

REDUCING URBAN WATER WASTE¹

Lester R. Brown[©]

U.S. President Theodore Roosevelt once noted that "civilized people ought to know how to dispose of the sewage in some other way than putting it into the drinking water." The one-time use of water to disperse human and industrial wastes is an outmoded practice, made obsolete by new technologies and water shortages. Yet it is still common around much of the world. Water enters a city, becomes contaminated with human and industrial wastes, and leaves the city dangerously polluted. Toxic industrial wastes discharged into rivers and lakes or into wells also permeate aquifers, making water—both surface and underground—unsafe for drinking.

The current engineering concept for dealing with human waste is to use vast quantities of water to wash it away, preferably into a sewer system, where it may or may not be treated before being discharged into the local river. The "flush and forget" system takes nutrients originating in the soil and typically dumps them into the nearest body of water. Not only are the nutrients lost from agriculture, but the nutrient overload has contributed to the death of many rivers and to the formation of some 405 "dead zones" in ocean coastal regions. This outdated system is expensive and water-intensive, disrupts the nutrient cycle, and can be a major source of disease and death. Worldwide, poor sanitation and personal hygiene claim the lives of some 2 million children per year, a toll that is one third the size of the 6 million lives claimed by hunger and malnutrition.

Sunita Narain of the Centre for Science and Environment in India argues convincingly that a water-based disposal system with sewage treatment facilities is neither environmentally nor economically viable for India. She notes that an Indian family of five, producing 250 liters of excrement in a year and using a water flush toilet, contaminates 150,000 liters of water when washing away its wastes. As currently designed, India's sewer system is actually a pathogen-dispersal system. It takes a small quantity of contaminated material and uses it to make vast quantities of water unfit for human use. With this system, Narain says, both "our rivers and our children are dying." India's government, like that of many developing countries, is hopelessly chasing the goal of universal water-based sewage systems and sewage treatment facilities—unable to close the huge gap between services needed and provided, but unwilling to admit that it is not an economically viable option.

Fortunately, there is a low-cost alternative: the composting toilet. This is a simple, waterless, odorless toilet linked to a small compost facility and sometimes a separate urine collecting facility. Collected urine can be trucked to nearby farms, much as fertilizer is. The dry composting converts human fecal material into a soil-like humus, which is essentially odorless and is scarcely 10 percent of the original volume. These facilities need to be emptied every year or so, depending on design and size. Vendors periodically collect the humus and market it as a soil supplement, thus ensuring that the nutrients and organic matter return to the soil, reducing the need for energy-intensive fertilizer.

This technology sharply reduces residential water use compared with flush toilets, thus cutting water bills and lowering the energy needed to pump and purify water. As a bonus, it also reduces

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garbage flow if table wastes are incorporated, eliminates the sewage water disposal problem, and restores the nutrient cycle. The U.S. Environmental Protection Agency now lists several brands of dry compost toilets approved for use. Pioneered in Sweden, these toilets work well under the widely varying conditions in which they are now used, including Swedish apartment buildings, U.S. private residences, and Chinese villages. For many of the 2.5 billion people who lack improved sanitation facilities, composting toilets may be the answer.

Rose George, author of *The Big Necessity: The Unmentionable World of Human Waste and Why It Matters*, reminds us why the "flush and forget" system is an energy guzzler. One, it takes energy to deliver large quantities of drinking-quality water (up to 30 percent of household water usage is for flushing). Two, it takes energy—and lots of it—to operate a sewage treatment facility.

In summary, there are several reasons why the advanced design composting toilets deserve top priority: spreading water shortages, rising energy prices, rising carbon emissions, shrinking phosphate reserves, a growing number of sewage-fed oceanic dead zones, the rising health care costs of sewage-dispersed intestinal diseases, and the rising capital costs of "flush and forget" sewage disposal systems.

Once a toilet is separated from the water use system, recycling household water becomes a much simpler process. For cities, the most effective single step to raise water productivity is to adopt a comprehensive water treatment/recycling system, reusing the same water continuously. With this system, which is much simpler if sewage is not included in the waste water, only a small percentage of water is lost to evaporation each time it cycles through. Given the technologies that are available today, it is quite possible to recycle the urban water supply indefinitely, largely removing cities as a claimant on scarce water resources.

Some places faced with shrinking water supplies and rising water costs are beginning to recycle their water. Singapore, for example, which buys water from Malaysia at a high price, is already recycling water, reducing the amount it imports. Windhoek, capital of Namibia and one of the most arid locations in Africa, recycles waste water for drinking water. In water-stressed California, Orange County invested in a \$481-million treatment facility that opened in early 2008 to convert sewage into safe clean water, which is used to replenish the local aquifer. Los Angeles is planning to do the same. For more and more cities, water recycling is becoming a condition of survival.

Individual industries facing water shortages are also moving away from the use of water to disperse waste. Some companies segregate effluent streams, treating each individually with the appropriate chemicals and membrane filtration, preparing the water for reuse. Peter Gleick, lead author of the biennial report *The World's Water*, writes: "Some industries, such as paper and pulp, industrial laundries, and metal finishing, are beginning to develop 'closed-loop' systems where all the wastewater is reused internally, with only small amounts of fresh water needed to make up for water incorporated into the product or lost in evaporation." Industries are moving faster than cities, but the technologies they are developing can also be used in urban water recycling.

At the household level, water can also be saved by using more water-efficient showerheads, flush toilets, dishwashers, and clothes washers. Some countries are adopting water efficiency standards and labeling for appliances, much as has been done for energy efficiency. When water costs rise, as they inevitably will, investments in composting toilets and more water-efficient household appliances will become increasingly attractive to individual homeowners.

Two household appliances—toilets and showers—together account for over half of indoor water use. Whereas traditional flush toilets used 6 gallons (or 22.7 liters) per flush, the legal U.S. maximum for new toilets is 1.6 gallons. New toilets with a dual-flush technology use only 1 gallon for a liquid waste flush and 1.6 gallons for a solid waste flush. Shifting from a showerhead flowing at 5 gallons per minute to a 2.5 gallons-per-minute model cuts water use in half. With washing machines, a European horizontal axis design uses 40 percent less water than traditional top-loading models.

The existing water-based waste disposal economy is not viable. There are too many households, factories, and feedlots to simply try and wash waste away on our crowded planet. To do so is ecologically mindless and outdated—an approach that belongs to a time when there were far fewer people and far less economic activity.