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Critical studies on rural water supplies in drought prone area and coalfield area of West Bengal

Dr A K Basu, R S Dhaneswan, A K Biswas, A K Ganguly, P B Sanyal and S R Kshirsagar

INTRODUCTION

India is actively involved, as a member country of the United Nations, in the International Drinking Water Supply and Sanitation Decade Programme. National Environmental Engineering Research Institute (NEERI) undertook a comprehensive evaluation of rural water supply schemes of 83 villages spread of 11 states in India (Appendix-I). West Bengal, situated in the North Eastern Part of India, with a population of 54.48 million having an area 87,853 sq.km. is a prominent partner in the National Decade Programme. This paper covers studies pertaining to the rural water supplies in the drought prone area of Bankura District and Coal field area of Burdwan District of West Bengal. Fluctuations in the Water level in the aquifers and low recharge of underground water during summer months create drought condition. In village of Bankura tubewells are constructed by deploying rock drilling rigs, surface water being inadequate. Like Bankura District, sinking of tubewell in the coal field area also becomes difficult due to hard rocks. Thus in the coal field areas surface water from Barakar river is conventionally treated and distributed to the villagers.

MATERIALS AND METHODS

Ekteshwar and Bikna in Bankura as well as Jemari and Ramdi in coal field loop were the typical study villages. As compared to this, Balarmpur and Jamirkuri were the corresponding reference villages. The water supply in the study villages was organised by the State PHE Department and those in reference villages there were no such organised system. Water samples were collected six times, once in each season for a period of two years. All analyses were done as per APHA Standard Method (Ref.1). During each visit engineering data and information of Health status as well as water supply were collected. These rural water supply schemes were evaluated with a view to identify technological, administrative, financial and socio-economic constraints and to propose recommendations for effective implementation, operation and maintenance to give the desired benefit to the villagers of the study area.

WATER SUPPLY AND HEALTH STATUS OF DROUGHT PRONE AREA OF BANKURA.

India Mark II hand pump tube-wells were used both in Ekteshwar and Bikna with a population of 392 and 2259 respectively. One tubewell is designed to serve 300 people where the water yield was in the range of 1200-1500 litres/hr./pump. Tubewell depth varied from 30m to 60m with a size of 3.81 cm diameter. The casing pipe diameter was 10.0-12.5 cm with a length of 6.0-9.0 meters In Balarampur village, water is drawn from openwells.

Consumption of water in study villages was observed to be about 16 lpcd. The quantity of water for drinking and cooking purposes was more or less equal. The drawal of water from tubewell was observed also to be same at morning and evening. Overcrowding of the hand pump tubewell was the main difficulty in fetching water and this was followed by the distance that villagers had to cover up to get potable water. In Balarampur, villagers were seen to travel about 1.5-2.0 Km to fetch water from the river bed during acute summer season. It was observed that 100% of the rural population go to the open field for defecation in both study and reference villages. Tubewell waters are used only for drinking and cooking purposes. Thus villagers exposed themselves to water from ponds, open wells and river, etc. for other uses and get contaminated. Even though 65% of the people are literate still it was observed that they are generally not aware of hazards of water-borne and infectious diseases. Immunization practices to prevent certain water-borne diseasse are almost non-existant. Dysentery/diarrhoea and worm infestation were the common ailments in these villages. Typhoid cases have also been reported. Comparative studies between study and reference villages showed that the health and sanitation of the study villages are only marginally better because of above stated reasons.

WATER SUPPLY AND HEALTH STATUS OF COAL FIELD AREA OF BURDWAN

Treated river water from Kalyaneshwari Water Works is supplied to the study villages of Jemari and Ramdi through public stand-posts. Population of Jemari was 1875 and that of Ramdi 135 only. Design per capita supply was 70 lpcd at a per capita construction cost of Rs.65/-(1 US $ = Rs.10.0) and Rs.3.00 for

maintenance and operation cost per capita per annum.

