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Improving the Performance of Waste Diversion Schemes: A Good Practice  
Guide to Monitoring and Evaluation

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# Chapter 7

## Monitoring capture rates



Monitoring capture rates is one of the more complex monitoring activities as it involves waste composition analysis of the residual and recycling / composting waste streams. This chapter describes how to measure capture rates and how to use the results to assess how your services or schemes are performing and the potential for improvements.

WRAP helps individuals, businesses and local authorities to reduce waste and recycle more, making better use of resources and helping to tackle climate change.

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# Monitoring capture rates

## 7.1 Introduction

You can use a number of different methods to assess how well your recycling service / scheme is doing in diverting materials away from the residual bin and into recycling or composting collections.

You can use these methods to answer a number of key questions that are relevant to looking at the effectiveness of a recycling service / scheme and how to bring about further improvements such as:

- Across all the households served, what proportion of the total quantity of a target material (e.g. paper, container glass, etc) is the service or scheme collecting?
- What proportion, on average, of the total quantity of a target material (such as paper, container glass, etc) is a participating household putting out for collection?

Capture rate monitoring is needed to answer these two questions.

## 7.2 What does 'capture rate' mean?

'Capture' refers to the quantity of a particular target material that is 'captured' by the service or scheme designed to accept that material. 'Capture rate' therefore refers to the proportion (as a percentage) of a targeted material that has been collected relative to the total quantity of that material arising (i.e. including both the residual bin and material recycled / composted).

Capture rates are usually calculated for a recycling service / scheme using data derived from operational sources (e.g. the amount of paper collected for recycling at kerbside) and the most relevant and up-to-date compositional data for residual waste available for that area (in this example, it would be the estimated quantity of paper in the residual bin). Although capture rates are usually estimated at the level of a recycling service or scheme, in particular monitoring situations a 'household-level' version might be calculated. The formula below shows how to calculate the capture rate.

**Capture rate is the quantity of target material 'captured' divided by the total quantity of that type of material present.**

$$\frac{\text{Weight of targeted material 'A' collected for recycling or composting}}{\text{Weight of targeted material 'A' collected for recycling or composting} + \text{Weight of targeted material 'A' collected for disposal}} \times 100$$

## 7.3 This sounds complicated – why is it so important?

Ideally when a recycling service / scheme is rolled out, both participation and capture rates should be high. However, it is more realistic to expect that not all participating households are putting out all of the targeted material all of the time. Nor is it realistic to expect high levels of participation across all areas served. Unless monitoring of both participation and capture is carried out, it is difficult to know which element needs to be worked on most to bring about improvement.

In general, improving capture rates becomes increasingly important as a kerbside service / scheme matures and participation rates plateau. Although it is far more involved than participation monitoring, there is no substitute for capture rate monitoring. Locally relevant data for both of these aspects of monitoring (participation and capture) are crucial.

Capture rate analysis is particularly important for alternate weekly service or schemes where participation tends to be high. The main ways for an alternate weekly service / scheme to improve is through encouraging **effective** participation by increasing capture and by reducing contamination (see Chapter 8).

#### 7.4 I have heard the term 'recognition rate' – how does this differ from 'capture rate'?

The term 'recognition rate' is simply the capture rate of a targeted material calculated only from those households that use the service / scheme. As already stated, capture rate refers to the overall quantity of material that is captured by a service / scheme. It takes account of all residents or households within a specific area, whether or not they use the service / scheme (often termed the total number of 'households served'). Recognition rate is simply the capture rate of a targeted material calculated only from those households that use the service / scheme. It can only be derived from analysis of both the residual waste and the material set out for recycling from participating households. Therefore, it follows the same formula as the capture rate formula given in Table 7.1 but only includes data from participating households.

Recognition rate is useful as it informs you about the quantity and type of material that could be recovered from households currently using the scheme. This will enable you to focus communications campaign messages on specific materials. For example:

A recycling scheme was found to contain low overall capture rates for container glass even though participation rates and material-specific set-out rates were high. Compositional analysis of both residual waste and material set out for recycling found that participating households were failing to divert jam jars and other non-bottle glass containers.

In this example, establishing the capture rate for participating households (container glass 'recognition rate') revealed a problem. The practicalities of working out recognition rate are detailed in Section 7.12.

#### 7.5 What kind of services or schemes would benefit from capture rate monitoring?

Capture rate monitoring is appropriate for kerbside services / schemes and materials recycled through household waste recycling centres (HWRCs). The approach to be used for kerbside schemes is discussed in Section 7.7 and that for HWRCs in Section 7.8.

