SOLID WASTE

Solid waste can be defined as material that no longer has any value to the person who is responsible for it, and is not intended to be discharged through a pipe. It is generated by domestic, commercial, industrial, healthcare, agricultural and mineral extraction activities and accumulates in streets and public places. The words “garbage”, “trash”, “refuse” and “rubbish” are used to refer to some forms of solid waste.

Present status in Pakistan

- It is estimated that presently, 56,000 tons per day of solid waste is generated in Pakistan.
- No weighing facilities are installed at any disposal sites
- Open burning of waste or open disposal
- Collection 51-69 %
- No Disposal facilities
- A lot of potential for recycling and involvement of private sector which is overlooked
- Hazardous hospital and industrial wastes are being simply treated as ordinary waste

Present status in Pakistan

- None of the cities in Pakistan has a proper solid waste management system right from collection of solid waste up to its proper disposal.
- Much of the uncollected waste poses serious risk to public health through clogging of drains, formation of stagnant ponds ,and providing breeding ground for mosquitoes and flies with consequent risk of malaria and cholera.

What is Solid waste Management

As discipline concerns the control of generation, storage, collection, transfer and transport, processing and disposal of solid waste in a manner, that is in accordance with the best principles of public health, economics, engineering, conservation aesthetics, and other environmental considerations, and that is also responsive to public attitudes

Development of Solid waste Management cont…

- It includes all administrative financial, legal, planning and engineering functions involved in solution of all problems of solid waste.
- History First book written was "Disposal of Municipal Refuse"1906 telling about waste disposal methods
  1) dumping on land, 2) In water,
  3) Plowing in soil, 4) Feeding to animals Hogs, 5) Reduction and;
  6) Incineration

Functional Elements of SWM

grouped into Six:

A- Waste generation,

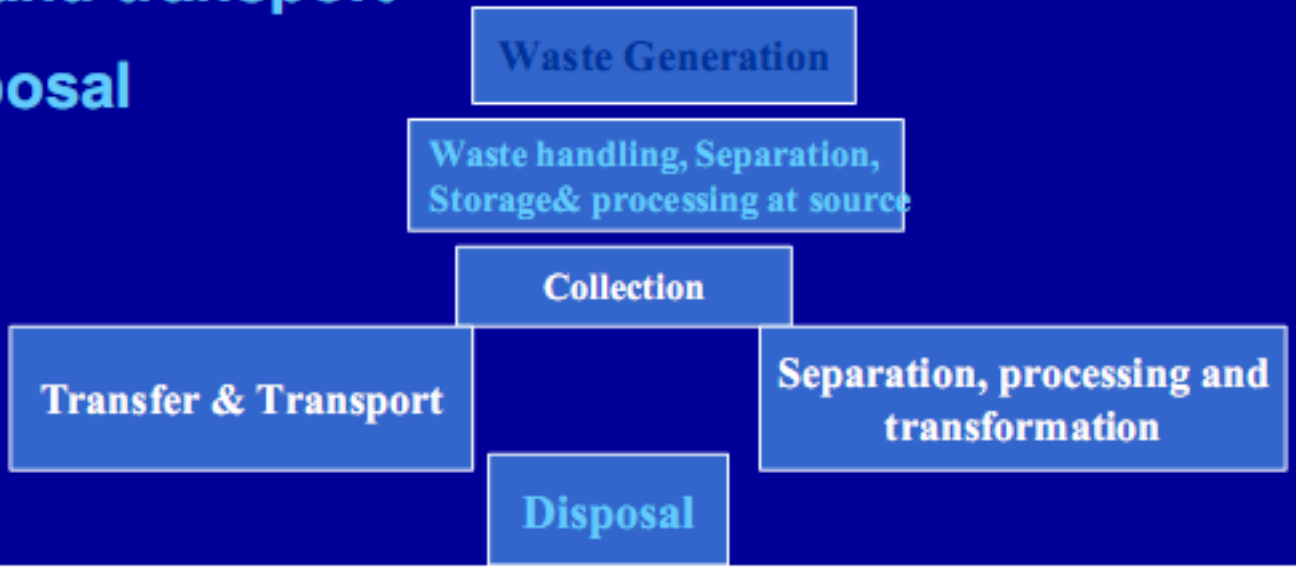
B- Waste handling, separation, processing and storage at source

C- Collection,

D- Separation, processing and transformation,

E- Transfer and transport

F- Final disposal



Waste generation

includes all activities in which a material is identified as no longer for use, for throwaway or gathered together for disposal. Example candy wrapping to be thrown outdoor once consumed. Waste generation steps varies with individual. At present waste generation activity is not controllable.

