

Tool 7.1.2 – Guide – Waste Survey

This guide applies to household and non-household waste generators (commercial, institutional and public spaces) waste survey. In the following sections, relevant differences are highlighted. Whenever information applies to both waste generators, they are referred to as participants.

1. Plan and prepare the study

1.1 Define what data is targeted

For a waste survey, you usually have two options to assess the amounts and composition of the waste.

Self-reported amounts: asking participants to estimate their waste production. To do so, it is helpful to use a container or a bag of a given size and ask the participants how much of the container they would fill every day. It is usually easier for participants to estimate a volume than to indicate a weight. Your result will then be given as a volume of waste. Having a standard size will help you analyse the results.

Measured amounts: using a scale or a given volume to measure the waste on site. When measuring the amount of waste, keep in mind that it may have accumulated over several days. In this case, you need to request how many days have passed since the last time waste was disposed of.

For both methods, you can aim to measure only the total amount of mixed waste, mainly if the participants are not accustomed to segregating their waste. Nonetheless, you could ask or measure some fractions of waste such as organics, recyclables and residual waste. Going beyond this classification of waste types might not make much sense, as it would become increasingly complex for the participants to estimate and yield only small amounts, resulting in even greater imprecision in the estimation. It is thus recommended to survey the total amount of waste, eventually including survey questions on organics and recyclable waste. Note that if you have a specific interest in a given material, you could also specifically survey such material. For example, you may be interested in estimating the number of PET bottles generated. You would then add a question specific to this material in your survey.

It is possible to decide to survey using one of the methods or even use both. You can adapt the provided survey template to meet your specific needs: **Tool 7.1.5 – Survey Form**.

1.2 Study length and seasonality

The waste survey requires that each sampled participant be visited once. The length of the study will thus depend on the size of your team and the number of participants to be visited. If this survey is coupled with others, the study could take longer as well. The survey could take anywhere from one day to a week, indicating the potential duration.

Waste generation and composition fluctuate throughout a week, in different seasons or during special events such as holidays. It is recommended to conduct the study during a typical, normal week, and repeating the study during another season may also be helpful. This is especially the case when high variations are expected, for example, when differences between rainy and dry seasons are pronounced. For comparability, the study design should be kept identical when repeated during another season or for monitoring purposes throughout the years.

When requesting participants to self-report the amounts they generate, consider emphasising that they should provide an average amount per day to account for variations throughout the week. If you measure waste weight, it could include several days of accumulated waste, and if it does, this will partly account for these variations.

1.3 Household survey sample size

When possible, **at least 96 samples should be selected** to provide a representative estimate of waste generation and composition.

Income level and higher levels of consumption can greatly influence waste generation and composition. For this reason, it is recommended to **cluster the study if significant consumption differences are expected. This could be done according to income level, housing type or your own categories, considering access to consumer goods.** If there are low-, middle-, and high-income areas, you would sample 32 households in each region and perform your analysis, showing results based on the income level. When the income level is unknown or in cases where households with different income levels are interspersed throughout the same area, housing type can be used as a proxy for the clustering. Note that if you proceed to use clusters, you will need to have information about how many households or populations are part of each category that you defined to use your results to calculate total waste generation. Alternatively, distribute your samples proportionally to the number of households within each cluster. You can then calculate a unique result that would be a representative average value for your city or area of interest.

1.4 Non-household Survey sample size

Waste generator type and unit of aggregation

There are multiple types of non-household MSW generators. Typically, this includes commercial, institutional and public spaces. In other contexts, such as refugee camps, for example, other non-household generators can be considered, including warehouses or distribution centres. List the non-household waste generator types relevant to your area of interest. Additionally, you must define the unit of aggregation. The unit of aggregation is the unit that will allow you to calculate the total waste generation per type of waste generator. It is equivalent to the “per person” when assessing waste generation at the household level. Table T 7.1 A Suggests some recommended units of aggregation. You must group the types of generators in clusters that are expected to be similar generators, and for which the aggregation unit makes sense and represents all of them. For example, it may be necessary to differentiate markets into subgroups based on the type of goods sold (e.g., food markets, clothing markets, etc.). You must define your own unit of aggregation and keep in mind that for each type of waste generator, you will need to gather information about the total number of a given aggregation unit in your area of interest. For example, if you decide to use the number of students as a reference for schools, you will need to gather information from all the schools in your area about their total number of students. The aggregation unit must be a reasonable measure that allows you to obtain information about. The planning department or responsible entity can help you decide on the segregation unit to use and inform you about the data availability for each one. To list your waste generators, you can use the provided template in **Tool 7.1.3 – Reporting Sheet**.

