



CLIMBING OUT OF THE GARBAGE DUMP: managing Colombo's solid waste problem

One week ago, a new order came into effect which bans the manufacture, sale and use of polythene or any polythene product which is 20 microns or below in thickness. This prohibition applies across the whole country.

Although EFL commends this move, by itself it tackles only the tip of the iceberg — or the garbage mountain — that Sri Lanka's residents face.

Garbage is one of our most pressing problems. It is everywhere: surrounding our homes, schools and hospitals, lining our roads, and blocking our drains, waterways and beaches. The mountain of garbage in Bloemendhal, on one of the main roads leading into Colombo from the international airport, has now become a landmark in our city for both tourists and locals alike.



Our garbage mountains are growing by the day, and even a quick glance at Colombo (or indeed any city in the country) helps drive home the point that Sri Lanka has an extremely serious problem regarding the suitable and sustainable management of solid waste.

Rotting rubbish is unsightly and foul-smelling, and makes it extremely unpleasant to live or work nearby. It also leads to an increase in the incidence of diseases borne by vectors such as rats, mosquitoes and flies. Blocked drains and waterways are a significant cause of local flooding, and plastics and other far less pleasant wastes in the form of untreated sewage are regularly encountered when swimming in the sea. More insidiously, the leaching of toxic matter and heavy metals (including lead and mercury) into the soil and waterways is a serious health hazard, poisoning our soils and water supplies.

Garbage is quite literally choking us. It is not being disposed of properly, collected effectively, or managed adequately. Festering heaps of wastes lie unattended in residential areas. Piles of trash are being dumped in beauty spots and environmentally sensitive areas.

Nobody enjoys living in a rubbish dump. Although all Sri Lankans regard garbage as a problem, and the Government too has identified solid waste as one of the most serious environmental and public health hazards in Sri Lanka today, the general feeling is that it is "somebody else's" responsibility. Years of deteriorating services, combined with a hitherto apparent unwillingness on the part of successive Governments to take effective, but potentially vote losing, measures, have resulted in general sense of hopelessness throughout the country.

Littering and unauthorised waste disposal outside designated areas are illegal. Our comprehensive legal system requires that solid wastes be managed properly, and sets out very clearly the responsibility of both Government and the general public for keeping the country clean by disposing of garbage in a proper and lawful manner. It also empowers the police to act swiftly in cases of illegal littering and improper dumping of garbage.

Yet little heed seems to be paid to the laws and regulations which govern waste disposal and management, either on the part of the general public, or by the authorities and those departments mandated to enforce them.

The time has come to enforce the laws which protect our natural environment and living areas, and to do away with the mountains of garbage that surround us. This is essential for our current and future health and well-being, and that of the planet we call home. As we describe below, better solid waste management on the part of all citizens is not just required by law, but also offers many lucrative opportunities to generate profits and save costs.

CLIMBING OUT OF THE GARBAGE DUMP:
managing Colombo's solid waste problem

EFL Policy Paper
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Introducing the problem

Littering and unauthorised waste disposal are illegal in Sri Lanka. Every citizen, including those in the corporate and the public sectors, has a legal responsibility to dispose of garbage only in designated sites. The State has a mandate to keep public places clean, and to collect and properly dispose of both private and public wastes. Any person who litters or dumps garbage illegally may be arrested by the police, and liable for a fine or imprisonment.

Solid waste management services in Sri Lanka come under the purview of local government authorities (LAs). While most local authorities conduct these services on their own, some LAs (Colombo and Kandy Municipal Councils for example) have outsourced waste management to private sector firms. Nevertheless, the solid waste management exercise, as a whole remains weak. The fundamental problem is a lack of accountability on the part of those who are elected to office, and apathy on the part of rate-payers to assert their rights and to hold officials accountable. The twin maladies stem from decades of politicisation, appalling governance at all levels and, of course, rampant corruption. The net result is that in most local authorities, the near absence of environmentally acceptable solid waste management creates significant public health risks to all income groups, and particularly to the poor who live in close proximity to waste dumps, and resort to scavenging activities to supplement their meagre incomes¹.

Over the past few years, there has been a lot of discussion about the problem of solid waste, and what to do about it. But for the most part this has remained at the level of talk — there has been little or no translation of these noble ideas into concrete actions. The problems of garbage and littering remain, and intensify by the day. A good example is Sri Lanka's National Strategy for Solid Waste Management, prepared by the Ministry of Environment and approved by the Cabinet of Ministers in 2000, which ostensibly covers all aspects that need to be looked at regarding the problem. So are the Technical Guidelines on Solid Waste Management in Sri Lanka, published in 2005 by the Central Environmental Authority. Considering the time and effort expended in producing these documents, had that energy been channelled instead into restoring good governance and the rule of law, Sri Lanka would not be in the predicament it finds itself in today.

The problem of garbage is, however, only partially the result of the State failing to discharge its responsibilities effectively. Just as the executive arm of government has shirked its responsibilities to keep our streets and public areas clean, the general public has also collectively continued to act with scant regard to the laws, and not lived up to its civic responsibilities. Littering is commonplace — on the streets, in public areas, and in residential zones. Private householders as well as companies and industries, schools and hospitals, all dump their wastes largely wherever they can conveniently do so. Offenders are rarely brought to book, and seem to care little either about the provisions of the law or about the benefits of living in a clean environment. In all too many cases, people merely take their garbage and dump it in a public area or outside somebody else's home or property, making it somebody else's problem to deal with, and somebody else's nuisance to live with.

At Environmental Foundation Ltd. (EFL)², our role is to endeavour to foster the required political and institutional will and be a catalyst for change. Further, we intend to facilitate dialogue between all interested parties to increase awareness. The general public needs to be mobilized to campaign for a cleaner and garbage-free Sri Lanka. That would not be possible without an attitudinal change in all Sri Lankans. Our final goal is to change the mindset of our people to think 'clean' by making them take responsibility for the waste they generate and to bring about a lasting solution to this 'garbage menace'.



