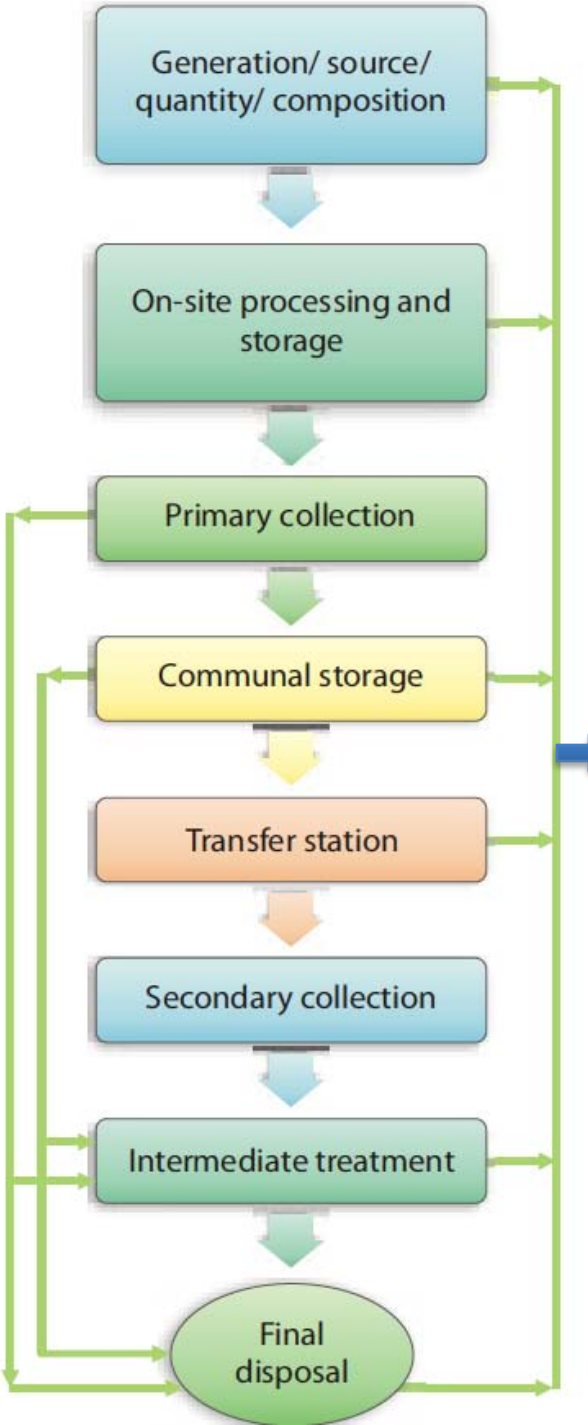
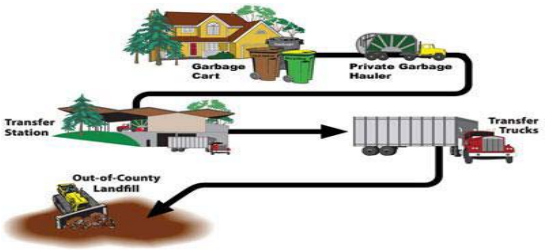
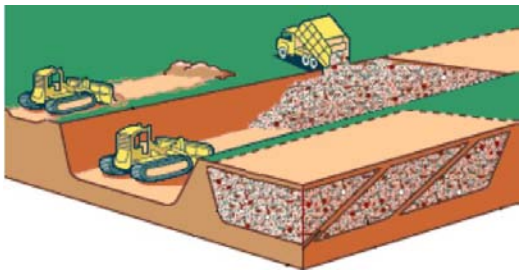
Source Reduction, on-site handling and processing of Solid waste

CE 431: Solid Waste Management

Functional Elements of Waste Management System







Source Reduction/Waste Minimization

- First element of any waste management chain for achieving integrated management of solid wastes
- Waste minimization refers to waste avoidance through the actions of the waste generators to avoid generating solid waste.
- Waste utilization comprises actions that make the waste a useful product or raw-material for other processes, eliminating the need for disposal.
- Hazard reduction means finding ways to reduce the toxicity of the waste.

On-site Processing and Storage

- second functional element of an integrated solid waste management system
- describes the separation of components and/or treatment of solid wastes
- used for materials that have already escaped source reduction and are on the way to being discarded into the environment at or near the source of generation
- On-site storage means storage of solid waste (both separated and/or mixed) at or near the source of generation before primary collection.

