

4. Waste Composition Analysis



4.1 Overview of the Method

Waste composition analysis (WCA) is a method used to physically separate, weigh, and categorize FLW. An entity may use this method to separate FLW from a “waste” stream that includes other material that is not FLW (e.g., packaging, yard waste, other solid waste items). Waste composition analysis may also be used to understand the different components that make up FLW (e.g., types of food categories, amounts of food versus associated inedible parts). A WCA may also be referred to as a “waste characterization study,” or “waste sort.”

A WCA provides an opportunity to collect very detailed information about FLW, where such information is useful for the decision-making needs of the entity using the FLW inventory. The FLW could, for example, be sorted into specific food categories (e.g., apples, cake, chicken). Moreover, items still in their original packaging could be sorted separately and information recorded about whether the item, when removed from the food supply chain, was opened or unopened, or how much was eaten. In the case of packaged products, if the details about which products became FLW are important to an entity’s goals, then, as part of a WCA, the entity could also record information from the packaging such as the item’s brand, or flavor, enabling it to understand more precisely which items were removed from the food supply chain.

In some countries, there is national or regional guidance on how to carry out a WCA. For example, Scotland has published *Guidance on the Methodology for Waste Composition Analysis: For local authorities commissioning waste composition analysis of municipal waste*.⁸

ADVANTAGES AND DISADVANTAGES

An advantage of using a WCA is that its use of weighing overcomes many of the under-reporting problems of methods such as surveys and diaries, and the inaccuracies of methods that rely on an approximation of FLW such as those based on assessing volume. When combined with other methods, such as surveys or diaries, the results of a WCA are useful not only for quantifying FLW but also for understanding why it might have been produced.

The main disadvantage of WCA is its cost. Other disadvantages include:

- ▶ A high level of expertise is needed to plan, carry out, and analyze the results
- ▶ The method is not appropriate for some waste streams (e.g., material poured down the drain)
- ▶ Depending on the climate, FLW may need to be dealt with very quickly, before it degrades and
- ▶ Given the costs involved in implementing a WCA, it may be possible to study only a small sample size, which will increase the uncertainty associated with the results

LEVEL OF EXPERTISE REQUIRED

WCA requires considerable expertise including:

- ▶ Knowledge of sampling theory and statistics to ensure that resulting data can adequately answer an entity’s research questions. (This is particularly important because it is unlikely that an entity will have the resources to undertake a study of the total population it seeks to quantify, and representative sampling will be required. This may also increase cost, if the entity needs to hire a consultant with these skills.)
- ▶ Skills in collecting and sorting samples, including waste handling, managing health and safety processes (e.g., conducting risk assessments for sorting sites), and organizing the logistics.
- ▶ Suitable equipment—notably vehicles, scales, screens and boxes—in sufficient quantity to conduct a study appropriate to an entity’s needs.
- ▶ An understanding of problems that can arise (e.g., material being collected by the normal collection vehicle instead of the vehicle designated for FLW) and ways to overcome them.

COSTS

The cost of a WCA will depend on the scale of the project, particularly how geographically clustered the sampling points are (advice on clustered sampling is given in Appendix A of the *FLW Standard*). The more the sorting team has to travel from place to place, the more cost will be incurred for staff time, vehicle fuel, and accommodation costs. Other items that may incur cost include:

- ▶ equipment rental, construction, or purchase (e.g., vehicles, screens, scales, boxes, brooms);
- ▶ electronic data-entry devices (e.g., tablet computers, smart phones);
- ▶ collection container purchase or rental for storing material pre- and post-sorting;
- ▶ disposal/recycling charges;
- ▶ sorting site rental;
- ▶ permit or license for carrying out the sorting.

4.2 Guidance on Implementing the Method

A WCA can be used at any of the stages in the food supply chain (from production to consumption). An entity implementing a WCA will need to undertake a series of steps.

1. SCOPE THE STUDY

As Chapter 6 of the *FLW Standard* explains, a well-defined scope, aligned with the five accounting principles and an entity's goals, is important for ensuring that an FLW inventory meets an entity's needs. The scope of an entity's inventory—defined by the timeframe, material type, destination, and boundary—will dictate to a large extent the scope of the WCA, although additional questions may be incorporated to meet wider goals. Chapter 6 also describes how the scope chosen by an entity for its FLW inventory should be aligned with its underlying goals for addressing FLW.

