

GROUNDWATER POLLUTION AND ITS PROTECTION IN HARYANA, INDIA

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ABSTRACT

A large variation in quality of groundwater in the semiarid region of Haryana state located in northern India has been studied. Three hydrogeochemical zones of low, medium and high groundwater mineralization have been deciphered. Groundwater quality changes occur through man's introduction of extraneous material into the subsurface environment and through interference with groundwater flow patterns by operation of canals and wells. The industrial development is limited but the non-point agriculture pollution due to continuing increase in use of fertilizers and pesticides over extensive alluvial lands may be perceptible in near future. The indiscrete installation of groundwater structures by improper design poses more serious threat to groundwater contamination from saline to fresh aquifers. Since a substantial amount of industrial development is foreseen, some areas will be lost for agricultural practices and transformed into urban and industrial areas. Groundwater pollution problem will be more intense in absence of suitable practices of pollution control. Protection of groundwater quality is of vital importance in the management of the natural resource.

INTRODUCTION

In 4.4 million ha area of Haryana more than 200 persons live per km². 67 % persons occupy primary sector of agriculture, 12% as industrial workers in secondary sector and 21% stay in tertiary sector of trade, commerce and other services. Livestocks are 160 per km². The rural population is 82% whereas only 18% is in medium category of urban centres. There are about 2000 factories including fertilizer plant, thermal power stations, sugar mills, textiles, paper mills, chemicals and rice mills etc. Sewage facilities are hardly provided in 10 to 12 towns.

Groundwater occurs in low to high quality aquifers (ref. 1) and is widely used for drinking, municipal supplies and agricultural production. Well depths extend to 10-300 m. More than 40% water supplies are met with from subsurface

reservoirs. Although the adequate analytical data on alteration in quality of groundwater due to pollution or various types of human activities are not available, an attempt has been made in this paper to determine qualitative characteristics and changes through surveillance of a network of monitoring stations each covering about 15-20 km² area. Groundwater quality pollution sources and approaches to pollution control have been discussed.

RESULTS

Groundwater quality

Density of groundwater structures varies between 1 and 16 per km². A number of groundwater samples have been chemically analysed which reveal EC_w from 0.25 to 70.0 mmhos/cm. Table 1 shows a generalised range of mineral contents in

TABLE 1

Generalised range of mineral contents in groundwaters

Region District	EC _w (mmhos/cm)		Milliequivalent per litre				Milligram per litre		
	Shallow (0-50m)	Deep (50-300m)	Cl	SO ₄	Ca	Mg	Cu	F	NO ₃
<u>Eastern</u>									
Ambala	0.25	0.35	0.4	0.2	0.7	0.9	0	0.4	5
	3.20	1.50	14.0	10.0	8.0	10.0	0.05	1.0	10
Kurukshetra	0.25	0.35	0.5	0.2	0.8	0.9	0	0.6	5
	6.00	10.50	48.00	42.00	16.00	19.00	0.05	1.2	10
Karnal	0.25	0.35	0.5	0.2	0.7	0.9	0	0.6	5
	8.00	12.00	62.00	60.00	20.00	24.00	0.05	1.5	20
Sonapat	0.25	0.50	0.5	0.2	1.0	1.0	0	0.6	5
	12.50	60.00	560.0	120.0	132.0	146.0	0.05	1.5	30
Faridabad	0.50	1.0	0.8	0.2	1.2	1.5	0	1.0	5
	8.00	20.00	184.0	26.0	58.0	65.0	0.05	2.0	60
<u>Central</u>									
Jind	0.40	0.35	0.5	0.4	0.8	0.9	0	0.6	5
	10.00	20.00	180.0	25.0	60.0	64.0	0.05	1.5	40
Rohtak	0.50	7.50	0.6	0.5	1.0	1.0	0	1.0	5
	20.00	45.00	390.0	68.0	115.0	122.0	0.05	2.0	50
Gurgaon	0.40	0.50	0.9	0.3	0.6	0.8	0	1.0	5
	70.00	22.00	720.0	150.0	140.0	250.0	0.05	2.0	60
<u>Western</u>									
Sirsa	0.25	0.50	0.5	0.4	0.4	0.6	0	1.5	5
	8.00	15.00	92.0	49.0	32.0	35.0	0.05	3.5	50
Hissar	0.25	0.50	0.5	0.4	0.4	0.6	0	1.5	5
	15.00	35.00	288.0	58.0	85.0	92.0	0.05	3.5	50
Bhiwani	0.50	0.70	1.0	0.5	1.0	1.0	0	1.0	5
	20.00	50.00	430.0	85.0	110.0	130.0	0.10	2.0	50
Mahendragarh	0.60	0.70	1.2	0.5	1.1	1.1	0	1.0	5
	15.00	30.00	260.0	45.0	75.0	90.0	0.10	4.0	60