Waste handling, separation, processing and storage at source

Handling consist of all activities like separation, processing and storage at source and associated management of SW until they are placed in containers for collection. Handling includes movement of loaded containers to the point of collection, separation at source.

On site storage is of primary importance because of public health concern and aesthetic consideration.

Collection

It includes not only gathering of solid waste and recyclable but also transport of material after collection to the location where vehicle is emptied

Separation

Includes recovery of separated material, separation and processing, components and transformation that occurs primarily in the locations away from the source of generation. Transformation here is used to reduce the volume and weight is reduced and requiring disposal, resource conservation products and finally energy. – Can be achieved by a variety of chemical and biological processes like composting.

Transfer and Transport

it involves

a) transfer of waste from smaller collection vehicles, to larger transport vehicles/equipments

b) subsequent transport of waste usually to long distance to a processing or disposal site

Disposal

is the last step in solid waste management- land filling or land spreading either directly from source or after processing and recovery of materials, residues of combustion. A modern landfill is not a dump but an engineered facility used for disposing of solid waste on land or within the earths mantle without creating nuisance or hazards to public health or safety

SOURCES OF SOLID WASTE

include

- Residential areas.
- Commercial areas.
- Institutions.
- Industries.
- Construction and demolition activities.
- Municipal services.
- Agricultural activities.
- Treatment plants.

RESIDENTIAL AND COMMERCIAL WASTE

Residential: generated from residential areas.

- Organic (combustible) and non-organic, includes food, paper, plastics, textile, garden trimmings, glass, household hazardous waste.
- Commercial generated from stores, restaurants, hotels, markets, offices, service stations, auto workshops, print shops e.t.c. includes Paper, cardboard, wood, glass, plastic, special waste.

- Commingled mixed wastes not separated at the source
- Putrescible waste that will decompose rapidly, primarily food

INSTITUIONAL WASTE:

- Generated by government buildings, schools, prisons and hospitals
- Does not include medical waste which are typically incinerated and manufacturing wastes from prison.

CONSTRUCTION AND DEMOLITION WASTE:

- Construction and repair of buildings and other sources (e.g. road repair, sewer jobs, renovations), wood, concrete, steel, shingles, stones, plaster, dirt, bricks, etc.

MUNCIPAL SERVICES:

- Results from the O&M municipal facilities and the provision of other municipal services.
- Street sweeping/cleaning, cleaning of drains, parks, food, paper, sweepings, dead animals.

TREATMENT PLANT WASTE AND OTHER RESIDUE:

- Solid and some solid waste from water, waste water and industrial treatment facilities.
- Characteristics vary depending on the nature of treatment process.

- **ASHES AND RESIDUES:**
- materials remaining from the combustion of wood , coal ,coke , and other combustible wastes.
- Fine powdery materials chalks and small amount of burned and partially burned materials.
- Glass, crockery and various metals are found in the residues of municipal incinerators.

INDUSTRIAL SOLID WASTE:

- Comes from processing and non-processing industries and utilities. Composition is site specific and depends upon the raw material, processor used and markets which provide the base for a given industrial activity.
- Industrial processes waste, scrap materials, etc. and non-industrial waste including food waste, special waste, hazardous waste, rubbish etc.

SOLID WASTE COMPOSITION

- Plastic, rubber, metal, paper, cardboard, textile, glass, food, animal waste, leaves, grass, straws and fodder, bones, wood, stones and fines
- Food Wastes: 8.4% to 21 %
- Leave, grass, straw, fodder: 10.2% to 15.6%
- Fines: 29.7 % to 47.5 %
- Recyclables: 13.6 % to 23.55 %

Environmental problems due to Solid Waste

Ground pollution: As water percolates through SW, 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.

