

Improper waste disposal and lack of adequate management plan in Pakistan has been the significant issues related to waste management. Recent years have seen some progress on this front through collaborative initiatives between government and civil society but much more is needed to uplift the flimsy scenario in this area of environmental protection and conservation.

Chapter 7 Waste Management – taking the responsibility

Inadequate collection and disposal of waste poses a serious health risk to the population and is an obvious cause of environmental degradation in most cities of the developing world. Mixed municipal solid waste is dumped either indiscriminately in the neighbourhood or, if collected by a waste collection service, disposed of in uncontrolled dumpsites.



Pressures

There are various sources of pressure on waste management techniques in Pakistan. Some of these are associated with sources of waste generation and treatment at generational stages while other pressures relate to lack of sheer gap of technological advancement in the country for solid waste management given the associated costs.

Hospital Waste

Waste management from both hospitals and municipalities is a gigantic problem in Pakistan. In Pakistan, around 250,000 tons of medical waste is annually produced from all sorts of health care facilities. Mixing of most of the hospital waste with municipal solid waste worsens the problem. Disposable syringes, foetuses, body organs, plastic bottles lay astray in the open dumps of the hospital waste [1]. Some hospitals and municipalities burn their wastes, which results in the production of large amount of highly toxic gases. It is quite unfortunate, that no monitoring has been done to measure the levels of these emissions and resulting pollution in the air.

Organic Waste

The organic fraction of this waste, often contributing to more than 50% of the total waste amount, threatens the health of residents as the indiscriminate waste dumps attract rodents and other disease carrying vectors. Organic waste is also responsible for pollution of soil and water bodies through leachate, and in the process of uncontrolled anaerobic degradation it contributes to global warming by the produced methane. A possible step in mitigating these detrimental effects is enhancing resource-recovering activities of the organic waste fraction. An obvious treatment and recovery option for organic waste is composting. However, before strategies can be developed on how to proceed, it is necessary to understand the existing organic waste management practices and try to assess current and potential markets for the converted organic waste.

Karachi is the largest city of Pakistan, a home to over 10 million people. The main components of urban solid waste management are faced with a major crisis because of the major concerns from the local pressure groups. There is a serious lack of long term plans, which result in a number of disjointed, ad-hoc and often counter productive policies, plans and administrative frameworks. Responsibilities for the collection, transport and disposal of household, commercial, and institutional waste as well as street sweepings, lie with the municipal authorities (Farhan, 2000). Sanitary workers are employed by Town Municipal

Administration to sweep streets and are often hired by residents to provide a primary waste collection service (Ali, S. M. and Cotton, A. 2001). Recently some private entrepreneurs, mostly refugees from Afghanistan have entered into the field of waste collection. Till 2001, the Karachi Metropolitan Corporation (KMC) was the responsible agency for solid waste management. Since August 2001, the administrative structure has been changed and the city is governed by the City District Government of Karachi which has replaced KMC and various other local authorities. The city of Karachi is now divided into 18 towns. The solid waste management remains the responsibility of city government and town municipal administration. Focus points of organic waste generation are at the two major markets of Karachi. According to estimates provided by Karachi Metropolitan Cooperation (KMC), approximately 100 tons/day originates from the Vegetable Market and some 70 tones/day from the Empress Market. Most of the waste generated at these markets are biodegradable and should thus constitute an excellent raw material for composting. Food wastes and garden waste are dominant in high-income localities as much of the remaining and half eaten food was disposed off in the refuse while the fresh food material was given to the servants. Here garden waste constitutes nearly 22 percent of the refuse compare to low-income settlements where dry leaves and other garden waste were found to be much less (< 9 %).



