MANAGEMENT OF SEWAGE

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"Excreta Does Matter"

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WHAT IS SEWAGE

World Bank Economist

- Drinking water polluted by human excreta?
- Liquid responsible for polluting our water-bodies?
- Resource?

QUANTITY

Out of 150 liters of drinking quality water supplied per capita per day approximately

- 80% (120/L/capita/day) ends up as sewage
- Up to 40 % (60 L/capita/day) is used for toilet flushing
- The remainder is kitchen, bathroom etc waste called grey water

So 150 L/capita/day of drinking water becomes 120L/capita /day of sewage or polluted water

COMPONENTS

The handling of this sewage – sewage management - has three components

- Collection & conveyance
- Treatment
- Disposal

COLLECTION & CONVEYANCE

- The most expensive component of all – almost 70% of the total cost
- Not a difficult engineering feat but implementation has problems
- Most of the cities and towns have very old systems which serve only a part of the population.

SEWAGE COLLECTION STATUS

Sr. No.	Item	Year		
		1971	1991	2008
	Wastewater			
1	**Generated, mld**	7007	16,271	35,558
2	**Collected, mld**	4307	11,988	30,224
	% of Generated	59	72	85*
3	**Not collected, mld**	2700	4283	5334

*Assumed in absence of data

NALLAS AND CANALS

Almost all megacities and towns in India have manmade open storm drains and natural open drains (nallas) that carry the storm water during monsoon to the receiving water bodies. Unfortunately inadequate sewerage results in significant amount of sewage finding its way into nallas and canals and almost all of these drains have become open sewers carrying domestic and industrial wastewaters.

NALLAS AND CANALS

The data from the CPCB database shows high B.O.D. in most of the drains

Typical quality of drains, nallahs and canals is illustrated by the status in Chennai. The B.O.D. in 1999, in the Buckingham Canal varied from 43 to 183 mg/l and in Otteri Nullah it varied from 84 to 112 mg/l. The causes were identified as discharge of sewage, industrial wastewaters and dumping of solid wastes etc.

WAY AHEAD

Considering the fact that sewage collection systems are expensive and difficult to implement in old areas of cities and principally wasteful in terms of use of drinking water for transport of human excreta it is necessary that all possible options of eliminating water borne carriage of human excreta should be explored

OPTIONS TO WATERBORNE SYSTEMS

The options include

- Dry toilets

  Aerobic composting

  Srinagar houseboats

  Indian single flush
- Dry collection systems

  Japan experience

OPTIONS TO WATERBORNE SYSTEMS

- Decentralized treatment

  Local reuse

    High rise buildings in Mumbai since 1964

    Industrial reuse – Union Carbide, Madras Refinery, Madras Fertilizers, Rashtriya Chemicals & Fertilizers etc.

TREATMENT

In highly populated urban areas waterborne systems may be the only option. In such cases the collected sewage needs to be treated to meet the standards specified to prevent pollution of water-bodies. There are no specific standards for sewage. The applicable standards are
"General Standards For Discharge Of Environmental Pollutants Part-a : Effluents"
as per the Environment (protection) Rules.

TREATMENT

These standards are disposal mode specific – Disposal in

- Inland Surface Waters
- Public Sewers
- Land for Irrigation and
- Marine & Coastal Waters

Another set of standards are specified under National River Action Plan

STANDARDS
(Inland Surface Waters)

Sr. No.	Parameter	Standard
1	pH	5.5-9.0
2	Oil & Grease, mg/L	10
3	Total Suspended Solids, mg/L	100
4	BOD, mg/L	30
5	COD, mg/L	250
6	Ammonical Nitrogen, mg/L	50

STANDARDS
(NRCP)

Sr. No.	Parameter	For Discharge on Land		For Discharge in Water	
1	B.O.D., mg/L	<100		<30	
2	Suspended Solids, mg/L	<200		<50	
3	Fecal Coliform, MPN	Desirable	Max. Permissible	Desirable	Max. Permissible
		1000	10,000	1000	10,000

