24th WEDC Conference Islamabad, Pakistan, 1998

SANITATION AND WATER FOR ALL

Drinking water quality of Hyderabad city

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HUMAN AND ANIMAL consumption is perhaps the most evident essential use of water. Each person on earth requires about two litres of clean drinking water each day, which amounts to 10 million m^3 per day for the world's population.

According to Agenda 21, the United Program of Action from the Rio Conference in 1992, an estimated 80 per cent of all diseases and over one third of deaths in developing countries, such as Pakistan are caused by the consumption of contaminated water, and on average as much as one-tenth of each person productive time is sacrificed to water-related disease (UN, 1993).

There is an inseparable linkage between the quality and quantity of water over the past decades, the natural quality of watercourses has been altered by the impact of various human activities and water uses. The four most important sources of water pollution worldwide are sewerage, industrial effluents, storm, urban run-off and agricultural run-off.

The problem of maintaining water quality is particularly acute in urban areas in developing countries and is hampered by two factors:

1. failure to enforce pollution controls at the main point source,
2. inadequacy of sanitation systems and of garbage collection and disposal.

In Pakistan the access to safe water is available to only 61 per cent population (85 per cent Urban, 47 per cent Rural). The proper sanitation facility is only available to 30 per cent population (60 per cent Urban, 13.5 per cent Rural) (Aziz, 1998).

The main source of water is River Indus, from where water is pumped to the two lagoons for pre-settlement. The

Table 1. Water Supply Distribution Network (PipeLine Dia, Material) and Timing Water Distribution Network (HDA) 1998)

FROM	TO	DIA	MATERIAL	TIMING
Old Treatment Plant (10 MGD)	Thandi Sarak (P/S) *	122cm	R.C.C	Round Clock
NewTreatment Plant (30 MGD)	Thandi Sarak (P/S) & Citizen Colony (P/S)	137cm	R.C.C	Round Clock
Citizen Colony (P/S) (1.0 M Gal.)	Qasimabad & Wadhu Wah	41cm	A.C.	5 a.m—12noon
Citizen Colony (P/S)	Hirabad & Eyes Hospital	60cm	D.I.	Round Clock
Citizen Colony (P/S)	Rajputana Hospital, Agha Khan Hospital & Memon Colony	30cm	A.C.	5 a.m-10 a.m., 5 p.m-10 p.m.
Thandi Sarak (P/S) (5.0 M Gal.)	Latifabad Unit no.6-12 (02 M Gal.)*	102cm	D.I.	5 a.m-10 a.m., 5 p.m-10 p.m.
Thandi Sarak (P/S)	Qasimabad & Hussainabad	51cm	A.C.	5 a.m-10 a.m., 5 p.m-10 p.m.
Thandi Sarak (P/S)	G.O.R Colony, Latifabad Unit No.4 –6 Chiragh Mahal Cinema	46cm	A.C.	5 a.m-10 a.m., 5 p.m-10 p.m.
Thandi Sarak (P/S)	Cantonment Area	51cm	A.C.	12noon-3p.m.
Thandi Sarak (P/S)	Fort hill (1.3 M Gal.)*	61cm	D.I.	Round Clock
Fort Hill	City Area	51	D.I.	Round Clock

* The pumping stations (P/S)

settled water then goes to old or new treatment plant . Roughly one third population is served with the untreated water. Hyderabad city water distribution network is shown in the table given above.

The new treatment plant NTP and associated pipeline network were constructed in early 80s and commissioned in early 90s. The old treatment plant OTP and other pipeline system of the city was built around 60s and are inferior quality (asbestos pipe or ductile pipe, made of iron) . Unfortunately the most of waste water drainage pipe lines are also laid in parallel and are 152-244 cm away from the drinking water pipelines. At some places the drinking water supply lines are placed on top of the waste water lines. In most parts of the city there is no surface drain and as a result these pipe lines are always submerged in the water. This all has resulted in the break-up of the pipe line joints causing mixing of waste water with the drinking water.

