Drinking Water Quality: A Major Concern in Rural India
(Some strategies towards cleaner water and the draft water policy-2012)

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ABSTRACT

Drinking water is most essential for livelihoods and for other consumptions. Here, the drinking water supply in Rural India was chosen for the study. Due to over population, increase in drinking water consumption was arisen. Relevant data were collected from relevant Government departments. The data were analyzed and the objective of the study was derived from the data analysis. Suitable suggestions and recommendations were made to decrease the problem of drinking water supply in a proper manner. This attempt will helpful to decrease the drinking water and its attribute problems in the study area and it lead to a sustainable example for future generations and also be a good fore step for the research field too. Water is a natural resource, fundamental to life, livelihood, food security and sustainable development. It is also a scarce resource. In India, water problems are man made and has become very complex. I hope with this national water policy, such problems will come to rest. People's health condition in any region, can be directly related to the quality of water. Hence it is very important to state the availability of “safe drinking water to all”. This must be included in the national water policy.

Keywords: Water quality, sanitation, Rural India, Ground water.

Introduction

Rural India has more than 700 million people residing in about 1.42 million habitations spread over 15 diverse ecological regions. Meeting the drinking water needs of such a large population can be a daunting task. The non-uniformity in level of awareness, socio-economic development, education, poverty, practices and rituals and water availability add to the complexity of the task. Despite an estimated total of Rs. 1,105 billion spent on providing
safe drinking water since the First Five Year Plan was launched in 1951, lack of safe and secure drinking water continues to be a major hurdle and a national economic burden. Around 37.7 million Indians are affected by waterborne diseases annually, 1.5 million children are estimated to die of diarrhoea alone and 73 million working days are lost due to waterborne disease each year. The resulting economic burden is estimated at $600 million a year.1. While `traditional diseases` such as diarrhoea continue to take a heavy toll, 66 million Indians are at risk due to excess fluoride and 10 million due to excess arsenic in groundwater. In all, 1,95,813 habitations in the country are affected by poor water quality. It is clear that the large investments have not yielded comparable improvements in health and other socio-economic indicators.

India has the largest rural drinking water supply program in the world serving about 1.6 million habitations spread over 15 diverse ecological regions and 742 million people. The provision of clean drinking water has been given priority in the Constitution of India, with Article 47 conferring the duty of providing clean drinking water and improving public health standards, to the State. According to the National Water Policy for ensuring sustainability of the systems, steps were initiated in 1999 to institutionalize community participation in the implementation of rural drinking water supply schemes through the sector reforms project which is expected to bring a paradigm shift from “Government oriented supply driven approach” to “People oriented demand responsive approach”.

Water Quality in the Rural Drinking Water Supply has emerged as a major issue. The Government of India had launched the National Rural Drinking
Water Quality Monitoring and Surveillance Program in February 2006, which has institutionalised community participation for monitoring and surveillance of drinking water sources at the grassroots level by gram panchayats followed by checking the positively tested samples at the district and state level laboratories. In view of the problems of pollution of national water resources, the Ministry of Environment & Forests issued the Notification on 22 June, 2001 constituting the "Water Quality Assessment Authority (WQAA)" with effect from 29 May, 2001.

The States implements drinking water supply schemes. The Government of India supplements the efforts of the States by providing financial assistance under the Accelerated Rural Water Supply Program (ARWSP). Additional assistance is also available to the States for Rural Water Supply Programme under various externally aided projects. The entire programme (ARWSP) was given a mission approach when the Technology Mission on Drinking Water Management, called the National Drinking Water Mission (NDWM) was introduced as one of the five Societal Missions in 1986. NDWM was renamed as Rajiv Gandhi National Drinking Water Mission (RGNDWM) in 1991. ARWSP, is currently being implemented through the Rajiv Gandhi National Drinking Water Mission. The prime objectives of this Mission are:

1. To ensure coverage of all rural habitations, especially to reach the unreached, with access to safe drinking water.
2. To ensure sustainability of the systems and sources; and
3. To tackle the water quality problems in affected habitations.
4. Based on various gaps existing in the present rural drinking water supply system in the country, the Department of Drinking Water
Supply, Ministry of Rural Development has very recently come up with a paradigm shift in policy under which the ARWSP has been renamed as “National Rural Water Supply Program (NRWSP)

Rural Water Supply in India-

The provision of clean drinking water has been given priority in the Constitution of India, with Article 47 conferring the duty of providing clean drinking water and improving public health standards to the State. Rural water supply (RWS) programmes in India can be divided into several distinct phases.

