A REVIEW ON INTEGRATED SOLID WASTE MANAGEMENT

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Abstract

Municipal Solid waste management (MSWM) has become an acute problem due to enhanced economic activities and rapid urbanization. Solid waste, which is a consequence of day-to-day activity of human kind, needs to be managed properly. We face problems associated with poorly managed solid waste operation. Increased attention has been given by the government in recent years to handle this problem in a safe and hygienic manner. Most cities do not collect the totality of wastes generated, and of the wastes collected, only a fraction receives proper disposal. The insufficient collection and inappropriate disposal of solid wastes represent a source of water, land and air pollution, and pose risks to human health and the environment. Solid waste management is characterized by inefficient collection methods, insufficient coverage of the collection system and improper disposal. An integrated planning and capacity building is required backed by financial support to control the situation. Life cycle assessment, categorization, recycling and reduction in all types of wastes and proper land filling are required. This paper proposes a discussion about solid waste types, their Impact on Human Health and the Environment, structure of integrated solid waste and Solid Waste Policy.

Keywords: *Integrated Solid waste management, Types, Impact on Human Health, and Solid Waste Policy.*

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1. INTRODUCTION

Municipal Solid waste management (MSWM) constitutes a serious problem in many Third World cities. Most cities do not collect the totality of wastes generated, and of the wastes collected, only a fraction receives proper disposal. The insufficient collection and inappropriate disposal of solid wastes represent a source of water, land and air pollution, and pose risks to human health and the environment. Over the next several decades, globalization, rapid urbanization and economic growth in the developing world tend to further deteriorate this situation. Solid waste management may be defined as the discipline associated with the control of generation, storage, collection, transfer transport, processing, and disposal of solid wastes in a manner that is in accordance with the best principles of public health, economics, engineering, conservations, and that is also responsive to public attitudes [1].

The nature and operation of solid waste management varies significantly from nation to nation. Distinctions such as these are not limited to the national scale however, and can be seen at the city and neighborhood level. Regardless of scale, these differences are to some extent attributable to prevailing socio-economic, financial, legal and political variables at that level. There is a clear requirement to reconcile the need for more effective waste management with the constraints that are faced by local municipalities or national governments. The identification of waste management as integral to sustainable urban development is increasingly recognized by the international aid and development community. The United Nations Conference on Environment and Development stressed that '...solid waste production should be minimized, reuse and recycling, maximized, environmentally sound waste disposal and treatment promoted and waste service coverage extended'.

2. DEFINITION AND TYPES OF MUNICIPAL SOLID WASTE

Municipal solid waste (MSW) refers to the materials discarded in the urban areas, for which municipalities are usually held responsible for collection, transport and final disposal. MSW encompasses household refuse, institutional wastes, street sweepings, commercial wastes, as well as construction and demolition debris. In developing countries, MSW also contains varying amounts of industrial wastes from small industries, as well as dead animals, and fecal matter [2].

Municipal solid waste (MSW): Also called urban solid waste, and is a waste type that includes predominantly

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household waste (domestic waste) with sometimes the addition of commercial wastes, construction and demolition debris, sanitation residue, and waste from streets collected by a municipality within a given area. They are in either solid or semisolid form and generally exclude industrial hazardous wastes. MSW can be broadly categorized into five broad categories as-

• **Biodegradable waste:** food and kitchen waste, green waste (vegetables, flowers, leaves, fruits), paper (can also be recycled).
• **Recyclable material**: paper, glass, bottles, cans, metals, certain plastics, etc.
• **Inert waste**: construction and demolition waste, dirt, rocks, debris.
• **Composite wastes:** waste clothing, tetra packs and waste plastics such as toys.
• **domestic hazardous waste** (also called "household hazardous waste") &**toxic waste:** medication, e-waste, paints, chemicals, light bulbs, fluorescent tubes, spray cans, fertilizer and pesticide containers, batteries, shoe polish. Sources of waste, waste generators& solid waste contents can be tabulated as bellow (Table-I) [3]-[8].