Treatment process in practice

In new treatment plant, NTP, (30 MGD) the raw water pre-settled in the lagoons (400MG) is pumped to the clarifiers after alum treatment. This water then goes to sand filters before supplying for human consumption. Theoretically the chlorine is added at the 3 points:

- Before entering the clarifier
- After leaving the clarifier
- After leaving the sand filters

The chlorinating system is available at the NTP but without chlorine and therefore no chlorine is added at any point. The sludge from classifier and sand filters is not properly handled, and some time it goes to the lagoons, which is meant for presettlement of raw water for the filtration plant. In old treatment plant, OTP, (10 MGD) the raw water is taken from the same lagoons and settled after adding alum. The clarified water is then passed through the slow sand filters before supplying to the consumers without any disinfection.

Sampling and experimental work

The samples were collected and analysed within 24 hours. All the samples were preserved in the ice box (near 4°C.). All the points were selected according to the flow network from raw source to the main distribution / pumping stations around the City.

The analytical work was conducted by using the HACH, DR/2000 Direct reading Spectrophotometer, Digital Titrator, pH meter, Total Dissolved Solids / Conductivity meter. All precautions were made to collect the representative samples and to get reliable data by taking average of three readings of individual parameters.

The water samples were collected from various distribution net work points starting from raw source (Indus River).These samples were analysed for different quality parameters. The analytical data of treated and untreated (settled) water are shown in Table 2 & 3 respectively.

Raw water

HDA takes raw water from Kotri Barrage upstream side. As shown in table. 2, the river water was surprisingly high in manganese content against the WHO standards. The iron and chromium (hexavalent) levels were also on the higher side. These results require further study.as many contaminants are added in the river before reaching the kotri barrage, specially from Thermal Power Station Jamshoro. Present study requires continuation to find the sources and causes of the pollution and to strengthen the base line data.

The Public Health Engineering Department at Hyderabad (PHE,1995) monitors the water quality of Indus River (Kotri Barrage up stream) under the GEMS Programme. For the 1995, it is reported that the Total Suspended Solids

Table 2. Physical and Chemical quality of Indus River, Lagoons, and Treated water (Date of sample collection and analysis 27–11–1995)

S.No	Location *Unit*	Temp. °C	PH *(H+)*	Hardness *Mg/l*	Chlorine *Mg/l*	Fluoride *Mg/l*	Iron *Mg/l*	Manganese *Mg/l*	Sulfate *Mg/l*	Nitrate *Mg/l*	Copper *Mg/l*	Chromium *Mg/l*	TDS *Mg/l*
	WHO		**6.5–8.5**	**500**	**0.2**	**1.5**	**0.3**	**0.1**	**250**	**10.0**	**1.0**	**0.05**	**1000**
1.	R.W.	23	7.98	124	0.00	0.15	0.23	3.2	42	0.2	0.14	0.04	152
2.	Lagoon	20	8.08	330	0.00	0.31	0.34	6.0	49	0.3	0.19	0.05	188
3.	NTP	24	8.05	124	0.00	0.15	0.04	2.8	50	0.2	0.02	0.02	172
4.	T.S/**I** (P/S)	23	7.87	128	0.00	1.00	0.06	0.6	50	0.1	0.01	0.03	183
5.	T.D./**II** (P/S)	23.5	7.90	124	0.00	0.29	0.05	0.7	49	0.1	0.10	0.04	179
6.	L.A–6(a)	24.5	7.69	219	0.00	0.27	0.02	0.3	200	0.1	0.02	0.03	400
7.	Fort Hill	23	7.84	105	0.00	0.27	0.08	0.3	53	0.2	0.03	0.04	205

Where: R.W.= Raw water, NTP= NewTreatment Plant, TS/ I=Thandi Sarak In, TS/II= Thandi Sarak Out, P/S =Pumping Station, L.A-6(a) = Latif Abad No.6 Treated water.

Table 3. Physical and Chemical quality of Un-treated water (Date of sample collection and analysis 27–11–1995)

