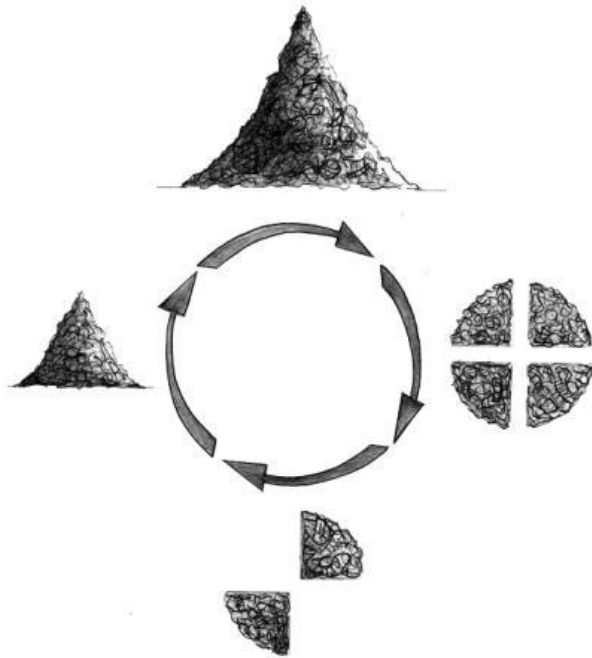


# Making Waste Work: A Toolkit

## How to measure your waste

A step-by-step guide



### How-to guide 1

Part of  
**Making Waste Work: A Toolkit**  
for community waste  
management in low and middle  
income countries

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[wasteaid.org.uk/toolkit](http://wasteaid.org.uk/toolkit)





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- Partnering with local organisations to improve the health, environment and livelihoods of people without waste services.
- Building the skills of local people to deliver practical solutions to the waste management crisis in their own communities.
- Raising awareness of the benefits of proper waste management and campaigning for greater change.

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## 1 How to measure your waste

You can find out what materials are available in the waste by carrying out a detailed waste audit.

**Summary:** A waste audit (sometimes called a *waste composition analysis*) will tell you what materials are available in the waste, and how much of each material is available (see *Making Waste Work*, chapter 7).

**Benefits:** A waste audit is a simple process that involves sorting and weighing the waste materials. Once you know what materials are in the waste, and in what quantities, you can best decide how to manage it (see *Making Waste Work*, chapter 8).

You will need to plan and prepare for your waste audit, making sure you have considered everything in the checklist below. Proper planning will help your waste audit go smoothly, and means you can replicate it at a later date or a different site and compare the results.

<b>Where will you get your waste from?</b>	It will probably be impossible to measure all the waste in your community so you will need to take samples. Think about where you will collect your samples and whether this is representative of the waste produced in your community. If you collect waste from the dumpsite, many recyclable materials that can be sold may have already been removed by householders and people scavenging for materials to sell. So if you want to know about <b>everything</b> that is in the waste, before anything is removed, you may have to collect direct from houses and businesses.
<b>Safety</b>	Think about what you might find in the waste and how it could harm you (see <i>Making Waste Work</i> , chapter 4.6). Find a safe place to do the audit.
<b>Seasonality</b>	The waste might change throughout the year, as events and seasonal changes affect the amount and types of waste produced. Rain will make some materials heavier and not others.
<b>Recording the information</b>	Design a form and spreadsheet for recording in advance.
<b>Setting up your site</b>	Think about the collecting, sorting and weighing equipment you will need. Is there shade to work in and water to wash hands with? Do you need a secure area for locking up your equipment?
<b>Managing and analysing your data</b>	Once you have the data, you can transfer it onto a spreadsheet. What you can do with your data depends on how much analysis you have done.
<b>Sharing your results</b>	Think about who you want to share your results with – there is no point producing a report that just sits on the shelf.

Figure 1: Checklist to use when preparing for a waste audit.