Table T 7.1 A: Suggested units for aggregation adapted from Waste Wise Cities Tool (UN-Habitat, 2021)

Generator type	Recommended unit of aggregation	Comment
Hotels	# of beds	If there is a shopping centre or restaurant, assess separately
Restaurants	#of tables/chairs	
Shops	# shops / # square meters	
Supermarkets	# square meters	
Schools	# of pupils, of students	If there is a canteen, assess it separately as a restaurant Consider whether they are boarding schools or not
Offices	# of employees, square meters	If there is a canteen, assess it separately as a restaurant
Markets	# of stalls	Consider the type of goods (vegetable market vs electronics market)
Hospitals*	# of beds	
Public spaces	# square meters	Differentiating public spaces by their frequency of use, if possible, is recommended.
Food distribution centres	# people served	
Camp infrastructure	# people served	
Humanitarian agencies	# employee	
Warehouses	# people served	

**Hospitals generate municipal solid waste (MSW) as well as hazardous health care waste. Ensure that you capture only the MSW fraction and that hazardous healthcare waste is separated for safety reasons, as healthcare waste must be managed separately.*

Sample size

Aim to survey waste generators of each type, and those you consider are representative of the waste generator type. As an indicative number of samples, approximately 10 samples can be selected for each type of waste generator, providing an estimate of waste generation. Furthermore, consider the following aspects to decide on your sample size:

- **Give more importance and dedicate more efforts to waste generator types that are expected to be the highest contributors to overall waste generation in your context.** If some waste generator types are expected to generate non-significant amounts of waste, you can decide not to survey them or reduce the number of surveys.
- When there are a small number of waste generators per type (<100), statistics tell us that we should assess a substantial share of the total. Nonetheless, this could result in an unrealistic amount of effort being required to gather the data. Instead, aim to measure waste generation at 10 to 20 % of the waste generators (and at least one waste generator).
- **Do consider the share of units of aggregation of each waste generator of a given type, and not only the number of waste generators.** For example, comparing small schools with hundreds of students to one huge school with several thousand students, it might be prudent to separate these waste generators into two types. You would then survey the large school and a sample (10-20%) of the smaller schools.

Remember that you will use the results from your samples to extrapolate the total amount of waste generated for the entire waste generator type. Make your own judgement based on common sense to assess whether the sample size is realistic for the survey and would yield a representative result for the entire waste generators of a given type category. You should strike a balance between the feasibility of the survey in terms of the work required and assess whether it is feasible. Reducing the number of samples is always possible, but it would yield less precise results. You can use the provided template to report the sample size in **Tool 7.1.3 – Reporting Sheet**.

Income level and higher levels of goods consumption can greatly influence waste generation and composition. For this reason, it is recommended to **cluster the study if significant consumption differences are expected. This could be done according to income level or your own categories, considering access to consumer goods**. If there are low-, middle-, and high-income areas, you would need to sample in each region and perform your analysis, showing results based on the income level. Note that if you proceed to use clusters, you will need to have information about how many units of aggregation are part of each clustered category that you defined to use your results to calculate total waste generation. Alternatively, distribute your samples proportionally to the number of aggregation units within each cluster. You can then calculate a unique result that would be a representative average value for your city or area of interest.

1.5 Consideration for large waste generators

For some large and complex waste generators, it might be necessary to inform in advance and schedule meetings with the managers and waste handlers of such entities. Analyse whether, in your case, advance notice is required and plan to include this additional process. Large waste generators may also require special considerations, as it may be challenging for them to self-report the amount of waste generated or for your team to measure the weight or estimate the volume on site. Nonetheless, you might be interested in measuring this more precisely, as they are large contributors to the total waste generated. Collecting the waste and weighing it on a weighbridge is one possibility. This can be the case for any waste generator, depending on its size, but will likely be relevant for markets, public spaces, shopping malls, and any large office, school, or hotel.

Note that collaborating with the company or entity responsible for waste collection is recommended, as they can provide support with means that may be necessary for assessing large waste generators, such as trucks or a weighbridge. Transportation of the waste to the disposal site after the assessment would also require specific coordination.

For large waste generators, it is also essential to consult with waste collection services, as they can provide information about the amount of waste they collect from a given non-household waste generator. You can then also compare the information gathered from the waste generator and the collection personnel.

1.6 Inform and engage local authorities and key stakeholders

Key stakeholders who must be informed about your study and engaged as much as possible are the local authorities and the service provider. The local authorities can help by providing support to the initiative, especially with a signed information letter to hand to the participants to formalise the process. An example letter is given in [Annexe 1 of the Waste Wise Cities Tool \(UN-HABITAT, 2021\)](#). This could be signed by the municipality, a local leader, or an organisation (responsible for WASH coordination, for example).

The waste management company or entity responsible for waste management must also be informed to prevent inadvertent interference in the process. They can play a key role by providing space, transport, equipment, materials, and personnel for the study.