Source	**Typical waste generators**	**Solid waste contents**
Residential	Single and multifamily Dwellings	Food wastes, paper, cardboard, plastics, Textiles, yard wastes, wood, Glass, metals, ashes, special wastes(e.g., Bulky items, consumer electronics, Batteries, oil, tires), and household Hazardous wastes.
Industrial	Light and heavy Manufacturing, fabrication, Construction sites, power and chemical plants.	Housekeeping wastes, packaging, food Wastes, construction and demolition Materials, hazardous wastes, ashes, Special wastes
Commercial	Stores, hotels, restaurants, Markets, office buildings, Etc.	Paper, cardboard, plastics, wood, food Wastes, glass, metals, special wastes, Hazardous wastes.
Institutional	Schools, hospitals, prisons, Government centers.	Paper, cardboard, plastics, wood, food Wastes, glass, metals, special wastes, Hazardous wastes
Construction and Demolition	New construction sites, Road repair, renovation Sites, demolition of Buildings	Wood, steel, concrete, dirt, etc.
Municipal services	Street cleaning, Landscaping, parks, Beaches, other recreational Areas, water and Wastewater treatment Plants.	Street sweepings; landscape and tree Trimmings; general wastes from parks, Beaches, and other recreational areas; Sludge.
Process (Manufacturing, etc.)	Heavy and light Manufacturing, refineries, Chemical plants, power Plants, mineral extraction And processing.	Industrial process wastes, scrap Materials, off-specification products, Slay tailings
Agriculture	Crops, orchards, vineyards, Dairies, feedlots, farms.	Spoiled food wastes, agricultural Wastes, hazardous wastes (e.g., Pesticides).

Table-I: Sources of Solid waste contents and typical waste generators.

3. GLOBALIZATION, GENERATION OF WASTES AND THEIR IMPACT ON HUMAN HEALTH AND THE ENVIRONMENT

A positive correlation tends to exist between a community's income and the amount of solid wastes generated. Wealthier individuals consume more than lower-income ones, which results in a higher waste generation rate for the former. The processes of accelerated population growth and urbanization translate into a greater volume of wastes generated. Globalization can promote economic growth, a desirable outcome. However, this economic growth –in addition to population increase and urbanization– will seriously strain municipal resources to deal with a booming amount of wastes. Higher incomes and economic growth also tend to have an impact on the composition of wastes. Wealthier individuals consume more packaged products, which results in a higher percentage of inorganic materials –metals, plastics, glass, textiles, and so on– in the waste stream. Higher volumes of wastes and a changing composition have a profound impact on waste management practices. It also points out the policy changes that developing countries need to make. More wastes being generated and with a higher content of inorganic materials could have a significant impact on human health and the environment. If those additional wastes resulting from population and economic growth are not collected, treated and disposed of properly, health and environment in Third World cities will further deteriorate [2].

3.1. Human Health Impacts:

The group at risk from the unscientific disposal of solid waste include the population in areas where there is no proper waste disposal method, especially the pre-school children; waste workers; and workers in facilities producing toxic and infectious material. Other high-risk group includes population living close to a waste dump and those, whose water supply has become contaminated either due to waste dumping or leakage from landfill sites.

3.1.1. Infections:

- Skin and blood infections resulting from direct contact with waste, and from infected wounds.
- Eye and respiratory infections resulting from exposure to infected dust, especially during landfill operations.
- Different diseases that results from the vector borne disease
  a. Flies breed in some constituents of solid wastes, and flies are very effective vectors that spread disease.
  b. Mosquitoes breed in blocked drains and in rainwater that is retained in discarded cans, tyres and other objects. Mosquitoes spread disease, including malaria and dengue.
  c. Rats find shelter and food in waste dumps. Rats consume and spoil food, spread disease, damage electrical cables and other materials and inflict unpleasant bites.