## Comparing waste at different times and places

If you are likely to want to compare waste at different times and places, use a standard approach. The method described here is from a UNEP/IETC publication<sup>1</sup> and should be used as a guide. You might choose to use more or fewer categories, but be consistent if you are planning to do any more audits in the future. The most important thing is to be consistent with your method and keep a record so you can compare results.

It is impractical to audit all the waste from a community, town or city; but sampling the waste over a period of time will give you a good idea of the amounts of different materials available. For example, you might take 25 samples, each of 100 kg, over a five-day period<sup>2</sup>.

<b>Paper &amp; cardboard</b>	1. Newspaper 2. Cardboard/boxboard 3. Magazines/catalogues 4. Office paper 5. Other/miscellaneous paper
<b>Glass</b>	6. Clear containers 7. Green containers 8. Amber containers 9. Remainder/composite glass
<b>Metal</b>	10. Tin/steel containers 11. Aluminium containers 12. Other ferrous metal 13. Other non-ferrous metal 14. Major appliances
<b>Plastics</b>	15. Clear PET bottles/containers 16. Green PET bottles/containers 17. Amber PET bottles/containers 18. HDPE containers 19. Film plastics 20. Other plastics
<b>Textiles</b>	21. Textiles
<b>Organics</b>	22. Food waste 23. Garden waste 24. Agricultural waste 25. Abattoir waste 26. Remainder/composite organics
<b>Construction &amp; demolition material</b>	27. Concrete 28. Lumber 29. Remainder/composite C&D
<b>Hazardous wastes</b>	30. Paint 31. Hazardous materials 32. Biomedical 33. Batteries 34. Oil filters 35. Remainder/composite waste
<b>Other waste</b>	36. Electrical and electronic equipment 37. Tyres 38. Furniture 39. Ceramics 40. Other

Figure 2: Suggested categories for a waste audit, as used by the UNEP/IETC.

<sup>1</sup> UNEP/IETC (2009). *Developing Integrated Solid Waste Management Plan, Volume 1, Waste Characterisation and Quantification with Projections for Future*.

<sup>2</sup> If the waste is very dry and/or contains a lot of plastic, you may want to reduce the sample size to 50kg but it is important to be consistent.

### Finding a suitable place for a waste audit

Think about how you will transport people to the site, and how you will collect and transport equipment each day. If you are sampling the waste from a dumpsite, choose an area close to the entrance so that waste can be taken as it arrives at the site. It is better to work with fresh waste because it will be less smelly and easier to separate into different categories.

Choose a place that is flat and shaded to ensure as pleasant and safe working conditions as possible. If it is likely to rain, use some sort of shelter (like a gazebo or sheet) to keep the people and the waste dry.