2. DETERMINE A SAMPLING STRATEGY

If an entity is undertaking a WCA for all the FLW that is within the scope of its FLW inventory, this step is not applicable, nor is Step 3 (gathering samples). Steps 4–10 will apply, however, except for certain aspects that relate back to sampling.

If an entity does not have the ability or resources to collect and sort the FLW of the whole population it is studying, a sample should be taken. Similarly, if an entity does not have the resources to sample all the FLW produced by an FLW-producing unit, a sample should be taken. General guidance on sampling is provided in Appendix A of the *FLW Standard*. There are several aspects of a WCA that need to be taken into account when designing a sampling strategy. Each is discussed below.

Table 4.1 | Contextual Factors that May Influence Composition of FLW

| FACTORS | HOUSEHOLDS | BUSINESSES |
|---------------------------|---|---|
| Physical | Location of container | Location of container |
| Collection-related | <ul style="list-style-type: none"> ▶ Type of collection container ▶ Frequency of collection ▶ Type of collections available (e.g., separate FLW collection) ▶ Whether collection fees are charged on the basis of volume or weight ▶ Quality of communications about accepted materials ▶ Availability of recycling or alternative disposal methods | <ul style="list-style-type: none"> ▶ Type of collection container ▶ Frequency of collection ▶ Type of collections available (e.g., separate FLW collection) ▶ Whether collection fees are charged on the basis of volume or weight ▶ Quality of communication with staff about accepted materials ▶ Availability of recycling or alternative disposal methods ▶ Guidance from waste contractor on accepted materials |
| Temporal | <ul style="list-style-type: none"> ▶ Festival periods ▶ School holiday periods | <ul style="list-style-type: none"> ▶ Peaks or troughs in business ▶ Staff holiday periods |
| Socio-demographic | <ul style="list-style-type: none"> ▶ Household size ▶ Age ▶ Urban/rural ▶ Ethnicity ▶ Presence of children ▶ Level of income ▶ Single- or dual-income ▶ Frequency of cooking/shopping | <ul style="list-style-type: none"> ▶ Economic sector ▶ Types of food and drink processed or sold ▶ Level of mechanization ▶ Degree of engagement with FLW-prevention initiatives ▶ Level of education of staff |

Contextual factors influencing the composition of FLW

Table 4.1 lists some of the contextual factors that should be taken into account when devising a strategy to select a representative sample for a WCA. The list is focused on households and businesses but most of these considerations apply to other entities as well.

Practicalities related to sampling FLW

The practicalities of taking samples can rule in or rule out certain sampling strategies, so it is sensible to consider them at this stage rather than later in the process. The issues to consider will vary, depending on how an entity’s FLW is collected, but they include:

- ▶ **Collection body.** Who normally collects the “waste” material? Is it a government body or a private waste management company? How feasible will it be to engage with them? Are lots of different players involved? How feasible will it be to sample the material collected by many waste companies as opposed to one? Will some types of arrangement need to be excluded?
- ▶ **Collection cycle.** Is the collection organized into “rounds” or “routes” serviced by one vehicle? Is it feasible to sample all the material in a round or route? How representative of the whole population being studied is the round/route?

- ▶ **Location of FLW.** Where are the containers located? Are they accessible? Will businesses with inaccessible containers need to be excluded? Will some sources of FLW need to be excluded (e.g., if FLW is kept in locked areas which cannot be accessed)? How will communal systems where quantities might be large and the precise source of the FLW is unidentifiable be dealt with?
- ▶ **Mixing of material.** How do the crews normally collect the material? Do they go ahead of the vehicle and group it all together so that material from individual FLW-producing units cannot be distinguished? Will these areas need to be excluded from the WCA?
- ▶ **Bulky collections.** How will very large containers that cannot be manually tipped or emptied be dealt with? Can arrangements be made for them, or will this type of container need to be excluded from the WCA?

Once the various considerations have been evaluated, a strategy should be decided upon and a sampling frame drawn up. In the simplest case the strategy will involve randomly selecting units from a pre-prepared list of all units (i.e., the sampling frame). More likely, cluster sampling will be required due to the cost of gathering data from geographically dispersed sites. An element of stratification of the sampling frame may be needed to ensure key characteristics of importance are covered. Additional guidance about these different sampling strategies is provided in Appendix A of the *FLW Standard*.

3. SELECT APPROACH FOR GATHERING FLW SAMPLES

There are three possible ways for an entity to collect samples of FLW: bulk sampling, small-area sampling, or sampling from individual FLW-producing units. In the case of the first two, the sampling unit is not the FLW-producing unit (see “bulk sampling” and “small area-based sampling” below). Which of these three options an entity selects will determine the nature of the sampling unit, which in turn impacts how the data are scaled up in a WCA (see Step 10 in this section).

