Working together for a world without waste

KERBSIDE COLLECTION OF PLASTIC BOTTLES GUIDE

A guide for local authorities to either roll out a plastic bottles collection at the kerbside, or improve the material quality and capture rates of their current kerbside plastic bottles collection service.

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WRAP's vision is a world without waste, where resources are used sustainably.

We work with businesses, individuals and communities to help them reap the benefits of reducing waste, developing sustainable products and using resources in an efficient way.

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Front cover photography: Detail of blue and green plastic bottles

Contents

1 INTRODUCTION

This guide has been developed to support local authorities in England and Scotland that are either planning to collect, or are currently collecting, plastic bottles at the kerbside. The guide focuses on maximising plastic bottle material quality and/or capture rates from plastic bottle-only collection services.

An increasing number of local authorities collect a wider range of plastic packaging than just plastic bottles. These household plastic packaging schemes target a varying range of materials, which can lead to higher yields of plastic being collected. However, for a number of reasons discussed below, the collection of household plastic packaging is currently a topic of some debate within the recycling industry. Whilst this document does not seek to compare the advantages and disadvantages of bottle-only versus household plastic packaging collections, it does focus on some of the benefits of bottle-only collections, particularly with regard to quality control.

For authorities that are planning to expand their plastic bottle collection service to incorporate other non-bottle plastic packaging, WRAP is due to publish an accompanying guide, which focuses specifically on supporting authorities in the collection of rigid household plastic packaging.

1.1 Target audience

Local authorities

This guide is aimed specifically at local authorities that:

- Currently have plastic bottle collections in place at the kerbside and are looking for advice on:
  - improving plastic bottle material quality; and/or
  - increasing material quantity.
- Are seeking advice on rolling out a plastic bottle collection service at the kerbside which achieves high plastic bottle capture and quality rates.

Senior officers

This guide is targeted at senior officers within waste teams at local authorities. It aims to communicate the key messages in a digestible and concise format that can be consulted easily during busy schedules.

To ensure ease of access, readability and the broad applicability of the guide, this document does not include detailed technical information on implementing the advice provided. Such detailed information can be obtained from WRAP's local authority advisory service.

1.2 Scope of this guide

As this document is aimed specifically at local authorities, the interventions that are highlighted are focused predominantly on those that can be implemented by local authorities themselves. This document focuses on how local authorities and their contractors can achieve the highest level of quality and quantity from a kerbside plastic bottle collection scheme. To this end, a number of local authorities, material recovery facility (MRF) operators and reprocessors were consulted and their feedback integrated into the guide.

1.3 Definitions

In this guide, quantity and quality are defined as follows:

- **Quantity** – meaning the quantity of plastic bottles captured at the kerbside. Two key measures of this are 'material capture', which is commonly measured in kilograms per household per year, and 'capture rate', which is the percentage of available material successfully captured for recycling by a kerbside collection scheme.
- **Quality** – quality is a subjective term as acceptable levels of impurity vary by reprocessor, and also depend on the equipment and manufacturing processes used, and the markets sold into. Fundamentally, therefore, the definition of quality could be viewed as the supplier's ability to meet the buyer's expectations, as set out in their specification. However, given the need to be specific in the context of the guide, quality is defined by the extent of impurities within the target material stream.

This guide focuses mainly on two grades of plastic: PET and natural HDPE bottle grades. These are both used in the UK for the production of rPET and rHDPE. There are two key stages where the discussion of quality is particularly important:

- firstly, when material is entering the plastic recovery facility (PRF) sorting process; and
- secondly, when material is entering the rPET and rHDPE preparation process.

A local authority's ability to influence quantity is limited to the earlier (collection) stages of the bottle recovery life cycle, including design of the recycling scheme and the degree to which households are encouraged to participate through effective communication programmes. Quality, on the other hand, is something that can be targeted throughout the bottle recovery cycle.

1.4 Our approach

To gather evidence for the development of this guide, several key areas of research were undertaken:

- industry-perspective interviews with plastics reprocessors;
- interviews with MRF operators;
- interviews with local authorities that have demonstrated they are collecting plastic bottles at the kerbside in high quantities and/or of good quality;
- European research; and
- analysis of secondary data.

Summary

This evidence-based guide is relevant to senior officers and other key decision-makers from local authorities that:

- are collecting, or are looking to begin collecting, post-consumer plastic bottles as part of the household kerbside dry recycling collection service;
- are interested in finding out how to improve the plastic bottle quality and/or quantity;
- do not wish to expand the plastic bottle collection to include non-bottle plastic packaging in the short to medium term.

2 STRUCTURE OF THIS GUIDE

This guide is organised so that it reflects the life cycle of plastic bottle collection and recycling from a typical local authority's perspective and highlights the key intervention points. This should allow readers to navigate easily to the most applicable sections, regardless of whether or not their authority has a collection regime in place

Contents	Audience	
	Local authority with plastic bottle collection service*	Local authority without plastic bottle collection service
Policy context	This section provides a summary of any relevant policy drivers in the context of plastic bottle collection in Scotland and England.	
Market context	This section provides insights from the sorting and reprocessing industry into the supply of plastic bottles, the types of sorting and reprocessing facilities and processes in the UK, and plastic bottle quality.	
Plastic bottle collection in the UK	This section presents the latest statistics for plastic bottle recycling in the UK.	
Scheme design	For authorities with an established plastic bottle collection in place this section is only going to be relevant if redesign is being considered (e.g. collection contract is coming to an end or service is performing poorly and a service change is being considered).	For authorities without a plastic bottle collection service this is a key section. It is recommended that it is initially skim-read to provide an overview before reading subsequent sections in order to incorporate the actions presented in later chapters in the design of any new service.
Household communications	This section examines 1) communications associated with the roll-out of a new scheme, and 2) ongoing communciations. Authorities would be advised to read section 7.3 on improving ongoing communications to households.	This section examines 1) communications associated with the roll-out of a new scheme, and 2) ongoing communications. Both forms of communication are of relevance to authorities wishing to implement a new service.
Point of collection	Authorities with a scheme can use the detail presented here to assist them in maximising the quality of material that is collected.	Authorities without a plastic bottle collection service will benefit from the discussion in this section as it contains a number of implications that should be considered when designing a new scheme.
Post-collection sorting & baling	This section provides guidance on how post-collection sorting and compaction can be used to improve the quality (and therefore value) of plastic bottle collections.	
MRFs	This section examines what measures local authorities can take in coordination with MRFs to ensure that they receive the highest prices for sorted and baled materials. Again, this section is relevant to both types of authorities, either as a source of ideas for implementation within the current scheme or for inclusion within future contracts.	

Figure 1 Document structure

*In 2010/11 90% of local authorities in the UK offered a kerbside service for plastic bottles

3 POLICY CONTEXT

Overview

Under the revised Waste Framework Directive there is a requirement to set up a separate collection of 'at least the following: paper, metal, plastic and glass' from the household waste stream by 2015. However, the current policy settings in both England and Scotland do not map out specific requirements for plastic bottle collection and recycling. This section provides a summary of relevant policy drivers in England and Scotland, and indicates relevant forthcoming policy in the Scottish context.

3.1 Relevant targets

In England, the overarching objective is to recycle 50% of household waste by 2020, as outlined in the most recent Waste Strategy for England (2007).[1] Scotland's targets, outlined in the Zero Waste Plan,[2] are to recycle 60% by 2020 and 70% by 2025, along with a maximum of 5% of waste to landfill by this time.

The Zero Waste Regulations are likely to place a requirement on Scottish local authorities to collect, as a minimum, paper, card, plastics, cans and glass.[3]

Therefore, in terms of increasing capture, this guide is particularly pertinent for Scottish local authorities. It is also worth noting that the Scottish targets, unlike those in England, are carbon based, which has further implications because of the carbon benefits associated with recycling plastic bottles (these items have a relatively high value within the Scottish Government's carbon metric relative to other materials).[4]

3.2 Reprocessing objectives

The 2011 Review of Waste Policy in England[5] set the scene for this guide by establishing a quality-related challenge. That is:

Ensuring that our approach to extracting recyclables, such as paper and plastic, from our waste generates material of sufficiently high quality to meet the needs of reprocessors here and abroad and to comply with the international rules on waste shipments.

In Scotland, the Zero Waste Plan aims to encourage collection and recycling of more plastics by developing facilities in Scotland.

1. Defra (2007) Waste Strategy for England 2007
2. Scottish Government (2010) Scotland's Zero Waste Plan
3. Scottish Government (2011) Policy Statement
4. Scottish Government (2011) Scotland's Zero Waste Plan: Carbon Metric Guidance, March 2011
5. Defra (2011) Government Review of Waste Policy in England 2011

4 MARKET CONTEXT

Overview

A number of major UK reprocessors were interviewed to obtain a balanced view of the market. Information was obtained on:

- the supply of plastic bottles;
- the types of sorting and reprocessing facilities in the UK; and
- the views of reprocessors on quality and sorting processes.

4.1 Definitions

In the context of this section, the following terms are important to understand:

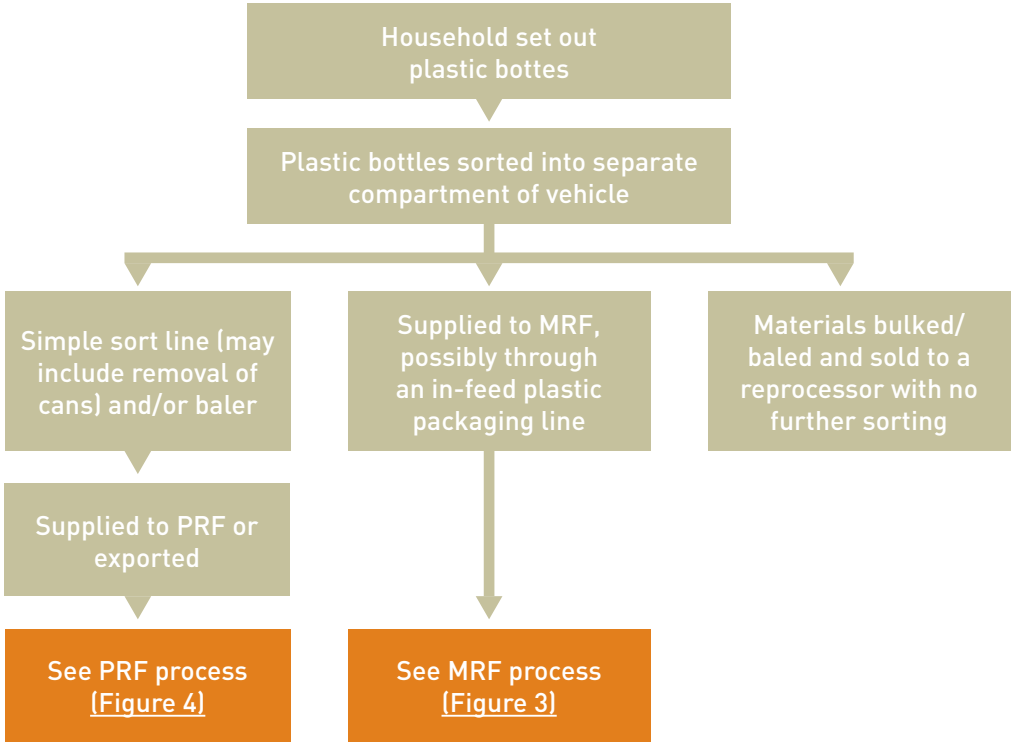
- **Material recovery facility**, or **MRF**, is a separation plant where kerbside recyclables are separated into material types and baled or loaded in bulk for further processing by specialist recyclers. Typical recyclables handled are paper, card, metals, mixed plastic bottles and sometimes glass. Some MRFs also separate one or more of the more abundant and higher value plastic bottle streams, typically PET or HDPE. However, MRFs increasingly concentrate on separating mixed plastic bottles for further separation at a specialist plastics recovery facility (PRF).
- **Plastic recovery facility**, or **PRF**, is a facility set up specifically to sort plastics by polymer type and/or colour. Some of the processes carried out at a PRF may also occur at the front end of a reprocessor site and some PRF operators have themselves invested in downstream reprocessing to make high-grade finished recycled polymers.