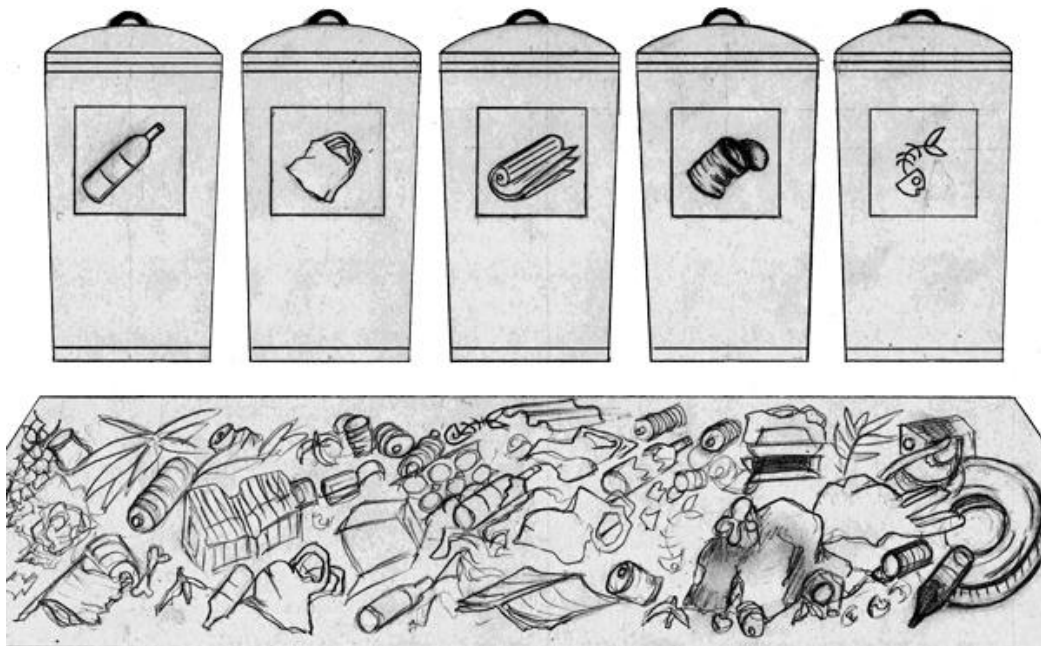


Figure 3: Find a flat, shaded location close to the dumpsite entrance, with enough space to spread waste out on a sheet and sort it into a number of containers.

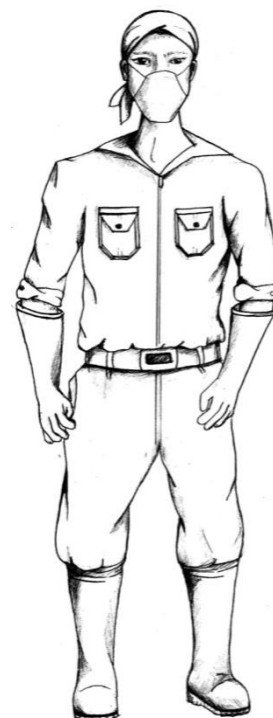
### Health and safety

Sorting waste can be hazardous and it is very important to protect the members of the sorting team.

- Choose a safe area, near to the site where you will finally be disposing of the waste but away from any vehicles. It should be in the shade, with access to water for cleaning, access to drinking water, and away from animals.
- Train the team properly on sorting, lifting, carrying and cleaning (as outlined in the training plan in Figure 6), the correct use of tools, and to ensure everyone understands the source of the waste being sampled (for example, to avoid waste from a hospital).
- Provide personal protective equipment (PPE) to all staff. This is shown in Figure 4 and listed in Figure 5.
- Supply a First Aid kit and make sure the team includes a trained First Aider.
- Avoid walking through waste when you cannot see the floor.



*Remember you could find almost anything at a dumpsite. Watch out for hospital waste, particularly needles and blood-stained waste. Even household waste can contain hazardous items like needles or solvents.*



### Equipment and staffing

Sorting waste is hard and dirty work and it is very important for the people involved to be trained properly (see Figure 6). As an example, 10 people can typically sort 5 x 100 kg samples a day; or 25 samples over a 5-day period. As sorters become more familiar with the different materials, they will take less time.

Below is the ideal equipment checklist for a team of 10 people auditing 5 samples per day.

Figure 4: Suitable PPE for a waste sorter.

Equipment	✓
Tables or worktops to sort on.	
A scale for weighing samples – generally up to 150 kg. Medical or bathroom scales can work well if you have a flat hard surface to use. If you only have sand or uneven ground to work on, either use a table or hang a set of scales from a tree.	
A heavy sheet to store the samples on.	
A sieve to separate the small pieces with a gauge of around 1 cm.	
5 shovels, 5 rakes, 2 hand brooms.	
Litter pickers (plastic or metal grabbers) to pick and sort the waste if needed.	
As many waste containers as you have categories of waste.	
2 wheelbarrows to collect waste from tractors and trailers.	
1 large First Aid kit including eye bath.	
Personal protective equipment for the people sorting the waste including: <ul style="list-style-type: none"> <li>• Overalls – if these are too hot, make sure the important areas are covered: forearms (with long gloves), lower legs (getting brushed), and stomach area (when sorting on tables).</li> <li>• Leather and/or latex gloves.</li> <li>• Rubber boots.</li> <li>• Disposable face masks – there are different types, we recommend standard FFP3.</li> <li>• Portable wash-water facilities with soap and disinfectant.</li> </ul>	
Washing water and soap.	
Drinking water and lunch for staff each day plus regular rest breaks in the shade between each sample analysis.	

