightened the participants on the role of community-based organizations in the management of water quality at village level by involving the local community members. She explained about the focus to identify contamination in the villages & rectify it by protecting the water source and taking preventive measures.

The Community Based Organizations (CBOs) focus on identification of bacterial contamination, Fluoride and Nitrate contamination and use Field Test Kits (FTKs) for water quality monitoring at the community level.

She explained the steps of water quality management program at village level as under:

i.) Orientation of community using relevant IEC materials;

ii.) Passing of community resolution;

iii.) Preparation of village level WQM register;

iv.) Identification of village volunteer;

v.) Survey of village profile and preparation of village pipeline map;

vi.) Selecting the water testing points for the first round of WQ test;

vii.) Water quality testing for Bacteria, Nitrate and Fluoride;

viii.) Water quality testing in case of abnormality;

ix.) Prioritization based on test results;

x.) Sanitary survey for prioritized villages (in mWater);

xi.) Informing the community about the test and survey results;

xii.) Prioritization for starting repair work;

xiii.) Cost estimation for the repair work of selected villages;

xiv.) Resolution for repair work;

xv.) Training of village cadre;

xvi.) Fund collection and starting of repair work;

xvii.) Verification and commissioning of repair work;

xviii.) Water quality test round 2 for Bacteria, Nitrate and Fluoride.

Ms. Gayatri Minj informed that the villagers also work on protecting water source through repair.

The Additional Secretary & Mission Director (JJM) appreciated the initiatives of Ms. Gayatri Minj in her village and complemented her for inspiring the delegation on important role played by community in water quality surveillance.
The Additional Secretary & Mission Director (JJM), DDWS summed up the discussions/presentations/deliberations of the conference. The conference ended with deliberations and closing remarks by Secretary (DDWS) along with recommendations for way forward.

The states/UTs were advised to take necessary action on following points:

i.) Immediate Short term Measure: States were advised that in water quality-affected habitations, especially with Arsenic and Fluoride contaminants, potable water has to be ensured on priority.

In some cases, planning and implementation of piped water supply schemes based on safe water source might take some time, therefore purely as an interim measure, installation of Community Water Purification Plants (CWPPs) may be taken up to provide 8 – 10 lpcd potable water to meet drinking and cooking needs of every household residing in such villages/habitations as per JJM guidelines.

ii.) NGT Direction: All States to ensure strict compliance of NGT’s Order and ensure timelines for total remedial, to be rescheduled to December 31, 2020. In the interim period, alternate arrangements need to be made for the supply of safe potable water to inhabitants of affected areas and submit the compliance report by 30th April, 2020.

iii.) Functionality of CWPPs: Based on reports of defunct CWPPs due to poor Operation and Maintenance issues post-installation, the Additional Secretary (JJM), DDWS advised state/UT public health engineers to take matter seriously and survey all CWPPs immediately and carry necessary remedial measures to ensure their functionality on sustainable basis;

iv.) Expedite NWQSM schemes: All schemes under NWQSM are to be completed by 31 December, 2020 as per NGT direction. The states/UTs are to speed up the physical and financial progress failing which states/UTs would be required to return the unspent fund to DDWS along with the interest accrued on the same as unspent balance with states is huge;

v.) Expedite NABL accreditation of all laboratories: The States/UTs are to ensure regular water quality testing of drinking water sources as per existing guidelines. All laboratories are to be improved and NABL accredited by 31 March, 2021 and mechanisms are to be in place to share the water testing data back with the community;

vi.) Monitor hotspots and generate pre-monsoon report within three months: Based on water-borne disease-burden data emerging from Health department, the States/UTs are to monitor hotspots, evaluate triggers identified by Health department w.r.t water-borne diseases and conduct mass water quality monitoring activities and generate a pre-monsoon report within three months.