How wastes are generated, managed and disposed of

Composition of solid wastes

As shown in the figure below, the composition of municipal solid waste in Sri Lanka is mainly biodegradable, in that it decomposes naturally. Just under half of total waste generated consists of materials such as metals, wood, glass, paper, building wastes, slaughterhouse wastes, sawdust, paddy husk, garment wastes, polythene and plastic.

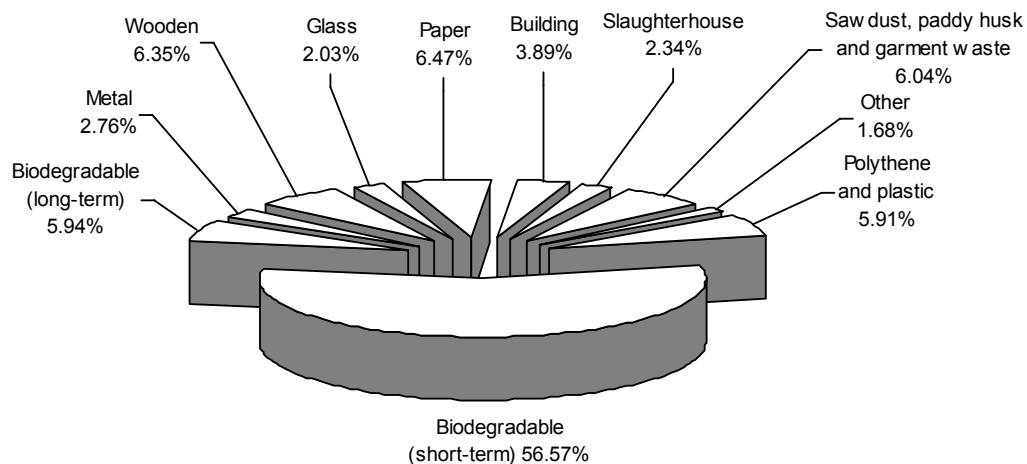


Fig. 1: Composition of Municipal Waste Collection in Sri Lanka, 2005

Source: Database of Solid Waste, Ministry of Environment, Sri Lanka, 2005

Collection and transportation

Per capita waste generation rates in Sri Lanka, particularly in urban areas, closely match rates in countries in East Asia. However, when comparing waste collection levels, Sri Lanka ranks below East Asian countries and is more in line with lower-income countries in South Asia. Waste collection services cannot keep pace with demand and need. Even through waste collection services in major towns (such as Colombo and Kandy) are provided daily, and every other day in smaller centres, this is not sufficient to cope with the accelerating output of garbage.

Daily waste collection in Sri Lanka is approximately 2,900 tons, of which 59% comes from Western Province. Based on population estimates, the amount of solid waste generated is estimated at around 6,400 tons per day³, which means that less than 50% of the sold waste generated each day gets collected. Of the more than 300 local authorities in the country, there are only 8 with a waste collection capability in excess of 50 tons per day, 19 able to handle between 20-50 tons day, and 284 local authorities equipped to collect less than 20 tons of solid waste. Although the Colombo Municipal Council area, with a collection capacity of 700-tons-per-day, leads the rest by far, the existing waste-collection infrastructure as a whole is finding it increasingly difficult to provide even the semblance of an acceptable daily collection and disposal service for the burgeoning volume of waste.

The overall coverage of solid waste collection services is low among most local authorities, averaging 65% for Urban Councils and just 50% for Pradeshiya Sabhas⁴. This is quite significant considering that 72% of the country's population lives in semi-urban and rural areas. Fortunately, the bulk of rural waste is organic and biodegradable, and householders themselves are managing disposal to a large extent. The coverage of Municipal Councils' collection services reaches close to 80% in a few urban areas.



The *collection* of waste, however, would seem to be the easy half of this vexing problem. *Disposal* of what has been collected is fast becoming an insurmountable hurdle especially in densely populated urban areas, due to lack of available sites.

While most local authorities claim that the main constraint to providing an efficient waste collection service is the serious lack of funds to purchase the necessary fleet of collection vehicles, in reality the problem is further exacerbated by inefficient operation of available equipment. Better and more effective deployment as well as routine maintenance of the vehicles would significantly enhance the existing waste collection effort. In areas where house-to-house collection on specified days in the week is not the norm, people resort to disposing of their wastes daily on the streets or in public areas for collection by the authorities. In the absence of a collection routine, householders cannot reasonably be expected to move their wastes out of their homes to coincide with an unknown waste collection schedule.

It is hardly surprising, then, that the streets should be littered with garbage throughout the day and night, with the cycle repeating itself no sooner the authorities have completed one 'waste collection round'. Better planning, strict adherence to a well-publicised collection schedule and soliciting active public participation would see a remarkable improvement without any additional cost implications. It is only after such elementary efficiencies have been ensured that the need for more funds for additional collection vehicles should even be considered⁵.

Disposal

Littering

Unfortunately the most common method of waste disposal is littering — the careless dropping of refuse or waste material in public places. Littering is also rife among the general public. In what has fast become today's easily disposable society, wastes too are disposed of on the roadside, in parks and in any conveniently open public space, outside houses (never one's own, of course), and out of the windows of moving cars.

As described in the next section, the authorities responsible for waste collection and disposal transport the garbage to open dump sites, which merely adds another dangerous dimension to an already serious problem.

The persistence of littering indicates a fundamental disregard for others' health, property and comfort. Few would consider dumping their garbage in their own backyards, or welcome others doing so. Yet they seem to have no problem with treating public spaces, or others' neighbourhoods in this way. 'Out of sight, out of mind' seems the accepted maxim as far as waste disposal goes; that it then becomes everyone's collective problem does not deter them from such anti-social behaviour.