Further definitions of key terms are given in the glossary.

4.2 UK sorting facilities

In cases where the kerbside collection system is multi-stream (kerbside sort), plastics that are not exported may be sent either directly for reprocessing/sorting at a PRF or to a MRF for further sorting into different polymer grades. The latter sorting process depends on the extent of the technology at the MRF. This is illustrated in Figure 2.

Figure 2 Collection and sorting of plastic bottles in multi-stream systems.



4.2.1 Material recovery facilities

In cases where the kerbside collection system is single-stream, the co-mingled recyclables will be sorted in a MRF to separate plastics from the other dry recyclables. A two-stream collection may also be sorted via a MRF in order to separate, for example, plastics from cans.

Figure 3 outlines how household plastics collected via single- or two-stream schemes may be sorted in different types of MRFs, based on the sorting technology used. We have characterised MRFs as 'small' (manual sorting), 'medium' (more mechanised/automated sorting) or 'large' (heavily mechanised/automated sorting). These MRF types are illustrative and there are many exceptions to the general rule that larger MRFs are more mechanised than smaller MRFs. However, it is the case that more mechanised MRFs are more capital-intensive and therefore generally larger. They typically sort plastics into a greater number of polymer streams, with the higher throughput making it financially viable to invest in more sophisticated optical sorting technologies to identify different polymer types.

A larger MRF case study is illustrated in Table 1 using the example of Biffa's Edmonton MRF.

Section 10 of this guide gives further details about MRFs.

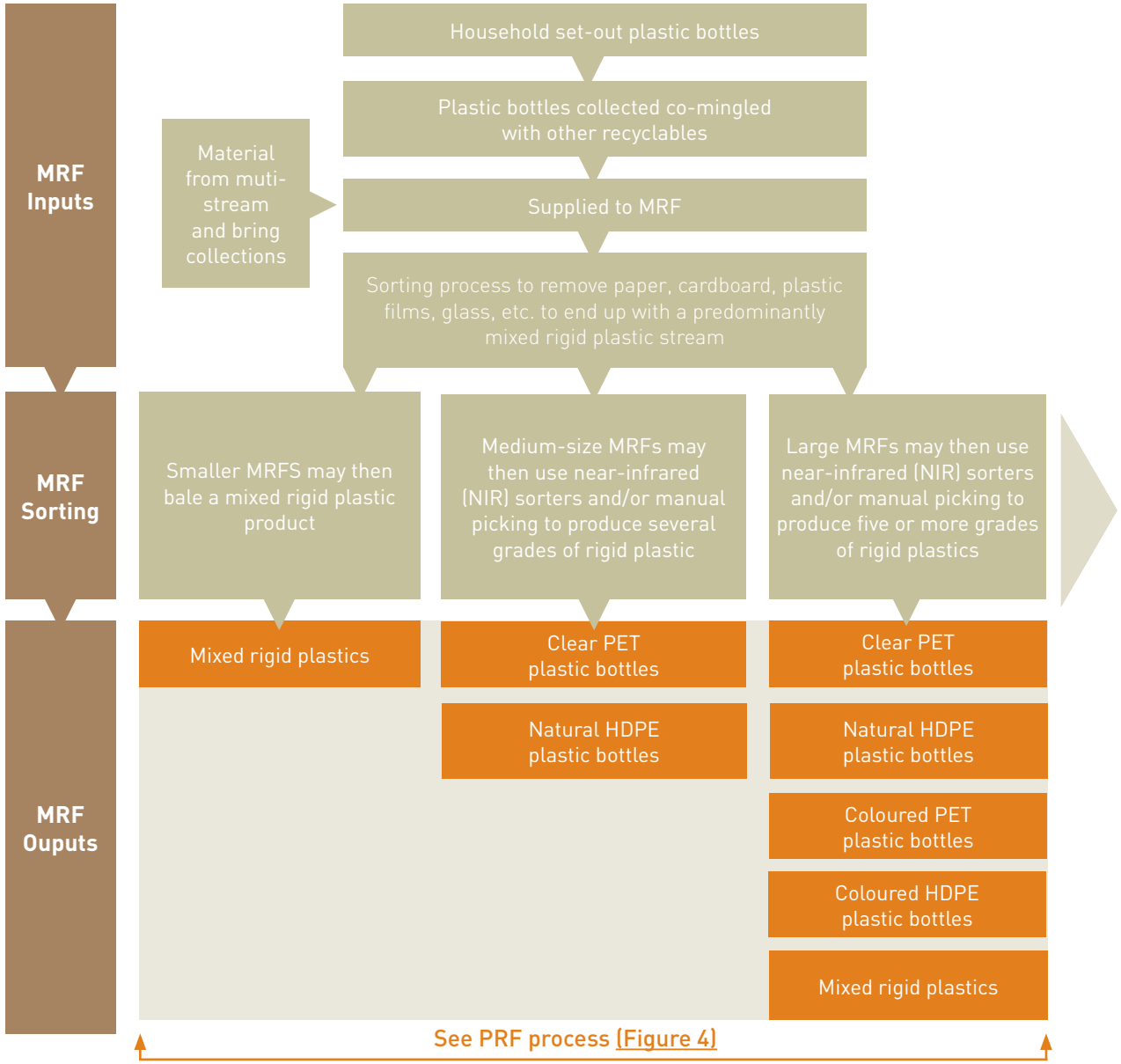


Figure 3 Single- and two-stream collection systems and the subsequent sorting of plastic bottles at 'small', 'medium' and 'large' MRFs.

Table 1 Biffa's Edmonton MRF – an example of good practice in the design and management of a facility to produce quality PET and HDPE bottle materials

Biffa's Edmonton Material Analysis Facility: A case study

Background

Biffa's MRF at Edmonton, North London, is a large modern MRF. Fully operational since June 2010, the plant was designed for a throughput of 300,000 tonnes per annum and is currently processing 220,000 tonnes per annum with a complement of 250 staff. This scale of operation has made it viable to incorporate a high degree of technology and manual quality control for the accurate sorting of plastics.

Processes that lead to quality plastic outputs – an overview

The Edmonton MRF separates five key rigid household plastic packaging product lines which include PET suitable for rPET production and natural HDPE that is supplied directly to the Biffa Redcar rHDPE production plant. The process diagram below shows in simplified terms how the plant separates plastic products. The plant actually has two lines for separating co-mingled materials and a separate in-feed line for mixed containers. There are also a few processes not noted in the diagram for simplicity. It is important to note that there is a significant amount of manual removal of plastic films at various stages of the process. The following sections detail the processes that help to maximise PET and HDPE quality. An overview process diagram is shown in Figure 4.

Testing input

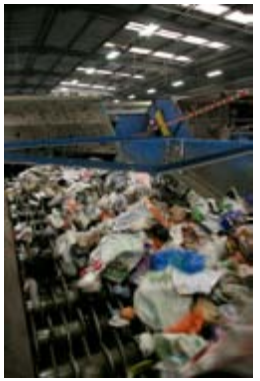
Biffa recognises that in order to produce quality materials, quality co-mingled input is required. Loads arriving at the plant are regularly sampled (and sorted as a gravimetric assay), and suppliers are given feedback on the quality of the loads. If necessary, loads are rejected.

Removal of other items to leave a container stream

The key to successful sorting of the separate plastic bottle streams from a mixed plastic packaging stream is to ensure that as much other material as possible is removed before near-infrared (NIR) separation of the polymer streams.
The Edmonton process includes numerous stages of separating other recyclates and contaminants. The significant processes are several stages of separating two-dimensional items (mostly fibres: paper and card) from three-dimensional items (containers: rigid household plastic packaging, glass and cans).

Pre-sort – manual removal of films and large items

2D/3D sorting. Papers go up, containers drop through



Removal of fibres and contaminants from the plastics and cans stream

Contamination of plastic product streams from fibres is a common problem with some MRF-sorted plastic products. In addition to some downstream process design and operations, the Edmonton plant incorporates equipment to remove small pieces of fibre that have escaped the previous fibre sort and have therefore ended up in the container stream. The plant includes an air drum separator that utilises a vacuum drum screen to remove light, small materials, such as small pieces of fibre, from the container stream. After this process further pieces of equipment (a fines screen and an air knife) remove additional small contaminants from the container stream.

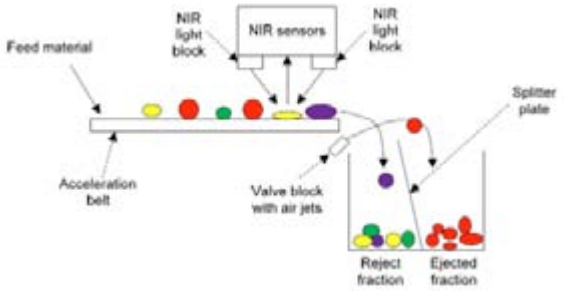
Air drum separator removing light fractions from containers

Air knife (at rear) and screen removing small/light items from plastics and cans

Near-infrared (NIR) sorters

The NIR sorters detect plastic polymers and colours. Each machine looks for target polymers and colours and when detected, instructs an air knife to blow off the wanted item (a positive sort). The NIRs are set up at Edmonton to result in quality PET Natural and HDPE Natural. The first NIR in line sorts all PET material positively, leaving everything else to pass. The PET-only stream then passes under a NIR which positively sorts for PET Natural. Thus material selected as PET Natural has been positively selected twice as PET. The same process occurs on material that passed the PET line for HDPE selection.

NIR process diagram (source: Axion for WRAP)



NIR Separator

NIR cleanliness

NIR sorters rely on light being reflected. If the light source and sensors become dirty the light cannot pass and items can be missed. The machines at Edmonton monitor this situation and shut down if they become too dirty. However, this is mitigated by a frequent cleaning schedule that results in the machines being thoroughly cleaned at least three times per shift. A clean air flow to the machine is also important to avoid air nozzle corrosion. The Edmonton air circulation is highly filtered to remove moisture in particular.

Post-NIR manual quality check

Although NIR sorters are an efficient way of sorting plastics they are not perfect and miss-sorts do occur. It is essential therefore to have a dedicated manual check of plastic stream quality. This stage is often absent from smaller MRFs. At Edmonton, three separate quality control cabins are operated: one for PET, one for HDPE and the other for mixed plastics and recirculating material. In each cabin the operatives pass incorrectly sorted material either onto the opposite belt or down a chute to be sent back round.