Figure 5: Ideal equipment list for a team of 10 people sorting 5 samples of waste a day.

**Training session**

Session title	Details	Resources
<b>What is the aim of the waste audit?</b>	<i>Introduce the aim of the waste audit.</i> Explain to the group that we want to understand what materials are in the waste, so that we can recycle more (and send less to the dumpsite).	None
<b>Sorting procedure</b>	<p><i>Show the team how to collect and sort the waste.</i> Steps are as follows:</p> <ul style="list-style-type: none"> <li>• Number each container and stick examples or pictures of each type of material on the front.</li> <li>• Deposit a 100 kg sample of waste on a plastic sheet using wheelbarrows and shovels. Spread the waste using shovels and remove any hazardous elements.</li> <li>• Separate the waste into the different materials, and sort it into the labelled containers. Where possible use pickers and shovels rather than hands.</li> <li>• When a container is full, either use a second container, or weigh and record, then tip the contents out and use the container again.</li> <li>• When complete, weigh each container on the scales with the waste inside it and record the weight.</li> <li>• Tip the waste out and record the weight of the empty container.</li> </ul>	<p>Equipment required to demonstrate the sorting process:</p> <ul style="list-style-type: none"> <li>• Shovels to mix and level waste</li> <li>• Waste picking equipment</li> <li>• Labelled containers (including sticky tape for attaching the label or sample to the container)</li> <li>• Tarps / plastic sheet spread out on the ground</li> <li>• Scales</li> <li>• Recording sheet</li> <li>• Pens</li> </ul>
<b>Health and safety and the use of personal protective equipment (PPE)</b>	<p><i>Ensure any risks to the welfare of the team are minimised.</i> Sessions include:</p> <ul style="list-style-type: none"> <li>• Dangers posed by waste, including from infection, needle sticks, glass, metal splinters, nails, razor blades, hypodermic needles and so on.</li> <li>• Supervisory staff to ensure that sorting staff adhere to health and safety measures.</li> <li>• Importance of avoiding dehydration and of taking adequate breaks.</li> <li>• Infection risks and importance of use of soap and water before eating, drinking and smoking.</li> <li>• Importance of good lifting techniques.</li> <li>• Importance of correct use of PPE and reasons for all.</li> <li>• Use of First Aid kit and eyebath in case of injury.</li> </ul>	<ul style="list-style-type: none"> <li>• Full PPE</li> </ul>

Figure 6: Template training session to prepare the waste sorting team before starting on a waste audit.

### A step-by-step guide to auditing waste

1. Select a suitable area as described above.  
Spread heavy sheets on the ground to stop the waste samples mixing with the underlying soil.
2. Set up tables for sorting the waste; label the waste storage containers with the categories selected for sampling and arrange them around the edge of the tables. Keep some containers available for weighing unsorted waste, and have some additional 'overflow' containers for sorted waste in case they are needed.
3. Place the scale near the storage containers (a sturdy tree can be useful for this if it is a hanging scale). Record the empty weight of each container (ideally, they will weigh the same), and re-check them periodically.