Solid Waste Collection and Disposal Flaws

Municipal solid waste (MSW) is collected in roadside bins and Municipal Corporation collects it infrequently. Solid waste generation ranges between 0.6 to 0.8 Kg/capita/day and the waste generation growth rate is 2.4% per year. Fairly around 40% of the generated waste remains either at collection points or in streets [2]. It is a common practise to burn this waste in open. Residential waste is usually collected and transported directly to a landfill site. However, these landfills are not designed properly causing problems like incomplete decomposition of MSW, methane production and leachate contamination of groundwater. At the collection points, different types of waste are not collected separately, and there is no proper waste collection system either. Waste is dumped un-segregated and collected by three methods: 1) hauled container system, 2) stationary container system and 3) bull carts.

In Pakistan, the containers are mostly transported from one place to another with help of a truck or tractor, which is overflowing and not covered properly. The waste spills out of the container and a lot of it falls in the streets before reaching the landfill site. Similarly, in certain areas bull and donkey carts are used to collect the MSW. The cart goes from street to street picking up the waste and is again not a proper system for waste collection. A fact sheet on Municipal Solid Waste Management (MSWM) has been developed by WWF Pakistan with a viewpoint to facilitate the readers on efficient practices of solid waste management.

Internal and External Issues

The problem of managing hazardous wastes is faced by Pakistan internally as well as at transboundary levels. Internally, the country is at a threat from 3 basic sources of hazardous waste – industrial chemicals, hospitals and stock of obsolete pesticides.

Amongst industrial chemical generating units, the petroleum and petro-chemical industries as well as pharmaceuticals, tanneries, textiles, pesticides, paint and dyes, fertilisers, inorganic chemicals and gender engineering industries contribute significantly to the hazardous waste levels. In addition, the post consumer electronic equipment has also been recognised as yet another sources of waste generation that contributes to hazardous waste

materials. Burning of plastics and chemical bath, which again releases toxic substances and result in air pollution, have been common practices amongst general public. These practices largely go unchecked by local authorities due to lack of awareness and checking mechanisms. Adding to this pressure are the recently adopted practices of using disposable needles, syringes and other medical items that are released into the environment without proper steps to manage their disposal. The large stocks of obsolete pesticides – quantities estimated at 3000 to 50000 tonnes – are another serious threat for waste managers.

State

Changing lifestyles, the increasing use of disposable materials and excessive packaging are all contributing to an increase in the amount of waste being created. Waste management is now a global concern. Problems associated with MSW management are complex because of the quantity and diversity of the nature of waste and financial limitations on public services in large cities. The problem is not only confined to land, it includes air and water as well.

Sources of Solid Waste Generation

Offices	Corrugated boxes, lunchroom waste, office paper, wood pallets
Households	Appliances, newspaper, clothing, disposable tableware, food packing, cans, bottles, food scraps, yard trimming
Commercial buildings	Corrugated boxes, food wastes, office paper, disposable tableware
Institutions	Office paper, cafeteria and restroom waste, classroom wastes, yard trimmings
Ferrous metals	Iron, steel, and tin and metal cans
Non-ferrous metals	Primarily Aluminium, Aluminium cans, copper, brass and lead
Wood based industries	Lumber, wood products, pallets and furniture
Rubber based industries	Tyres, footwear, wire cords, gaskets
Textiles	Furniture, clothing, and footwear
Miscellaneous	Other organic and inorganic materials, including rock, sand, dirt, ceramics, plaster, bones ashes, etc.

Based on the sources of solid waste, there are 2 primary components of municipal solid waste collection. The first is the hauled container system where containers loaded with MSW are taken to the disposal site, emptied and brought back to the same site or to the next site. In Pakistan, the container is mostly transported from one place to another with the help of a truck or tractor. The other system for solid waste collection is stationary container system where the containers are emptied into vehicles, so a number of containers can be emptied in one trip.