CRITERIA

S. No.	Parameters	Requirement for Waters of Class		
		A- Excellent	**B- Desirable**	**C- Acceptable**
(i)	pH	7.0 to 8.5	6.5 to 9.0	6.5 to 9.0
(ii)	DO (% Saturation)	90-110	80-120	60-140
(iii)	BOD, mg/1	Below 2	Below 5	Below 8
(iv)	EC, μmhos/cm	<1000	<2250	<4000
(v)	(NO_2+NO_3)-Nitrogen, mg/1	<5	<10	<15
(vi)	Suspended solid, mg/1	<25	<50	<100
(vii)	Fecal Coliform, MPN/100 ml	<20 per 100 ml	<200 per 100 ml	<2000 per 100 ml
(viii)	Bio-assay (Zebra Fish)	No death in 5 days	No death in 3 days	No death in 2 days

TREATMENT

Basically four steps

- Preliminary – Screening, Grit removal
- Primary – Clarification (with or without chemicals
- Biological – Aerobic, anaerobic
- Tertiary – Coagulation, Filtration, Activated Carbon, Membrane etc.

TREATMENT

The aerobic biological treatment range from simple natural processes requiring large land areas with little on no power and relatively lower performance level (Oxidation ponds, wetlands etc.) to highly complex systems like Membrane Bio-reactor (MBR) and Moving Bed Bio Reactor (MBBR) which have a very low foot print and high performance level.

SLUDGE HANDLING

Sewage treatment will generate solids depending upon the processes used. The biological sludges may have to be treated for stabilization.

The sludges have to be dried/dewatered to reduce their volume before ultimate disposal.

The ultimate disposal will depend on the nature of the sludge – hazardous or non-hazardous.

TREATMENT & SLUDGE HANDLING

The choice of technology/process will depend on many factors such as

- Availability of land
- Mode of disposal
- Capital & operating costs
- Skill of operator

Indian experience with treatment has been, unfortunately, rather dismal.

STATUS OF TREATMENT (CLASS I CITIES)

Sr. No.	Item	Year		
		1971	**1991**	**2008**
1	**Treatment Capacity, mld**	2756	4037	11,554
	% of Generated	39	24	32.5
2	**Not Treated, mld**	**4251**	**12,234**	**24,004**

REASONS FOR PRESENT STATUS

- Untreated sewage going to the water body has almost doubled from around **12,000 mld to 24,000 mld**.
- There are **302 Class I cities and 467 Class II towns** having ***no*** **sewage treatment facilities (2001?)**
- Not only 21% of sewage passes though treatment plants, only 60% of this sewage meets the required standards. Overall this means that **only about 12% of sewage generated in Class I cities and Class II towns meets the standards for disposal in surface waters.**

REASONS FOR PRESENT STATUS

Aside from treatment deficiencies the other reasons include low flows in the rivers

The new policy of the Govt. of India has given priority to minimum flows in rivers but this needs to be implemented in letter and spirit.

ACTION PLANS

To improve the water quality of our water-bodies Action Plans were initiated

- Ganga Action Plan was initiated in 1985 and the program of River Action Plan was extended in 1996 to cover other rivers under National River Conservation plan (NRCP) under the National River Conservation Directorate (NRCD) of the MoEF
- Similarly MoEF initiated National Lake Action Plans (NLCP) in 2001

RIVER ACTION PLANS (2010)

Sr. No.	Item	Coverage/Cost
1	Rivers	38
2	States	20
3	Towns	172
4	Schemes	
	Sanctioned	1105
	Completed	842
5	Volume	
	To be tackled	4397.80 mld
	Tackled (in addition to GAP I)	3196.44 mld
6	Expenditure	
	Sanctioned	Rs. 5148.01 Crore (Rs. 51480 million)
	Incurred (including State Govt. Share)	Rs. 3667.54 Crore (Rs. 36675 Million)

RELATIVE STATUS OF OUR RIVERS
2010
(BASED ON RIVER WATER CRITERIA FOR 15 PARAMETERS)

Sr. No.	River	Relative Status
1	**Ganga**	Polluted
2	**Yamuna**	Polluted
3	**Brahmaputra**	Less Polluted
4	**Krishna**	Polluted
5	**Godavari**	Polluted
6	**Narmada**	Less Polluted
7	**Tapti**	Polluted
8	**Mahanadi**	Polluted
9	**Brahmani**	Less Polluted
10	**Subarnarekha**	Less Polluted
11	**Cauvery**	Polluted
12	**Mahi**	Less Polluted
13	**Periyar**	Less Polluted
14	**Beas**	Polluted
15	**Sutlej**	Polluted
16	**Sabarmati**	Polluted

WAY AHEAD

Govt. Of India Policy Document 1992

"While it is estimated that three fourths by volume of the wastewater generated is from Municipal sources.."