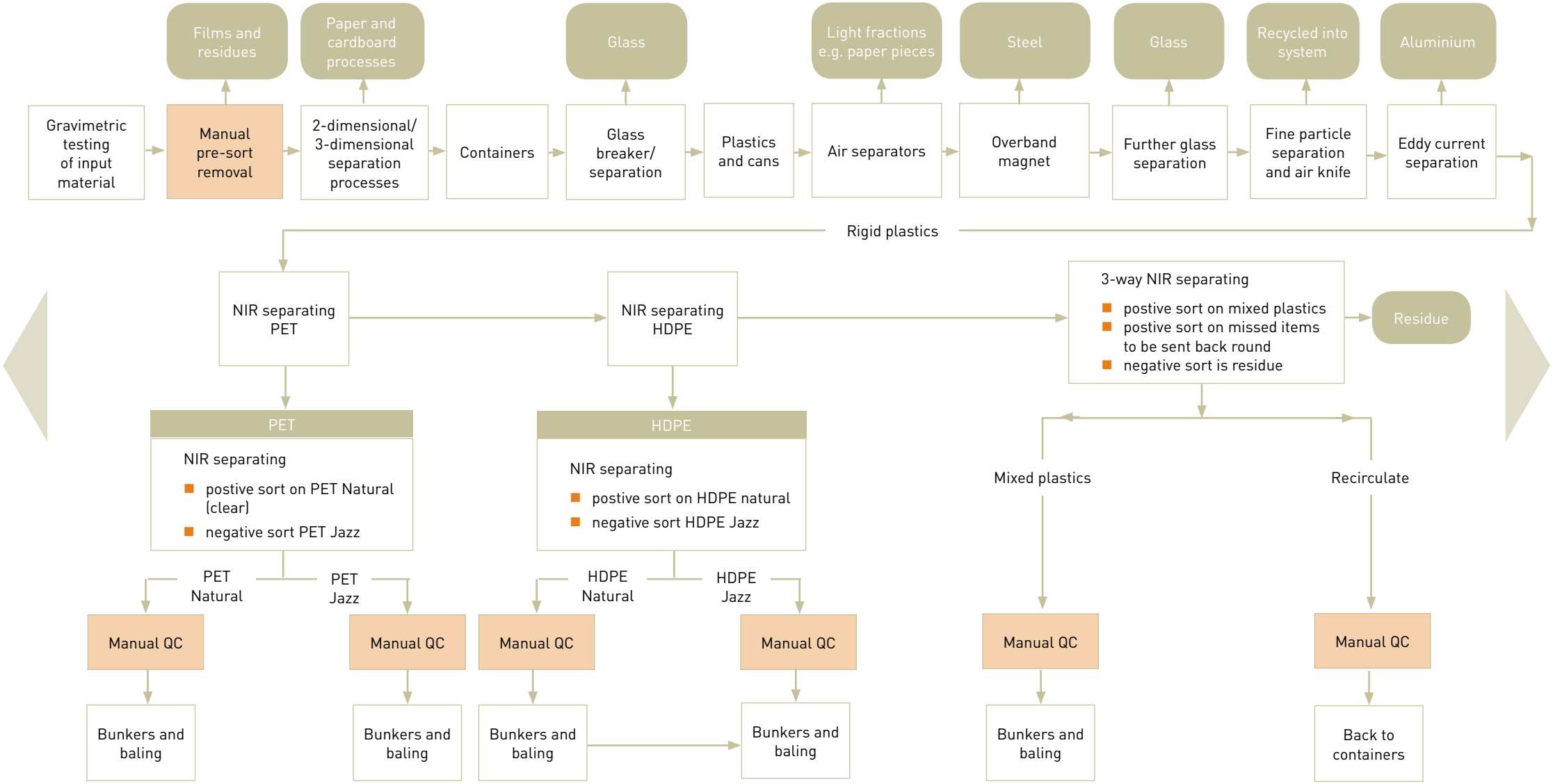
Post-NIR quality check for HDPE

Bunker and baling control

Sorted material is held in bunkers before being sent to a baler. When switching from one material to the next, a mixed bale is produced. At Edmonton, good practice is followed and mixed bales are either split and resorted or downgraded. Workers are incentivised to ensure the quality of the bales. Finished bales are stored undercover so they do not absorb moisture from rainfall.

Finished HDPE natural being baled

Figure 4 Edmonton process flow diagram with a focus on plastic bottles



4.2.2 Plastic recovery facilities: front-end of the reprocessing facility

The output from the separate collection or MRF processes may be either:

- baled and sent to a UK reprocessor;
- baled and exported; or
- fed in to a PRF for further sorting.

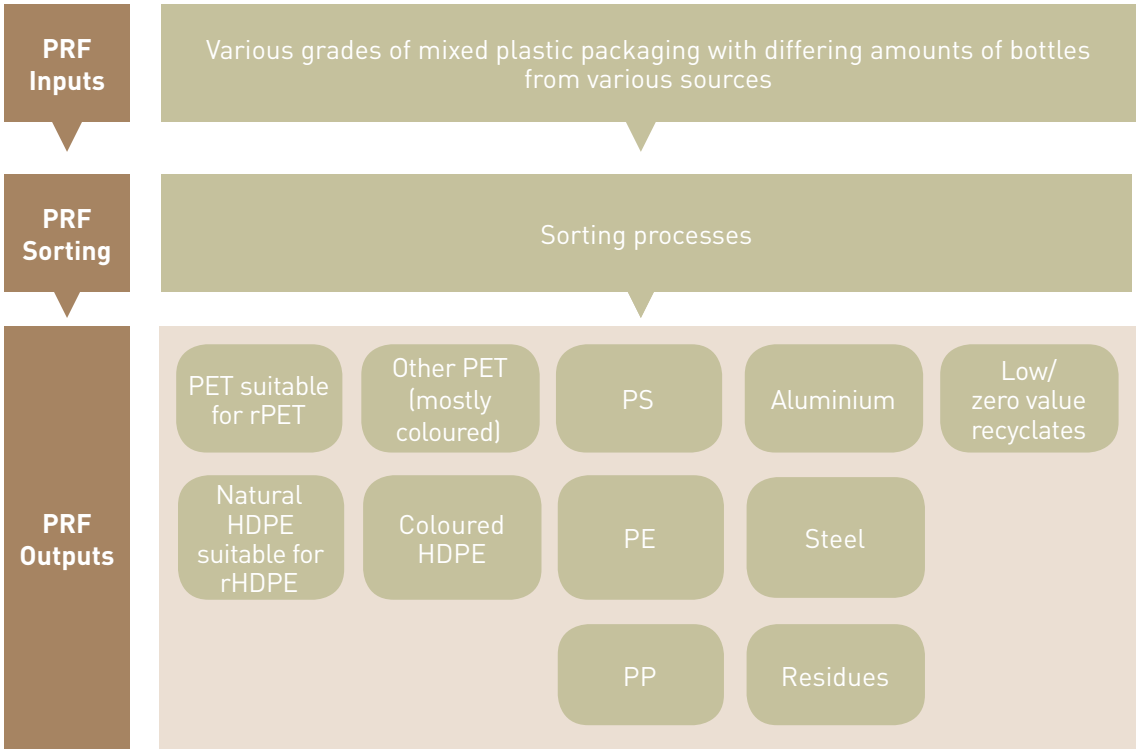
Further sorting in a PRF may be necessary in order to produce the high quality plastic bottle bales required by bottle reprocessors in the UK (a good quality plastic bottle bale is considered to be at the very minimum 85% plastic bottles).

It is important to note that although there are several PRFs in the UK, they are all set up in slightly different ways, and are therefore designed to accept a variety of different input streams. The majority of PRFs are designed to accept a predominantly bottle-rich input material stream, and therefore have limited capacity to handle non-bottle plastics and other contaminants. However, there are a smaller number of facilities which have capacity to handle a wider range of input materials, including mixed plastic packaging and metals.

At present most facilities in the UK have been designed for input material that is close to 40% PET, 40% HDPE and 20% other. The inclusion of non-bottle rigid plastic packaging will therefore substantially alter this mix and could impact on sorting and reprocessing efficiencies.

An example of the typical outputs arising from a PRF is shown in Figure 5 which makes it clear that the plastics are sorted into many more polymer grades than is achievable at typical medium and large-scale MRFs.

Figure 5 Typical outputs from PRFs



4.2.3 Reprocessing

Once the different grades of plastic bottles have been sorted, material is typically flaked and cleaned using various washing processes. Some producers then sell the flaked product. Other producers have extrusion facilities to change the flaked material into pellets. The flaked or extruded material is referred to as rPET or rHDPE and in closed-loop processes is used to produce new plastic packaging.

Most of the larger UK plastic reprocessors have the sorting, washing and flaking facilities at the same site; hence discussions about the quality of materials reaching these facilities include both the sorting process and the downstream reprocessing.

Key messages for local authorities

The type of kerbside collection employed (single-stream co-mingled, two-stream or multi-stream) will determine the requirement for MRF and/or PRF sorting facilities. Being aware of how these facilities function, and their requirements with regard to feedstock quality, can help ensure that quality issues are dealt with further upstream of the sorting process. Whilst PRFs typically are more specialised and produce a higher quality plastic polymer output, in practice, due to differences between facilities, it is necessary to be familiar with the specific sorting facility with which the local authority or its collection contractor is under contract.

Details of typical material grades post-MRF and PRF sorting processes are described and illustrated in Appendix A. All technical terms are explained in the Glossary.

4.3 Changing feedstock

As noted in section 4.2.2, most UK facilities were designed for input material that is close to 40% PET, 40% HDPE and 20% other. However, feedstock is changing to include a greater proportion of non-bottle rigid plastic packaging. This is substantially altering input proportions (for example, reducing concentrations of PET and HDPE), which is having knock-on effect on sorting and reprocessing efficiencies.

4.3.1 Why has feedstock changed?

There are various views on why the proportions of PET and HDPE in PRF feedstock have fallen. Data does not support the idea that the sale of PET or natural HDPE bottles has diminished over time. In fact, the numbers of plastic bottles (i.e. PET and HDPE) entering the waste stream have actually risen in recent years as a result of improved local authority collections and increased consumption.[6] The industry's most common view is that proportions of HDPE and PET have decreased because a greater number of local authorities with a plastic bottle collection are not actively managing the collection of target materials only. Over time, this has led to greater volumes of non-bottle rigid plastic packaging entering the recycling stream, which effectively 'dilutes' the plastic bottle bales that are sent to PRFs.

4.3.2 The impact of the changing feedstocks

The increased proportion of non-bottle rigid plastic packaging in the plastic bottle stream means that PRFs now have to cope with a stream significantly different from the one they were originally designed to handle. This means that:

- sorting lines need to run at a slower speed to cope with processes that were designed to handle lower quantities of non-bottle rigid plastic packaging/ contaminants;

6. Recoup (2010) UK Household Plastic Packaging Collection Survey 2010,

- the net value of sorted material is lower due to increased amounts of lower grades/contaminants;
- the net impact of these two points ensures that income per hour is lower. This is reflected in the price paid for the input material (in other words, the price paid to an authority or its contractor);
- the capacity of sorting processes is reduced with regard to final rPET and rHDPE production. This results in an increasing capacity gap between:
  - the UK's capacity to sort bottles and rigid household plastic packaging; and
  - the UK's capacity to wash and prepare PET and HDPE into rPET and rHDPE.

Key messages for local authorities

This section has highlighted significant feedstock problems for the reprocessors as increasing amounts of mixed plastic packaging dilute the presence of PET and HDPE bottles. Fundamentally, this is reflected back to local authorities as a cost, through a reduction in the price they receive for their plastic bottles.

This major impact on both reprocessors and local authorities clearly suggests that the rise of mixed plastic packaging recycling is posing a significant quality issue for the current market. At present, a further problem is the limited UK infrastructure for sorting plastic bottles from a mixed plastic packaging grade to produce a high quality product.

4.4 Reprocessor view regarding the market reaction to quality changes

The rise in non-bottle plastics within plastic bottle grades has begun to cause a shift in the market. This shift has, however, been slow and as a result there is still limited UK capacity for the sorting of a mixed plastics material stream to the standard required by many UK reprocessors.