The solid waste disposal process in Pakistan is one which is least developed. 3 primary ways of disposing waste are in practice – landfill, size reduction and screening. Residential wastes are usually collected and transported directly to a landfill site. When new landfills are being planned, the most important issue is to find a location that is acceptable to the public and to local regulatory agencies. In the management of existing landfills, the major concern is to ensure that proper operational procedures are followed carefully and routinely. In the past, the term sanitary landfill was used to describe landfill where the waste was covered at the end of each day's operation. Today, sanitary landfill refers to an engineered facility, designed and operated to minimise public health and environmental impacts. Problems with landfills are subject to biological and physical factors in the environment. As a result, they change over time and may cause the several problems including leachate contamination of groundwater; methane production; incomplete decomposition and separation. The separation of solid waste components is one of the most positive and effective ways to

recover and reuse materials. Size reduction is a process in which collected waste materials are mechanically reduced in size. In practice, the terms shredding, grinding, and milling are used interchangeably to describe mechanical size reduction. The objective of size reduction is to obtain a final product that is reasonably uniform and considerably reduced in size in comparison with its original form. In addition, screening is used to separate mixtures of materials of different sizes into two or more sizes by using screening surfaces. Many new technologies have been developed to solve MSW problems, but unfortunately, these technologies are either too sophisticated or expensive for use in developing countries like Pakistan.



The Solid Waste Management (SWM) Department of Karachi Metropolitan Corporation (KMC) estimates that only 50% of the city's daily generation of 7,000 tons of rubbish is collected from the streets by the municipal service, while the rest remains at collection points and on dump sites. As the urban

environment in Pakistan continues to deteriorate, there is growing recognition of the need for a sanitation policy and sound operational strategies for dealing with the problem.

The formal sector of SWM comprises the government agencies which provide SWM services, such as the municipal service. Informal sector activities are those which are not regulated and controlled by government agencies, either in the form of the recycling enterprises of itinerant waste buyers and dealers or through self employed (private) and municipal sweepers collecting solid waste against an agreed payment from households.

There are independent operators dealing in waste collection, purchase, separation, restoration, resale and recycling, with the scale of operations ranging from itinerant manual workers to large recycling factories. Of the key sources for managing waste collection in the informal sector, following worth a brief mention here:

- Kabaris are large-scale waste dealers who operate from shops and warehouses. There are approximately 1,000 in Karachi and most specialise in just one type of waste which they buy at auctions or from middle dealers and resell to recycling plants, or recycle themselves.
- The Safai Kamai Bank operates every Tuesday from a bazaar in Karachi and uses the slogan "Garbage is Gold". People can bring their dry garbage for sale on a per kilogram basis – the price paid depends on the item. Items purchased include newspapers, other paper waste, plastic bags, metal, glass and plastic bottles.
- Waste Busters collect rubbish from households and charge about US\$2 a month, which includes the delivery of about 30 rubbish bags. The refuse is taken to the transfer station where it is sorted out and loaded onto trucks for recycling.
- A local NGO, Pakistan Environment Welfare and Recycling Program (PEWARP), has established a small production unit manufacturing three organic products from waste purchased from itinerant buyers at Karachi's huge vegetable market. The vegetable waste is crushed and the liquid extract collected which results in liquid concentrate sold as a pesticide, dilute liquid sold as fertiliser and solid residue.
- Shehri, a Karachi based NGO, also known as 'Citizens for a Better Environment' is primarily concerned with the protection and conservation of the natural and built environment. It has produced recommendations for improved bin designs and promotes awareness on solid waste management.

Due to ineffective development planning, large cities are confronting a number of complex urban problems. It is estimated, that the urban areas of Pakistan generate about 54,850 tons of solid waste daily or about 20 million tons per annum.

Presently only a part of solid waste is collected, transported and dumped. The means are inefficient and in most cases inadequate to cope with the present day challenges i.e. bulk and composition of municipal waste. Presently there is not a single city with properly planned and efficient system of SWM reaching the acceptable standard of environmental protection. Proper method of dumping the wastes is not employed. Hazardous hospital and industrial wastes are simply treated as ordinary waste. In most of the areas solid waste especially plastic bags get into open drains and sewers choking the system. In addition, bio-non-degradable solid wastes including toxic hospital and industrial wastes are found lying in heaps. Open burning of waste and bio-non-degradable component of wastes like plastic bags are adding to the pollution problems. Owing to the low levels of development and economic levels, it is not possible to make use of latest techniques, technologies and equipment being used in developed world. For this reason many parts of the large urban areas and in some cases entire cities have turned into environmental black spots. Our present system on solid waste management is in dire need of its over hauling on comprehensive basis. The respective municipalities despite spending their 20 to 40% budget have not been able to achieve the desirable standards of environmental quality. In view of this, it would be appropriate to involve private sector in solid waste management (SWM) on the whole or partial basis for any part or whole of the city. The involvement of private sector will enable the respective municipality to achieve the desirable standards of solid waste management with the reduced cost due to their efficiency and management.

