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A practical, economy-class landfill

August 29, 2007

Carol Goar

Patrick Hettiaratchi, who teaches environmental engineering at the University of Calgary, likes to compare waste disposal systems to vehicles.

A conventional landfill site is like a buggy cart, he says. It's simple and cheap, but it gobbles up land, produces contaminant-loaded leachates and emits noxious methane. It also looks unsightly and smells awful.

A gasification plant is like a top-of-the-line Porsche. It incinerates garbage with high efficiency and minimal air pollution. But it is extremely expensive and leaves behind highly toxic ashes.

Hettiaratchi is a Volkswagen Beetle man.

He is developing a technology that will triple the lifespan of conventional landfill sites, convert the methane produced by rotting garbage into usable energy and leave behind uncontaminated land for housing or commercial development.

"It's a very low-tech operation," he says. "I've been working on it for 15 years."

The heart of his system is a "biocell," which is essentially a large pit, lined with clay and plastic and sealed with an organic bio-cap that lets in water but traps fumes.

The cell is loaded with 50,000 tonnes of garbage. Theoretically, anything can go in – there are broken bicycles and mattresses and everything else imaginable in the one Hettiaratchi is testing in Calgary – but waste that decomposes quickly works best.

When it is full, the cap is applied. Then the oxygen is sucked out of the cell, water is added and the leachate (garbage juice) that collects at the bottom of the pit is continually pumped to the top and allowed to filter back down. This accelerates the breakdown of the waste and increases the methane output.

The gas is captured, piped out and used to make cheap electricity.

This process goes on for three to five years. It is odour-free, requires little maintenance and produces roughly 300 kilowatts of power.

Eventually the methane production dwindles to the point that extraction is no longer economical. Oxygen is pumped back into the cell and it becomes a giant composter. This part of the cycle takes about a year.

Finally, the cell is opened, the compost is removed, any recyclable materials are harvested and the residue is moved to a traditional landfill.

Then the process starts all over again. Ideally, five or six biocells would be operating simultaneously on staggered rotations.

"It's a common sense approach," Hettiaratchi says. "If Toronto had tried something like this 15 years ago, it wouldn't have problems now."

The Alberta engineer doesn't claim that his process is the ultimate in green technology. Biocells take up a lot of space. They're not visually attractive. And they don't get rid of everything; 30 per cent of what goes in is still there at the end.

But the system is relatively inexpensive. It doesn't pollute the air or the groundwater. It doesn't smell. And it reduces the amount of methane – one of the most potent greenhouse gases there is – in the atmosphere.

Hettiaratchi's laboratory, so to speak, is the Shephard landfill in southeast Calgary. He started loading his first biocell in the summer of 2005 and sealed it last November. Already, it is producing enough gas to feed the on-site generator.

If this pilot project – funded by the City of Calgary and the Natural Sciences and Engineering Research Council of Canada – is a success, Hettiaratchi will get all six cells operating, then look at ways to adapt the model to regions with different topography and climatic conditions.

Toronto, for instance, is more humid than Calgary, which would cause its garbage to decompose faster and produce methane for a shorter time.

The city would also have practical concerns. It just spent $220 million on a landfill near St. Thomas. It would have to abandon its green bin program to make Hettiaratchi's technology cost-effective. And it would have to change its thinking: Biocells are meant for communities seeking local solutions.

But should Toronto decide to climb out of its buggy cart, Hettiaratchi is offering a low-cost, environmentally responsible alternative.