

Waste management lessons from an open garbage dump in the Philippines

By William Goodings, P.Eng.

EXECUTIVE SUMMARY

Communities, especially smaller ones, need not pursue sophisticated techniques to solve their waste management challenges. Retired engineer William Goodings describes how mixed organic/inorganic dump sites can be simply and cheaply converted into productive composts, eliminating eyesores and foul odours. Goodings developed his method while on a volunteer assignment in the Philippines for the Canadian Executive Service Organization.

In his recounting, Goodings describes how he used local materials, mostly for free, to help a municipality transform a problematic waste site into an operation that benefited the nearby community. The key was aerobically stabilizing the dump's organic wastes. Goodings maintains that his methods, replicated in other developing world communities, are also applicable in Canada, especially in remote areas.

In 2002, as part of an assignment with the Canadian Executive Service Organization (CESO), I designed and implemented the conversion of an open garbage dump serving a small city in the Philippines into a mixed-solid municipal-waste passive-composting facility. To accomplish this conversion, I used free local materials, no additional disposal equipment and no additional workers. The conversion eliminated almost all odours and most of the flies and health hazards from the site, reduced pollution, and helped the municipality recover and reuse almost 90 per cent of its municipal solid waste (MSW).

When considering MSW facility siting and design, it is essential to evaluate only those solutions that fit the context of local priorities for spending public money. According to the UN Environment Programme guidelines, “... rather than striving for absolute avoidance of pollution or risk to human beings, policy-makers should direct resources where they would yield the greatest return to society.”

My solution was novel and, of necessity, relatively cheap and simple. The cost to operate our new composting facility was no more than the cost to operate the open dump. This conversion was so successful that over the next four years, I was asked to assist eight small municipalities in Bolivia, Honduras and Sri Lanka to demonstrate the techniques I had developed in the Philippines.

While the Philippines clearly faces different economic challenges than Canada, some of the lessons learned in my project may be applicable here, especially in remote communities.

THE ENGINEERING PROJECT

My task was to find ways to improve the municipal waste-disposal system in San Carlos, a city of 118,000 people 500 kilometres south of the capital of Manila. The goal was to solve related health issues that affected people living in homes in the site's neighbourhood.

When I first visited the site, I saw that it was a two-hectare open dump located in an abandoned, three-metre-deep fish-farming pond that was being “reclaimed” by filling it with garbage. The dump was located in the heart of a housing area for very poor families that lived cheek by jowl with the site and, for the most part, also scavenged the waste to earn a living. Stockpiles of recovered metal, plastic, corrugated cardboard, cloth and glass bottles were part of every home.



The author's experiments in waste management transformed a smelly, rat-infested and thoroughly unhealthy dump site serving the city of San Carlos, Philippines, into a passive composting system

These people allowed their livestock (pigs and goats) to consume the organics in the garbage. Their children and pet dogs used part of the site as a playing field. All of the trees surrounding the dump were festooned with thousands of plastic shopping bags that had blown out of the dump because the garbage had no earth cover. A rear-loader packer garbage truck delivered waste to the site every day. To obtain the choice waste to be scavenged and later sold, some people would stand at the rear of the discharging truck, virtually under the cascading waste. All wore floppy sandals, and no one wore gloves or other protective clothing. All sorts of disease carriers swarmed the area: clouds of flies, rodents, vultures and the neighbourhood's goats and pigs.

The stench of the putrefying organics was overpowering. Since the neighbouring homes had no doors and few windows, the inhabitants' tolerance for this lifestyle was hard to comprehend. Furthermore, they probably lived there because it provided free food for their pigs and goats.

The municipality's plan for the operation provided for earth cover but only when available (i.e., when municipal construction projects had excess earth). This seemed to be a rare occurrence. The owner of the site had leased it to the municipality for use as a dump, intending, when it was full, to turn it into building lots, probably for the very light bamboo structures that served as houses in this area.