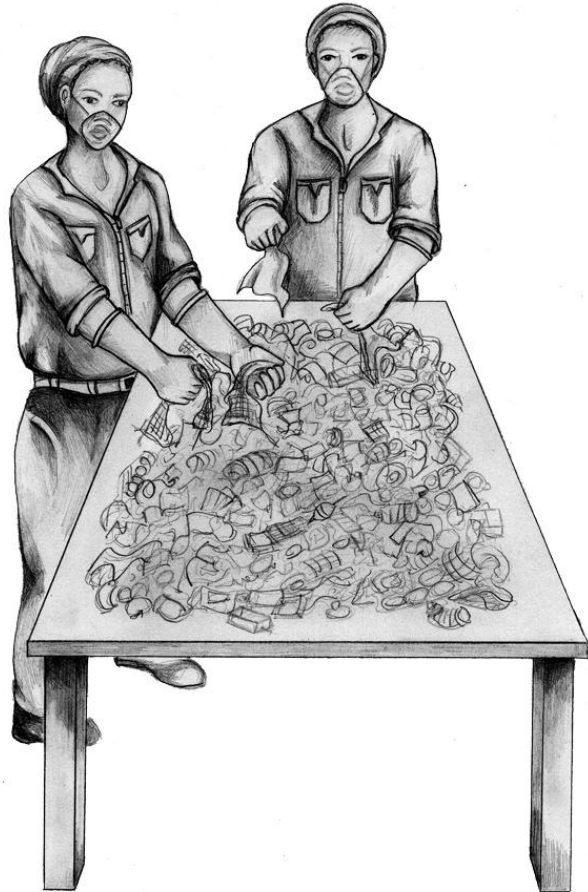


Figure 7: Using a table makes the sorting process quicker and more comfortable.

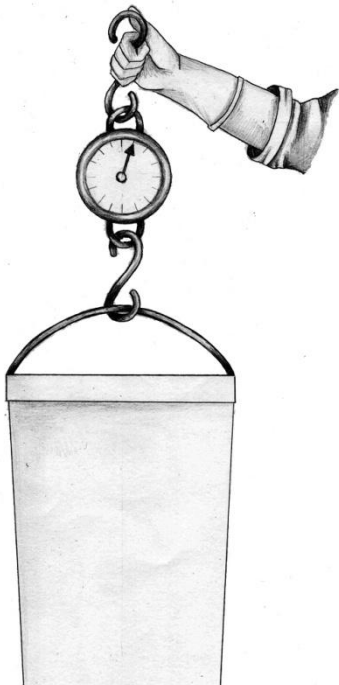


Figure 8: Use hanging scales to weigh samples.

4. Consider how you will take samples of waste, to make sure they are representative. If your study is about office waste then try to sample from several offices; if you are interested in household waste, try to collect samples from both wealthy and poor areas. Take care that the waste is not dangerous, for example from a hospital, unless you are prepared for this. Beware of building waste as it may contain asbestos which can be fatal if inhaled.



5. Collect the following information on each sample:

- Date
- Time
- Vehicle details, such as handcart or truck
- Origin of waste, such as offices in commercial district
- Weather conditions.

6. Sample the agreed amount of waste (either 50 or 100 kg) and place it on the tarpaulin or plastic sheet. To weigh the sample, place waste into empty containers and weigh the required amount. If this is difficult, one method is to stand on the scales, set it to zero, then hold a sack or container and record how much the weight increases. Remember you will need to subtract the weight of the empty containers.



Figure 9: Hang the scales from a tree to weigh the full containers.

7. Begin sorting the waste sample without delay.

Empty all bags, packets, and other containers of their contents and separate the different materials (such as metal lids from glass jars). Where something is made using more than one material and is difficult to separate (such as paper and plastic stuck together), place with whichever is the dominant material.

8. Place each separate item in the correct storage container. If there is any confusion, supervisors can advise sorters of the correct container.

9. Sort all the waste until the largest item you have left is around 1 cm. The pieces that are smaller than 1 cm are called *fines*. These will take a long time to sort, so it helps to work with a smaller, representative amount, and then multiply the results back up to give an estimate of the total. To produce a small representative sample size, follow the steps below and in Figure 10.