Advantages of Source Reduction and On-site Processing

- generation of clean recyclable materials
- removal of hazardous materials from general waste streams in order to
- minimize health risks to the general population, particularly the waste handlers
- improved working condition within recycling plants
- improved efficiency of energy recovery processes, thus helping to operate the waste treatment system cost-effectively
- improved quality of end-products minimization of overall waste management costs.

Benefits from source reduction greatly outweigh those of recycling, incineration, and land-fill in terms of reduced energy use, reduced greenhouse gas emissions and increased positive environmental impacts (USEPA, 1999).

Source Reduction

Importance

- In order to minimize environmental degradation, **'end-of-pipe' treatment technologies to 'front-of-pipe' waste reduction**
- Emphasized at the United Nations Conference on Environment and Development in Rio de Janeiro in 1992, (Agenda 21,)

Beneficial consequences related to climate change

- It reduces the consumption of energy through reuse of goods by consumers and use of minimum quantities of materials in industry. This leads to the production of fewer products, which ultimately saves the energy required to collect raw materials, to produce the products, and to transport them to the consumers.
- Emissions at treatment and disposal sites are reduced.
- Pressures on vegetative cover and trees are decreased as source reduction minimizes the demand for raw materials for new products.

Main Strategic options in source reduction

Table 3.1

- Decreased Consumption of products
- Resource Recovery
- Reduction of toxicity
- Awareness

On site Processing and Collection

Key Concepts

- resource recovery to generate less waste
- hazard reduction
- separation of different fractions of waste

Process description

Significance

- On site processing is one of the most effective and sustainable ways to achieve resource

recovery.

- It reduces hazards and diverts different fractions of material present in the waste

stream to locations for appropriate treatment in the solid waste mgt.

- It reduces the quantity of general waste and minimizes the toxicity of the general waste stream (if hazardous materials are diverted).

- It minimizes the cost of the operation and reduces maintenance problems of biological - treatment and recycling technologies. The economic viability of most biological treatment options largely depends on separation of waste materials at source.

- Without sorting at source, expensive pre-sorting and final refining

Source Separation and collection in developed vs developing countries

- Most developed cities or countries (North America, Australia, Japan, Korea etc) have

adopted municipally – sponsored source separation and collection system. In some

cases, separation of post-consumer materials by waste generators has been made

mandatory (IETC, 1996).

- For example, in Japan and Australia, cities have implemented laws and regulations

governing disposal that bans substances such as batteries, tires, waste oil, CFC gases,

etc. In Japan, to ensure that separation of waste is carried out properly; households are

required to use transparent plastic bags for waste disposal, so that collection crews can easily

identify the contents.

Mixed Materials

collection of all (non-separated) waste from residential and commercial establishments, as well as from industrial enterprises. External actors either collect the mixed waste from the source of generation, or the waste generators are responsible for bringing their waste to communal collection points or containers

Source separated materials

Waste materials that have been separated at source are collected and transported to recycling and resource recovery facilities

- Dry Recyclable materials

- Biodegradable materials
- Hazardous materials

Figure 3.1: Materials collection bank

Problem: Effect of home recovery on Energy content of Collected Solid Waste

- Problem 3.1: Using the typical percentage distribution data given in Table 2.12 (Chapter 2), estimate the energy of the remaining solid wastes if 80 per cent of the cardboard, 70 per cent of the paper and 90 per cent of wood is recovered by the homeowner

Constituent	Solid Wastes, (kg)	Energy, (kJ/kg)	Total Energy, (kJ)
Food waste	32.5	19,342	628,615
Paper (mixed)	35	15,072	527,520
News print	5	17,661	88,305
Cardboard	4	15,365	61,460
Rubber	0.5	41,375	20,688
Plastics	3	26,191	78,573
PVC	0.5	23,018	11,509
Leather shoe	0.5	17,803	8,902
Textiles	3	22,338	67,014
Yard waste	13	18,733	243,529
Wood	3	18,090	54,270
Total	**100**		**1,790,385**

Implementation of source reduction and on-site processing

- competence of waste generators
- motivation of waste generators
- economic incentives
- convenience
- environmental education
- legislation.

Calculation of Source Reduction

Source reduction for a given period of time involves the following formula:

- Source reduction=(projected waste generation at a given time) – (actual waste generation at that time)

• For a small community, this can be measured by conducting a survey at the source of waste generation for a given period of time.

