Report

April 2015

Plastics Evidence

Evidence Base for Plastics Recycling in Scotland

Contents

1 Introduction

This is the concluding report of a four year project commissioned by Zero Waste Scotland to establish and develop an evidence base for plastic waste arisings and recycling in Scotland. The data on arisings and recycling of plastic covers a range of sources, including:

- Households
- Commercial and industrial
- Construction and demolition
- Agriculture
- Waste electrical and electronic equipment (WEEE)
- End of Life Vehicles (ELV)

A detailed description of how arisings and recycling data has been calculated is provided in previous reports in this series[1].

Section two of this report summarises annual data estimates over the period of the project, commenting on the key trends and comparing against data from other sources. An overview of current plastic reprocessing facilities in Scotland is given in section three. Section four discusses key issues impacting on the plastics collection, sorting and reprocessing sector. Finally, section five concludes on potential areas for action to increase collection, sorting and reprocessing of plastic in Scotland.

2 Recent data trends for plastics recycling in Scotland

This section provides a summary of data gathered on waste plastic arisings and recycling in Scotland over the four year period 2009 to 2012. A comparison of the data reported from other sources is also provided, including an explanation of key differences in scope and recycling rates.

The various source data used to calculate these estimates is published over different time periods. A key source is the waste data published by the Scottish Environmental Protection Agency (SEPA). The most current data available from SEPA (at the time of writing) for business waste generated is for 2012. The analysis is, therefore, provided up to this period.

2.1 Plastic waste arisings and recycling 2009 to 2012

One of the key issues in estimating the arisings and recycling of plastic waste from different streams in Scotland has been the wide variation in estimates from commercial and industrial sources. This has led to the arisings and recycling estimates being quoted as an ‘upper level’ and a ‘lower level’ for each year. A change in methodology used by SEPA in the reporting of waste generated by businesses (based on analysis of statutory data returns, implemented for 2011 reporting) has resulted in a closing of this gap. This can be seen in figure 1, below.

[1] Developing the Evidence Base for Plastics Recycling in Scotland - http://www.zerowastescotland.org.uk/content/plastics-recycling-business-opportunities-report-ifm002-001-0

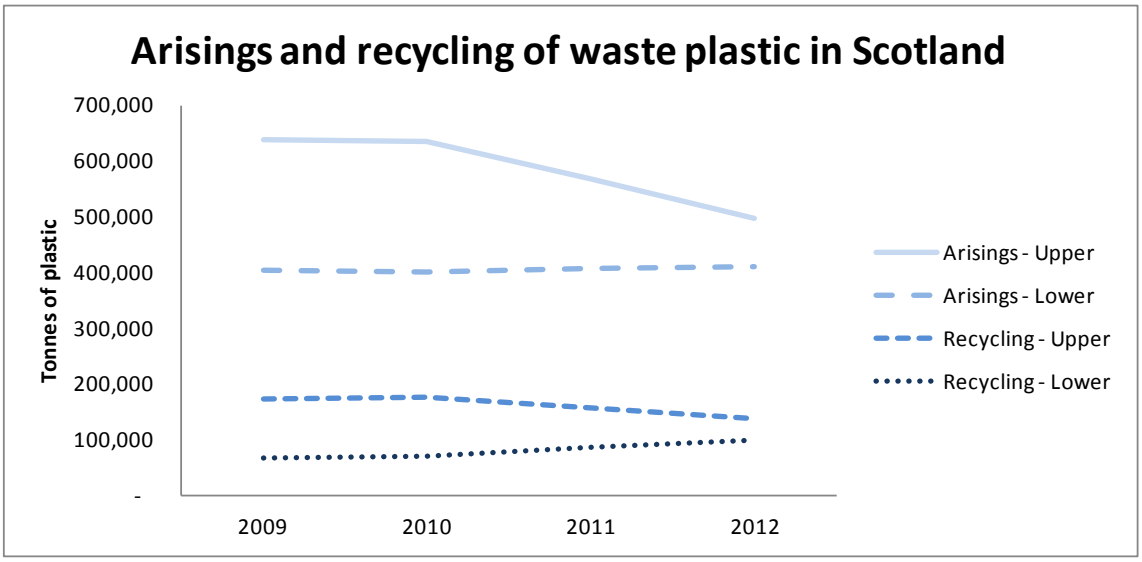

Figure 1 Upper and lower range estimates of plastic arisings and recycling in Scotland

The top two lines in the above figure show how the range of estimated plastic waste arisings have come closer together, mainly due to a change in methodology in SEPA business waste data reporting. This suggests that earlier upper estimates of plastic arisings in 2009 and 2010 were too high. The 2012 upper level estimate of plastics arising from all sources is over 497,000 tonnes. The lower level arisings estimate for the same year is just below 410,000 tonnes.

