Start Your Waste Recycling Business

A TECHNICAL STEP-BY-STEP-GUIDE OF HOW TO START A COMMUNITY-BASED WASTE RECYCLING BUSINESS

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Technical Handouts

INTERNATIONAL LABOUR OFFICE

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This Training Material is based on a training package that was originally produced in 2001 for the Sustainable Lusaka Programme by a task force of the International Labour Organization:

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1 Solid Waste Management

1.1 What is Waste?

Everyone produces waste. Some people produce more waste than others, but everyone produces some waste as leftover food, dirty water or garbage, just to mention a few. So, what is it that we call waste?

Waste can be defined as something which the original owner or user no longer values, and has been discarded or discharged by the original owner or user. It is something you do not want any more and want to throw away. Waste is therefore an inevitable by-product of any process that one can think of.

For example, you eat rice and beans, when you feel full the remaining rice and beans become unwanted. You are not hungry anymore, so they loose their value for you. You throw the remaining rice and beans away and they have now become waste. You buy a tin of milk, you use the milk for tea and you throw the tin away. Or, you buy a pair of shoes wrapped in a paper or contained in a box. You take out the shoes for use and you have no further use for the paper or box. So, you want to get rid of them, because they have no value to you anymore. They have become waste. You can give many more examples from your own experience of things that you do not need anymore and have become waste.

Waste can be categorised differently, but one way of categorising waste is into the following:

- Domestic waste
- Commercial waste
- Industrial waste
- Mine waste
- Hazardous waste
- Health care waste
- Agricultural waste
- E waste

The management regimes for these different classes of waste are not well defined in some cases, particularly e-waste. Regardless of the class of waste, its management typically involves 5 stages which are:

- Generation
- Storage
- Collection
- Transportation
- Disposal

1.2 What to Do with Waste?

So, what do you do with this waste? You will have to get rid of it by throwing it away, burying it or burning it. You don't want to keep it because you have no further use for it. However, the disposal of this waste might be a problem for you. Why? Because you do not want these things to be laying in the yard, smelling, rotting and maybe endangering yourself or your family.

Remember: The waste thrown away by you might still of value to someone else. Someone else might pick it up and use it.

For example, the tin thrown away by you might be picked up immediately by a boy named Kabwe who sells it to people who make local kerosene lamps from tins. Also, the paper or box you threw away can be picked up by Kabwe. Are the tin and paper or box still waste in this case? The answer is No. This "waste" is valuable for Kabwe and is not waste to him. Kabwe can use the box and paper at home to keep things in. He can also sell both the box and the paper to small industries in Lusaka that make new things out of wastepaper.

In the same way, when you buy a bottle of Mazowe[1] made of plastic or a bottle of black current juice made of glass, you drink the Mazowe or juice and throw the bottle away. A girl named Moza comes along and picks the bottles up. She takes them to her mother who cleans them and uses them at home to store local beer, kerosene oil or cooking oil in them. Moza can also sell the bottles to Kabwe or to someone else, who in turn sells it to people who use the bottles as honey containers or local beer containers. Kabwe can also sell the bottles to plastic and glass industries that can use them to make other, new things from these used bottles. The process of turning waste into new useful things is called **recycling**. Recycling will be discussed in more detail in later sessions in this manual.

Box 1.1: Recycling in Dar es Salaam

In Dar es Salaam there is an industry that makes electric conduits from plastic water bottles. There is also a glass industry that makes new glass bottles, plates and other glass products from used and broken pieces of glass. Indeed, the bottles that were waste to you were something useful for others.

Proper management of waste requires that all the 5 aspects of waste, i.e. generation, storage, collection, transportation and disposal should be managed well – the volumes of waste that are generated should be controlled and minimised wherever possible; storage containers should be adequate and suitable; collection should be frequent; transportation vehicles should be appropriate for the purpose; and disposal of waste should be at well managed sanitary landfills.

1 Mazowe is a concentrated orange drink that is mixed with water before drinking it.

1.3 Solid Waste Management

Waste is usually found in solid or liquid form. **Solid waste** is any waste that is hard or *solid* and not water-like or *liquid*, for example; broken glass, used plastic bags, left over food and food remains, torn cloth, yard sweepings, etc. are all called solid waste. **Liquid waste** is any waste which is in a watery form, or which can flow. For example; dirty water used for washing clothes or dishes, or for flushing the toilet; milk that has gone bad; used engine oil, etc. are all liquid waste You can give more examples of solid and liquid waste from your own experience.

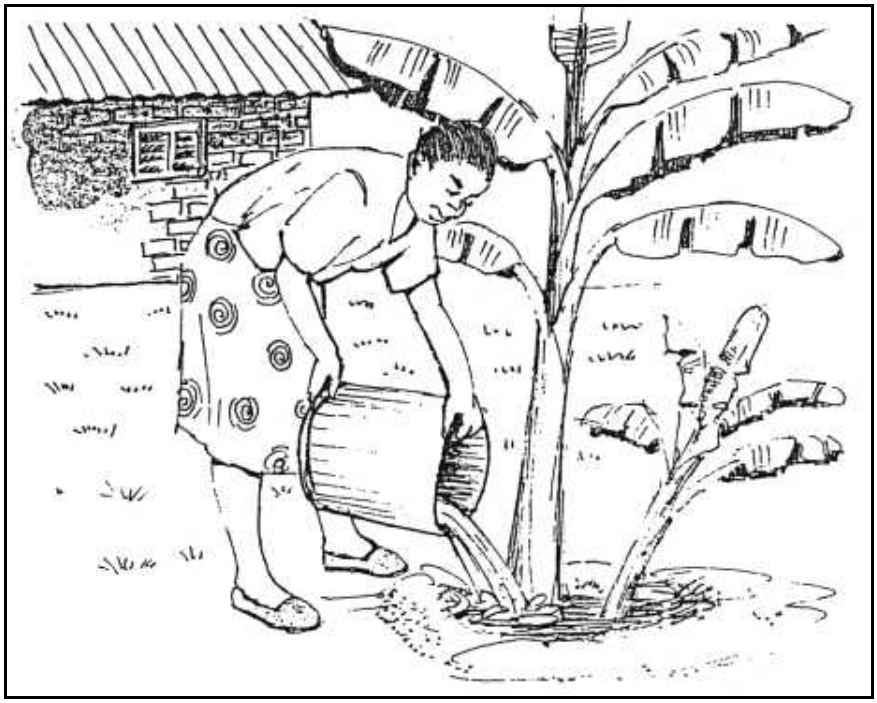


Figure 1.1 Woman disposing of liquid waste

The main subject in this training manual is how to deal with solid waste in a proper way. We call this **solid waste management**.

An increasing number of people, including yourself, realise that solid waste can be a big problem that needs to be handled with care. Now, how do you deal with waste in your own situation? Do you throw it away in an acceptable way? Or, do you just throw it wherever you like? If the answer to the first question is yes, than you are practising some sort of solid waste management.

1.3.1 Good and Bad Practices in Solid Waste Management

Good Practice in Solid Waste Management is the collection and proper disposal of solid waste in a systematic manner, regularly and in time. Proper disposal includes: recycling, composting, treatment, and regulated dumping. All of these will be dealt

with in this manual. They require separate attention to be fully covered and understood.

Figure 1.2 Illegal dumping of waste in the community

1.3.2 Solid Waste Mismanagement

On the other hand, **Mismanagement of Solid Waste** is the case when waste is not disposed off in a proper way, not collected regularly, or not collected at all. In this case the waste can cause risks to people's health and the environment you live in. Uncontrolled burning of waste, burying of waste, and uncollected piles of garbage are all examples of waste mismanagement. It is a risk to do these things and this is why:

- Uncontrolled burning of waste pollutes the air you breathe. It may produce poisonous gases that might cause diseases like cancer. Also, certain kinds of waste like spraying cans can explode when you burn them.
- Uncontrolled burying of waste can pollute the ground water and in turn the water you drink. This also may produce poisonous gases that might cause diseases like cancer, or produce gases which might burst into flames.
- Uncollected piles of garbage attract animals and insects that can be harmful and can spread diseases. Sharps or sharp objects like needles, broken glass and razor blades and other dangerous (hazardous) waste might be present in waste piles and harm children, scavengers and the

animals we keep at home like dogs and cats. Piles of waste look ugly, smell badly and make people living nearby feel uncomfortable.

So, good practice in solid waste management is very important, to avoid these risks to our health and the environment we live in.

1.3.3 How to Deal With Solid Waste?

There are three global options for dealing with waste.

1. The first option is to collect the waste and transport it to a legal and well-protected dumpsite, where it can be disposed off. In this case waste remains as waste.
2. The second option is to re-use waste, or recycle it. This includes composting of any waste that can rot. In this option waste becomes something useful again, as was already explained earlier in this session.
3. The third option is the treatment of waste. This includes controlled burning and controlled burying of waste. In this case waste can become a source of useful energy for example in the form of heat or gas for cooking.

You may want to ask yourself the question: *Which option fits to our own situation?*

Above we have seen the three global options for good practice in solid waste management. Now we will look at realistic options under the given circumstances. What is desired in Community Based Solid Waste Management is summarised in the chart depicting a well-developed solid waste management system below.

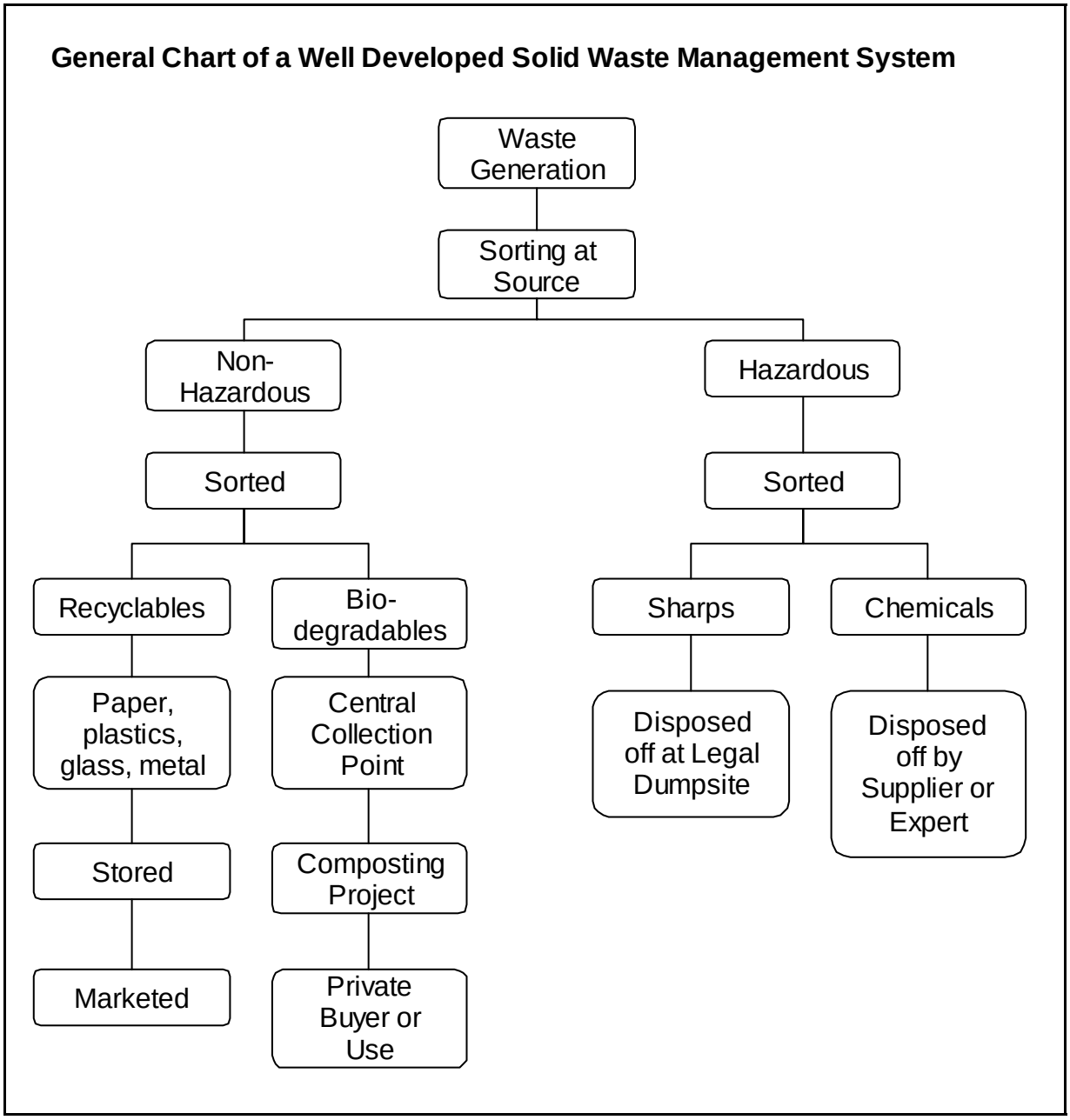


Chart 1.1 Well developed waste management system

1.3.4 Solid Waste Management in Zimbabwe

In developing countries, including Zimbabwe, the problem of Solid Waste Management is becoming more and more complicated and requires long-term and sustainable programmes for its solution. Considering African cities, experience tells that less than 20% of urban solid waste is collected and disposed of properly. We can say that solid waste management is not satisfactory in developing countries. As part of the solution, some cities and towns have privatised solid waste management services, and/or involved the communities in the management of solid waste by introducing Community Based Solid Waste Management.

Box 1.2 below deals with some of the experiences with community based solid waste management in the city of Dar es Salam. It explains what their situation is and how they are dealing with solid waste. Maybe you can learn from their experiences.

Box 1.2: Community Based Solid Waste Management in Dar es Salaam

Dar es Salaam city is one of the examples where community based solid waste management is being practised. Let's take a closer look at what they are doing.

The city authorities have been unable to provide adequate services of waste collection and disposal and therefore decided to privatise these services in late 1998. Solid Waste Management (SWM) in Dar es Salaam is now undertaken jointly by the City Authorities under 3 municipalities and licensed private contractors.

How is this done?

- The Dar es Salaam City Authorities allocate areas to be served for solid waste collection, to Community Based Organisations (CBOs) and private companies. These groups are known as contractors in solid waste management.
- Many of these private companies own vehicles that transfer waste directly from households to the legal dumping place.

Community based organisations operate in a situation similar to yours, in the lower income areas of Dar es Salaam. Let's look at how these CBOs operate in Dar es Salaam:

- The CBO collects waste from house to house on fixed days using hand carts. Many women do the waste collection and also push waste carts.
- The collected waste is moved to a collection point or transfer station. A collection point is a place agreed upon by residents and CBO to temporarily store waste. A transfer station is a built up structure in the form of block containers for storing waste longer than at collection points. See the picture of a transfer station in figure 1.
- The CBO hires a vehicle to transfer waste from the collection point or transfer station to the legal dumping site.
- Alternatively the CBO contacts the Dar es Salaam city authorities to help them with transport to transfer waste to the legal dumping site. In this case the CBO meet fuel expenses and some token money for the vehicle crew.
- The CBO collects the Refuse Collection Charges or fee for collecting the waste, from each household by physically going from house to house. Sometimes they have to involve a local leader to ensure that people will pay.
- Some CBOs and companies sweep main roads that pass through their area of operation and get paid by the Dar es Salaam city commission. This adds to their income and complements the solid waste collection fees.
- Some CBOs and private companies have started sorting some waste such as cans, plastic, paper and glass for recycling and sell these items to middlemen (people who buy and sell to industries) or directly to the recycling industries.

Like many African countries, rural people in Zimbabwe migrate to the urban centres in order to find a livelihood. This means that a large number of the Zimbabwean people lives in cities or towns, which we call *urban* areas. Harare, the capital and largest city of the country, is growing fast and has today an estimated population of

nearly 2 million people.

The waste problem is also growing as:

- more people means more waste production,
- increase in industrial activities and advancement in technology, means more waste is produced, and a larger part of this waste is hazardous,

Besides the growing size of the city of Harare and its population, and advancement in technology, other reasons for insufficient solid waste management include:

- ✓ Lack of resources: funds, equipment, tools, and skilled manpower.
- ✓ Lack of political will: solid waste management is not a priority.
- ✓ Lack of public awareness, people do not understand the dangers of solid waste mismanagement.

Indeed, the waste management situation in Zimbabwe is approaching crisis levels. There is poor management of waste in all five aspects of waste management, ranging from the generation, storage, collection, transportation right through to the disposal of waste. This is evidenced by the illegal dumps that have become a common feature of almost every suburb in urban areas, and is particularly glaring in most high density suburbs and this poses a threat to human health and environmental well being.

At the generation stage the amount of waste that is produced by residents, industry and commerce is unsustainably high, as there is little in the way of integrated waste management that is practised. As a result, the local authority, which has the mandate for providing storage facilities, collecting and disposing of waste, fails to cope in a lot of cases. Research has shown that 72% of what is discarded as waste can be recycled, reused, composted or processed into other goods.

Another major problem with the current waste generation patterns is the failure to separate waste at the point of generation. If waste is not separated at source, it becomes difficult to apply any integrated or sustainable waste management techniques, such as reusing and recycling.

For the storage of waste, local authorities have the responsibility to supply bins in which waste is temporarily stored before collection. A number of local authorities have been unable to supply adequate storage bins especially in public places, and as result, littering has become one of the biggest problems in such towns and cities, turning some public places into environmental eyesores as people throw waste indiscriminately on the ground. It is important to note that even though there are inadequate bins in public places, the public at times exhibit very negative attitudes and choose to throw litter on the ground even in places where bins are provided.

The collection and transportation of waste is the responsibility of the local authority. Many of the local authorities are again failing to cope with the provision of this service, due to inadequacy of resources. In most cases, there are inadequate vehicles, and those that are there oftentimes do not have fuel to collect waste.

Lack of collection of waste has resulted in the mushrooming of illegal dumps throughout the urban areas and some growth points, as people try to find coping mechanisms to counter the non-collection of waste. These are mostly rampant in the high density suburbs but now they are creeping to some of the low density suburbs and are even encroaching onto the outskirts of the Central Business District, as shown in Photo 1.1.

Photo 1.1 An illegal dumpsite at Number 2 Leopold Takawira St in Harare

Illegal dumpsites are favourable breeding grounds for vermin, flies and mosquitoes. They have also become sources of unpleasant odours, compromising human health. The risk of diseases such as cholera, dysentery and diarrhoea increases where waste is not regularly collected and properly disposed of. In some instances, the illegal dumps are found close to market places where food is sold, as shown in Photo 1.2.

Photo 1.2 Illegal dumpsite next to a food market stall

One of the biggest waste related environmental problems is the state of the official disposal sites that are found throughout Zimbabwe. These official disposal sites are operated as crude dumps instead of sanitary landfills. Crude dumping is a method of waste disposal in which the waste is merely dumped and left uncovered. Sanitary land filling on the other hand involves the compaction of the waste before covering it with a soil layer so that it is not exposed. A sanitary landfill should be lined to prevent leachate from seeping into the ground, but currently, municipal dumps are not lined, thereby allowing leachate to seep into the ground and pollute groundwater resources.

The dumps have no gas collection facilities, hence methane gas that forms readily in landfill areas often cause uncontrolled fires at dumpsites. The waste at the dumps is not compacted or covered with soil; hence there are a lot of flies, vermin and unpleasant odours emanating from these official dumpsites. Some hazardous wastes are dumped together with non-hazardous and biodegradable waste. The area surrounding the dumpsite is generally filthy, as shown by Photo 1.3 below and constitutes an environmental hazard.

Photo 1.3 Leachate from the Golden Quarry dumpsite flowing down the road

1.4 Conclusion

From your own experience of living in an urban settlement you know that waste disposal is a problem and that there is no proper solid waste management system in some of these areas. This session has given a first introduction of the concept of solid waste management and has introduced you to some of the terminology used. Further an example was given from Dar es Salaam. Hopefully the session has given you some ideas for discussions on how to solve the solid waste management problems in your area.

1.5 Exercise Training Questionnaire

ANSWER WHERE POSSIBLE/APPLICABLE

Name (not necessary)	
Employment	
Organisation/type	
Residence	

1. What would you like to learn from this training?

2. What is waste in your own words:

3. Which one of the following problems do you think is the most important in your community? (rank them as 1st, 2nd, 3rd etc)

☐ Not enough clean drinking water.

☐ Much Malaria

☐ High crime rate

☐ Bad roads

☐ Waste all over the place

☐ Not enough toilets

4. Do you think the waste in your community is a problem.

☐ Yes; Why?

☐ No; Why?

☐ Don't know; why?