Solid Waste Management Performance Indicators

Rate of waste generation/person	0.283 to 0.613 kg/c/d
Rate of waste generation/household	1.896 to 4.291 kg/c/d
Rate of waste collection	51 to 69 %
Expenditure for waste collection	334 to 1000 Rs./ton
Expenditure / person / year	35 to 39 Rs./c/y
Expenditure / house / year	224 to 603 Rs./h/y
Total staff / population	0.62 to 3.54 S/1000 p.
Population / staff member	282 to 1,613 p./staff
Total staff / household	4.53 to 23.72 s/1000 h
Households / staff members	42 to 221 h/s
Total staff / waste collected	2.63 to 15.67 s/ton
Waste collected / staff member	64 to 380 kg/staff

Source: <http://wedc.lboro.ac.uk/publications>

Solid domestic waste is typically dumped on low-lying land. Then it is burnt to reduce its volume and lengthen the life span of the dumpsite. However, refuse does not burn well and smouldering dumps produce clouds of smoke that can be seen from miles away, smell bad, and create a breeding ground for flies and rats. The result is unsightly and unsanitary conditions. This land could be used for more productive purposes and potentially valuable recyclable materials are lost. However, there is no proper waste collection system and waste is dumped on the streets while different types of wastes are not collected separately. There are no controlled sanitary landfill sites and citizens are not aware of the relationship between ways of disposing off waste and the resulting environmental and public health problems.

Recycling waste materials

The separation practices are well established and, as a result, quantities of certain waste components, such as bottles, newspapers, plastic, food waste and aluminium cans etc. are considerably reduced in the waste stream. Once re-saleable waste components have been separated from waste they are considered to be raw materials:

Waste Material	Common Reuse and Recycle
Broken glass	Glass bottles
Bottles	Washed and used again
Bread	Livestock feed
Newspapers	Various types of packing
Ferrous metal	Recycled in re-rolling mills
Paper	Cardboard etc.
Aluminium	Re-melt in moulds for various industries
Plastics	Uses/recycling depends upon type: toys, shoe soles, shopping bags, sandals etc.
Plastic bags	Buckets and other household containers
Magazines, books	Sold again at reduced prices
Old furniture	Sold again at reduced prices

Impact

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 characterised 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 – as well as uncollected waste in general – attract rodents and flies which provide a transmission route for disease.

At present very little awareness exists among the stakeholders in Karachi about composting, the product compost, and its characteristics. Alternative nutrient supply to crops is currently practised through the application of raw sewerage (on vegetables resulting in high health risks regarding to human consumption) and animal manure. The consumption of soil nutrients or similar products is also growing. Thus there is a possibility that if compost were introduced, it may be well received by the increasing potential users.

Improper disposal of municipal solid waste (MSW) has serious results for the environment and human health. Problems can spread over a wide area. For example disposal of wastes into nallahs, canals and rivers can pollute the water supply along the whole length of the watercourse. Infections and diseases can spread from dump sites into the general population.

Serious health hazards directly associated with improper solid waste management include skin and eye infections are common; dust in the air at dumpsites can cause breathing problems in children and adults; flies breed on uncovered piles of rotting garbage and spread diseases like diarrhea, dysentery, typhoid, hepatitis, and cholera. Mosquitoes transmit many types of diseases like malaria and yellow fever similarly, dogs, cats and rats living around refuse carry a variety of diseases including plague and flea born fever. In addition, intestinal, parasitic and skin diseases are found in workers engaged in collecting refuse.