The scheme was commissioned in 1972. The service level was designed for piped water supply to be such that one stand post with one tap having 2 hours supply in the morning 2 hours in the evening may serve 250 persons. The terminal pressure was 2.5-3 m and per capita water supply was actually observed to be 40 lpcd. In Jamirkuri, the villagers are consuming the raw water of Barakar river. Almost equal volumes of water are used for drinking and cooking purposes. Similarly, villagers draw equal volumes of water in the morning and evening most of the times. Over-crowding at public stand-posts during limited supply hours has been identified to cause difficulties to the villagers. This is followed by other difficulties such as long distance, insufficient pressure, etc. Breakdown in water supply is mainly due to mechanical faults. Taps from most of the PSPS were missing and there was considerable wastage of water.

During the period of breakdown of water supply and other hours of the day, villagers use well and pond water, thereby subjecting themselves to the hazards of water pollution.

Villagers of Ramdi and Jamirkuri have no latrine in their houses and adopt open field defecation. In contrast to this, 35% of the villagers at Jemari use some form of latrine for defecation. 10-21% of the people have knowledge about water-borne and infectious diseases. Immunizational status is also poor and people are ignorant about the preventive measures to control morbidity from such human activities. Dysentery, diarrhoea and worm infestation, were common diseases in these villages, particularly in Jemari and Jamirkuri. Only in study villages, 30-40% people believe that dysentery and diarrhoea have been reduced significantly owing to the introduction of piped water supply.

RESULTS

Selected Physico-chemical and Bacteriological parameters are incorporated in Table 1.

TABLE 1. Water quality of selected villages in drought prone and coal field areas

Parameters	Drought Prone Area			Coal Field Area		
	Ekteshwar	Bikna	Balarampur	Jemari	Ramdi	Jamirkuri
PH	7.5-7.6	7.2-7.6	7.2-7.6	7.5-7.8	7.3-7.8	7.6-8.0
TDS	260-330	254-964	286-430	64-120	70-120	96-858
T. ALKALINITY ($CaCo_3$)	100-142	130-230	74-124	22-56	20-50	22-64
T. HARDNESS -do-	180-204	170-513	120-182	80-100	74-92	64-452
CARB HARDNESS -do-	100-142	130-230	74-124	22-56	20-50	22-64
NON-CARB HARDNESS-do-	42-82	42-289	8-106	25-66	24-64	22-234
CALCIUM -do-	95-120	115-322	80-100	52-60	52-60	40-247
MAGNESIUM -do-	58-86	54-239	25-86	29-41	16-37	25-202
CHLORIDES (Cl)	44-69	24-214	52-108	1-5	3-6	4-111
SULPHATES (SO_4)	16.2-19.2	11.5-112.5	10.7-32.5	6.5-17.0	10.0-17.2	2.2-61.0
T. IRON (Fe)	0.02-0.12	0.08-0.5	0.06-0.14	0.02-0.32	0.02-0.22	0.02-3.8
RESIDUAL CHLORINE (Cl_2)	-	-	-	less than 0.1	traces -0.9	-
BACTERIOLOGICAL (MPN/100 ml)						
Coliforms	32-1600	0-79	1100-7900	13-2400	0-280	230-24000
F. Coliforms	4-1600	0-8	700-3300	0-140	0-170	0-24000
E. Coli	4-220	0-8	200-3300	0-110	0-130	0-9300
F. Streptococci	0-920	0-7	1300-4900	0-130	0-130	14-1500

(All range values except pH are expressed in mg/1)

From the results of analysis it was observed that the tubewell water at Bikna showed high total dissolved solids and high hardness, and other parameters were within the permissible limits. As compared to this, in Ekteshwar the chemical quality of water was more or less acceptable. Similar was the situation at reference village of Balarampur. Bacterilogically water quality, both in Ekteshwar and Bikna, was unsuitable for potable purposes. Lowest bacterial count was observed from water samples of Bikna. The water at Balarampur was observed to be grossly polluted and this was followed by high bacterial counts in Ekteshwar.

The source of treated water supply in two study villages in coal field area is river water and the chemical quality of such treated water conforms to permissible limits of drinking water standard. However owing to improper chlorination, residual chlorine was observed most of the time to be less than 0.1 mg/1 at Public stand posts (with the exception of one value of 0.9 mg/1). In Jamirkuri the water quality-even though untreated-from chemical point of view was comparatively acceptable except for high values for hardness (452 mg/1), TDS(858 mg/1) and total Iron (3.8 mg/1). Bacterilogical count was observed to be the highest in Jamiruri and is un-acceptable for human consumption. In study villages, bacterial counts were also observed to be occasionally high, due to improper chlorination.