5. Do you think waste management can be a business opportunity in your community? If so, how?

6. What are the main problems caused by waste in your area? Provide ranking

- Looks bad and smells bad
- Health risks such as cholera
- Danger to children
- Attracts pests. Such as rats and mosquitoes
- Others; specify

7. Is there any waste collection in your compound?

- None
- Sometimes
- All houses have their waste collected regularly
- Don't know

8. If there is some waste collection in your compound, how is it done?

9. If waste is not always collected, what is the main reason?

- People around are not aware that waste is a problem
- The government does not collect waste
- No one offers to collect waste
- There are no dumping places
- Others; specify

9. If none of waste collection is done in your compound, are there any plans to start

- If yes; how and when

- If no; why

10. Which option is the best to solve waste problem in your compound

- Reduce production of waste
- Collect store, and transport waste
- Select collection, recycling including composting of organic waste and reuse of waste
- Controlled dumping of waste (land filling)
- Controlled burning of waste
- Others; specify

11. What type of waste do you think is a problem (or opportunity for recycling) in your compound?

A) Metal, glass	B) Paper, plastic	C) Hospital waste,
D) Pesticides, paints	E) Batteries	F) Organic/vegetables
G) Human excreta	H) Wood shavings	I) Cloth rags and tailoring
cuttings	J) All the above	K) Others, specify

12. Do communal or collective waste containers or collection points or exist

Yes No

13. Describe how people store waste in their residence in your compound
A) In buckets B) In plastic bags C) Others, specify

14. What do you do with your own waste at home

15. What is to be done in your community if waste is a problem for you?

16. Any other comment?

2 Laws, Regulations And Policies Governing Solid Waste Management

We are now aware that waste is something with no value to us. We would like to throw it away as soon as possible. Experience has shown that people dump waste near their neighbour's houses or in their back or front yard. They also throw it on the roads, footpaths, in drains, in rivers and streams, etc. To avoid such bad waste dumping which harms the environment and the community, the Zimbabwean law provides rules and regulations on how solid waste is to be collected and dumped or disposed of. Various government authorities have been given power to supervise and take care of these rules and regulations.

2.1 Legislative Environment for Waste Management in Zimbabwe

Proper management of waste requires an effective legal framework. There are a number of Acts that cover waste management in Zimbabwe, with the principal one being the

- Environmental Management Act (CAP 20:27), and its associated regulations, in particular Statutory Instrument 6 of 2007, on Effluent and Solid Waste Disposal. This Act and the regulations are administered by the Environmental Management Agency. The other Acts include the
- Urban Councils Act (CAP 29:15);
- Rural District Councils Act (CAP 29:13);
- Public Health Act (CAP 15:09);
- Municipal by-laws

2.2 Practice of the Main Laws

2.2.1 The Environmental Management Act (CAP 20:27)

Administration of the Environmental Management Act

The Act establishes structures for its management. These include the Environmental Management Agency, which is responsible for implementation of the Act, the Environment Management Board, which manages and controls the operations of the Agency, the National Environment Council which advises on policy issues, as well as the Standards and Enforcement Committee, which is a committee of the Board, responsible for advising and making recommendations on various standards.

Environmental rights and principles of environmental management (Section 4)

The Act lists down a number of environmental rights and principles of environmental management. The rights pertinent to waste management include the right to a clean

and healthy environment, as well as the right to protect the environment for the benefit of present and future generations and to participate in measures that prevent pollution and environmental degradation These rights, however, are not enshrined in the National Constitution, and infringement of these rights is not a criminal offence.

The Act makes use of the Polluter Pays Principle, whereby any person who causes pollution or environmental degradation is expected to meet the cost of remedying such pollution or environmental degradation.

Quality Standards for Waste

The Act provides for the formulation of quality standards on air, water, soil, noise, vibration, radiation and waste management (Section 10). The Standards and Enforcement Committee will recommend to the Board standards for waste, their classification and analyses, and advise on standards for disposal methods for such waste. It will also recommend measures for the handling, storage, transportation, segregation and destruction of any waste (Section 69).

Collection and Disposal of Waste

The Agency is expected to regulate and monitor the collection, disposal and treatment of waste (Section 10).

Waste Reduction

The Act requires all persons whose activities generate waste, to employ measures essential to minimise the waste through treatment, reclamation and recycling (Section 70). The Agency can issue orders to such persons requiring them to minimise their waste. The Agency is thus responsible for ensuring that waste is re-used and recycled where possible and otherwise disposed of in a responsible manner through regulating and monitoring (Section 10).

By-laws for environmental management

The Agency is expected to make model by-laws to establish measures for the management of the environment within the jurisdiction of local authorities. The Agency is thus expected to make model by-laws for waste management.

Serving Orders and Undertaking works for the Protection of the Environment.

The Agency is expected to undertake any works deemed necessary or desirable for the protection / management of the environment. It also serves written orders on any persons requiring them to undertake measures to protect the environment. The Agency can therefore undertake works or issue orders for the proper management of waste.

Environmental Audits of Projects

The Agency is expected to carry out periodic environmental audits of projects. During these audits, one area that will be looked at is the management of waste in a particular project.

Prohibition against discharge of waste

The Act prohibits the discharge or disposal of any waste in a manner that causes environmental pollution or ill health to any person (Section 70). It also requires that all persons that transport waste or operate waste disposal sites should be licensed to do so by the Board. Failure to comply is regarded as a criminal offence, for which one can be fined.

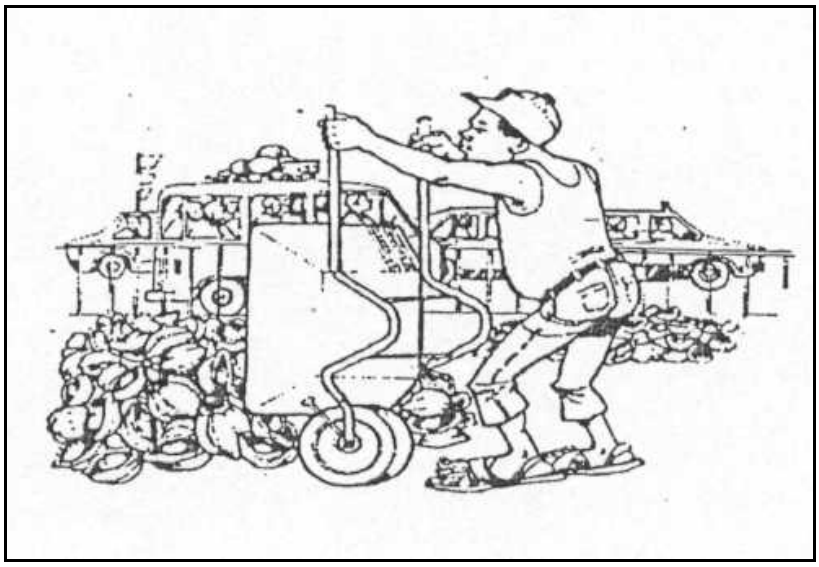


Figure 2.1 Dumping of waste in public places is an offence.

Hazardous waste (Section 72)

The Standards and Enforcement Committee is expected to recommend to the Board standard criteria for the classification of hazardous waste with regard to determining:

- Hazardous waste
- Corrosive waste
- Flammable waste
- Toxic waste
- Radioactive waste
- Any other category of waste the Board may consider necessary

The Board is expected to issue guidelines on the making of regulations for the management of each category of hazardous waste

- Regulations will be for the control of exports and imports, and the distribution, storage, transportation and handling of chemicals and materials

Prohibition against Littering

The Act prohibits littering of any place (Section 83). It also requires owners of

transport conveyances to ensure that no litter is thrown from their conveyances. The Regulations (SI 6) further require the owners of transport conveyances to place sufficient bins in their vehicles. Failure to comply with this part of the Act and the Regulations is regarded as a criminal offence, for which one can be fined.

The Act also requires all persons in control of or responsible for the maintenance of any place to provide adequate and suitable containers for the discarding of litter.

Waste Management Plans

The Regulations (SI 6) require all generators of waste, except at household level, to prepare, implement and adhere to waste management plans consisting of

- an inventory of the waste management situation specifying quantity of waste produced and the components of such waste
- specific goals for
    - The adoption of cleaner production technologies
    - Reduction of waste quantities
    - Recycling and sorting of waste wherever practical
    - Safe transportation and disposal of wastes that cannot be recycled
    - Adoption of environmentally sound management of waste

Local authorities are also required to prepare waste management plans.

Waste Prevention Targets

The Regulations allow the Agency to set waste prevention targets with regard to the emission and disposal of waste by any generator of waste. These may relate to:

- Acceptable levels of emissions and disposal of waste
- Design of products containing few pollutants
- Development of products in such a form that residuals can be recycled
- The incorporation of recycled materials in the manufacture of certain products
- The creation of distribution modes that reduce residual waste to a minimum
- The consumption of products such that little waste is generated
- The preferential procurement by government agencies of products that cause little pollution after consumption or on becoming waste

Waste Management Enterprises (Section 14 to 21 – Regulations)

The Regulations require all persons operating waste collection enterprises or waste management enterprises, to be licensed.

Landfills

The Regulations require all new landfills that are constructed after January 2007 to be lined. The regulations also require that those operating old, unlined landfills / dumpsites, should stop operating these landfills by January 2012. Failure to comply is regarded as a criminal offence.

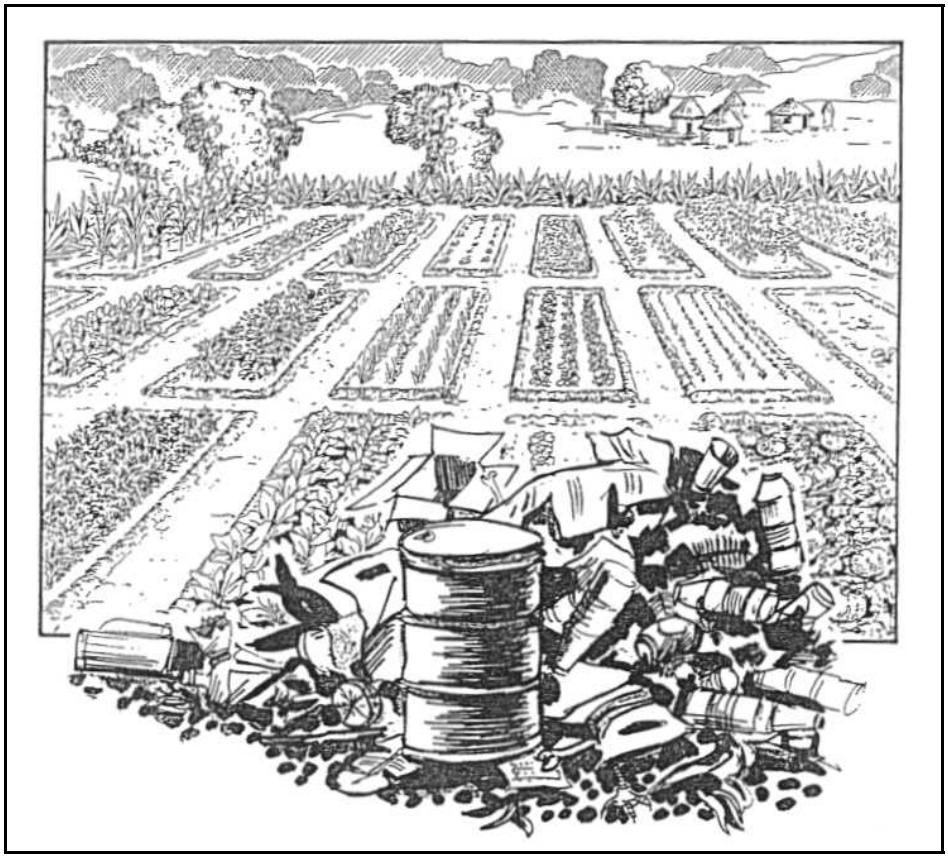


Figure 2.2 This kind of scene has to be prevented by the Environmental Management Act.

2.2.2 Urban Councils Act and Rural District Councils Act

These are administered by the Ministry of Local Government, Public Works and Urban Development. The Acts both allow for local authorities to charge a fee for refuse removal service where this service has been provided.

2.2.3 The Public Health Act

The Public Health Act is administered by the Ministry of Health and Child Welfare. The Act prohibits nuisances, which are defined as "*any accumulation or deposit of refuse, offal, manure, or other matter whatsoever which is injurious or dangerous to health"*.

2.2.4 Municipal By-Laws

A few local authorities such as Harare, Bulawayo, Gweru, Masvingo, Mutare, Kwekwe and Rusape have by-laws on waste management. Others such as Chitungwiza address waste management issues in their Public Health by-laws, while others such as Chipinge and Epworth have no by-laws at all. Even in those local

authorities which have waste management by-laws, enforcement has been lacking.

2.2.5 Policies Pertaining to Waste Management

A number of policy documents, which make reference to waste management, exist. The *National Sustainable Development Strategy of 2004*, which is Zimbabwe's official response to the Johannesburg Plan of Implementation, recognises that poor waste management, including the management of hazardous waste from industrial activities, are among the key urban problems in Zimbabwe, and recommends the adoption of cleaner production technologies as the only solution to problems related to industrial waste management.

The Science and Technology Policy (2002) acknowledges that pollution of the country's water systems, air and the general environment is increasing and requires urgent action. It singles out industrial waste as having an adverse effect on the environment. It also recommends the adoption and implementation of cleaner production technologies as the answer to some of the problems associated with industrial waste.

2.3 Relevance of the Existing Laws

The laws and regulations provide guidelines for handling and final disposal of solid waste, which does not pose danger to the public. The laws are basically meant to empower Local Authorities and EMA to protect the environment and control diseases.

However, in spite of the existence of a comprehensive legislative environment for waste management in Zimbabwe, waste management continues to be huge challenge for Zimbabwe as a nation. There is thus need to relook at the legislative environment for waste management, with a view to improving it and making it effective in addressing waste management problems. To this effect, a new Strategy for National Waste Management in Zimbabwe is being drafted.

2.3.1 Effectiveness and Strengths of Existing Laws

- The laws are in principle effective, as they cannot be overridden by any other laws.
- When fully enforced the new existing laws and the Waste Strategy can assist in putting in place an effective system of solid waste management that improves the health situation and reduces the present environmental contamination and pollution.
- Further, the proposed Waste Strategy laws provide an avenue for privatising solid waste management. For instance the Environmental protection Act empowers EMA to provide licenses, technical and advisory services to any

waste operator. In this case this law is not only limited to local authorities, but includes private sector operators as well.

2.3.2 Weaknesses of Existing Laws

As the written laws' strength is in providing a framework for enforcement, the major weakness is the lack of effective enforcement in practice. This is due to a lack of resources, such as manpower and logistical support like transportation, in the institutions charged with enforcement. For example a nuisance can be reported but the personnel responsible would have no means of getting to the scene due to lack of man power or transport.

- Lack of concern for statutory duties: unwillingness by shopkeepers, factories, and institutions to adhere to statutory duties such as maintaining storage containers for waste.
- Lack of public awareness of the existing laws and regulations and a general decreasing level of sensitivity and concern to aesthetic standards and quality of the urban environment by the population.
- Lack of proper guidelines on how the private sector can operate with the Council in providing effective Solid Waste Management.

It is important to note that these laws were not meant for profit making bodies, but for the protection of the environment within which business ventures of different kinds are conducted. The laws do provide certain guidelines for business operations in solid waste management, but are not there to protect those in business alone without considering the environment they work and live in. Therefore, as any other business venture, waste business need to follow laid down procedures of running business in Zimbabwe.

2.4 Towards sustainable waste management in Zimbabwe

A new Strategy "*A Clean Zimbabwe"* is being put in place to take Zimbabwe to a more sustainable waste management situation. This Strategy is based on the following principles:

Cradle – to- grave	This is a policy of controlling waste from its creation (cradle) to its final disposal (grave).
Life cycle principle	According to this principle, products should be designed, produced and managed so that all environmental concerns are taken into consideration, accounted for and minimized during

	generation, use, recovery and disposal.
Duty of Care Principle / Extended producer responsibility	The individual or organisation that produces waste (the Generator) is under all circumstances, responsible for that waste from cradle to grave.
Integrated Waste Management	This is an internationally accepted approach used to manage waste, which requires that waste generation should be avoided or minimized as much as possible. Any waste that is generated should be recycled or reused wherever practicable. Any waste that cannot be recycled or reused should be treated or compacted to reduce toxicity and volume. Any waste that cannot be subjected to the above should be disposed of in a properly designed and managed landfill.
Polluters Pays Principle	The person who causes pollution must pay for its clean up and for any damages caused
Precautionary Principle	According to the precautionary principle, unknown waste must be treated as extremely hazardous until it is identified and classified.

2.4.1 Strategic Objectives

Three broad areas need to be addressed in order to achieve sustainable waste management and have a clean Zimbabwe. These comprise the involvement of all stakeholders in waste management issues, the improvement of the legislative environment for waste management, and the development of waste management enterprises among CBOs and industries. The three strategic objectives are:

A. To ensure involvement and participation of all stakeholders in waste management issues;
    a. To have 40% of the population aware of sustainable waste management practices and legislative requirements pertaining to waste management through stakeholders by December 2008
    b. To form partnerships with stakeholders by December 2008 (the partnerships should improve enforcement by EMA and the LA)
    c. To introduce incentives for sustainable waste management by June 2008 (for large industries)
B. To promote efficient and effective enforcement of environmental legislation;
    a. To review national legislation pertaining to waste management by March 2008
    b. To harmonise LA by-laws for waste management with the national legislation by October 2008 (look at support for CBOs involved in waste management)

C. To develop waste management enterprises among CBOs and industries.

a. ***To come up with incentives that promote the establishment of waste management enterprises among CBOs and SMEs by June 2008***
b. ***To build capacity of LAs to manage waste sustainably by December 2008***
c. ***To Facilitate the establishment of 30 CBOs involved in waste management by June 2009***

The following criteria will be used to prioritise actions that will be undertaken in the Strategy.

- Potential for Rapid and Visible Results
- Optimum Utilisation of Available Resources
- Prevention and minimisation of waste
- Potential for Job Creation

2.5 Group Work

In the situation that you will be working in, it will be important that the community is co-operative and participates in waste collection, separation, recycling and disposal. There are rules and bye-laws which have to be obeyed for this to happen.

1. Are the existing laws effective? If not, why? Give suggestions for alternative ways, and rules that might work in your situation.

2. If the existing rules were to be adhered to, would they be sufficient to make people co-operate with you?

> (a) If yes, give suggestions on how the existing rules can be made to work, so that your customers will co-operate with you in solid waste management.
>
> (b) If no, give alternative by-laws and suggesting on how they can be adhered to in such a way that your customers will participate well in solid waste management?

3. Experience has shown that whether there are rules/laws to be obeyed or not, it is difficult for people to participate in solid waste management. More specifically it is difficult to get people to pay for waste collection services, to put waste in proper containers, to separate waste or to place the waste outside the house at collection time, etc. In your case, can the regulatory framework support you to:

> (a) Make your customers provide you with the waste that you require for your recycling business?
>
> (b) Make your customers separate waste and put waste in proper containers?
>
> (c) Make your customers put waste outside the house at collection time?
>
> (d) If these and other critical activities for your business are not supported by rules and regulations, explain or suggest how you are going to get people to co-operate.

4. Think of which rules and regulations you will have to adhere to in your operations.

5. Write all answers from the group on flip-charts for further discussion.

3 Community Participation, Roles of Stakeholders, gender dimension and contracting for Solid Waste Management

3.1 Why Community Participation?

In the past the government took responsibility for the delivery of services such as water supply, construction of roads and waste collection. However, to date, due to lack of resources the government in Zimbabwe is unable to provide all these services. In Harare, especially the low-income areas suffer from the lack of services provided by the City of Harare.

As a result, in many African countries, the government is looking more to communities and the private sector for assistance with service delivery. Communities often have knowledge and experience that can be used in the delivery of services. They can also often contribute and provide resources. Enterprises are often more efficient and cost effective in delivering services than the council and they are only paid after the work is carried out satisfactorily.

In Harare the various departments of the City of Harare are responsible for the delivery of different services. They do not necessarily have to do all the work themselves, but can also make sure it gets done by contracting part of the work out to private businesses or to communities. Another example of private sector and community involvement is the collection of waste backlog recently carried out by the City of Harare.

Communities themselves may see that there is an opportunity to make a living out of waste collection and recycling and have started their own initiatives to collect and recycle waste.

3.2 Types of Community Participation

There are various ways in which a community can be involved in its own development. They can participate:

- In decision making (for example in deciding that waste in the community should be collected by a Community Based Enterprise and that residents have to pay a fee);
- In planning and design (for example in discussions on where the waste containers should be located);

- In waste recycling and composting;
- In raising awareness on the importance of environmental cleanliness and waste management
- By contributing money (for example by paying the waste collection fee);
- By contributing labour (for example by supporting a cleaning campaign on Saturdays)

There are two basic approaches to community involvement. The first is community participation, where control over the services largely remains with the relevant government authorities, eg cleaning campaigns organised by the City authorities. The second approach is community management, in which case the community becomes responsible for the management of the service provision. This is a more radical approach in which the local authority gives the responsibility for the provision of the service to the community and devolves power and responsibilities to the community, as has been the case in Epworth.

3.3 Advantages and Disadvantages of Community Participation

Some advantages and disadvantages of community participation are listed in the table below:

Subject	**Advantage**	**Disadvantage/challenges**
Decision making	Residents support decision and will contribute.	Time consuming
	A feeling of ownership is created in the community.	Who can represent the community?
Planning and design	Community knowledge will be used	Time consuming
Implementation	Community experience will be used.	Can the quality be guaranteed?
	Jobs can be created in the community.	
	Skills for operation and maintenance remain within the community.	

Subject	Advantage	Disadvantage/challenges
Operation (e.g. collecting waste and recycling)	Jobs are created in the community.	
	Under communities control and not relying on outside help.	
	Developing partnerships with City Council that can also be used for other initiatives.	
Contribute resources	(Partial) ownership within community.	Unplanned settlements are mostly very low-income.
		How to deal with people who can not pay?
Supervision	There is direct accountability to the community.	External supervision might be necessary to ensure laws and standards are met.
	More transparent.	Risk of corruption?