3.1.2. Chronic diseases:

- **Hepatotoxicity**
  Hepatotoxicity (from hepatic toxicity) implies chemical-driven liver damage. The liver plays a central role in transforming and clearing chemicals and is susceptible to the toxicity from these agents.
- **Nephrotoxicity**
  Nephrotoxicity (from Greek: nephros, "kidney") is a poisonous effect of some substances, both toxic chemicals and medication, on the kidney. There are various forms of toxicity. Nephrotoxicity should not be confused with the fact that some medications have a predominantly renal excretion and need their dose adjusted for the decreased renal function (e.g. heparin).
- **Pulmonary toxicity**
  Pulmonary toxicity is the medical name for side effects on the lungs.Most cases of pulmonary toxicity are causes of chemical compounds and particulate matter.
- **Neurotoxicity**
  Neurotoxicity occurs when the exposure to natural or artifical toxic substances, which are called neurotoxins, alters the normal activity of the nervous system in such a way as to cause damage to nervous tissue. This can eventually disrupt or even kill neurons, key cells that transmit and process signals in the brain and other parts of the nervous system. Symptoms may appear immediately after exposure or be delayed. They may include limb weakness or numbness, loss of memory, vision, and/or intellect, headache, cognitive and behavioral problems and sexual dysfunction. Individuals with certain disorders may be especially vulnerable to neurotoxins.
- **Immunotoxicity**
  An immunotoxin is a chemical that can cause immune system malfunction (immunotoxicity) with exposure. When the immune system function is suppressed (immunosuppression) there is an increased susceptibility to infectious diseases and cancers. Immunotoxins can also cause autoimmune disease, where an overactive immune system attacks the bodies' cells.
  Chronic diseases will happen if the leachate that containing heavy metals contaminate our water source supply and indirectly it will affect the human food chain [25]-[28].

4. COLLECTION AND STORAGE

- Littering on the project site should be prohibited.
- To prevent clogging of the storm drainage system, litter and debris removal from drainage grates, trash racks, and ditch lines should be a priority.
- Trash receptacles should be provided in the contractor's yard, field trailer areas, and at locations where workers congregate for lunch and break periods.
- Litter from work areas within the construction limits of the project site should be collected and placed in watertight dumpsters at least weekly, regardless of whether the litter was generated by the contractor, the public, or others. Collected litter and debris should not be placed in or next to drain inlets, storm water drainage systems, or watercourses.
- Dumpsters of sufficient size and number should be provided to contain the solid waste generated by the project.
- Full dumpsters should be removed from the project site and the contents should be disposed of by the trash hauling contractor.
- Construction debris and waste should be removed from the site biweekly or more frequently as needed.
- Construction material visible to the public should be stored or stacked in an orderly manner.
- Storm water run-on should be prevented from contacting stored solid waste through the use of berms, dikes, or other temporary diversion structures or through the use of measures to elevate waste from site surfaces.
- Solid waste storage areas should be located at least 50 ft from drainage facilities and watercourses and should not be located in areas prone to flooding.
- Except during fair weather, construction and highway planting waste not stored in watertight dumpsters should be securely covered from wind and rain by covering the waste with tarps or plastic.
- Segregate potentially hazardous waste from non-hazardous construction site waste.
- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris [14]-[18].

5. CURRENT PROBLEMS:

Collecting, transporting and disposing of MSW represent a large expenditure for Third World cities. Waste management usually accounts for 30-50 percent of municipal operational budgets. Despite these high expenses, cities collect only 50-80 percent of the refuse generated. In India, for instance, about 50 percent of the refuse generated is collected, 33 percent in Karachi, 40percent in Yangoon, and 50 percent in Cairo, And disposal receives less attention as much as 90percent of the MSW collected in Asian cities end up in open dumps. In areas that lack refuse collection –usually low-income communities– residents tend to either dump their garbage at the nearest vacant lot, public space, creek, river, or simply burn it in their backyards. Uncollected waste may accumulate on the streets and clog drains when it rains, which may cause flooding. Wastes can also be carried away by runoff water to rivers, lakes and seas, affecting those ecosystems.