It is important to remember that looking at an individual service / scheme (e.g. a kerbside collection) only gives data on the performance of that service / scheme based on the quantity of material presented at the kerbside (i.e. residual + dry recycling or composting) and cannot be generalised to other collections (e.g. bring sites).

For some materials (e.g. paper), it is likely that there will be several options for disposal within your local authority. Paper can be deposited in a kerbside

#### TOP TIP

Capture rate refers to the overall quantity of material that is captured by a service / scheme.

Recognition rate is the capture rate of a targeted material from those households that use the service or scheme.

**It is important to remember that looking at an individual service (e.g. a kerbside collection) only gives data on the performance of that service based on the quantity of material presented at the kerbside (i.e. residual + dry recycling or composting) and cannot be generalised to other collections (e.g. bring sites).**

collection, at HWRCs or at local bring banks. You can combine data from all the services / schemes operated within your authority (and any areas not served) to calculate an overall capture rate. This is sometimes referred to as 'diversion rate'.

To do this you would need to complete a table such as Table 7.1. Note that this table is designed for the main sources of household waste only; you would need to add columns for municipal waste and other types of household waste. The remainder of this chapter focuses on kerbside collections and HWRCs.

**Table 7.1** Example table for recording quantities of material from different sources to determine overall capture rates

Material	Disposed (residual waste) (tonnes)			Recycled (separate streams) (tonnes)					Total produced (tonnes)  I	Capture rate (%)  J
	Kerbside collection	HWRC	Total	Kerbside collection	Bring	HWRC	Other	Total		
	A	B	C	D	E	F	G	H		
Paper (example)	6000	200	6200	2000	300	1000	0	3300	9500	34.7%
Card	<i>From comp analysis</i>	<i>From comp analysis</i>	<i>A + B</i>	<i>Use LA data</i>	<i>Use LA data</i>	<i>Use LA data</i>	<i>Use LA data</i>	<i>D + E + F + G</i>	<i>C + H</i>	<i>(H / I) x 100%</i>
Cans										
Glass										
Plastic bottles										
Textiles										
Garden waste										
Other										

For some materials collected at HWRCs (e.g. wood), it is possible to calculate a total capture rate or 'diversion' rate based on the data only from the HWRC. This is because, for these materials, the HWRC operates a **closed loop** disposal system for that material, i.e. there is only one route for disposal of wood provided by the local authority and that is through the HWRC. Once you know the quantity of wood diverted at the HWRC and the quantity of wood remaining in the HWRC residual waste, you have accounted for all the wood in the household waste stream. This is not the case for other materials.

For guidance on estimating the tonnage of material collected through furniture and WEEE (waste electrical and electronic equipment) reuse schemes and bulky item collections, see Chapter 6.

## 7.6 Do I need a waste composition analysis?

Capture rate analysis relies on knowing the composition of the residual waste stream, and this can only be established by means of a compositional analysis. Depending on the collection system and how your tonnage data are recorded for

dry recycling or composting, it may also be necessary to undertake a waste analysis of these streams, for example co-mingled collections of dry recycling where only total tonnage collected is recorded. Many local authorities have carried out residual waste analyses and have used the information to calculate their service / scheme capture rates. Of course there are a range of possible reasons for carrying out compositional analysis and a number of different design options and key questions to be answered, only one of which is to calculate capture rates.

The Scottish Environmental Protection Agency (SEPA) has published guidance on carrying out a household waste composition study which can be found on the SEPA website ([http://www.sepa.org.uk/science\\_and\\_research/publications.aspx](http://www.sepa.org.uk/science_and_research/publications.aspx)).

WRAP recommends that a professional company with appropriate experience, insurance and health and safety policies is employed for this task. Although anyone can learn how to carry out a waste analysis given suitable training, this is not the purpose of this document.

There are ways to avoid compositional analysis but these tend to produce less reliable results. One approach is to visually inspect what is left in the residual waste to get a general idea of the materials that aren't being effectively recycled. To do this you should collect a representative sample of households' residual waste and record the presence or absence of materials for each household.

Due to the mixed nature of residual waste, assessing the presence of a given material based using visual inspection can be very difficult. When making a visual inspection, you should take account of health and safety factors since it is likely to involve opening bags of waste and fairly close exposure to waste. As with all types of monitoring, careful consideration should be given to sample selection and size, and to operational health and safety procedures.

## 7.7 Monitoring capture rates of kerbside collections

### 7.7.1 *What's the general idea?*

The general approach involves determining the average composition of residual waste collected at the kerbside and comparing this with the quantity of waste collected at the kerbside for recycling and/or composting. This enables you to calculate a capture rate for each material.

### 7.7.2 *Can I have a step-by-step guide?*

Following these steps will enable you to calculate a capture rate. An example of the calculation in practice is included below each step. See also Section 7.10 and Annex 5 on commissioning a waste analysis.