S.No	Location	Temp.	Turbidity	PH	Hardness	Chlorine	Fluoride	Iron	Mang-anese	Sulfate	Nitrate	Copper	Chromium	TDS
	Unit	°C	*NTU*	*(H+)*	*Mg/l*	*Mg/l*	*Mg/l*	*Mg/l*	*Mg/l*	*Mg/l*	*Mg/l*	*Mg/l*	*Mg/l*	*Mg/l*
	WHO 84–93			**6.5–8.5**	**500**	**0.2**	**1.5**	**0.3**	**0.1**	**250**	**10.0**	**1.0**	**0.05**	**1000**
1.	L.A–6(b)	22.0	25.0	7.60	225	0.00	4.00	0.12	0.7	242	0.2	0.04	0.04	552
2.	L.A–12	24.0	40.0	7.12	600	0.00	0.75	0.22	0.2	750	2.0	1.41	0.01	1142
3.	H.A–Oww	25.0	20.0	7.80	130	0.00	0.25	0.09	0.6	55	0.1	0.03	0.02	207
4.	P.A–Nww	23.0	10.0	8.03	118	0.00	0.39	0.11	0.5	41	0.2	0.03	0.02	177
5.	P.A–Oww	23.5	30.0	8.21	105	0.00	0.40	0.03	0.3	46	0.1	0.01	0.01	167
6.	H.R.	25	23.0	7.86	124	0.00	0.31	0.11	1.0	38	0.2	0.04	0.03	169

Where: L.A-6 (b)=Latifabad No.6 Setteled water, H.A=Hussain Abad, P.A=Parat Abad,OWW=Old Water Works, NEW=New Water Works, H.R= Hala Road uplift pumping station

and Faecal Coliforms are higher in the month of May and onwards (150 mg/l, 66/100) as compared to the values of February which are the lowest (40 mg/l, 4/100). The highest values are recorded in the month of August (2250 mg/l, 170/100).

Lagoons

The two lagoons (230 MG & 170 MG) were commissioned in period 1989-90 with total capacity of 400 MG and initial retention time of 10 days for presettlement. At the time of initial run it is reported that the water was containing more chlorides probably because of the salts leaching out of the soil. With passage of time (about 2 months) the water quality became normal due to settlement of solids, making a layer in the bed and blocking the pores. Lagoons were designed to reduce at least 75 per cent of the total silt load, but it varies from season to season. In summer when canals are flowing full, the solids coming to lagoon are relatively larger in size and heavier as such their settlement is quick and the solids removal rate in lagoons was nearly 90 per cent whereas in winter it was reduced to 75 per cent. As no desilting is carried out in last 10 years this has resulted in the reduction of lagoon capacity to 70 per cent of the initial capacity i.e. from 400 MG to 280 MG. Now due to reduction in retention time from 10 days to about 7 days, the above load removal figures have been reduced to approximately 80 per cent in Summer and 60-65 per cent in Winter (HDA, 1998) .

The iron, and hexavalent chromium (table 2) are found higher than WHO guide line values. The manganese content was alarmingly high in the lagoon as compared to all other samples showing manganese content above WHO standards. The soil samples of lagoons are to be tested to confirm the source of the manganese and other contaminants present in water.

Treated water

The treated water from new or old treatment plant is supplied to the consumers without chlorination . Therefore the drinking water available to the consumers is not bacteria (coliform) free. Table. 2 also show that the manganese level was still higher than the WHO standard though this level was found considerably reduced from the value for the river or lagoon.

Untreated water

The LA-6(b) sample was high in fluorides and manganese content as compared to WHO standard. The sulphates were also found on higher side. On enquiry it was found that the raw water is added into this water to meet the high demand of water specially in Summer, hampering its quality. The LA-12 sample was highly contaminated with reference to WHO guideline values as it contained high TDS, sulphates and copper along with manganese. The untreated (settled) water of Hussainabad, Paretabad, and Hala road areas was also found high in manganese content, the one source of this being river.

Conclusion

The Indus river water quality was not as good as anticipated. Although the detail analysis was not carried out because of shortage of funds/facilities, the preliminary results of this and public health study show that the manganese, hexavalent chromium, iron, coliforms, TSS are higher for any good river water quality.

The lagoons seem to be the source of further increase in the iron, manganese and hexa-valent chromium contamination.

Hyderabad dwellers are supplied with the contaminated water as it is hardly chlorinated and contains very high quantity of manganese.

References

AZIZ, J.A., 1998, country report prepared for WHO regional work shop on " Introducing environmental health manual" , Amman, Jordan.

HDA BOOKLET, 1992, and data report, 1998. NTP, WASA, Hyderabad.

Public Health Engineering Hyderabad report on GEMS programme, from 1980 to 1995.

WHO guidelines on drinking water quality, 1984 /93.

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