Reprocessor/PRF operator feedback suggests that around half of the recovered plastic bottles and the bulk of other mixed plastic packaging are currently exported. Increasing quantities of non-bottle plastics are likely to lead to more plastics (including more bottles) being exported in the short term (or at least until additional UK capacity for sorting non-bottle mixed plastics comes online). In cases where a mixed plastic stream was previously a quality plastic bottle stream, UK reprocessors and manufacturers are missing out.

Key messages for local authorities

The key message from the UK reprocessors/PRF operators to local authorities is that presently the collection of all household plastic packaging (either because of a specific focus on mixed plastic packaging, or a lack of management of a bottle-only collection) may be contributing to the export of plastic bottles that could otherwise be sorted and reprocessed in the UK. Retaining materials within Scotland in order to reap the economic benefits of reprocessing is an important part of the Scottish Government's Zero Waste Plan. This is strongly supported by both Zero Waste Scotland and WRAP in both Scotland and England.

UK reprocessors/PRF operators have voiced some concerns about the export of these materials. Whilst there will be many reputable overseas reprocessors, there may also be some examples where working conditions and environmental protection are of a questionable standard. In addition to social and environmental concerns, the export market is also having an economic impact, with UK reprocessors being outbid for materials. This is because overseas operators typically have lower overheads due to lower energy, labour and disposal costs. The cost of shipping does little to close this gap, allowing overseas reprocessors to pay a significant premium for lower quality material that requires greater levels of sorting, cleaning and processing.

Local authorities can have increased confidence in the end market for their product by ensuring a good level of reporting by contractors to assist in the traceability of the recyclables they collect. Authorities can also use evaluation criteria in the procurement process (of either service contractors or reprocessors) to increase the likelihood of higher quality recycling (e.g. closed-loop recycling). In order to do this, it is possible to use quality criteria relating to the security of outlets, material traceability and end uses of materials, alongside price criteria.

4.5 Reprocessor/PRF view on MRFs

All PRF operators/reprocessors report that some MRFs are contributing to the problems that PRFs are experiencing with PET and HDPE concentrations. This is partly due to higher levels of non-bottle plastics in their MRF outputs, but also due to higher levels of non-plastics such as paper, glass and textiles.

It is reported that sorting processes in some MRFs are inadequate in terms of their capability to produce a high quality bottle grade. This may be further exacerbated as some MRF operators (according to feedback from PRFs/reprocessors) do not feel there is sufficient economic advantage to sort properly. As a result these operators are producing outputs that cause process problems in PRFs through, for example, glass contamination, which is abrasive and contributes to machinery wear; textile contamination, which frequently gets tangled in belts and other machinery; or streams of bottle PET and bottle HDPE natural which contain significant proportions of other mixed non-bottle plastic grades.

Reprocessor/PRF feedback is less clear on whether some MRFs may also provide part of the solution. A number of more modern MRFs sort plastics into a large number of plastic categories, including sorting PET-rich and HDPE-rich products. In theory, this sorting should replace some of the necessary bottle sorting capacity that is required. However, reprocessors report that these materials are rarely sorted to a high enough standard to be used without being sent through the entire PRF sorting process. As a result, the additional premium that is asked for these materials is arguably higher than their worth to UK reprocessors.

4.6 Reprocessor/PRF view on technical capability

The lack of capacity to effectively sort bottles from a mixed plastic packaging stream is reportedly due to the limited availability of appropriate technologies in the UK, but this is not to say that the technology does not exist and that it will not develop rapidly in the coming years. There are no major technical problems in sorting these materials if a plant has been designed to take them. There are, however, potential economic barriers relating to the cost of sorting lower-value materials such as mixed plastic packaging (which will mostly be exported once sorted), largely due to the lower sorting costs abroad.

Possible minor issues associated with sorting mixed plastic packaging may be encountered when dealing with the sorting of multi-polymer composite packaging. For example, an HDPE tray with a PET film lid still attached may be sorted by an optical sorter into either the HDPE stream or the PET stream, thereby contaminating either stream. There are also minor issues with elevated levels of food residues, which contribute to machinery wear and increase the costs of washing processes.

Key messages for local authorities

It is important to understand the specific capabilities of the MRF facility accepting materials from the local authority. The collection scheme design, and materials targeted, should be taken into account when procuring MRF contracts, to ensure compatibility between the collection system and MRF input specification.

5 PLASTIC BOTTLE COLLECTION IN THE UK

Overview

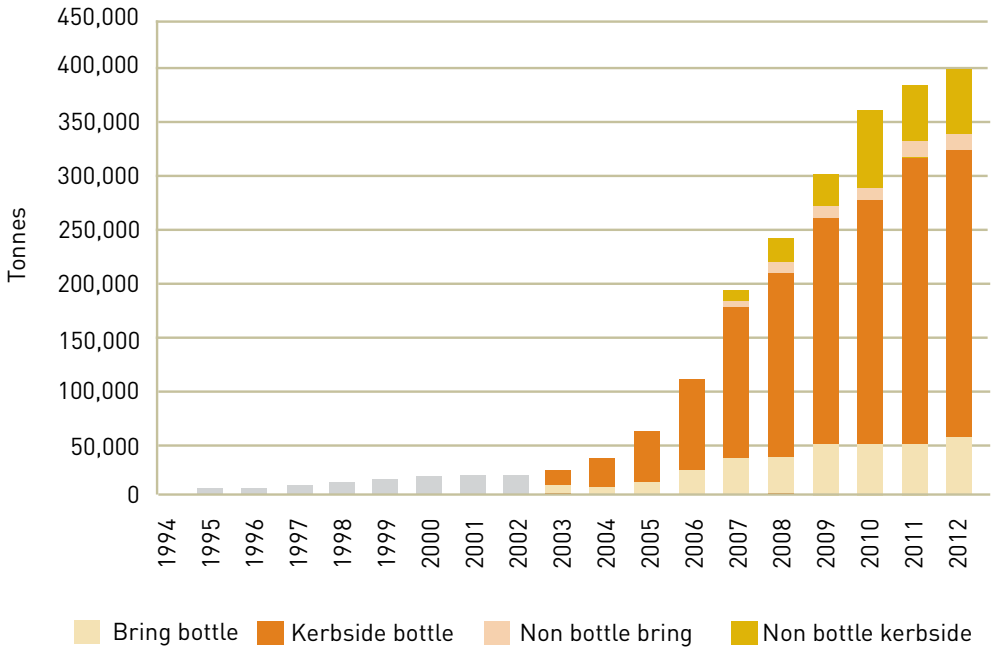
Although the collection of plastic bottles has increased dramatically over the last decade, capture rates are still relatively low. It is important to be aware of how a local authority's capture rate benchmarks against other authorities, in order to understand an authority's scope for improvement in the future.

The collection of plastic bottles has increased dramatically over the last decade, from less than 13,000 tonnes in 2000 to over 280,000 tonnes in 2010 (Figure 6).[7]

Recoup reports that 548,000 tonnes of plastic bottles were consumed in 2005. Of this, an estimated 23,000 tonnes were consumed outside the home, while the remainder – 525,000 tonnes or 96% – entered the household waste stream. Recoup assumed an annual growth rate of 2% per year, which gave a total consumption of 593,000 tonnes of plastic bottles in 2009 (568,000 tonnes assumed to have been consumed in the home).

At this rate of growth, it is reported that recycling rates for plastic bottles have increased from 13% in 2005 to 48.5% in 2010 (rates for 2006, 2007, 2008 and 2009 were 20%, 35%, 39%, and 46% respectively).[8,9]

Figure 6 Rise in tonnes of plastic bottles collected by bring and kerbside collection schemes in the UK



Source: Recoup (2011) UK Household Plastic Packaging Collection Survey 2011, presentation delivered by Stuart Foster, Deputy CEO of Recoup.

7. Recoup (2011) UK Household Plastic Packaging Collection Survey 2011, presentation delivered by Stuart Foster, Deputy CEO of Recoup.
8. Recoup (2011) UK Household Plastic Packaging Collection Survey 2011, presentation delivered by Stuart Foster, Deputy CEO of Recoup.
9. Recoup (2010) UK Household Plastic Packaging Collection Survey 2010,

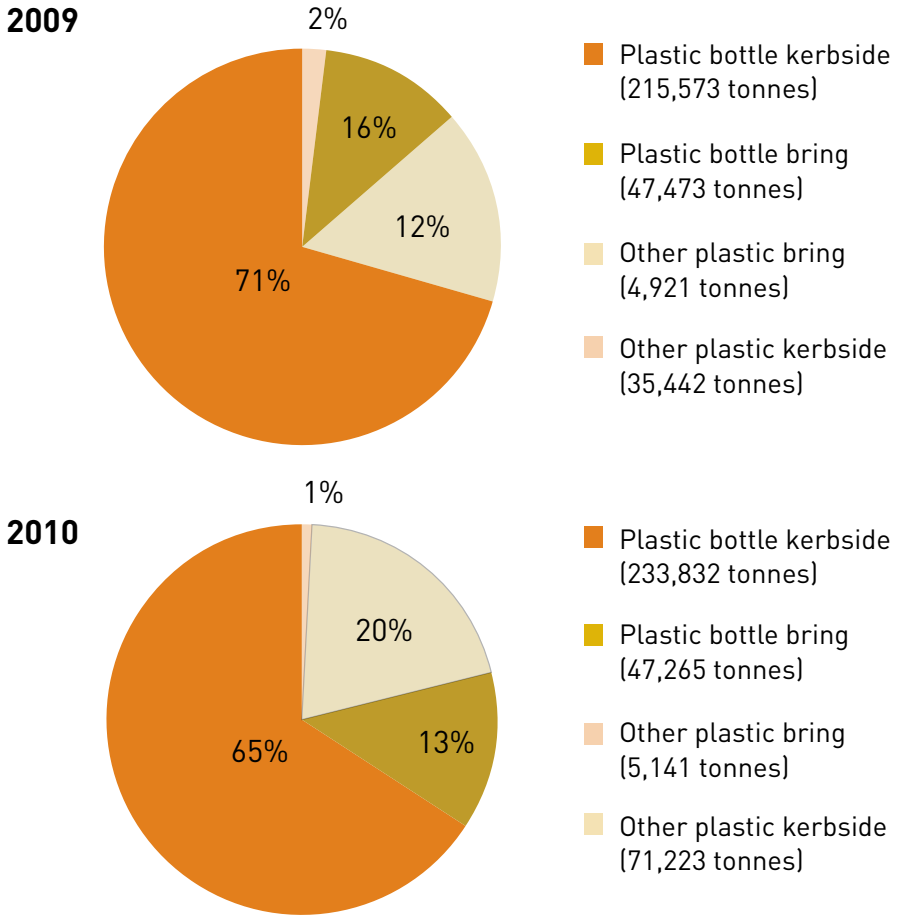
Recent rises in capture rates have been associated with expanding kerbside collection services and a decreasing reliance on bring sites. This is illustrated in Figure 7, which shows that between 2009 and 2010 plastic bottle collection increased by 18,051 tonnes; this rise was due to an increasing reliance upon kerbside collections, with a slight fall in tonnage collected via bring sites.

Although the capture rate for plastic bottles has increased markedly in recent years it is still relatively low at 48.5%, especially considering that in 2009/10 87% of UK households had access to a kerbside collection service which collected plastic bottles. According to Recoup's 2010 survey 74% of authorities collecting plastic bottles at the kerbside offered a plastic bottle-only service, with the remaining 26% offering collection services for non-bottle rigid plastic packaging (pots, tubs and trays only) or mixed plastics packaging (including plastic films).