Solid waste also contributes heavily to ground and water as well as air pollution levels. The most serious problem is groundwater contamination. As water filters through any material, chemicals in the material may dissolve in the water, a process called leaching. The resulting mixture is called leachate. As water percolates through MSW, it makes a leachate that consists of decomposing organic matter combined with iron, mercury, lead, zinc, and other metals from rusting cans, discarded batteries and appliances. It may also contain paints, pesticides, cleaning fluids, newspaper inks, and other chemicals. Contaminated water can have a serious impact on all living creatures, including humans, in an ecosystem. When

waste is burnt heavy metals like lead, toxic gases and smoke spreads over residential areas. The wind also carries waste, dust and gases caused by decomposition. Putrefaction of waste in sunlight during daytime results in bad smells and reduced visibility.

Response

The government has initiated a plan to privatise the MSWM in the country. This could be done using the present network of recyclers and scavengers to collect and process garbage. It would be in their interest to make arrangements with individual households and industries to segregate different recyclable at the source. This interest of the private collector in segregated garbage could be translated in payment in terms of 'free' garbage collection or cash payment for the segregated material. Nevertheless, much remains to be done and there is an urgent need now, more than ever before, to manage MSW from the time it is created to its safe disposal. The public and local municipal authorities need to work together. It is important to create awareness about the consequences of pollution so that people become conscious of the need to deal with this problem.

Pakistan has responded to its environmental problems by developing laws, establishing Government agencies and accepting technical assistance from donors. Despite this, the response remains fragmented and environmental institutions, laws, and other initiatives do not solve the whole problem. Environmental legislation is still not well developed in Pakistan, especially in comparison to the developed world. For example, there are no national quality standards for MSW. Currently, individuals dispose off wastes by throwing away plastic bags, wrappers, fruit peels, cigarette butts, etc. in public places. Littering spreads pollution and ends up clogging drains and causing sanitation problems. This can be controlled by making roadside dustbins or proper disposal of waste at home. If proper waste management is practiced, this waste could be converted into useful products.

Raising public awareness through media campaigns has been a welcomed step from the government's regularly authorities. However, the culture of reduce, reuse and recycle is still a long way from setting in as a trait of more conscientious society.

Solid waste management is also one of the core areas identified in the National Environmental Action plan as SWM planning in Pakistan is developing into a complex task because of increasing population. The primary focus of the program is to strengthen institutional capacities and policy processes for solid waste management. Currently the collection capacity of the concerned departments is less than desirable levels and only about 60% of the solid municipal waste is collected while remaining goes unattended.



Hospital waste incineration is gaining momentum in Pakistan. 'Private Sector Hospital Waste Management Program' is an example of one such project sponsored by a European donor. Under this project, two incinerators were installed one each at Shalamar Hospital Lahore and United Christian Hospital Lahore. The incinerators were said to meet the existing NEQS for air emissions in Pakistan. However, these emission standards are not stringent enough to ensure a safe operation. Such machines are also working at other renowned hospitals like Shaukat Khanum and Sheikh Zaid Hospitals in Lahore and Agha Khan Hospital in Karachi. Government has installed two incinerators at Karachi Metropolitan Corporation's (KMC) worth US\$703,442/-, which will burn the waste from KMC's hospitals. Pakistan Council for

Scientific and Industrial Research (PCSIR) has also invited applications to fabricate incinerators for Hospital Waste Management (HWM).