At first, I believed that the situation could probably be solved by more frequent earth coverings and the on-site sorting of all organics for composting. While the municipal authorities probably favoured opening a new site, I chose to work on improving the existing one. Even though small amounts of pollution would continue, a new site would not necessarily be an improvement, especially if it was selected without the benefit of information on soils, groundwater quality or land use. Any improvement to the old site might at least retard its rate of polluting.

Throughout the process, I was conscious of the municipality's limited resources and the UN guidelines stressing that such policy decisions should be based on maximizing overall social return rather than solving only the problem at hand.

PROJECT DESIGN

Under my direction, the waste workers set out to separate the organic from the inorganic matter in the freshly delivered MSW in order to form a pile that could be composted. The neighbours joined in, but their pigs and goats soon arrived to enjoy the luxury of easier pickings. As a result, efforts to create a composting pile became hopeless.

However, I soon realized that approximately 80 per cent of the waste was organic and capable of composting, if one included the scrap wood, yard waste, paper and cardboard. I stopped the attempt to physically separate the garbage and instructed the truck drivers to dump all waste in specific spots. We had them create windrows about two metres deep with a five-metre base, believing that it might be a way to build a composting system.

I felt that the waste needed to be covered because these unsightly windrows of garbage might have to stand for six or seven months. I concluded that covering was also essential to reduce the loss of moisture in the piles and minimize the amount of rainwater penetrating the garbage. The waste management workers came up with an

economical solution—import rice hulls from the local millers who had large piles that had no value. We decided that a 15-centimetre layer of donated rice hulls could be used effectively to cover the windrowed waste. As a result, the rotting and wind-blown garbage was transformed into a windrow of garbage that seemed to be a windrow of rice hulls.

Within three days, the temperature of the waste just below the rice layer reached the 50 to 60 degrees Celsius needed to support composting. In that passive windrow of mixed municipal waste, our team had created a composting system that was stabilizing organics (i.e., reducing the harmful waste pathogens).

Oxygen depletion is a problem in composting piles of organic waste. Frequent turning of the waste is the only way to add oxygen, but this was an impossible task in the San Carlos site because the windrows consisted of a tangled mass of solid waste. However, I expected that the oxygen levels were likely to remain satisfactory throughout the six or seven months it takes to compost because we had kept all of the bulky items such as wood waste, bottles, metal and other inorganics. Their presence permitted a free and constant flow of oxygen essential to support the biosystems, which consist of the billions of aerobic bacteria, beetles, worms and sow bugs that are naturally present in any decomposing organic material.

INITIAL RESULTS

After three days, fewer houseflies were present at our covered windrow, probably because the fly maggots in the garbage had either died in the high temperatures or could not emerge as flies because of the 15-centimetre layer of rice hulls. All other vectors (birds, rodents, etc.) appeared to have lost interest in the decomposing organics, probably because of the very high temperatures. Pathogenic bacteria in the waste would have been reduced or destroyed in temperatures of about 50 degrees Celsius.

I suggested to the municipal authorities that since the scavengers had lost their source of recyclables, their patience should be rewarded by giving them the spoils at the end of the seven-month composting period. They could sift and sort through the reduced piles for all inorganic recyclables and use all or some of the mature compost. However, I could not then see the results of this initiative because I had to leave after six weeks, the typical length of a CESO assignment.

FINAL RESULTS

When I returned to San Carlos a year later to work on another CESO project, I found that the anticipated benefits had been exceeded. The layer of rice hulls apparently had kept the piles moist enough during the normal long periods of drought and dry enough during the monsoon season. The bulky wastes had permitted sufficient oxygen to remain in the piles. The rice hulls had become part of the finished compost.

Some locals were given the opportunity to sieve and separate the compost from the inorganics and bulky wastes. They found that glass and metals were relatively clean because the biosystems had consumed all of the organic matter that had clung to them when they were originally delivered to the site. This time, the scavengers did not have to contend with the filth of fresh garbage. Whole bottles, steel and aluminum containers, sheets of steel, rusted steel automobile parts and certain plastics were divided among the neigh-



Donated rice hulls from local rice millers, above, were used to create a 15-centimetre layer over the windrows of garbage that kept it moist and warm and repelled vermin and monsoon rains

bours and taken away and sold to scrap dealers.