Open dumping of solid wastes generates various environmental and health hazards. The decomposition of organic materials produces methane, which can cause fire and explosions, and contributes to global warming. The biological and chemical processes that occur in open dumps produce strong leachates, which pollute surface and ground water. Fires periodically break out in open dumps, generating smoke and contributing to air pollution. Fires at open dumps often start spontaneously by the methane and heat generated by biological decomposition. Dump managers in some cities deliberately set periodic fires at the dumps in order to reduce the volume of the wastes, which allows more wastes to be disposed there and thus extends the life of the dumps. Human scavengers may also cause intentional fires, since metals are easier to spot and recover among the ashes after the fires than among piles of mixed wastes. Food leftovers and kitchen wastes attract birds, rats, flies and other animals to the dumps. Animals feeding at the dumps may transmit diseases to humans living in the vicinity. Biodegradation of organic materials may take decades, which may limit the future use of the land on which open dumps are located [2].

6. IMPORTANCE OF WASTE REDUCTION:

In the affluent countries, the main motivations for waste reduction are frequently related to the high cost and scarcity of sites for landfills, and the environmental degradation caused by toxic materials in the deposited wastes. The same considerations apply to large metropolitan areas in developing countries that are surrounded by other populous jurisdictions. The places that currently do not have significant disposal pressures can still benefit from encouraging waste reduction. Their solid waste departments, already over burdened, cannot afford to spend more money and effort on the greater quantities of wastes that will inevitably be produced as consumption levels rise and urban wastes change. Solid waste managers in developing countries tend to pay little attention to the topic of reducing non-organic wastes because the wastes they collect are between 50% to 90% organics, dirt and ashes. These municipal wastes, however, are amenable to composting or digestion, provided they contain very low levels of synthetic materials. Solid waste departments thus have an interest in promoting diversion of synthetic recyclables from the waste stream. Each household generates garbage or waste day in and day out. Items that are no longer needed or do not have any further use for fall in the category of waste and we tend to throw them away. There are different types of solid waste depending on their source. In today's polluted world, learning the correct methods of handling the waste generated has become essential. As the cities are growing in size and in problems such as the generation of plastic waste, various municipal waste treatment and disposal methods are now being used to try and resolve these problems [19]-[24].

7. INTEGRATED SOLID WASTE MANAGEMENT?

Integrated solid waste management (ISWM) is a comprehensive waste prevention, recycling, composting, and disposal program. An effective ISWM system considers how to prevent, recycle, and manage solid waste in ways that most effectively protect human health and the environment. ISWM involves evaluating local needs and conditions, and then selecting and combining the most appropriate waste management activities for those conditions. The major ISWM activities are waste prevention, recycling and composting, and combustion and disposal in properly designed, constructed, and managed landfills (Fig.I). Each of these activities requires careful planning, financing, collection, and transport, all of which are discussed in this. ISWM is defined as the selection and application of appropriate techniques, technologies, and management programs to achieve specific waste management objectives and goals. Understanding the inter-relationships among various waste activities makes it possible to create an ISWM plan where individual components complement one another. The unep international environmental technology centre (1996) describes the importance of viewing Solid waste management from an integrated approach [9]-[13].

Fig. I: The major ISWM activities.

8. SOLID WASTE POLICY: THE NEED FOR AN INTEGRATED WASTE MANAGEMENT APPROACH:

In order to handle growing volumes of wastes, the proper policies need to be enacted and implemented. In the developed world the approach to waste management regarded as the most compatible with an environmentally sustainable development is called "Integrated Waste Management." This approach consists of a hierarchical and coordinated set of actions that reduces pollution, seeks to maximize recovery of reusable and recyclable materials, and protects human health and the environment. Integrated Waste Management aims to be socially desirable, economically viable and environmentally sound. The Integrated Waste Management approach, however, should be adapted to the local conditions when implemented in Third World cities. Integrated Waste Management has the following structure:

8.1. Waste Prevention:

Waste prevention is given the highest priority in Integrated Waste Management. This is a preventive action that seeks to reduce the amount of waste that individuals, businesses and other organizations generate. By not creating waste, fewer collection vehicles and a fewer number of refuse collectors would be needed; fewer and smaller waste handling facilities would be required, and it would extend the life of the landfills. Society as a whole would be benefited from a successful implementation of a waste prevention program.