Open dumping

Once collected, the current preferred option for the final disposal of solid wastes by local authorities is open dumping, with no regard for the serious environmental and public health impacts. Open dumpsites are small, generally between 1-2 hectares in extent, and are usable only for a short time. A high proportion of these sites are privately owned, are marshy or low-lying; owners use garbage as landfill to increase the commercial value of the property.

Public property such as forests, the banks of streams and rivers, and the seashore are used extensively as disposal sites by local authorities, and there is little or no enforcement by the regulatory authorities to prevent this. Septage (septic tank sludge) is often dumped at solid waste disposal sites without any precautionary measures to minimize environmental and health risks. Soil covering is rarely, if ever, undertaken.

Local authority staff managing solid waste disposal sites regularly burn the waste to extend the life of the landfill site, regardless of the resulting air pollution. Generally, a properly operated disposal site with little containment but good operational management would cost about SLRs



200-300 per ton of waste. At present, most local authorities spend less than SLRs 50. However, the main reason for such poor practices in waste disposal is the lack of political commitment to address waste disposal issues properly.

Scavenging activity at solid waste disposal sites is alarmingly widespread. Informal discussions with 'professional' scavengers reveal that daily income from scavenging ranges between SLRs 400-700 per day, while the daily wage of an unskilled worker is around SLRs 450 per day². Better organisation of waste collection and sorting, and strict enforcement of regulations pertaining to the disposal of medical and other hazardous waste, would ensure more effective re-use and recycling, while reducing the health risks to scavengers.

Sanitary/engineered landfills

A sanitary landfill site is one designed for the final disposal of waste in an environmentally sound manner. There is a clear distinction between open dumping, which is a currently common disposal practice in Sri Lanka, and having a sanitary landfill site.

A sanitary landfill site is designed to minimize the adverse effects associated with solid waste disposal. The design includes containment of leachate and gas, daily cover for the working surface, run-off and run-on diversions to decrease potential surface and groundwater pollution. Additionally, a sanitary landfill site is also aesthetically more acceptable. In the case of an engineered landfill site, the methane gas, which is produced as a result of the decomposition of garbage, is burned without treatment.

There are currently no sanitary landfills in Sri Lanka. The only functional engineered landfill is the Moon Plains landfill site in Nuwara Eliya, managed by the Nuwara Eliya Municipal Council. Even though this is not lined, the soil has a high clay content, and therefore most of the leachate can be collected and treated. It was a project funded by Japanese International Cooperation Agency (JICA) and was completed in 2004. Although sanitary landfills were proposed for many other sites, including Colombo, an appalling lack of political will, coupled with objections by some groups, led to these projects being abandoned.

Incineration

Incineration in the context of waste disposal is the controlled combustion process for converting solid, liquid and gaseous combustible wastes into gas and residue containing non-combustible material. During combustion, moisture is vaporized and oxidized. Carbon dioxide, water vapour, ash and non-combustibles are the end-products. Incineration without adequate control systems leads to the release of gases that cause air pollution; hence suitable precautions need be taken.

In dealing with municipal waste, incineration is not economically viable in Sri Lanka at present because of the high moisture content and low calorific value of the waste. At present a few small-scale incinerators are installed in hospitals and factories to dispose of hazardous waste. These are not operated under the stipulated conditions, thereby causing public nuisances to the people in the surrounding communities.

Alternative processing and treatment methods

Over the past decade or so, there have been attempts by Local Authorities, Non-Governmental Organisations and even the private sector to engage in waste processing, recycling, composting and anaerobic digestion of municipal solid wastes with varying degrees of success.

Recycling

Community-based source-separation, re-use and recycling schemes, initiated by a variety of stakeholders such as NGOs, local authorities, and community groups have been implemented amongst low-, middle- and high-income households in certain urban local authority precincts. Significant success has been achieved when these schemes were linked directly to livelihood improvement programmes for the poor; similar success was not achieved where schemes were stand-alone ventures.



The Colombo Municipal Council (CMC) promotes recycling of glass, paper and polythene through its source-separation programmes, which have been introduced to more than 3,000 households within the areas where the CMC is responsible for waste collection. Under these schemes each CMC employee earns extra money from the recyclables sold at market price. Recycling centres set up at Torrington Road and Green Path have proved to be both successful and sustainable. This has led to the establishment of another recycling centre in Wellawatte, to be run by the private sector.

Composting

Compost is organic matter that has been broken down to stable end-products for use as natural fertilizers and soil conditioners. At present, while there is significant potential for composting (because most of the solid waste generated in Sri Lanka contains biodegradable waste), the commercial returns on the capital investment required are so insignificant as to make such endeavours financially unviable.

Several small-to-medium-scale composting plants have been constructed and are in operation. Japan International Corporation Agency (JICA) reports that most composting operations have failed due to local authorities not paying adequate attention to operation and proper equipment maintenance, besides embarking on the venture in the mistaken belief that all waste treatment costs can be recovered from the sale of compost.

Regardless of the success or failure of composting to date, with proper training of staff, the allocation of adequate funds for operation and maintenance, and a clear recognition of the benefits of composting, local authorities should be able to recover some of the costs through the sale compost and, more importantly, reduce significantly the health hazard and pollution from garbage dumped in open landfills.

Solid waste management: what the law provides for

Much confusion has been created as a result of finger-pointing at different levels of Government about who is responsible for solid waste management, and who is liable when garbage is dumped and disposed of improperly. Yet a host of laws and regulations define very clearly how, where and by whom waste should be disposed of, and what is permissible and what is not. Very simply, the laws of the land specify methods and procedures for waste disposal, allocate both private and public responsibilities to keep the country clean, and make any kind of unauthorised waste disposal or littering illegal and punishable by court with a fine or imprisonment. It is a sad indictment on today's society, on the breakdown of the rule of law and our woeful lack of collective civic sense, that these regulations and the responsibilities they create are never brought into public debate and appear to have little or no impact on people's day-to-day lives.

