The challenges ahead — solid waste management in the next millennium

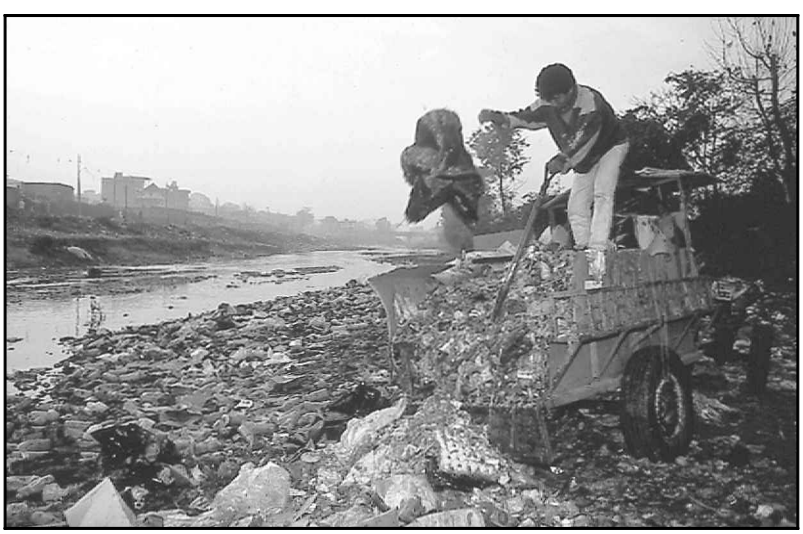
Andy Cotton, Mariëlle Snel and Mansoor Ali

For many cities in the South, uncollected solid waste has become a major health hazard, yet municipal waste management services may collect as little as 25 per cent of total refuse produced. How can this 'public health crisis' best be addressed?

Communities living near dump sites suffer the nuisance of smoke and smells; such sites and uncollected waste attract rodents and flies, providing a transmission route for disease.

Solid waste (or refuse) is any material which the holder discards, intends to discard or is required to discard (apart from gaseous and liquid waste). Over the years *Waterlines* has published many pioneering articles on water and sanitation — it is appropriate that we are now able to complement this with an issue dedicated to solid waste management (SWM), by comparison a neglected field. Here, we cover a wide range of issues related to SWM in developing countries, including household ownership, public policies and environmental aspects. We focus on the 'hard' issues, the collection, transportation and disposal of waste, but also look at 'soft' issues such as the social aspects of solid waste management, including the informal collection of waste. Because a number of innovative initiatives are taking place in Asia, a majority of the articles in this issue have an Asian-based focus. This should not undermine the importance of developments also taking place in the formal and informal SWM sector in South America and Africa.

1. Snel, M. (1997). 'The formal and informal sector of solid waste management', PhD Thesis, University of Sussex, Brighton.



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Uncollected solid waste can be a more serious health hazard than sanitation waste from on-site sanitation systems.

Increases in population and migration into cities have created serious environmental problems including inadequate solid and liquid waste management, lack of safe water and minimal pollution control. Many southern cities are characterized by overcrowded housing, contaminated water supplies, and lack of proper sewage disposal, drainage or waste collection, all of which contribute to an unhealthy urban environment. Communities living near dump sites also suffer the nuisance of smoke and smells, and such sites — and uncollected waste in general — attract rodents and flies which provide a transmission route for disease. The main factors influencing this 'public health crisis' are the population expansion, especially in urban areas, and the inability of governments to keep up with the increasing need for adequate and sustainable urban infrastructure.[1]

Environmental issues

Cities in developing countries have to deal with increasing quantities of waste — items generated by households, commercial waste, industrial, institutional and hospital waste — the composition of which is continually changing. The generation rates and composition of household waste, for example, vary considerably in place and time as a result of cultural traditions, such as food habits, and more particularly, differing socio-economic characteristics. Developing countries produce on average between 300 and 600 grams of municipal waste, per person, per day. Table 1 compares the quantity and quality of solid waste generated in low-income, middle-income and industrialized countries.