The incinerator set up in a Karachi hospital in 1981-82 is UK manufactured dual chamber incinerator with a capacity of 250kg/hour. The incinerator has a manual loading and de-ashing system, without having any flue cleaning equipment attached to it. Sometimes, excessive water in the waste causes incomplete combustion, which results in emissions of black smoke. Another incinerator made its way in a Karachi hospital in 1990-91 and is also UK made dual chamber with a capacity of 75kg/hour with a manual loading and de-ashing system, again without having any flue cleaning equipment. The conditions are further aggravated due to its low chimney height and location in a congested area. A Japan-made single chamber incinerator with a capacity of 170-180kg waste/hour was installed in 1986 in a Lahore medical complex with manual loading and de-ashing system, without a flue gas cleaning equipment attached to it. Its poor designing, problems in control and relays combined with incomplete combustion result in emission of black smoke. Four USA made non-trademark incinerators, each with a capacity of 60-80 kg/hour were installed in a medical science institute in Islamabad in 1993. It is shocking that the waste in these incinerators is burnt in plastic bags again resulting in toxic emissions. Recently, Ministry of Health, Government of Pakistan has prepared "Guidelines for Hospital Wastes Management". It recognises that most of the incinerators in Pakistan are installed without any emission control and proper monitoring devices. The guidelines aim at bringing hospital waste under emergency control; and introducing safer, more effective and more permanent control systems. However, the incineration technology is still foot loose in the country due to poor enforcement of legislation. WWF has been playing its role to divert this trend and make the public and policy makers aware of the threats, which incineration carries. Various press releases and articles have appeared in the print media highlighting the deadly impacts of incineration technology. A fact sheet has also been developed on Hospital Waste Management (HWM) promoting safer non-burning alternatives to incineration. Despite these efforts, waste management in Pakistan and the future of incineration technology in Pakistan still seems fearless and much needs to be done to curb this expanding problem. The first and gigantic step in bringing an anti incineration revolution should be a massive awareness raising among the public, government and the policy makers. Waste management at source should be introduced. Proper segregation can help in recovering and recycling of many parts of the waste stream. WWF strongly urges the international donors to provide technical and financial assistance to developing countries like Pakistan to introduce non-burning technologies for waste management. We also feel that the first important step in this situation is to bring out these issues at the front with a special focus on their remedial measures.

The Solid Waste Management Environmental Enhancement Project (SWEEP), (a project aiming to improve operation and management of solid waste disposal with the participation of local residents), was scheduled to be implemented in May 1997, utilizing the Japan Human Resources Development Fund (JHRDF) established in the United Nations Development Program (UNDP). Accordingly, the RMC planned to conduct its own activities using the equipment procured through the Grant Aid from Japan in line with SWEEP. However, as SWEEP did not actually get started until October, the procured equipment for garbage collection and land reclamation did not really start being used until March 1998, although they were ready as early as March 1997.

RMC bought 300,000 square meters of land in Mouza Losar, 25 km southeast of Rawalpindi City, as the new final disposal site planned in the Rawalpindi Package and planned to fully

adopt sanitary landfill methods for this site. However, the process was time consuming and the sanitary landfill method was only being used on a provisional site. Due to these delays, the old disposal site was still being used, although in the initial plans it was supposed to be closed. Therefore there was no improvement in the sanitary environment in that vicinity. Also, the equipment was damaged a great deal because it was used in inappropriate locations.

Similarly, although the Pakistan side was supposed to have completed a new mechanical workshop to take care of equipment operation and management (O&M) in 1997, it was not finished until 2000 and the equipment provided in the project only began to be used from this point. In 1995, the collection rate was only 40%, and has been maintained in the 90% range since the new administrative system was adopted. The initial goal of 64% was achieved.

Garbage collectors stated that once the container method was adopted for garbage collection, there was a dramatic improvement in sanitary conditions and that odors and flies decreased. A questionnaire survey was administered to 100 residents selected arbitrarily from four areas where the RMC provides the garbage collection. They all responded that the garbage in the city had decreased and that there had also been improvements from an aesthetic viewpoint. By covering garbage with soil in the sanitary landfill method, four technicians and two managers from the Department of Sanitation stated that sanitary conditions of water had been improved and fires due to the release of methane gas had been eliminated. However it depends on residents' awareness whether they dispose garbage in the containers, and information has not been completely disseminated so there are many cases in which garbage is left around the containers. This has resulted in many complaints from nearby residents concerning odours and garbage scattering caused by dogs and birds. About half of the residents responded to the questionnaire stated that they had become used to disposing their garbage into the containers.

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