Many people are not aware that as well as being able to take legal action against other citizens and companies who infringe the law, they have the legal right to demand that Local Authorities and government agencies discharge their responsibilities regarding waste collection and disposal. When a Local Authority is not carrying out their statutory duties a citizen can get relief from the Court of Appeal under the provisions of the Constitution; when Local Authorities are neglecting their duty, a *Writ Mandamus* (an order) can be obtained, directing them to fulfil their statutory obligations. Under Section 98 of the Criminal Procedure Code, people can file an action against any person (including a Local Authority) in the case of public nuisance. Section 98 of the Criminal Procedure Code also says that that any unlawful obstruction or nuisance should be removed from any way, harbour, lake, river or channel which is or may be lawfully used by the public or from any public place. Any citizen can make a complaint to the Police of any public nuisance and when the police is not taking an action they can file a case by way of a private plaint.



The legal framework required for solid waste management is adequately catered for under the many Local Government Acts (the Municipal Councils Ordinance, Urban Councils Ordinance, Pradeshiya Sabhas Act), as well as the Nuisance Ordinance and the Police Ordinance.

The Local Government Acts stipulate that local authorities are responsible for the collection of domestic and industrial rubbish and solid wastes, and for their disposal in designated sites. All wastes collected by the local authority become the property of the council, which has full powers to sell or dispose of it. The Acts also require councils to clean the streets and dispose of household waste, as well as to provide places suitable for the proper disposal of wastes, to take appropriate measures and precautions to ensure that refuse is not disposed of in ways that will cause a public nuisance.

The Nuisance Ordinance provides for the better preservation of public health and the suppression of nuisances; according to this Act, throwing dirt and refuse from any garden or house on to roads or into drains amounts to an offence. Section 56(a) of the Police Ordinance states it shall be a duty of a police officer to use his best endeavours and ability to prevent all public nuisances. Section 63 deals specifically with the duties of a Police Officer in relation to obstructions and nuisances on roads, emphasising that any person who litters or disposes of garbage and wastes into public thoroughfares shall be liable for a fine or imprisonment, and that any police officer may take such a person into custody without a warrant.

Various other regulations and legal provisions define where and how wastes may, and may not, be disposed of. Neither solid nor liquid wastes may be dumped into canals and other waterways, into open areas, or onto public property which has not been designated as a waste disposal site. Public property also includes public drains and other utilities, all of which are owned by the Local Government Authority (of the area), or by the Central Government represented by the Urban Development Authority or the Sri Lanka Land Reclamation and Development Corporation. Public drains and other utilities are protected by all these agencies as well as by the general provisions in the Nuisance Ordinance and the Penal Code, which make it an offence for anybody to obstruct or block them, or to dispose of wastes into them.

The Fauna & Flora Protection Ordinance and the Forests Ordinance both provide for the protection and management of Sri Lanka's fauna and flora, and prohibit disposal of waste in all Protected Areas. The police are responsible for ensuring that public properties are not damaged in any way, and for bringing to book those causing such damage.

It is illegal to pollute the environment. Pollution is defined in the law as "any direct or indirect alteration of the physical, thermal, chemical, biological or radioactive properties of any part of the environment by the discharge, emission or the deposit of wastes so as to affect any beneficial use adversely or to cause a condition which is hazardous or potentially hazardous to public health, safety and welfare, or to animals, birds, wildlife, aquatic life or to plants of every description".

Standards for water quality, air quality and noise levels have been set for Sri Lanka. Any activity that does not conform to these standards is classified as unacceptable pollution, and is illegal. The National Environmental Act (NEA) prohibits any person from depositing waste, which will cause pollution except with a license obtained from the Central Environmental Authority (CEA) and (in sea areas) from the Marine Pollution Prevention Authority. The CEA is also responsible for the co-ordination of all regulatory activities relating to the discharge of wastes and pollutants into the environment and requires all local authorities to comply with recommendations relating to the unauthorized and/or untreated discharge of waste and the storage, transport and disposal of any material that is hazardous to health and the environment.

The NEA further requires potential landfill sites to be subjected to an Environmental Impact Assessment. For a potential site to be developed as a solid waste disposal site it should first be identified and the necessary clearances obtained after going through either an Initial Environmental Examination (IEE) or an Environmental Impact Assessment (EIA) process as required by the law.



Opportunities to benefit from waste

It is the responsibility of each company to minimise the waste it generates, to recycle as much as possible and finally to dispose of its waste products in an environmentally safe manner. There are various methods and processes, described below, which offer opportunities for firms to benefit from environmentally sustainable waste management practices, some of which help save on costs (reuse of products or as acceptable substitutes for purchased inputs, for instance) while others help generate additional income.

Biodegradable waste

As noted earlier, more than 60% of waste generated in this country is biodegradable; in other words, it is capable of natural decomposition. Although there are various ways of recycling biodegradable waste, composting is generally considered to be the most environmentally friendly option. It also provides an end-product which can be gainfully used by the producer or sold to others.

In the case of composting, if the compostable waste is separated at the point of generation, processing becomes easier and less costly. This requires having separate waste bins for organic (such as kitchen waste) and for non-organic discards. Organic waste composting can be performed using 'bins', 'windrows' or 'channels'. *Bin-composting* is where the waste is placed in a closed bin to maintain temperature and humidity at levels which promote composting. *Windrow-composting* is where the organic waste is piled in long rows, usually outdoors, with or without roof cover. *Channel-composting* is where the organic matter is deposited in long concrete channels, usually arranged inside a building. The compost will need to be turned over regularly to maintain stable levels of temperature, oxygen and water.