Air pollution

When 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 results in bad smells.

Solid Waste Treatment

- **COMBUSTION/Incineration:** Chemical reaction of oxygen with other organic material to produce oxidized compounds
- Used to destroy organic fraction of waste = reduce volume and threat to environment (destroys toxic compounds)
- **PYROLYSIS:** Combustion in the absence of oxygen OR to split through a combination of thermal cracking and condensation reaction in an oxygen free atmosphere, into gases, liquids and solid fractions.
- **BIOLOGICAL TRANSFORMATION OF MSW**
- **LANDFILLING/DISPOSAL**

Composting of SW

- defined as "biological decomposition of biodegradable organic constituents of waste under controlled conditions to a state sufficiently stable for nuisance free storage & handling and for safe use in land applications"
- About 70% of MSW is decomposable / compostable
- Main organisms involved in composting are: actino-mycetes (filamentous bacteria), fungi and protozoa

Objectives of Composting

- to transform biodegradable OM into biologically stable material thereby reducing the original volumeof the waste
- to destroy pathogens, insect eggs and other unwanted organisms and weed seeds that may be present in MSW;
- to retain maximum nutrient content; and
- to produce a product that can be used to support plant growth and as a soil amendment as fertilizer and soil conditioner

Composting time depends on

- Nature of waste
- Moisture content
- Available nutrients
- Other environmental factors

- Under controlled conditions, can be made more effective and efficient
- Organic matter + O_2 +nutrients +microbs ------ New cells + resistant OM + CO_2 + H_2O + NH_3 + SO_4 + heat
  - Reduces weight/volume of the organic fraction of MSW
  - Produces compost (a humus like material that can be used as a soil conditioner)
  - To produce methane - BioGas

STEPS IN COMPOSTING

- **PREPROCESSING**
- **Receiving**
- **Sorting/separation: removal of recyclable material, metals, debris, glass etc. - affects the quality of**
- **Size Reduction/Screening: to provide greater surface area for microbes to attack,**

  to improve insulation,

  to facilitate homogenizing of initially heterogeneous material, to reduce depth for oxygen diffusion.

  If size is too small, it impedes the diffusion of oxygen and CO2 from the sites being attacked especially during thermophylic stage when Oxygen demand is the highest.
- **Typical range for feed material = ½ - 2 inches.**

STEPS IN COMPOSTING

- Adjustment for waste properties (e.g C/N ratio)
- Decomposition and curing/maturation:
- Types are: Static piles and in-Vessel composting
- Preparation and marketing of the final compost product: Grinding, screening, air classification, blending with various additives, granulation, bagging, storage and transportation

Collection in Residential Area

Collection in Residential Area

Recycling (Scavengers)

- AN OVERVIEW OF GREEN GOLD PROJECT

Green Gold

A-Community Based Solid Waste Management Program

PHASES IN PROJECT

- Phase I
  - **MASS COMMUNITY MEETING**
  - **BASE LINE SURVEY**
  - **COMMUNITY MOBILIZATION**
  - **Change in Basic Concept**
    - **Reduce**
    - **Reuse**
    - **Recycle**
  - **TRAINING OF THE LOCAL NGO/CBO and CCB**
  - **COLLECTION FROM DOOR TO DOOR**
  - **DISPOSAL (At TMA site)**

PHASES IN PROJECT

- Phase II

- **SOURCE SEPARATION**
- **COLLECTION**
- **Resource Recovery**
- **DISPOSAL (Organic at TMA site)**

PHASES IN PROJECT

- Phase III

  - **Resource Recovery of Inorganic**
  - **Composting of Organic**
  - **Marketing of Manure**
  - **Training of Other Stake Holders**

Why Composting?