Bulk sampling

This approach involves intercepting FLW after it has been collected by the normal collection vehicle. The vehicle will typically collect material from many FLW-producing units and take it somewhere to be tipped, either straight into the disposal facility, or to a transfer site where it will be consolidated and then sent to the disposal facility.

It may be possible to sort and weigh the FLW at the disposal or transfer site, or it may be possible to ask the vehicle to divert to a special site where the sorting and weighing will take place. See Step 7 in this section for issues to consider in relation to the site. The benefit of a bulk sampling approach is that an entity can sample large quantities of FLW at relatively low cost because it is relying on the normal vehicle delivering it.

The FLW being analyzed in this scenario is one step removed from the units that produced it because it has been collected by a third party. As such, the sampling unit will be the transfer site, the vehicle from which the FLW is taken, or possibly the area from which the intercepted vehicle has collected the FLW. The definition of the unit will depend on which of these (transfer site, vehicle, area) the sampled FLW is considered to be representative of. The data will then require scaling up to all transfer sites, all vehicles, or all areas within the inventory scope. An entity shall nonetheless describe in its inventory report as much as is known about the FLW-producing units that generated the FLW (see guidance related to describing “boundary” in Section 6.6 of the *FLW Standard*).

Small area-based sampling

This involves choosing a specific physical area from which to sample (e.g., a street, a neighborhood, a business cluster). This chosen physical area becomes the sampling unit. The material from all the FLW-producing units in that area is collected and combined into one larger sample.

The advantage of this approach is that an entity can closely control the type of area included in the study (e.g., only affluent areas, areas with low levels of car ownership) without going to the additional expense of collecting from each FLW-producing unit separately. The FLW will then need to be taken to the sorting and weighing site for analysis.

In this approach to sampling, the sampling unit will be the street, neighborhood, or business cluster. The data will require scaling up to all streets, all neighborhoods, or all business clusters within the inventory scope. As with bulk sampling, an entity shall nonetheless describe in its inventory report as much as is known about the FLW-producing units that generated the FLW (see guidance related to describing “boundary” in Section 6.6 of the *FLW Standard*).

Individual sampling of FLW-producing units

This approach keeps material from individual households or other entities separate when sampling and sorting the FLW. If there are multiple FLW-producing units, FLW is often placed in separate bags—either by the FLW-producing unit or by the WCA study team—which are tagged with a unique identifier that refers to the FLW-producing unit. This identification allows the FLW to be anonymous to all but those who know which code corresponds with which unit, yet allows it to be linked to survey responses and other information about the FLW-producing unit during the analysis phase.

The information derived from this approach is particularly useful when combined with questionnaire responses from those specific FLW-producing units because it enables an entity to link FLW to characteristics of the people or entities producing it. The entity can then draw conclusions about any correlations. However, individual sampling can be expensive due to the added costs of collecting the FLW and keeping it separate, analyzing it separately, and entering data for every FLW-producing unit separately. In some cases, individual sampling will also require informed consent from the parties being sampled, rather than use of a simple “opt out” arrangement. This is because of the direct links being made between FLW and the people or entity that produced it (see Step 4 in this section about issues of consent).

In this approach to sampling, the FLW-producing unit will be the household or other entity that generates the FLW and the data will require scaling up to all the FLW-producing units within the inventory scope.

At the end of this process, an entity will have determined whether FLW-producing units or some other sampling unit (e.g., streets, neighborhoods, individual households, individual businesses, whole waste collection rounds) are to be sampled.

4. CONSIDER ISSUES OF CONSENT

If the entity undertaking a WCA is also the entity that has ownership of the FLW, then this issue will not arise. However, where the entity undertaking the study does not have ownership, it needs to consider the following issues related to obtaining consent to sort through another entity’s FLW.

An advantage of using a WCA is that its use of weighing overcomes many of the under-reporting problems of methods such as surveys and diaries, and the inaccuracies of methods that rely on an approximation of FLW such as those based on assessing volume.

An entity should investigate the relevant legal framework to ensure that it does not inadvertently break the law. For example, in many countries, in order to transport waste material from its source to a sorting site, an entity will need a waste carrier's license. In some countries, it is illegal to sort through "waste" generated by a household without the household's consent. If undertaking a WCA for a business, an entity that takes away the material for WCA analysis without obtaining prior consent from the business may be breaking the terms of the company's contract with its waste contractor. An entity should also consider what is culturally acceptable. In some cultures, sorting through "waste" without consent is ethically unacceptable.