3.4 Roles of Stakeholders in Solid Waste Management

For any activity to take place, people have to be involved with commitment. The people, who are involved in an activity or have a stake, are known as **stakeholders**. These stakeholders can be organisations, institutions, companies, individual people, etc. For example in the activity of solid waste management in Harare, the stakeholders include, The Environmental Management Agency, The City of Harare, District Offices, Private Companies, Local Government Authorities, Community Based Organisations (CBOs), NGO's, individual waste collectors, community members etc.

There are different players involved in the management of waste, and these include the local authorities, Central Government, NGOs, CBOs, industry, public, institutions and donors.

Local authorities

Local authorities have the mandate for providing waste management services for the areas under their jurisdiction. These services include provision of waste storage containers in public places and to households and institutions, collection and transportation and disposal of waste, as well as management of disposal sites. They are expected to charge for the provision of these services.

Central Government

Central Government sets out policies and legislation for waste management. The Environmental Management Agency enforces legislation governing waste management. Ministry of Local Government, Public Works and Urban Development, being the parent ministry for local authorities, also sets out policies and legislation for the functions of local authorities.

Non Governmental Organisations

NGOs conduct projects and programmes for improving environmental well being. They work with communities, thereby improving the environment while at the same time improving people's standard of living. A number of NGOs have assisted in the setting up of community based organisations involved in waste management. NGOs also advocate for policy reform.

Community Based Organisations

Community Based Organisations are emerging players in the waste management sector. They are involved in public education, waste collection, recovery, recycling. A number of CBOs are actively involved in waste management in Harare, Chitungwiza and Epworth, and in some areas, they are making quite a significant impact on the waste management situation.

Public and community

The public generate waste. They have a big role to play, which they have not taken up, most probably due to lack of awareness of the role they can play. The public need to reduce the amount of waste that they produce, hence they need to be made aware of ways that they can employ to reduce the amount of waste generated.

Industry

These are the main generators of waste, both from the manufacturing processes that they carry out, as well as from their products after they have been used by the public. They therefore have a very big role to play in waste management. They can reduce the amount of waste that they generate through cleaner production, recycling and other sustainable waste management practices. Some industries are doing that now, but there is need for much more to be done. Industries can also sponsor waste management initiatives.

Donors

Donors can sponsor waste management initiatives. A number of donors in Zimbabwe are currently investigating ways of assisting CBOs involved in waste management to improve their operations.

3.5 Group Work: Stakeholders and Their Possible Roles

It is always good for the specific roles of each stakeholder to be known to all parties involved in an activity. The roles are to be specified and agreed upon. First of all we want you to think of solid waste management in your situation and of how you would like the roles to be divided between the stakeholders. Also we want you to think of the roles you would want to fulfil as a Community Based Enterprise.

Exercise 1:
Before you can divide roles over the different stakeholders, you will have to think of the different roles that have to be fulfilled in order for the SWM system to function properly in your compound.

1. Think back of the previous sessions and what tasks need to be performed to make it all work. Write all the roles and tasks your group comes up with on a flipchart.

2. Now think of all the stakeholders that have to be involved in the SWM in your community to make it a success. Write them all down on a flipchart.

3. You now have the stakeholders involved and the roles to be performed in SWM in your community. Try to divide the roles over the different stakeholders the way you think best.

3.6 Stakeholders and their possible roles

In the table below you find some of the roles various stakeholders in solid waste management can play. Compare the results of the group exercise. Is there a big difference between how the role in SWM are divided in Harare and the way you would want it to be organised in your. Where you are not sure or the role division is not clear, indicate which roles you think are appropriate for the stakeholder in your situation and give remarks in the column for remarks.

Stakeholder	Possible roles	Remarks
Central government, Environmental Management Agency	■ Policies and legislation and regulations for waste management ■ Enforcement of regulations ■ Issuing licences ■ Registration of waste CBOs ■ Ministry of Local Government, Public Works and Urban Services sets out policies and legislation for local authorities ■ Others:	
Local Authorities (City of Harare)	■ Provision of waste management services ■ Provision of storage containers ■ Collection, transportation and disposal of waste ■ Charging for services ■ Making regulations, by-laws ■ Enforcement of regulations ■ Supervision and monitoring ■ Landfill management ■ Manage special waste ■ Can outsource services, issuing of contracts ■ Others:	

Stakeholder	Possible roles	Remarks
District Office	■ Supervision ■ Monitoring ■ Awareness raising ■ Enforcement of regulations ■ Fee collection ■ Provide land (for example for recycling activities) ■ Others:	
Waste service provider/CBE	■ Provide waste collection services ■ Awareness raising ■ Monitoring ■ Enforcement of regulations ■ Fee collection ■ Primary Transport ■ Secondary transport ■ Cleaning of roads ■ Cleaning of drains ■ Others:	
Community based waste recyclers	■ Provide waste collection services ■ Awareness raising ■ Re use, recycling and composting ■ Products out of waste ■ Others:	
Public and Community members	■ Generate waste ■ Payment of services ■ Handing waste to service provider ■ Waste separation ■ Bringing waste to containers ■ Awareness creation ■ Cleaning of paths and small drains and participate in clean up campaigns ■ Buying waste products ■ Others:	

Stakeholder	Possible roles	Remarks
Industry	■ Major waste generators ■ Can improve waste management practices (reduce or cleaner production, recycling etc) ■ Sponsor waste management initiatives ■ Market for recyclable products ■ Others:	
Truck owners	■ Can participate in waste collection ■ Others:	
NGOs	■ Implement community based projects and programmes ■ Work with communities ■ Help establish CBOs ■ Technical support and capacity building	
Donors	■ Can sponsor waste management initiatives ■ Others:	
Other stake holders:		

3.7 The Concept of Gender and Sex

Gender is a new concept to many particularly the people at the grassroots level. It is also a confusing concept as it is viewed as a women's issues by many people. For most people it is not easy to point out the differences between gender and sex unless s/he has been made aware of it for instance by gender sensitisation. This session aims at increasing your awareness of gender issues and focuses on integrating them into solid waste management

3.7.1 Definitions of concepts

- **Sex:** is the term that identifies the biological differences between men and women, characteristics that are universal and unchanging.
- **Sex Role:** Is a role that a male or female performs by virtue of their biological make-up. A sex role can be performed by only one of the sexes. There are very few sex roles, for example: getting pregnant by women, bearing babies by women, breast-feeding by women, men making women pregnant, speaking with a deep voice by men, etc.
- **Gender:** is the term that identifies the social differences between men and women that are learned, are changeable over time, and have wide variations within and between cultures.
- **Gender Roles**: are learned behaviour in a given society. Gender roles condition activities, tasks and responsibilities that are considered feminine and masculine. Gender roles are interchangeable, this means that they can be swapped between man and women. For example it is considered to be a woman's job (gender role) to sweep the house, but there is nothing that makes it impossible for a man to do the sweeping.
- **Gender Sensitisation:** Is the systematic effort to promote awareness of gender differences and implications that these differences have on planned change and in development efforts.

3.7.2 Summary: Sex and Gender

The table below lists some distinctions between sex roles and gender roles;

Gender Roles	**Sex Roles**
Differ from society to society	Same in all societies i.e. universal
Change with history or over time i.e. dynamic	Do not change with history or over time i.e. fixed
Vary within the society	Do not vary in any society

Affected by social and cultural factors e.g. religion	Not affected by religion or other social and cultural factors
Are very many and complex	Few and mostly limited to reproductive functions

3.7.3 Gender Myths and Stereotypes

Gender myths and stereotypes are society's biases that ascribe certain roles to men and others to women. They are based on how women and men are related and interact in society. They involve several constructed roles, types of accepted behaviour, accessibility to resources, and the manner that power is held and exercised in the society and the family. A good example in waste is women not driving waste trucks and men not sweeping the house. The two case studies given in 6.4 and 6.5 below highlight such typical myths and stereotypes.

3.8 Gender and Waste

Due to gender roles and myths, women and men do have different attitudes towards solid waste. In many societies or communities, women and children have the responsibility for keeping the family courtyard clean, taking out the garbage, and dumping it somewhere.

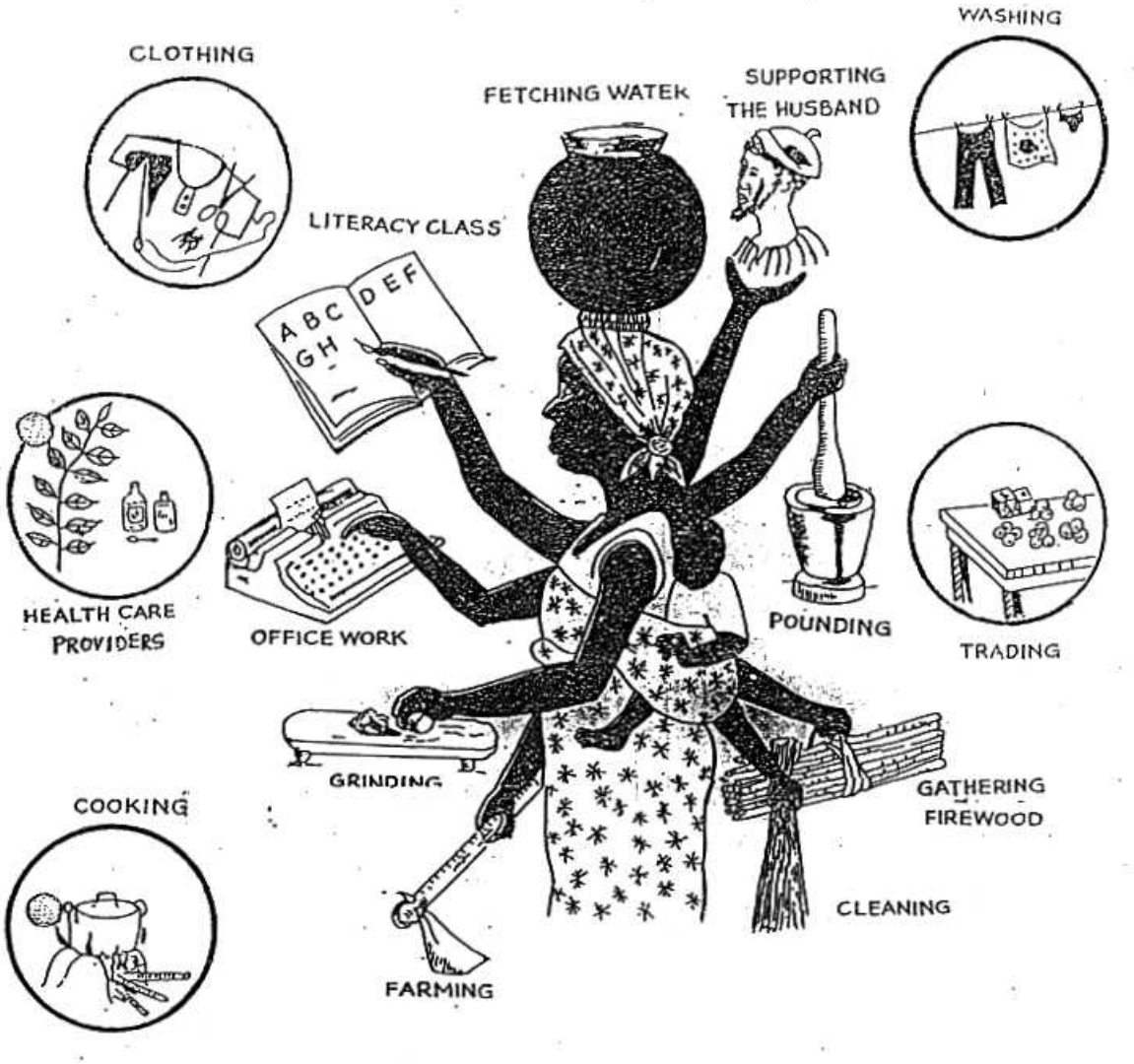
Women also appear to be very creative in recycling and re-use of waste in their own houses, especially in the low and middle-income families. The following are examples of materials that are re-used or recycled by households:

1. Glass bottles and plastic bottles are washed and reused for storing cooking oil, drinking water, salt, sugar, kerosene, local beer, etc.
2. Newspapers and other waste paper are used for: wrapping things like buns, covering school exercise books, lighting of cooking fires, as toilet papers, etc.
3. Food waste is collected to feed livestock and used to make compost.
4. Empty cooking oil containers and paint tins are re-used as plant or flowerpots.
5. Plastic and paper bags are re-used as shopping carrier bags.

In many societies, it are mainly young men who go from door to door to collect recyclable materials. For example glass bottles: beer, soft drinks, and medicine bottles, as well as newspapers and magazines. They sell these items to middlemen or industries for recycling or to other individuals for re-use.

Can you describe who are doing these activities in your community?

Figure 3.1 The Work Load on Women in Africa:



Box 3.1: Women in waste management: the case of Dar es Salaam

In Dar es Salaam both women and men gain an income from collection and disposal of solid waste. Some contractors in solid waste management have only female labourers. It turns out that women are as capable as men to carry out solid waste management activities, including recycling.

During a training in mobilisation skills, organised by ILO, a discussion was raised on the question why it was mostly women who were sweeping streets and carrying waste, as well as doing various voluntary jobs in waste management, while handcarts were only pushed by men. Often the person who pulls the cart is better paid than a sweeper. Participants in the course, all of them members of groups involved in solid waste management or local leaders, had a lively discussion and concluded it was only because of the idea that women would not be strong enough. An old women stood up and said: "Look how ideas about the strength of women change, whenever it is convenient. We women do all kinds of heavy work in the fields, we carry heavy loads, why should we not be capable of handling a handcart?"

Immediately after the training, two women groups mobilised women to pull/push hand-carts instead of boys who were employed until then. It was soon noted that they were collecting more money than before, because the boys had been dishonest, pocketing part of the money they collected.

It is now a usual phenomenon in Dar es salaam, to see women (young as well as middle-aged) pulling or pushing carts with garbage. Women have proven to be good waste fee collectors and many companies, and Community Based Organisations (CBOs) involved in Solid Waste Management services are using women as revenue collectors.

Scavengers (waste pickers) may sort solid waste that is dumped outside the household area looking for things they can re-use or sell. These scavengers can be both female and male, and often also include children.

Men tend to dominate the salaried jobs in waste management. On the other hand, women do most of the unpaid work at home. In most countries, truck loaders and drivers and most of the management of solid waste departments or enterprises are men. Women often do street sweeping.

How is this in your community? Is it possible to use more women for loading and driving of waste collection vehicles and for management activities? If yes, how?

3.8.1 The Situation in Zimbabwe

As you will all know, at household level, women and girls and servants, the majority of whom are women, are the ones normally handling solid waste management. These people are the ones who are responsible for the cleanliness of the homes. At economic level women are involved in activities as street sweeping and men are the ones who work as labourers and drivers on collection vehicles. Women are few at the decision making level in solid waste management.

3.8.2 Case study: Accident

A father and his son were driving to a party when their car stalled on the railroad tracks. In the distance a train whistle blew a warning. Frantically, the father tried to start the engine, but in his panic, he couldn't turn the key, and the car was hit by the onrushing train. An ambulance sped on the scene and picked them up. On the way to the hospital, the father died. The son was still alive but his condition was very serious, and he needed immediate surgery. The moment they arrived at the hospital, he was wheeled into an emergency operating room, and the surgeon came in, expecting a routine case. However, on seeing the boy, the surgeon blanched and muttered, "I can't operate on this boy – he is my son"

Who is the surgeon?

Why?

3.9 Group Work Gender Roles: how much are women and men involved in SWM activities?

Exercise:

Write down who is doing what in your family with waste:
Who produces waste?
Who collects waste?
Who stores waste?
Who disposes of the waste outside the house?
Is waste reused or recycled, if yes, how, and by whom?

1) Is there any activity in Solid Waste Management (SWM) that cannot be done by men?
2) Is there any activity in SWM that cannot be done by women?
3) Why the differences in involvement in different tasks and roles between man and women (if they exist)?
4) Brainstorm on strategies for how best these different gender roles in SWM can be integrated and utilised to benefit both men and women.
5) Give any other comments or remarks

3.10 What Is a Contract

A contract is a binding agreement between two partners. For example if two people have agreed on something they write down exactly what they agreed. This **contract** is then signed by both people to bind them to what they have agreed to. If, for example after 2 months, there is a conflict because the people forgot what they exactly agreed to, they can refer to the contract to solve the conflict.

In the case of waste collection, there could be a contract between the business group and the Local Authority. In this contract the Local Authority agrees that the business group can collect solid waste in a certain area and is allowed to collect fees for their services from the residents/or receive payment for the services by the Local Authority.

To say it more difficult: A contract is a set of agreements, which serve as a mutual reference for the client and the contractor with regard to the implementation of a specific action or service, be it waste collection, running a water tap etc.

The **client** is usually the party that benefits from the services provided under the contract and the one to make full payments after successful completion of the obligations agreed to in the contract.

The **contractor** is the party that agreed to provide the services specified in the contract within a certain time and for a specified remuneration.

3.10.1 Conventional Contracts

The type of contract referred as conventional contracts is the type of contract normally used in the private sector. Especially in the construction sector, conventional contractors need to be registered as contractor to be allowed to compete for a job. A tender procedure will be used to decide on which contractor put in the best bid and gets the job. As often large sums of money are involved the contracts have a certain format approved by the government and are in a legal language to ensure they can be used in court.

3.10.2 Community Contracts

Community contracts facilitate the development of constructive partnership between community groups or a community group and a government institution, or between a community group and a co-operating partner or NGO. Community contracts are used to define the tasks and responsibilities of different community groups and/or the

government and/or a co-operating partner or NGO. Therefore community contracts should be written in simple language using the local language. The community contract has to be completely understood by all parties before it is signed. The main aim of community contracts is to actively involve communities in the planning and implementation of activities. Whereas, **conventional contracts** are written in a legal language that is difficult to understand for people who do not have a legal background, **community contracts** are made as simple as possible, as it is normally not expected that they will have to be used in court.

3.10.3 Advantages and Disadvantages of Conventional and Community Contracts

Conventional Contracts		**Community Contracts**	
Advantages	**Disadvantages**	**Advantages**	**Disadvantages**
Clear task division	Difficult language	Simple language	Not suitable for use in court
Clear responsibilities and legal status	Educated people can take advantage	Task, responsibility, and profit clear	Legal status not clear
Costs clearly defined	Costly to draft (needs lawyer)	No need for a lawyer	Only suitable for limited amounts of money
Can always be referred to		Can be referred to in case of conflict	Will Government accept this contract?
Can be taken to court in case of conflict		Good reminder of what was agreed	Can not be used in court

3.10.4 Contract Partners

Who are the contract partners?
The main contract partners are:

- The contractor (eg Community Based Enterprise)
- The client (eg Local Authority)
- The support organisation (eg an NGO)

3.10.5 Contractor

The contractor carries out the work as specified in the contract and receives payment (or is authorised to collect the payment). In the case of waste collection the business group is the contractor.

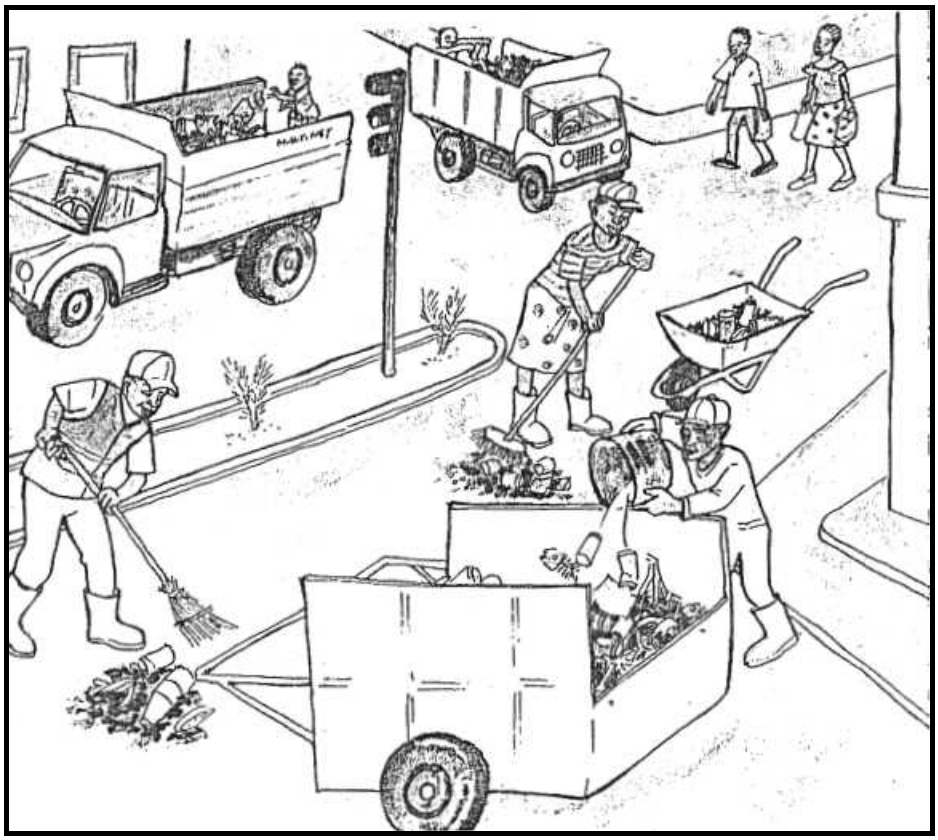


Figure 3.2 A solid waste contractor at work.