There are several ways in which waste generation can be prevented:

- By enacting public policies that discourage the production, sale and consumption of products containing unnecessary packaging material
- By enacting public policies that discourage the production, sale and consumption of disposable products
- By enacting public policies that encourage the production, sale and consumption of reusable or recyclable products
- By enacting public policies that encourage the production, sale and consumption of long-lasting products (which do not have to be discarded often)
- By enacting public policies that promote the consumption of large-size products. The amount of packaging material –plastics, glass or metal– needed to contain a kilogram or liter of a product decreases as the size of a product increases. In other words, larger bottles and containers require less material per unit of product than smaller ones. When they are discarded, it results in

less waste that needs to be collected, transported and disposed of

- By enacting public policies that encourage the production, sale and consumption of repairable products (that do not have to be discarded when they malfunction)
- By minimizing the weight of products. Public policies could encourage the production, sale and consumption of light-weight products (which, when discarded, would result in a reduction of the weight of the waste to be collected, transported and disposed of)[2]

8.2. Reuse:

Once the waste prevention program has been implemented, the next priority in an Integrated Waste Management approach is promoting the reuse of products and materials. Reuse consists in the recovery of items to be used again, perhaps after some cleaning and refurbishing. Reusing materials and products saves energy and water, reduces pollution, and lessens society's consumption of natural resources compared to the use of single-use products and materials. Reuse of materials and products is regarded as more socially desirable than recycling the same materials. Cardboard boxes that are used for shipping products, for example, can be folded and sent back to the manufacturer to be reused for shipping the same or other products. Cardboard boxes can also be recycled at paper mills, but in order to recycle the boxes water and energy are required. Paper recycling also generates sludge in the process, which need to be disposed of. Beverage bottles –soda or beer bottles– can be disposable, returnable (reusable) or recyclable. Reusable bottles have the lowest environmental impact of the three, while disposable bottles require the most energy, water and generate the largest amount of waste and pollution. Products, such as office furniture and appliances, can also be reused. Some private companies, such as Dow Chemical, have created programs by which products no longer needed in a particular location can be sent to another plant within the same company where they can be reused. If the materials / products are not needed within the company, they can be sold to another. Thus, a reuse program not only saves money, but it can also be a source of revenue for the companies that implement them. Reuse can be profitable for the companies that engage in it: Xerox implemented a cardboard box reuse program that saved them money by not having to buy new boxes for its shipments of products, parts and components. Therefore, reuse of products and materials can prevent pollution, reduce waste, and improve industrial and economic competitiveness. Even though private companies have created reuse programs on their own, if public policies existed to promote it, reuse could dramatically increase. Public policies that provide incentives for businesses and individuals to engage in reuse can have a significant and positive economic and environmental impact [2].

8.3. Recycling:

After the reuse of materials and products, recycling comes next in the Integrated Waste Management hierarchy. Recycling is the recovery of materials for melting them, re-pulping them and reincorporating them as raw materials. It is technically feasible to recycle a large amount of materials, such as plastics, wood, metals, glass, textiles, paper, cardboard, rubber, ceramics, and leather. Besides technical feasibility and know how, demand determines the types and amounts of materials that are recycled in a particular region. Areas with a diversified economy and industrial base usually demand more different types of raw materials that can be recycled. It provides an income to the scavengers who recover recyclable materials. Factories that consume recyclable materials can be built for a fraction of the cost of building plants that consume virgin materials. Recycling saves energy, water, and generates less pollution than obtaining virgin raw materials, which translates into lower operating costs. Recycling also reduces the amount of wastes that need to be collected, transported and disposed of, and extends the life of disposal facilities, which saves money to the municipalities. Recycling can result in a more competitive economy and a cleaner environment, and can contribute to a more sustainable development. Recycling can be conducted in a number of ways. In the developed world, municipalities have created recycling programs, which usually involve separation of recyclable materials at the source of generation. In this type of programs, individuals and businesses separate their recyclable materials in a different container and before they are mixed with the rest of their garbage.

