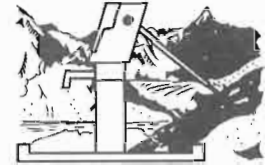




## WATER, ENVIRONMENT AND MANAGEMENT

### Rural drinking water supply in India

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#### INTRODUCTION

According to 1991 census, the population of India has been provisionally placed at 844 million. Thus, India ranks second in the world after China (1,114 million) and over thrice that of USA (249 million). About 16% of the world population lives in India and as per World Bank projections, India's population is likely to cross the one billion mark and touch 1,007 million by 2000 AD, with a growth rate of average 2.5% per year. About 74.3% of this population is residing in rural areas although the average density is of 267 persons per sq km.

The country receives about 400 mil.hectre metre of annual rainfall, ranging between 100 mm in the western part of Rajasthan to more than 10,000mm in its North-Eastern part. Out of this amount, about 70m.ha.m is evaporated 165m ha m is available in form of surface water and about 50m ha is available in form of ground water. Only 37% percent of surface water and 28% of ground water is utilisable at present. By the year 2000, about 40% of ground water may be utilised.

Rural water supply in India is based on mainly ground water (85%), the rest being surface water. It utilises around 8-9% of total ground water and 2-3% of surface water, as of now. The National Water Policy of September 1987 states that,

" In the planning and operation of systems, water allocation priorities should be broadly as follows :

Drinking Water  
Irrigation  
Hydropower  
Navigation-Industrial and  
other uses

Irrigation and Multipurpose projects should invariably include a drinking water component, wherever there is no alternative source of drinking water. Drinking Water needs of human beings and animals should be the first charge on any available water."

Water supply was decided as a subject to be dealt by the State

Government, in 1950 by the newly formed independent Government of India as there was no significant existing programme around that time. In 1972 the Accelerated Rural Water Supply Programme under direct funding and supervision of the Federal Government was established. But this programme was temporarily withdrawn in favour of the Minimum Need Programme fund provided under the state plan, and reintroduced in 1977 after UN Water Conference. Subsequently Rural Water Supply was formed a part of Department of Rural Development in 1985 and the National Drinking Water Mission was launched in 1986.

The goal of the Mission was set to achieve the provision of adequate safe drinking water

- . Within accessible reach
- . To the entire Rural population
- . On sustainable basis
- . Using Appropriate Technology
- . With full participation of people

The concept of public Health and Rural Water Supply was already linked together in mid-fifties but safe drinking water only was emphasised to be provided under the Mission programme with application of location specific technology. India falls under the group of moderate to rapidly developing countries. The different types of pollution problem now occur in developing countries in much more rapid succession than in advanced countries due to modern International trade of chemicals, the ubiquitous dispersion of persistent contaminants and changing hydrological cycles. In order to meet all these challenges, the Mission objective was set as below :

- . cover all remaining villages with adequate water supply.
- . supply 40LPCD (litre per capita per day) in all areas for human beings and additional 30 LPCD in desert areas per cattle.
- . Evolve cost effective technology mix to achieve above objectives within limits of plan allocation.
- . Take conservation measures for sustained supply of water
- . Improve performance and cost effectiveness

- of ongoing programmes
- . Create awareness on use of safe drinking water

Safe drinking water has been defined as water free from biological contamination (viz afflicted with guineaworm, cholera, typhoid) and chemical and physical contamination (i.e. turbidity, suspended solids, excess fluoride, brackishness, iron/magnese, arsenic, nitrate etc.).

According to health statistics available, it is concluded that 80% of total diseases are caused due to use of unsafe water and on this account about 73 million mandays are lost every year. As such, the Mission has identified problem villages as those having

- . no water source within
  - 1.6 km horizontal distance
  - 15 metres depth
  - 100 metres vertical distance
- . Biological contamination (guineaworm, cholera, typhoid)
- . Chemical contamination (excess fluoride, brackishness, iron, arsenic, nitrate)

A host of scientific organisations has been working on various technological aspects of the water related problems. Various technological solutions have been proven at laboratory level and also demonstrated under supervision of the scientists which seem to be feasible to be applied at the village level provided man power and infrastructure development can be organised at the appropriate level. A real challenge has been posed to the Mission authorities both at Federal and State level in developing diversified resources appropriate for the application of technologies, in the variety of conditions prevailing in farflung areas of the country. Use of local talent and renewable resources has been a main theme for satisfaction of public through participation in water supply system. The paper discusses involved issues and expectations in a number of cases which are indicative of the situation which may prevail at the turn of the century.

#### APPLICATION OF INNOVATIVE TECHNOLOGY

The technologies taken into consideration by the Water Mission relate to improvement of both quality and quantity of water. In many cases ground water gets depleted due to persistent withdrawal irrespective of suitable recharge arrangements and recurring draught. It also gets inflicted by chemical, physical or bacteriological pollutants arising out of effluents from

industries, agricultural and municipal establishments through direct plumage as well as through seepage or infiltration. A major emphasis has been laid on alternative water of adequate quantity and which needs only conventional treatment to attain desired standard at reasonable costs. In case tapping of alternative sources work out to be uneconomical new technologies can be resorted to. But many of the technologies were not fully demonstrated at the field conditions and the need for modification in accordance with the specified field conditions were not fully identified. We shall now try to narrate the parameters involved in few prominent technologies as well as the diversity of requirement to suit the specific field conditions.