Specific Objectives

1. To know the various water quality problem in Uttar Pradesh State.
2. To know the no. of inhabitants in Rural areas affected by water quality problem.
3. To know the morbidity due to viral hepatitis.

Methodology

The nature of drinking water supply in has been found by using the questionnaire based data. Secondary data has been used. Random sampling method has been adopted in the selection of samples people of different social status have been interviewed to get relevant information. Collected information was manipulated, cartographically as well as statistically so as to explain various aspects of water supply in. Especially the location and distributional aspects of consumption, economic status and distribution of different sources are explained.
cartographically. However, the study is essentially qualitative through certain amount of quantification has been attempted. This data was collected through surveys in each village, based upon a sample drawn from the village population; the sample was based on the community structure within each village. Considering the constraint of time and the overall areas to be covered. The various social science research methods and techniques were used to collect primary and secondary data from different sources with a view to gain insight and document the existing perceptions and conditions relating to drinking water and sanitation situation in rural areas of the selected 65 districts. The details are as follows:

**Library Research:**
The books, study reports and other documents relating to drinking water and sanitation were perused and relevant information were culled out for the present study.

**Sample Survey:**
In each of the 65 districts taking into consideration the geographical, socio-cultural differences, 20 villages were selected randomly for the sample survey. In each of these villages a sample of 30 households giving representation to different sections were chosen for data collection relating to water and sanitation. Different instruments of data collection were utilized for sampled individual, family and the village. The villages were selected using random number table from the list of villages in the district. From this, first complete household enumeration was undertaken and from the list of Households in the villages, 30 household was selected using random table number to cover different
social / caste categories proportionate to their relative strength in the village population. In the sampled household any adult male/female available was intensively interviewed on the basis of prepared and pre-tested household interview schedule.

Data interpretation-
In this paper the water demand in the domestic and industrial sectors could increase substantially. We assume that the average domestic water demand would increase from 85 litres per capita per day (lpcd) in 2010. In a rapidly booming economy, we expect the contribution of the industrial sector to increase very much, and the industrial water demand to also increase accordingly. However, the dearth of information—the types of industries, their growth, water use and the extent of recycling—is a constraint for future projections in the context of increasing economic growth.

Figure 1 gives a schematic representation of how various government agencies are involved in supplying drinking water to the rural people. Besides, the efforts of the Central and State governments are also backed by international organisations such as the bilateral agencies of Japan, the United Kingdom, the United States, Denmark, Sweden, Germany, Australia, Netherlands, etc., and multilaterals such as the World Bank, WHO, UNICEF (Water and sanitation programme-South Asia), UNDP and the European Union. These external support agencies (ESA) have made invaluable contributions to the sector in terms of sustaining demonstration and experimentation at the project level, research, introduction of technological innovations etc.
In 2010, a Central Pollution Control Board countrywide survey found 66 per cent of samples had unacceptable organic values, while 44 per cent had coliform. Chemical contamination through over-exploitation of groundwater, resulting in excessive iron, nitrates, arsenic and fluoride is equally widespread. Arsenic contamination is now grim reality in, ironically, almost the entire Gangetic belt notwithstanding its ample rivers while fluoride contaminated drinking-water similarly affects 20 States. Reports say that there are high fluoride-levels in drinking-water in villages with a prevalence of deformed children from Madhya Pradesh, Jharkhand, Assam and Uttar Pradesh. The problems of chemical contamination are thus
prevalent in India with 1, 95,813 habitations in the country are affected by poor water quality ([Water aid background paper, 2008](#)). Fig 2 and 3 indicate the crisis that exits in safe drinking water supply in terms of quality. It is surprising to note that states like Bihar and Haryana do not show any problem related to chemical contamination.

