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DRINKING WATER QUALITY IN PUNJAB

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ABSTRACT

There is scarcity of data pertaining to drinking water quality in Punjab. In general both rural and urban water supplies have been found contaminated by faecal matter. Land disposal of certain industrial effluents and the use of synthetic fertilizers and pesticides have degraded the groundwater quality in certain parts of the province to unacceptable levels. Areas like Kasur, Raiwind and Manga have high fluoride concentrations in groundwater which have caused serious health implications, especially in children. An analysis of the available data reveals that diarrhoea occupies second position amongst the 15 top priority diseases in children upto 5 years of age indicating poor quality of drinking water supplies. The paper highlights strategies to ensure safe drinking water supplies to the communities.

INTRODUCTION

Drinking water quality and consumer's health are intrinsically linked. Faecally polluted waters are major contributors to various infectious diseases which are of significant concern in developing countries where such diseases have not been brought under control. With rapid industrialization, the chemical aspects of water quality have also become a cause of increasing concern as toxic chemicals in industrial effluents pose a high risk to human health.

Drinking water supplies are generally obtained from either surface water sources (such as rivers, streams or lakes) or the underground aquifers. With particular reference to the province of Punjab, over 90 percent of urban water supplies are based on groundwater due to its availability in shallow and deep water bearing strata. In rural areas, wherever sweet aquifers are available, supplies are obtained from groundwater. Due to anthropogenic activities both sources are subject to pollution. This paper describes the water quality issues in Punjab and delineates the strategies to improve upon the existing situation.

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WATER QUALITY

The disposal of untreated municipal, industrial and agricultural wastewaters has degraded the quality of surface waters in Punjab. Such waters now require elaborate treatment prior to supply for human consumption. The shallow groundwater is also being contaminated at places by industries that discharge wastes directly on the ground. The practice of boring soakage pits, receiving septic tank effluent, upto the groundwater table is also a major cause of faecal pollution of groundwater in urban and rural areas.

In Punjab insufficient attention is given to water quality issues and the quantity remains the priority focus for water suppliers and water users. No urban water supply meets WHO drinking water quality guidelines. The lack of attention is not always equated with lack of awareness as many individuals and institutions are aware of the shortcoming. Nevertheless, the rural communities which are mostly illiterate lack awareness regarding the ailments associated with poor quality of water. In rural areas there is no system in place to assess the quality of water. The institutions responsible for water quality monitoring i.e. Public Health Engineering Department (PHED) and Local Government and Rural Development Department (LG & RD) maintain that there is not much point in monitoring the quality of water where alternative sources of supply do not exist. It has been a general practice with public water supply agencies to examine the water quality of the source at the time of its development only for very few parameters normally confined to bacteriological quality and salinity. If the results of those parameters are within permissible limits the source is considered suitable and the scheme is approved and implemented. No detailed analysis of the constituents which can pose threat to human health is carried out. As such there is scarcity of data pertaining to water quality. This is an alarming situation in the light of recent problems of high levels of arsenic in the groundwater (leading to severe ulceration and skin lesion) in Bangladesh and excessive fluorides in groundwater (leading to severe arthritis) in parts of India and Pakistan. Pakistan has developed National Environmental Quality Standards (NEQS) but does not have standards for drinking water quality. Government departments with responsibility for supplying water claim to follow the WHO guidelines (1984) but this is largely theoretical due to lack of quality monitoring.

Earlier studies carried out at the Institute of Environmental Engineering and Research (IEER) by Ali and Ahmad (1994) on groundwater quality at various locations in Punjab are summarized in Tables 1 and 2. With respect to WHO

guidelines, the chemical quality of water was generally adequate whereas bacteriological quality was questionable.

In recent years many investigations have revealed that in certain areas of Punjab, the drinking water quality has significantly deteriorated with respect to certain constituents such as faecal coliforms, pesticides, nitrates, fluorides and chromium.

Table 1: Water Quality from Hand Pumps and Open Wells in Punjab (Ali and Ahmad, 1994)

Cluster No	Ground water Level (m)	Public Hand Pumps		Private Hand Pumps		Open Wells	
		Coliform per 100 ml	E.Coli per 100 ml	Coliform per 100 ml	E. Coli per 100 ml	Coliform per 100 ml	E. Coli per 100 ml
1.	20	-	-	9-800	0-0	600-5000	80-2000
2.	10	10-240	1-10	14-72	0-0	200-4100	82-1500
3.	3	81-690	9-10	125-1400	4-300	570-2000	40-400
4.	3	2-180	9-10	48-125	6-10	290-600	30-80
5.	5	31-109	0-20	21-1OO	6-10	54-150	3-6
6.	10	13-51	6-20	9-225	0-10	29-300	1-20
7.	10	0-14	0-3	0-12000	0-150	23100-31200	30-8000
8.	7	10-700	0-1O	0-70	0-0	2000-2100	20-100
9.	5	0-4000	0-200	0-9000	0-2000	450	200
10.	7	0-200	0-10	0-400O	0-166	400	1700

Note: WHO Guidelines suggest complete absence of Coliforms and E.Coli in any 100 ml of the sample for drinking water supplies.