As a result of the combination of the high organic content of household waste

and a tropical climate, uncollected waste can become a major health hazard in developing countries. However, this organic waste also has a high recycling potential — it can be converted into compost, fuel pellets, biogas or other useful products.

The calorific value of urban solid waste — which determines how suitable it is for incineration — is low in developing countries, usually less than 1500kcal/kg, so the incineration of domestic waste is not normally a suitable option in the South. Unfortunately many international projects, especially in the 1970s and 80s, attempted to solve SWM problems in these countries using their own 'traditional approaches', for example, importing incinerators which were then left to rust and deteriorate.

Operational issues

Overall, municipal collection can be divided into three stages — sweeping and kerb-side collection; transport by hand-carts/tricycles to large on-road collection points; and transportation by vehicles to the disposal sites. The following diagram illustrates the various stages of the solid waste chain.

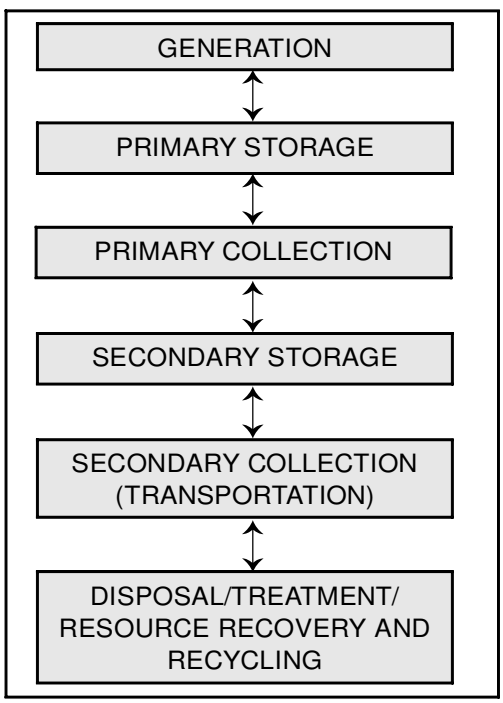

Figure 1. Solid waste chain.

In the first instance waste is stored near houses or in large bins in the neighbourhood, if they exist. This waste is later collected and finally transported to 'official' disposal sites.

Characteristics	*Low-income countries*	*Middle-income countries*	*Industrialized countries*
Waste generation (kg/person/day)	0.4 to 0.6	0.5 to 0.9	0.7 to 1.8
Waste Densities (wet weight basis-kg/cubic metre)	250 to 500	170 to 330	100 to 200
Moisture content (% wet weight at point of generation)	40 to 80	40 to 60	20 to 40
Composition (% by wet weight)			
Paper	1 to 10	15 to 40	15 to 50
Plastic	1 to 5	2 to 6	2 to 10
Metals	1 to 5	1 to 5	3 to 13
Glass, ceramics	1 to 10	1 to 10	4 to 12
Leather, rubber	1 to 5	-	-
Wood, bones, straw	1 to 5	-	-
Textiles	1 to 5	2 to 10	2 to 10
Vegetables	40 to 85	20 to 65	20 to 50
Misc.	1 to 40	1 to 30	1 to 20
Particle size, % greater than 50mm	5 to 35	-	10 to 85

Table 1. Quantity and quality of solid waste generated in low, middle and industrialized countries.[2]

Collection

Municipal waste management services have been known to collect as little as 25 per cent of total refuse produced within a city, leaving the remainder uncollected. Collection efficiencies vary from one city to another and from one area to another within a city — low-income areas may receive a very poor level of service compared to high-income and commercial areas. Such a situation will inevitably cause hazardous conditions and health problems. Within the typical urban area the municipal services collect between 50 to 70 per cent of the refuse, but serve less than 50 per cent of the population. Developing countries need both money to expand this coverage, and strengthened capacity to operate and maintain an improved service. The factors required for cost-effective collection systems are covered in **Manus Coffey**' s article on page 23.

Transportation

Major deficiencies in collection and transportation systems include lack of planning regarding the collection route (often depots are not visited in any systematic way), an inadequate number of vehicles, lack of workshops for maintenance and spare parts, and inappropriate vehicle designs (vehicles are often too large for high density areas with poor access).

