

From Sewage, Added Water for Drinking

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FOUNTAIN VALLEY, Calif. — It used to be so final: flush the toilet, and waste be gone.

But on Nov. 30, for millions of people here in Orange County, pulling the lever will be the start of a long, intense process to purify the sewage into drinking water — after a hard scrubbing with filters, screens, chemicals and ultraviolet light and the passage of time underground.

On that Friday, the Orange County Water District will turn on what industry experts say is the world's largest plant devoted to purifying sewer water to increase drinking water supplies. They and others hope it serves as a model for authorities worldwide facing persistent drought, predicted water shortages and projected growth.

The process, called by proponents “indirect potable water reuse” and “toilet to tap” by the wary, is getting a close look in several cities.

The San Diego City Council approved a pilot plan in October to bolster a drinking water reservoir with recycled sewer water. The mayor vetoed the proposal as costly and unlikely to win public acceptance, but the Council will consider overriding it in early December.

Water officials in the San Jose area announced a study of the issue in September, water managers in South Florida approved a plan in November calling for abundant use of recycled wastewater in the coming years in part to help restock drinking water supplies, and planners in Texas are giving it serious consideration.

“These types of projects you will see springing up all over the place where there are severe water shortages,” said Michael R. Markus, the general manager of the Orange County district, whose plant, which will process 70 million gallons a day, has already been visited by water managers from across the globe.

The finished product, which district managers say exceeds drinking water standards, will not flow directly into kitchen and bathroom taps; state regulations forbid that.

Instead it will be injected underground, with half of it helping to form a barrier against seawater intruding on groundwater sources and the other half gradually filtering into aquifers that supply 2.3 million people, about three-quarters of the county. The recycling project will produce much more potable water and at a higher quality than did the mid-1970s-era plant it replaces.

The [Groundwater Replenishment System](#), as the \$481 million plant here is known, is a labyrinth of tubing and tanks that sucks in treated sewer water the color of dark beer from a sanitation plant next door, and first runs it through microfilters to remove solids. The water then undergoes reverse osmosis, forcing it through thin, porous membranes at high pressure, before it is further cleansed with peroxide and ultraviolet light to break down any remaining pharmaceuticals and carcinogens.

The result, Mr. Markus said, “is as pure as distilled water” and about the same cost as buying water from wholesalers.

Recycled water, also called reclaimed or gray water, has been used for decades in agriculture, landscaping and by industrial plants.

And for years, treated sewage, known as effluent, has been discharged into oceans and rivers, including the Mississippi and the Colorado, which supply drinking water for millions.

But only about a dozen water agencies in the United States, and several more abroad, recycle treated sewage to replenish drinking water supplies, though none here steer the water directly into household taps. They typically spray or inject the water into the ground and allow it to percolate down to aquifers.

Namibia’s capital, Windhoek, among the most arid places in Africa, is believed to be the only place in the world that practices “[direct potable reuse](#)” on a large-scale, with recycled water going directly into the tap water distribution system, said James Crook, a water industry consultant who has studied the issue.

The projects are costly and often face health concerns from opponents.

Such was the case on Nov. 6 in Tucson, where a wide-ranging ballot measure that would have barred the city from using purified water in drinking water supplies failed overwhelmingly. The water department there said it had no such plans but the idea has been discussed in the past.

John Kromko, a former Arizona state legislator who advocated for the prohibition, said he was skeptical about claims that the recycling process cleanses all contaminants from the water and he suggested that Tucson limit growth rather than find new ways to feed it.

“We really don’t know how safe it is,” he said. “And if we controlled growth we would never have to worry about drinking it.”

Mayor Jerry Sanders of San Diego, in vetoing the City Council plan there, said it “is not a silver bullet for the region’s water needs” and the public has never taken to the idea in the 15 years it has been discussed off and on.

Although originally estimated at \$10 million for the pilot study in San Diego, water department officials said the figure would be refined, and the total cost of the project might be hundreds of millions of dollars. Although the Council wants to offset the cost with government grants and other sources, Mr. Sanders predicted it would add to already escalating water bills.

“It is one of the most expensive kinds of water you can create,” said Fred Sainz, a spokesman for the mayor. “It is a large investment for a very small return.”

San Diego, which imports about 85 percent of its water because of a lack of aquifers, asked residents this year to curtail water use.

Here in Orange County, the project, a collaboration between the water and sanitation districts, has not faced serious opposition, in part because of a public awareness and marketing campaign.

Early on, officials secured the backing of environmental groups, elected leaders and civic groups, helped in part by the fact the project eliminated the need for the sanitation district to build a new pipe spewing effluent into the ocean.

Orange County began purifying sewer water in 1976 with its [Water Factory 21](#), which dispensed the cleansed water into the ground to protect groundwater from encroaching seawater.

That plant has been replaced by the new one, with more advanced technology, and is intended to cope with not only current water needs but also expectations that the county's population will grow by 500,000 by 2020.

Still, said Stephen Coonan, a water industry consultant in Texas, such projects proceed slowly.

“Nobody is jumping out to do it,” he said. “They want to make sure the science is where it should be. I think the public is accepting we are investigating it.”



Axel Koester for The New York Times

This Orange County, Calif., Water District plant will purify sewer water to feed drinking water supplies, but not directly to the tap.



The plant will process 70 million gallons a day.



After a process of microfiltration, chemicals, ultraviolet light and reverse osmosis, the treated sewer water will be injected underground to refill aquifers.

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