Water Recycling and Reuse

WATER RECYCLING

- Water recycling is reusing treated wastewater for beneficial purposes such as agricultural and landscape irrigation, industrial processes, toilet flushing, and replenishing a ground water basin (referred to as ground water recharge).
- For example, when an industrial facility recycles water used for cooling processes. A common type of recycled water is water that has been reclaimed from municipal wastewater, or sewage. The term water recycling is generally used synonymously with water reclamation and water reuse.
- Water recycling offers resource and financial savings.
- Recycled water for landscape irrigation requires less treatment than recycled water for drinking water.
- Gray water, or grey water, is reusable wastewater from residential, commercial and industrial bathroom sinks, bath tub shower drains, and clothes washing equipment drains. Gray water is reused onsite, typically for landscape irrigation. Use of non-toxic and low-sodium (no added sodium or substances that are naturally high in sodium) soap and personal care products is required to protect vegetation when reusing gray water for irrigation [1].

MOTIVATIONAL FACTORS FOR RECYCLING/REUSE [2]

- Opportunities to augment limited primary water sources
- Prevention of excessive diversion of water from alternative uses, including the natural environment; possibilities to manage in-situ water sources
- Minimization of infrastructure costs, including total treatment and discharge costs
- Reduction and elimination of discharges of wastewater (treated or untreated) into receiving environment [3]
- Scope to overcome political, community and institutional constraints

- **Environmental Benefits of Water Recycling**: In addition to providing a dependable, locally-controlled water supply, water recycling provides tremendous environmental benefits. By providing an additional source of water, water recycling can help us find ways to decrease the diversion of water from sensitive ecosystems. Other benefits include decreasing wastewater discharges and reducing and preventing pollution. Recycled water can also be used to create or enhance wetlands and riparian habitats [1].
- Recycling water on site or nearby reduces the energy needed to move water longer distances or pump water from deep within an aquifer. Tailoring water quality to a specific water use also reduces the energy needed to treat water [1].

USES OF RECYCLED WATER

- agriculture
- landscape
- public parks
- golf course irrigation
- cooling water for power plants and oil refineries
- processing water for mills, plants
- toilet flushing
- dust control
- construction activities
- concrete mixing
- artificial lakes

Uses of water recycled from water treatment plant:

[A] Secondary Treatment; Biological Oxidation, and Disinfection

- Surface irrigation of orchards and vineyards
- Non-food crop irrigation
- Restricted landscape impoundments
- Groundwater recharge of non-potable aquifer
- Wetlands, wildlife habitat, stream augmentation
- Industrial cooling processes

[B] Tertiary and advance treatment

- Landscape and golf course irrigation

- Toilet flushing
- Vehicle washing
- Food crop irrigation
- Unrestricted recreational impoundment
- Indirect potable reuse- Groundwater recharge of potable aquifer and surface water reservoir augmentation

QUALITY ISSUES OF WASTEWATER REUSE/RECYCLING [4]

Despite a long history of wastewater reuse in many parts of the world, the question of safety of wastewater reuse still remains an enigma mainly because of the quality of reuse water.

- There is no evidence of increased enteric diseases in urban regions housing areas irrigated with treated reclaimed wastewater, and
- There is no evidence of significant risks of viral or microbial diseases as a result of exposure to effluent aerosols from spray irrigation with reclaimed water [3].

Table 1.10.1. Pathogen survival time [3].

Type of pathogen	Survival time in days			
	In feces and sludge	In sewage and freshwater	In soil	On crops
1. Viruses				
Enteroviruses	<100(<20)	<120(<50)	<100(<30)	<60(<15)
2. Bacteria				
Fecalcoliforms	<90(<50)	<60(<30)	<70(<20)	<30(<15)
Salmonella spp.	<60(<30)	<60(<30)	<70(<20)	<30(<15)
Shigella spp.	<30(<10)	<30(<10)	-	<10(<5)
Vibrio cholerae	<30(<5)	<30(<10)	<20(<10)	<5(<2)
3. Protozoa				
Entamoeba-hystolytica cysts	<30(<15)	<30(<15)	<20(<10)	<10(<2)
4. Helminths				
Ascaris-lumbricoides eggs	many months	Many months	many months	<60(<30)

PRIMARY WATER QUALITY CRITERIA [5]

In India, the Central Pollution Control Board (CPCB) has developed a concept of "designated best use". According to which, out of several uses a particular water body is put to, the use which demands highest quality of water is called its "designated best use", and accordingly the water body is designated. The CPCB has identified 5 such "designated best uses".

Table 1.10.2. Water quality criteria [5, 6].

Designated-Best-Use	**Class of water**	**Criteria**
Drinking Water Source without conventional treatment but after disinfection	A	• Total Coliforms Organism MPN/100 mL ≤ 50 • pH between 6.5 and 8.5 • Dissolved Oxygen ≥ 6 mg/L • BOD (5 days at 20^{o}C) ≤ 2 mg/L
Outdoor bathing (Organised)	B	• Total Coliforms Organism MPN/100 mL ≤ 500 • pH between 6.5 and 8.5 • Dissolved Oxygen ≥ 5 mg/L • BOD (5 days at 20^{o}C) ≤ 3 mg/L
Drinking water source after conventional treatment and disinfection	C	• Total Coliforms Organism MPN/100 mL ≤ 5000 • pH between 6 to 9 • Dissolved Oxygen ≥ 4 mg/L • BOD (5 days at 20^{o}C) ≤ 3 mg/L
Propagation of Wild life and Fisheries	D	• pH between 6.5 to 8.5 • Dissolved Oxygen ≥ 4 mg/L • Free Ammonia (as N) 1.2 mg/L or less
Irrigation, Industrial Cooling, Controlled Waste disposal	E	• pH between 6.0 to 8.5 • Electrical Conductivity at 25^{o}C (μmhos/cm): Max. 2250 • Sodium absorption ratio: Max. 26 • Boron: Max. 2 mg/L

REFERENCES

[1] http://www.epa.gov/region09/water/recycling/ accessed on June 15, 2012

[2] http://www.nou.edu.ng/noun/NOUN_OCL/pdf/pdf2/ESM%20322.pdf accessed on January 19, 2010

[3] http://www2.gtz.de/Dokumente/oe44/ecosan/en-wastewater-treatment-agriculture-1992.pdf accessed on June 15, 2012

[4] http://www.eolss.net/ebooks/Sample%20Chapters/C07/E2-14-01.pdf accessed on June 15, 2012

[5] CPCB, Guidelines for Water Quality Management, 2008.

[6] http://www.cpcb.nic.in/upload/NewItems/NewItem_97_guidelinesofwaterqualitymanagement.pdf accessed on January 19, 2012