**Step 1** Carry out or commission a waste composition analysis of the residual kerbside waste. This will tell you what proportion of the waste is made up of each material. If you don't know the weight of each material collected separately for recycling, for example if it goes co-mingled to a materials recovery facility (MRF), then include the recycling in the analysis.

It is also sensible to conduct compositional analysis of kerbside-sorted systems because it provides an opportunity to explore material quantity and capture rates in more detail, and to calculate the recognition rate and explore issues linked to the quality of participation. The examples



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## CASE STUDY

### Northumberland waste analysis

Northumberland County Council identified the need for a waste composition analysis to assess the impact of a recent campaign to increase recycling. This was focused on socio-demographic location.

The analysis was carried out pre- and post-campaign over the six district council areas. Waste was hand sorted and weights noted for each material with contamination levels calculated.

The results generated an improvement plan focused on addressing the problems of low capture rates and high contamination of recycling bins.

For more information, see full case study in Annex 1

below relate only to residual waste but the same principles apply to the analysis of materials collected for recycling.

e.g. Results of the residual waste compositional analysis show:

Newspaper = 12%

Food waste = 30%

Glass bottles = 3%

**Step 2** Apply these proportions to the known tonnage of residual waste to produce estimates of the quantity of each waste material in the residual waste.

e.g. Total residual waste = 65,000 tonnes in 2008/09. Therefore:

Newspaper ( $65,000 \times 0.12$ ) = 7800 tonnes in 2008/09

Food waste ( $65,000 \times 0.30$ ) = 19,500 tonnes in 2008/09

Glass bottles ( $65,000 \times 0.03$ ) = 1950 tonnes in 2008/09

**Step 3** Obtain data on the quantity of each material separately collected for recycling and/or composting at the kerbside.

e.g. Newspaper = 3000 tonnes in 2008/09

Food waste = 1900 tonnes in 2008/09

Glass bottles = 1500 tonnes in 2008/09

**Step 4** For each material, add the quantity collected for recycling or composting to the quantity in the residual waste. (If you have carried out waste composition analysis on the material put out for recycling you can use these data but they are usually less robust than weight data and should only be used where co-mingled collections make separate weighing impossible; apply the percentage composition data to the co-mingled tonnage data).

e.g. Newspaper =  $3000 + 7800 = 10,800$  tonnes in 2008/09

Food waste =  $1900 + 19,500 = 21,400$  tonnes in 2008/09

Glass bottles =  $1500 + 1950 = 3450$  tonnes in 2008/09

**Step 5** Divide the quantity collected for recycling or composting by the figure calculated in step 4 and multiply by 100. This is the capture rate.

e.g. Newspaper =  $(3000/10,800) \times 100 = 28\%$

Food waste =  $(1900/21,400) \times 100 = 9\%$

Glass bottles =  $(1500/3450) \times 100 = 43\%$

### *7.7.3 How do I decide when and how often to sample the waste?*

When working out capture rates it is important to consider the seasonality of different materials. For example, is the capture rate of garden waste in the winter, when we would expect to see less organic material, different to the capture rate in the summer when there is more material? Ideally, a separate waste analysis study would be required for each season but, as a minimum, should be conducted in spring and autumn to allow for seasonal differences.

### *7.7.4 How do I get hold of the waste to be analysed?*

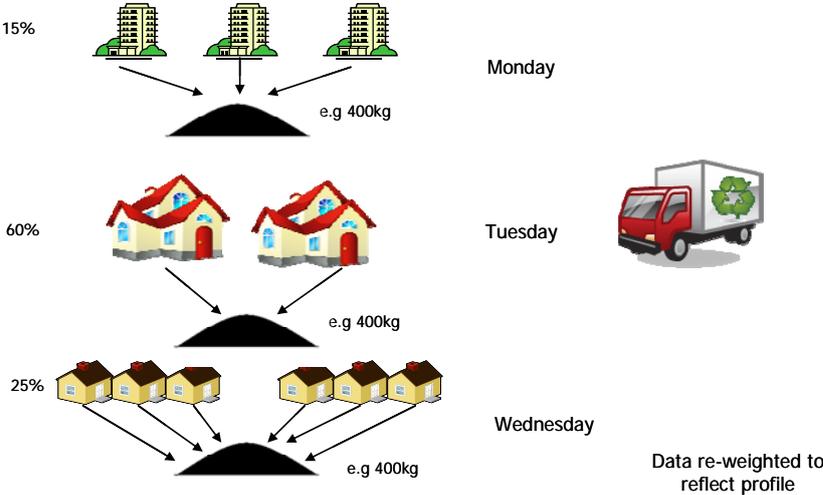
First you must decide where you are going to collect the waste and how to ensure that it is representative. Refer to Chapter 3 for how to select the rounds for your sample. Once you have decided which rounds you are going to select the waste from, you need to decide which method you are going to use for collecting and sorting the waste. There are two possible approaches.