DISCUSSION

From the foregoing data, it will be apparent that there has been no significant effect on the health status of the people due to poor or grossly inadequate sanitation and personal hygiene in drought prone and coal field areas. Lack of sanitary latrines, soakage pits for disposal of wastewater produced in houses and compost pits for taking care of garbage and cattle dung are possibly the biggest contributory factors for such state of affairs. People's health education and awareness, motivation etc. are lacking which accentuate the problem of appropriate resource utilization for welfare of the villagers. The water from ponds and open wells are to be cleaned and disinfected when used particularly during the breakdown periods of tubewell hand pumps and/or during acute summer months. Besides adopting measures of increasing the supply hours and proper chlorination in the coal field area, the State PHE authority should more systematic and rigorous aspects of operation and maintenance to improve upon the existing situation. Wastage of water at the public stand-posts be controlled by constant vigilance and effective community participation. One of the viable methods of reducing such wastage is to encourage house connections particularly in Jamari, where people can also afford to pay for such services. For online assessment of water supply to the villagers, it is imperatively necessary to resort to periodic analyses of chemical and bacterial quality of water by the State PHE so that a desired quality of water is made available.

There is little awareness amongst the villagers due to inadequate general and health education. Moreover lack of immunization have made the situation more difficult to arrest the incidence of water-based diseases. Training facilities should be provided to the staff of Gram Panchayet as additional adjunct to the existing personnel in study villages engaged for operation and maintenance of water supply. Workshop facilities, at District level, to undertake minor as well as major repairs will be useful. State Government takes complete financial responsibility for construction as well as operation and maintenance of water supply scheme in these villages. No water tax is collected from users. Statutory provision should be made-particularly if house connections are provided for levy of water tax on the beneficiaries and ensure return of part or whole of the expenditure on operation and maintenance. This will reduce the recurring expenditure incurred by the state Government in Coal Field Area.

It has been noticed that lesser drawal of water is due to inadequacy of design and the resulting overcrowding at hand pumps and public stand posts. Thus there is a need to review the norms and develop suitable design guidelines for intermittent water supply.

Based on the information gathered during the survey and other relevant conditions in the village set up of other parts of India, NEERI recommended (Ref. 2, per capita rate of water supply to be as shown in Table 2. Even though these norms pertain to all India data still these serve as a useful guidelines for the study villages covered here.

TABLE 2. Recommended per-capita rate of supply (lpd)

Description	House connections	Public stand-post/hand pump
Drinking	5	5
Cooking	3	3
Ablution	10	6
Bathing	20	15
Washing utensils and house	15	10
Washing of clothes	20	15
Flushing	8	6
	81	60
Leakage/Wastage at 10%	8	6
	89	66
Say	90	70
Cattle need including leakage/wastage	20	20
	110	90

Judging the above norms it was apparent that villagers of the study area were getting inadequate water for their various uses. Available mass media, Gram Panchayat and social worker must join hands with the technical and scientific personnel to improve upon such gaps and inadequacies.

CONCLUSION

Based on onsite observation and experiences, the following structural constraints were observed :

- Scarcity and non-availability of materials in time
- Inadequate allocation of trained personnel for operation and maintenance, particularly in drought prone area
- Outmoded financial and administrative procedure causing delay in implementation
- Non-availability of adequate data on health aspects for meaningful interpretation of health impact.

Critical studies revealed that except for a few chemical parameters, water supplies, both in drought prone and coal field areas are of acceptable nature. However, the bacterial quality is of doubtful character, particularly in Balarampur and Jamirkuri, where there is no organised water supply system. Bacterial counts in water from the study villages like Ekteshwar and Bikna (drought prone area) may be reduced to appropriate level, by adopting measures like selection of proper site and aquifer, construction of suitable platform with adequate drainage system. Similarly in study villages like Jemari and Ramdi (coal field area) the bacterial quality of water can be improved by adopting effective chlorination and by constructing suitable platform with adequate drainage system at Public stand posts. Unless and untill the water supply programme is matched with the appropriate sanitation practices, the health of the villagers is not likely to improve.

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