**Figure 2-** Percentage of affected habitations chemical contamination wise (as per ARWSP Norms)

*Source: [http://www.ddws.nic.in/](http://www.ddws.nic.in/)*
**Figure 3:** Percentage of chemically contaminated habitations -- Not Covered (NC) and partially covered (PC) (as per ARWSP Norms)

*Source: http://www.ddws.nic.in*

In this context, the Ministry of Water Resources is assisting the WQAA in carrying out and coordinating its functions. The Water Quality Review Committees have been constituted in the States with the objective of improving coordination amongst the Central and State agencies, review/assess schemes launched/to be launched to improve quality of water resources, review water quality data analysis and interpretation in order to identify problem areas and develop action plans for improving quality on a sustainable basis, identify hot spots for surveillance/monitoring and to look
into other specific miscellaneous issues related to water quality arising from
time to time. Based on the recommendations of Expert Committee and Task
Force, a gazette notification on the Uniform Monitoring Protocol for
adoption by all the water quality monitoring agencies has been issued in
June, 2005. A Working Group has also been constituted by WQAA to deal
with issues relating to minimum flows in river systems. In accordance with
the decisions of WQAA, the Water Quality Monitoring Committee
(WQMC) is also constituted to assist the WQAA in its functions. WQMC, in
turn, constituted 3 Standing Groups to initiate action considering present
status and requirement/modality about action to be taken on related
functions of WQAA as per the gazette notification. In order to make State
Water Quality Review Committees more effective and to establish co-
ordination among various agencies in the field of water quality monitoring,
one workshop at national level and four Workshops at regional level, have
been organised.

Health Cost: The health burden of poor water quality is enormous. It is
estimated that around 37.7 million Indians are affected by waterborne
diseases annually (viral hepatitis, cholera, jaundice, typhoid are examples),
1.5 million children are estimated to die of diarrhoea alone and 73 million
working days are lost due to waterborne disease each year. The resulting
economic burden is estimated at $600 million a year. Ten million people are
vulnerable to cancers from excessive arsenic and another 66 million are
facing risk of fluorosis, now endemic in 17 States. Fluorosis is affecting
future generations too through pregnant mothers whose anaemia is caused
by fluorosis. Anaemia produces low birth-weight babies who in turn
manifest their mothers’ nutritional deficiencies through physical and mental
deformities. Besides, there prevail health impacts of drinking-water with
other environmental pollutants such as industrial wastes. Fig 4 reflects on the cases of water borne diseases like cholera and acute diarrhoea occurring in various states of India.

Figure 4: State wise Cases Due to Cholera in India 2007 and Acute Diarrhoeal Disease in 2006

Source: Report from Ministry of Health and Family Welfare

Water Resources and Utilization-
-India has 16 per cent of the world’s population and four per cent of its fresh water resources.
Estimates indicate that surface and ground water availability is around 1,869 billion cubic meters (BCM). Of this, 40 per cent is not available for use due to geological and topographical reasons.

Around 4,000 BCM of fresh water is available due to precipitation in the form of rain and snow, most of which returns to the seas via rivers.

Ninety two per cent groundwater extracted is used in the agricultural sector, five and three per cent respectively for industrial and domestic sector.

Eight nine per cent of surface water use is for agricultural sector and two per cent and nine per cent respectively are used by the industrial and domestic sector.

It is expected that by around 2020, India will be a ‘water stressed’ state with per capita availability declining to 1600 cu m/person/year. A country is said to be water stressed when the per capita availability of water drops below 1700 cu. m/person/year.

1. Current scenario

Current scenario, a few paragraphs on the current status of drinking water quality in Indian should be provided. The gap analysis of Indian drinking water quality vis-à-vis the international water quality to be brought in. At present there is big gap in Indian standards for drinking water and international standards.

2. Public policies on water resources and its management

Policies on water resources and its management, should be self driven with clear objectives and targets that are achievable. Also this must bridge the gap
in public awareness and the current status. Draft policy, by and large covers all these except for the safe drinking water.