Key messages for local authorities

In order to get a good understanding of each local authority's plastic bottle recycling performance it is recommended that WRAP's kerbside dry recycling performance benchmarking tool is used (http://labenchmark.wrap.org.uk/). This shows the latest analysis of national datasets and the breakdown by ONS/nearest neighbour group.[10]

Figure 7 Breakdown of the percentage and quantity of plastic packaging collected via scheme type (2009–2010)



Source: Recoup (2010) UK Household Plastic Packaging Collection Survey 2010, www.recoup.org/business/default.asp; and Recoup (2011) UK Household Plastic Packaging Collection Survey 2011, presentation delivered by Stuart Foster, Deputy CEO of Recoup.

10. Waste & Resources Action Programme (2011) Dry Recycling Performance Benchmarks

6 SCHEME DESIGN

Who is this section for?

- Local authorities without a plastic bottle collection service; and
- Local authorities wishing to redesign/retender their collection service.

Overview

This section discusses system design features such as containment and collection frequency, as well as how to counter contamination through effective design. It also describes features of the service that can be dealt with effectively through the commissioning and procurement process, such as contractor reporting and communications.

The way in which collection systems are designed impacts upon the material mixture within which plastic bottles are collected. This can range from a mixture of plastic bottle polymers at one end of the scale, to a co-mingled mixture of dry recyclable materials collected for recycling at the other.

For local authorities without a plastic bottle collection system in place, the process will have to start by systematically planning and designing a collection scheme which best suits local demands and needs. This section addresses key decision-making areas.

For authorities with a plastic bottle collection system in place, information derived from WRAP's online benchmarking tool for dry recycling performance[11] may instigate a service redesign for those authorities with potential for capture rate improvement.

Alternatively, if the local authority is coming to the end of a collection contract, it may wish to revisit the overall operation of the scheme.

A reprocessor's perspective

There is no consistent view on what local authorities should be doing. However, there are some emerging themes that two or more reprocessors have expressed. With regard to managing the mixture of mixed plastic packaging and plastic bottles it is suggested that local authorities:

- Carefully consider the consequences of specifying a mixed plastics collection or allowing plastic bottle-only services to drift towards a mixed plastic packaging collection; and
- Consider the available UK sorting capacity to deal with mixed plastic packaging and bottles.

In the context of this guide, 'scheme design' can mean either:

- procurement of the service contract whereby plastic bottles are specified as one of the materials being collected; or
- where plastic bottles are added to the list of recyclables being collected at the kerbside, either part way through a contract or as part of a change to an in-house service.

11. Waste & Resources Action Programme (2011) Dry Recycling Performance Benchmarks, Date Accessed: 17 October 2011

6.1 Containment and collection frequency and their impact on quality and quantity

Plastic bottles are a bulky material and therefore providing sufficient capacity for their storage and collection is vitally important. The sections which follow outline some of the key issues associated with containment and collection frequency that need to be considered when developing a new scheme.

6.1.1 Recycling containment

There are typically three options for the collection of plastic bottles at the kerbside:

- kerbside collection boxes (typically ranging from 35 litres to 55 litres in capacity);
- wheeled bins (usually 180 or 240 litre); or
- sacks (either disposable or reusable).

Anecdotal evidence suggests that material quality depends directly on the extent to which a scheme encourages households to sort plastic bottles into separate containers. Schemes include:

- multi-stream or kerbside sort schemes which specify that plastic bottles must be in a particular container (kerbside box or sack); and
- two-stream schemes which specify that plastic bottles must be in a specific container, separated from at least some other recyclable materials.

6.1.2 Recycling capacity

The recycling capacity available to a householder depends on:

- the type and volume of container provided; and
- the frequency of collection.

Provision of sufficient recycling capacity has a direct effect on the quantity of plastic bottles collected. Thus, whether rolling out a new scheme or adding plastic bottles to a current collection system, recycling capacity needs to be carefully considered.

WRAP considers that a volume equivalent to 100–120 litres per week is appropriate for a kerbside collection scheme that includes plastic bottles.

For co-mingled collections, which most commonly utilise a wheeled bin of 240 litres collected on a fortnightly basis, capacity may be less of an issue than for a kerbside sort scheme. Where smaller containers are provided, such as boxes or sacks, it is important to ensure that sufficient capacity in total is provided. It should be noted, however, that smaller containers are frequently collected weekly to compensate for the smaller container volume.

For further information, refer to the following reports:

- Entec UK Ltd (2007) Alternate Weekly Collections Guidance, Report for Waste & Resources Action Programme, July 2007
- WRAP (2008) Kerbside Recycling: Indicative Costs and Performance, June 2008
- Eunomia Research & Consulting (2009) The Financial Costs of Collecting Mixed Plastics Packaging, Report for Waste & Resources Action Programme, June 2009
- WRAP (2009) Choosing the Right Recycling Collection System, June 2009
- Brook Lyndhurst Ltd (2009) Waste Collection Commitment, Report for Waste & Resources Action Programme and Local Government Association, August 2009
- Resource Futures (2010) Analysis of Kerbside Dry Recycling Performance in the UK 2008/09, Report for the Waste & Resources Action Programme, September 2010

Key messages for local authorities

Recycling capacity directly affects capture rates and must therefore be carefully considered by local authorities. Given the scope of this guide, it is clearly not possible to discuss all collection system types in detail; thus, the above generic description of container provision and collection frequency is vastly simplified. It aims merely to highlight the main alternatives and how overall capacity is determined by the interrelationship between container volume and collection frequency. The main point is that if recycling capacity proves to be a limiting factor for the householder, anecdotal evidence suggests that an increasing number of people may revert to placing recyclables into the residual waste bin. This seems to be particularly true where an alternate weekly collection system is in place (i.e. where recyclables are collected one week and refuse the next).

Sufficient recycling capacity for the target materials must be made available in order to maximise the potential for plastic bottle captures (see WRAP's benchmarking study regression analysis results on the impact of containment volume on yields).[12]

6.1.3 Refuse containment

Restricting the capacity of residual waste containment, whilst also providing sufficient recycling capacity, can clearly encourage householders to divert dry recyclables from their residual waste bin (this is particularly true for bulky items such as plastic bottles). However, there may be an unintended consequence of restricting such residual capacity. Anecdotal evidence suggests that where residual capacity is restricted too much, i.e. there is insufficient room for a householder's waste, the overflow may be placed in the recycling container. This can result in a high level of contamination, which may lead to the whole recycling container being rejected and disposed of in the residual waste stream. This is clearly the exact opposite of the intended effect.

12. Waste & Resources Action Programme (2011) Dry Recycling Performance Benchmarks,

6.2 Commissioning and procurement

Besides containment and collection frequency issues, the commissioning/ procurement stage is the best time to deal with a series of other issues including contamination, reporting and contractor communications. Where services are contracted out, specific service requirements must be outlined in the service specification document and the conditions of contract.

6.2.1 Policy on dealing with contamination

It is important to be clear about the authority's approach to dealing with unspecified materials put out by service users. A clear policy will ensure minimal confusion when it comes to staff training and actually rolling out the scheme. If collection services are to be contracted out, the authority should specify that the contracting firm provides a method statement on how it will implement the service rules. There are a number of approaches that can be adopted with regard to dealing with contamination at the kerbside. These are outlined in more detail in section 7, which covers communication with residents.

6.2.2 Reporting requirements

Local authorities should stipulate that all contractors give details of contamination levels in their regular reports, and that they make efforts to reduce contamination in poor-performing areas by giving direct feedback to service users.

An onboard computer system in each collection vehicle (Figure 8) is an increasingly common and effective method for data recording. Such systems, which frequently include portable hand-held devices, can report in real time households that have not followed the authority's service rules.

Figure 8 Onboard computer systems can be used to provide systematic and effective monitoring and feedback

One reprocessor reported that Stirling Council was producing good quality materials and that they achieve this partly through the use of onboard computer systems. Using this technology, the authority is effectively able to monitor and report on incidents when households place non-target items out for recycling.
A case study of Stirling Council is provided in Table 2.

Table 2 Stirling Council. An example of good quality material arising from good practice in kerbside communications and efficient management of contamination

Stirling Council: A case study

Service description

Recycling is collected via a multi-stream weekly box collection along with a separate food waste collection. Refuse and garden waste are collected in wheeled bins on an alternate weekly cycle.

Lessons learned

The council was identified as producing good quality material and has been collecting kerbside sorted plastic bottles since 2007. The authority recently introduced a separate food waste collection service and as part of this undertook an extensive campaign to help residents understand which materials can and cannot be recycled. The authority also provides clear online information about its recycling services and explains its rationale for not collecting mixed plastic packaging.

The authority operates a strict policy with regard to contamination: boxes containing any non-targeted items are rejected at the kerbside with a notice indicating which materials cannot be accepted. The collection crew record all offences in real time using an onboard computer system, and on the second offence households are issued with a written letter. This letter tells the residents about the recycling service and what materials can be put out for recycling.

All plastic bottles are taken to the authority's depot where they are bulked and baled before being sent on for reprocessing within the UK.

6.2.3 Communications through the recycling chain

It is important to establish on-going communications between the different levels of the recycling chain; in other words, to ensure that there are established means of communication by which feedback from reprocessors can reach contractors, the authority and householders.

Effective scheme design is integral to optimal performance (both in terms of quantity and quality). Key factors to consider when designing the kerbside infrastructure include:

- collection frequency (for both residual and recycling);
- container choice (for both residual and recycling);
- contamination policy; and
- reporting requirements and communications with contractors and reprocessors.

7 HOUSEHOLD COMMUNICATIONS

Who is this section for?

- Authorities **without** a plastic bottle collection service (sections 7.1, 7.2 and 7.3)
- Authorities with an **established** plastic bottle collection service (sections 7.1 and 7.3)

Overview

Effective communication is of central importance to any collection scheme. To this end, section 7.2 provides advice for communications relating to the roll-out of a new collection scheme, while section 7.3 examines the need for on-going communications.

Behaviour is a complex issue, influenced by social and economic factors as well as a wide variety of moral and cultural norms. In view of this, the field of behaviour change has received much attention in recent years, with a substantial body of work now covering the field of waste prevention and recycling. A comprehensive communication programme is essential to ensure that the authority achieves both high capture rates and good quality material.

7.1 Key messages for effective communications

Communications can be split into two categories:

- communications associated with the roll-out of a new service (section 7.2); and
- on-going communications to encourage participation and the correct use of the services provided (section 7.3).

Both on-going communications and communications associated with the roll-out of a new service are integral to achieving high capture rates and good quality material. Communications aimed at promoting the effectiveness of plastic bottle collections should bear the following important points in mind:

- avoid the use of the plastic polymer numbering system, as this is known to confuse householders;
- where plastic bottles are added to an existing kerbside dry recycling service, inform all residents of the changes to the service and use this opportunity to remind them of the other services on offer;
- supply the householder with a leaflet, or a sticker for their collection container, which clearly states exactly what can, and cannot, be placed into each bin;
- give crew sufficient training on how to effectively and consistently implement an authority's policy on dealing with contamination;
- implement a method for recording repeated misuses of the recycling services and ensure that the recycling officer follow ups on them with a letter or personal visit;
- to overcome any language or literacy issues ensure that all leaflets and communication media are as simple and pictorial as possible;
- consider undertaking a doorstepping programme after the roll-out of a new scheme to ensure that hard-to-engage/low-performing areas are suitably targeted; and
- ensure that the service website is kept up to date and that it mirrors the information provided to the householder via printed media.

Local authorities are referred to WRAP's website for further advice on the design and production of communication programmes, information on the barriers to recycling at home, and a number of useful case studies. Improving Recycling through Effective Communications will be of particular interest to those wishing to create any communications programme.

To communicate the plastic bottle message wider we have created communications material which has gone through rigorous consumer testing, including flyers, posters and bus advertising. This can be found on our Recycle Now partners site.

