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Voice of a Global Citizen

Two Approaches to Sewage Treatment -- and to the World

Down the slope from the condominiums at the Sugarbush ski resort near Warren, Vermont, are two sewage treatment plants, side by side. They are so different they are caricatures, not only of each other but of the different mindsets that created them.

One plant is a square, windowless structure with a sign at the entrance reading DANGER CHLORINE GAS. Hanging on the wall is a gas mask and instructions IN CASE OF CHLORINE EMERGENCY. Inside is a maze of pipes and dials, gas cylinders and reaction chambers. Bags of sodium hydroxide are piled up, each one stamped DANGER CAUSTIC.

The other plant is an arched plastic greenhouse. Inside is a pool of effluent with air bubbling through it. The place smells not like sewage but like a greenhouse, humid and fertile. At the far end grow bamboo, cattails, and swamp irises. There is just one warning sign, put up as a joke -- NO DIVING.

Both plants are experimental, each handling only 5000 gallons of sewage a day. They are here because the state of Vermont warned Sugarbush that the effluent from its leachfield contained unacceptable levels of ammonia. Sugarbush called in the Dufresne-Henry Company of Springfield, Vermont, which said there are two possible ways to go -- a breakpoint chlorine system, or a solar-aquatic system. Sugarbush is trying out both.

The breakpoint system adds sodium hydroxide to effluent, then blasts it with chlorine gas, turning ammonia to harmless nitrogen. Excess chlorine is removed with sulfur dioxide. Then the whole business is filtered through activated carbon.

In case you didn't follow that chemistry, one of the operators summed it up, "We make some wicked, wicked water here!" Wicked because this plant handles extremely high ammonia loads, so it uses high chemical concentrations. But wicked only in its intermediate steps. In the end the effluent passes Vermont standards. The plant works.

It is designed around the question, "what chemical processes get rid of ammonia?" The solar-aquatic plant begins with a different question, "how does nature handle ammonia?"

Nature turns waste into new life. Soils and waters are full of bacteria that transform ammonia into nitrate, a fertilizer. Plants take up nitrate and are eaten by animals, which excrete ammonia, and the cycle goes on.

Over at the solar plant John Todd of the Four Elements Corporation of Warren, Vermont, punches holes into a styrofoam sheet. He sticks willow cuttings into the holes and floats the sheet on the pool. "The Chinese do this," he says. "The willows draw the nutrients out and make fine animal feed."

Effluent entering the greenhouse is treated with pond bacteria. Algae multiply in the water, taking up nutrients. John is about to add some daphnia, freshwater shrimp, to eat the algae, and then some largemouth bass to eat the shrimp.

It takes five days for the effluent to flow from one end of the greenhouse to the other. Then it is filtered by an artificial marsh of water plants. The plants have commercial value (watercress, bamboo) or pretty blooms (marsh marigold) or the ability to take up toxic substances (cattails, bulrushes). The roots of the aquatic iris produce a substance that kills salmonella bacteria.

John expects the water coming out of the artificial marsh to be as pristine as a mountain stream. He scoops up a beakerful of it. It's faintly green. "We're still not getting all the algae out," he frowns. "The daphnia will take care of that. But look at the watercress at the outtake pipe." They are yellow and shriveled. "They're starving. There's no nutrient left."

Tests show that the ammonia is essentially gone and that concentrations of bacteria and algae have dropped dramatically. This sewage treatment plant works too.

The operators at the breakpoint chlorine plant have difficulty controlling it. "We have to watch it like a hawk -- it's real operator-intensive." The greenhouse, in contrast, is organism-intensive. It has many forms of life and many biological pathways, some of which work on sunny days, some on cloudy days, some at high ammonia levels, some at low.

John figures half an acre of greenhouse would be needed for all the sewage of Sugarbush, and 120 acres for the city of Providence, Rhode Island. He is planning greenhouses fifty feet across for Providence. They will treat sewage and also house a business that raises flowers and herbs. He says the capital cost will be about one-third that of an equivalent sewage treatment plant.

Though the two plants and the two mindsets are in direct competition at Sugarbush, the people involved don't act like competitors. They act like people learning together. They're honestly interested in both plants, in their strengths and weaknesses.

They agree that the chlorine plant is expensive and hard to control. No one likes to work there. They love the solar plant, but it has yet to prove itself in the Vermont winter. It could be poisoned by an ecologically-unaware condominium-dweller pouring toxic stuff down a sink. And it requires special expertise, not in chlorine chemistry, but in interrelated webs of living things.

The mindsets behind these plants are the same ones that offer us choices between nuclear power and solar power, between garbage incinerators and recycling, between agribusiness and organic farming. All the choices are technically workable, but there are trade-offs -- important trade-offs.

Sugarbush hasn't yet made its decision. It's not a trivial choice.

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