2. Cointreau, S.J. (1987). *Solid waste recycling: Case studies in developing countries.* Integrated Resource Recovery. A global research, development and demonstration project of the UNDP, World Bank, Washington DC.

Disposal

Disposal practices in less developed countries range from 'no-system' to 'moderately controlled disposal', depending on the size of the city, the collection systems in place and socio-economic indicators. As cities develop, the most common disposal systems are the ones with slight and moderate controls.[3] At some disposal sites, bulldozers are used to compact the waste or cover it with soil, but usually this is done manually. Poor disposal practices can lead to pollution of water resources through leachate[4] and the build up of gases which can cause explosions; such hazards — which are dependent on factors such as waste composition, moisture and climate — therefore need to be controlled at the site. Monitoring of groundwater is also necessary to detect changes in water quality that may be caused by the escape of leachate and landfill gases.

One method of avoiding explosive hazards within larger dump sites is through the placement of pipes to release the gases; this may also allow the anaerobic decomposition of waste to be converted into energy for heating, cooking and other purposes. There are some pilot projects in developing countries, such as India and China, where methane gas is generated at landfill sites, but it has yet to be seen if they will prove successful. Unfortunately, municipalities often lack the finances necessary to employ adequate expertise and planners to manage disposal sites efficiently, so disposal is often implemented in the least-effective, cheapest and dirtiest ways.

Financial issues

Financing waste management is another major challenge. Generally, the sub-issues of cost recovery, operation, maintenance and capacity building remain unresolved. Municipal expenditure on the collection and transportation of refuse varies considerably — in India, for example, the percentage variation in expenditure on conservancy services can range from 7 to 76 per cent of total municipal expenditure, depending on the population and size of the city. **Adrian Coad**' s article on page 6 emphasizes this great diversity in terms of municipal revenues and expenditure on waste management.

Privatization

Many cities in developing countries have focused on alternative methods for managing their solid waste — one such method has been the privatization of some or all of waste management services.

There are various advantages to privatization when considering the rapid urbanization and escalating demand for public goods and services. For the private sector, providing waste management services to parts or all of the city can be a profitable opportunity, and one which gives a strong incentive to look for innovative means to reduce costs. Private firms can also provide a more flexible service — being able to respond more quickly to changes in demand than municipalities.

For the municipalities, some advantages of privatization are lower administrative and staff overhead costs; less need to provide finance for capital equipment; a supervisory rather than a service-providing role; and, potentially, increased efficiency in terms of management and organization. However, negative implications of this shift in responsibility may include the application of high technology with substantial capital causing a loss of employment among people who have been practising waste collection for generations; there may also be a decrease in municipal staff working in the health department. In addition, there is the danger of eroding informal recycling activities with the introduction of large-scale operations and other sophisticated recycling machinery, while the service provided may be inefficient and inadequate, as contractors have their own vested interest in cutting costs.

Social issues and the informal sector

Most collection, transportation and disposal of waste is by the formal sector; it was only after industrialization that the informal sector of waste separation and recovery emerged in numerous cities in developing countries. Here three articles look at the social aspects of the informal recycling sector. **Mansoor Ali** on page 10 focuses on the overall development of the informal sector in the South, with **Jo Beall** (page 13) describing the interlinkage between the collection of household waste and private sweepers in Faisalabad

3. Cotton, A., Ali, M. and Westlake, K. (1997). 'Draft framework for the disposal of municipal solid waste in developing countries'. Report for the Department for International Development, London.

4. Landfill leachate comprises liquid that has entered the landfill from external sources such as surface drainage, rainfall, groundwater and water from underground springs as well as the liquid produced from the decomposition of waste.

Shezad Noorani/Still Pictures

For many municipalities privatization seems a magic solution, but one that may jeopardize the livelihoods of large numbers of waste pickers.

