

Developing the Evidence Base for Plastics Recycling in Scotland

A detailed review of the current position of plastic recycling in Scotland, based on analysis of tonnage arisings, the established infrastructure for managing waste plastics and estimating current and future plastics recycling by type and source

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Zero Waste Scotland works with businesses, individuals, communities and Local Authority to help them reduce waste, recycle more and use resources sustainably.

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Written by: Iain Weir, John Taylor and Hayley Welsh

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Optimat Limited has made all reasonable attempts, within the scope and resources available to the project, to ensure the data in this report are accurate. Estimations of the plastic waste arisings and recycling rates in Scotland are based on published sources which have been fully referenced in this report. As such, the accuracy of the data contained within this report is reliant on this referenced information. Optimat Limited does not therefore accept any liability which may arise through the use of the content of this report.

Executive Summary

This report describes the results of work to develop a robust evidence base of plastics arisings in Scotland and how these are managed. It quantifies plastic waste arisings in each of the 32 Scottish Local Authority areas and aggregates them to a Scottish level. It also details waste plastics processing capacity in Scotland and maps how waste plastic arisings are managed and recycled. Plastics arisings from the household, commercial and industrial (C&I), construction and demolition (C&D) and agricultural (Agri) waste streams, together with waste electrical and electronic equipment (WEEE) and end of life vehicle (ELV) arisings, are included in the analysis. It therefore contributes to the development of a robust evidence base that is considered to be required to guide investment decisions.

Plastic Arisings and Destination

The estimated arisings and destination of waste plastic are summarised in the figure below.

Plastic in Scotland	Plastic landfilled/incinerated by source - 2009							Total	Total
	Household	C&I (LOWER)	C&I (UPPER)	C&D	Agriculture	WEEE	ELV	(LOWER)	(UPPER)
Arisings (tonnes)	251,831	50,841	284,438	35,473	22,945	30,653	11,990	403,733	637,330
Recycling (tonnes)	21,358	22,879	127,997	6,385	4,589	9,502	2,398	67,111	172,230
Recycling (% of arisings)	8%	45%	45%	18%	20%	31%	20%	17%	27%
Landfilled/ Incinerated (tonnes)	230,473	27,963	156,441	29,088	18,356	21,151	9,592	336,622	465,100
Landfilled/ Incinerated (% of arisings)	92%	55%	55%	82%	80%	69%	80%	83%	73%

Figure 1: Summary of waste plastic arisings, recycling and landfill/incineration (2009)

As can be seen from the above figure, two estimates have been developed for total plastic waste arisings. This was necessary due to the significant variation in the evidence on plastic arisings from C&I sources and highlights the need for improved data on arisings from these sources. This data is also presented by Local Authority area in the report.

These figures underline that there is significant potential to increase the tonnages of plastics recycled in Scotland.

Waste Management and Reprocessing Capacity

The plastic waste management and reprocessing capacity in Scotland comprises a wide range of activities from collection to manufacture of secondary raw materials or products. There are a wide range of collection activities delivered by both private and public sector organisations. This is supported by a number of materials recycling facilities (MRFs) and waste transfer stations that segregate comingled materials. The capacity of this part of the supply chain, which handles all dry recyclables, is estimated by the industry at almost 1,000,000 tonnes per annum.

Focusing on plastics alone, the capacity for handling, sorting and processing of segregated waste plastics, in single or mixed form, is limited. There are a number of SMEs that collect and manage waste plastic arisings for sale to reprocessors or to export markets. The capacity of this group of companies is estimated at around 25,000 tonnes per annum. The reprocessing (manufacture of secondary raw material) capacity is estimated at around 50,000 tonnes. Therefore the capacity of managing collected waste plastics in Scotland is limited.

Baseline and Projected Recycling

Implementation of The Zero Waste (Scotland) Regulations is expected to contribute significantly to an increase in recycling rate across a number of materials, including plastic. This report has projected the following increases in recycling across a range of waste sources.