The bottom two lines in the above figure show the convergence of upper and lower estimates of plastics collected for recycling from all sources. The lower level estimate of recycling has increased from over 67,000 tonnes in 2009 to over 98,000 tonnes in 2012 (a 46% increase in recycling over that period). This compares to an increase in the lower level estimate of plastic arisings of 1.5% over the same four year period. The upper level estimate shows a fall in recycling (to just below 138,000 tonnes in 2012 compared with over 172,000 tonnes in 2009) but this is due to the associated fall in arisings due to the change in SEPA methodology for estimating business waste data.

The lower level estimate suggests that the overall plastic recycling (from all sources) has increased from 17% in 2009 to 24% in 2012. This represents additional annual recycling of over 31,000 tonnes in 2012 compared to 2009.

2.2 Comparison with other data estimates

A number of other reports provide estimates of plastic recycling rates. These are compared in the table below summarising the different scope of materials included in each report.

Report source and name	Plastic recycling rate	Period and scope of data
Zero Waste Scotland – Plastics Evidence Base	**24%** to **28%**	2012 data estimate for Scotland; All packaging and non-packaging plastic waste from households, commercial & industrial, construction & demolition, agriculture, WEEE and ELV sources
Valpak/WRAP – Plastic Packaging Market Study	**27%** based on current estimates of plastic placed on the market **32%** based on revised estimated used in the Valpak/WRAP report	2013 data estimate for the UK; Plastic packaging only – consumer and non-consumer (construction & demolition, agriculture and commercial & industrial sources)
RECOUP – UK Household Plastics Collection Survey	**37%** overall *(58% plastic bottles)* *(37% rigid plastic packaging)* *(19% pots, tubs & trays)*	2012 data for the UK; Plastic packaging from households only
Plastics Europe – Plastics – the facts 2014/15	**22%**	2012 data for the UK; All post consumer plastics waste

Table 1 Comparison of reported plastic recycling rates and scope of materials covered

The above table shows a range of plastic recycling rates. The scope of the data covered in this report is wider than both the Valpak/WRAP report (which only includes packaging waste) and the RECOUP report (which only includes packaging waste from households). The most comparable figure is the recycling rate of 22% for the UK reported by Plastics Europe. Direct comparison suggests that Scotland has a higher overall plastics recycling rate than the UK, although care should be taken in reaching this conclusion as different methodologies are used.

3 Scottish reprocessing of plastics

The plastics reprocessing supply chain in Scotland consists of a number of companies involved in shredding, granulating, compounding and manufacture of new product. These companies are described below.

Avanti Scotland

Avanti Scotland is based in Alva and is part of the wider Avanti Group. In addition to a broad range of waste management services, the Scottish operation specialises in reprocessing of plastic. The reprocessing facilities include shredding, washing and granulating equipment. The washing facility enables decontamination and cleaning of multiple polymer types and is the only such plant in Scotland capable of washing contaminated hard plastics. Input materials are sourced from various sectors including food, automotive, chemical, pharmaceutical and general manufacturing. Types of plastic include intermediate bulk containers, drums, water and gas pipe, crates, contaminated food buckets, automotive plastics and bottles, amongst others. Output materials include a range of granulated product types (8mm-10mm) including polyethylene and polypropylene. These are sold on to both producers of end products in manufacturing operations and also compounders who produce recycled polymers of various grades and additives.

BPI Recycled Products

BPI has a recycling plant based in Dumfries that shreds, washes and compounds waste plastic film. The plant specialises in reprocessing waste agricultural film including silage bale wrap (LLDPE) and silage pit cover (LDPE). The plant has a capacity to reprocess some 30,000 tonnes per annum with the output pellet used to manufacture a range of 'Plaswood' furniture (decking, fencing, outdoor furniture) at the site in Dumfries. The company also uses the output material to produce recycled film products (such as refuse sacks) at other operational sites in the UK.