Involvement of PRIs and community participation is one of the major component to achieve the objectives of Jal Jeevan Mission.
vii.) **Strengthen water quality surveillance**: Identify and train five women from every village on using FTKs and sharing details with community, raising alarm with necessary authorities when required, etc. Women like Smt. Gayatri Minj have shown that empowered communities are well equipped to handle water quality surveillance.

viii.) **Build community ownership**: Involvement of PRIs and community participation is one of the major components to achieve the objectives of Jal Jeevan Mission (JJM). The RWS/ PHE departments are to shift the approach from 'infrastructure development' to 'utility based'. It is the primary responsibility of states/ UTs to build the capacity and empower the Gram Panchayat and/or its sub-committee, i.e. Village Water and Sanitation Committee (VWSC)/ Pani Samitis/ User Group, etc. and provide them an enabling environment to plan, implement, manage, operate and maintain the in-village rural water supply infrastructure;

ix.) **Empanel Implementation Support Agencies (ISAs)**: NGOs/ VOs/ women SHGs/ CBOs/ Trusts/ Foundations referred as ISAs play a critical role as partners in mobilizing and engaging communities to plan, implement, manage, operate and maintain their in-village water supply infrastructure and handhold community in water quality surveillance. States/ UTs are to empanel ISAs at the earliest and map villages to them for taking the work forward;

x.) **Identify sector partners**: Organizations like UN Agencies, international development agencies, big foundations/ trusts/ NGOs may be identified as sector partners at state-level for support on implementing JJM;

xi.) **Adhere to legal and Constitutional provisions**: It was reiterated that the Constitutional and legal provisions on supplying safe drinking water to the public are to be adhered failing which legal consequences will follow;

xii.) **Use PFMS**: It was discussed that Government of India has developed Public Financial Management System (PFMS) to ensure transparency and healthy management of public money throughout the country. PFMS helps in transparent fund flow and its utilization. All the states/ UTs were requested to register and map all agencies, i.e. SWSM and DWSMs on PFMS by 31 March, 2020 and to incur expenditure through PFMS only. If any State has not yet implemented PFMS, then it will not be allowed to avail the fund after 31 March, 2020.

The conference ended with vote of thanks to all dignitaries, experts and participants present in the conference by Director (WQ), DDWS, MoJS, New Delhi.

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<table>
<thead>
<tr>
<th></th>
<th>Arsenic</th>
<th>Fluoride</th>
<th>Salinity</th>
<th>Iron</th>
<th>Nitrate</th>
</tr>
</thead>
<tbody>
<tr>
<td>CGWB report</td>
<td>20 states</td>
<td>23 states</td>
<td>17 states</td>
<td>26 states</td>
<td>20 states</td>
</tr>
<tr>
<td>IMIS of DDWS</td>
<td>5 states</td>
<td>17 states</td>
<td>11 states</td>
<td>16 states</td>
<td>states</td>
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</table>

Table 6: Presence of water quality contamination hotspots across country as per CGWB and IMIS
Maps indicating the spread of Fluoride and Arsenic based on CGWB Report on water quality and data reported by states on IMIS, DDWS
(Note: A district is highlighted even if there is a single small hotspot in the entire district. The highlight does not necessarily indicate that the entire district is contaminated.)
## Basic water quality parameters

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Characteristic</th>
<th>Unit</th>
<th>Requirement (Acceptable limit)</th>
<th>Permissible limit in the absence of alternate source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>pH value</td>
<td>-----</td>
<td>6.5-8.5</td>
<td>No relaxation</td>
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<tr>
<td>2.</td>
<td>Total dissolved solids</td>
<td>mg/L</td>
<td>500</td>
<td>2000</td>
</tr>
<tr>
<td>3.</td>
<td>Turbidity</td>
<td>NTU</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>4.</td>
<td>Chloride</td>
<td>mg/L</td>
<td>250</td>
<td>1000</td>
</tr>
<tr>
<td>5.</td>
<td>Total alkalinity</td>
<td>mg/L</td>
<td>200</td>
<td>600</td>
</tr>
<tr>
<td>6.</td>
<td>Total hardness</td>
<td>mg/L</td>
<td>200</td>
<td>600</td>
</tr>
<tr>
<td>7.</td>
<td>Sulphate</td>
<td>mg/L</td>
<td>200</td>
<td>400</td>
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<tr>
<td>8.</td>
<td>Iron</td>
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<td>No relaxation</td>
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<td>9.</td>
<td>Total Arsenic</td>
<td>mg/L</td>
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<td>No relaxation</td>
</tr>
<tr>
<td>10.</td>
<td>Fluoride</td>
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<td>1.5</td>
</tr>
<tr>
<td>11.</td>
<td>Nitrate</td>
<td>mg/L</td>
<td>45</td>
<td>No relaxation</td>
</tr>
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<td>12.</td>
<td>Total coliform bacteria</td>
<td></td>
<td>Shall not be detectable in any 100 ml sample</td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>E-Coli</td>
<td></td>
<td>Shall not be detectable in any 100 ml sample</td>
<td></td>
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