Unlike in conventional contracting, in a community contract situation the contractor is from **within** the community and is therefore at the same time beneficiary of the service provided or assets created. In conventional contracting there normally is a bidding procedure whereby the cheapest and best quality offer gets the contract. In community contracting the prices are normally established in joint discussions and bidding is normally not necessary.

If a community group enters into a contract with an external organisation it is important that they have a proper legal standing which conforms to the laws of the country. This can be a registered CBO or association or a small-scale enterprise.

3.10.6 Client

The client is normally providing the funds or authorises the collection of funds. For example in waste collection, the Local Authority is the client as they represent the beneficiaries and they authorise the collection of funds or alternatively the Local Authority continues to collect the fees and pay the CBE directly for the services provided.

In community contracting the municipal authority and the community groups can work together in partnership to set the goals for the development work. For example the City of Harare could sign a contract with a CBO to remove the backlog waste in

some settlements in Harare. The contract would specify what work the CBO need to carry out and what payment they would receive if the work was carried out correctly.

3.10.7 Support Organisation

Sometimes a third party is present to help the contractor or the client to supervise the work. We could call that a **support organisation**. Often the community does not have enough experience to implement the community contract on their own. Therefore assistance is needed from an external support organisation. These can be government departments, NGOs, private sector consultants, international agencies and national institutions. Also, the government and/or other contract partners do not always have the capacity to deal with community contracts and they too sometimes need assistance. The level and type of technical assistance needed depends on the experience of the different partners and the complexity of the works. It is therefore important to find out what the capacity and experience of the different contract partners is in doing similar work before entering into a contract. The technical assistance, and/or training that a community and/or partners will receive, has to be put clearly in the contract. The goals and activities have to be put as specific as possible in the contract. This will help to decide which organisation(s) can best give the needed technical assistance.

3.10.8 General

The responsibilities in contract are divided over the client (the Local Authority) and the contractor (a CBO from the community). If the responsibilities are not made clear properly or not well divided within the community, there might be conflicts of interest within the community. As the client and the contractor are both from the same community, the community has to give incentives and sanctions to its self. It is therefore very important to clearly define the relationship between the different actors involved, and to clarify their respective roles, rights and obligations.

Box 3.2 Example where contracts could be important

The main aim of this example is to give you a better understanding of the different roles involved in contracting and how a contract document can help in clarifying roles and responsibilities.

For example, business group X has agreed to collect waste in a certain area Y including 50 houses. The Local Authority has given authorisation to the business group X to collect fees from the households. This contract started two months ago and in the first month the waste was collected well and everybody was happy. However, this month:

- The residents complain that the waste is only collected once a week, polluting the environment and giving a bad smell. In addition the contractor does not collect the waste that has “fallen” in the drain. The residents complain to the contractor but if nothing

happens they go to the Local Authority asking them to intervene.

- The business group (contractor) complains that the residents are not paying the fee and do not pay on time. They also feel that the Local Authority is not giving good instructions to the residents on how the waste should be packed.

- A Technical Support Organisation (NGO) could assist the Local Authority and the contractor to solve this conflict

If there was a written contract between the business group and the Local Authority, the roles and responsibilities would have been agreed by the parties and it would be easy to find out what the problem is and propose what measures to take. However, if there was a contract between the parties maybe the contract should be made more specific or maybe it needs to be renegotiated.

3.11 Simple Community Contract

Below you find an example of a community contract form. A specific form for the Zimbabwean situation will have to be developed. This should contain standard clauses that are applicable to the type of work to be carried out.

Form of contract

The first party to the contract is:

The Client is: Name: Address: Telephone/Fax:

The Client is represented by the following person or his/her nominee: Name: Address: Telephone/Fax:

The second party to the contract is:

The community contractor is the CBO Name: Address: Telephone/Fax:

The community contractor is represented by the following person or his/her nominee: Name: Address: Telephone/Fax:

Description of Services and Conditions:

The Works are (LIST THE WORKS) **The site is** (LIST THE SITE OR AREA OF OPERATIONS) **The starting date is** (INSERT THE DATE) **The completion date is** (INSERT THE DATE) **The total price is** (INSERT THE PRICE) **The schedule of payment is** (INSERT SCHEDULE OF PAYMENT HERE)

The contractor shall perform the works/services within the contract duration for the payment made by the client according to the contract.

The following documents are part of the contract:
(*list the documents as per the individual contract, for example, the contract document usually consist of*)

1	the agreement (this document)
2	the contractors offer or tender (or equivalent document like minutes or letters)
3	the conditions of contract (a set of standard clauses which govern the work, for example this includes what will happen if the contractor fails to do the work or if payment is not on time, who will assist in case of a conflict)
4	reference to drawings and site information (could be just a sketch of the area which will be served)
5	Specifications and description of work (how often will waste be collected and from where and to which location, during which hours will the water point be open etc.)
6	price list (what will the contractor get and from whom, which costs are included and which will not be reimbursed etc.)

(INCLUDE OR EXCLUDE THE ABOVE DOCUMENTS AS APPROPRIATE)

Signatures of the Client/Partner (partners are the parties to the contract) with full names and addresses:

Date……..	Date……..
……..	……..
Client	Contractor

Signature of the two witnesses with full names and addresses:

Date……..	Date……
……..	……
Witness 1	Witness 2

4 Types of Solid Waste and Generation Rates

4.1 Introduction

In Zimbabwe, urban areas continue to grow at a much faster rate than the provision and expansion of necessary infrastructure and services. This has created waste management problems as most local authorities have severe financial constraints, curtailing their ability to provide effective waste disposal. All the towns, cities and growth points face the challenge of littering, waste dumping and or improper waste disposal due to lack of integrated waste management strategies.

In the world today many people are realising that there is value in what other people have discarded as waste. Examples from many developing countries show that people are making a living from the collection of waste plastics, waste paper, cardboard boxes to name but a few. A number of organisations are working with community-based organisation in Africa (eg Zimbabwe, Zambia, Kenya, Uganda etc) and Asia (Sri Lanka, Indonesia etc) to come up with sound business ventures in waste collection. Communities are identifying the type of waste that is likely to bring them a livelihood. It is necessary therefore to identify waste by type and determine how much of it is produced over a given period of time.

4.2 Types of Solid Waste and Waste Classification

This session will make you think of the different types of waste that are thrown away by people and will make it clear why it is important to recognise some of these types of waste.

4.2.1 Types of Solid Waste According to Substance

To start with, consider solid waste produced in your area. You can recognise different types of solid waste that you produce by thinking of the material they consist of. Waste consists of different substances that range from plastics, paper, glass, textiles, organics etc. A broken plastic dish or plate, a discarded plastic bottle, a torn plastic bag, etc. are all plastics. Similarly, broken glass, a broken glass plate, a bottle, or a jar, all belong to the type of waste called *glass*. Used newspapers, sugar bags, old exercise books, cardboard boxes, etc., all belong to the type of waste we call *paper*. Onion peels, left over spinach, a rotten potato, maize stalks and cobs, and banana peels belong to the *organic* waste. An old tattered dress, a discarded part of a pair of trousers, an overall coat etc are all textiles**.** All of these and others are specific types

of waste classified according to the kind of materials that the waste consists of.

These specific waste types or groups can be further split into more specific groups depending on one's desire for detail. For example plastic can be specified as hard plastic or soft plastic, and different types of plastic can be given specific scientific names. But, that is beyond the scope of this training manual.

Waste can also be classified into two main groups on the basis of whether it naturally rots or not:

i. **Organic waste:** eg food leftover waste that can rot and that is made of natural materials.
ii. **Inorganic** or **non-organic waste:** eg plastic, iron, glass, metal and all other waste that cannot rot.

4.2.2 Types of Solid Waste according to whether hazardous or non hazardous

There are also wastes that have potential to cause damage or harm to a person or any living organism. For example some discarded household batteries contain mercury, alkaline, silver, zinc, nickel or cadmium. Automobile batteries contain lead and acid all of which have potential to cause harm to the environment as well as humans during handling. Chemical wastes, expired drugs, left over paint, etc. can often be poisonous or irritating for the skin, the eyes or the lungs. Some hazardous wastes are highly flammable, ie they can easily catch fire or explode. Human excreta and hospital waste often contain diseases causing agents and are therefore hazardous. Hazardous waste can bring about health risks. These dangerous wastes also include needles, knives and razor blades etc.

Box 4.1: Hazardous waste in Harare

Observations have shown that:

- Mixed waste from domestic, commercial/informal industry and from medical sources is being deposited in undesignated areas
- People use and store a variety of different hazardous products in their home and at work, such as rat poison, pesticides, wood preservatives, stain removers, paint thinners, batteries, expired drugs and chemicals, that result in hazardous waste.
- Human excreta found in the streets, pavements and sanitary lanes is threatening public health with diseases.
- Some households have small industries in their backyards and tend to mix waste from these industries and home waste. Such activities/industries include hair saloons, tie and dye, surgeries, garages, welding, black smiths, etc.

4.2.3 Types of Solid Waste According to Source

Another much used way of classifying types of waste is according to the source where the waste was generated. Figure 4.1 below describes the different groups of waste according to where they come from.

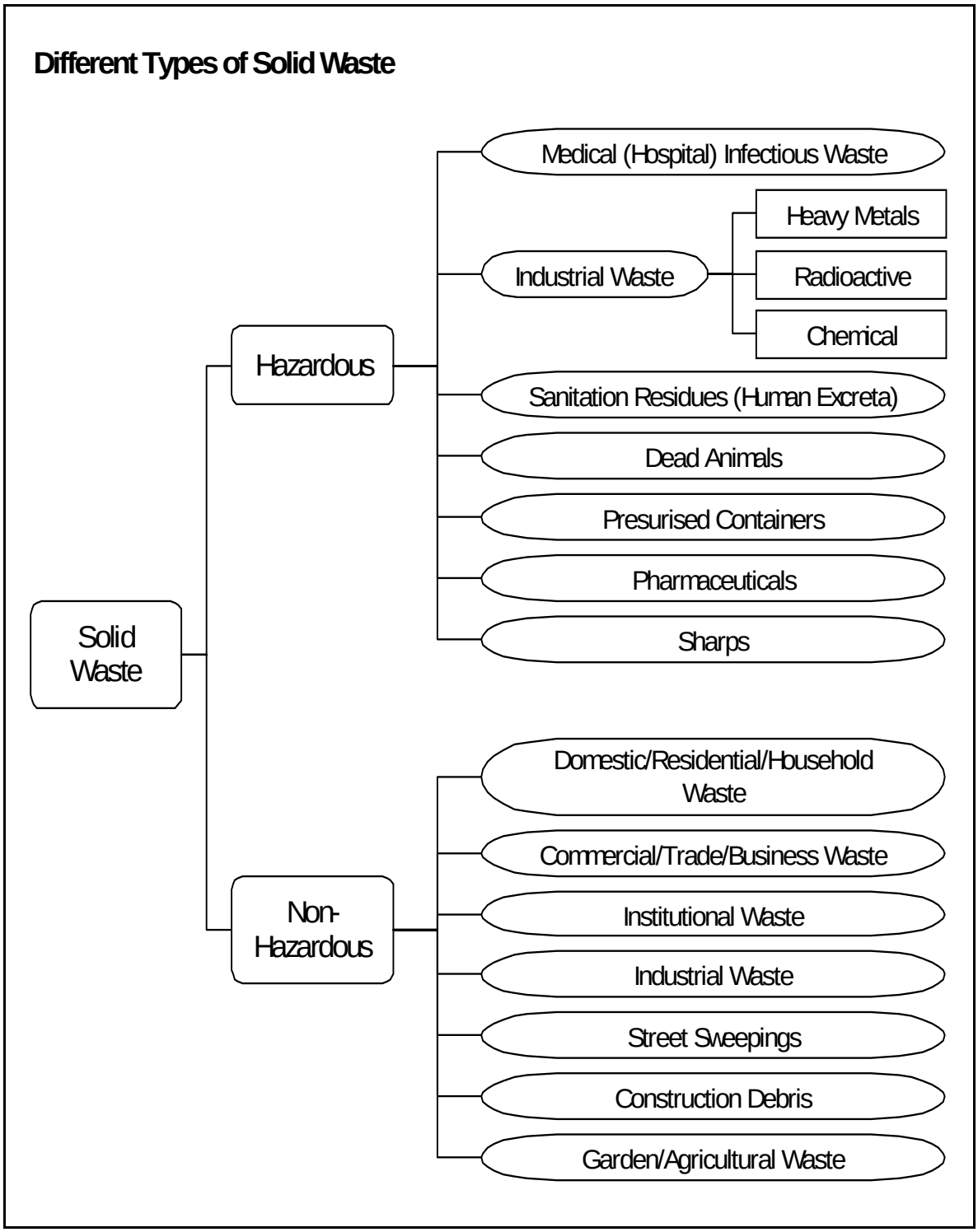


Figure 4.1: Different types of solid waste according to source

All industrial and domestic activities take out resources from and release wastes into the environment. Industrial processes have the potential to cause wide spread environmental damage. A large number and wide range of contaminating wastes are generated during production, packaging and service delivery phases of any industrial activity. Table 4-1 below presents a typical profile of the sources and constituents of urban landfill wastes.

Table 4-1: Typical urban landfill wastes, their sources and constituents

Motor and associated industries	Used oils, oil sludge, coolants, bake friction materials, paraffin and hydraulic fluids, bay wash water
Chemical industries including agrochemicals	Waste fertilizers, pesticides, drums, bottles, tin packets, cyanides
Construction industry	Contaminated rubbles, asbestos breakages, paints
Food industry	Meats, flour, beverages, food additives, contaminated processed foods, oils, water, fruit and vegetables
Home and Personal	Waxes, lotions, inks, soaps, fats, paper, plastics, chemicals, dyes, rags, etc
Metal fabrication	Inks, metallic sludge, coolants, lubricants, contaminated saw dust, chromium, metal sharps, spent chemicals etc
Paper and Print	Inks, papers, paraffin, pulp, chemicals
Health Institutions	Pharmaceutical waste, expired drugs, bottles, needles, contaminated containers and bandages, and other biological and clinical wastes
Soaps and Edible Oils	Fats, sludge, alkalis, acids, oils soaps
Leather industries	Shavings, fats, muddy water, dyes, chemicals, containers
Miscellaneous	Tobacco wastes, broken glass, plastics, scrap metal etc

4.2.4 Classification of solid waste in Zimbabwe

Household or domestic waste is solid waste composed of garbage and rubbish generated by households or homes. In high-density neighbourhoods up to two thirds of this category consists of organic waste, including ash produced through traditional cooking and soil from floor sweeping. In communities where toilets are not enough or where sanitation facilities are limited domestic waste might also include human excreta.

You must realize that household waste from your residential area can contain hazardous waste. It is important to determine the types of hazardous waste you expect

to find in this waste and how you can handle it. Think of the special care you have to take and the protective clothing and or gear (including boots, gloves and face masks) you might need to wear to handle this waste.

It is necessary to always use protective gear, as you cannot be sure of the contents of a pile or a bag of waste that you are collecting.

Commercial waste: This is all solid waste coming from business places such as stores, markets, office buildings, restaurants, shops, bars, etc. Commercial waste typically consists of packaging and container materials, used office paper, wood shavings, food waste, etc.

Industrial waste: Industrial waste comes from processing industries. Industrial waste might include chemical waste, which is hazardous waste.

Note: It is not the responsibility of a ordinary waste collector to handle hazardous waste. Such waste is to be handled by specialised, well-trained and well-equipped people. Industries or producers of hazardous waste are responsible for the collection and proper disposal of such waste.

Institutional waste: Waste from police camps, barracks, schools, hospitals, prisons, and other public buildings. Where the institution involves residents, the waste composition is similar to those from households. Some institutions, e.g. hospitals, can generate hazardous waste.

Street Sweepings: These include dust/sand, leaves, paper, etc. In high-density neighbourhoods, street sweepings might also contain household refuse, drain cleanings, and human and animal excreta

Box 4.2: Hazardous hospital waste in Harare

In Harare there are many surgeries and dispensaries within the residential areas. Some of these clinics or surgeries mix dangerous hazardous waste with ordinary domestic waste collected by a CBO or private companies or municipalities. Observations have also shown the presents of hospital waste and home industry waste in various collection and transfer points.

Construction debris: The nature of construction waste depends upon the materials used for the purpose of construction. It can contain, wood, brick-stones, concrete, glass, and metals, to name a few.

4.3 Solid Waste Composition and Generation Rates

The amount and composition of waste generated and to be collected at different locations differs. Offices and learning institutions or schools, produce a lot of paper waste, while restaurants and hotels produce a lot of food leftovers, bars usually produces a lot of empty bottles and cans, households often produces a bit of everything. There are ways to find out how much waste and what kind of waste a certain industry, shops, business entities, schools or households produce.

People who collect and dispose of waste need this kind of information in order to:

- Decide on what equipment to buy
- Know what kind of temporary storage facilities is required
- Know the collection points and transfer stations.

Temporary storage facilities should have enough capacity; otherwise surplus waste will overspill and pollute the area.

4.3.1 Waste composition

Waste composition describes the individual components that make up waste. Knowledge of the solid waste composition is important as it assists a person to know the equipment they require to transport their waste and to determine the management programmes and plans needed. In professional waste collection, waste with a low density (light waste) is usually compressed or compacted to reduce the weight per cubic meter and the transport costs.

Another reason why waste collectors are interested in waste composition is because some of it may be harmful or dangerous (hazardous). Collectors risk being cut by the sharp edges of metals and broken glasses or being affected by chemicals in the waste. On the other hand, if you know the likely waste composition, you can decide whether recycling is an attractive option. The amount of waste generated is described as waste generation rates.

4.3.2 Waste generation rates

The waste generation rate is the type, weight and volume of waste produced per source unit in a certain amount of time. This is calculated as the weight and or volume of waste produced per over a given period of time e.g. kgm^3/person/day. The unit can be a household or person it can also be a business entity or a known geographical area, for instance a residential area.

Waste collectors need to know the waste generation rates in their area of operation, to help them to plan for the collection and dumping or disposal of waste. Generation rates also help to determine the number and type of waste collection equipment and tools, and the waste storage and disposal facilities you will need. The waste

generation rates also help to determine the frequency of collection: how often should waste be collected from households in a certain area/street or residential area. You will also need to know the waste generation rates to design or plan the best route to follow when you are collecting waste from the households in your residential area.

To estimate the weight and the volume of the waste per customer in a given period of time (per day, per month), you will have to collect waste samples from households and business in your own community. Asking people to store their waste for a fixed number of days or a week can do this. You can give them bags to store the waste in during this period. Afterwards you collect the bags with waste from these people. Then you have to weigh the waste samples to see how much is thrown away in the selected period and you have to check what kinds of waste these people have thrown away. You will do this in the group work at the end of this session.

4.3.3 Waste Generation Rates in Zimbabwe

Recent Studies have estimated the mass, volume and composition of waste generated in Harare, Bulawayo and other cities and towns. The estimates are for both high-density and low-density residential areas. Generally, the solid waste generated in most urban centers has high proportions of non-degradable solid waste such as metals, glass, plastics and miscellaneous waste (see Tables 4-2 and 4-3 below).

Table 4-2: General composition of waste collected by some Local authorities (maximum recorded % of total weight) in 1995, 1998, 2004.

Urban area	Paper & cardboard	Glass & Ceramics	Metals	Plastics	Leather & Rubber	Textiles	Vegetables / Putrescibles	Misc
Harare	25	5	7	10	15	8	25	20
Bulawayo	20	5	10	10	3	2	10	40
Gweru	20	8	7	10	5	8	25	18
Chegutu	25	15	15	15	6	6	10	8
Shurugwi	20	10	10	15	6	6	15	18
Kadoma	22	7	9	10	8	12	25	20
Norton	15	8	17	18	4	-	26	12
Marondera	20	15	15	-	15	7	25	20
Victoria Falls	34	6	5	15	2	4	26	8

Adapted from Sources: MLGRUD 1995, SOER 1998, Masocha 2004

Tables 4-2 & 4-3 below, show that in Zimbabwe up to 15% of the total weight of urban solid waste is plastic. This is a significant proportion of the waste considering that plastic is the least dense constituent of urban waste. Even then plastic waste constituted 10% of the total weight of urban waste in the major industrial cities of Harare and Bulawayo in 1998 (Table 3-3). The tables also show that 10-15% of the

solid waste generated in Harare and Bulawayo is of vegetable origin and degradable. There is great potential for recycling both the non-degradable and biodegradable solid waste including plastics in Harare, Bulawayo and other cities and towns.

Table 4.3: General composition of urban waste collected by Harare and Bulawayo Municipalities (% of total weight) in 1998)

Type of waste	Harare	Bulawayo
Paper & cardboard	30	20
Glass and ceramics	10	5
Metal	10	10
Plastics	10	10
Leather & rubber	5	3
Wood	5	5
Textiles	5	2
Vegetables	5	10
Miscellaneous	20	35

Remarkable changes in composition and density of urban waste have been observed in Harare in the last 45 years. Fore example, the density of urban solid waste decreased by 50% from 460 to 230kg/m^3, and the volume increased two fold between 1965 and 2000. There has been a significant two to there-fold increase in paper and plastic content during the same period. The trend is continuing.

The population of Harare grew by 33.3% from 1.5 million to 2 million people between 1992 and 2002. Studies carried out in 1995 showed that Harare and Bulawayo produced 660 and 413 t/day of solid waste (Table 3-4) Furthermore, Harare and Bulawayo municipalities estimated that they disposed 1000t/day and 400t/day of solid waste in 1997 respectively.