Figure 5- Improved water management services

3. Water framework law

There must be a definite goal for reducing the withdrawal of fresh water from water sources, by means of water recycling and re-use. Though the government is encouraging water recycling and re-use, it is not implemented effectively. At present, even for gardening, vehicle washing, fire protection etc, fresh/potable water is used.

70% of the water drawn from the source is used and let into sewer lines as waste water. If the same is properly treated and recycled then there will be little reduction in drawing the fresh water. This can be implemented as micro-program, targeting communities, apartments, and commercial establishments, which will definitely give the great results.

4. Uses of water

Minimum quantity of water for every one is a must along with that, safe
drinking water availability is much more important.

5. Enhancing the water available for use
The available land and water bodies are limited. Policy should focus on how to maximize the usage of water by recycling. In the countries in the middle east, available fresh water per capita was 170lpd. By adopting water recycling and re-use, there was reduction is tapping the fresh water from the natural sources from 170lpd to 110lpd.

The target of Abu Dhabi was to bring it down to 75lpd per person by end of 2020. The total requirement of water per person still remains the same as 170lpd. Our policy should emphasis such requirement.

6. Demand management and water use efficiency
India is one among those countries who have very poorly managed the water. In India, most of the water problems are manmade. In developed countries, water leakage (which is not available for billing) is <3%. However in India, water leakage/pilferage is as high as 45%. This is huge loss to the government and a huge threat for the sustainable development of the country.

Policy must emphasis the need for the efficient water transport and usage. Secondly, incentive scheme shall be provided for improving the water transport system. Also, a separate body shall be established to forecast the water demand by different users and lay the program for providing the required type of water for the different users, there by increase the efficiency of water usage. Special incentives for recycle and re-use of waste water must be provided.
7. Project planning and implementation

Water crisis is constantly increasing in India. Time is of the essence. Correct identification of the project and planning of the implementation is essential. There must be clear identification of micro projects, macro projects and mega projects. Since the mega projects gestation period is too long, it is the need of the time is to put more thrust on micro and medium scale projects. Hand book for planning, implementation and monitoring procedures must be put in place for reducing the over run of cost and time.

8. Preparedness for flood and drought

Encouragement of the alternative technologies should be provided. Government should make an outline (for the fixed budget) for such technical development to tackle floods & drought. Small players should be encouraged by providing soft loans or help in 'kind' for development of such plants/equipment.

Observation and data Interpretation-
Figure 6: Water demand for different usage

Data Source: http://planningcommission.nic.in/data/dataf.htm

From the 1990s, there has been a considerable increase in rural water supply in the five year plans, with Rs.16,711 crore being the budget outlay in the Eighth plan; Rs.39,538 crore in the Ninth and Rs.42,000 crore projected for the 10th Five Year Plan. In this figure it can be easily seen that domestic water demand is more than other types of water demand.
Despite the enormous allocation made to the various ministries the expenditure has been very low. The Ministry of Water Resources incurred only 22% expenditure out of the plan outlay of Rs.3, 600 crores in the first 2 plan periods. The approved outlay for water supply (rural and urban) was Rs.44, 206.55 crore and expenditure was to the tune of 27% of the approved outlay. The Department of Drinking Water Supply (DDWS) was allocated Rs.14,200 crore for rural WATSAN & expenditure was 36% of allocated funds. The investment in the Watson sector does not commensurate with
health benefits. Above Figure depicts the morbidity on selected water borne diseases.

![Morbidity due to viral hepatitis](image)

**Figure 8: Morbidity due to viral hepatitis**

*Data Source: Central Bureau of Health Investigation*

While accessing drinking water continues to be a problem, assuring that it is safe is a challenge by itself. Water quality problems are caused by pollution and over-exploitation. The rapid pace of industrialization and greater emphasis on agricultural growth combined with financial and technological constraints and non-enforcement of laws have led to generation of large quantities of waste and pollution. The problem is sometimes aggravated due to the non-uniform distribution of rainfall. Individual practices also play an important role in determining the quality of water. Water quality is affected by both point and non-point sources of pollution. These include sewage...
discharge, discharge from industries, run-off from agricultural fields and urban run-off. Water quality is also affected by floods and droughts and can also arise from lack of awareness and education among users. The need for user involvement in maintaining water quality and looking at other aspects like hygiene, environment sanitation, storage and disposal are critical elements to maintain the quality of water resources.