The matured compost was tested and found to be satisfactory for growing vegetables and flowers. Many of the homes of these same poor had thriving gardens thanks to the free compost. About 90 per cent of the waste had become useful. Unused compost had been thinly spread over the garbage for cover and used to support the tree plantings as site restoration.

LESSONS FOR OTHER PARTS OF THE WORLD

Most waste management engineers design, build and operate composting facilities in order to make quality compost. In San Carlos, the primary aim of the composting facility was to stabilize organics in mixed MSW. In this case, a good compost product was a happy side benefit. Although periods of cold temperatures will retard the rate of composting, the system restarts when ambient temperatures rise. This means that similar passive composting systems for MSW would likely work in the temperate climates of North America.

If nitrogen values in the solid waste are found to be too low, chicken and other fowl droppings could be added to raise the nitrogen content by applying them in a slurry mix. The addition of liquefied urea or nitrogen-rich fertilizers would accomplish the same objective. These additives are required if items such as carbon-rich newspaper and cardboard exist in large proportions.

A better location for this kind of composting operation is always the surface of an established sanitary landfill, where all systems to control possible adverse environmental effects of leachate production are already in place. (Leachate is rainwater that percolates through fresh garbage and into the ground water.) Small towns in Canada's north that are far from recycling plants might be

candidates for this novel approach to solid waste treatment. The cover does not have to be rice hulls. In Honduras, where I carried out a similar trial, sawdust was used. It is available in most communities.

CONCLUSION

The first key to the success of the San Carlos experiment lay in leaving together all wastes, large and small, organic and inorganic. This provided a natural aerating system and eliminated the need to manually turn the waste to maintain adequate oxygen levels.

The second key to success was the use of rice hulls to cover the piles of garbage. The hulls helped retain moisture in periods of drought and deflected most of the rainwater during the monsoon period. It also enhanced the appearance of the composting windrows.

The San Carlos method demonstrates that aerobically stabilizing organics in mixed unsorted MSW, above ground, can be done cheaply and in just seven months. By the dint of perseverance and ingenuity, I had turned a smelly, troublesome and contaminating dump site into a passive composting system. In so doing, I eliminated all of the negative features of the open dump site: fly infestation, rodents, wind-scattered plastic shopping bags and the practice of feeding waste to pigs and goats. The new system made it possible for poor people to scavenge more thoroughly and efficiently in a safer and healthier environment. Importantly, composting does not produce methane gas.

Finally, my San Carlos experiment achieved the community's desired goals by devising a simple, low-cost solution applicable to both developing and developed countries. As well, the experiment adhered to UN guidelines by being simple and low cost. City officials were pleased. The San Carlos mayor, Eugenio Lacson, said: "We're totally convinced of the technology, and I believe it is just right for a city like ours, given our existing resources. It is safe and it uses indigenous materials."

ADDENDUM

As a result of this first assignment, CESO sent me to Bolivia, Honduras and Sri Lanka, where I applied the San Carlos method to eight more dumps, successfully demonstrating to waste managers that they, too, could change their open dumps into composting operations. The government of Bolivia also asked me back to La Paz to prepare a composting solid waste manual and then hold a training session for solid waste management staff from several small local municipalities. For more on my Bolivian adventure, see www.citizens4change.org/en/texts/CESO_story.php.

William Goodings, P.Eng., worked for most of his career as a consulting engineer with Proctor & Redfern Ltd. at its head office in Toronto. Under his leadership as vice president, the firm developed a large client base of municipalities that required assistance to meet new waste management environmental legislation. Goodings was a founding member of the Compost Council of Canada and has been a board member of the Ontario Society of Professional Engineers since 2007.

After his first retirement in 1993, he served for two years as director of solid waste management for the government of Bermuda. Upon his final retirement, he registered with the Canadian Executive Services Organization (CESO) as a solid waste management adviser. The first of his 17 CESO assignments was in San Carlos, Philippines.