Table 2: Groundwater Quality Data of Some Cities of Punjab (Ali and Ahmad, 1994).

City	pH	TDS mg/l	Harness mg/l $CaCO_3$	Chlorides mg/l	Iron mg/l
Lahore	7.6 - 7.8	260 - 290	192 - 196	14 - 95	0.2 - 0.5
Faisalabad	8.2 - 8.4	220 - 600	74 - 186	21 - 52	0.1 - 0.4
Rawalpindi	7.5 - 7.8	300 - 342	90 - 120	18 - 50	0.5 - 0.6
Multan	7.5 - 8.1	400 - 1160	170 - 370	40 - 220	0.1
Jhelum	7.4 - 8.3	500 - 540	160 - 182	5 - 14	1.0 - 1.2
Rahim Yar Khan	7.3 - 7.5	300 - 500	150 - 170	12 - 20	0.2 - 0.9

Note: WHO Guideline values for drinking water quality are:

Iron = 0.3 mg/l TDS = 1000 mg/l Chlorides = 250 mg/l

In most urban centres the supplies are faecally contaminated. The major reason to this effect is intermittent supply through leaking pipes and cross-connections with nearby laid sewer lines. In a survey conducted by Punjab Public Health Engineering Department (1991), 99 percent of the water samples obtained from hand-pumps and wells in 114 villages of Punjab were found unfit for human consumption due to faecal contamination. In urban centres like Lahore (Ali and Ahmad; 1994), Raiwind (Afzal et al., 1998), and Rawalpindi/Islamabad and adjacent locations including Pearl Valley (Saleem, 1999) the sampled waters were also found highly contaminated by faecal matter.

Pesticides residues persist in water table and sometimes break down to even more toxic components contaminating the water system. Waters intended for drinking supplies must, therefore, be analysed for pesticides contents. Very few studies have however, assessed the water contamination from pesticide use in Punjab. Ali and Jabbar (1991) revealed that the shallow groundwater in Samundri area drawn from a depth of 10-13 m was contaminated with pesticide residues. The amounts of various pesticides found were within the WHO safety limits. A study conducted near Faisalabad (PCRWR, 1992) also revealed the contamination of shallow groundwater with pesticide residues. In another study, Afzal et al. (1998) detected parathion and malathion pesticides in shallow groundwaters of Raiwind. The use of pesticides in Pakistan in 1998 has been reported to be about 46,000 tonnes (CEHA, 1998) of which about 50 percent is in Punjab. It is estimated that the use will increase by 33 percent and 81 percent by the year 2010 and 2025 respectively. Although presently the levels of pesticide concentrations in groundwater are within safe limits, there is a possibility that these limits would be exceeded in future.

Due to heavy use of fertilizers, nitrate contamination of groundwater has become quite significant in Punjab. High nitrate levels have been detected in some of the drinking water samples from surface and groundwater sources in Islamabad and Rawalpindi (Chandio et al., 1998) and Gujar Khan, Kahuta, Murree and Taxila (Tahir et al., 1998). Studies conducted by Latif et al. (1999), in Faisalabad area indicated that the concentration of nitrate nitrogen in shallow water exceeded the permissible limits of 10 mg/l set by WHO guidelines. Afzal et al. (1998) have reported nitrate concentrations above 45 mg/l in Raiwind shallow groundwaters. Tasneem et al (1999) studied the impact of chemical fertilizers on groundwater quality in Kasur area and found nitrate concentrations ranging from 1-171 mg/l. They observed that out of 14 drinking water samples six had nitrate contents above WHO permissible limits

(45 mg/l). A detailed survey conducted by Bashir (1998) in southern Punjab covering water supply sources of Bahawalpur, Bahawalnagar, Rahim Yar Khan and Sadiqabad has shown high concentrations of nitrates in surface waters, tubewells, shallow wells and hand pumps in the area. It is estimated that the use of fertilizers will increase by 6 percent in year 2010 and 19 percent in year 2025. As such there is increasing possibility of high nitrogen levels to be found in groundwaters in areas of intensive agricultural activity.

Drinking waters in certain areas of Punjab are reported to have high concentrations of fluorides. Extensive studies undertaken at IEER in areas within salt range between Kasur and Mianwali have shown high fluoride levels in water samples obtained from shallow wells and hand pumps. Samples with fluoride concentrations in the range of 5.01 to 23.6 mg/l were obtained from towns of Raiwind, Kasur and Sargodha (Tariq et al., 1981).