**Bacterial contamination**

Bacterial contamination of water continues to be a widespread problem across the country and is a major cause of illness and deaths with 37.7 million affected by waterborne diseases annually.

**Contamination due to over-exploitation**

The problems that emerged from groundwater use were not limited to depleting sources, but also contaminants that did not need to be dealt with before. As of now, the scenario is fearful and alarming. There are a variety of problems that relate to quantity as well as quality. Eighty per cent of our drinking water needs are met by groundwater, which is depleting at an alarming rate, compounded with large scale contamination.
Figure 9-above figure shows the number of habitant affected by water quality problems

**Data Source:**

It is estimated that about 66 million people in 20 states are at risk due to excess fluoride and around 10 million people are at risk due to excess arsenic in ground water.
Figure 10 - Various water quality problems

In this figure there are a lot of problems facing rural people in Uttar Pradesh. It is estimated that about 66 million people in 20 states are at risk due to excess fluoride and around 10 million people are at risk due to excess arsenic in ground water. Another major cause for concern is the pollution of ground and surface water from increased fertilizer and pesticide use in agriculture and from industrial sources. The consumption of fertilizers shot up from 7.7 million tones in 1984-85 to 13.9 million tones in 1994-95 and that of pesticides from 24,305 tones in 1974 to 85,030 tones in 1994-95. The rise in the usage of such compounds has degraded the quality of surface water resources by causing nitrate contamination.

**Behavioural practices:** Interventions for providing safe drinking water can become ineffective in the absence of improved sanitation. In order to provide access to sufficient quantities of safe water, the provision of facilities for a sanitary disposal of excreta, and introducing sound hygiene
behaviour are of utmost importance. Thus prevention of water contamination at source is necessary to ensure the portability of supplied water.

**Cultural practices**: There are various religious practices that revolve around sources of water. Immersion of idols in surface water bodies is a prime cause of deteriorating water quality. Water bodies have been used as dumping grounds for various offerings that have degraded the portability of surface water. Defecation on boundaries of water bodies results in bacteriological contamination.

**Pollution Load - Domestic and Industrial Wastes**

90% of the sewage generated by municipal councils and over 50% of sewage discharged by municipal corporations goes untreated.

- The industrial sector contributes 30729.2 million cubic meters of effluent being discharged into our water bodies.

- In India, an estimated 200,000 tones of faecal load is generated every day.

**Priority and programmes**

- Since 2000, water quality monitoring has been accorded a high priority and institutional mechanisms have been developed at national, state, district, block and panchayat levels. The government has also outlined requisite mechanisms to monitor the quality of drinking water and devise effective Information, Education and Communication (IEC) interventions to disseminate information and educate people on health and hygiene.

- The Government of India launched the National Rural Drinking Water Quality Monitoring and Surveillance Programme in February 2006. This envisages institutionalization of community participation for monitoring and
surveillance of drinking water sources at the grassroots level by gram panchayats and Village Water and Sanitation Committees, followed by checking the positively tested samples at the district and state level laboratories.

- From 2006-07 onwards, the states have been directed to earmark up to 20 per cent of Accelerated Rural Water Supply Programme (ARWSP) funds for tackling water quality problems.

- With the aim of setting up laboratories, the Government of India has sanctioned 430 district level laboratories out of which 252 have been established till 2005. Various state governments and other organizations have also established 158 laboratories.

- Government of India has made an allocation of Rs.1,045 crore for the current financial year (2009-10), to states and Union Territories for tackling water quality problems due to excessive fluoride, nitrate, arsenic, iron and salinity.