- a. Record the weight of the total 'fines' category (for example, 5 kg).
- b. Pour all the fines into a cone shape on the floor.
- c. Flatten it out using a shovel.
- d. Divide into four and discard two opposing quarters.
- e. Combine the remaining two quarters.
- f. Repeat until the sample size is small enough to sort in a short space of time. Record the weight of this final sample (for example, 500 g).
- g. Sort the final sample into categories and record the weight of each material.
- h. Multiply the weight of each category of fines back up to account for the original sample size (in this example, multiply each category of fines by 10 to account for the 5 kg of fines in the total sample).

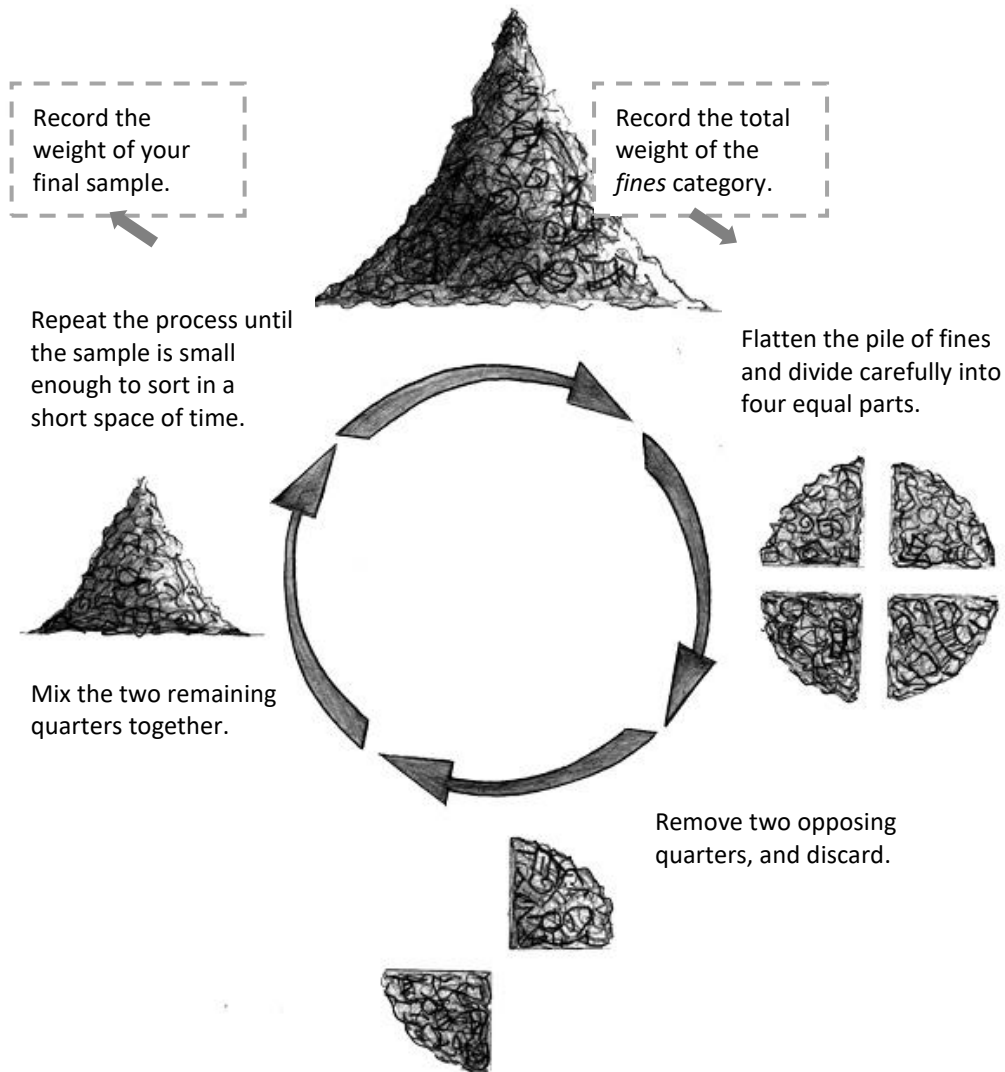


Figure 10: How to produce a small and representative sample of fines.