Scottish local authorities will be sent a CD of the resources by 6 February 2012. Support is available at partnerbranding@zerowastescotland.org.uk or 0808 100 2040.

7.2 Communications prior to service roll-out

Before a new collection service is introduced, it is essential that all households are made aware of the intended changes, why they are being made, and what the implications of these changes will be for them e.g. in sorting practices, range of materials accepted and collection times. As mentioned above, WRAP has produced a number of guides, cost estimates and case studies to help authorities in their communication programmes.

7.3 Types of on-going communications

7.3.1 General communications to all residents

Changing people's behaviour is often a long-term process that requires on-going support with periodic reminders. This is especially true in neighbourhoods with a high turnover of residents. On-going communications are aimed at improving the quantity and quality of captured materials by providing general reminders about the services on offer. It is also important to give feedback on the performance of the service and to thank residents for their efforts. All communication media should be as simple and pictorial as possible to ensure that they are accessible to all. New communication programmes can be initiated when there are slight modifications to other areas of the existing service, for example:

- when a new material is added to a service; or
- when collection frequencies are altered.

These are times when residents can be reminded of the full range of recycling services provided, including plastic bottle collections.

7.3.2 Targeted communications at the point of collection

An ideal opportunity for on-going communications is at the point of collection and this has been shown to have a marked impact on improving the quality of material placed out for collection. If collection crews identify contamination at the kerbside, and adopt a structured and consistent procedure for notifying the responsible households, it is often possible, over time, to significantly reduce contamination levels on any given round.

Crews

At the point of collection, communication with the householder is undertaken in the first instance by the crews. Should contamination be identified, a typical feedback loop would begin with a crew member leaving a written communication that described the materials that are acceptable and those that are not. This approach provides justification for not emptying a container or for leaving some materials behind.

Written feedback can be in the form of:

- bin stickers;
- bin tags; and/or
- a feedback card through the letterbox.

Anecdotal evidence suggests that bin tags are more popular with residents, as they are less permanent – although they can only be used on containers with handles. It is always worthwhile posting a card through a resident's letterbox, in case the bin tag or sticker is not seen by the householder responsible for recycling. The types of information that can be included on a bin sticker are shown in Figure 9.

Figure 9 An example of a bin sticker used in Coventry

It is important to ensure that the sticker/tag/form is quick to complete – a notice which just requires a simple tick is the best solution. It is worth remembering that any writing by a crew member will be done in a rush (and will take up the crew member's time), so the message may not be clear to the householder.

When designing feedback forms, consultation with the crews is important as they are the ones most likely to know the most common types of contamination.

Crew training

All crew members should be aware of the local authority's policy on dealing with contamination and be trained in the best course of action. If a strict approach is taken. It is essential that a consistent message is sent to residents. This requires that all collection crews are suitably trained and adopt a common approach. If the authority uses onboard computer systems in its collection vehicles, staff will need to be trained to use them.

Crew reporting

Crews should email a daily report (or communicate in real time if this technology is available – see the Stirling case study in Table 2) after each round and highlight any issues for the attention of the recycling officer. If any issues arise during the day's rounds, the recycling officer should follow these up by, for example, writing a letter or even paying a personal visit (this may be especially effective for flats where it might be difficult to identify the precise households concerned). If there are any repeated issues with a particular household, then the managing officer should be alerted. In such cases, a recycling officer should be sent to the household to discuss the contamination issues.

7.4 Case studies

Three case studies were identified for their high performance in the recovery of plastic bottles: Kettering Borough Council, the Royal Borough of Kingston upon Thames, and the London Borough of Redbridge. In 2009/10 each authority was collecting between 15.5 and 18.1 kg of plastic bottles per household, which places them amongst the higher performers nationally. The details for each authority and the key messages from each are outlined in Table 3.

In each case the local authorities appear to have achieved high capture rates because of their effective communication schemes, combined with a strict policy on rejecting contamination at the kerbside. Two examples of communication materials used by Kettering Borough Council and the Royal Borough of Kingston upon Thames are reproduced in Appendix B. It should be noted, however, that these are not presented as examples of best practice as such, but are reproduced here to help illustrate some of the clear forms of communication used by the two case studies. As stated above, WRAP has provided substantive information on developing and implementing communication programmes and these should be consulted for further details, for example the Recycle Now partners site.

Table 3 Three case study examples of authorities achieving high plastic bottle capture rates (<15kg per household per year)

Case Study one: Kettering Borough Council

Service description	Key figures	Lessons learned
Kettering Borough Council		
Refuse: ■ 240-litre wheeled bin, collected on an alternate weekly cycle. Recycling (kerbside sort): ■ Two 55 litre boxes: ○ one for paper; and ○ one for plastic bottles, cans and glass. ■ 240-litre wheeled bin for garden waste and cardboard. The service is delivered by an in-house organisation. Plastics are not accepted at any bring sites in the borough.	Kettering Borough Council collects waste and recycling for its 43,000 inhabitants using a kerbside sort system. Overall recycling/composting performance was 42% in 2009/10 (against an average in England of 39.7%). In that year it achieved an impressive capture rate of **15.5 kg of plastic bottles per household**. This represents 10% of the total dry recycling by weight.	The council believes that two elements work together to keep both capture rates and quality high: 1. Education of the recycling crew and the householders; and 2. The system set-up, including frequency of collection, type of containers used, and the use of kerbside sorting. All recyclables are sorted at the kerbside, thus allowing for the easy identification and removal of contamination. The crews responsible for recycling have been instructed to use contamination stickers where non-bottle plastics are found in the box, and in extreme or recurrent cases to leave the box unemptied with a sticker explaining the reason to the householder. The communications to the householder make it clear that plastic bottles are the only plastics acceptable. On the council website there is a 'What Goes Where?' section with an accompanying leaflet. These list the items that must be placed in each container. The council has just moved to a picture-based leaflet. It is hoped that this will make the message more accessible to householders whose first language is not English. An example of the authority's pamphlet which outlines the local recycling services can be seen in Appendix B.

Case Study Two

Kingston upon Thames		
Refuse: ■ 180-litre wheeled bin for households with up to five residents – 240 litre for households greater than five (flats receive a 240 to 820 litre wheelie or bulk bin) – collected fortnightly. Recycling (kerbside sort scheme): ■ One 55 litre box for plastic bottles, paper, glass bottles/jars, cans/ tins, textiles and shoes, food and drink cartons, batteries – collected weekly. ■ Cardboard stored in white bag and collected weekly. ■ Food waste is collected weekly from a 23 litre caddy (residents are provided with a 5 litre caddy for indoor use). 240 litre wheeled bin for garden waste (charged service) – collected fortnightly.	The majority of households in Kingston upon Thames are serviced by a kerbside sort scheme (45,000); while a smaller number have their dry recyclables collected co-mingled (6,000). Overall, recycling/composting performance was 46.16% in 2009/10 (against an average in England and London of 39.7% and 31.8% respectively). In 2009/10 a total of 732 tonnes of plastic bottles were collected via the kerbside sort collection service, which amounted to an impressive **16.28 kg per household** over the year.	The authority rolled out a new service in 2008 and at first experienced a few issues with contamination. However, this was soon remedied by an effective communications programme. The authority has a strict approach to contamination and rejects any contamination at the kerbside with a contamination sticker. An example of the authority's online communication sheet is shown in Appendix B.

Case Study Three

London Borough of Redbridge		
Service Description Refuse: ■ Residual waste collected in sacks on a weekly basis. Recycling (two-stream): Two 55l boxes collected weekly: ■ first for tins/cans, glass bottles/ jars, and plastic bottles (no other plastics); and ■ second for paper and card. Collections completed by contractor: Enterprise.	In 2009/10 and 2010/11, using a two-stream collection scheme, the authority collected 1,745 and 1,798 tonnes of plastic bottles, respectively. In 2009/10 plastic bottles constituted 13% of the kerbside dry recycling, or 18.05 kg per household over the year (assuming collection from 96,688 households – collections increased from 94,221 households in the first quarter to 99,155 households in the fourth). In 2009/10 the authority achieved an overall recycling rate of 31.6% (average for London was 31.8%), up from just 7% in 2000/1.	The council started collecting plastics at the kerbside in 2004. Initially, this service was provided on a fortnightly basis and in 2007 weekly collections commenced. When introducing a second box for the collection of card (the authority started out with one recycling box) the council undertook a comprehensive communication campaign, consisting of leaflets and an extensive doorstepping campaign. The authority is now using Recycle Now iconography, a borough magazine, and occasional doorstepping campaigns to promote recycling within the area. It does not accept contaminated boxes and leaves a note highlighting unacceptable levels of contamination when it occurs. This leads to a reported contamination level of just 2% at the sorting phase.

A reprocessor's perspective

Whilst there is not a consistent view on what local authorities should be doing with regard to household communications, there are some emerging themes that several reprocessors have expressed:

- authorities should send out a clear message that all plastic bottles (regardless of polymer) can be recycled; and
- bottle tops are not a problem.

Table 4 highlights a number of other quality issues that are of concern to reprocessors and should be borne in mind when devising communication schemes on plastic bottles. Some are more relevant than others, and the ease with which they can be tackled may also vary widely, depending on local conditions and openness to change.

It should be borne in mind that local authorities may not be best placed to resolve the issues highlighted, but they might be useful when considering messages to service users.

Table 4 Quality issues raised by reprocessors

Reprocessor quality issue	Action
Elevated levels of non-target plastic items (i.e. items other than plastic bottles)	Take actions to improve MRF management or feedback to householders receiving multi-stream services.
The presence of PVC bottles	This is largely a problem for the packaging industry to be aware of. Whilst the presence of PVC bottles is an issue, it is still felt that a clear message to householders that all bottles (regardless of polymer) can be recycled is the most appropriate action for the local authority.
Milk bottles containing milk contaminants, leading to flies, maggots and higher washing costs	Local authorities could make service users aware of the problem through on-going communications.
Soft drink bottles surviving with contents, which are finally released in PRF processes, causing higher machinery maintenance costs (carbonic acid is a strong corrosive)	Local authorities could make service users aware of the problem.
The presence of natural HDPE detergent bottles	This is largely a problem for the packaging industry to be aware of. Whilst the presence of natural HDPE detergent bottles is an issue, it is still felt that a clear message to householders that all bottles (regardless of polymer) can be recycled is the most appropriate action for the local authority.
Elevated levels of dirt and grease	This can be addressed through improved MRF management and on-going communications with households.
PVC labels on PET bottles	This is largely a problem for the packaging industry to be aware of.

Key messages for local authorities

Communications fall into two categories:

- those associated with the roll-out of a new service; and
- on-going communications to encourage participation and the proper use of the services provided.

Both are integral to achieving high capture rates and good quality material. The above discussion on communications and the three case studies give rise to several key points. Local authorities should:

- inform all residents of changes to their service;
- supply the householder with clear details of what can, and cannot, be placed in each container;
- ensure that all crew members understand the authority's policy on dealing with contamination;
- devise a method for recording repeated misuses of the recycling services;
- ensure that all leaflets and communication media are as simple and pictorial as possible;
- avoid the use of the plastic polymer numbering system, as it is known to confuse householders;
- consider undertaking a doorstepping programme after the roll-out of a new scheme to ensure that hard- to-reach/poor-performing areas are suitably targeted; and
- ensure that their website is kept up to date and that it mirrors the information provided to the householder via the leaflet.

In developing communication media and programmes, refer to WRAP's comprehensive resources for further assistance.[17]

13. Waste & Resources Action Programme (2011) Communications: Resources to Help you Improve High Quality, Effective and Efficient Communications, Recycle Now partners website.