The first approach involves collecting waste from a sample of households on each selected round and bulking the sample for sorting.

It is normal practice for contractors to use a Luton-type vehicle for the collection of waste from the kerbside for waste compositional analysis. The number of households to be included in the sample is normally between 35 and 50 depending on the collection system, the quantity of residual waste arising, the payload of the vehicle and the size of the sorting team. WRAP recommends that at least 150 households be included in any individual waste audit with around 1–2 tonnes of waste sorted.

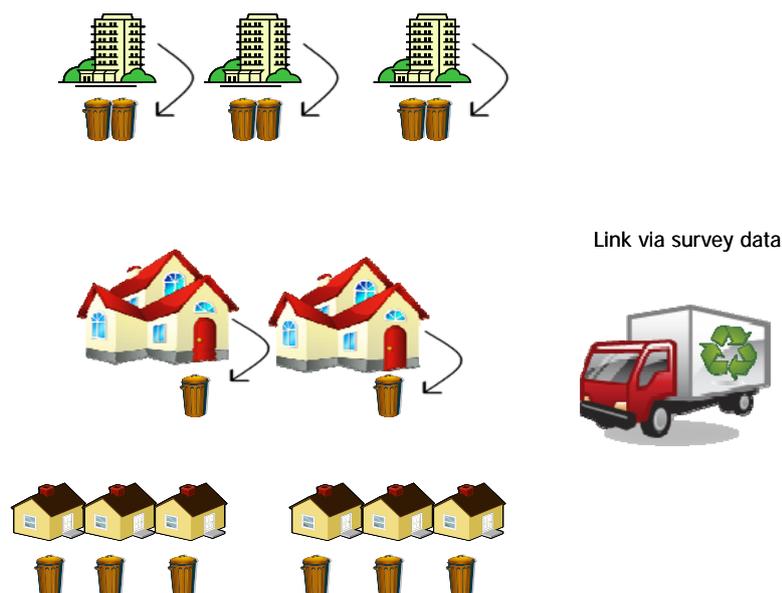
As Figure 7.1 shows, the same quantity of waste will be collected from each round. In this example, there are three collection rounds (Monday, Tuesday and Wednesday), with 400kg of waste collected from each, giving a total of 1.2 tonnes of waste to be sorted. The three rounds together represent the local authority area (e.g. by ACORN category or house type) but the data will have to be weighted to represent the overall profile (see Chapter 3, Section 3.9 for guidance on weighting).

**Figure 7.1** The bulked household approach



In the second approach (Figure 7.2), the same sampling process is used for the rounds but the difference is that the waste collected from each household is kept separate and sorted individually. This method is very time-consuming and costly in comparison with the simpler approach, but provides a lot of very useful data – particularly if combined with participation monitoring and a household survey. The differences in how individual households perform can be analysed and the information used in targeted communications campaigns or in the design of services.

Figure 7.2 The household by household approach



## 7.8 Monitoring capture rates at household waste recycling centres

### 7.8.1 What's the general idea?

Monitoring capture rates at household waste recycling centres enables an assessment to be made of the quantity and proportion of materials that are segregated at the site for recycling, composting or reuse. This provides very useful information for the local authority but also for the site operator as many contracts are now designed to provide incentives for site staff to divert more waste away from landfill. Without such monitoring data, it is difficult to identify the potential to improve site segregation efficiencies.



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### 7.8.2 Can I have a step-by-step guide?

Following these steps will enable you to calculate a capture rate for various materials at your HWRC. An example of the calculation in practice is included below each step. See also Section 7.10 and Annex 5 on commissioning a waste analysis.

Due to the manner in which waste is disposed at HWRCs it is important to consider the method of analysis employed. Careful consideration should be given as to whether you should include an assessment of the bagged material depending on what material you want to include in the capture rate analysis. For example, it is likely that paper not destined for the paper banks on site will be disposed of in black refuse sacks. Therefore, to estimate the quantity of paper in the residual waste, the analysis should include the contents of black refuse sacks. However, other material such as wood is unlikely to be disposed of in black refuse sacks and, in this case, an analysis of black sacks will not be needed.

