Executive Summary

The amount of unwanted discards thrown away in industrializing nations[1] has reached crisis proportions in recent years. Rising population,[2] rural to urban migration, increased globalization of Western consumer patterns and the proliferation of single-use disposable products and packaging are partly to blame. Landfills, typically nothing more than open dumps, are filling up and people are sprawling beyond city borders, limiting the ability to develop new landfills. In an effort to find new solutions to growing disposal headaches, many nations are shifting to the formal private sector, embracing technology-driven approaches, and turning to the old technique of waste incineration. However, incinerators—no matter where they are built—have numerous liabilities. Waste incinerators:

- generate pollution,
- harm public health,
- place huge financial burdens on host communities,
- drain local communities of financial resources,
- waste energy and materials,
- thwart local economic development,
- undermine waste prevention and rational approaches to discard management,
- have an operating experience in industrialized countries checkered with problems,
- often exceed air pollution standards,
- create toxic ash,
- can go financially bankrupt from tonnage shortfalls, and
- often leave citizens and taxpayers paying the bill.

Incineration technology, designed and tested for the discard streams and infrastructure in industrialized nations, can be expected to perform even more poorly in industrializing countries due to differences in discard stream characteristics, inadequate regulatory structures and institutional arrangements, lack of convertible currency for purchase of spare parts, lack of skilled workers, and economic systems that favor labor over capital.

Incinerator proposals—along with proposals to centralize and privatize waste management systems—are often presented as the only solution to handle growing amounts of discards. Fortunately other options exist. Indeed, non-incineration alternatives can be comprehensive, handle discarded materials from large urban areas, and be carried out in industrializing countries with minimal resources. Furthermore, alternatives cost a fraction of the cost of incineration, employ many more workers than incineration, and pollute far less. In industrializing countries, source-separation recycling and composting programs (in which recyclable and organic materials are segregated at the household level) have the potential to divert 90% of household waste from disposal, a level incineration cannot achieve.

Chennai (formerly Madras), India, makes a good case to illustrate the benefits of a recycling/composting approach compared to reliance on incineration. A US$41 million incinerator has been proposed for the city (population 4.3 million) that would gasify 600 tonnes per day of municipal discards. Local authorities are moving toward privatizing waste collection and, as a result, have already jeopardized community-based recycling and composting initiatives. In fact, Chennai is home to Exnora International, a nonprofit organization spearheading a decentralized recycling/composting approach that has inspired similar projects across India.

In Chennai the infrastructure exists to collect only 2,500 of the 3,500 tonnes of discards generated each day. Almost 30% is left uncollected littering streets and neighborhoods. This is typical of less-industrialized nations. Thus incinerators in Chennai, at most, could hope to receive 2,500 tonnes per day. But not all material discarded is incinerable; about 5 to 10% is considered "by-pass" materials that might, for instance, include large nonburnable items such as engine blocks, or represent waste landfilled when the incinerator is not working. In addition, on average 25% by weight of what is burned ends up as ash that still requires landfill disposal. In our Chennai example, incineration would only divert 1,750 metric tonnes a day or half of the total waste generated. In contrast, Exnora's decentralized community-based waste reduction approach involving segregated collection of recyclables and organics for composting has the potential to divert 90% of all the 3,500 tonnes generated each day. The heart of Exnora's program is teaching citizens to take responsibility for their discards and not to litter. (See pages 47-51 for more information on this approach.) This approach can go even further when combined with programs to reduce the overall volume and toxicity of materials used. In terms of costs, the recycling/composting approach is far more cost-effective (US$4.6 million compared to US$119 million). Furthermore, the incineration

Definition of waste incineration

For the purpose of this report, waste incineration refers not just to the mass burn (with or without energy recovery) and refuse-derived-fuel systems well established in industrialized countries, but to any type of thermal treatment system for discarded materials that wastes resources and emits pollutants. These include technologies based upon combustion, pyrolysis, and thermal gasification. Like combustion, pyrolysis and gasification systems produce dioxins, furans, and other persistent pollutants.