8 POINT OF COLLECTION

Overview

The point of collection provides a critical 'window of opportunity' for identifying and controlling contamination. Overall material quality can be improved by rejecting contamination at the kerbside, while at the same time educating households (assuming crews use appropriate reporting strategies – see section 6.2.2 above).

Anecdotal evidence suggests that over time a strict policy on contamination improves the quality of material set out and helps save crews' time at the kerbside. This section highlights some important actions that can be undertaken at the kerbside to improve the quality of material collected.

The type of actions which can be taken, and the ease with which they can be carried out, depend largely on an authority's chosen form of containment and the design of the collection system. If, after reading the following sections and referring to WRAP's online benchmarking tool,[18] an authority wishes to alter its scheme design in any way, then it will be wise to refer back to section 6.0.

Outlined below are a number of key points which can be considered at the point of collection – or should be borne in mind by those who have not already rolled out a collection service for plastic bottles.

8.1 How the containment type and collection system influences quality

The key influencing factor at the kerbside is the crews' ability to regulate the collection system. The extent to which a crew can do this depends on a combination of both the containment used and the collection methodology. The following sub-sections cover a range of containment types/collection schemes and aim to demonstrate how these influence the crews' ability to influence householder behaviour.

8.1.1 Multi-stream or kerbside sort collection

Plastic bottles collected in boxes which are fully sorted at the kerbside

The materials set out for collection in a box are clearly visible as they are being sorted into material types at the kerbside. Any unspecified materials can be left behind in the box by the collection crew. There is a clear incentive for the crew to do this, as leaving materials can reduce the sorting time and help to maximise vehicle capacity, thereby potentially making their round quicker. Leaving the contaminating materials in the box also provides a direct feedback loop to the householder, which should impact upon behaviour for future collections.

18. WRAP (2011) Dry Recycling Performance Benchmarks

8.1.2 Two-stream collection

Plastic bottles collected in boxes which are partially sorted at the kerbside/plastic bottles collected in boxes before being tipped into a slave wheeled bin

Some box collection schemes specify the materials that should be placed in each container. Under such circumstances, one box may be reserved solely for plastic bottles and cans. Such co-mingled cans and bottles might then be tipped into a specific compartment (or slave bin) while the remainder would be manually sorted. While it may be possible to remove contaminants before tipping this box of plastic bottles and cans, this is likely to be less thorough. Crew training can encourage this good practice but it will still add time to the collection process and is likely to discourage thorough quality control.

Plastic bottles collected in a single-use sack

Single-use sacks offer another possible solution. These can be put out separately or as part of a co-mingled recycling stream. However, operational experience suggests that time constraints limit a crew's desire to prevent contamination from entering the recycling stream. Operatives tend to reject only those bags that are abnormally heavy, or contain easily identifiable contaminants.

One possible way forward is the use of transparent sacks that allow the identification of contaminants within the bag. However, the subsequent solutions can create their own problems. Crew members could tear open such bags to remove the contamination, but this is a slow process that may create litter. A second solution is to reject the whole sack but this may send a negative message to the householder, who may resort to putting recyclables in the waste bin.

8.1.3 Co-mingled collection

Plastic bottles collected in a wheeled bin

A fully co-mingled bin-based system presents difficulties in identifying any contaminating materials as it is difficult to ascertain what is in the bin prior to emptying. The bin lid can be lifted to ensure there are no easily visible contaminants, but this does not preclude the possibility of hidden contamination. Furthermore, while bin weight can indicate severe levels of misuse (e.g. rubble disposal), the majority of contaminants may not be easily identified in this manner.

8.2 Crew training

The containment type and collection system largely determine the extent to which collection crews can identify and reduce the collection of contaminating materials. However, there is a need to train and retrain crews to help ensure that the authority's service rules are being followed. This is particularly important under systems where there is no direct incentive for crews to do this. In these systems such additional checking as lifting the lids of wheeled bins and sorting through materials represents additional time and effort for the crews. Such additional effort would not typically be undertaken unless training is effective and correct working practices strictly enforced.

It is important when training crews to emphasise the reasons why it is so important to maximise material quality. This should focus on practical, local issues such as improving council/contractor material revenues or reducing gate fees, alongside environmental arguments.

One relevant message that crews should receive as part of their training is that investing their time in 'educating the public', through the provision of accurate and consistent feedback, is likely to be time-saving in the long run as public behaviour will improve over time. This of course is not always the case, particularly in areas of high resident turnover.

8.3 Compaction

Compaction setting on the RCV can influence the ability to sort materials efficiently at the MRF. High levels of compaction are more likely to exacerbate issues of bottle bale contamination, as well as increasing the amount of time taken for the MRF to sort material to a given quality standard. However, reducing compaction settings can also reduce payloads, so a good balance should be struck between payload and sorting issues. From the local authority's perspective, this may manifest itself through a higher MRF gate fee.

Key messages for local authorities

The point of collection provides important opportunities for managing the quality of captured materials. The level of influence that a well-trained crew can have at the kerbside is considerably greater for a multi-stream system than a single-stream system.

9 POST-COLLECTION SORTING AND BALING

Overview

This section is relevant for authorities wishing to design a new multi-stream or kerbside sort scheme and for authorities that already operate one. In systems where plastic bottles are collected via a multi-stream service, a post-collection sorting process prior to any baling can be beneficial. This may be a very simple system such as a manual sorting line from which non-bottle plastics, and other contaminants, are removed. Such practices can play an important role in improving materials quality and increasing the value of products passed on to reprocessors, in turn increasing income for the authority.

As a means of improving material quality for systems where plastic bottles are collected via a kerbside sort or multi-stream collection, a post-collection sorting process prior to any baling can be beneficial. This may be a very simple system such as a manual sorting line from which non-bottle plastics, cans where they are collected in the same mix, and other contaminants are removed.

During interviews, reprocessors stated that they greatly prefer densely packed and securely bound bales. For authorities that deliver materials direct to reprocessors, it may be worth investing in bottle piercing and baling equipment. One reprocessor identified Angus Council as providing good quality baled plastic bottles and, as the case study below suggests, this has been enhanced through the use of a bottle piercing machine to aid compaction at the authority's depot (Table 5).

Post-collection sorting also provides an opportunity to undertake output quality sampling of the collection rounds. Sampling can also be used to identify the contamination levels of different rounds, which can be used constructively to highlight areas in need of greater communications. Such immediate feedback can be extremely valuable and can also allow for long-term monitoring of trends.

Table 5 Angus Council – an example of compaction at the depot

Angus Council: A case study

Service description

Recycling is collected via a multi-stream weekly box collection. Refuse and garden waste are collected in wheeled bins on an alternate weekly cycle.

Lessons learned

The council was identified by a reprocessor as producing good quality material and has been collecting plastic bottles at the kerbside since 2004 (collections of these items started in 2000 at each of the authority's seven HWRCs). The council has invested in a bottle piercing machine at its depot to help improve compaction before materials are compressed and baled before being transported to their designated plastics reprocessor. The bottle piercing machine is effectively a rolling spiked drum that pierces bottles fed into the machine. The authority built the machine for approximately £18,000.

According to the authority, the low level of contamination means that the high compaction rates are not a problem for their reprocessor and this saves transport costs. The authority reports that the kerbside sort system and an effective communications campaign helps ensure minimal levels of contamination. As a result, the authority does not undertake any post-collection sorting at its depot.

To ensure contamination is kept to a minimum, the council's collection staff are instructed to reject non-target items at the kerbside. Dry recyclables are sorted into the collection vehicle and this gives staff ample opportunity to identify misplaced items. These items are left behind with a note explaining why the materials were rejected.

The authority has run a number of communication programmes in the past, notably during the implementation of service changes. In addition, Angus Council has a number of avenues whereby it provides information on its recycling services. These include: the authority's website, local authority news, pamphlets, and posters at each of its HWRCs.

10 MATERIAL RECOVERY FACILITIES (MRFS)

Overview

This section is relevant for authorities wishing to design a new scheme that will require sorting of dry recyclables at a MRF. It is also of relevance to authorities that already use a MRF to separate out their plastic bottles from their dry recycling. The aim is to highlight the ways in which quality can be improved through improved MRF management.

In order to maximise the quality of bottles being sent to reprocessors, it is important that local authorities consider the following when contracting with a MRF:

- how the MRF operates;
- what the value of the potential output streams from the MRF are; and
- which markets does the MRF deliver to?

Local authorities can influence the behaviour of MRF operators by using contractual incentives and obligations between the authority and the MRF. These can incorporate strict requirements/and or provision of incentives for MRF operators to maximise the quality of outgoing materials.

MRF operators can influence quality of material via:

- load inspection and feedback to local authorities, which makes identification of low-performing areas possible;
- random sampling;
- improved sorting into different plastic polymers:
  - baling mixed bottles is usually the most cost-effective method for smaller MRFs ; or
  - as volumes grow, it can be financially preferable to sort out the main polymer types – that is, PET (e.g. soft drinks) and HDPE (e.g. milk bottles), and also by colour (e.g. natural/jazz).
- improved baling:
  - tightly bound bales usually offer the best value and are preferred by reprocessors; and
  - loosely packed bales achieve less value and may even be rejected by reprocessors. Large horizontal balers can be used to produce tight bales (optimising machine settings for plastic bottles can increase shipment weights by as much as 20%).

A reprocessor's perspective

There is no consistent view on what local authorities should be doing. However, a number of reprocessors suggested that the supply chain could be improved by:

- Carefully procuring collection and MRF services;
- Considering whether there is sufficient sorting capacity;
- Auditing what collection contractors and MRF operators do with the materials that are collected; and
- Checking that if local authority plastic bottles are exported the shipments comply with the rules relating to the export of wastes.

An innovative response to monitoring contamination at the front end of a MRF has been undertaken by Project Integra, which in 2006 opened a material analysis facility (MAF) at Veolia's Alton MRF in Hampshire. The results of the contamination analyses are used to calculate returns on the sale of recyclables and to adjust WasteDataFlow entries. A case study of Project Integra's MAF is shown in Table 6.

Table 6 Project Integra. An example of good practice in contamination monitoring and control

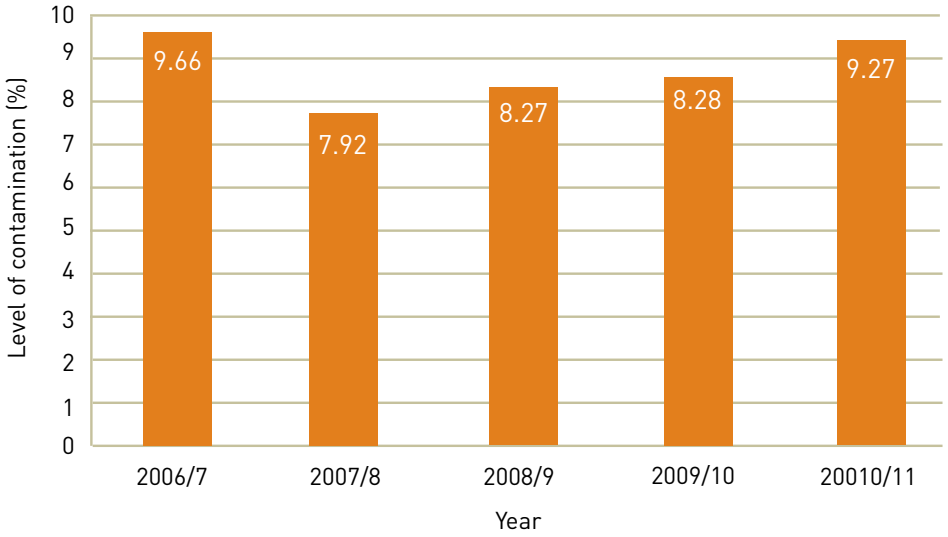
Project Integra's Material Analysis Facility: A case study

Background

Project Integra is a partnership between all of the district authorities in Hampshire, Hampshire County Council, the unitary authorities of Portsmouth and Southampton, and Veolia Environmental Services. All 750,000 households served by Project Integra can access a co-mingled service for paper, card, aluminium and steel cans, aerosols and plastic bottles. In order to maximise income and improve the environmental benefits gained from the region's recycling services, Project Integra has taken active steps to reduce contamination. Key to this was the development of a material analysis facility (MAF) in the spring of 2006. This facility, operated by Veolia Environmental Services, is attached to Alton MRF, one of two MRFs operated by the partnership in Hampshire (together the two MRFs process 157,000 tonnes of dry recyclables a year). The MAF was designed to fulfil three main tasks:

- analysis of incoming co-mingled dry recyclables – to allow assessment of incoming material quality in relation to the input specification of the facility, apportionment of contamination across the partners and the identification of low-performing areas;
- analysis of other streams – for example, the analysis of residual waste (allowing capture rates to be estimated), and the analysis of the reject stream from the two MRFs (which supported the development of a business case for adding magnetic and eddy current separation to this conveyor in order to separate smaller metal items); and
- analysis of outgoing sorted materials – to ensure that quality standards of outgoing products are maintained and sales values optimised.