CK Group

The CK Group specialise in the collection of waste plastic for recycling and the distribution of regrind and compound. The company operates two processing facilities in the UK with one of these located in Scotland. The Melrose processing facility includes shredding (to ~ 25mm diameter), granulating (to ~ 10-12mm diameter) and compounding to a uniform pellet. Input materials include wheelie bins, caps and enclosures, crates, pipe, etc. Output materials are predominately PE compound, destined for applications including the manufacture of pipes and automotive parts. In 2014, new laboratory facilities were developed at the site to provide testing and certification for recycled plastic material.

Mainetti

Mainetti is the UK's leading manufacturer of clothes hangers, supplying half the country's annual demand. Based in Jedburgh, two thirds of the company's output is produced from recycled processes with recycled material equating to 3,000 tonnes per annum. Materials used include High Impact Polystyrene.

Panel 2 Panel

Panel 2 Panel is a manufacturer of construction panels for wet area applications based in Dumfries. It uses several recycled plastic input streams ranging from tightly controlled post-industrial scrap, through general commodity grade recycled polyolefins to unsorted waste plastics which are currently not recyclable on a commercial scale. The company obtains these materials through a close relationship with suppliers (close and open working is essential in order to ensure the necessary control and visibility of the feedstock quality, properties and volumes). Some of the input streams are actually the waste products from other recycling processes. Panel 2 Panel uses a unique and patented process to produce a composite from the plastic materials. The output product is a high quality and high value construction panel for wet area applications such as washrooms and robust partitioning. Aside from fulfilling a waste demand requirement, its primary objective is always to produce products with the performance that the market demands.

Polymer Extrusion Technologies (UK)

Polymer Extrusion Technologies (UK) Ltd is a specialist plastics processor based in Dumfries. The company works with customers across Europe, handling a wide range of plastics including PET, PBT, PP, HDPE and PEN and offers toll services for post production waste that can then be used as 100% replacement for virgin polymer. Food grade PET pellet (produced under full European Food Standards Agency approval) is also produced from post consumer or post industrial recyclate (predominately bottle waste).

Plastic Technology Services

Plastic Technology Services Ltd is a specialist plastic recycler and compounder based in Dumfries. The company processes a range of plastics including polypropylene, polyester, polyethylene and polystyrene into recycled compound. This includes toll services for post production plastic waste and recycling of post consumer waste. The in-house testing facilities assess the quality of input material and control quality of output material. The production capacity is in excess of 12,000 t.p.a. and output material is supplied to moulders and sheet manufacturers in the UK.

WRC Recycling

WRC Recycling is based in Johnstone, Renfrewshire. The company offers a range of waste management services with a particular specialism in plastics recycling. Inputs to the process include surplus or damaged crates and wheelie bins, water and gas pipes, PVC window frames, plastic bottles and packaging foam, amongst others. Onsite reprocessing equipment enables shredding (to 20mm-25mm) and granulating (8mm-10mm). Output materials include a range of granulated polymers including high density polyethylene, polypropylene, PVC, acrylic and nylon. These are sold for onward use in a range of manufacturing operations.

Wyllie Recycling

Wyllie Recycling is based in Perth and offers a broad range of waste management services. The company processes a significant volume of plastics from a number of sources including households (e.g. juice and milk bottles, polythene and PP5 plastic containers), commercial & industrial (including polypropylene, polythene, hard plastics, PET and HDPE) and agricultural plastics (including polytunnel, polythene, polypropylene bags and hard plastic drums). Onsite reprocessing includes shredding and granulating of plastics that are sold onwards for use in manufacture of new products.

4 Industry issues

A number of interviews were carried out with representatives of different parts of the supply chain. This included companies involved in collection, sorting and reprocessing plastic. These discussions highlighted a number of current and future issues. Each of the main issues identified are described below.

4.1 Oil price impact

The price of recycled plastic tracks the price of virgin plastic, typically offering a cost advantage in addition to any competitive advantage through improved environmental credentials of end products. Virgin plastic prices are closely linked to the key raw material, oil. From a position of approximately $100 per barrel (of Brent Crude Oil) in September 2014, an unpredicted price fall occurred to a low of approximately $50 per barrel during January 2015. A modest improvement occurred during February 2015 where the price increased to over $60 per barrel but has fallen again to $55 per barrel at the end of March 2015[2].

This has had a number of impacts for those involved in plastics recycling. Firstly, as customers expect a discount against virgin prices, the prices paid for recycled plastic have dropped significantly, in some cases to a level where it is uneconomic for recyclers to sell. Where space is available stockpiling is being used until prices rise. Where space is not available the companies are forced to place the material on the market and accept the rate paid. In some cases recyclers are reporting a lack of demand at all for some lower grade materials. This, in turn leads to reduced cashflow for businesses meaning they are reducing their own purchases of plastics from waste generators and collectors.