It was further deduced that the average solid waste generation was 0.7 kg/person/day in the major cities. This implies that the plastic waste generation in the major cities was about 70g/person/day in 1995. It was projected that these major cities would produce more than 1400 and 474 t/day of waste in 2002 (Table 3-4). Indeed many tones of waste are generated annually in the major industrial cities.

4.3.4 Domestic Waste Generation Rates in Zimbabwe

It has been found that the average domestic waste generation rate o in the urban residential suburbs was about 0.485 kilograms per person per day in 1997. The waste generation rates for commercial activities have not been determined.

Generally the waste generation in low-income residential areas is lower than in high-income areas. However, the amount of solid waste generated in the cities varies from one residential area to another.

A study by Kativu (2001) established that in Gunhill (a high income residential area) and Crowbrorough (a low income residential area), the waste generation rate was 0.481kg and 0.301kg per person per day respectively. There were no estimates

indicating the average compositions of waste from these residential areas

Table 4-4: Daily waste production and management in selected cities in 1995 & 2002

Urban area	**Estimated production in 1995(t/day)**	**Estimated production in 2002(t/day)**	**% Collected (estimate) 1995**	**% Collected (estimate) 2002**	**% Uncollected 1995**	**% Uncollected 2002**
Harare	660	1400	89	54	11	46
Bulawayo	413	474	98	60	2	40
Kadoma	40	112	90	54	10	46
Chinhoyi	40	121	82	50	18	50
Marondera	38	72	96	58	4	42
Bindura	18	76	67	40	33	60

Adapted from SOER, 1998

Table 3-4 shows that in 1995, more than 85% of the municipalities collected more than 82% of the solid waste generated daily. However, the recent economic downturn has negatively impacted on the performance of local authorities. Consequently most of the cities are reported to be collecting less than 50% of the solid waste generated due to fuel shortages and shortage of foreign currency for the repair of an old fleet of vehicles and equipment. Even the sub-contracting the private sector to collect the solid waste has not helped much. The uncollected waste remains strewn on the ground, littered in open drains or in garbage dumps, often resulting in municipal sewer and storm water drains blockages.

Illegal dumping of waste is growing in and around most of the urban centers. This reflects the failure by local authorities to effect proper and efficient waste management. This illegal dumping often manifests itself through the growth of uncollected mounds of waste. Dumping often occurs at backyards, roadsides and unused open spaces.

Solid industrial wastes are disposed at sanitary landfills and illegal open dumps in Harare. Fires are a common occurrence at the dumpsites. These dump fires convert wastes such as plastics into toxic material, which pollutes air water and soils.

The most common solid waste disposal method used in Zimbabwe is sanitary landfill (or controlled tipping) and composting. In Harare, more than 85% of the collected solid wastes are disposed by sanitary land filling. This method mainly involves the selection of open pits on geologically and topographically suitable sites and excavations in preparation for landfill operations. The compacting of solid waste using bulldozers and landfill compactors adversely affects the quality of land for other land-use options. Refuse composting is not widely used in the country although there is potential to use this technology in the large centers such as Harare.

4.3.5 Waste Generation Rates in Zambia

Similarly in Zambia, it was found that the domestic waste generation rate of high-density suburbs was about **0.56 kilograms per person per day**. The respective waste generation rates for commercial waste (here: waste generated by market stalls) was about **1.7 kilograms per stall per day**. Results for other types of waste were not applicable to high-density suburbs. The density of domestic waste in high-density suburbs of Lusaka was found to average **395 kilogram per cubic-meter**. The density for commercial waste was **207 kg/m^3.**

The composition of the domestic waste in high-density compounds was about 66% soil mixed with minor amounts of dust, stones charcoal remains and ashes and about 25% putrescibles (materials that rot, such as food leftovers, leaves and grass). The remainder was made up of paper and cardboard (3%), plastic (3%), and other components (2%). In the composition of waste for markets stands, soil still makes up for about 50% of the total waste, followed by putrescibles at 23%, cardboard and paper at 12% and plastics at about 7%. All other items made up for less than 4% of the waste. The table below summarises these results.

Table 4-5: Solid waste generation and composition in Lusaka, Zambia

Solid waste particulars	**Households**	**Businesses/markets**
Amount of kilograms/day	0.56 per person	1.7 per stall
Density (kg/cubic meter)	395	207
Composition	Mixed soil 66% Putrecibles 25% Paper and cardboard 3% Plastics 3% Others 3%	Mixed soil 50% Putrecibles 23% Paper and cardboard 12% Plastics 7% Others 8%

Source: LCC/ECZ: Solid Waste management Master Plan Project Report for the City of Lusaka, Phase 1 – Diagnosis – Final Report; January 1997

The figures above might be taken as a starting point for your own analysis, but it is very likely that they vary from compound to compound. They vary because of different ways of living, activities taking place, culture, income, etc. Therefore, and to obtain exact figures, it is necessary for you to conduct your own analysis for your own compound.

4.3.6 The importance of waste composition and generation rates to waste collectors

Waste collectors need to know the waste generation rates in their area of operation in order to:

- Help them to plan for the collection and dumping or disposal of waste.
- Help to know the number and type of waste collection equipment and tools,
- Know the waste storage and disposal facilities you will need.
- Help to determine the frequency of collection i.e. how often should waste be collected from households in a certain area/street or compound.
- Design or plan the best route to follow when you are collecting waste from the households in your compound.

Practical ways of determining waste generation rates include the following:

i. Ask the people in your community to store their waste for a fixed number of days or a week. You can give them bags to store the waste in during this period.
ii. Afterwards you collect the bags with waste from these people.
iii. Then you have to weigh the waste samples to see how much is thrown away in the selected period
iv. You then need to check or sort out the waste to see what kinds of waste is thrown away in your community

4.4 Calculating Waste Generation Rates

The process of obtaining the composition of waste can be done practically during the training and will be done in the group work exercise. The waste generation rate for one household can be calculated after knowing the number of days it took a household to collect a certain amount of waste. By dividing the amount of waste collected by the number of days it took to collect the waste, you know the amount of waste generated daily by this household. If you do this for several households of different sizes and income groups (minimum 10 families, but preferably more) in your compound, you can calculate the average waste generation rate in your settlement. Now if you know the number of households in the area that you have to collect the waste from, you can calculate how much waste there is to be collected every day of the week.

4.4.1 Example: Calculating Waste Generation Rates

You have given empty mealy meal bags to 5 households and asked them to collect all their waste in it for 5 days. After the 5 days you collect the bags from the households and weigh them. These are the results:

Table 4-6: A result table for waste generation rates

Unit Description	Kg collected	Kg/ H/hold /day	Kg / person / day
Phiri H/hold (9 people)	22 kg	22/5 = 4.4	4.4/9 = 0.49

Banda H/hold (10 people)	25 kg	25/5 = 5.0	5.0/10 = 0.50
Ncube H/hold (7 people)	15 kg	15/5 = 3.0	3.0/7 = 0.43
Marongwe H/hold (9 people)	13 kg	13/5 = 2.6	2.6/9 = 0.29
Matemai (6 people)	10kg	10/5 = 2	2/6 = 0.33
Total of 5 households	**85kg**	**85/5 = 17**	**17/41= 0.41**

So 5 households produce 85 kg in 5 days. This means that they produced 17 kg per day. If we now divide this figure by 5 (for the 5 households), we get the average amount of waste generated per household per day. We can also calculate the average amount of waste generated per person per day as shown in the table above.

Average waste generation rate: 85/25 = 3.4kg per household per day

Note: that in Table 4-6 above, the amounts of waste generated per family per day can differ considerably. In this example the Banda household collected 5.0 kg per day whereas the Marongwe household collected only 2.6 kg per day. Because of these differences it is important that you collect from a number of households (minimum 10) from different social and economic background to get a reasonable average.

Note in the table above that not only the amount of waste generated per household differs per household, but that also the amount of waste generated per person differs per household. This has to do with many factors like the income level of the household (more money, more waste), the size of their plot (sweepings), etc. The Mataemai household generates 0.33kg of waste per person per day whereas Banda household generates only 0.50 kg per person per day. Therefore it is likely that the Banda and the Matemai households are from high and low income residential areas respectively.

Waste generation in the area your group has to cover:

Now if you know that there are 253 households in the area you have to cover with your waste collection activities, this means that you will have to collect

253 x 3.4 = **860.2 kg of waste per day**.

Imagine that you do not know the number of households in your area, but you do know that there are about 3500 people living in the area you have to cover. Then you can use the generation rate per person per day to calculate the amount of waste generated daily in the area you have to cover as follows:

3500 x 0.41 = **1435 kg per day**

Similarly rates for markets can be obtained if the number of days to collect a certain amount of waste from a market place is known for several market places.

4.5 Group Field Work Part 1

Requirements:

- Pre-selection of 5 households in a community
- Information on the number of people n each selected household and the date they start using the waste container.
- Waste from households in the community
- 5 Big plastic/Polythene bags distribute for use 5 days before the exercise
- 30 Medium sized plastics/polythene bags to sort waste into plastic, paper, glass, items that can rot, metal scrap and others
- Protective clothing (10 pairs gloves, 10 dust coats, respirator musks for all participants)
- 2 or more weighing scales
- 5 Calculators

The **first set of objectives** of this field exercise are to:

- Have an idea of how to do a waste analysis
- To calculate waste generation rates (household/day, person/day)
- Identify and separate the types of waste from households.
- Measure the mass of each type of waste separated
- Calculate the proportion of each type of waste to the total mass generated

The exercise:

Each group is provided with a plastic/polythene bag with waste

i. Weigh how much waste is in the plastic/polythene bag.
ii. With gloves on your hands and coats put on, empty the plastic/polythene bag and sort the waste, identifying it by types.
iii. Weigh each type of waste on the weighing scale and calculate the percentage of the total amount of waste you were given. You calculate the percentage by taking the weight measured divided by the total weight and multiplying it by 100. (Weight measured/total weight*100 = percentage of this type of waste in the total weight).
iv. Write the results in the table on the next page. (Also, make your own table on a flip chart and write your results in it).
v. Calculate generation rates as indicated earlier

Table 4-7: Group Fieldwork results presentation model

Household Name:			
Number of People			
Start Date		**Weighing Date**	
Total Mass			
Type of Waste	**Mass**	**Percentage of total**	**Remarks**
Plastics			
Paper			
Glass			
Items that rot			
Metal			
Others			
Total			

Table 4-8 general observations could be made whilst in the community

	General Items To Be Checked / Observed	**Yes or No?**	**Comments or Remarks**
1	Are there illegal dumps, or scattered/piled of waste in the compound?		
2	Are there people scavenging?		
3	Presence of different types of waste: for each type of waste suggest possible sources and think of how you can handle such waste safely. Suggestion of re-use or recycling?		
4	How is waste stored waste present at community level (if stored)?		
5	How is waste stored at the household or family level?		
6	Is there any sorted waste at household level?		
7	Are waste collection and disposal activities present? If so, by whom		
8	Are recycling activities undertaken in the community? If so, give examples		
9	Any other important observations?		

4.6 Recommended Best Practices

Waste must be sorted and separated at source. This results in dramatic increase in materials recovery and use and recycling. It must be easy for households and industries to sort their waste. To take it to a collection depot or to have it collected. It is important to provide incentives and or to ensure that consumers see the benefit s of sorting waste at source so that they continue sorting.

It is important to improve your knowledge about the waste that you are interested in because of the large number of hazardous substances that may be contained therein. We still know very little about some of the long-term risks and effects of handling hazardous substances. Always place greater emphasis on reducing the hazard that is posed by the waste you are collecting. Always practice good personal hygiene.

The frequency of waste collection recommended by the World Health Organisation is as follows;

i. Solid waste must be collected daily in the central business district.
ii. Solid waste must be collected at least once and twice every seven (7) days in low income and high-income residential areas respectively, to break the breeding cycle of disease vectors like houseflies.
iii. Waste should not be left standing at shopping centres for more than 48 hours.
iv. Collection services should run as scheduled and not in erratic fashion.

5 Re-Use, Recycling and Composting

5.1 Introduction

Waste management has become one of the major challenges confronting urban local authorities in Zimbabwe and other developing nations. Rapid urbanization has resulted in increased social and environmental challenges and also placed a considerable strain on urban services such as solid waste management.

- **What is waste?**

Waste is any by-product of production or things or leftovers that have lost their use-value to the person who used it first. This does not mean that waste is useless for everybody. For example, at the waste dumpsite or the waste disposal site, there are usually waste pickers or collectors, who collect some of the disposed waste as valuables to them and other users. They pick for example: cans, carton boxes, metal scrap, plastic and glass bottles etc.

Instead of having to collect valuable materials from the waste that is dumped at the legal dumpsite, there are other ways of reducing the amount of waste dumped. Firstly, it is possible to refuse to accept taking things that have to be thrown afterwards like plastic shopping bags or unnecessary wrapping paper. Also, you can reuse plastic bags, bottles, etc. instead of throwing them. Lastly, materials that could be used for recycling can be separated from the waste before it is dumped at the legal dumpsite.

5.2 Solid waste management and sustainable development

An increasing number of persons and organizations long for a future when waste will cease to exist because it would not be produced or it would be a re-used resource. However, a lot of awareness work need to be done to change negative attitudes that many people have towards recycled products. This largely explains why generally there is low demand for recycled products in the Zimbabwe despite that most of them are cheaper than virgin products.

Zero waste tolerance implies encouraging people to produce without waste or with as little waste as is possible. It means that in the production and delivery of goods and services, non-renewable resources have to be preserved, and the waste and pollution must be avoided or kept at minimum level. Waste management promotes sustainability in that activities, such as resources recovery, recycling/ reuse and

composting reduces the raw material demand during production as well as disposable waste, thereby saving non-renewable resources. Waste management practices such as recycling promotes sustainable consumption ie the use of goods and services that respond to basic needs and bring a better quality of life, while minimizing the use of natural resources, and production of toxic materials and emissions of waste and pollutants over the life cycle so as not to jeopardize the needs of future generations.

5.2.1 Waste trade

Industry can reduce the waste load into the environment to conformity with environmental standards through improved resource management systems that include trading in waste to promote waste use. However, the opportunities for trading in waste and the economic benefits from trade in waste differ between industries and must be treated on a sector or cluster basis. Nevertheless, the potential benefits to industry and to down stream communities that are already trading in waste are enormous.

Waste trading is based on the principle that **where there is industrial waste (muck) there is money**, and establishes linkages and partnerships between producers and users of industrial waste in selected sectors of the economy, and promotes economic use of industrial waste to reduce the pollution burden on the environment and the pressure on natural resources exploitation to contribute to sustainable development. The trade in industrial waste promotes closed loop principles and waste audits. The strategy when implemented helps to change industrial mindsets such that industrial waste is managed as an asset with economic value. This strategy indirectly promotes separation of wastes at source.

5.2.2 Waste Conversion

This practice involves the change of waste into energy or manure. Waste conversion projects can be considered for rural and urban areas in Zimbabwe. Rural examples include biogas plants and heat energy obtained from waste incineration or from burning methane obtained from waste treatment procedures. There is need though to create a market for this type of energy in the face of cultural resistance to the use of human manure and biogas from human excreta for example.

5.2.3 Incineration

Incineration is a waste disposal method that involves the burning of waste at high temperatures. Incineration converts the waste into heat, gaseous emissions, and residual solid ash. Other types of heat treatments include pyrolysis and gasification. Waste to energy (WtE) is a modern term for burning waste in high efficiency furnaces/ boilers to produce steam and or electricity and incorporating modern air

pollution control systems and continuous emissions monitoring. Incineration does not consume much land as landfill. Engaging into incineration might be expensive business to start but this can be a long-term big business for urban communities in Zimbabwe.

5.3 Solid Waste Management in Zimbabwe

The current waste management activities in Zimbabwe are shown in Figure 5.1 below.

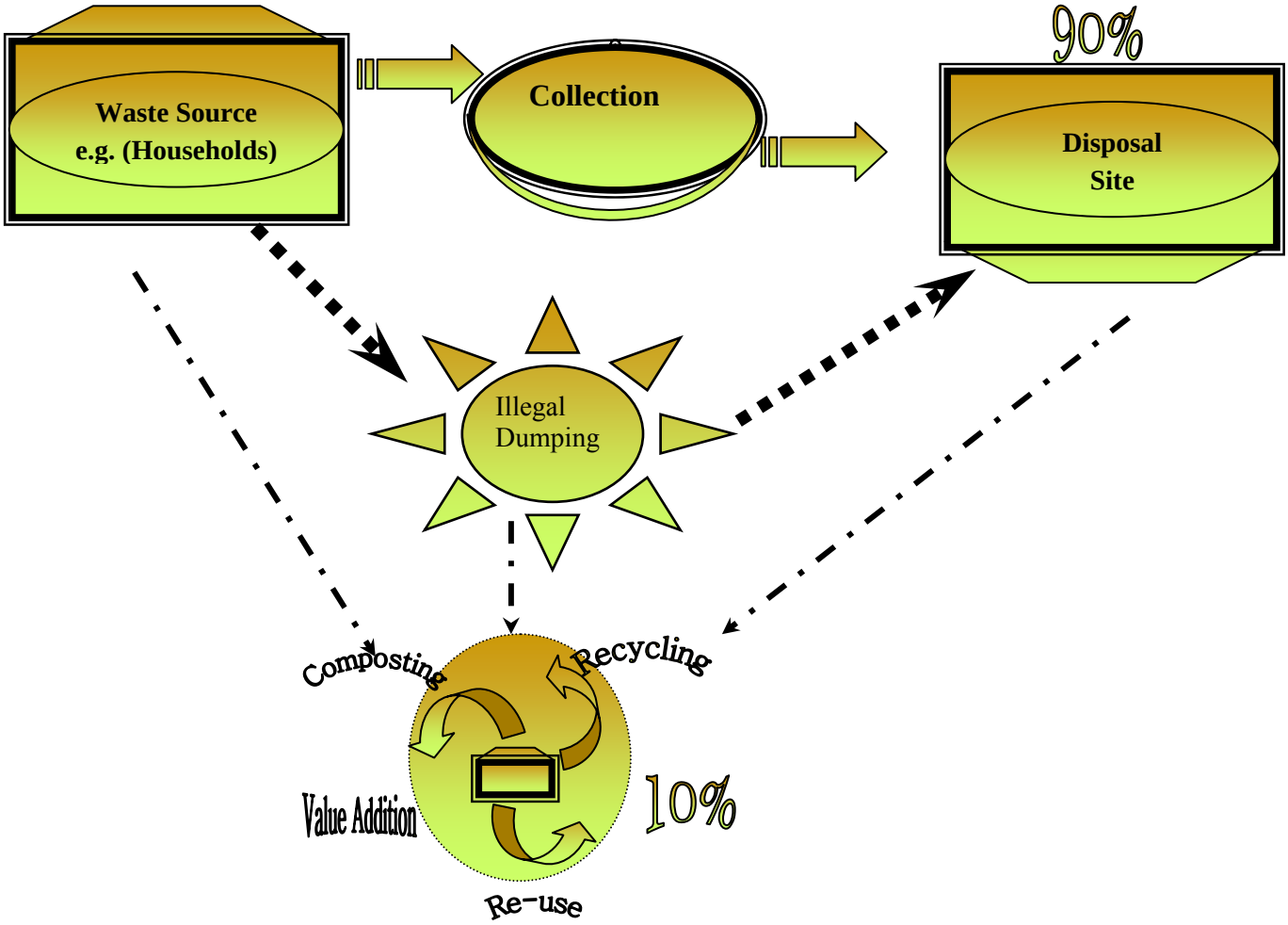


Figure 5.1: Current Management Practice In Zimbabwe

From figure 5.1 we can see that

i. Most of the waste is collected by Municipal Authorities and agents to the disposal/landfill sites (Pomona, Warren Westerly).
ii. Generators of waste often dispose of uncollected waste at illegal dumping sites.
iii. Solid waste is collected for re-use, re-cycling and value addition either from households, illegal dumping sites and disposal sites.
iv. Less than 10% of the reusable waste is being recycled

Photo 5.1: One of the many illegal Waste dumps in Malborough, Harare Source: Maviza A (2007)

Photo 5.2: Separated empty plastic bottles awaiting collection by unknown individuals in the illegal waste dump in Malborough. Source Maviza A (2007),

Photo 5.3: Separated cans and scrap metal awaiting collection by unknown individuals in the illegal waste dump in Malborough. Source Maviza A (2007)

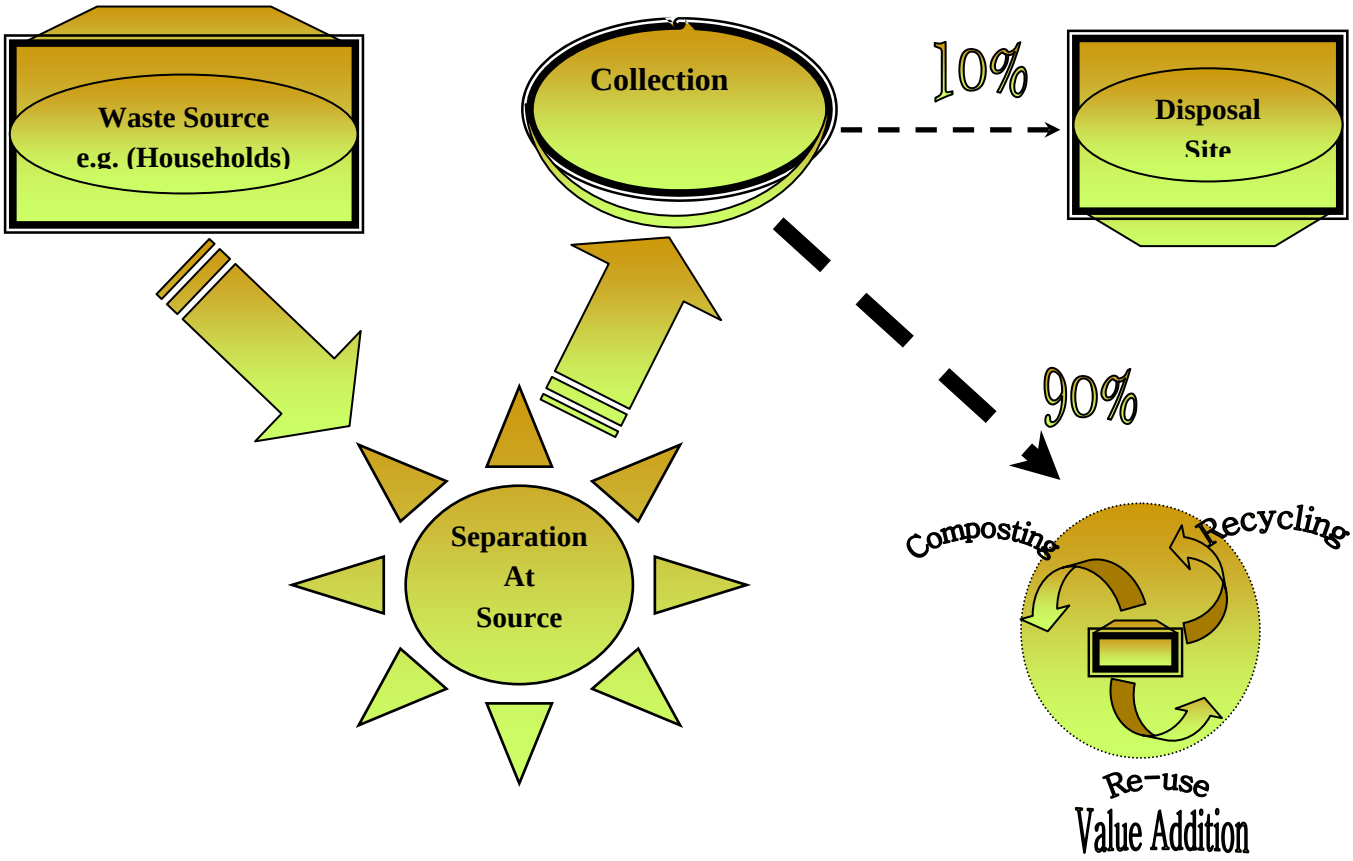


Figure 5.2: Recommended Waste Management Practice for Zimbabwe

From figure 5.2 we can see that

i. All solid waste must be separated and sorted at source before collection for either recycling, re-use, value addition or for disposal
ii. This way, Municipal Authorities and agents would collect less than 10% to the disposal/landfill sites and at least 90% o of the waste will be reused and recycled
iii. However, this requires establishing temporal storage sorting centres, awareness and incentives for public participation.
iv. There are several economic, social and environmental benefits to that.