• For nationwide information, the estimate generally involves the calculation of the

On site Storage

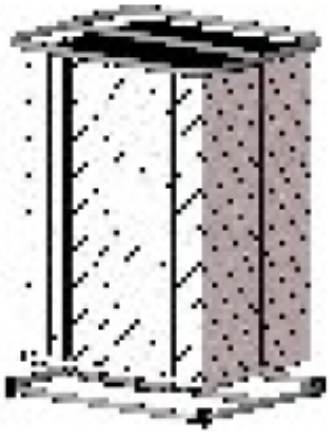
On-site storage

Influenced by a number of factors

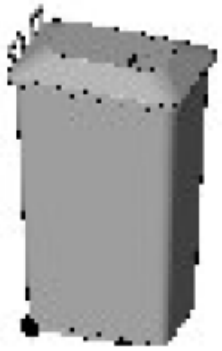
- type of storage containers used
- location of storage containers
- public health and aesthetics
- availability of resources for waste management
- available methods for waste collection and further transportation.

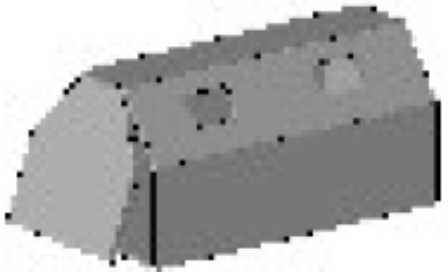
Storage Containers

Table 3.3: Typical storage containers for waste used in industrialized cour



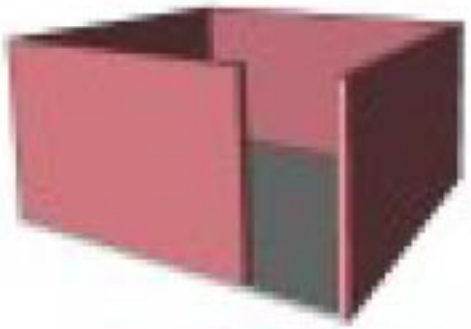
- Portable galvanized iron
- Portable plastic bins
- Plastic/paper bags
- Portable roll out conta
- Demountable containe

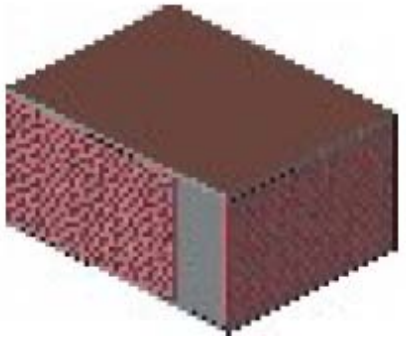




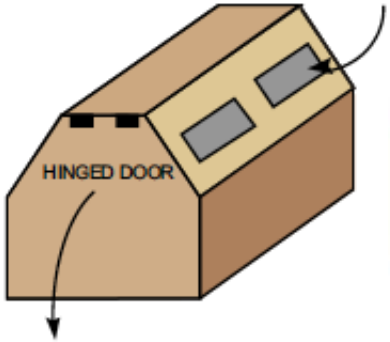
Storage Containers

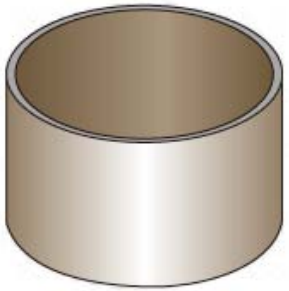
- Table 3.4: Typical designs used in developing countries





- Fixed enclosur
- Fixed Depots
- Fixed storage bi
- Demountable
- Concrete pipe sections
- Drums





Design of Storage Containers

General Considerations

- Nature of Waste
- Capacity Margin
- Compatibility
- Standardization
- Efficiency
- Convenience
- Public health and aesthetic
- Social

Size of Storage Containers

- The size of a storage container can be calculated using the following simple equation 3.5.

Size of storage container = (N X G X F) / D + capacity margin (3.5)

Where,

N = number of population served (nos, cap);

G = average rate of waste generation (kg/cap/day);

F = weekly frequency of collection (= 7 days/

Table 3.5: capacity margin of storage container.

Collection	Excess capacity required (%)		
	Individual	Communal	
Days per week		Attended	Unattended
6	66	66	100
7	33	33	50