10. Weigh and record the total weights of each storage container, including any larger waste items sorted but not stored in the containers. Remember to subtract the weight of the empty container from your results.
11. Remove the sorted waste by wheelbarrow and if suitable offer it to informal recyclers for recovery. Make sure you dispose of everything else in a way that is least harmful to the environment as possible.

### Analysing and presenting your results

Record the final weight of each category in a table (include the weight of the fines, but not of the containers). When you have completed all your samples (in this example, 25 samples of 100 kg each) add the weights and calculate the percentage of each material group in the waste. Do not worry about decimal places, just round up or down to the nearest whole number. Calculate the percentage of each material in the total sample (for organics in this example, the sum would be 911/2500, and the multiplied by 100).

<i>Main material groups</i>	<i>kg</i>	<i>%</i>
<i>Organics</i>	<i>911</i>	<i>37</i>
<i>Other</i>	<i>482</i>	<i>19</i>
<i>Plastics</i>	<i>381</i>	<i>15</i>
<i>Textiles</i>	<i>195</i>	<i>8</i>
<i>Paper and paperboard</i>	<i>145</i>	<i>6</i>
<i>Construction and demolition</i>	<i>139</i>	<i>6</i>
<i>Hazardous waste</i>	<i>131</i>	<i>5</i>
<i>Glass</i>	<i>34</i>	<i>1</i>
<i>Metals</i>	<i>83</i>	<i>3</i>
<b>TOTAL</b>	<b>2500</b>	<b>100</b>

Figure 11: Example weights and percentages of a 2.5 tonne waste analysis (25 samples of 100 kg).

Here is the same data converted into a pie chart:

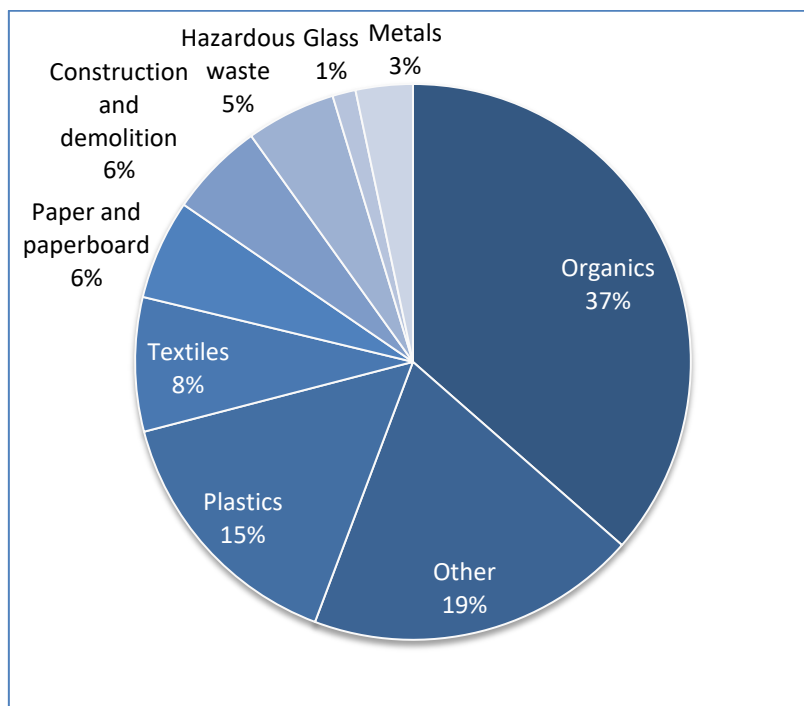


Figure 12: A pie chart showing example waste audit results.