groundwaters. Low mineralization water is rated to hold ECw upto 2.0 mmhos/cm, medium ECw 2.0 to 3.0 mmhos/cm, and high mineralization water has ECw greater than 3 mmhos/cm (Fig.1). Table 2 provides the information on alteration in water quality of shallow aquifers at selected industrial focal points over a period of 4 years. The change is reflected on accumulation of salts and reduction as well.

TABLE 2

Change of ECw in dug wells at few industrial places

Place	ECw during April (mmhos/cm)			
	1975	1976	1977	1978
Panchkula	0.67	0.52	0.38	0.88
Ambala	2.59	0.97	2.42	1.37
Kaithal	2.21	2.06	NR ^a	2.59
Hissar	2.10	NR	2.06	3.78
Rohtak	1.61	1.52	1.65	2.07
Dadri	5.62	6.17	3.20	5.59
Rewari	1.95	2.09	2.44	3.88
Dharuhera	2.68	2.47	5.00	3.10
Gurgaon	1.47	1.52	NR	1.75
Faridabad	3.80	1.43	1.41	NR
Ballabgarh	4.28	3.86	4.40	5.00
Murthal	NR	NR	NR	3.38

^aNR = not reported

Pollution sources

Sewage and industrial effluents are point sources and the agriculture non-point pollution is in extensive cultivated land but is of very less magnitude. In past 12 years the fertilizer consumption in NPK has increased from 4 to 57 kg per hectare. The salinity hazards in groundwater in desert region (ref.2) are prominent due to natural processes. All the three categories of groundwater pollution viz point source, non-point source and natural processes of mineralization(ref.3) are represented in the state.

Approach to pollution control

Water well designs in a complex subsurface environment of marginal and saline aquifers need to be carefully evolved to avoid intrusion. The Sewage discharge should be treated suitably which is presently not performed. Industrial effluent is also left uncontrolled. There should be effective actions to make the industrialists realised and follow the pollution measures. Perhaps poor economy and apathy towards anticipating serious problems of groundwater pollution do not encourage the people to adopt stringent measures.

Groundwater quality monitoring

Groundwater levels are measured on more than 3000 well points during pre and

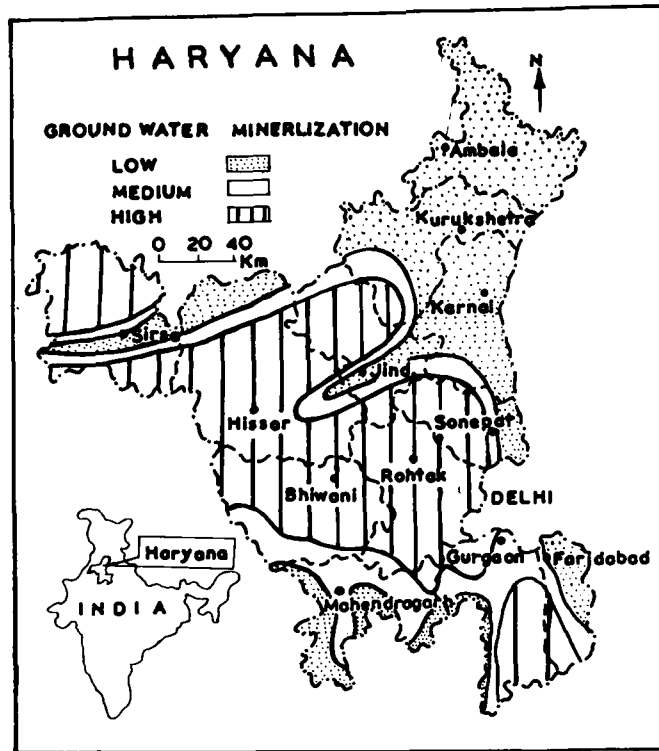


FIG. 1. Hydrogeochemical zones in Haryana.

post monsoon period every year and selective water sampling is done. But from the view point of pollution study adequate groundwater quality monitoring is required (ref.4). A proper education to the concerned people may help adoption of the programme of pollution control.

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