The Resource Association has called for retailers to continue to pursue voluntary environmental commitments on the use of recycled material in end products (e.g. plastic milk bottles) to halt a shift away from recycled plastic to virgin material use as a result of the significant reduction in virgin price[3].

Recyclers are continuing to work with their supply chain to improve the quality of material available to maximise access to markets and prices received.

[2] Source – www.nasdaq.com, accessed 24th March 2015
[3] Source - http://www.letsrecycle.com/news/latest-news/retailers-told-not-to-turn-back-on-recycling-commitments

4.2 Transportation costs

Material transportation costs are a large part of the cost base of plastics collectors and recyclers. The costs of accessing geographically dispersed and/or low levels of arisings can make collections uneconomic. Collectors and recyclers attempt to address this issue by forming networks of smaller collectors around the country that can bulk materials until haulage becomes economic. This works well for heavier materials with a good onward market, such as uPVC window frames, but can be marginal with other materials, such as agricultural film. The costs of onward shipping of materials from recyclers are addressed through continual investment in baling and other size reduction equipment (shredders, granulators and compounders) to allow more material to be transported. Several investments in this type of capacity were made by plastics recyclers in 2014 and early 2015.

4.3 Problem plastic types

A number of plastic types have been identified as being marginal or uneconomic to recycle due to a range of factors:

- **Low grade PVC (e.g. gutter pipes, etc)** – poor onward market for low grade PVC combined with the polymer not being a desired input into waste derived fuel production due to negative chemical effects on the energy generation plant and emissions
- **Expanded Polystyrene (EPS)** – high cost to weight ratio for haulage due to the low density of the material. There is good market demand for EPS after thermal or mechanical densification but investment in this type of equipment can only be justified at higher arising levels at specific points of arisings
- **Mixed rigid plastic from civic amenity sites** – a recent Zero Waste Scotland funded trial has demonstrated that significant amounts of rigid plastic flow through local authority civic amenity sites but is not currently being separated. Further work is being carried out on this area to improve the automated sorting process. Even with this in place local authorities will need to be convinced separate collection of mixed rigid materials is practical from both economic and space perspectives
- **Residual plastic from sorting of mixed household collections** – after the 'prime materials' (e.g. PET bottles, HPDE milk bottles, PP containers, etc) are separated at MRFs the residual plastic can be used in waste derived fuel production due to the high calorific value of plastic (subject to limitations on PVC content as mentioned earlier). There is a particular issue with automated sorting of black trays due to issues with detection. WRAP has recently funded a trial to increase recycling of black crystalline polyethylene terephthalate (cPET) trays[4]

4.4 Lack of robust data on plastics still going to landfill

Earlier section 2.1 provides estimates of plastics going to landfill or incineration/energy recovery of between 311,000 tonnes and 359,000 tonnes, consisting of plastics from the following streams:

- 191,000 tonnes from households
- Between 53,000 tonnes and 101,000 tonnes from commercial & industrial
- 18,000 tonnes from construction & demolition
- 20,000 tonnes from agriculture
- 20,000 tonnes from WEEE
- 9,000 tonnes from ELV

This means that between 78% and 81% of plastics going to landfill or incineration come from household or commercial & industrial sources. However, there is no current robust information about the composition of this material and, therefore, what potential value could be accessed. There is also

[4] Source: http://www.wrap.org.uk/sites/files/wrap/In_market_trial_to_prove_recycling_process_for_black_CPET_trays_case_study.pdf

limited information on the split between landfill and incineration (with or without energy recovery) as a treatment route for plastics. More information about the composition of material being sent to landfill from household and commercial & industrial sources would help reduce this information gap and be useful to support service design of local authority and private sector approaches to plastic waste collections and subsequent sorting infrastructure.