**Step 1** Carry out or commission a waste composition analysis of the residual waste. This will tell you what proportion of the residual waste is made up of each material.

e.g. Results of the residual waste compositional analysis show:

Recyclable paper = 5%

WEEE = 4%

**Step 2** Apply these proportions to the known tonnage of residual waste over a relevant period of time (say a month or year) to produce estimates of the quantity of each waste material in the residual waste.

e.g. Total residual waste = 20,000 tonnes in 2008/09 therefore:

Recyclable paper ( $20,000 \times 0.05$ ) = 1000 tonnes in 2008/09

WEEE ( $20,000 \times 0.04$ ) = 800 tonnes in 2008/09

**Step 3** Obtain data on the quantity of each material separately collected for recycling, composting and reuse at the site over the relevant time period.

e.g. Newspaper = 1500 tonnes in 2008/09

WEEE = 4500 tonnes in 2008/09

**Step 4** For each material work out the total amount of material passing through the site; add the quantity collected for recycling, composting or reuse to the quantity in the residual waste.

e.g. Newspaper =  $1000 + 1500 = 2500$  tonnes in 2008/09

WEEE =  $800 + 4500 = 5300$  tonnes in 2008/09

**Step 5** Divide the quantity collected for recycling, composting or reuse by the figure calculated in step 4 and multiply by 100. This is the HWRC's capture rate.

e.g. Newspaper =  $(1000/2500) \times 100 = 40\%$

WEEE =  $(4500/5300) \times 100 = 85\%$



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### 7.8.3 How do I decide how many sites to sample?

Many local authorities and site operators will have more than one site. It is often useful to gather information about capture rates for every site because site-specific differences can be crucial; for example, staff at some sites can be more proactive than others about diverting goods from the residual waste skip, and catchment areas can be quite different. If this is unaffordable, then a decision has to be made about the number of sites to include depending on how the information is to be used.

If you want to generalise about HWRC capture rates across the authority area, you need to choose sites that, taken together, represent a good cross-section. You might do this if benchmarking and ongoing monitoring is important. Factors to be considered include:

- urban / rural catchments;
- busy / quiet (low / high tonnage); and
- affluent / deprived catchments.

If different organisations manage the sites you should ensure that all the organisations are represented in the selection. If you take this approach, you are likely to need to include a minimum of five sites (or all of them if you have five or fewer) and more if you have very diverse sites.

Table 7.2 gives an example of a sampling matrix showing the number of sites that fall within each category (shading denotes sampled sites to get good coverage of factors).

**Table 7.2** Example sampling matrix for HWRC capture rate monitoring

Factors		Urban		Rural	
		Affluent	Deprived	Affluent	Deprived
Busy	Contractor 1	0	1	0	0
	Contractor 2	1	2	0	0
	Council run	1	0	1	0
Quiet	Contractor 1	0	1	1	0
	Contractor 2	1	0	1	1
	Council run	0	0	1	0

There may be other factors that you want take account of in your sample selection such as whether the site has trader restrictions in place.

If you want to look at where the biggest room for improvement lies, target those sites you believe are performing poorly and/or those that receive the most residual waste. If you take this approach you **cannot** generalise about all sites because the sample is unrepresentative, but you will be generating monitoring data that can directly inform better site management. If you take this approach the number of sites studied is not important.

When commissioning a waste composition of HWRCs, it is advisable to decide in advance of any tendering exercise how many sites are to be sampled so that bids are comparable. Once you have decided on your preferred contractor for the work you can always increase or decrease the number. If you intend to do this, it is worth stating in the specification that the number of sites you have selected is for bidding purposes only and the actual number may change in discussion with the successful bidder.

#### *7.8.4 How do I decide when and how often to sample the waste?*

Waste entering HWRCs on weekends is different to waste entering on weekdays. This means that you should survey your chosen sites at both weekends and weekdays. It should be borne in mind that the waste entering sites on Mondays could be different from other weekdays due to a weekend spill-over effect. Bank holidays should be avoided as waste may be 'non-typical' at these times. As a minimum, residual waste from each site should be analysed on one weekday and one weekend day, but preferably more.

Seasonal variations are very important for the composition of HWRC waste and sites should be surveyed at least twice in a year, once in the summer (June, July or August) and once in the winter (December, January or February) as this will provide extremes that can be averaged. If resources permit, spring (March, April, May) and autumn (September, October, November) analyses should also be carried out. As a minimum, survey each site in the summer and the winter.

Your waste composition contractor will be able to advise you further on sampling issues.

**As a minimum, residual waste from each HWRC site should be analysed on one weekday and one weekend day, but preferably more ... and site in both the summer and the winter.**

### 7.8.5 How do I get hold of the waste to be analysed

There are two possible approaches. The first involves selecting vehicles as they pull up to the residual bin or enter the site and either asking the occupant to deposit waste into a dedicated container or locating the sorting team on site and sorting through the selected residual waste as it is taken from residents. In this approach it is important that only waste destined for the residual waste skip is included in the sample and that vehicles are selected at random throughout a whole day. The second approach involves taking filled residual skips to a sort site for analysis.