It can take anything from a month to a couple of years to turn waste into compost, depending on several factors, including the types and quantities of materials being composted: the temperature, moisture content and the amount of air in the mix. Sawdust and paddy husk, though biodegradable, take a long time to degrade. Typically, composting time is inversely proportional to the quantity being composted.

Compost should be homogenous and rich in colour, with a texture similar to loam or potting soil. The particle size of the compost should provide good porosity so that, when added to soil, it allows for great root growth and moisture retention. However, it should be noted that the quality of the compost would depend on the degree of contamination and type of organic waste. Plants and animals have a tendency to bio-magnify heavy metals in their respective systems, which introduces a significant risk to crops and, hence, to the human food chain. To overcome this potential hazard, heavy metal standards for compost should be rigorously enforced.

Compost can be sold to small-scale farmers and households to use as a soil conditioner/fertiliser. With increasing demand from consumers for organic foods, the demand for good quality compost will also grow in tandem. Furthermore, the high demand for compost in the Middle East presents a new export market opportunity as well.

Bio-gas

The composting process produces gases, comprising mainly of methane (55%-75%) and carbon dioxide (25%-45%). These by-products can be converted into energy. The methane in bio-gas combusts more cleanly than coal; and produces more energy with less carbon dioxide emission. The harvesting of bio-gas is an important aspect of waste management since methane is a greenhouse gas with a greater global warming potential than carbon dioxide.

Bio-gas is an acceptable substitute in a wide variety of applications now using natural gas, including electricity production, process heating in industries, for cooking and, when compressed, as a fuel in vehicles powered by internal combustion engines or fuel cells. Some examples of the



conversion of organic wastes to bio-gas exist for Sri Lanka, which have showed varying success. Where projects have failed, the stumbling blocks have almost always been implementation and management, rather than technological constraints.

Metal waste

Steel and other iron-containing matter are some of the most recycled materials, and one of the easiest materials to recycle, as it can be separated magnetically from the waste stream. Recycling is via the steelworks, where the scrap is either melted in an electric arc furnace or used as part of the charge in the basic oxygen furnace. Any grade of steel can be recycled to top quality new metal with no downgrading from prime to lower quality materials, as steel can be recycled repeatedly. Around 40% of crude steel produced is from recycled material.

Most tins and cans are made from aluminium and can be recycled. These are shredded and ground into small pieces and melted in an aluminium smelter to produce molten aluminium. At this stage the recycled aluminium is indistinguishable from virgin aluminium and further processing is identical in both cases. In Sri Lanka the steel and aluminium collected is crushed, baled and exported to India as there are no existing production facilities to melt and recycle.

Glass waste

Waste glass is collected and sorted according to its colour. The collected glass waste (cullet) is taken to a glass recycling plant where it is monitored for purity and contaminants are removed. The cullet is crushed and added to a raw material mix in a melting furnace. It is then mechanically blown or moulded into new jars or bottles. Use of broken glass helps to reduce the production cost, as it requires a lower temperature in its production process and will in turn increase the life span of the equipment. The amount of raw materials required for glass production is also less, thus saving natural resources and energy.

Glass cullet is also used in the construction industry for aggregate and for glasphalt, a road-laying material containing around 30% recycled glass. Glass can be recycled indefinitely as its chemical structure does not alter when reprocessed.

The Ceylon Glass Company currently uses 40% of cullet in its production process and can use a further 20% if waste glass is available. However, the company, though equipped for the purpose, does not recycle green glass, which at present is used in landfills. There are opportunities for waste glass collection and supply to other manufacturers or for the production of new glass products.

Paper waste

Paper can be directly recycled or treated with other biodegradable wastes. In direct recycling it is separated into its component fibres in water, producing a pulpy slurry. A cleaning process removes non-fibrous contaminants and, where necessary, sodium hydroxide or sodium carbonate is used to de-ink the material. This fibre is then ready for making recycled paper.

Paper can only be recycled a finite number of times due to the shortening of paper fibres making the material less versatile. Often recycled paper is mixed with some virgin material content. This is referred to as *down cycling*. This does not however exclude the material from being used in other processes such as composting or anaerobic digestion, where further value can be extracted from the material.

Reuse and recycling of paper is quite common in Sri Lanka. Paper is mainly reused to make paper bags, though on a very small scale. There is a high demand for paper in up-country areas, where paper is used to wrap vegetables and other produce.

Existing technology can use various types and grades of waste paper for the production of recycled paper. The National Paper Company collects around 2,000 tonnes of waste paper



annually and uses it in its production plant in Valachchenei. At present, due to financial constraints, only waste paper pulp is used for production.

Building and construction waste

Building and construction waste is generated when old buildings are demolished. Demolishing is done manually or with the use of machinery in Sri Lanka, not by blasting (as is done in Europe and North America). Manual demolishing of buildings makes it easier to separate rubble.

The cement, rock and mortar can be used for the foundation, and also to make concrete blocks that will be needed for subsequent building purposes. Smaller pieces of concrete are used as gravel for new construction projects. Crushed recycled concrete can also be used as the dry aggregate for brand new concrete if it is free of contaminants. Bricks and roof tiles shouldn't be used in the same way as the clay has already been burnt. However, they can be crushed and used for the laying of pathways, filling up of ruts on roads or rammed into soft earth to harden the ground prior to commencing construction activity.

Cloth and garment wastes

When considering textile recycling one must understand what the material consists of. The composition of the waste will determine the method of recycling and the durability of the end-product. Most textiles are composites of cotton (biodegradable) and non-biodegradable synthetic plastics.

Cloth and garment wastes should be sorted to separate those that can be reused or worn again. Damaged textiles can be further sorted into grades to make industrial wiping cloths and for use in paper manufacture or as material suitable for fibre reclamation and filling products.