Combustion is simply put, burning or oxidation of compounds. Combustion of hydrocarbons produces heat, light, water, and carbon dioxide. Ash is a combination of materials incompletely combusted and new solids formed during oxidation. The two most common combustion technologies for solid waste are:

- **Mass burn**, in which waste is directly burned. Often the heat produced during the burning is used to convert water to steam to drive a turbine connected to an electricity generator.
- **Refuse-derived fuel (RDF)**, in which mixed waste is processed prior to direct combustion. The level of processing varies among facilities, but usually involves shredding and removal of metals and other materials with low Btu content. The processed materials are then used as fuel either in the same manner as at mass burn plants or to fuel existing facilities such as cement kilns.

Pyrolysis is the thermal degradation of materials by heat in the absence of or with a limited supply of oxygen. In a pyrolysis unit, materials are heated to a temperature between 800 and 1400 degrees Fahrenheit (427 to 760 degrees Celsius). The lack of oxygen aims to prevent combustion. However, eliminating all oxygen is virtually impossible; some oxidation occurs and results in the formation of dioxins and other related hazardous compounds. Pyrolysis results in three products - gas, fuel oil, and a solid residue called "char" (likely to contain heavy metals).

Thermal gasification is similar to pyrolysis except that the thermal transformation of solid waste takes place in the presence of a limited amount of air or oxygen, producing a combustible gas. This gas can then be used in either boilers or combustion turbine/generators. This process generates solid and liquid byproducts, which may contain high levels of toxic contaminants.

A note on tonnage units: In this report, "tonne" refers to a metric ton (1,000 kg). All tonnage is given in metric tonnes.

A note on terminology: This report often uses the term "discards" for what many call "waste." Discards are used resources that are reused, recycled, composted, or wasted. Waste is discarded material removed from commerce (or the environment) and whose residual value is destroyed by burning, burying, or other means.

Table 1: Comparison of incineration versus a recycling/composting approach in Chennai, India

	Incineration	Recycling/Composting Approach
Metric tonnes per day generated	3,500	3,500
Metric tonnes per day diverted from landfill disposal	1,750	3,150
Diversion level	50%	90%
Capital cost (US$)	$119 million	$4.6 million
Workers employed	320	5,600
Impact	waste encouraged dirty environment with much litter citizens oppose system increased truck traffic and pollution citizens continue throw-away habit reliance on foreign technology and know-how	waste reduced clean environment and neighborhoods citizens support and are involved in system decreased truck traffic (reliance on pedal power) citizens take responsibility for waste reliance on local resources and know-how

Note: Incineration costs are based on a 600 tonne-per-day incinerator planned for Perungudi in Chennai (plant cost is Rs 200 crore or US$41 million). (One crore is 10 million Rs.) Three incinerators would be needed to handle the 1,750 tonnes per day. Jobs for the incinerator are based on employment figures for U.S. incinerators. The costs and employment for the recycling/composting approach are extrapolated from Exnora International's recycling/composting program model, which is working in many communities across India. Tonnage data for Chennai was reported in The Hindu, June 18th, 2002, and attributed to Exnora International.

Source: Institute for Local Self-Reliance, Washington, D.C., U.S., April 2004.

system has a far more detrimental impact on the environment, local economic development, and other quality-of-life aspects such as truck traffic. See Table 1.

While the figures above are theoretical, they are based on actual data of operating projects. Indeed, numerous projects around the world have demonstrated that integrated programs for waste prevention, reuse, recycling, and composting can significantly reduce disposal at a lower cost than incineration.

To be effective, discard management systems must be based on appropriate technical solutions and be designed with local conditions and needs in mind. Most industrializing countries have limited experience with operating and maintaining centralized discard handling systems. Thus, the less complicated the technology, the more successful it will be. Most industrializing countries have a significant informal sector already engaged in extensive recycling activities. A system designed in partnership with this sector and with other community efforts and micro-enterprises will also have a better chance of success. In fact, integrating the informal sector and community initiatives into citywide discard management planning is not only possible but may be the key to success. The informal sector and community programs may need only an institutional structure and land for activities such as composting to be scaleable to city levels. Indeed, community projects can become mainstream solutions. They need not be forever relegated to local small efforts.