It is also essential for local stakeholders to be engaged, as they might benefit from redoing a waste survey in the future. Being fully involved in this process will help them learn, become empowered, and take ownership of the generated data, which is key to ensuring sustainability and long-term impact.

1.7 Train the survey team, plan for materials and equipment

1.7.1 Size the survey team

The size of your survey team will depend on the number of participants to be surveyed, their accessibility, and the length of each survey. Regarding the survey length, you can estimate how long it would take by trying it out once it has been finalised and adapted to your needs. As an indicative length, each participant could take from 10 to 20 minutes to complete the survey, especially if you have to weigh the waste. Consider the time required when surveying additional information, including waste characteristics.

1.7.2 Train the survey team

Train the team to practice the survey several times and ensure they understand the information they must communicate to the participants, as well as how to measure waste. The team must also be trained on the sampling process, according to the method you decide to use. You can use the provided template as a base for the training and adapt it to your specific needs: **Tool 7.1.4 – Training Template**.

1.7.3 Equipment and materials

Each surveyor must be equipped with their data collection materials, pens and printed surveys or digital survey apps on their tablets.

When asking participants to self-report their waste, each surveyor must have a container or bag of the same shape and size to guarantee a uniform standard of measurement for all.

When the survey **includes weighing waste**, each surveyor needs a scale (kitchen or hanging) that measures at least 5 kg, a container that can be placed on the scale and hold a plastic bag, and plastic bags to fill with the waste from the participants.

1.7.4 Personal Protective Equipment

If the survey includes weighing waste, each team member should be adequately equipped to handle the waste safely and securely. Instruct the team to use gloves when handling waste, wash their hands regularly, especially before eating or drinking, and provide each person with a hand disinfectant. Reusable gloves would be more convenient and produce less waste, as they would only be used when handling the waste.

1.8 Prepare official information and informed consent letters

To inform and obtain consent from participants, you should prepare an official information letter and an informed consent form that can be signed. The consent can also be given orally, simply by asking the participants if they are willing to participate in the study. The information letter should include general information about the study and its objectives. The authorities could endorse it through a signature.

1.9 Determine sampling points

Household

To guarantee representativeness of the study, your sampling points should be selected randomly. You have several options to do so:

1. **Lottery method:** each household in a given income group is assigned a unique number and randomly picked. You can complete this process by physically printing and randomly selecting the numbers, or by using a computer to generate random selections. For this method, you need to have a list of all the households available.
2. **Map and grid method:** Use a map of your area with a 1:2'500 scale and overlay a 1 cm x 1 cm grid. Assign a number to each grid cell and randomly select the sampled cells. You will then select a household from each of the chosen cells. To do so, use a consistent method for each cell; for example, start at the centre of the cell and visit the closest house to this point. If the household does not accept participation, proceed to the next nearest household and continue in this manner.

Non-household

For non-household waste generators, the most practical method is the lottery method. Each waste generator in a given group type is assigned a unique number and is then randomly selected. You can complete this process by physically printing and randomly selecting the numbers, or by using a computer to generate random selections. For this method, you need to have a list of all the waste generators available.

Representative areas

To ease logistics and limit the travel distance required to collect waste, the study can be performed in selected areas considered representative of the study area. Select **at least three representative areas within your study boundaries and apply random sampling to each of them, distributing the number of samples equally across** each area. When relevant to cluster per income levels or other factors that you consider appropriate for waste generation, select at least one representative area for each category, such as low, middle, and high-income levels.

You must report the method used in the study to ensure it is comprehensive, comparable, **and replicable in the future**.

2. Conduct the survey

This survey should be conducted by an adult, preferably someone responsible for waste management. Ensure that participants are asked to participate and that they do so willingly. You need to **register the number of persons living in the household at the time of the study or register the unit of aggregation when surveying non-household waste generators**, which is an indispensable data to derive the waste generation rate. You can use the provided draft template, **Tool 7.1.5 – Survey Form**, to do so. Each participant will also be assigned a unique ID, which needs to be maintained throughout the study. It can be helpful to use a map to report the location and unique IDs, for example, if a follow-up visit is planned in another season or in the years to come. A good practice is to have your team record the GPS position and tag it with the unique ID. Throughout the process, refer to the unique ID only when necessary and never disclose the participant's name to maintain respect for their privacy.

3. Analyse and process the data and report the results

3.1 Calculate waste generation per capita

For the calculation, you can use the provided Excel sheet: **T 7.1.3 – Reporting Sheet**.

Depending on the process that you established for your survey, either you requested the participants to self-report the volume of waste they generate, or you measured the weight. There are then two calculation paths:

If you have **measured the weight** of the waste, you can use the weight value directly, accounting for the number of days the waste was stored since the last collection or disposal.