Fibre reclamation mills sort textile waste according to fibre type and colour. *Colour-sorting* eliminates the need to re-dye the textiles made from the recycled material. The textiles are shredded into 'shoddy' fibres and blended with other selected fibres, depending on the intended end use of the recycled yarn. The fibres can also be compressed for mattress production. Textiles sent to the flocking industry are shredded to make filling material for car insulation, roofing felts, loudspeaker cones, panel linings and furniture padding.

Polythene and plastic

Discarded polythene and plastics, because of widespread use, are one of the biggest problems encountered in waste management. Another reason is that they are not biodegradable, and remain in the environment once disposed of. The majority of plastics produced today are thermoplastics, meaning that they soften when heated, and thus are easier to recycle.

Polyethylene, polypropylene, polystyrene and polyvinyl chloride can all be recycled. If the product contains more than one type of polymer, processing may prove more complex; in that case, incineration with energy recovery is preferable. The technology is available – though not yet used in Sri Lanka – to produce distillate from plastics, for use as fuel for diesel burners, trucks, buses and other vehicles.

PET (Polyethylene terephthalate) is a thermoplastic polymer resin of the polyester family used in synthetic fibers; in making beverage, food and other liquid containers; in thermoforming applications; and in engineering resins often in combination with glass fiber. It is one of the most important raw materials used in man-made fibers. Post-consumer PET is often sorted into different colour fractions: transparent or uncoloured PET, blue and green coloured PET, and the remainder into a mixed colours fraction. This sorted post-consumer PET waste is crushed and pressed into bales, which are then transported to recycling companies. Transparent post-consumer PET attracts higher sales prices compared to the blue and green fractions. The mixed colour fraction is the least valuable.



Recycling companies will further treat the post-consumer PET by shredding the material into small fragments. Traces amounts of the original content, including shredded paper labels and plastic caps, are still present in the shredded material. These are removed to finally produce pure PET fragments, or "PET flakes", which are used as the raw material for a range of products that would otherwise be made of polyester. Examples include polyester fibres, a base material for the production of clothing, pillows, carpets, polyester sheets, strapping, or once more into PET bottles.

There are a few plastic-recycling companies in Sri Lanka, and the bulk of the PET flakes produced is exported to India where they are used to manufacture finished products. The efficiency of local recycling plants could be improved by ensuring higher capacity utilisation, which would require a far better collection and sorting system for plastics and polythene than we have at present.

Electrical and electronic waste

E-waste or Waste Electrical and Electronic Equipment (WEEE) is one of the fastest-growing components of the waste stream, and certainly one of the most insidiously toxic to humans. It contains extremely hazardous substances (such as chromium, cadmium and mercury, to name just three) that alter the chemical, electromagnetic and genetic environment of the planet.

For the global economy to thrive, manufacturers of electronic equipment must keep selling more and more, year on year. To do that, the public need in turn to be lured into buying more and more, year on year. High-pressure advertising helps to do just that; people are persuaded to discard equipment in good working order and purchase paraphernalia claiming to incorporate the latest technological advances that, in any case, mean little or nothing to them in reality.

So what gets discarded in this ever-widening vicious circle ranges from hand-held calculators to laptops and desktops, and from mobile phones to refrigerators. It has been estimated that 500 million personal computers worldwide were confronted with a surprisingly premature and abrupt end to their otherwise useful life-cycle between 1994 and 2003. Sri Lanka too has had more and more deadly WEEE finding its way unnoticed and unrecognised into landfills and waste dumps over the past two decades.

Manufacturers of electronic items could play a major proactive role in waste management by extending product-life, and by adopting necessary ageing strategies for their products. That, however, seems a forlorn hope considering what the international electronics industry aims at: namely, built-in obsolescence to shorten product-life to keep selling newer products to the same consumers that much sooner. Revenues can still be generated by the extension of product-life through upgrades, repair and servicing. This would have the added bonus of cutting back on resource extraction in the context of fast-depleting and finite natural reserves, energy consumption, atmospheric pollution and waste. Unfortunately, genuine Corporate Social Responsibility seems to begin and end largely on paper, and the pursuit of profit before all else remains the guiding principle of business worldwide.

The most dangerous aspect of WEEE is that it contains extremely hazardous substances (such as chromium, cadmium and mercury, to name just three) that alter the chemical, electromagnetic and genetic environment of the planet and hence need to be disposed of with utmost care. The best possible strategy therefore is to not ingest the earth with these poisons and to delay discarding items containing them for as long as possible by resort to repair and reuse of such equipment and its components. Plastic and metal parts can be recycled, after dismantling and extracting the hazardous substances. This can be done either manually or through a mechanical process. Metals can also be recovered through incineration and refining, where the combustible material is incinerated. Most electronic equipment contains valuable elements and substances suitable for reclamation, including lead, copper and gold. These precious metals can be removed from printed circuit boards and components via chemical processes.



In the USA and the EU manufacturers are held responsible for the recycling of WEEE, especially in the case of personal computers. In Sri Lanka it is often difficult to hold manufacturers accountable, as many internationals operate via franchises or through dealers, and their factories are not located in this country. The next best thing, then, would be for local dealers to be persuaded to organise regular WEEE management seminars in the principal cities and towns to spread public awareness of the danger lurking in discarded electronic equipment. There are several illegal WEEE recycling shops operating in urban areas, and manufacturers' representatives here could help educate workers on proper and safe recycling practices as a part of their Corporate Social Responsibility programmes.

End-of-life vehicles

The old joke has it that vehicles come to Sri Lanka to die. The disposal of end-of-life vehicles (ELVs) is proving to be a major problem in waste management. With the number of vehicles on our roads increasing exponentially each year, the problem is likely to become acute to the point of unmanageability.

Some of the parts of discarded vehicles, such as seats and carpets, are invariably reused. The general metal content of a car, about 75%, can be recycled and extracted as pure steel in an arc furnace. Another product in recycling ELVs is waste oil which, if extracted properly, can be reused as fuel for industrial burners.