Some successful innovative approaches to managing discards and reducing waste in the global South include the following.

- **Cairo, Egypt**: informal sector workers—known as zabbaleen—collect one-third of Cairo's household discards, about 998,400 tonnes per year. The zabbaleen, who live in five neighborhoods surrounding Cairo, recycle and compost 80 to 90% of what they collect. One neighborhood, Mokattam, is

home to approximately 700 garbage collecting enterprises, 80 intermediary traders, and 228 small-scale recycling industries.

- **Mumbai, India (formerly known as Bombay)**: citizens have set up neighborhood associations – each known as an Advanced Locality Management (ALM) – in which members keep their environment clean and separate their discards into biodegradable and non-biodegradable types for composting and recycling. Many ALMs vermicompost (worm compost) wet organic materials and work with ragpickers to recycle other discards. About 650 ALMs exist, representing about 300,000 citizens.

- **Barangay Sun Valley, the Philippines**: approximately 3,000 households participate in a recycling and composting program that diverts 70% of their household discards from disposal. "Biomen" collect segregated organic material (kitchen scrap and garden trimmings) for composting on a daily basis using pedicabs. The same pedicabs collect segregated recyclables from households. They deliver recyclables to the nearest "eco-shed" for further sorting and baling. Processed material is sold directly to scrap or "junk shop" dealers.

- **Rio de Janeiro, Brazil**: in 2000, this state passed a mandatory packaging take-back law, which requires the take-back of all plastic packaging and its subsequent reuse or recycling.

A growing zero waste movement is gaining momentum worldwide and innovative regulatory systems requiring "extended producer responsibility" for products promise to reduce disposal even further. Local, national, regional, and international networks of concerned citizens and professionals have formed to halt proposals for new incinerators, phase out old ones, and push for alternative systems based on sustainable production and consumption patterns.

Zero waste is a worthwhile goal, but it will take some time to achieve it. Just as a journey of a thousand miles begins with a single step, so too does aiming for zero waste. The road to zero waste can begin with the simple and relatively inexpensive act of keeping organic and putrescible material out of landfills and dumps. This alone won't provide a total solution, but will go a long way toward solving problems related to dirty, leaking, and overflowing dumpsites. This is especially true in the global South where organic material makes up the largest component of the discard stream. Composting can cut the discard stream by almost half in a relatively short time period. The beauty of composting is that it can be accomplished inexpensively via low-tech means on a small-scale. More often than not, it can be done with local know-how and local resources. Keeping materials segregated is essential to success.

This report:

- discusses the history of municipal solid waste incineration, its fall from grace, and how incinerator companies are seeking new markets for their obsolete technology,

- identifies jurisdictions restricting or banning municipal solid waste incineration,

- lists some of the many communities fighting planned incinerators,

- details 20 reasons incineration is a losing financial proposition for host communities inindustrializing nations,

- provides a checklist for evaluating a proposed municipal solid waste incinerator project,

- debunks some common myths about incineration,

- summarizes the growing zero waste movement,

- presents non-incineration discard management strategies (focusing on replicable recycling and composting techniques),

- shares information on some model recycling and composting programs operating successfully in the global South,

- highlights the unique and important role of the informal sector in recovery activities, and

- outlines ten steps to get started on the path to zero waste.

This report does not address the growing push to burn industrial toxic materials or health care waste in the global South. It also does not focus on the serious environmental problems incineration poses. Environmental and public health impacts are addressed in other resources such as Greenpeace's 2001 report, "Incineration and Human Health: State of Knowledge of the Impacts of Waste Incinerators on Human Health."[3] Information on medical waste management is available from Health Care Without Harm, *www.noharm.org*. Information on toxics use reduction and clean production are available from Clean Production Action at *www.cleanproduction.org*.