## Breakdown of results

Think about what you need to know – sometimes it is useful to break the information down into further sub-groups.

In the example above, plastics only made up 15% of the *weight*. However, plastic is not very heavy so even though it does not weigh very much, there might still be a large *volume* or quantity.

To find out which types of plastic make up the overall category ‘plastics’, see How-to guide 7.1 *Identifying common types of plastic*. Within this example, LDPE film (a group including plastic bags, water pouches and other similar plastics) made up 57% of the total weight of plastics. The other significant group was woven PP, generally rice sacks and other similar containers, at 14%.

<i>Plastics</i>	<i>kg</i>	<i>%</i>
<i>LDPE film</i>	<i>217</i>	<i>57</i>
<i>Other plastics</i>	<i>80</i>	<i>21</i>
<i>Woven PP</i>	<i>53</i>	<i>14</i>
<i>Fines - plastics</i>	<i>15</i>	<i>4</i>
<i>Green PET</i>	<i>11</i>	<i>3</i>
<i>HDPE</i>	<i>4</i>	<i>1</i>
<i>Clear PET</i>	<i>0</i>	<i>0</i>
<i>Total</i>	<i>381</i>	<i>100</i>

Figure 13: Different types of plastic separated into more specific categories.

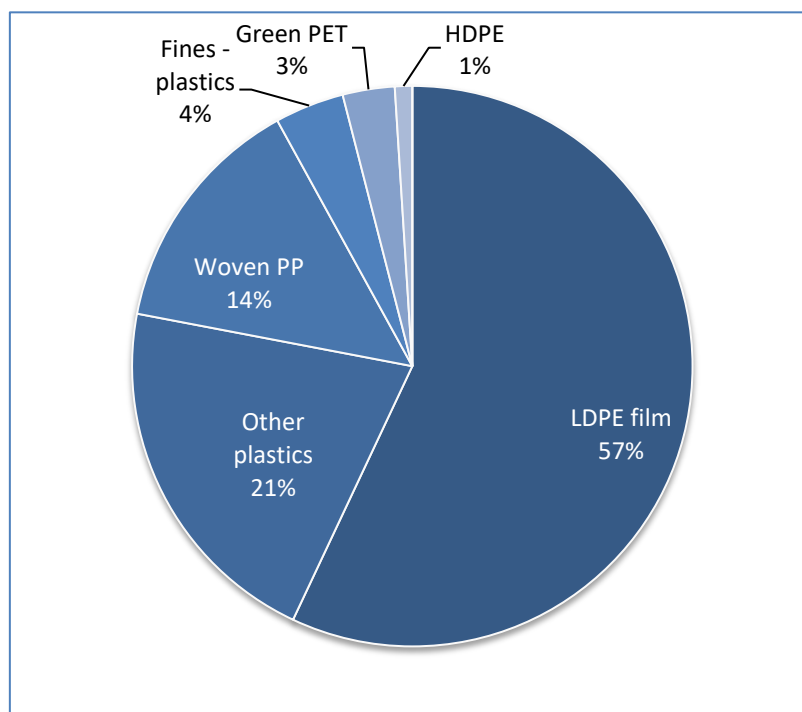


Figure 14: A pie chart showing the different types of plastic in the waste sample.

You can do the same with all of the waste groups you want to consider, for instance organics, textiles, hazardous waste, construction waste, glass, metals and ‘other’.

### What do the results mean?

The results tell you what is in your waste, so you can decide which materials will be available and suitable to work with.

Consider waste reduction and recycling projects that:

- **Reduce the quantity** of materials ending up the waste dump, to reduce the significant environmental impact of waste disposal.
- **Maximise the value** of reprocessed material, so you can develop a sustainable business model for your recycling enterprise. The technique should be fairly simple and low cost. This will ensure it is accessible to the local community, maintained into the future, and possibly replicated in other communities.



*When you decide on a material to work with, try to find out where it is from and ask if it can be kept separate for you to collect.*