Alton MRF was opened in 2005 and the MAF was commissioned soon after. Initially contamination declined (from 9.66% in 2006/07 to 7.92% in 2007/8), but then increased slowly year on year until reaching 9.27% in 2010/11 (see bar chart below). It is worth noting, however, that the increase in 2010/11 is most likely due, at least in part, to a change in the sampling procedure used to measure contamination levels. As described below, the sampling methodology was modified in 2010/11 to enable greater flexibility and to ensure that more detail could be captured.



The MAF's success has been recognised with many awards and acknowledged by the Environment Agency as an example of best practice in England. The strong commitment to maintaining the quality of incoming and outgoing products has helped Project Integra to form good relationships with reprocessors, who appreciate the consistent high quality materials provided by the two Hampshire MRFs.

Methodology

As of 2010/11 analysis of contamination takes place three times each year, with each event lasting seven weeks (it had previously been two nine-week slots). Over these 21 weeks, which are exclusively dedicated to analysing contamination, the MAF collects six samples on a daily basis and manually sorts them into three main categories (each sample comprises two representative sub-samples):

- Recyclables – MRF accepted recyclables;
- Contraries – recyclables which are not accepted at the MRF; and
- Residues – non-recyclable materials.

As of 2010 the recyclables category was further subdivided to provide more detailed compositional breakdowns. Each year the MAF aims to collect samples from at least 50% of the rounds run by each of the waste collection authorities. This enables low-performing areas to be identified by each authority and facilitates the accurate apportionment of financial resources.

The following infrastructure has been put in place for the analysis of the samples:

- a hopper with two automated conveyor belts;

- a cabin with nine sorting chutes;
- electronic scales;
- sampling crates;

- two collection vehicles; and
- a forklift.

Costs and funding

The MAF took approximately two months to construct, with an additional month required to test and streamline operations. It cost approximately £100,000 to develop, including the purchase of the forklift truck, scales and sampling crates. The facility employs five full-time staff, including a manager, a supervisor, a collection driver and two sorters who segregate the samples. The MAF operates five days a week, with Veolia Environmental Services running an extra shift to analyse the composition of outgoing materials.

At present the operational costs of the facility are split evenly between the following three stakeholders:

- 1/3 Veolia Environmental Services;
- 1/3 waste disposal authorities (split according to population); and
- 1/3 waste collection authorities (contribution split evenly between 13 authorities).

Communications

In order to promote the collection of plastic bottles, consistent communications were provided across Project Integra's waste collection authorities. A wide selection of media and approaches were used, including: leaflets, bin stickers, bin tags, fridge magnets, bus and RCV advertising, posters in supermarkets, and advertisements at bus shelters and in council magazines. In these communications the description 'bottle shaped and plastic' has been used and attention has also been drawn to plastic bottles arising in all areas of the house – not just the kitchen.

Key messages for local authorities

Project Integra has successfully demonstrated an innovative approach to cooperation between local authorities and their MRF contractor. Where such arrangements are envisaged at the procurement stage, it is relatively straightforward to introduce contractual requirements regarding quality management and control.

GLOSSARY

- **Clear PET bottles:** mostly derived from beverage containers, such as soft drinks and mineral water.
- **Coloured HDPE bottles:** typically used to make shampoo and laundry detergent bottles.
- **Coloured PET bottles**: mostly derived from beverage containers and other household food and cosmetic products.
- **HWRC:** household waste recycling centre
- **Material Recovery Facility (MRF):** a separation plant where kerbside recyclables are separated into material types and baled or loaded in bulk for further processing by specialist recyclers. These materials typically include paper, card, metals, mixed plastic bottles and sometimes glass. Some MRFs also separate one or more of the more abundant and higher value plastic bottle streams, typically PET or HDPE. Increasingly, MRFs concentrate on separating mixed plastic bottles for further separation by a specialist Plastics Recovery Facility (PRF).
- **Multi-stream, or kerbside sort:** involves the sorting of materials at kerbside into different compartments of a specialist collection vehicle.
- **Natural HDPE bottles:** mostly used for the packaging of fresh milk.
- **Near-Infrared (NIR) sorting:** an optical sorting technology used widely in plastic recycling to enable plastic packaging and other plastic wastes to be separated by polymer type and colour. This enables the production of high quality materials which can substitute for virgin polymers in the manufacture of new items.
- **Non-bottle rigid plastic packaging:** non-bottle rigid plastic packaging typically comprises plastic pots, tubs and trays. This material category specifically excludes plastic bottles, construction plastics, foamed plastics, flexible plastic films and bulky household plastic items such as washing up bowls and toys.
- **PE:** polyethylene (PE) is a plastic polymer that is used in a number of packaging items (e.g. food packaging, film and bags).
- **Plastic bottles:** household plastic bottles.
- **Plastic films:** these are typically manually sorted and include a variety of plastic polymers, most commonly low-density polyethylene (LDPE); materials include plastic bags and plastic wrappings used for food and other household goods.
- **Plastic Recovery Facility (PRF):** a facility set up specifically to sort plastics by polymer type and/or colour. Some of the processes commonly featuring in a PRF may also occur at the front end of a reprocessor site and some PRF operators have themselves invested in downstream reprocessing to make high-grade finished recycled polymers.
- **PP:** polypropylene (PP) is a plastic polymer that is used in a number of household items (e.g. food containers and plastic cutlery/crockery).
- **PS:** polystyrene (PS) is a plastic polymer which is used in a number of household items (e.g. plastic cutlery/crockery and children's toys).
- **PVC:** Polyvinyl chloride (PVC) is a biologically and chemically resistant plastic that is typically used to produce non-food bottles, larger household items (e.g. children's toys and plastic furniture) and construction materials (e.g. sewer pipes, door/window frames, coatings for electric wires, plastic tiles, etc.).
- **RCV:** refuse collection vehicle
- **rHDPE:** recycled high-density polyethylene (rHDPE) refers to post-consumer HDPE materials which have been reprocessed (e.g. cleaned and flaked) for inclusion in new products.
- **rPET:** recycled polyethylene terephthalate (rPET) refers to post-consumer PET materials which have been reprocessed (e.g. cleaned and flaked) for inclusion in new products.
- **Rigid household plastic packaging:** this stream contains a mixture of plastic polymers used in general household packaging (e.g. margarine tubs, yogurt pots and food trays) and plastic bottles.
- **Single-stream co-mingled:** involves the collection of materials in a single compartment vehicle with the sorting of these materials carried out at a MRF (materials recovery facility).
- **Two-stream co-mingled:** residents are provided with two recycling containers and are asked to place different materials in each container, typically paper/card (fibre) in one and plastics, glass and cans (containers) in the other. These materials are kept separate, but are generally collected on one vehicle which has two chambers.

APPENDIX A: PLASTIC BOTTLE GRADES

Typical grades of plastic bottles post-PRF/MRF

Plastics polymers (predominantly HDPE and PET) are typically sorted using automated and manual sorting techniques. Manual sorting of the different plastic polymers is reported to be most prevalent in the UK, with optical sorting used in MRFs with large throughputs (i.e. where the cost of installation can be justified).[19] There is no one complete list of products produced by PRFs and MRFs. MRFs in particular vary considerably in the type and combination of products that are produced. However, typical post-PRF/MRF plastic grades are as follows (and illustrated in Figure 10):

- **Clear PET bottles** – mostly derived from beverage containers, such as soft drinks and mineral water. Their commercial value means that they are frequently separated out. After sorting the final baled products frequently contain between 2.6% and 9.5% non-target items.[20]
- **Coloured PET bottles** – mostly derived from beverage containers and other household food and cosmetic products; final baled products frequently contain between 5.6% and 10.7% non-target items.
- **Coloured HDPE bottles** – typically used to make shampoo and laundry detergent bottles. Final baled products frequently contain between 6.9% and 11.3% non-target items.
- **Natural HDPE bottles** – mostly used for the storage of fresh milk. Their value in combination with efficient sorting ensures low levels of contamination in the final baled product (median lies between 1.9% and 4.0% of non-target items).
- **Non-bottle rigid plastic packaging** – typically comprises plastic pots, tubs and trays. This material category specifically excludes plastic bottles, construction plastics, foamed plastics, flexible plastic films and bulky household items such as washing up bowls and toys.
- **Plastic films** – these are typically manually sorted and include a variety of plastic polymers, the most common being low-density polyethylene (LDPE). Other materials include bags and wrappings used for food and other household goods.

Figure 10 Examples of different commonly used plastic polymers and their products. A. Clear PET used for mineral water; B. Coloured PET used for common household products; C. HDPE natural used for milk containers; and D. mixed plastic packaging consisting of various plastic polymers

19. Waste & Resources Action Programme (no date given) Recovering Value from MRFs,
20. Figures on contamination presented here and immediately below come from median figures presented in: ENVIROS (2009) MRF Quality Assessment Study, Report for the Waste & Resources Action Programme, November 2009,

In MRFs it is not uncommon for this list to be reduced to a small number of product streams such as, rigid household plastic packaging and plastic films. In some MRFs, further sorting occurs to extract the more valuable streams such as Clear PET and Natural HDPE, leaving behind a mixed plastic packaging stream (with a low content of valuable items) and plastic films. The larger MRFs commonly produce the full range of materials listed above; a few examples of the baled products are shown Figure 11.

Figure 11 Examples of different MRF outputs. A. HDPE Natural; B. Clear PET; C. rigid household plastic packaging; and D. plastic film[21]

A

B

C

D

21. Figures taken from: Sante Fe Solid Waste Management Agency (2009) Plastics Recycling Info, date accessed: 20 October 2011 and Nextek Ltd (2009) Commercial Scale Mixed Plastic Recycling, Report for the Waste & Resources Action Programme, June 2009

APPENDIX B: EXAMPLE COMMUNICATIONS

Examples of household communications

Examples of communications used by two case study authorities are provided in Figure 12 and Figure 13.

Figure 12 Example of communication leaflet provided by Kettering Borough Council

Source: Kettering Borough Council, What Goes Where? Information on what should go in each bin.

Figure 13 Example of online refuse and recycling details provided by the Royal Borough of Kingston upon Thames

Source: Royal Borough of Kingston upon Thames (2011) A to Z of Recycling in Kingsto

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