Sources of plastic waste	Year					
	2009 Recycling		2014 Recycling		2025 Recycling	
	Tonnes	% of arisings	Tonnes	% of arisings	Tonnes	% of arisings
Household	21,358	8%	79,879	32%	90,981	36%
C&I (Lower)	22,878	45%	30,606	60%	32,020	63%
C&I (Upper)	127,997	45%	171,232	60%	179,139	63%
C&D	6,385	18%	24,388	69%	26,161	74%
Agriculture	4,589	20%	6,884	30%	11,473	50%
WEEE	9,502	31%	10,729	35%	12,261	40%
ELV	2,398	20%	4,197	35%	8,393	70%
Total (Lower)	67,111	17%	156,682	39%	181,289	45%
Total (Upper)	172,230	27%	297,307	47%	328,409	52%

Figure 2: Baseline and Projected Plastic Recycling by Source

Plastic recycling activity is projected to increase significantly to 2014 with between 157,000 and 297,000 tonnes being recycled. This is projected to rise at lower rates to between 181,000 and 328,000 tonnes by 2025.

Type of Plastic Waste Arisings

Each source of arisings obviously has a different assumed composition. At a broad level, the arisings of plastic film and dense plastic are shown in the figure below.

Sources of plastic waste	2009				
	Plastic Film		Dense Plastic		Total
	Tonnes	% of arisings	Tonnes	% of arisings	
Household	74,475	30%	177,356	70%	251,831
C&I (Lower)	37,623	74%	13,219	26%	50,841
C&I (Upper)	210,484	74%	73,954	26%	284,438
C&D	1,774	5%	33,699	95%	35,473
Agriculture	19,008	83%	3,937	17%	22,945
WEEE	0	0%	30,653	100%	30,653
ELV	0	0%	11,990	100%	11,990
Total (Lower)	132,879	33%	270,854	67%	403,733
Total (Upper)	305,741	48%	331,589	52%	637,330

Figure 3: Broad Plastic Type by Source of Arisings

The above data shows that the ratio of plastic film to dense plastic is sensitive to the uncertain C&I figures. A more detailed breakdown of the estimated type of plastic (PET, PP, PVC etc), by source, is provided in section 2.2 of this report.

Other Key Issues Arising

This analysis also highlights that:

- There are a range of public and private sector activities to collect waste plastics in Scotland
- These activities can be developed to increase both the quantities and quality of plastics collected for recycling
- Scotland is an integral part of the UK plastics recycling infrastructure. The majority of the waste plastics collected in Scotland is reprocessed elsewhere in the UK
- There is limited capacity in Scotland for the management and handling of collected waste plastic

- The capacity for reprocessing waste plastics in Scotland is similar to the lower estimates for recycling – although this capacity mainly processes materials from elsewhere
- Significant tonnages of material are exported to the Far East. This is typically material of lower quality

Key Conclusions

Based on the analysis carried out it is concluded that:

- It is necessary for collection, management and reprocessing activities to all be developed to increase plastic recycling levels in Scotland
- These must be developed in parallel. It is not economically practical to expect one stage of the supply chain to be developed in advance of others
- There is significant value in optimising the integration of each part of the supply chain, to optimise the quantity and quality of materials available for reprocessing
- Scotland must be considered as an integral part of the UK plastic recycling infrastructure. New initiatives that complement existing UK recycling capability will offer maximum benefit to Scotland
- Increasing the quality (in terms of materials specificity, cleanliness and contamination) of materials collected will increase the potential for local (UK) recycling of materials

Opportunities for development of the recycling capacity and infrastructure in Scotland will be identified and developed in the next stage of this study. A report that identifies, describes and models the viability of these opportunities and estimates the potential to increase recycling capacity in Scotland will be prepared in April 2012.

Contents

1. Introduction	1
1.1 Background	1
1.2 Scope of Analysis	1
1.2.1 Sources of Waste Arisings, Materials and Types of Waste	1
1.2.2 Plastics Waste Management and Processing Capacity	1
1.2.3 Management and Reprocessing of Waste Plastics	2
2. Analysis of Plastic Waste Arisings for Each Local Authority Area and for Scotland	3
2.1 Plastic Waste Arisings by Local Authority	3
2.2 Plastic Waste Arisings in Scotland	6
3. Characterisation of the Plastics Waste Management and Reprocessing Capacity in Scotland	8
3.1 Materials Collection	8
3.2 Materials Segregation	14
3.3 Plastics Handling and Sorting	16
3.4 Manufacture of Secondary Raw Material	17
3.5 Secondary Product Manufacture	18
3.6 Refuse Derived Fuel Manufacture	18
3.7 Exporting	18
4. Mapping of the Destinations of Waste Plastic Arisings	20
4.1 Management of Household Waste Plastic	20
4.2 Management of C&I and C&D Waste Plastic	22
4.3 Management of Agricultural Waste Plastic	23
4.4 Management of WEEE	23
4.5 Management of End of Life Vehicles	24
4.6 Summary - A Composite Analysis for Scotland	24
4.7 Future Trends in Plastic Waste Arisings in Scotland	28
5. Conclusions	31