Recycling used tyres is already a common practice in Sri Lanka, where they are re-treaded or re-moulded and used, particularly on heavy vehicles. End-of-life tyres (ELTs) can also be used for coastal protection as erosion barriers, in breakwaters, as road embankment-markers, sound barriers and bunkers. Tyres can be shredded and used as foundation for roads and railways, as a draining material replacement for sand and gravels, and as an insulating under layer for roads. Tyre-derived aggregate drains up to 10 times better than well-graded soil and provides 8 times better insulation than gravel.

Crumb and powdered rubber can be used for flooring for playgrounds and sports stadiums, shock-absorbing mats for schools, paving blocks or tiles for swimming pool surroundings, and as roofing materials. ELTs can also be used as an alternative to fossil fuels; the calorific value of one passenger car tyre is equivalent to 7.6 litres of oil. Since combustion industries are currently facing issues with regard to increasing energy costs, there is obvious opportunities for tyre-derived fuels. In Europe, whole or shredded tyres are used as a supplementary fuel to partially meet energy demand of the cement industry.

Land filling

Prevention, reuse and recycling should always be favoured over disposal, and waste should not be land filled where an alternative use is possible. Regardless of the degree of reuse and recycling practised, there will always be a role for landfills in the waste management process. Landfills can also be the best waste management option for specific types of waste like those contaminated with asbestos, soil treatment residues, and inorganic sludge. Hazardous substances need to be carefully treated, and "neutralized", before being deposited in landfills.

Presently land filling is carried out in urban, low-lying marshy areas. This increases the value of the land by making it sufficiently stable for future construction activity. One potential drawback of landfills is that the leachate could cause surface and groundwater pollution. Even more of a problem, which should discourage the practice altogether, is that when marshland is filled, the natural seepage and run-off paths for rainwater get blocked off, resulting in frequent flooding of such built-up areas.

One possible alternative is to fill up and reclaim abandoned quarries and strip mines. This can form a first step in the rehabilitation and re-vegetation of these abandoned lands. However, great



care should be taken in that the waste used for filling should comprise appropriate material, and the filling should be done in an environmentally sustainable manner.

Waste-to-energy

As the organic components of the wastes in landfills decompose naturally, landfill gas (LFG) is produced. Half of LFG is methane (CH₄), a greenhouse gas that contributes to global warming. Instead of allowing LFG to escape into the air it can be captured, converted, and used as an energy source. LFG can be extracted from landfills using a series of wells and a blower (or vacuum) system. The collected gas should be processed and treated.

The methane can be used to generate electricity, which can be supplied to neighbouring houses or, if volumes warrant, be supplied to the national grid. LFG can also be used to replace fossil fuels in industrial and manufacturing operations. Here, a pipeline directly to the end-user, preferably one located close to the landfill, carries the gas. It can also be used for firing small pottery and glass blowing kilns, cement, brick and paper manufacturing units.

Incineration

Like land filling, incineration should be one of the last options considered in the waste management process. There are, however, instances where incineration would be preferable, the disposal of medical waste being one of them. Here too energy can be generated: the heat is transferred to generate electricity by using a steam turbine/generator. The efficiency of the waste-to-energy (WTE) plants can be increased by combining them with gas turbine generators. This super heats the steam generated in the WTE boiler, allowing more energy to be recovered from the WTE plant, and reducing the rate corrosion.

Climbing out of the garbage dump: a call for action

EFL calls for proper enforcement of the laws on solid waste management, which are designed to protect the natural environment and living areas and to ensure clean and healthy living conditions for human beings. This necessitates action by the State agencies that are mandated to collect and dispose of solid waste, and to ensure that the law is upheld. It also requires that members of the general public, including industries and the corporate sector as well as householders, take their environmental rights and responsibilities seriously, and start to take action to deal with the waste that they themselves generate.

By the government

The State has the responsibility for ensuring that individuals, establishments, corporate entities and Local Government Authorities conduct their day-to-day activities according to the law. At the moment they are not discharging these responsibilities adequately. EFL therefore calls for the government to immediately undertake the following actions:

- **Public awareness:** A rapid and effective awareness campaign on the illegality of littering and improper disposal of wastes.
- **Law enforcement:** Enforcement of the existing laws and regulation that govern waste disposal and management.
- **Imposition of appropriate fines:** Imposition of appropriate and adequate fines and penalties for littering and pollution. Current fines for littering under the Police Ordinance, Nuisance Ordinance and Penal Code specify a maximum of fifty rupees. This is absurdly low — even if enforced, this would not act as a deterrent, and is hugely disproportionate to the gravity of the offence referred to. Fines for littering need to be revised immediately, and to continue to be updated on a regular basis.



- **Monitoring the actions of Local Authorities:** Ensure that Local Authorities discharge their duties, including collecting and disposing of wastes properly. Where they fail to do so, call for their re-election and/or take appropriate measures to oversee their workings.
- **Implementation of appropriate strategies and plans:** Implementation of key elements of the National Strategy on Solid Waste Management, such as: encouraging farmers to produce and use organic compost instead of chemical fertilisers; setting waste disposal standards which specify what can and cannot be land filled; setting up of collection centres for recyclable items, encouraging sorting of waste at source; and working with and encouraging informal collectors of recyclable materials.

By the general public

The general public has a major role to play in the process of effective waste management. There is a need for people to take responsibility for the waste they create, and for them to be made aware of their duty to dispose of it in an environmentally friendly manner. EFL calls for members of the general public to immediately:

- Abide by the existing laws which govern waste management and disposal, and cease illegal littering and pollution.
- Report those who litter and pollute illegally, to the Police and the Local Authorities.
- Take action (including legal action) to ensure that Local Authorities carry out their waste collection and management duties effectively.