(Pakistan). Finally, on page 27 **Mariëlle Snel** focuses on a scheme which interlinks the formal and informal recycling sector through a community-based primary collection scheme. Some of the issues these articles discuss include the potential of the informal sector for the recycling of waste; the livelihoods of waste pickers; and the potential input of waste pickers in community-based waste disposal schemes.

The challenges ahead

The past decade or more has seen major advances in more appropriate solutions for water supply and sanitation in developing countries; there has been much less innovation in the field of solid waste management. In this issue we highlight some possible solutions, these often being tailor-made to particular local situations, such as the use of 'appropriate' rather than highly sophisticated (and often extremely expensive) technology.

Our expectation of the future is that it will be one of gradual progress to meet the ever-increasing population and accumulated waste generated as a result. We envisage a move towards continuing gradual privatization of SWM services with local governments focusing more on community participation through the assistance of non-government and community-based organizations, with recycling in waste management continuing to play a role, not only because of its important environmental, but also its economic, benefits. The challenges ahead for solid waste management in developing countries reflect the need to balance the move towards privatization and that of community initiatives. This will mean progressive strides, rather than great leaps, towards dealing with the challenges of solid waste management in the next millennium. ■

about the authors

Andy Cotton is a senior programme/project manager at WEDC and specializies in infrastructure and services for the urban poor. E-mail: A.P.cotton@lboro.ac.uk

Mariëlle Snel is a researcher in urban services at WEDC and specializes in solid waste mangement. E-mail: M.M.E.P.snel@lboro.ac.uk

Mansoor Ali is a programme/project manager at WEDC and specializes in solid waste mangement. E-mail: S.M.ali@lboro.ac.uk

Contact: WEDC, Loughborough University, Loughborough, Leics. LE11 3TU, UK. Fax: +44 1509 211 079.

voice box

Is *Waterlines* too positive?

For some time now my students (mostly development professionals from the South) have been complaining that *Waterlines* only really offers very positive write-ups of projects. They feel that this does not adequately reflect reality and it is of only limited use as a learning tool. From their own experiences they would like to see more acknowledgement of, and reflection on, the difficulties experienced in implementing community-based approaches, the less tractable problems etc. They have suggested to me that many *Waterlines* articles serve as a mild form of propaganda for the implementing agencies concerned! I realize that you have a focus on 'best practice' and that organizations might be reluctant to publicise less successful or problematic projects, but is there any way that the balance can be redressed slightly?

Frances Cleaver is a lecturer at the Development and Project Planning Centre University of Bradford, Bradford, UK.

Editor: Individuals and organizations are, of course, reluctant to write-up case studies and projects where there have been serious difficulties, or which have failed altogether. Comments please on how this might be dealt with to The Editor, *Waterlines*, IT Publications Ltd, 103-105, Southampton Row, London WC1B 4HH, UK. Fax: +44 171 436 2013. E-mail: journals.edit@itpubs.org.uk

Coming up in the April 1999 issue

April's *Waterlines* — in an edition co-ordinated by Guy Howard at the Robens Centre for Public and Environmental Health — will focus on issues concerning the development of on-site sanitation and its potential impact on groundwater quality. This has been a matter of increasing importance in developing countries over recent years, particularly in the context of sustained health improvement. Some in the sector maintain that the benefits of sanitation improvement outweigh any potentially negative impacts, whilst others argue that groundwater is a scarce and valuable resource and is threatened by on-site sanitation. In this issue we will present some of the arguments from both sides of the debate, reviewing recent research into the subject, with data from Uganda, Bangladesh and India, and will also suggest some possible ways forward.

contributions

Waterlines welcomes written contributions. If you have information you feel would be of value and interest to other readers, send us your manuscript. Manuscripts should be less than 2000 words long. Photographs and illustrations are very important, and should be black-and-white and captioned. The editor regrets that no responsibility can be accepted for the return of the original manuscript or illustrations. Where opinions are expressed in *Waterlines* they are those of the authors and not necessarily those of the Intermediate Technology Development Group. Where technical articles and advertisements from outside sources are published, the details, effectiveness, and data on which they are based are assumed to be correct and are taken on good faith to be so.

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