Obtaining consent is a particular issue with WCA because of the sensitive nature of sorting through someone else's FLW, particularly from households where personal items might be encountered. Whether or not consent of the entity producing or owning the FLW is required will depend in part on where the FLW is intercepted. For example, it is not usually contentious to analyze bulk loads of FLW at a transfer site (bulk sampling) because

the source of the FLW will not be known. However, sometimes an entity may want to be able to link the FLW to those generating the FLW (e.g., to link the FLW to household socio-demographics or to a particular business sector), in which case the FLW may need to be collected at its source. In this case, the process might be more sensitive and the issue of obtaining consent should be carefully considered.

Obtaining consent may, however, affect the accuracy of results. This is because the effect of alerting the participants to the study can lead to participants changing their behavior and generating fewer or different items of FLW. One approach to avoiding this is to plan a waiting period of several weeks between seeking consent and carrying out the WCA so that behavior has a chance to revert to normal, and not to inform participants of the timeframe in which the WCA will be conducted.

If consent is required, two main approaches are possible—offer an "opt out" or require "opting in." Each is discussed below.

Opt-out approach

Allowing potential participants to opt out of the WCA is the simpler and arguably more effective approach from a research perspective. The entity undertaking the study should alert those FLW-producing units selected for sampling to the forthcoming WCA, describe its purpose, and encourage them to take part. To reassure the sampled units, there should be controls in place to ensure that personal information is kept confidential (see Section 8.5 of the *FLW Standard*).

Opt-in approach

In this approach, the FLW-producing units being studied should be contacted in advance and asked to participate. Where possible, consent should be “informed consent,” that is, the representative of the FLW-producing unit should be given full and honest information about the process. Where a record of the consent is required (e.g., a signature of the participant against a statement of consent), an effective way to obtain the consent is in combination with a survey. The entity should be very clear about the benefits of participating to persuade as many units to take part as possible. This is particularly important where a probability sampling strategy has been adopted (see Appendix A of the *FLW Standard*), because sample size can quickly be eroded by non-participation. Incentives can be provided to increase the level of opting in (see Chapter 7 in this document for ideas).

In general, in line with good research practice, the people or entity whose FLW is being collected should be able to make a telephone call to a place of authority (e.g., the police, the local community council) to check that the work is genuine research. This means that the relevant local authorities should be pre-briefed. In some countries, identity theft from discarded documents has made the news and people may be concerned that someone is trying to “steal” their waste for gain. Reiterating that only the FLW will be analyzed and that all other material will be disposed of in the usual way (whatever that may be

for the local authority or municipality in question) could allay many of these fears. In addition, it is good practice to have prepared frequently asked questions (FAQs) and responses in case of interest. Responding promptly and openly to expressions of interest by the media may also deflect what might otherwise become a hostile story about “snooping.”

5. DETERMINE THE FLW CATEGORIES TO BE ANALYZED

The scope of the FLW inventory and an entity’s quantification goals will dictate the categories into which the FLW must be sorted and weighed. In order to maximize the value of the WCA, an entity may also record information for categories beyond the scope of the inventory, provided their inclusion does not compromise the main objectives of the study. A list of categories should be prepared at this stage.

6. CONSIDER HEALTH AND SAFETY RISKS

The health and safety of those handling waste material is an important consideration for WCA. This standard does not provide detailed health and safety guidance. Whether an entity is carrying out the WCA itself or contracting with a specialist company, it shall ensure that safe systems of work are employed; that staff are given appropriate levels of training, personal protective equipment and vaccinations; and that detailed health and safety policies and procedures are produced and followed. In particular, the entity shall comply with relevant health and safety law and best practice guidance.

Policies should be drawn up, before commencement of the study, on the procedure to be followed if workers find hazardous material (e.g., asbestos, syringes), illegal material, or items suggesting that a crime may have been committed.

7. OBTAIN SAMPLES OF FLW, OR MIXED MATERIAL CONTAINING FLW, AND SELECT SITE FOR SORTING

The approach taken to obtain the samples of FLW, or the mixed material containing the FLW, will be dictated as much by practical access issues as by technical sampling considerations. It is possible that sampling will need to be conducted in two stages: obtaining the sample, and then sub-sampling from that sample to generate a quantity that can be sorted and weighed manageably. General guidance on physically sampling FLW is provided in Appendix A of the *FLW Standard*.