**Service Providers**

In India, the primary responsibility for providing drinking water and sanitation facilities lies with the state governments. With the 73rd and 74th Constitutional Amendments, the states have the authority to give the responsibility of local supply of water to Panchayati Raj Institutions (PRIs) and Urban Local Bodies (ULBs).

The role of the Centre is to allocate funds and guide investments, encourage research, develop human resources through training and other capacity-building efforts, promote water quality monitoring, provide guidelines for
various programmes and ensure the implementation of the water supply programmes.

Responsibility of various agencies

The role of the Central government is to guide investments in this sector, encourage the need for training and research, and also to promote water quality monitoring and human resources development programmes. The states plan, design and execute water supply schemes and operate through departments like Public Health Engineering Departments, Panchayati Raj Engineering Departments or Rural Development Engineering Departments and Water Boards. The Central Water Commission (CWC) in the Ministry of Water Resources (MoWR) is responsible for regulating the use of surface water for irrigation, industry and drinking water purposes. It also mediates in inter-state water allocation disputes. Central Groundwater Board (CGWB) under the MoWR has an overseeing responsibility for the monitoring of groundwater levels and rates of depletion and the production of water resource inventories and maps. National Rivers Conservation Directorate (NRCD) under the Ministry of Environment and Forests (MoEF) oversees the implementation of Action Plans to improve the quality of the rivers in India Central Pollution Control Board (CPCB) under the Ministry of Environment and Forests (MoEF) promotes basin-wide pollution control strategies. Health and Economic Burden Poor water quality spreads disease, causes death and hampers socio-economic progress. Around five million people die due to waterborne diseases. In addition, these diseases affect education and result in loss of work days, estimated at 180 million person days annually. The annual economic loss is estimated at Rs.112 crores.17 Water-related diseases put an economic burden on both the household and
the nation’s economy. At household levels, the economic loss includes cost of treatment and wage loss during sickness. Loss of working days affects national productivity. On the other hand, the government spends a lot of money and time on treatment of the sick and providing other supportive services. Water quality and the poor According to Down to Earth, rural people in India spend at least Rs.100 each year for the treatment of water/sanitation-related diseases. According to the Government of India, this adds up to Rs.6,700 crore annually, which is just Rs.52 crore less than the annual budget of the Union Health Ministry and more than the allocation for education However supplying clean water alone would not solve health-related problems. Only an integrated approach of water quality improvement with improvement in water availability combined with sanitation and hygiene education will help address this issue.

Policy Towards cleaner water-

Providing safe drinking water to all in rural India is a challenging task. Given the diversity of the country and its people, solutions have to be diverse. One has to look at an approach that seeks the participation of users through interventions engaging the communities with various government schemes and policies. Citizens should be made aware of the demand for clean drinking water as a right. Such an integrated approach would incorporate collaborative efforts of various sectors involving the government, civil society and needless to say the people. Role of Government
1. **Supporting awareness drives:** One of the major challenges is to make people aware on the need to consume safe water. There are examples where despite being provided potable water by the government, people drink water from contaminated surface sources. The government needs to support civil society and organizations involved in increasing awareness. An integrated campaign can result in widespread information dissemination amongst the masses on the ways and means of preventing contamination of water sources.

2. **Testing and remedial action:** There is an urgent need to enhance the monitoring network by establishing monitoring stations across all regions and seasonal assessments of all water sources. In case of contamination being detected, an action plan for dealing with sources should be provided. The challenge lies in establishing well-equipped laboratories with well-trained staff. This also calls for training of people and infrastructure development. Although there has been wide usage of field testing kits, they often give false or semi-quantitative results. One can rely on field testing kits for a broader picture, but laboratory tests are necessary for accurate results. The generated data should be made available in the public domain. The data in respect of water quality affected habitations is available in the website of DDWS but many of the state water and sanitation departments do not have such data. Generating data, its interpretation and communication is essential for effective management of water and the use of Geographical Information System (GIS) can assist in mapping, modeling and decision-making.