5.4 The Solid Waste Management (SWM) Hierarchy

Another important strategy is the development and promotion of Integrated Waste Management in Zimbabwe emphasising the adoption of strategies that reduce the volume and pollution strength of waste before treatment and final disposal. The Waste Management Hierarch shown in Figure 6.2 below typically illustrates this. The Waste Management Hierarch is applicable at national provincial district, municipal and enterprise level:

The SWM hierarchy represents an approach to SWM, which prioritises the various

options in dealing with solid waste. According to this hierarchy, optimisation of any SWM system means focusing on moving it up the hierarchy, away from disposal into the direction of waste avoidance. See the illustration of the SWM hierarchy below. From this illustration you can see that avoidance of waste generation is the best option. The second best option is to minimize the amount of waste you generate. The third most desirable option for dealing with solid waste is the recovery of materials by practising recycling and reuse where possible.

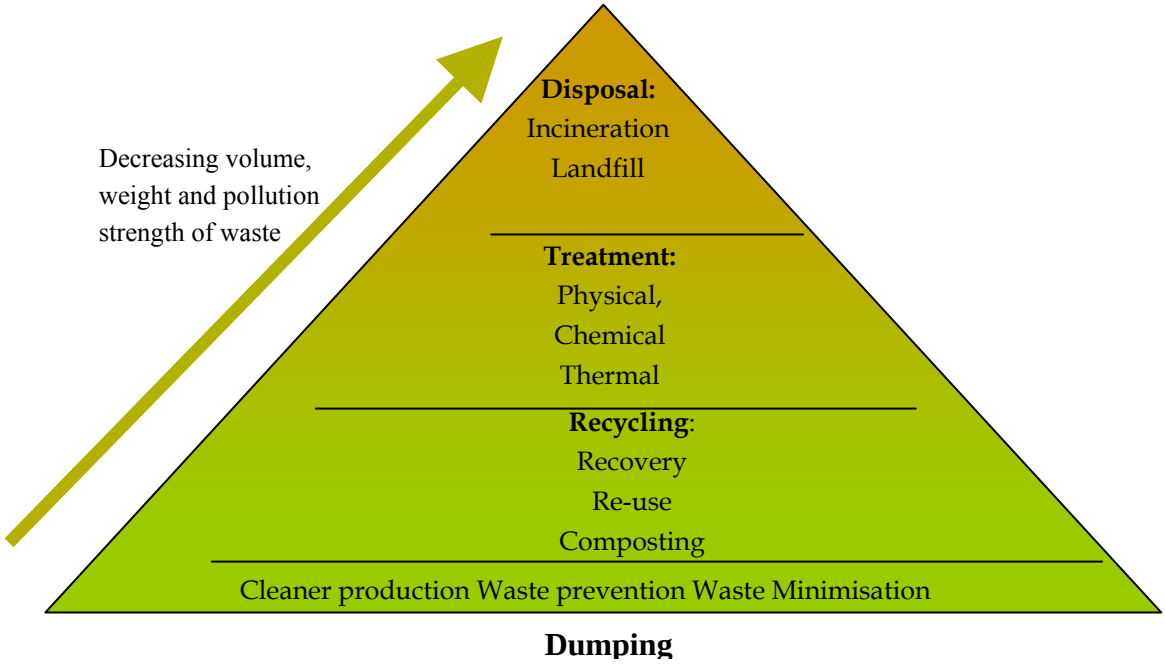


Figure 5.3: The Waste Management Hierarchy

Crude dumping of solid waste is an undesirable and unsustainable option in a SWM system and is therefore, shown outside the pyramid. Even in highly sophisticated SWM systems there will always be a portion of the waste that will need to be treated and disposed off. The landfill therefore remains an essential component of any SWM system. However the first steps in intergraded solid waste management are waste avoidance and minimisation.

5.5 Waste refusal, Re-use and Recycling

5.5.1 Waste refusal or avoidance

This means not generating unnecessary waste. Not accepting unnecessary plastic bags, or wrapping papers and other containers when you go shopping is one way of avoiding to bring waste to your home. In this way the amount of waste you generate

will be reduced.

5.5.2 Waste reuse

There are different forms of recycling. Waste reuse is a form of recycling, which refers to using something again which would otherwise have been thrown away. A good example for waste that is re-used is waste paper. Waste paper can be newspapers, magazines and books, cardboard and mixed papers etc. Waste paper is re-used as toilet paper, tobacco paper, wrapping paper for foodstuff and others.

Another example of re-use that was already given in earlier sessions is the re-use of glass bottles. Glass bottles are often not thrown away or picked from the waste to be sold to marketers for re-use in the bottling of cooking oil, beer, soft drinks, honey, etc. At household level both glass and plastic bottles and other containers are widely re-used in the kitchen to store drinking water, salt, sugar, pepper, etc. Things that can be re-used are called re-usables.

5.5.3 Waste recycling

Recycling means taking a product or material at the end of its useful life and turning it into a usable raw material to make another product. Waste recycling is the process of reclaiming material that would otherwise be disposed of as waste. It is a method of resource recovery. The modern trend in waste management is to consider waste material as a resource to be exploited, instead of simply a nuisance to be managed and deposited off. The material maybe extracted and recycled, or converted to another product. The process of extracting resources or value from waste is variously referred to as secondary resource recovery, recycling and other terms. There is growing acknowledgement that disposing waste is unsustainable in the long term as there is finite supply of most raw materials.

Waste recycling is the re-use of the waste material to make a new product of the same material. For example, it is relatively easy to produce paper from old paper or clothes? Or an even better example is that you can melt any discarded glass and produce a brand new bottle from it. This is what we call recycling of waste.

Waste recycling refers to methods of isolating certain waste materials and using them to produce new goods. Materials with a high potential for recycling are:

- Paper. Waste paper, like newspapers, magazines, cardboard, books, and letters can be used to make new paper or cardboard.
- Metal. For example scrap metal, auto wrecks, aluminium (beverage) cans, used copper wire, etc. can be used to make new metal products.
- Textile. Textile off-cuts, old clothes, etc, can be used for the production of doormats, cushions, mattresses, kid’s underwear, homemade caps and

duster coats, stuffing dolls and others. Also, textile can be used in the production of high quality paper.

- Plastic. Waste plastic such as broken buckets, plastic bottles, shopping bags and containers can be melted and formed into new products.

Materials, like the ones mentioned above, that can be used for recycling are called **recyclables**.

Most of the materials are recovered from open dumps. Studies carried out in 2003 show that there are over 1200 and 2000 dumpsite waste harvesters in Harare and Bulawayo respectively. These people directly earn a living from informal waste recovery. The recovery of recyclables is a low–skill occupation with relatively free entry, low capital investment yet offering enormous on the job training.

Informal waste harvesting currently practiced in Zimbabwe includes activities such as:

- The retrieval of waste from public places by itinerant waste harvester.
- The unsanctioned retrieval of recyclables and other items of personal value from refuse trucks by waste collectors employed by municipalities during collection.
- Dumpsite recovery and the informal waste exchange involving households, middleman, waste harvests, collectors, traders and wholesalers.

However, a small percentage of the solid waste generated is recycled. Therefore, recycling needs to be encouraged because:

i. It generates employment and income;
ii. Stimulates the build up of industrial skill and repair and remanufacturing;
iii. Prolongs the lifespan of disposal sites; and
iv. Promotes sustainable resource use.

Currently in Zimbabwe recovering and recycling of solid waste is a small business because:

i. The activities are a major source of income and livelihood to just less than of 1% of the total urban population;
ii. Less than 10% of waste paper, plastics and scrap metals are recycled nation wide
iii. Recycling is confined to plastic, scrap metal, paper, cardboard and glass bottles (mostly soft drinks – deposit refund systems) because of substantial demand and being a significant constituent of solid waste.

5.5.4 Challenges and constraints

The main challenge of conducting waste recycling business is attitude towards waste. Many people do not want to associate themselves with waste. To them waste

collection and recycling is a dirty business. As a result marketing waste is also a challenge. There is also lack of financial capacity on the party of CBOs to conduct waste collection and or recycling on large scale so as to attract lucrative markets. Furthermore household waste is usually mixed up and difficult to separate. For example, plastics and organic waste such as vegetables are found in the same bin. This complicates waste separation and is time consuming. The prevailing economic constraints makes it very expensive to transport waste material from one place to another, thereby making it difficult for poor communities to engage on such business without funding during the initial stages. Another challenge to informal waste collectors is the risk and exposure to diseases, injury and chronic toxicity through contact with infectious and carcinogenic materials during waste picking and or separation.

5.5.5 Waste recycling in Harare

There are several CBOs involved in waste collection and selling the collected waste to companies that recycle in Harare. Some NGOs are also supporting these initiatives through training and financing demonstration projects. The common waste collected is plastic. In Chitungwiza's Zengeza 3, located 30km south of Harare, three groups; Zengeza 3 Waste Management Group, Shambidzikai Environmental Awareness & Wenhamo Cooperative are carrying out waste collection. Just Joy & Tisinungureiwo Mbare group collects waste in Mbare. In Epworth, a peri-urban settlement, three community-based organizations, CNM Environmental Action Group, Two by Two Waste Collectors and Epworth Coalition for Sustainable Development (ECOSAD) are involved in waste collection activities. These groups are offering waste collection services to over 1000 households. The groups separate recyclable waste from organic waste and other non recyclable wastes such as empty scuds and soft drinks bottles, and papers and cardboard to companies like Delta Co-operation and National Waste Collectors respectively.

5.6 Recycling as a Business

It is interesting to consider recycling as a business. Recycling depends on the composition of the waste that you are collecting. If there are large quantities of recyclables in the waste that you collect you might consider separating them from the rest of the waste, to sell them to middleman or industries.

Before you can start with the collection of recyclables you need to know who your clients are. You may find some potential clients in your neighbourhood. The informal sector uses a lot of recyclables. Usually these are small clients. Bigger clients are companies that produce (semi-) finished products, like the paper, plastic, metal, and glass industries. Not all of these companies are already aware of the benefits of using waste as a raw material. Also, not all these industries are available in Harare.

You can virtually recycle any thing from; batteries, household items, auto mobil parts, mobile phones, metals and aluminum, electronocs and appliances, paper, plastics, glass, tyres etc

Consultans can be approached to assisting on what you can recycle and how to recycle and to determine the profitability of recycling a prticular product. The following are some selected recycling tips.

Box 5.1; Recycling tips; the example of used batteries

i. All waste batteries are classified as hazardous waste and recycling is always the best option.
ii. Ordinary household batteries and rechargeable batteries contain some hazardous chemicals and harmful metals so ideally should not be thrown out with the day to day waste; they should be recycled or returned to manufacturer for reuse and or disposal.
iii. Local councils or garages sometimes offer battery-recycling services.
iv. Contact your local council or grage to see if they are running a battery collection scheme.
v. Contact the battery manufacturer for further recycling advice.

However, please note that ordinary batteries require a lot of energy to make, so in order to save energy, use rechargeable batteries and electricity mains instead of ordinary batteries. Rechargable batteries are the most environmentally friendly option as can last for up to several

Box 5.2: Recycling tips; the example of old clothes or textiles

i. All homes produce used colthes as waste
ii. There are industries that accept old clothes and textiles for recycling
iii. Collect donated old clothes to charity al sell them to buyers of usable used clothes.
iv. Old clothes can be used to make other textile items, such as pillows, cushion covers or cleaning cloths.
v. When donating shoes, make sure they are tied together so they don't separate.

Box 5.3: Recycling tips; the example of glass

i. Separate glass into 3 colours: green, brown and clear.
ii. Make sure you wash out the glass bottles or jars before storage
iii. Sort and store the glass in the appropriate container.
iv. Take great care when handling broken glass, wear gloves if possible.
v. Take advantage of the local supermarkets that accept glass and pay for used bottles; you can sell glass weekly or regularly
vi. Glass industires alo accept glass for recycling
vii. Glass blowers often accpt glass for value additon in making sourveniours
viii. Many households use anad re-use glass containers as jars and vases for storing food, salt, sugar, nmilk, spices etc.
ix. There is a potentially good market out there
x. Reuse glass whenever possible.

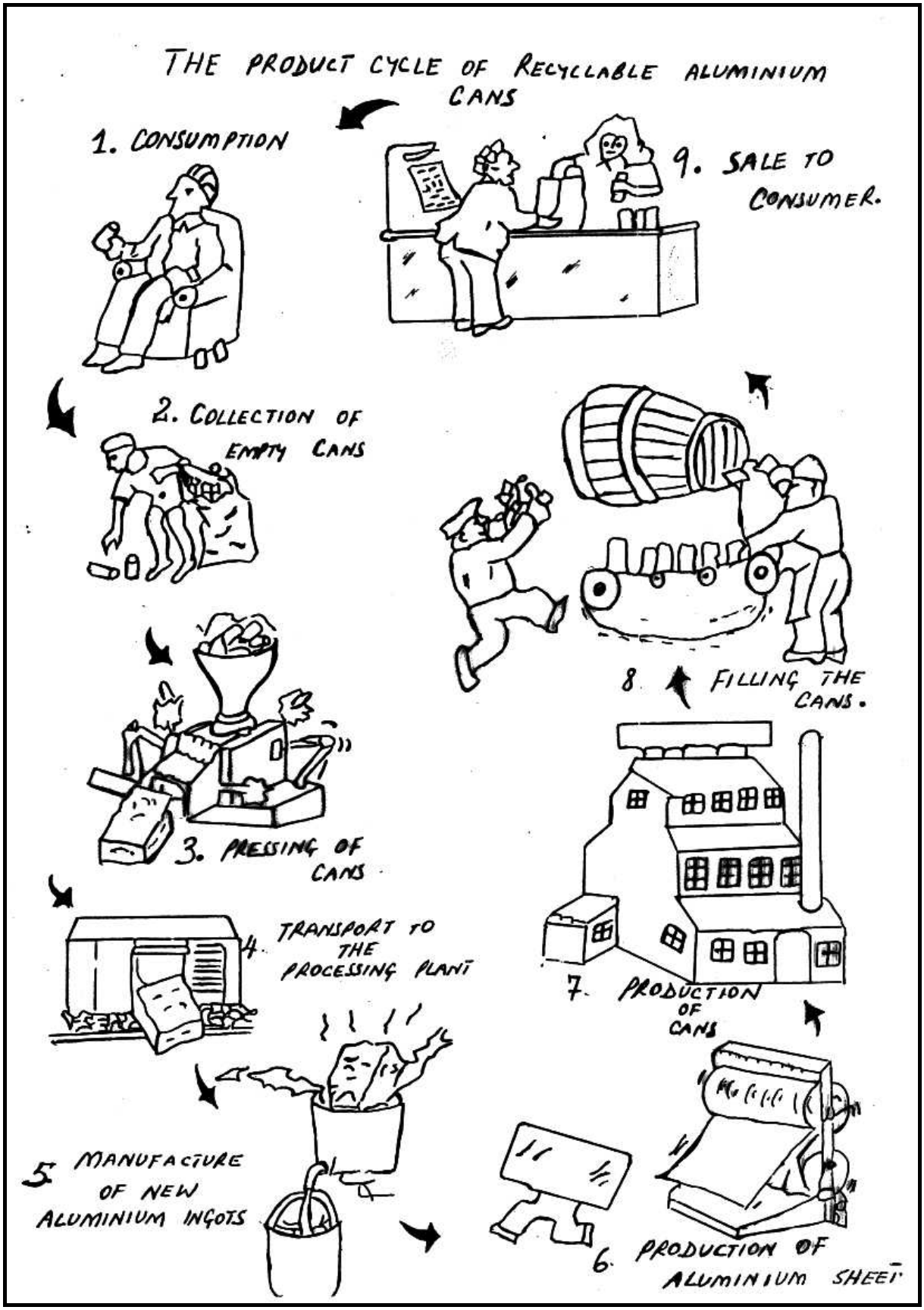


Figure 5.4: The product cycle of recyclable aluminium cans.

After having identified your clients, you need to investigate how much these companies are willing to pay and what are the requirements towards both quality and quantity. The bigger companies usually only buy per minimum amount of recyclables. For example, a minimum quantity of one tonne (1000 kg) is not uncommon. The quality requirements can differ a lot, but often you may be required to sort and clean the waste. You may have to sort on colour (for glass and paper), kind of material (metals) or origin (plastics). These and other requirements are usually determined during market surveys.

If you would seriously be thinking of starting recycling, you might have problems with meeting the quantity requirements of these companies. Therefore, in many cases you will have to join hands with other Community Based Enterprises before you can start recycling as a business. Through combined forces, you may be able to allocate enough space to store the recyclables until you have enough to hire a truck and transport them to the factory. Also, somebody may be interested to operate as a middleman. This means that s/he buys the recyclables from you and transports and sells them to the companies. In this way you will get less for the recyclables, but you also do not have the problems of storage, minimum quantity requirements and transportation of the recyclables. Therefore, if there are middleman wanting to buy certain recyclables from you this might be the easiest way to start.

Figure 5.5: Storage of recyclables in Dar es Salaam

We have now looked at some options to meet the quantity requirements for recycling, let's now take a closer look at how to separate the recyclables from the waste. The recyclables can be separated at different locations. **Separation at source** means that the producers (of the waste) separate and sort the recyclables from the waste. In fact the recyclables do not mix with the waste. It is important that the producers of waste receive appropriate incentives to keep these recyclables separated from the rest of the waste. A good method to stimulate people to keep the recyclables aside is to buy them from them. This means that the waste collector becomes a middleman.

It is also possible to separate the recyclables **at temporal sorting centre**. The disadvantage of this method is that the recyclables are now mixed with the rest of the waste and often dirty or contaminated. It takes more effort to clean them.

After separating the recyclables from the waste, you might have to sort or clean them before you can sell them to middlemen or industries. Cleaning of recyclables can be an art in itself as dirt can be enclosed in the recyclables. You may consider to cut or crush the recyclables, to make the inside of the tins, bottles, etc. accessible for cleaning. Cutting or crushing also has the advantage that you reduce the volume of the recyclables, which results in lower transport and storage costs.

Plastics were an important waste that should be recovered and recycled rather than burnt or dumped in landfill sites. There are several successful small-scale vendor schemes that can be developed into practical, efficient and cost-effective nationwide plastic waste recovery and recycling schemes with full cooperate and statutory backing and partnerships. Over the years small-scale networks for collection of plastic waste by vendors and, waste collectors, waste dealers and recycling enterprises have sprung up. However the level of recycling estimated to be less than 5% in 1998 is still very low compared to 60% in India, 16% in South Africa, 12% in Japan, and 10% in China. The collection of plastic waste is a source of livelihood for a significant proportion of the low-income urban communities. Plastic waste collection is a more lucrative business compared to the collection and retail of other waste items. Plastic waste tends to offer the highest profit margin in the waste recycling and reuse market.