If you have a **self-reported volume**, you must first convert it to a weight. For mixed waste, you can use an approximate density of 0.2 kg/L if the waste is low in organics and 0.4 kg/L if the waste contains a high fraction of organics (at least half of the volume). Measure the volume of the container you are using for the assessment and calculate the equivalent in kilograms: $\text{weight [kg]} = \text{volume [L]} \times \text{density [kg/L]}$. Since you asked for daily waste generation, there should be no need to consider accumulation in this case.

Household

You must calculate the waste generation per capita for each household. To do this, you divide the weight of the daily waste by the number of persons living in the household.

With the waste generation per capita for each household, you can now:

1. Average all the household values to have the waste generation per capita.
or
2. Average based on your cluster categories, and have one household waste generation per capita for each. For example, one for each income level.

This result can then be used to estimate the total amount of waste generated in the area of interest. You have to multiply the household waste generation per capita by the total population to have the total amount of waste generated. When considering clusters, such as different income levels, you use the population at each income level and multiply it by the corresponding household waste generation per capita.

Non-household

This analysis should be done for each type of waste generator individually. First, you must calculate the waste generation per unit for each waste generator. To do this, you divide the daily weight by the number of aggregation units.

With the waste generation per unit for each waste generator, you can now calculate the average value to obtain the waste generation per unit for this type of waste generator. This applies only if you do not have clusters.

This result can then be used to estimate the total amount of waste generated in the area of interest for this type of waste generator. You must multiply the waste generation per unit per day by the total number of units to determine the total amount of waste generated each day. Note that to be able to do this calculation, you have to gather the information about the total number of units for each of your types of waste generators.

To obtain the total waste generation from non-household sources, sum all the totals for each type of waste generator that you have measured and calculated.

Finally, calculate the **non-household waste generation per person** by using the total waste generation from non-household sources and dividing it by the total population living in the area of concern.

3.2 Calculate the waste composition

To calculate the waste composition, you can use the **T 7.1.3 – Reporting Sheet**.

Household

Report the values that you have surveyed. If you need to adapt the sheet to your own waste categories, ensure that the formulas are consistent in your new document. The percentage is then directly calculated in the tool.

Non-household

Report the measured values and use a separate sheet for each type of waste generator. If you need to adapt the sheet to your own waste categories, ensure that the formulas are consistent in your new document.

The waste composition of the non-household waste must be calculated based on the total amounts of waste generated for each waste generator type. The first step is to calculate the total weight of each fraction by multiplying the composition % and the total weight generated by this waste generator type. Once you have the total weights for each fraction of waste and for each waste generator type, the values are summed, and the final composition of non-household waste can be calculated. You can use and adapt the provided Excel sheet for the calculation **T 7.1.3 – Reporting Sheet**.

3.3 Presenting waste composition results

You can present your composition results either through a simple table, showing each category and its respective percentage, or visually through a graph. A typical way to visually show the composition results is with a pie chart, as shown in Figure T 7.1 A. You can use the **T 7.1.3 – Reporting Sheet** to prepare the presentation of your results.

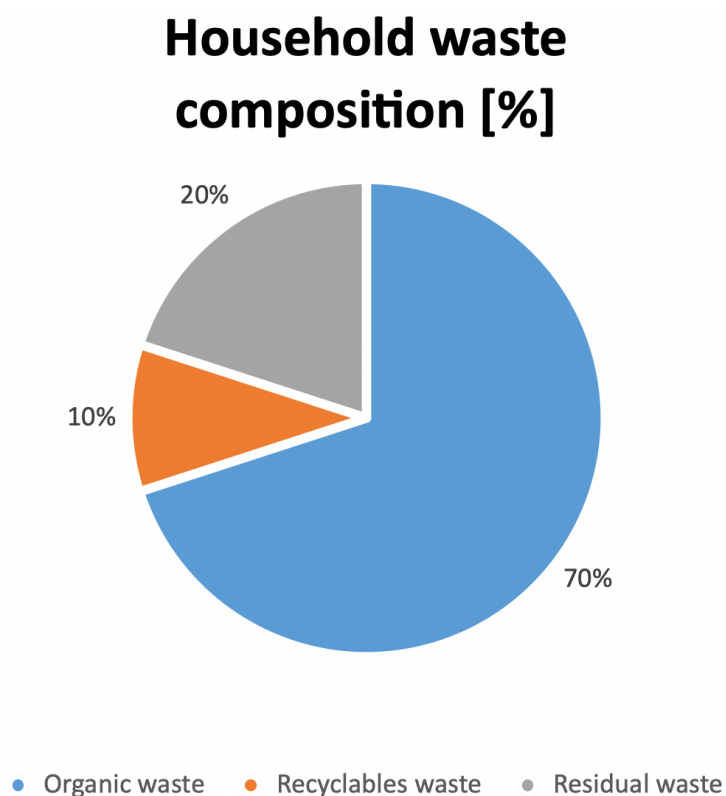


Figure T 7.1 A: example for visual representation of waste composition