Appendices (Separate document)

Appendix A – Sources of Data, Assumptions and Limitations

Appendix B – Detailed Analysis by Local Authority

Appendix C – WEEE and ELV ATFs

1. Introduction

1.1 Background

The Scottish Government's Zero Waste Plan¹ sets a vision of a closed loop economy in Scotland where the economic potential is accrued from materials arising in the waste stream. Associated targets are 70% recycling and a maximum of 5% to landfill by 2025. The Scottish Government has more recently carried out a consultation exercise² on measures to support its Zero Waste Plan. These new measures, assuming they are implemented, will place additional demands on the waste management industry and will present both opportunities and challenges for businesses.

Currently the majority of waste plastic arisings are landfilled and it is widely agreed that this is not a sustainable position.

The Scottish Government Zero Waste Plan recognised this issue and identified the need to stimulate investment in additional capacity to:

- Reduce the tonnage of plastics waste going to landfill in Scotland
- Increase the quantity of post-use plastics sorted and reprocessed back into useable feedstock for other plastic packaging and products in Scotland
- Promote projects which will displace the use of virgin plastics in the manufacturing of plastic based products by adding or increasing the plastics recycled content

However, it is also recognised that decisions on investment in new facilities can only be based on a robust understanding of the market opportunity and that this robust evidence base doesn't currently exist.

This report describes the results of work to develop a robust evidence base of plastics arisings in Scotland and how these are managed. In doing so it:

- Quantifies plastic waste arisings in each of the 32 Scottish Local Authority and for Scotland
- Details waste plastics processing capacity in Scotland
- Map how waste plastic arisings in Scotland are managed and recycled

The report therefore contributes to the development of a robust evidence base that is considered to be required to guide investment decisions. This report is the first stage of a broader project which will also identify the potential opportunities for added value reprocessing and recycling of waste plastic in Scotland. Further updates to the evidence base are planned for early 2013 and again in early 2014.

1.2 Scope of Analysis

1.2.1 Sources of Waste Arisings, Materials and Types of Waste

This study has assessed plastics arisings from the household, commercial and industrial (C&I), construction and demolition (C&D) and agricultural (Agri) waste streams. Within this scope it also identifies waste electrical and electronic equipment (WEEE) and end of life vehicle (ELV) arisings. It has detailed the tonnages arising by material (e.g. polyethylene (PE), polypropylene (PP), etc) and by type (e.g. bottle rigid, film, etc). It has carried out this assessment for each of the 32 Local Authority areas and also for Scotland as a whole.

1.2.2 Plastics Waste Management and Processing Capacity

Similarly the plastics waste management and processing capacity across Scotland has been identified by Local Authority area. It is recognised that several players are typically involved in handling waste materials from the source of arising to its use in a secondary product so a supply chain approach has been taken to this analysis. The supply chain model we have used, which highlights the key activities in plastics waste management and recycling for all sources of waste arisings included in this analysis is shown below:

¹ Scotland's Zero Waste Plan, The Scottish Government, 2010

² <http://www.scotland.gov.uk/Publications/2010/12/01105835/0>, December 2010

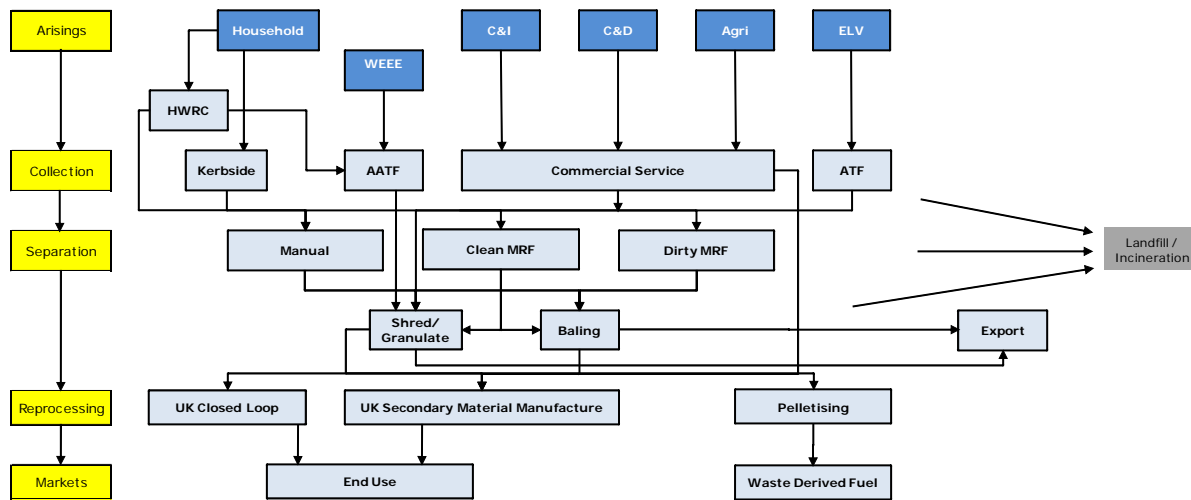


Figure 4: Plastic Waste Management and Processing Supply Chain Model

This model recognises that waste plastics are often mixed with other materials at the collection stage, materials separation activities (in materials recycling facilities (MRFs) or waste transfer stations (WTSs)) are critically important in the value adding process and companies specialising in plastics recycling typically become involved in the “downstream” stages of the supply chain.

However, it must be noted that in a number of cases it is not possible to quote actual processing capacities in Local Authority areas as the data relates to a very small number of companies and is thus commercially sensitive.

1.2.3 Management and Reprocessing of Waste Plastics

It is important that the end destination (i.e. reprocessing in Scotland, reprocessing elsewhere in the UK, exporting or landfilling) of plastic waste arisings is identified. In this analysis, the destinations of household waste plastic arisings are presented for each Local Authority by materials and type. However it has not been possible to define for C&I, C&D and Agri arisings due to the quality of data available.

2. Analysis of Plastic Waste Arisings for Each Local Authority Area and for Scotland

Estimates of plastic waste arisings were made for the following waste streams:

- Household
- Commercial & Industrial (C&I)
- Construction & demolition (C&D)
- Agriculture

In addition to these sources it was agreed to consider two specific waste streams that had a significant plastic component. These were:

- Waste Electrical & Electronic Equipment (WEEE)
- End of Life Vehicles (ELV)

To avoid double counting the WEEE and ELV waste arisings were not included in the analysis of the household, C&I, C&D and agricultural waste sources.

A detailed explanation of the data sources, assumptions and limitations is included in Appendix A.

During the data gathering phase of the project it became apparent that there were significant variations in the estimates of plastic from C&I sources, depending on the calculation methodology used. This is described in detail within Appendix A and has resulted in both a 'lower' and 'upper' estimate being provided for the C&I waste stream. Whilst the data used for other waste sources is considered to be relatively more robust than C&I it should be noted that where composition analysis data has been used to disaggregate total waste arisings to identify plastic elements (e.g. in household waste stream) any small error in composition percentage can be magnified when applied to a total arisings figure.

This section summarises the plastic waste arisings by Local Authority area and by source and also provides an overview of arisings in Scotland.

2.1 Plastic Waste Arisings by Local Authority

The figure below summarises the estimated plastic arisings by Local Authority and by source.