Waste composition contractors may have their own preferences about the approach. The choice of method is often dictated by the level of detail required and site practicalities. Some sites are too busy to have people on site sampling vehicles and/or space for dedicated skips for on-site analysis. The first method often results in less detailed composition data due to the constraints of being able to inspect residents waste in detail in front of them. If the second method is used it is important that non-compacted loads (either by on site heavy plant or compaction units) are delivered as high compaction will adversely affect the quantity and quality of the sort.

Whichever approach is adopted, the co-operation of site staff is crucial.

### 7.9 How should I go about the waste composition element?

If you commission a professional organisation to carry out the composition work, it will advise on the most appropriate sample.

The bottom line is that there are no hard and fast rules on this. Theoretical sampling requirements must be balanced against the operational realities of waste management and budgetary constraints. The aim is to come up with a strategy that is sufficiently robust for the purposes to which the information will be put; waste composition analysis is very far from being a clinical trial. Waste composition analysis is not an exact science as it deals with the outputs of (relatively) unpredictable human beings. Nevertheless, the level of accuracy obtained from most waste analyses will be adequate for calculating capture rates.

**“Waste composition analysis is not an exact science ... it is a specialised activity and, unless you have trained and experienced staff, WRAP recommends that a professional company be engaged.”**

### 7.10 Commissioning external agencies

Waste composition analysis is a specialised activity and, unless you have trained and experienced staff, WRAP recommends that a professional company be engaged. The following gives more in-depth advice, covering the specifics of outsourcing this kind of monitoring. Annex 5 includes a template to facilitate preparation of a brief.

#### 7.10.1 How do I go about commissioning a waste composition analysis?

A full tendering exercise should be run by anyone wishing to commission waste composition analysis and references requested.

When assessing the tenders, look for the following key characteristics in an organisation:

- strong track record of similar work – contact previous clients for references;

- experienced and trained staff, especially the team that will be sorting the waste and the team supervisor;
- detailed health and safety procedures covering waste collection, lifting, manual handling, waste sorting and infection precautions;
- proof of being a registered waste carrier if waste is being collected as part of the work;
- public liability insurance (at least £2 million and ideally £5 million) and professional indemnity insurance (at least £500,000); and
- procedures to deal with queries and complaints from members of the public if collecting waste direct from households.

It is very important that you compare like-with-like when assessing bids. Check the following:

- Sometimes contractors will collect a quantity of waste and then take sub-samples for sorting. Don't be misled about the total quantities to be sorted – ask specifically about this. Check, for example, that if a refuse collection vehicle (RCV) load is delivered for analysis, will it all be analysed, and if, for example, the waste from 35 households is picked up, will it all be sorted? Sub-sampling is often necessary for practical reasons but make sure when you compare bid prices that you know what is included in each;
- Analysing bulk loads of waste is cheaper, tonne for tonne, than analysing waste that is collected from areas selected by socio-demographic profiling. Both approaches have a place, but make sure you are clear about what is being proposed;
- All approaches to waste analysis require local authority involvement of one kind or another. Possible types of involvement include selecting areas for sampling, collecting the waste, providing a sorting area and disposing of the sorted waste. Check what you will be expected to provide and that it is reasonably consistent across the bids;
- How do the contractors intend to ensure that the sample is representative? (See also Chapter 3.)
- Cutting back on samples can reduce the price of a waste analysis, but it can also reduce the reliability of the data. In this field the cheapest is not necessarily the best and you should make sure that the method being proposed is robust, particularly if the price is considerably cheaper than the other bids. It may be that the bidder has misunderstood your needs and it is best to clear that up sooner rather than later; and
- The price of waste analysis is not usually very sensitive to the number of categories the waste will be sorted into, but you should check what each bidder is proposing. Organisations that provide these services are usually quite flexible on the categories that can be used, so don't reject a bidder just because you don't like the categories they are proposing to use.

One factor that is negotiable in all waste analyses is the number and specification of categories into which waste will be sorted and the results reported. You should ensure that the materials you collect for recycling and composting are separately identifiable within the category list used and that each has a category of its own. This is essential for calculating reliable capture rates.

For kerbside collections, waste composition analysis aimed at assessing capture rates is a specific type of waste analysis and you should make this very clear in the specification. For co-mingled recycling or composting collections, it is essential that both residual waste and recycling or composting waste be collected from the same set of households. This may mean selecting the survey week carefully or coming back the subsequent week for alternate weekly collections. A full picture of waste and recycling or composting collected from the households in one collection cycle is required.