5.7 Value Addition

Adding value to waste enables one to make significant profit from waste. Adding value can be as simple as cleaning and sorting and can be a complicated innovative industrial process that results in a new product altogether. Value addition involves the use of a re-usable part of waste to make a valuable (new) product. Examples include:

i. Oil lamps that can be produced from old tins and

ii. Very nice toys produced from tins and wire.
iii. Furnace slag as a cement ingredient Incinerator ash into ceramic and synthetic masonry
v. Turning coal ash into zeolites (a form of fertilizer)
vi. Briquetting of e.g. rice husks, used paper, food wastes, wood shavings etc for use as fuel.
vii. Waste conversion is an end-use strategy for converting waste into energy or manure. Examples include;
    a) Biogas plants and waste treatment for methane projects.
    b) Waste incineration for heat energy
    c) Use of old tyres / waste oils as fuel in kilns.

An easy way to judge whether you have added value as a technical writer is to ask the question, "Has this product exceeded customer expectations?"

5.8 Composting

A special form of recycling is composting. Composting is the process of natural conversion of biodegradable or waste that can rot (organic potion of the solid waste) to a stable product under controlled conditions. Compost is a natural product enriched with different essentials elements and compounds that can be very suitably used as a fertilizer through value addition. Composting is particularly favoured in hot and humid climates that accelerate the rate of biodegradation. To make compost, the organic portion of the solid waste is separated from the in-organic portion before composting. Composting can either be mechanised or semi-mechanised depending on the scale and variation of methods of handling the waste and of controlling the conditions. The common simple composting techniques use windrows and barrels. Many successful small-scale community-composting plants are installed close to the source of organic waste and use simple techniques such as windrow and barrel composting that are low cost systems easy to operate and maintain. Refer to figure 6.5 below.

Compost contains a lot of humus. Humus is the stuff that remains when organic matter is broken down by microorganisms. It is also some kind of food for plants. Therefore, farmers use compost materials to improve soil conditions. Compost not only supplements expensive inorganic fertiliser, but it also gives the soil more air and a higher water binding capacity. This is a great advantage especially in semi-arid areas. Compost materials are a reasonable alternative to cow manure because it promotes less weed growth, and can be fortified to contain the desired micronutrients for optimum crop/ plants growth. If you would like to use compost as food for plants, you need to use a lot of it. If you have your own small farm or vegetable garden, try it! You will save money, because fertiliser is normally quite expensive.

Fortunately there is increasing demand for compost manure. Before starting commercial production of compost, you need to study your future clients and think of how you are going to convince them to buy your compost.

Composting is a natural conversion of biodegradable (organic) portion of the solid waste for example vegetables waste from vegetable markets like Mbare musika to a stable product called compost, under controlled condition. Compost is a natural product enriched with different essential elements and compounds that can be very suitably used as fertilizer, thereby opening the possibility of value addition. The organic matter rots or decomposes very fast in hot humid environment.

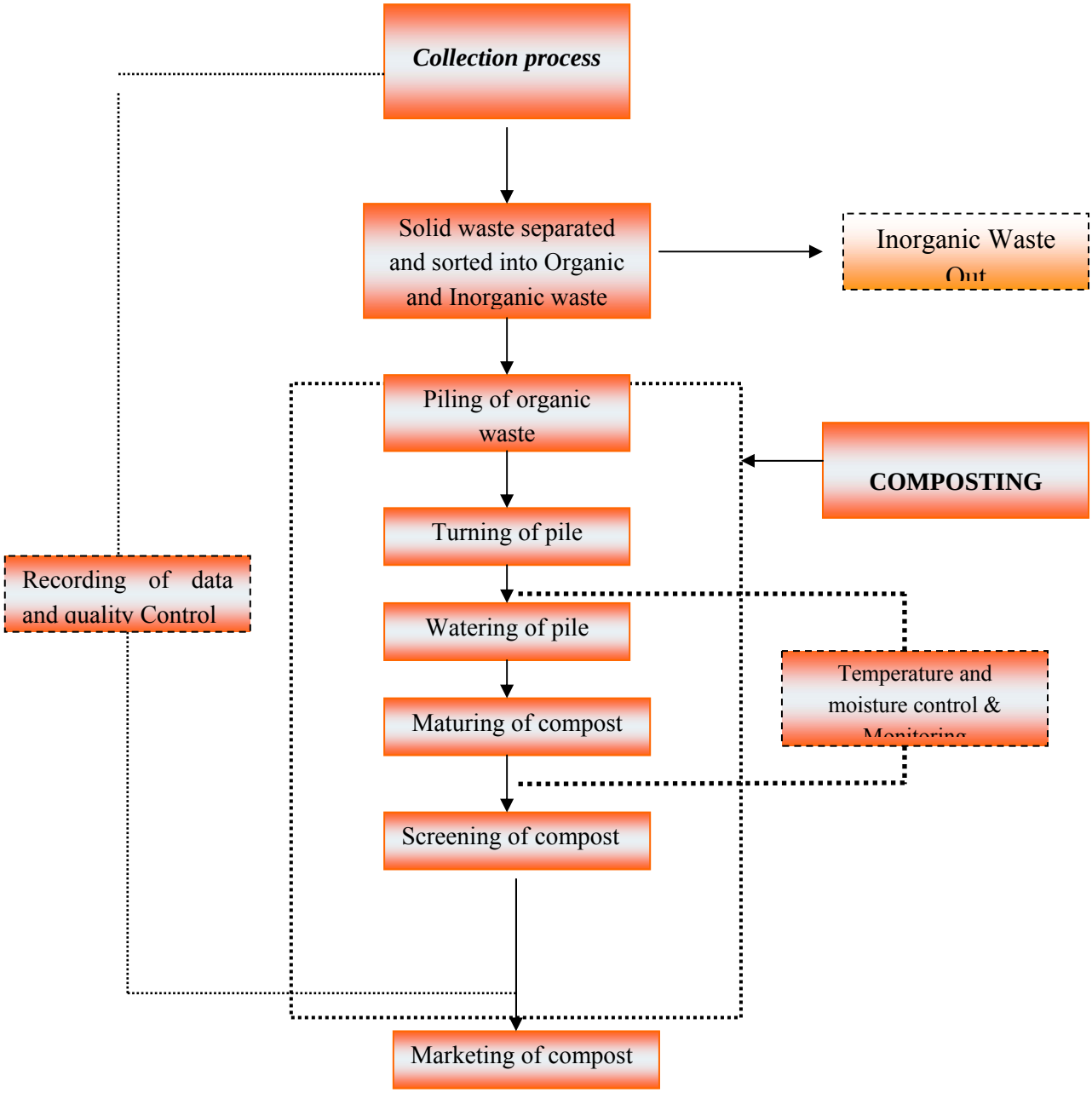


Figure 5.5: Schematic steps in small- scale composting (Adapted from the Urban Think Tank 1999)

You can compost kitchen food scraps, yard waste, vegetable market waste, grass, plants and animal waste etc. To get a good quality manure from a compost;

i. *Open air composting by simply building piles of material in a designated place or area. You can also use compost bins that are partially closed. You can also use worms to speed up the process in large composting processes. You can also control temperature and moisture content during composting to speed up the process. e.g. in a greenhouse.*
ii. *Composting takes 21-28 days in which one has to turn and wet the heaps every 5-days.*
iii. *Composting is best done on prepared surfaces called windrows measuring 2m wide, 1.5m high and 10-25m long.*
iv. *Allow your compost to mature for 21 days before packaging and selling*

Box 5.4: Opportunities in composting; organic fertiliser production

There is a severe shortage of fertilisers in Zimbabwe.

On 27 August 2007 the Herald reported that fertiliser manufacturing companies had produced only 160 000 tonnes against a demand target of 600 000 tonnes for the 2007/8 cropping season.

The alternative ways for making more fertiliser available to farmers include making and selling (organic) fertilisers

Organic fertilisers can be made from waste materials that rot in a compost

The compost can be made to be the right one for each target crop by adding necessary nutrients

This is value addition that brings more money to the business of making manure from waste.

Advice to add value to your business: As already pointed out earlier, recycling and composting are useful and generate income. But they can only be of economic interest if they are well organised and if there is a market for the products. Therefore, you are advised to develop your business from a waste collection service to more lucrative value added business that attracts more customers and increases your profit margins through, recycling, waste conversion, and composting and other ways of value addition. This training serves to motivate you to value add your business and add more rewarding composting and recycling activities.

5.9 Waste Recycling in Harare

Below find a Table 6 that shows what kind of materials are recycled in Harare, where they are found, and who the buyers are. This is to give you an impression of the potential of recycling. However, proper market surveys are required to establish the marketing strategies, penetration process and profitable pricing schemes.

Table 5.2: Some of the Materials that are Recycled and or can be recycled in Harare

Waste Type	**Examples of Potential Source**	**Potential Buyers**
Paper and Cardboard Waste	Printing shops/factories, offices, learning institutions, supermarkets shops, households	a) Softex Tissue b) National Waste Collectors c). Pulp & paper Board Mills d) Paper dealers / Middlemen e) Market vendors (cardboxes f)) Hunyani Pvt Ltd
Plastic Waste	Households, shops, hotels, markets, Packaging Industry etc.	a). Eco Plastics, b). Industries c) Motorists (plastic containers) d. Middlemen
Scrap Metal Waste	Bars, restaurants, hotels, households, workshops, Garage, construction sites, Industries.	a). Aluminium Industries, b). Metal Industries e.g. SteelNet c). Scrap dealers d) Foundries e.g. Sirmet Foundries (e.g. requires 30tonnes of cast iron that they can buy at ZW$30 000.00/kg as at October 2007)
Glass	Bars, restaurants, hotels, households, workshops, construction sites, households etc.	a) Beverage industries e.g. DELTA, AFDIS b) Door to Door Collectors (bottles only) c) Households d) Glass Blowers e) Construction (for decorative finishings) f) Supermarkets e.g. TM
Organic Waste	Households, Hotels, Vegetable market places, Food processing factories, Tobacco Processors, Farms etc.	a) Horticulturists b) Farmers c) Household d) Gardeners
Rubber Waste	Motorists, Motor Industries, Shoes Industries,	a) Motorists b) Rubber Products Industries e.g. Dunlop, Pigott Maskew c) Boiler Operating Industries (e.g. Cement Manufacturers) d) Home industries (Sandal & mats making)
Others : Textiles (Cloths) Leather etc		

5.10 Group Field Work Part 2 Exercise

This is a continuation of the group fieldwork in chapter 4. The participants are required to do the following:

i. Find out how much waste remains for dumping after all recyclable and re-usable materials have been sorted out.
ii. Describe the type of waste that is finally to be dumped (in terms of volume of total, composition, weight, etc.).
iii. Identify the types and quantities of recyclable materials you are likely to find in the waste from your selected households.
iv. Which **2 types** of waste would you prefer to recycle/re-use, what are your potential sources and who are your potential customers? Fill your suggestions in table below

Table 5.3: Results of waste sorting for recycling and re-use

Type of Waste Recommended for recycling	Possible other sources	Possible Customers

5.11 Recommended Best practices

i. Take steps to eliminate waste production, practice good housekeeping
ii. Conduct a waste audit & develop a waste register (ie to account for the costs related to wasted raw materials).
iii. Conduct a demonstration project to promote value addition to waste ie wealth from waste projects
iv. Tape into available technical assistance and services
v. Always remember “Where there is waste there is money”
vi. Be zero tolerant to waste in your business.

6 Routing And Service Schedule

6.1 Introduction

Zimbabwe like most developing nations in Africa faces the challenge of ensuring effective and consistent solid waste collection particularly from its urban centres. As noted in the preceding chapters, population increase, urbanisation accompanied with industrialisation has resulted in an increase in the demand for waste collection and other various services. Apart from having adequate equipment in the waste collection process, **Routing and Service Scheduling** is one important aspect that cannot be overlooked if the whole process is to be effectively undertaken.

- What is Routing?

Routing in general is the process of selecting paths in a *network* along which to send physical traffic i.e. the determination of the most efficient route (s) that people, goods, materials and or means of transport have to follow.
Routing in solid waste management is therefore the process of determining which is the best (cost-effective) or easiest way to collect waste from one point A (e.g. households to another point B (a skip bin or disposal site). Routing is a practical activity, which must be conducted at the site where the waste collection and transportation will be taking place. This is important because it helps you establish factors of consideration for the overall planning of your Waste Collection Business.

- What is Service Scheduling?

Scheduling in general is setting an order and time for planned events i.e. the determination of when each process or task runs, including assignment of time frames. **Service Scheduling in solid waste management** refers to the step-by-step determination of suitable or ideal timed schedules for the effective/efficient collection and transportation of solid waste in a certain area/neighbourhood.
In any neighbourhood/locality, there are many possible routes that can be used to collect waste from the household units to the transfer stations or disposal sites. However one question that needs to be answered is, ***"Which route is the best (or more cost-effective)?"*** That is to say, which route is the easiest to manoeuvre on, or which one takes you to the desired destination in the shortest possible time with minimum effort and least inconvenience. As earlier mentioned in the Waste Collection, Transportation and Disposal Session, most of the costs of the Contractor are related to transportation of the waste. The type of route you choose therefore has an effect on the profit levels of your waste collection business.

6.2 Challenges to effective routing in Zimbabwe

The rate of growth of urban centres in Zimbabwe has exceeded the capacity of municipalities and local authorities to respond effectively to service delivery challenges. Waste management has become one of the major challenges confronting urban local authorities in Zimbabwe. There is an increase in migration from rural areas to urban areas in search of employment. This has led to rapid urbanization resulting in increased social and environmental problems and an increase in the demand for solid waste management services. Because of this, effective routing and service scheduling has become a challenging waste management system activity at either community base level or municipal level.

The following routing and service scheduling challenges have been observed at Municipal/Local Authority Level:

i. Inadequate provisions for and frequent breakdown of solid waste collection equipment;
ii. Rampant illegal dumping of waste in undesignated places;
iii. Emergence of unplanned illegal or squatter settlements; and
iv. Centralisation of waste collection system that cannot cope with the rapid urbanisation and relatively high waste generation rates.

The following routing and service scheduling challenges have been observed at Community Base Level;

i. Inadequate waste collection equipment
ii. Lack of adequate expertise, information and training on how to plan and effectively manage some waste management CBOs
iii. Financial constraints adversely affecting the availability of manpower and operational logistics.

6.3 Factors to Consider for effective Routing

Designing the route for waste collection before actual collection is important because it gives you an opportunity to get rid of potential obstacles to the business and helps you to keep costs to the minimum or have a very cost-effective waste collection system. When deciding on the best and most appropriate route; certain factors typical for the particular locality/suburb/neighbourhood must be considered. These factors include some of the following:

i. Housing density and social class,
ii. Generation rates,
iii. Location of temporal storage areas/skip bins
iv. The road network and
v. Availability of and type of equipment to be used.

6.3.1 Housing density and social class

The amount of waste generated also depends to a greater extent on density of houses and the income levels in a given area (social class). For example, in a street with several blocks of flats or with houses built close to each other (i.e. high density suburbs such as Mbare in Harare, Njube in Bulawayo, Chinotimba in Victoria Falls and Seke in Chitungwiza), the amount of waste produced will be higher than in a street of the same length but with the houses built far apart. In an area where people earn a bit more money (high-income social class), the amount of waste generated will be higher per household than an area where people earn less money (low-income social class). This is because those with more money are likely to buy more goods and will have more packaging and used goods to throw away than people with less money. It is therefore important to consider such factors when planning a waste collection route and service schedule. This background information will be used to decide on the type of equipment to use and the number of collection trips necessary to service a particular area cost-effectively.

6.3.2 Waste generation rates

Different households generate different amounts of waste. Normally the waste generation in any household is measured by considering how much (in terms of mass) waste each person generates per day and multiplying it with the number of people in that household. This means therefore that in households where there are many people, the waste generation rate is much higher than in households where there are few people. This in turn means that in areas where households have more people, there is more waste to be collected than in areas where households have fewer people. In considering this, one may know where to schedule more collection times following which route in light of generation rates in a particular area/neighbourhood.

6.3.3 Location of Temporal storage areas/ Skip bins

In choosing or setting up an effective waste collection routing system, it is very critical for one to consider the location of temporal storage areas/skip bins. This is particularly critical for community-based enterprises that use low capacity collection equipment such as pushcarts, which have to be emptied more frequently when full. Sometimes the temporal storages areas/skip bins are located uphill or in a place which is not easily accessible at certain times of the day and will require an individual to use so much effort to push up the loads to them.

In hilly or uneven areas, more effort is required to move the waste from one place to another. It is easier to move an empty car uphill than a full one, so when planning the route, you should make sure that you do not have to move uphill with a full cart if

you can avoid it. In such cases a good study of the road network must be done. This also means that temporal storage areas/skip bins should be built at low places, not at high ones.

Also, when the slopes are too steep, sometimes you might have to use another route. The alternative route may be longer, but it might still save you time because it is easier to move on it. The same can be true if a road or track is very uneven. It can sometimes be easier to take a longer route to the temporal storage area /skip bin, because it is easier to travel on it.

6.3.4 The Road Network System

The road network must also be considered carefully because some roads are blocked during peak hours and it is better to avoid such roads or streets when designing your routes for waste collection. The type and lay-out of road network is also critical in that roads in an area may have traffic circles, loops, dead-ends, too many junctions, or maybe a major road (with high traffic flow) etc which all directly or indirectly affect the routing and efficiency of the collection system. e.g. if a route is set to pass through a major road with high traffic flow, one might find themselves spending too much time trying to cross such a road in their collection exercise. Again in cases of where there is use of motorised waste collection equipment, the road network becomes very critical in the scheduling and routing of the waste collection

6.3.5 Equipment

One needs to keep in mind the relationship between the carrying capacity of the collection equipment (pushcart or wheelbarrow) being used and the time it takes to load and empty it is of limited capacity and has to be emptied at a temporal storage area/skip bin. It is therefore important to consider the weight of the full load and to find a route with minimum travel time and inconvenience. The loading capacity of the chosen equipment depends on the type of waste and the weather and road surface conditions. You can load more dry waste (if pressed) in a cart than wet or moist waste that is heavy and is pushed with difficulty. As a result, the loading capacity of the pushcart is reduced during the rainy season and vice versa. The travel time has to consider the loading time at different households and the offloading time at the temporal storage area/skip bin.

6.3.6 Timing and service schedule

While one may consider all of the above factors in coming up with good routing system, it is important that a service schedule is drawn up which shows **when** (date and time) the waste will be collected **where**. A well-designed service schedule facilitates collection of waste at minimum costs because it ensures that collectors visit an area only when there is

sufficient waste to collect. It also ensures that waste does not pile up in the community due to poor service scheduling. A service schedule involves simply planning time and place for waste collection. This can be in the form of a timetable, which states when specific areas will receive the service. Families and households then have to adjust to the given schedule. The collectors on the other hand have to stick to the timetable to avoid inconveniencing the community. Refer to the example of a typical service schedule given on the next page (Fig 6.1).

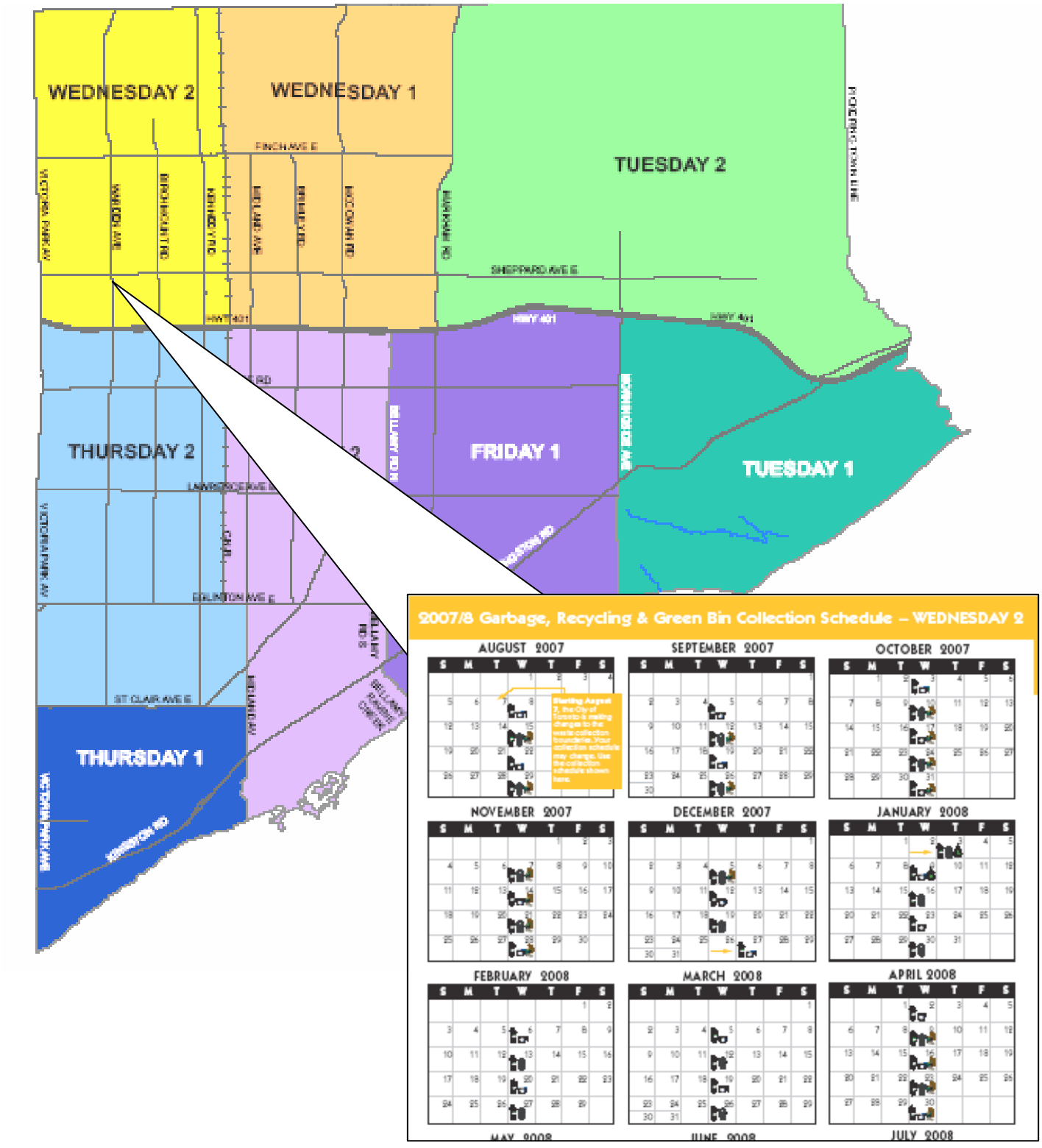


Figure 6.1: An example of a waste collection schedule for an Urban district

Service scheduling also involves planning when to repeat waste collection for each area and how many times in a week waste collection should be done. i.e. it is collected twice a week from market place

6.4 Group Work: Classroom Exercise

It is preferable that an exercise is conducted in class before a practical routing exercise is done in the field.