Local Authority	Tonnes of plastic arisings by source - 2009							Total (LOWER)	Total (UPPER)
	Household	C&I (LOWER)	C&I (UPPER)	C&D	Agriculture	WEEE	ELV		
Aberdeen City	12,506	4,162	23,285	763	6	1,591	472	19,500	38,623
Aberdeenshire	14,950	2,108	11,795	1,546	2,711	1,327	762	23,405	33,091
Angus	5,824	739	4,135	3,391	406	614	303	11,276	14,671
Argyll & Bute	5,010	699	3,910	93	883	517	231	7,433	10,644
Clackmannanshire	2,515	301	1,683	0	46	274	120	3,257	4,639
Dumfries & Galloway	9,666	1,174	6,570	147	2,323	853	421	14,585	19,981
Dundee City	6,932	1,481	8,285	621	0	913	257	10,203	17,007
East Ayrshire	5,620	733	4,103	344	587	646	280	8,211	11,580
East Dunbartonshire	6,534	516	2,885	66	48	509	252	7,925	10,294
East Lothian	5,558	547	3,061	2,306	434	508	238	9,592	12,106
East Renfrewshire	4,034	404	2,260	357	20	422	209	5,447	7,302
Edinburgh, City of	16,852	6,313	35,320	2,174	7	3,055	807	29,208	58,215
Eilean Siar	1,265	203	1,138	47	1,461	149	75	3,200	4,134
Falkirk	7,574	1,237	6,923	1,537	71	862	363	11,644	17,330
Fife	16,075	2,624	14,679	247	1,031	1,990	854	22,821	34,877
Glasgow City	27,848	8,639	48,333	8,322	0	3,998	1,079	49,887	89,581
Highland	10,486	2,229	12,468	824	3,379	1,324	617	18,858	29,098
Inverclyde	3,515	590	3,301	8	119	453	156	4,841	7,552
Midlothian	3,665	559	3,125	1,797	196	431	193	6,841	9,407
Moray	4,390	730	4,087	243	1,138	495	241	7,238	10,594
North Ayrshire	4,935	831	4,647	2,321	373	744	295	9,499	13,316
North Lanarkshire	15,368	2,632	14,728	3,663	110	1,820	680	24,274	36,369
Orkney	805	169	946	0	679	117	69	1,837	2,614
Perth & Kinross	7,206	1,392	7,788	1,087	2,524	844	392	13,444	19,841
Renfrewshire	8,974	1,896	10,609	1,971	50	1,056	367	14,313	23,026
Scottish Borders	5,167	871	4,872	399	1,363	644	324	8,767	12,768
Shetland Islands	1,634	232	1,298	20	734	130	68	2,818	3,884
South Ayrshire	5,344	1,014	5,673	346	396	658	271	8,029	12,688
South Lanarkshire	17,269	2,529	14,151	150	958	1,729	700	23,335	34,957
Stirling	3,255	968	5,417	58	570	512	261	5,625	10,073
West Dunbartonshire	4,236	559	3,125	104	58	500	225	5,682	8,248
West Lothian	6,818	1,759	9,840	519	265	972	408	10,739	18,820
Total plastic arisings	251,831	50,841	284,438	35,473	22,945	30,653	11,990	403,733	637,330

Figure 5 - Estimated Plastic Waste Arisings by Local Authority Area and Source

The above figure shows the importance of the household waste stream with C&I sources also contributing a significant amount to the total arisings (particularly the upper estimate).

The graphs below show the data graphically, first for the lower estimate and secondly for the upper estimate.