4.5 Impact of new Waste (Scotland) Regulations in 2014

The Waste (Scotland) Regulations 2014 have now been in place for over a year. This legislation places a legal requirement on businesses to present a number of waste materials (including plastic) for collection, separate from general waste. Local Authorities have a duty to offer separate collections to householders. The first SEPA waste data reporting of the impact of this new legislation is likely to be available in 2016. A number of industry representatives were asked for their views about how this legislation has impacted in the volume of plastic collected for recycling. A mixed picture emerges from the responses to this question. Views included:

- The impact is difficult to judge due to other factors influencing the amount collected, such as changes in economic output, reduction in price in the final quarter of 2014, etc
- The legislation has had an impact but there are diminishing returns as the easier to access materials were already being pulled out, driven by the market
- Enquiries to deal with niche plastics have increased (e.g. contaminated plastics from food and chemical sectors). This could be a result of legislative changes but it is hard to tell
- There has been some increase in volume of plastics collected but the additional variety of plastic types is leading to some cross contamination issues – e.g. contaminated food packaging and coated plastics
- There has been no noticeable difference in the amount of plastics collected in 2014

Based on the above feedback, there is no uniform view on the impact of the Waste (Scotland) Regulations on plastics collected for recycling. As previously stated it is likely to be 2016 before the first data appears to properly assess the impact.

4.6 Levels of plastic packaging placed on the market

In 2014 Defra and Valpak commissioned research into the level of plastic packaging being placed on the market. This is a fundamental aspect of calculating the UK performance against packaging recycling targets. The research was conducted by WRAP and Valpak and concluded that estimated plastic packaging placed on the market in 2013 was 13% lower than the official Defra estimate for that period[5]. In part this is due to improvements in light-weighting of packaging. Defra is currently considering the implications of this report for measuring recycling rates achieved against the targets set in the packaging regulations.

The lower level estimate of total plastic waste arisings in Scotland (packaging and non-packaging) uses the official Defra estimates of plastic packaging placed on the market as one of the data sources. If these figures are overstated by the scale suggested by the WRAP/Valpak report then the lower range estimate for plastic waste arisings in Scotland could be over 30,000 tonnes less than stated.

4.7 Role of the public sector

As with private sector businesses the public sector must also present waste plastic for separate collection in accordance with the Waste (Scotland) Regulations.

[5] Plastic Packaging Market Study (Plastic Flow) 2014 - http://www.wrap.org.uk/sites/files/wrap/Plastic_Packaging_Market_Study_2014_0.pdf

One area where many local authorities can prominently demonstrate compliance with these regulations is within their own waste management operations. There are numerous examples of local authorities separately collecting surplus and damaged wheelie bins, for example, which are then shredded, granulated and compounded for use in manufacturing new products. However, industry feedback suggests there are some local authorities where the accepted practice is not to present damaged wheelie bins for separate collection but to send them to landfill with the general waste they are collecting. This raises the question of whether they are complying with regulations.

5 Potential areas for action

In response to some of the key themes and issues identified in this report a number of potential actions could be considered:

- Reducing investment uncertainty
- Addressing problem streams
- Accessing low level dispersed arisings

Each of these is described below.

5.1 Reducing investment uncertainty

In the current climate of low oil prices and resultant reduced revenues, investment in plastics recycling infrastructure is challenging. Over the past few years, however, there has been a steady investment in plastic sorting, granulating, shredding and compounding capacity in Scotland. New manufacturing capacity, using recycled plastics, has developed (e.g. Panel 2 Panel). These investments by industry (and in some cases supported by public sector funding) are improving the performance of plastics recycling in Scotland, as evidenced by the data in section two.

Uncertainty about the volume and type of plastic still available to be pulled from the flow of material to landfill is still high. The strategy has been to invest in equipment to pull material out of the waste stream with that material often being exported for reprocessing outside Scotland.

To support further investment in sorting and (over a longer period) reprocessing, more data is required on the potential plastic material available in different geographical areas of Scotland. Providing this will require funding of a regular programme of robust composition analysis to characterise the estimated 300,000+ tonnes of plastic still being landfilled each year. Investigation could be made into the potential to resource this via an 'Approved Body' accessing the Scottish Landfill Tax Communities Fund[6].

5.2 Addressing problem streams

Some of the industry highlighted problem waste streams were described in section 4.3. Continued efforts are being made to obtain value from these streams and avoid landfill. Where possible, these efforts should be supported by the public sector. For example, development of sorting equipment targeting rigid plastics from civic amenity sites requires funding to develop the technology and also actions to support implementation by local authorities. This could include provision of business model evidence to demonstrate the economic case, common characterisation of plastic types and signage for communication to the public and development of case studies of successful implementation.