The materials commonly separated at the source include metals, glass, paper and plastics. The cleaner and the more homogeneous a material is, the higher the price industry is willing to pay for it. Therefore, source separation is preferable to salvaging materials from mixed wastes. "Materials Recovery Facilities" (MRF's) have been used in some developed countries. MRF's are plants where recyclables are recovered sorted and processed for sale to industry. MRF's can either process source-separated recyclables from a recycling program, or mixed wastes the way they are collected from residential and other sources. MRF's typically use different types of magnetic and pneumatic equipment, as well as conveyor belts and human sorters to classify the recyclable materials. In the developing world, municipalities usually lack recycling programs. That does not mean, however, that recycling does not exist. Informal recycling is common throughout Africa, Asia and Latin America. Scavengers carry out the bulk of recycling of municipal wastes. Scavengers salvage recyclable materials on the streets, before collection crews arrive, at communal refuse dumpsters, at illegal open dumps, as well as at municipal open dumps and landfills, The structural causes of scavenging are under development, poverty, unemployment, the lack of a safety net for the poor, as well as industrial demand for inexpensive raw materials. These factors are likely to continue to exist in India. Therefore, a public policy that supports scavenging activities would be humane, as well as make social, economic, and environmental sense. Support for scavenging activities could take the form of:

- Legalization of scavenging activities. National legislation could recognize the social, economic and environmental impact of scavenging by legalizing this activity
- National legislation could promote recycling activities in the country
- Actively supporting the formation of scavenger micro-enterprises, scavenger cooperatives and public- private partnerships. National legislation and guidelines would greatly facilitate scavenger efforts to organize themselves
- Allowing, from a legal and institutional point of view, community-based refuse collection to exist and function
- Allowing community-based organizations to obtain loans in order to provide waste management services
- Microcredit has demonstrated in several countries that can be an effective tool for creating jobs and reducing poverty. Microcredit schemes could be created to provide loans to potential refuse collectors for purchasing locally-made collection vehicles [2].

8.4. Composting:

Composting is the process of aerobic biological decomposition of organic materials under controlled conditions of temperature, humidity and P^H so that the result is a soil conditioner that can be used in landscaping, agriculture and horticultural projects. Considering the high proportion of organic matter in the waste generated in Third World cities (typically over 30%), composting can be an option to reduce the amount of wastes that are land filled, thus extending their lifespan. When composting is conducted under controlled conditions, it does not generate odors and does not attract flies or other animals. Composting recycles nutrients by returning them back to the soil. In developing countries, experience with composting of mixed municipal solid wastes has been largely negative. When inorganic materials –such as plastics and metals– are mixed in with organic matter, they are considered contaminants and the quality of the compost is lower. The lower the content of inorganic materials that enters the process, the higher the quality of the resulting compost. Source separation of organic matter at residences for composting is difficult to conduct. Market waste, however, usually contains a high percentage of organic matter, since it is composed, to a large extent, of discarded produce.

Market waste could be recovered and composted at a relatively low cost. Hotels should also be encouraged to create recycling and composting programs, and to institute source separation activities into inorganic and organic wastes. In this way, all organic materials could be composted. Hotels would also benefit from a greener image, which they could use in their marketing campaigns. Hotels would publicize their commitment and efforts in environmental protection. It would be a win-win situation for hotels, the economy and the environment. There are several composting technologies and equipment. In-vessel composting is the most sophisticated and expensive method, but it has the advantages that it can be conducted in small space, and the process is faster. In-vessel composting takes place in an enclosed structure (reactor) and consumes electricity. Therefore, in-vessel composting entails high construction and operating costs. Windrow composting is the least expensive option and may be more appropriate to the socioeconomic and climate conditions prevalent in many Third World cities. In windrow composting, the organic material is arranged into long piles that are turned periodically to aerate them and to prevent the development of anaerobic conditions. The windrow method takes advantage of the solar energy and therefore uses little energy, maintaining costs low. Temperature, moisture and P^H in the compost piles must be monitored to ensure that composting occurs under optimal conditions. The windrow composting method is labor-intensive and can thus create jobs for unskilled workers. This composting method requires an open space, preferably over a paved surface with a slight downward slope and ditch to collect any excess runoff water. Since organic matter usually contains high moisture content, evaporation and decomposition can reduce the weight of the material by about 50%. Composting also prevents pollution and extends the life of landfills. It is socially desirable to divert as much organic matter from the landfills as possible, if it can be done at a low cost [2].