The objectives of this exercise are to:

- Locate the position of temporal storage areas and or skip bins on the map.
- Use peoples' experiences and knowledge of the community to plan and design a network of routes to be used during routing.
- Come up with service schedules for collection of waste in an area

Activity 1:

Each group is provided with a map of their community or an area similar to theirs and a pencil:

1) Indicate the temporal storage areas and or skip bins on the map.
2) From your experience and knowledge of the area plot on the map a network of routes that can be used for waste transportation.
3) Indicate areas where a pushcart can be used and areas where a pushcart cannot pass.
4) If there are areas, which are inaccessible by pushcart: what will you do to collect waste from these areas?
5) Show on the map where the tools and equipment will be stored.
6) Indicate the major waste generation points.
7) Indicate how the trips will be done.

The following tips can help you in planning and designing.

Start collection from where the equipment is stored to avoid moving long distances with empty carts.

- Start from the major sources of waste.
- Design routes that go down the slope.
- The routes should as much as possible not go through the same street more than once.

Activity 2:

Estimate the approximate time needed to establish which routes give the shortest travel time.

Note that the shortest route may not always be the fastest if there are obstacles in the way like heavy traffic, hills, etc.

6.5 Group Field Work Part 3 (optional): Practical Routing Exercise

As earlier stated, it is important that the routing exercise takes place in the very location where waste collection and transportation will be taking place. This is because you need actual information to help you plan your activities and calculate how much time and equipment you will need to collect and transport the many kilograms of waste in your area from the houses and the market to the temporal storage areas or skip bins.

Requirements for the routing exercise

The following are the requirements for the routing exercise:

- Community Map
- Writing paper and pen
- One weighing scale
- Waste collection equipment (comprising one pushcart, two shovels, one rake and protective wear)
- Information on the average waste generation rates of that particular community or others for similar communities in Zimbabwe
- Members of the community in which the routing exercise will take place must be informed in advance (at least one week) so that they can accumulate the waste to be collected for the exercise.

The Routing Process

Before going to the site of the exercise, you need to understand the objectives and importance of the routing exercise. Once in the community/neighbourhood y/area:

- Check the location of the temporal storage areas and or skip bins on the community Map (as established during the classroom exercise).
- Identify the main roads and streets and paths, then, bearing in mind the factors discussed earlier, plan the possible routes for transporting the waste to the designated transfer points.
- Estimate or calculate the volume of the pushcart to be used.
  i. Establish the approximate density of the waste.
  ii. With the available equipment set, conduct a waste collection exercise using the routes mapped out in preparation for the exercise.

Note: Depending on the waste generation in a particular area, the pushcart might fill before you reach the transfer station and you might have to make more than one trip to the temporal storage area or skip bin in one route.

The exercise should be conducted on more than one route so that you can get balanced results.

The following findings must be documented during the routing exercise:

i. Amount of waste it takes to fill the pushcart.
ii. The average time it takes to collect the waste from the households.
iii. The average time it takes to transport the waste to the transfer station and come back to where you were collecting
iv. The number of trips it takes to collect the waste from all the houses in a particular route.

Equipment choice

The Routing exercise offers the opportunity to assess the suitability of available tools and equipment and to suggest possible adjustments. The routing exercise also provides an opportunity to practically determine the number of people needed per collection group (working units).

Factors to consider when using the equipment include:

i. The size and capacity of the pushcart in relation to its weight, the load it can carry and the ease with which it can be moved.
ii. The height of the pushcart: does it allow for easy loading and tipping.
iii. The ease of unloading.
iv. The type of tools and equipment required to efficiently collect, transport and dispose of the waste.

Note: Choice of equipment should take into account hygienic handling of the waste.

Compare the finding of the physical exercise with those of the exercise conducted in class and make the relevant conclusions.

Determination of Requirements to service an area

The information gathered during the routing exercise is used to make certain calculations that will help the group arrive at actual estimates of how much time and equipment is needed to manage the waste collection business. The information will also help the group determine how many people are needed to do the work and how many days in a week waste collection should be done. Below is a case example of how these calculations are done.

i. Background Information

- In Section A (Seke - Chitungwiza)* there are 1000 households to be serviced by

Kubatana Environmental Action Group*.

- It was estimated that each household generates 8 kg of waste per week under normal circumstances.
- The group uses a pushcart with a loading capacity of 200 kg.
- Estimated average travel time per return trip in Section A is 60 minutes.

ii. Calculations

a) The total amount of waste generated in Section A per week will be:

1000 x 8 kg = **8000 kg per week**

b) The number of trips required to move this waste to the different transfer stations using a 200 kg capacity handcart is:

$$\frac{\text{Total amount of waste}}{\text{Capacity of the push cart}} = \frac{8000 \text{ kg}}{200 \text{ kg}} =$$ **40 trips per week**

The number of trips the group has to make per day to collect all the waste generated in a week to the temporal storage area/ skip bin is:

$$\frac{40 \text{ trips}}{5 \text{ working days}} =$$ **8 trips day per day**

c) The total travel time required to make 8 trips is calculated as follows:

8 trips x 60 minutes = 480 minutes per day

$$\frac{480 \text{ minutes}}{60 \text{ minutes}} =$$ **8 hours per day**

d) Calculating the equipment and minimum number of people required for the work

Working Units

Considering that waste is normally heavy matter and that waste transportation needs the use of some basic equipment, it will be difficult for one person to do the process of waste collection alone. It is therefore preferable that those in the business of waste

collection work in teams or working units. A working unit is centred on the main equipment to be used. In our case example, it is a 200 kg capacity handcart.

A single working unit may comprise of the following:

i. 1 Pushcart as the main transportation equipment.
ii. 1 or 2 shovels for loading waste onto and off the pushcart
iii. 1 rake/street broom for gathering scattered waste and to put waste on a heap

Note: One working unit will require at least two people, one to handle the pushcart, and the other to handle the waste. However, depending on the amount of waste to be dealt with, this number can be increased.

In our case example, the Kubatana Environmental Action Group, which consists of 5 people (divided into 2 working units), needs to make 8 trips per day to remove the 8000 kilograms of waste generated in one week by the community in Section A. We calculated that 8 trips would take them 8 hours a day at 1 hr per trip. If the group desires to improve their operations they can:

i. Increase the number of working units
ii. Acquire pushcarts with a greater carrying capacity i.e. more than 200kg
iii. Increase the collection days to 6 from 5 and then spread the trips over the days. This will make the number of trips fewer per day.

If the number of working units in our case study example is doubled, the teams will be able to make the required trips per day in one morning. This will leave them with the whole afternoon to conduct other business activities such as record keeping and collection of money. This would, however mean that they need more sets of equipment, as all the working units will be in the field at the same time.

Working in shifts

It is also possible for the Kubatana Environmental Action Group to work in shifts. If two working units are able to do half the job in the morning, the equipment will be free for the rest of the day hence another working unit can therefore utilise it for the remaining time i.e. in the afternoon.). One set of equipment can thus be shared by two teams per day. This is called **working in shifts**.

In such a case, the waste-collecting group will need only one set of equipment, which the two working units can share. If the membership of the group is to be doubled (to 10 members), Kubatana Environmental Action Group can be sub-grouped into working units as shown in Figure 9.2 below:

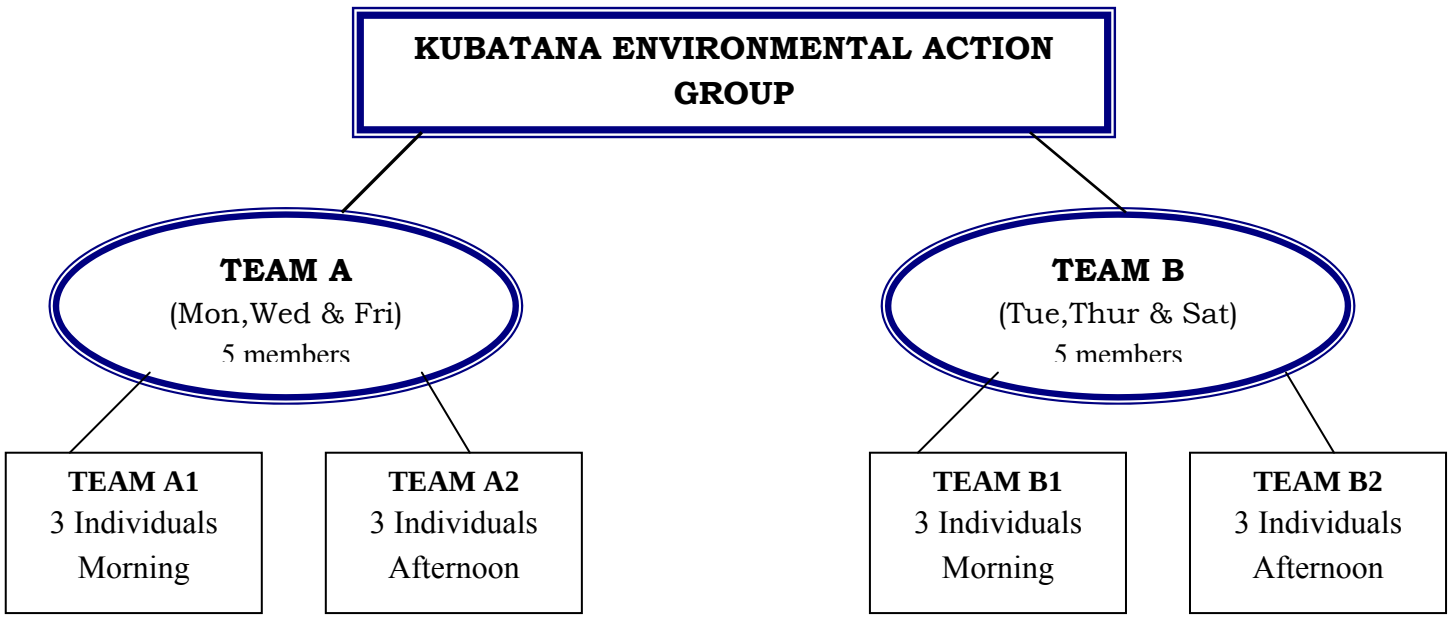


Figure 6.2: An example of Waste Collection Teams working in shifts

6.6 Overview of waste collection groups and their operations

Table 6.1 below is a brief overview of some of the community-based organisations involved in the waste collection business showing their service schedules.

Table 6-1: Examples of waste collection groups operating in Harare

Name	Area of Operation	No of members	Type of equipment	Service Schedule	Routing
United Waste Collectors*	Epworth	2	Handcarts, Shovels, racks & brooms	Mon; Tue; Thur; Fri (One trip per day untimed)	-Follows the road network and certain footpath though not consistent.
Recycle Paper & Plastic Tech*	Mabvuku (Harare)	6	Pushcarts, Shovels, racks & brooms	Mon-Sat (0800Hrs start)	-Follows available road network with fixed collection points
Dzivarasekwa Environmental Association*	Dzivarasekwa (Harare)	5	Tricycles	Once a week (Wed)	-Generally consistent following the existing road network

Note: All name used marked with an asterix (*) are not real names of the groups.

6.7 Recommended Best Practises

It has been noted that good routing and service scheduling significantly improves the efficiency and profitability of any solid waste collection and management operations. However most community-based organisations /enterprises face the challenge of improving their operations through proper routing and service scheduling. The following practices are recommended for those seeking to improve their operations and maximise on profits:

i. Setting up proper administrative structures to facilitate proper planning of activities and operations.
ii. Establishing a database of waste management system/operations capturing all information relating to routing, operation area, generation rates, area maps showing infrastructure and road network system and waste types etc.
iii. Periodically reviewing performance and internal and external auditing of operations with assistance from environmental consultants.
iv. Making plans based on accurate calculations to determine suitable and adequate equipment and set up cost-effective routes, service schedules and labour distribution.

7 Occupational Safety and Health

7.1 Importance of Occupational Safety and Health

Occupational Safety and Health refers to the safety and health risks of workers in their day to day working environment. Occupational Safety and Health for solid waste collectors or handlers is important because solid waste handling can be dangerous. It can negatively influence one's health and cause harm if not properly done.

The main dangers in solid waste management are:

- Cuts and wounds from sharp objects;
- Contamination from hazardous waste such as hospital waste;
- Poisoning by chemical waste;
- Respiration problems caused by breathing polluted air. This can come from chemicals, from the fumes that are generated by waste or by dust created when handling the waste or sweeping;
- Burns caused by biting chemicals;
- Muscle and back strains due to wrong posture or having to lift heavy waste;
- Violence, mainly by citizens opposing temporary dumping of waste near their premises and by scavengers at the dumpsite. Also due to late or lack of payment of salaries;
- Risk of road accidents, particularly for road sweepers;
- Risks involved with the handling of dead animals and other hazardous waste;

Occupational safety and health measures try to prevent diseases, accidents and injuries to workers in solid waste management.

7.2 Accidents

90% of accidents are caused by negligence, and could easily have been prevented. Negligence is influenced by certain factors such as: habits, attitude and behaviour (e.g. failure to use safety regulations and equipment), emotions, physical environment, weather, equipment and facilities used, and the season of the year. Increased risks of negligence can result from alcohol or drug abuse, tiredness (e.g. too long working hours), lack of supervision, and ignorance and poor education, etc.

Accidents can be reduced, if not avoided completely, if ignorance is avoided.

7.3 Household Hazardous Waste

Community based waste collection and disposal deals mostly with household waste, which might contain hazardous waste, as we have seen in earlier sessions.

It was pointed out in earlier sessions that many people use and store a variety of different hazardous products in their home, such as: polish, wood preservatives, stain removers, paint thinner, batteries, pesticides, etc. Some households have small industries in their backyards and tend to mix the waste from these industries and household waste. Such industries include: hair salons, tie & dye and batik makers, garages, welding shops, black smiths, etc. All of these produce chemical waste to a greater or lesser extend.

Some households mix human excreta with waste. This is dangerous for it can spread diseases and can infect the collectors.

Box 7.1: Current Protection Measures in Dar es Salaam

Shoes: The weather is mostly hot in Dar es Salaam. Most workers (sweepers, collectors, truck loaders) wear open shoes or light shoes. Some workers wear stronger leather shoes or boots to protect their feet. However, even when available, some do not wear the boots, as they complain that these cause blisters or are too hot.

Gloves: Are used to some extent. They wear out easily and have to be replaced often. Most sweepers do not use them. Leather gloves are too hot hence not preferred.

Face masks: Most street sweepers use mouth and nose caps. Those who do not have them cover their mouths and nose with a piece of cloth.

Uniforms: A few waste contractors provide uniforms to their workers. The wearing of protective gear and uniforms makes the worker recognised and respected as belonging to a waste organisation. Due to the colours used (green and dark blue) the uniforms do not give increased protection from accidents by increasing the workers visibility.

Occupational safety and health has been addressed in many training sessions, but these were usually attended by community leaders and company owners. As such most workers are not aware of the importance of wearing protective gear. On the other hand none of the workers has so far been seriously affected by waste.

All these household hazardous waste materials may threaten the health and safety of waste handlers when improperly handled.

7.4 Different Hazards

Solid waste management workers are exposed to dangers during their day to day work. Hazardous waste materials can affect waste handlers through various exposure

routes. They include:

(a) Through the mouth (ingestion route): eating without washing your hands may result in toxic substances entering your body where they can cause immediate or long term health problems.

(b) Through the nose (inhalation route): dust that is contaminated or contains poisonous particles can be breathed in. So can poisonous gases that pollute the air. These are breathed in and come into the body where they can create health problems.

(c) Through the skin (dermal contact): Skin is an excellent barrier to many toxic substances. However, some may be absorbed or affect the skin. In mild cases this can result in skin rashes, in serious cases the skin may be damaged and the body wounded by aggressive chemicals.

7.5 Safety Measures

For safety and health protection measures, the following things are important:

1) Educate workers about specific occupational hazards;
2) Exposure to dangerous (hazardous) situations should be minimised;
3) Ensure use of protective gear such as gloves, boots, dust mask, goggles, etc. where appropriate;
4) Workers who have taken drugs or alcohol which may affect their performance should be excused from work;
5) The use of alcoholic drinks or drugs during work should be avoided;
6) Workers should not work too long hours, exposing them to fatigue;
7) Ensure availability of first aid kit within reasonable reach of the work site;
8) Use reliable equipment and maintain it in good condition;
9) Undergo medical check-ups regularly;
10) Undergo immediate treatment after observing any of the following:
    a) Headaches, dizziness, blurred vision,
    b) Irritation of the eyes, skin, or respiratory track and behavioural changes,
    c) Breathing difficulties,
    d) Abnormal coughing,
    e) Lack of co-ordination,
    f) Change in complexion, skin discoloration,
    g) Changes in speech pattern;
11) Do not eat or drink anything while working;
12) Wash hands and face before leaving the place of work.

Solid waste management and workers should try to understand and take into consideration all these measures.

7.6 Group Work

1. For the following activities, identify and list the health hazards and the kind of accidents that are likely to occur to you when doing these activities:
   (a) waste collection,
   (b) waste storage,
   (c) waste transportation,
   (d) dumping of waste,
   (e) waste burning,
   (f) recycling of waste, and
   (g) burying of waste.

2. Indicate for each of the identified health risks or accidents and what the causes are.

3. What precautions can be taken to minimise the health risks and prevent these accidents from happening?

Write your answers on flip charts.

8 References

Chenje et al (eds), (1998); The State of Zimbabwe's Environment

Chibanda, D, (Harare City Health Department, 1990), Waste management in city of Harare

Chidavaenzi M, 2004); Strategies and Innovations in Waste Management

Chidavaenzi M, 2004); Plastic Waste Management in Zimbabwe; A Country Status Report

Kativu D. (2001), Economic Aspects of Solid Waste Managemnet In Harare, unpublished, MEPP Dissertation, Department of Geography & Environmental Science (UZ)

Masocha, et al (2005); Waste Management; State of the Environment Report, Harare, Zimbabwe

Mutepfa, F & Marongwe N, 2005, The State of Environment Report Land Chapter

Practical Action in Southern Africa (2006), Improving the urban environment with organizations of poor women and men

Saburro Matsui, (1993), Industrial Pollution Control in Japan

SIRDC-ESI, (2005); The Socio-Economic Environment, State of the Environment Report

Sustainable Consumption and production in Asia and Pacific (2004), A review of status and trends

Swedish Environmental Protection Agency (2005); A Strategy for Sustainable Waste Management

UNIDO (2002; Municipal Solid Waste Management in Asia and Africa; A Comparative Analysis

U.S. Environmental Protection Agency (1995), Municipality Solid Waste Management

U.S. Environmental Protection Agency (1995), Decision Maker's Guide to Solid Waste Management

Zaranyika, MF (1997) Sources of pollution along the Mukuvisi River

http://practicalaction.org/zimbabwe/ Practical Action in Southern Africa (2006), Improving the urban environment with organizations of poor women and men

http://iswa.co.uk/solidwaste/html International Solid Waste Association (ISWA)

http://www.ciwm.co.uk/pma/3261 The Charter Institute of Waste Management

Every business comes out of an idea.
The Technical Handouts are for you to have easy access to technical aspects with regards to starting and managing a solid waste recycling business. The technical information in this document together with the business management training module will help you organize your thoughts to set up a successful waste recycling business

The Technical Handout covers important aspects to consider before embarking upon your waste recycling business.
In the document you will find information on

- **Waste management**
- **Relevant laws and regulations**
- **Aspects of community participation**
- **Role of stakeholders**
- **Recycling and composting techniques**
- **Occupational safety and health**