## 7.11 Dealing with queries from the public about composition monitoring

At one time it was quite acceptable for local authorities to collect waste and take it for analysis without informing households in advance; indeed, it was thought that informing residents would change the types of waste they set out and affect the results of the study. It is now accepted best practice for residents to be informed in advance and given the opportunity to opt out.

Two options are available to local authorities, and the one chosen depends on the nature of the study.

1. If waste is to be collected and analysed from individual households without being bulked up, then informed consent should be obtained. This is particularly important if the waste analysis work is to be combined with a questionnaire, e.g. to research links between waste production and household characteristics. Informed consent should be obtained by visiting each household in person, explaining the purpose of the study and precisely what is involved, and asking a responsible adult to sign to give their permission for their waste to be analysed. Households that do not wish to give their permission should be excluded from the study. The household should also be left with a letter that sets out what has been discussed and allows them to change their minds at a later stage. The letter should state clearly who has commissioned the work and who should be contacted in case of a query, as well as explaining what will be done with the information collected and the controls that are in place to ensure confidentiality.
2. If waste from a block of households is to be collected, mixed together and analysed as a whole, there is no requirement for informed consent because no information on individual households will be collected. Households should, however, be issued with letters offering them the chance to opt out. These letters should be hand delivered by a trusted party, e.g. local authority officers or the selected waste composition contractor. The letter should set out the purpose of the study, the benefits to the study of the maximum number of households being involved, the controls that will be in place to ensure confidentiality, and who to contact in case of queries or to opt out. A telephone number and email address should be supplied for households to use to opt out.

It is important to ensure that full records are maintained of households that have refused permission or opted out of the study, and that these are passed on to the waste composition contractor to avoid waste being collected in error.

In addition to obtaining consent or enabling opting out, the following procedures should also be put in place:

- Local police and council call centres should be informed so that residents who call suspecting identity theft can be reassured;
- The people collecting the waste should behave professionally, speak English (and Welsh if operating in areas where this is residents' first language) and carry identity badges;
- Each team should carry a letter of authority from the local council to provide to residents who enquire on the day of collection; and
- A procedure for enabling households to opt out on the day of collection should be put in place, including making arrangements for the normal collection crew to collect the waste / recycling.

It is also good practice to prepare a statement for the council's website and a series of frequently asked questions for residents with queries.



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## 7.12 What is required for recognition rate monitoring?

To determine the recognition rate, you will need to be able to distinguish between the waste generated by those householders that participated in the recycling or composting collections and others that were non-participants. This means that all samples will need to be tagged at the point of collection in order to identify each collected item of waste as originating from participants or non-participants respectively.

The calculation for recognition rate requires you to assess the quantity of the target material in the residual waste **only** in the households that set out recycling or composting. However, to determine the overall scheme capture rate you will then also need to analyse the residual waste from non-recycling householders (see Section 7.7) and combine the results.

If your collections of residual and recyclable / compostable waste occur on alternate weeks, then collect the recyclables / compostables first, noting down which households set out. The following week, visit all the households in your sample again to obtain the corresponding residual waste samples. These samples should then be tagged according to whether or not the samples were obtained from households that had set out recycling or composting during the previous week.

## 7.13 What is the likely cost for kerbside household waste analysis?

The cost of a waste composition analysis depends on several factors and the design of the study will always be a compromise between data needs and budget. Factors to consider are outlined below and then generalisations are made about what you might expect to pay.

### Factor 1: Sample size

For headline categories (i.e. food waste, garden waste, paper and cardboard, plastics, metals and glass), WRAP recommends that between 35 and 50 households per collection round be targeted (each round representing either an ACORN group, housing type or other socio-demographic criteria). The number of households sampled will depend on:

- the collection system;
- the quantity of residual waste arising;
- the payload of the vehicle used for the collection; and
- the size of the sorting team.

WRAP recommends that at least 150 households be included in any individual waste audit with around 1–2 tonnes of waste sorted. However, for local authorities with fairly homogenous socio-demographics, a smaller sample may be sufficient.

For analysis of materials that appear less frequently and in smaller quantities in the household waste stream (e.g. small WEEE), a larger sample is required to have the same confidence in the mean value being an accurate estimate. (See Chapter 3 on sample selection for considerations in obtaining a representative sample.)

The more waste you specify to be analysed the more analysts are required and the higher the cost. You need to be confident that sufficient waste is being sorted but be mindful of the cost implications.

**WRAP recommends that a minimum of 35 households per sampling strata are targeted.**

Similarly, most organisations make use of hire vans to pick up the waste from households. One Luton-sized van can contain the waste from approximately 35–40 households – less if the area is served by wheeled bins. To collect more than 40 households' worth of waste in each area will require additional vans or trips, hence additional costs.