If a waste management company routinely collects FLW on a certain day, the sample should be collected on that same day, and as close to the usual time of waste collection as possible. This is because the timeframe over which the sample has been produced will normally be known only in relation to the normal collection schedule; this is essential information for scaling up the data. If the sample is collected on a different timeframe, it may not be representative of the whole period. This means that, in advance of collecting the sample, an entity will need to:

- ▶ Find out the normal day and time of collection
- ▶ Liaise with the organization that would normally collect the waste and ask it not to collect during the period of sampling. It is risky to rely on the sampled FLW-producing unit to make these arrangements. An entity should take on this responsibility

It is a common pitfall of WCA that the waste management company responsible for routine collections mistakenly picks up the intended samples of FLW, despite requests not to do so. Therefore, in order to ensure that routine waste collection does not accidentally collect the FLW, the following is recommended:

- ▶ The day before routine collection, the normal waste collector should be reminded that the entity will be collecting a sample
- ▶ The entity should aim to collect the FLW at least one hour ahead of the normal collection time to avoid the samples being collected accidentally by the normal vehicle
- ▶ If possible, the entity should liaise with the actual driver of the vehicle rather than management to communicate the importance of not collecting the FLW intended for the study

Prior to the sample being taken, an entity should also collect any other required background information such as where to locate the container that is to be sampled.

An entity will need to decide whether the sample is to be sorted on the FLW-producing unit's site or elsewhere. Where the sampling unit is a waste transfer site, it may be feasible to sort and weigh the sampled FLW at that site. Businesses are unlikely to have space for sub-sampling, sorting, and weighing FLW, and this is even less likely for households. In these cases, a separate site at which the FLW can be sorted (the "sort site") must be secured.

An entity should consider the following variables in selecting a site for sorting the FLW for weighing:

- ▶ Lighting may be required, especially in the winter months
- ▶ Where electricity is not available, a generator may be needed
- ▶ The needs of the individuals undertaking the sorting must be taken into account (e.g., toilet and washing facilities, area for eating)

- ▶ Cover may be needed in windy or rainy climates (sorting under temporary cover such as tents is possible but not ideal)
- ▶ Local laws may be in place related to storage and processing of waste. In some countries, analysis of waste may be permitted only at sites licensed for waste management activities (e.g., an entity may need to apply for a temporary license, which may take some time)

If the sample is to be removed from the location from which it was taken, an entity will need to consider how this will be achieved. In particular:

- ▶ Can the whole container be removed from the sample location? If so, what arrangements will be made for temporary replacement containers, and how will the original container be returned? And what type of vehicle will be required to lift and move it?
- ▶ If the container cannot be removed, how will the sample be physically moved in a safe manner from the container in which it is normally stored? What temporary container will be used to store the FLW? And how will the FLW be transported?
- ▶ Is it feasible to request that the normal waste collection company delivers the FLW to the sort site?

Any vehicles used must be non-compacting to ensure that material can be sorted and separated and large enough to carry what can be substantial volumes and weights of FLW without spilling and mixing samples. In some countries, for example, a vehicle that transports waste must be authorized, which means that it must be owned or hired by a “Public Service Company (PSC).” In other countries, organizations that move waste around must be registered.

If an entity is taking a large sample, careful consideration should be given to how it will be stored because it may take several days to sort and weigh it. During this time it will need to be kept secure, avoiding unpleasant smells for neighbors and staff, windblown litter issues, and pollution due to leaching. An entity may need to supply containers at the sort site for the FLW while it is waiting to be sorted.

8. SORT AND WEIGH THE FLW

Sorting stations are normally set up allowing sorters to have their own areas. Normal practice is to use screens made of wire mesh, which allow FLW that is too small to sort to fall through onto a plastic sheet below. The mesh size can vary, but 10mm is thought to be reasonable for FLW analysis. The small particles (or “fines”) can be collected and weighed as one category. The screens should be set at a height that is comfortable for the individuals sorting the material. Boxes are placed around the screen, one for each category into which the sample will be sorted. Typically, individual sorters will tip a small sub-sample of material onto their screens, pick out items of the various categories, and put them into the correct box. Some agitation of the material may be required to allow small particles to go through the screen, although squashing it through is not acceptable.