Other problem waste streams require different approaches. For example, targeting post consumer household black trays could require cooperation with WRAP around their recent funded trials to sort

[6] SLfT1000 Scottish Landfill Tax Legislation Guidance - https://www.revenue.scot/sites/default/files/SLfT%20Legislation%20Guidance.pdf

cPET, low grade PVC requires market development support and EPS collection requires capital investment support to enable a viable service offering.

5.3 Accessing low level dispersed arisings

Transportation costs were highlighted by industry as a key issue. This is linked to low level arisings of plastic waste that can be uneconomic to collect from some, more remote, geographical areas. As previously described, one strategy used by the industry to deal with this is to develop a network of smaller collectors around the country who bulk material until transportation is economically viable.

This strategy could be supported by reducing the administration burden on those collecting and storing waste material. This may attract non-traditional sites to participate in these activities. For example, agricultural markets collecting and bulking agricultural plastic waste. The potential to support the access of low level and dispersed plastic arisings via The Regulatory Reform (Scotland) Act could be investigated[7].

6 Conclusions

In summary, the conclusions of this research report include:

- Arisings of waste plastic (packaging and non-packaging, from all sources) in Scotland is estimated to be between 410,000 tonnes and 497,000 tonnes in 2012
- In the same year, plastics collected for recycling is estimated to range from 98,000 tonnes to 138,000 tonnes. These figures represent 24% and 28% of arisings, respectively
- The estimates are provided as upper and lower ranges to reflect the significant differences in estimating arisings from commercial and industrial sources. The methodology used to estimate the upper range of arisings has changed over the period of the project (2009 to 2012), making comparison over time difficult. However, comparing the lower range estimates shows an increase in annual plastics collected for recycling from 17% in 2009 to 24% in 2012. This represents additional annual recycling of over 31,000 tonnes in 2012 compared to 2009
- The capacity of the supply chain, involved in plastics shredding, granulating, compounding and manufacture of new product, has increased since the research project commenced in 2012 with stakeholders reporting additional processing equipment investment (either recently completed or planned). Many of these investments had received financial support from the public sector
- The current operating environment is challenging for many of the companies in the plastics recycling supply chain, mainly due to the low price of oil and, therefore, virgin polymer. Transport costs associated with low volume geographically dispersed arisings continues to limit the amount of material collected
- Specific problem plastics types were identified by the supply chain, including: low grade PVC, expanded polystyrene, mixed rigid plastic from civic amenity sites and residual plastic from sorting of mixed household collections
- The lack of robust data on the amount, and composition, of plastics going to landfill has been identified by industry representatives as a barrier to investment. The significant differences in estimated arisings of plastic waste from commercial and industrial sources (developed during this research project) leads to uncertainty for investors about potential availability of material
- Feedback from various waste collectors and reprocessors highlights different views as to the impact of the new Waste (Scotland) Regulations that came into effect at the beginning of 2014. Some report a definite positive impact on the amount of plastic waste collected whilst others are uncertain or perceive there has been little impact. One respondent reported an increase in volume but that

[7] The Regulatory Reform (Scotland) Act has a primary purpose of improving regulation to create more favourable business conditions in Scotland and delivering benefits for the environment - http://www.gov.scot/Topics/Business-Industry/support/better-regulation/BetterRegulationBillConsultation

this was accompanied by higher levels of contamination. SEPA waste data covering the period 2014 will be published in 2016
- Recent research, conducted by WRAP and Valpak for Defra/Valpak, has concluded that estimated plastic packaging placed on the market in 2013 was 13% lower than official Defra estimates (used to assess recycling performance against packaging regulation targets). If this figure was applied to Scotland then this would mean plastic waste arisings would be 30,000 tonnes less than the current (lower range) estimate of 410,000 tonnes of plastic waste arisings
- Industry feedback highlighted some good practice of the public sector leading by example in recycling its plastic waste. However, there were also areas for improvement identified including the situation where some local authorities were landfilling damaged wheelie bins rather recycling

In response to the issues identified by industry, a number of areas for action have been identified. These include:

- Undertaking a regular programme of robust landfill compositional analysis to identify the amount and type of plastic waste not currently being recycled. This will support the current strategy of developing the sorting of different types of plastic to demonstrate what is available from the waste stream
- Continued support for innovative processes to target the sorting and improve quality of problem waste streams
- Reduce barriers to others becoming involved in bulking of low level dispersed plastic arisings

Focusing on these three areas will help to overcome the economic and technical issues related to some problem plastic types and generally reduce uncertainty for investment in plastic reprocessing infrastructure.

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