In addition to the above contaminants, water quality at certain places is poor due to presence of other ions. Wastewaters from Kasur tanneries are known to contaminate the drinking water supplies from hand pumps with high concentrations of chromium, sodium chloride and sulphides. Islamabad drinking water supplies are reported to contain traces of lead (Chandio et al., 1998). Ahmad (1998) has also reported the presence of cadmium and lead in water samples taken from wells in Rawalpindi and Islamabad areas. Water supplies in D.G. Khan are known to contain very high levels of hardness and sulphate concentrations (Hussain and Mateen, 1998). There, however, appears to be no anecdotal of indication of medical problems related to arsenic in Punjab area. The metal is not being analysed and as such no arsenic results are available with respect to concentration in drinking water supplies. Nevertheless it would be desirable to undertake the surveillance of drinking water quality for arsenic content in the province.

HEALTH IMPACTS

In Punjab the poor quality of drinking water has posed health risk to the consumers. It is unfortunate that no well organized surveys have been undertaken to correlate water quality with health issues and only sporadic data are available. At present no agency is involved in regular monitoring of drinking water quality. There is also a wide gap between water supply and sanitation coverage in Punjab resulting in the spread of various diseases in large parts of the province.

In general the poor quality of drinking water has given rise to high incidence of water borne diseases. The cases of cholera, typhoid and dysentery are consistently reported in urban and rural areas. It is estimated that 25,000 to 34,000 cases of water borne diseases are hospitalized every year in Lahore area (Scott and Furphy, 1993). Basic Health Units of Rawalpindi Division were reported to register more than 80,000 cases of water related diseases in one year (Chandio et al., 1998). Tahir et al. (1998), have reported daily admission of about 200 children and 50 adults in Rawalpindi hospitals on account of water borne diseases. According to the Department of Health (G.O.Punjab, 1997) the number of reported diarrhoeal cases amongst children of less than 5 years of age in all 34 districts of Punjab totalled 212967 making 26.62 percent of all reported cases of 15 priority infectious diseases which mainly affect the younger population. Diarrhoea thus ranked second among priority diseases (after acute respiratory infection) clearly indicating the faecal contamination of drinking water supplies. The out break of hepatitis E in Islamabad in 1994 (Dil, 1997) was also indicative of poor drinking water quality. Some incidences of methemoglobinemia in southern Punjab have been reported by Bashir (1998) due to excessive nitrate levels in water. On the other hand dental fluorosis is quite evident in Kasur, Pattoki and Raiwind. In July 2000, more than hundred cases of deformed bones and arthritis in children have been reported from many villages around Manga Mandi situated near Lahore. These villages include Kot Asaddullah, Kot Radha Kishan, Talab Sarai, Kalalan Wala and Chah Sadhe Wala. The probable reasons for this effect include very high concentrations of fluorides, upto 29 mg/l, in handpump water supplies and malnutrition. In Kasur contamination of groundwater with tannery effluent has caused diseases like skin irritation, nausea and abdominal disorders (UNIDO, 1999).

WATER QUALITY MANAGEMENT STRATEGIES

In view of the above discussed situation, it is imperative that strategies be developed to ensure safe drinking water supply to the communities. In the first instance it would be desirable that the country as a whole establishes drinking water quality standards which may be enforced under the Pakistan Environmental Protection Act, 1997.

In urban areas, it would be desirable to adopt continuous water supply system in place of the intermittent one to prevent the contamination of drinking waters. The agencies responsible for urban public water supplies must regularly monitor the drinking water quality to ensure a safe water supply to consumers. For this

purpose, their existing laboratories need to be upgraded staff and equipment-wise. In management strategy, monitoring of shallow urban groundwater should be given priority as it is extensively used for private supplies.

In rural areas, there is a need for surveillance of bacteriological quality of water sources and monitoring of shallow groundwater supplies for the impact of fertilizer and pesticide use. This responsibility may be entrusted to the Punjab Environmental Protection Department (EPD). EPD, Punjab may also undertake survey and mapping of water quality in the groundwater development areas to support source considerations by the water supply agencies in project planning. EPD should also check the illegal practice of disposing of industrial effluents in groundwater through the use of soakage pits by various industries located in urban and rural areas. In addition the relevant research institutions in the province should be asked to propose cost effective technologies to defluoridate groundwaters for water supply purposes in the affected areas. Lastly the use of mass media be fully employed to create awareness about the importance of safe drinking water.

CONCLUSIONS

The foregoing discussion concludes that both urban and rural drinking water supplies in Punjab are largely contaminated due to anthropogenic activities and naturally occurring contaminants in the soil. The poor water quality has resulted in high incidence of water borne diseases and serious health implications, especially in children. At present little attention is being paid to water quality issues. To safeguard the public health, there is urgent need to regularly monitor the drinking water quality. Environmental Protection Department and the agencies responsible for water supply should be entrusted with this responsibility. To ensure safe water supplies, the illegal practice of discharging industrial effluents in soakage pits must be stopped. Efforts are needed to promote continuous water supply system in urban areas. It would be highly desirable to establish drinking water quality standards in Pakistan. In addition there is need to explore cost effective technologies for defluoridation of groundwaters.

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