There are three options for waste disposal which are used through out the world

- Sanitary land filling
- Incineration
- Composting

Composting is Cost effective, replicable and technically easy

Composting

- Green Gold Project Use Windrows Technology for composting of waste
- Which produce quality manure with good NPK value
- With good C/N Ratio
- Biologically effective for all type of soils

Utilization of Solid waste in Green Gold

- **Organic Waste transform into Manure** — **50%**
- **Inorganic waste as resource recovery** — **45%**
- **Waste Sent to Landfill site** — **5%**

Economic Feasibility

HR Requirements

House Hold	1000		
Description	Qty	Rate	Total Salary
Collection Workers	4	3500	14,000
Plant Worker	8	3500	28,000
Supervisors	2	7000	12,000
Manager	1	10000	10,000
Total	**15**		**64,000**

Cont…..

Economic Feasibility

1	i-Operational Cost	Unit	Rate	Qty	Total
1.1	Composting Material	Lump sum	3000	1	3,000
1.2	Lab Instruments	Lump sum	3000	1	3,000
1.3	Stationary and Printing of logs	Lump sum	3000	1	3,000
1.4	Gloves, Boots etc	Lump sum	2000	1	2,000
1.5	Salaries for Administration Staff	Monthly	22000	1	22,000
1.6	Staff salary for support staff	Monthly	42000	1	42,000
	Sub total				75,000
2	ii- Operational Cost				
2.1	POL and maintenance of vehicles	Monthly	5000	1	5,000
2.2	Utility Bills and Sundries	Monthly	5000	1	5,000
2.3	Lab Charges	Monthly	2000	1	2,000
	Sub total				12,000
	Total				87,000

Cont…

Economic Feasibility

Expected Income & Expenditure Chart

Population	HH	Waste Produced		Weight in Ton	
6300	1008	3213		3.213	
Type of Waste	**Percentage**	**Total (kg)**	**Compost**	**Rate**	**Income**
Organic per day	65%	2088.45	522.1125	0.5	261.06
Inorganic per day	35%	1124.55			
Total	**100%**	**3213**			**261.06**
Inorganic			**50Kg Pack**	**Rate**	**Income**
Rags	27%	303.6285	6.1	0	0
Plastic Bags	42%	472.311	9.4	3	1416.93
Paper and Packages	21%	236.1555	4.7	2	472.31
Glass	4%	44.982	0.9	2	89.96
Plastic Bottle	3%	33.7365	0.7	3	101.21
Other	3%	33.7365	0.7	0	0
Total per day	**100%**	**1124.55**			**2080.418**
Organic Sale (Month)					**7,832**
Inorganic Sale (Month)					**62,413**
Service Charges Collection (Month)					**30,240**
Total Expected Income (per Month)					**100,484**

Life of Land Fill Site

Sr#	Description	Local Government	Green Gold
1	Daily Waste production (ton)	4000	4000
2	Waste Transported to Land Fill (ton)	4000	200
3	Monthly Area covered at Land fill	60000	6000
4	Year Land fill covered	720000	72000
5	Life of 6 Million Cubic Meter Land fill (Years)	8	83

Program Services Comparison

Sr#	Services	Local Government	Green Gold
1	Awareness about Solid Waste Management	No	Yes
2	Community Involvement for SWM	No	Yes
3	House to House Collection of Waste	Partially	Full Coverage
4	Collection at Transfer Stations	Yes	No
5	Transportation to Land fill	Partially	No
6	Transferred to Composting Plant	No	Yes
7	Segregation of Organic and Inorganic	No	Yes
8	Resource Recovery	By Scavengers	Project staff
9	Percentage of Resource Recovery at all informal, Formal and by House hold it self	40%	95%
10	Composting (Manure Preparation)	No	Yes
11	Socio Economic Benefits	Minimum	Maximum
12	Cost Benefit Ratio of Project	Minimum	Maximum
13	Security of Land fill site	Minimum	Maximum

IMPACTS OF THE PROJECT

- Clean and healthy environment
- Healthy community
- Proper management of the waste
- Preparation for the Total Sanitation project
- Awareness about neat and clean environment
- Implementation for other villages and urban areas.
- Sanitized community

Non Toxic Material & Compost

REDUCE

A Waste Management Project

GG

Green Gold

RECYCLE

REUSE

UNDP

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