Areas that have fortnightly collection of residuals can produce large quantities of waste to be analysed, adding to the costs. If costs are to be kept down, you may have to decide on a reduced sample size.

### **Factor 2: Repeat audits**

When undertaking repeat waste audits, of key importance is the need to account for seasonal variation. If only annual audits are undertaken, they should be carried out at the same time of the year for comparability. Ideally, audits should be undertaken in two phases, accounting for summer and winter differences.

**As a minimum, two phases of audits should be undertaken to account for seasonal differences.**

### **Factor 3: Socio-demographic diversity**

The higher the diversity, the more rounds (strata) that will require sampling. Many waste composition contractors use proprietary socio-demographic profiling – ACORN or MOSAIC – in which the profile determines the sampling strategy. For most local authorities, you should expect to have between three and five main categories of residents and each will need sampling. This is usually one day of fieldwork for each socio-demographic category.

### **Factor 4: Partnerships**

It is preferable that each district, borough or unitary authority within a partnership is sampled separately so that results are valid for each partner individually. The results can then be combined to generate a picture for the partnership as a whole. If resources mean this isn't possible, or if results are only required at the partnership level, it is possible to obtain a representative sample at much reduced cost by profiling the partnership areas as a whole. It should be made clear to bidders if this is an option. When assessing bids, look out for different approaches as this can significantly affect costs.

### **Factor 5: Collection system**

Analysing the composition of waste and recycling collected through alternate weekly systems is usually more expensive. This is because the fieldwork has to take place over two weeks as all the recycling or composting must be collected, as well as the residual waste, and this means a return trip for the fieldwork team.

The same applies to systems where one type of recyclable material is collected in week 1 and another in week 2. For systems which collect residual waste weekly, the fieldwork can usually be designed so the collection coincides with the recycling or composting week so all the fieldwork can be completed in one week.

### **Factor 6: Size grading and other special requests**

Some authorities request that size grading be carried out as part of a waste analysis. This is useful where an advanced processing plant is being planned, such as anaerobic digestion, pyrolysis / gasification or mechanical–biological treatment (MBT) because the equipment can be sensitive to size variations in the waste feedstock. Calorific value (CV) can be calculated from a modelling exercise using published data on material CVs and based on the composition of the residual waste, or a sample can be sent to a laboratory for analysis. Because laboratories work with such small quantities of waste, ensuring that the tested sample is 'representative' needs careful consideration and discussion with the laboratory. Making special requests such as this will add to the price of the analysis.

### 7.13.1 Typical costs

For kerbside collections, taking account of the above caveats and at 2009 prices, a single district, borough or unitary authority should expect to pay between £7000 and £15,000 per season for an analysis of collected household waste. Most organisations that provide this service will give estimates for budgeting purposes before submitting a fully costed bid and this should give you a better indication for your specific needs.

For HWRCs, the critical price issues are:

- the amount of waste to be analysed;
- the number of days of sampling; and
- the number of sites to be included.

You can expect to pay between £800 and £3000 per day per site. The more days that are spent on site, the less the cost per day as the fixed costs such as project management and report writing are spread more widely.

## 7.14 Summary of chapter

This chapter has:

- introduced and defined the term 'capture rate' (Sections 7.1 and 7.2);
- explained why capture rate analysis is important (Section 7.3);
- explained the meaning of the term 'recognition rate' (Section 7.4);
- outlined the kinds of services that would benefit from capture rate analysis (Section 7.5);
- described why waste compositional analysis is required to determine capture rates (Section 7.6);
- explained how to monitor capture rates at the kerbside (Section 7.7);
- explained how to monitor capture rates at HWRCs (Section 7.8);
- signposted guidance on conducting a waste composition analysis (Section 7.9);
- given guidance on commissioning a waste composition analysis (Section 7.10); and
- provided advice on likely costs associated with the different methods (Section 7.13).

## 7.15 Where do you want to go next?

Chapter 1 provides an **introduction** and helps you decide which chapters you need to look at.

Chapter 2 explains how to set **monitoring aims, objectives and KPIs**. It then explains how to use the results of monitoring to **improve a service or scheme or to measure the effects of a communications campaign**.

Chapter 3 gives details for consideration when **sampling and profiling**.

Chapter 4 deals with monitoring **awareness, claimed behaviour and satisfaction**.

Chapter 5 deals with monitoring service or scheme **usage and participation**.

Chapter 6 looks at the use of **tonnage data**.

Chapter 8 considers monitoring of **contamination levels**.

Chapter 9 looks at approaches to measuring **waste reduction**.

Chapter 10 deals with monitoring **communications campaigns**.

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