The categories into which the sample will be sorted need to be very clearly defined so that, if multiple individuals are sorting, the placement of the FLW will nonetheless be consistent. Staff training will be crucial to ensure that all individuals involved follow the agreed method of categorization. This is particularly important when categorizing the FLW as “food” or “associated inedible parts” since what is considered inedible varies based on a number of factors, including cultural norms. Additional guidance on categorizing FLW by these material types is provided in Section 6.4 of the *FLW Standard*.

Meals are especially hard to classify because they consist of many different components, which are nearly impossible to separate given that thick gloves are typically worn for protection by those undertaking the sorting. A method of deciding how to assign meals to categories will be required to avoid sorters making their own decisions and introducing inconsistency. One possible option is to assign the meal according to the main ingredient/component.

Even with the best classification method there will always be some material that is impossible to identify. In the United Kingdom this has been referred to as “composite gunge” or “semi-solid mixed food.” A category for this material should be included in the list and clear instruction given to sorters on when it can be used. An entity must be realistic about the level of sorting that can be achieved.

An entity should give guidance to sorters on how to handle items in packaging. The *FLW Standard* stipulates that the weight of packaging is excluded from estimates of FLW. Ideally, packaging should be removed from items before weighing. Emptying packaging will lead to a more accurate estimate of FLW, but will slow the sort down and require tools, adding to the cost of the exercise. (See Section 8.3 of the *FLW Standard* for additional guidance on how to deal with packaging when quantifying FLW.)

Once the sample is sorted into categories, the weight of each category should be determined. Guidance on weighing and assessing volume of FLW is provided in Chapter 1 and Chapter 3, respectively, of this document. An entity should also determine the weight of the material that is not FLW so it can carry out a simple mass-balance calculation at the end of the process, in which the sum of the weighed sub-samples is compared to the weight of the whole sample, to make sure that no sub-samples have gone astray.

Records must be kept of each weight, and pre-coded datasheets should be prepared for this task. The datasheets can be electronic or manual, depending on the technology available at the site and the preferences of the team.

An entity will need to provide a location for the sorted and weighed material to be stored prior to recycling or disposal. If the sort site is not a waste management site, arrangements for recycling and disposal will need to be made.

9. MANAGE THE DATA

If an entity has manually recorded the data, it will need to enter it into a spreadsheet or database. In order to check the quality of the data entry, it is good practice to check one in 10 records by making a comparison between the paper-based form and the database. If significant errors are uncovered then all the data should be checked and may need to be re-entered. If the data have been recorded electronically on site, they should be transferred to data analysis software.

If an entity took samples, it should compare the sum of the weighed samples with the weight of the whole sample that it took before sorting commenced. A degree of loss is to be expected in the sorting process because FLW adheres to boxes and screens, but if the loss is more than 10 percent then the data may contain errors.

When combined with other methods, such as surveys or diaries, the results of a WCA are useful not only for quantifying FLW but also for understanding why it might have been produced.

10. ANALYZE THE DATA

If data were produced from a physical sample of FLW or from a sample of FLW-producing units, they will require scaling up. Guidance on scaling up the data is provided in Appendix A of the *FLW Standard*.

For bulk and small-area samples, analysis may involve only summing the samples and scaling up to the population of interest. One disadvantage of bulk sampling and small-area sampling is that no conclusions can be drawn about variation in FLW produced by individual FLW-producing units contributing to the sample. Confidence intervals, which indicate levels of data accuracy, will need to be calculated based on variability between the sampled units instead (e.g., neighborhoods, vehicles, areas). Guidance about using confidence intervals is provided in Section 9.3 of the *FLW Standard*.

For a WCA that has taken a small area-based sampling approach and used several areas to represent a larger area (e.g., three streets of 50 households with different levels of affluence to represent one council area), the data must be weighted in proportion to the prevalence of each sub-area within the greater population area.

An entity will need to consider at the data analysis stage how to deal with incomplete data records. For example, sampled households and businesses may not have set out their waste on some occasions during the sampling period. It is normal statistical practice to delete incomplete records, but there may be specific occasions when leaving them in the dataset is advisable (e.g., where it might offset over-representation of other households or businesses).

Once the weight of FLW is obtained from a WCA, an entity may use it to calculate the percentage of a mixed waste stream that is FLW. Where an entity intends to combine the WCA results with survey or diary data to investigate possible causes of FLW, the FLW data for each category of food should first be normalized by conversion to an amount per household or per person (or another suitable metric). Guidance related to normalization is available in Appendix C of the *FLW Standard*.

Endnotes

8. Zero Waste Scotland (2015).