3. **Capacity building of communities:** The roles of panchayats are becoming more important and stress is being laid on community-based approaches in
dealing with water-related problems. A prerequisite for increasing community participation is training of people from the communities so that they are able to make well-informed decisions. The objectives of decentralization can come about only if there is an attitudinal change among government functionaries as well as the people, with respect to decentralization, transferring authority and responsibility to the people at the community level. The role of the government in implementing capacity building programmes is essential. Gram Mitra for monitoring water quality

To strengthen the village level water quality monitoring, teams by the name of Gram Mitra are being involved in the villages across Gujarat. Training is organized at the block level in coordination with the Government of Gujarat, block level functionaries with the support of NGOs. As hands on exercise, the Gram Mitras are asked to get one sample from a drinking water source in the village along with the sanitary survey of that source. During the training the testing of these samples link between the sanitary situation around the source and the quality of water is established. These Gram Mitras undertake monitoring of water sources in villages across the state and also spear awareness on ways and means to keep surroundings of water sources clean.

4. Inter-agency coordination:

One major bottleneck in an effective policy formulation and implementation has been the current institutional set-up involving various government agencies. There is a fragmented approach at the state and central level with the involvement of numerous agencies in the supply and management of water. Better co-ordination amongst ministries and departments would ensure effective implementation. The option of a single nodal ministry with
the overall supervision and administration pertaining to water resources may be looked into as is the case with countries like Australia.

5. **Making the service provider accountable**: Article 21 of the Constitution of India, relates to the Protection of Life and Personal Liberty and the right to pollution-free water is guaranteed under this provision. The user has the right to know whether water being provided at source is free from any contamination as claimed by authorities. Financial expenditure on water supply schemes and testing water quality should be known to the public. The example of Tamil Nadu water supply and drainage board should be emulated by other states where financial expenditure is in the public domain through their website. Constitution of India- Provision for Right to Water Under fundamental rights provided by the Constitution of India, Article 21 entitles 'protection of life and personal liberty'. It states that *'no person shall be deprived of his life or personal liberty except according to procedure established by law'*.

6. **Water quality standards and provision of water under the Food Law Bill**: The quality of drinking water supplies in India by public agencies is presently governed by Bureau of Indian Standards (BIS) specifications IS: 10500-1991. In case of drinking water monitoring, standards such as IS: 2488, for sampling methods and IS: 3025 for testing procedures should also be adhered to.

7. **School Water Supply Programme**: India has one of the largest numbers of school going children, especially in rural areas with about 6.3 lakh rural schools. As per National Family Health Survey 75 percent of the children in the age group of 6-14 years are attending schools in rural areas. A matter of
concern is that out of these 6.3 lakh rural schools only 44 per cent have water supply facilities. The survey also points out that half of all Indian children are undernourished and half of all adult women suffer from anemia. At the time of the survey, 30 per cent of all children under the age of three had fever, another 20 per cent had diarrhea, and another 20 per cent had symptoms of acute respiratory infection13.

8. Role of environment sanitation and hygiene: A direct relationship exists between water, sanitation, health, nutrition and human well being. Consumption of contaminated drinking water, improper disposal of human excreta, lack of personal and food hygiene and improper disposal of solid and liquid waste have been the major causes of diseases in our country.

9. Awareness:

The user should be made aware of the importance of preventing contamination of water and also of the importance of clean and healthy surroundings near water sources. Effective IEC campaigns by civil society will play an important role in spreading awareness. One has to keep in mind that such campaigns should be based on the local needs and problems and use tools that are easily understandable by the people.

10. Accountability:

Users should also realize their individual responsibility in maintaining the quality of water supplied to them. Cultural and behavioral practices like open defecation, bathing of cattle results in contamination of water sources. The responsibility of maintaining the safety of water provided also rests with the users. Factors like contamination at source and storage in clean vessels lies with the users.
11. **Community Based Water Quality Monitoring**: Many water quality problems are caused due to communities being unaware of the different aspects of managing and maintaining the quality of water resources. Raising their awareness of appropriate practices will help them realize the grim realities of depleting water sources and at the same time help in engaging them in monitoring and maintenance. There have been initiatives for community driven water monitoring programmes, such as the Community-managed Water Quality Surveillance Programme in Alappuzha district of Kerala.

