Greener, Cleaner Landfills May Love That Dirty Water

By Paul Francuch

"This project is about properly managing the waste we generate" says Krishna Reddy, professor of civil and environmental engineering.

With a $130,000 grant from the National Science Foundation and a $120,000 from CReeD, France's Research Center for Environment, Energy and Waste, Reddy and his students are testing a way to successfully recycle leachate – the waste liquid that is generated in landfills – back into the waste heaps, adding moisture to accelerate anaerobic microbial biodegradation.

The U.S. Environmental Protection Agency has issued research and development permits to about a dozen landfill operators to test this "bioreactor concept," as it's called. Partnering with French-based Veolia Environment, a major international operator of landfills and waste removal companies, Reddy is studying where leachate moves and how it behaves after being re-injected. Two Veolia landfills in the U.S. and one in France serve as test sites.

"The problem with uncontrolled injection is possible failure," Reddy says. "There's a case from Colombia where they did massive recirculation and the result was a huge collapse of the landfill."

EPA wants hard data on how well the bioreactor concept works before approving its use.

Presently, leachate is drained from landfills, collected and sent for waste water treatment. Collection is required to continue for 30 years after a landfill is closed in order to protect ground water supplies from contamination.

Researchers have found that better-engineered landfills from recent decades are doing a good job of preserving – rather than breaking down – a lot of solid waste. That's partly because hungry microbes don't like the dry conditions there.

Landfill owners hope that recycling leachate provides microbes the moisture they need to hasten compacting and settling of solid trash.

While the number of U.S. landfills has steadily declined since 1988, capacity has remained relatively constant and new landfills are much larger than those from the past.

Sites that reach capacity can eventually be converted for other uses, such as industrial parks

and golf courses. But the conversion can't take place until the waste is settled.

To make sure bioreactor landfill technology is helpful and not harmful, Reddy and his students will monitor landfills that inject leachate in different ways to see where the waste water flows and what it does.

Post-doctoral student Solenne Grellier developed methodology called electrical resistivity tomography that uses an array of landfill surface electrodes to monitor the water movement.

"We measure electrical resistance, which is linked to water content," says Grellier. "The method allows use to get something like a photograph of what's happening in the ground without digging."

Site samples of leachate and solid waste are also gathered for laboratory analysis at UIC.

Ph.D. student Janardhanan Gangathulasi shreds and mixes the materials, noting how much methane and carbon dioxide is produced. "We monitor what gases are produced over what time period," he said. "It gives us another parameter to help determine the stability of the bioreactor."

Reddy developed a mathematical model that he hopes could be used by landfill operators to successfully and safely redirect leachate for productive use. He'll be monitoring and collecting data for at least another two years, using it to test his model.

"The whole idea is to provide recommendations on operating, monitoring and design of bioreactor landfills that won't have failures," he says. "We want to degrade waste faster, while eliminating environmental risk to surrounding sites."