Technologies as well as analytical procedures for various pollutants in water and the methods of chemical, physical and bacteriological treatment in order to derive the desired quality have been demonstrated in various Mini Mission projects in affected states as indicated below :

- . Guineaworm Eradication - 5043 stepwell conversion approved in six states.
- . Control of fluorosis - 104 fill and draw type defluoridation plants.
- 377 Hand pump attachments in 14 states and 1 Ut.
- . Removal of Excess Iron - 11,908 iron removal plants sanctioned in 14 states and 1 UT.
- Control of Brackishness - 142 desalination plants approved in 12 states and 3 UTs.
- . Detection of new sources - Satellite imagery prepared for 447 districts (out of total 466) Bore well failure reduced to 8%.
- . Solar photovoltaic pumping system - 142 numbers approved for arid/hills, tribal areas etc.

- . Water quality monitoring laboratories
  - 100 laboratories at district level
  - 26 mobile laboratories approved.

The details of technologies are not included for space constraint. Most of these systems were new to the authorities in the states for the purpose of operation and maintenance. Even simple system like hand pumps could not achieve 100% working order at any given point of time. The central government took initiative in demonstrating the technology for the first time and directly contracted out the plants for installation while infrastructure and man power development were the responsibilities of the state authorities. The policy laid down in respect of operation and maintenance included introduction of 3 or 2 tier system for hand pumps in states, involvement of women, local people and panchayats and 10% of fund available for projects under Central Sector was earmarked for operation and maintenance.

PROBLEM FACED IN APPLICATION OF NEW TECHNOLOGY

- . Defluoridation
 

Fill and draw type defluoridation units have been installed for communities of 250 people and above in which the raw water is treated with prescribed amount of lime and alum, allowed to stand for few hours and potable water from upper layer is drawn for consumption. This system is working fairly satisfactorily. The hand pump attached small defluoridation units however are not working properly and there is need for design improvement.
- . Iron Removal
 

This is based on principle of allowing the water to stand in a packed bed for aeration converting ferrous iron to ferric state which is removed by adsorption with the bed material. These units are not working satisfactorily with fluctuation in quality

of raw water both due to design and operation limitations which are being improved.

- . Desalination by Reverse Osmosis

These units are not suitable for raw water with TDS value >20000 ppm, require minimum 16 hours of steady power supply and raw water pretreatment to make it free colloidal, suspended, bacterial and virus impurities. The membrane is sensitive to the narrow pH range which has to be maintained. The high pressure pump and dosing pump require maintenance. The cost is high and the disposal of concentrated brine pose environmental problem.

- . Arsenic Removal

Arsenic is found in ground water from specific geological formation which is avoidable by abandoning the source or tapping deeper strata. Technology for removing arsenic by coagulation and flocculation is yet to be standardised. This is achieved by converting affected wells into sanitary wells; providing alternate sources; but 100% conversion of affected source is not achieved so far.

- . Guinea worm abatement

- . Handpump

The India Mark II hand pump is difficult to be maintained at village level as such UNICEF has initiated introduction of India Mark III which can be easily repaired at village level.

- . Water Testing Laboratories and kits

The district level laboratories are working satis-

## Solar PV Systems

factorily but the portable kits are susceptible to give erroneous results under varied conditions, which need to be standardised.

These are suitable for places where no electricity is available and sun shines for 5-6 peak hours, sources are more than 1.6 km away and ground water is available at a depth higher than 50 meter. They need protection from animals and other miscreants and strong civil and mechanical structures. The inverter required for AC pumps adds to cost, as such DC pumps are desirable. Part time operators are needed for trouble free operation. Suitable for centralised water storage and multiple supply points.

## OUTLOOK FOR 2000 A.D.

Although the prescribed consumption level is 40 LPCD of potable water, the actual does not exceed 25 LPCD level as of now. This is expected to increase beyond 40 LPCD with overall improvement of quality of life of people. Moreover, the villages which are fully or partially covered today, may turn to no source or problem village with depletion of water table or increase in pollution in ground water with passage of time. This will require newer technologies for treating the water to potable level along with the standardisation of the above technologies. New problem areas would continue to crop up along with persistence of quality and quantity problems.

The importance of human preference prevails supreme in rural water supply in India and it is still a long way for rural people to realise what happens behind the flow of clean water through the stand post/pump outlet. A vast section of people does not have the idea of questioning the quality of water from any natural source and may have to struggle for mere availability of a source of water. In near future this situation may not be feasible to be changed substantially. But it has already been experienced

that number of people have become alert in respect of the harmful ingredients present in the water. With 100% coverage of the districts with stationary or mobile laboratories, the public interaction and information regarding quality of water in villages is likely to experience a major boost before the turn of the century. With an organised action programme, data on significant water sources can be made available to village chiefs although the establishment of quality monitoring system may take longer than this. A Nation-wide survey of status of Drinking Water Supply in Rural Habitations in progress is expected to bring out comprehensive data in these regards.

Training for human resource development is already a part of water supply programme, which is supplemented by specially organised training for science based projects and also education for recognising and avoiding water of non-potable quality. But the traditional superiority of piped water supply prevailed and cost competitiveness of alternative methods with application of new technology, could not be established in absence of large scale adoption. Potable water and sanitation should be made a part of basic education and culture in the present circumstances so that people are motivated to make it a part of life style and also willingly opt for suitable water supply system with physical and financial participation.

In order to achieve the above mentioned goals, Government of India proposes the following strategies the next decade:

- . Coverage of remaining no-source villages
- . Coverage of habitations with special emphasis on SC/ST
- . Augmentation of service level
- . Improved operation and maintenance
- . Quality improvement
- . Water resource management and prevention of failure of sources
- . Health Education, Community Participation and Awareness programme.

**Note:** The views expressed are of the authors and not necessarily of the organisations they work for.