"For Class I cities of the Country, less than five percent of the total wastewater generated is collected and less than one fourth of this is treated."

"Economic instruments will be investigated to encourage the shift from curative to preventive measures…"

WAY AHEAD

2006
"Develop and initiate, initially on a pilot scale, public private partnership models for setting up and operating effluent and sewage treatment plants….

"Enhance the capacities of municipalities for recovery of user charges for water and sewage systems."

"Enhance reuse of treated sewage and industrial wastewaters before final discharge to water bodies."

WAY AHEAD

The new policy seems to have taken no cognizance of what happened in these areas during the intervening period of 14 years.
It would have been more focused if the lessons learnt in these years were reviewed.

WAY AHEAD

Policy is a statement of intent to achieve defined objectives.

It is imperative that a policy statement is followed by a Strategic Action Plan (SAP) with time frame which will implement the policy to achieve the objectives.

Without an SAP the policy remains on paper and there is no accountability.

WAY AHEAD

Such a plan should clearly state how the objectives of the policy are to be achieved, with a time frame and address the following

- What needs to be done
- How and when would it be done
- Who will do it (accountability)
- What is the cost

WAY AHEAD

Some components of such a plan could be

- Existing infrastructure must perform to design capacity and achieve design standards (say by 2020?)
- Strengthen the Municipal finances and skills to operate and maintain STPs (say by 2020?)
- In smaller towns insist on adopting natural systems of treatment even if this means some relaxation of standards. The ponds in smaller towns and villages could provide a good natural system of treatment with appropriate modifications.

WAY AHEAD

- Enormous amount of data from monitoring of water-bodies is available. This must be analyzed and used to determine the impact of measures taken at least once a year and hot spots should be identified
- For each water-body beginning with the 14 major rivers, important lakes and coastal and marine waters targets with time frame should be set for each hot spot to improve its status from the existing one – Acceptable should become Desirable and so on.

WAY AHEAD

- A strategy to handle nallas and canals in urban areas and ponds in semi-urban and rural areas should be developed
- The National Policy of minimum environmentally acceptable flows in rivers should be implemented within a specified time frame .

DISPOSAL

Most of the sewage – treated, partially treated or untreated – finds its way into rivers, lakes and costal/marine waters.

This affects the water quality of these receiving water-bodies as seen for the present status of rivers

Same state of affairs applies to lakes and coastal and marine waters.

WAY AHEAD

Ideally, to protect the quality of our water-bodies, not only all sewage must be collected and treated to comply with the prescribed standards, ***all discharges*** of sewage into the water-bodies even after treatment should be stopped.

Realistically the aim should be to maximize reuse/recycle and minimize disposal into water-bodies.

WAY AHEAD

Some reuse/recycle options

Local (decentralized)

- Residential complexes

  Separation of grey and toilet water

  Grey to gardens

  Toilet after treatment to recycle for flushing

  Bombay Housing Societies

- Commercial

  Treatment and recycle for (as an example) for air-conditioning make up water

  Bombay High Rises

WAY AHEAD

Local

- Industrial

  For various industrial processes after relevant treatment

  Union Carbide

  Madras Refinery

  Madras Fertilizers

  Rashtriya Chemicals and Fertilizers

WAY AHEAD

Centralized

- Irrigation after meeting the required standards for unrestricted/restricted use and for appropriate crops

  Bombay Municipal Corporation Master Plan 1979

WAY AHEAD

Centralized

- Industrial especially where city/industry "coupling" is possible

  Thane Municipal Corporation and Thane Belapur Industrial area

  Vapi & Vapi GIDC, Ankleshwar & Ankleshwar GIDC etc.

  The water used by industrial estates could then be released for domestic use of the cities.

WAY AHEAD

It is necessary to recognize the following facts

- Sewage treatment for reuse/recycle is much simpler than that for industrial wastes
- The sewage needs to be treated only to the level of municipal water quality and this is achieved by adding simple water treatment unit processes to the sewage treatment plant
- Privatization of centralized STPs supplying water to industries at a reasonable profit would open up a new market