8.5. Incineration:

In an Integrated Waste Management approach, incineration occupies the next to last priority, after waste prevention, reuse, recycling and composting have been undertaken. Incineration is the burning of wastes under controlled conditions, usually carried out in an enclosed structure. Incineration may include energy recovery. Wastes generated in developing countries, however, usually do not allow energy recovery, due to their high moisture and high content of organic matter. Experience with incineration in developing countries has been mostly negative. Incinerators built in Africa, Asia and Latin America did not function as promised. In Lagos, Nigeria, incinerators were built at a cost of U.S. $ 10 million. The moisture content of wastes was so high that fuel had to be added to maintain combustion, which increased costs significantly. The incinerators never operated normally, one was abandoned and the other turned into a community center. Similar experiences have been observed in India, Mexico, the Philippines, Indonesia, and Turkey. Therefore, incineration of MSW is likely to fail in many Third World cities [2].

8.6. Sanitary Land filling:

Final disposal of wastes at sanitary landfills is given the lowest priority in an Integrated Waste Management approach. A sanitary landfill is a facility designed specifically for the final disposal of wastes that minimizes the risks to human health and the environment associated with solid wastes. Sanitary landfills commonly include one, two or three different liners at the bottom and sides of the disposal area, in order to prevent leachates from polluting nearby surface waters or aquifers. Liners also prevent the underground movement of methane. Waste arriving at landfills is compacted and then covered with a layer of earth, usually every day. This prevents animals from having access to the organic matter to feed. Sanitary landfills may also include other pollution control measures, such as collection and treatment of leachate, and venting or flaring of methane. It is possible to produce electricity by burning the methane that landfills generate. Disposing of all municipal wastes collected at landfills is not desirable from a social, economic and environmental point of view. Sanitary landfills require significant investments and they often present political obstacles for their construction, due to local opposition. Residents who live near a proposed landfill may oppose its construction. This opposition is termed “Not in my backyard” or NIMBY syndrome. Extending the life of landfills and diverting as much as possible by waste prevention, reuse, recycling and composting can make economic sense. Diverting materials from landfills can also create jobs, reduce poverty, improve economic competitiveness, reduce pollution and conserve natural resources. Sanitary landfills are necessary for final disposal of the wastes that could not be prevented, reused, recycled or composted. Ideally, sanitary landfills should be used primarily for non -reusable, non-recyclable and non-compostable residues. Sanitary landfills constitute a dramatic improvement over disposal of wastes in open dumps. Sanitary landfills greatly reduce pollution and risks to human health and the environment compared to open dumping [2].

CONCLUSION:

MSWM in the Third World is unsatisfactory. The improper management of solid wastes represents a source of air, land and water pollution, and poses risks to human health and the environment. Despite considerable expenses, the situation tends to further deteriorate due to the rapid growth of cities likely to occur over the next few decades. Globalization is likely to boost economic growth in the developing world, which would increase the amount of wastes that need To be collected, transported and disposed of, further straining Third World cities. Conventional solutions to MSWM in the Third World often rely in high-tech, high-cost, Bureaucratic, and centralized alternatives. Conventional solutions usually do not consider the Profound differences between First and Third World conditions, resulting in less than optimum Outcomes. Conventional solutions frequently involve the transfer of MSWM technology from industrialized to developing countries. International development banks and bilateral development agencies tend to favor this transfer of technology. The experience on the use of advanced technology in developing countries, however, has been largely negative. Compactor trucks, incinerators, in vessel Composting, and materials recovery facilities tend to be inappropriate to the conditions prevalent in developing countries. The transfer of technology and successful models for waste management in Third World cities should be examined. An analysis of best practices and lessons learned in order to promote South-South transfer of technology and waste management methods should be conducted.

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