12. **Maintenance**:  
The lack of maintenance of rural water supplies and infrastructure is an area of concern. This may be due to lack of funding capacity, apathy or unwillingness on the part of the communities to handle operation and maintenance. This calls for a change in the shift among the users that the onus of maintaining a water source rests with the people and the communities as they are the owners of the system and are most likely to be impacted in case of the degradation of the water supply system.

13. **Looking for alternate water sources: Water Harvesting**  
Rain Water Harvesting and subsequent recharge of groundwater can help lower the concentration of minerals in aquifers. Setting up community-based water harvesting units will involve creating social mobilization, awareness and confidence among all sections of the community.

14. **Dual water supply and waste water treatment**
To reduce the burden on fresh water sources, the option of dual water system is being worked out in several parts of the country. The success of this system lies in the fact that filtered purified water is used only for drinking purposes while other source of water may be used for purposes other than drinking. This is also is cost saving measure as resources spent on providing clean water is saved by using alternate sources. Waste water treatment can also be another effective means of reducing the burden on freshwater sources.

15. Exploring simple, low-cost treatment technologies

Once contamination is detected in a water source, there is need for treatment. In case of rural areas, modern water purification technologies might not be viable. In villages, it is important that simple technologies that are easy to use and can be operated without much technical know-how be promoted. The price factor is also important as technologies with high operational and recurring costs might not be useful. In India, one cannot neglect the use of traditional methods of water purification. The use of traditional methods, however, should not be publicized unless its effectiveness have been proved through appropriate research.

The selection of an appropriate technology is governed by acceptance by users. Use of modern technologies such as reverse osmosis and ozonation are effective in the treatment of water but their feasibility in a rural setting needs to be worked out in terms of capital expenditure and manpower in operating and maintaining such systems. There is also a need for proper field testing before any product is launched with proper certification and validation by prescribed authorities.
16. **Revival of traditional water conservation structures**

Traditional water conservation structures like tanks, lakes, ponds have been in use in India since ages. These served as sources of water for people by capturing rainfall and surface runoff. However in the past few decades one has seen many of these structures becoming dysfunctional. The usefulness of these structures still holds good and there has been initiatives across the country for revival of such systems. These structures are a good source of water and have proved useful in dry arid regions of the country.

17. **Community enterprise for water**

Communities, civil society, technology provider can form enterprise for delivery of water services. Each of the stakeholders plays an important role in the operation and maintenance of water purification system and delivery. The example of Reverse Osmosis water enterprise system in Gujarat is an initiative where WASMO in collaboration with a technology provider has set up community managed reverse osmosis system in 71 villages across the state to address the problem of salinity.

**Conclusion**-

In India, investments in community water supply and sanitation projects have increased steadily from the 1st plan to the 10th plan. However, the health benefits in terms of reduction in waterborne disease have not been commensurate with the investments made.

Though health sector is bearing the burden of water and sanitation related infectious diseases, presently it does not have adequate institution or
expertise for monitoring and surveillance of community water supply programmes in the country.

India has witnessed significant improvement in rural water supply with increasing coverage of areas and a large volume of financial resources made available. A series of schemes are aimed at improving the supply of drinking water for rural habitations and now for monitoring and ensuring quality. The past few years have seen greater emphasis on water quality monitoring and surveillance with specific allocation being made under Central grants. There has been great focus on setting up and upgrading laboratories at the state and district levels, and on water monitoring through field testing kits. However, awareness, surveillance, monitoring and testing, mitigation measures, availability of alternate water sources and adoption of hygienic practices continues to remain roadblocks. There is a need to promote sanitary inspection along with the community based water quality monitoring and surveillance at the grass root level as a mechanism to identify problems and to take corrective measures.

One of the greatest challenges has been the convergence of various departments associated with water: water and sanitation programmes have operated largely in isolation from programmes in health and education. A wider approach is needed where water and sanitation issues are looked at with the aim of reducing disease, improving hygiene, improving educational levels and reducing poverty. Safe drinking water can be assured, provided we set our mind to address it.
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