EFL also urges members of the general public to start to take active steps to reduce the waste they generate as they go about their day-to-day lives, including:

- **Waste avoidance and reduction:** The generation of waste in the process of consumption is inevitable. As a obvious corollary, increased consumption means increased waste as well. However if everyone plays his or her part in making a considered effort to avoid the usage of unwanted material and engages in good housekeeping practices, the waste generated can be appreciably reduced. Excessive and unnecessary packaging causes a colossal increase in the generation of solid waste. Consumers should, as a matter of prudent policy, opt for products that use biodegradable and/or recyclable materials for packaging (paper, glass, cloth) rather than harmful polyvinyl chloride (PVC) and other petroleum derivatives that are not biodegradable.
- **Sorting:** People can help to sort their own wastes depending on the space available for sorting and on how they plan to dispose of it. For example, waste can be handed over at designated collection points for subsequent sorting into paper, polythene, plastics, glass, metals and bio-degradables. Alternatively, a general separation of recyclable and organic wastes is also possible. However, separation at source should be the preferred approach as it results in better quality and quantity of re-usables, and also reduces considerably the volume of waste that needs to be dumped.
- **Re-use:** A product is considered waste when it is no longer of any use. Reusing items for as long as possible helps to reduce the amount of waste generated. Consumers should be encouraged to reuse products for other purposes without discarding them after one use. Consider, for example, that the reuse of polythene bags just one more time would reduce the current demand for polythene by half; of course.
- **Recycling:** Recycling of waste also helps to reduce and reuse the amount of waste to a considerable extent. What is not generally realised is that recycling not only reduces the environmental costs of resource extraction, it saves energy as well. The public should as far as possible be encouraged to hand over their waste to recycling centres or collection points that take in waste for recycling purposes. There are collection points set up by the CMC at



Torrington Road, Green Path and Wellawatte which accept glass, paper, plastic, polythene, tins and coconut shells. In addition, glass discards can be given to the Ceylon Glass Company in Ratmalana, and paper is accepted at the National Paper Co. Ltd. office at Union Place.

- **Composting:** Domestic waste in Sri Lanka is typically composed of a high proportion of biodegradable products. If a fraction of this waste can be composted, even at the domestic level, and taken care of at the point of generation, it will reduce the waste that needs to be dumped on roadsides or used as landfill material. Compost can be used to fertilise gardens and home gardens, and enrich the soil. At every home 'in-vessel composters' made of barrels, ferro-cement, wire-mesh or plastic can be used to compost waste. Plastic models are commercially available at a cost of SLRs 2,000-3,000. 'How to compost kitchen waste in your garden' is a publication that gives detailed information on composting, the methodology involved and its many benefits.

By the corporate sector

Companies and industries generate a large proportion of the waste generated in Sri Lanka today. EFL calls for businesses and industries to immediately:

- Abide by the existing laws that govern waste management and disposal, and cease illegal littering and pollution.

EFL also urges members of the corporate sector to start to take active steps to reduce the waste they generate as they go about their day-to-day business, including:

- **Waste avoidance/reduction:** Manufacturers play a major role in the generation of material that eventually becomes waste, and so should take an active role in the reduction of waste generation. Manufacturers should as far as possible use biodegradable material in the manufacturing process. However, there will be instances where synthetic material (plastics, polythene) need to be used. In such instances, manufacturers should wherever possible use recycled or biodegradable plastics. Complex products should be designed in a modular fashion, making the recycling, service and maintenance of products easier and cheaper. Joints and fastenings should be made so that they can be taken apart easily and non-destructively, after the end of their life cycle. Producers should adopt measures to make the materials easily identifiable to enhance their sorting and recovery. Packaging should also be minimised, and recyclable material used, since consumers invariably discard packaging directly after purchase. Shops and supermarkets should promote the use of long-lasting bags made from biodegradable materials and minimise use of polythene bags.
- **Re-use:** The waste generated by firms is largely non-biodegradable, yet most of it can be reused. The reuse of paper should be encouraged in all offices. Both sides of the paper should be used when photocopying documents. The reverse side of one-side printed sheets, as well as old envelopes, can be used for internal office memos and for rough work.
- **Recycling:** The active participation of staff should be sought for recycling of waste within the premises of each business. Waste can be sorted and then given to collection points or to recycling centres. Companies such as Abans and Neptune collect all types of paper waste from firms for recycling. Private entities such as supermarkets can also be brought into the loop as designated collection points for recycling ventures, and can even sell the collected items to generate funds to subsidise manufacture of more environmentally-friendly and reusable cloth bags. Backward integration with allied supply chains will help to identify user points for the collected waste, e.g. polythene bag manufacturers. Customers can be encouraged to recycle by the offer of discounts and price reductions, and the businesses involved can use these promotions as part of their Corporate Social Responsibility agenda.



¹ Pilapitiya S., 2006, Challenges of solid waste management in Sri Lanka: past, present and future, *Proceedings of the Seminar on Solid Waste Management in Sri Lanka: Opportunities and Constraints*, University of Peradeniya, Sri Lanka.

² See <http://www.efl.lk> for more information about EFL.

³ Vidanaraarachchi, C.K., Yuen, S.T.S., Pilapitiya, S, 2006. Municipal solid waste management in the Southern Province of Sri Lanka: problems, issues and challenges. *Waste Management* 26, 920-930.

⁴ ANZDEC Limited, 2005, *Delivering Natural Resource and Environment Management Services Sector Project, Draft Final Report*

⁵ ANZDEC Limited *op. cit.*

Environmental Foundation Ltd (EFL) is a non-profit public interest law group, whose mission is the conservation and enhancement of the natural environment through legal means. Since 1981 EFL has established itself as a driving force in promoting environmental justice for the people of Sri Lanka through the provision of mediation, representation and advocacy services, and legal and scientific support.



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