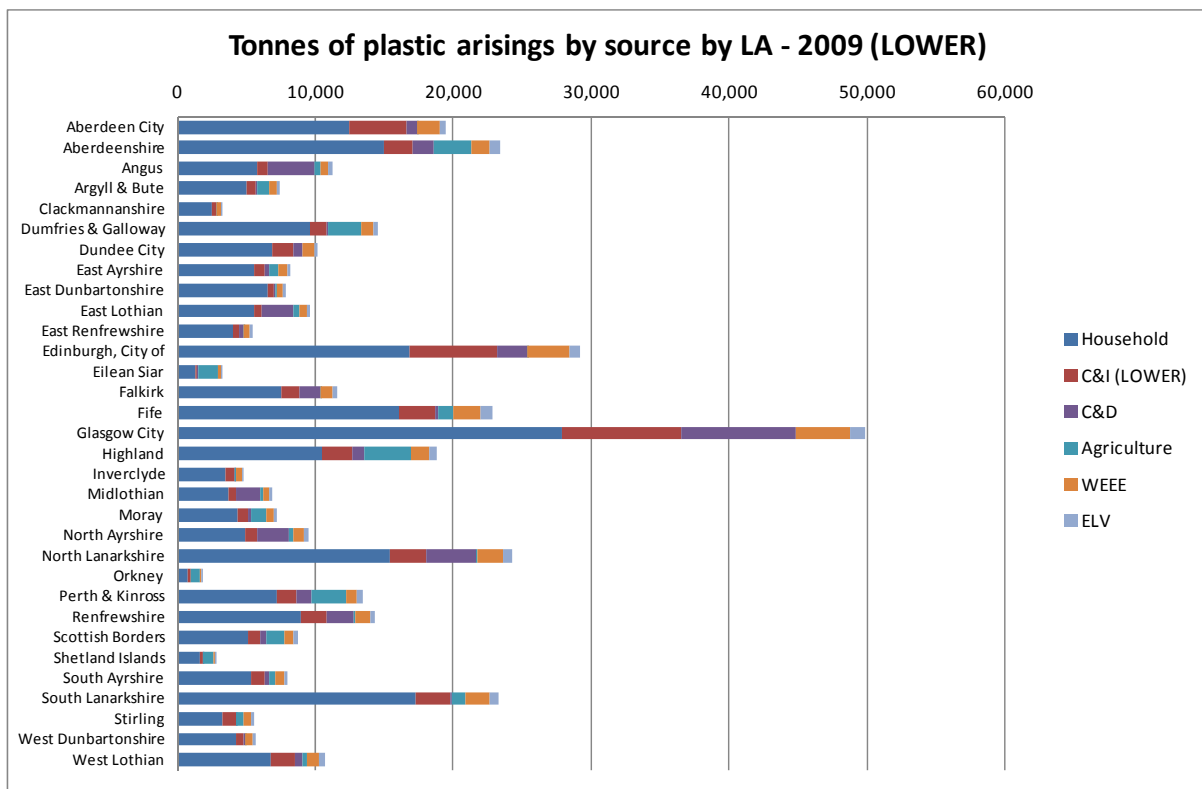


Figure 6 - Lower Estimate of Plastic Waste Arisings by Local Authority Area and Source

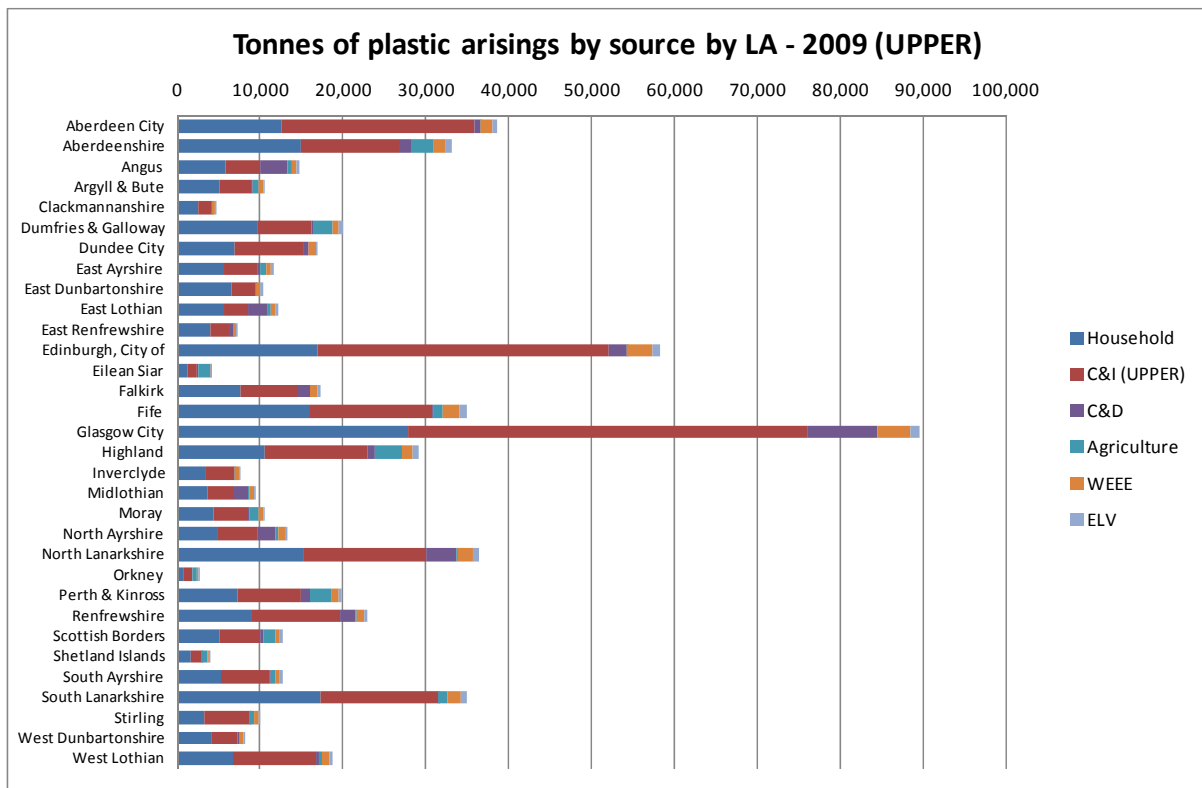


Figure 7 - Upper Estimate of Plastic Waste Arisings by Local Authority Area and Source

A detailed breakdown of the plastic arisings in each Local Authority is provided in Appendix B.

2.2 Plastic Waste Arisings in Scotland

Estimated plastic waste arisings in Scotland are summarised in the figure below.

Household		Tonnes
	Carrier bags	20,959
	Bin bags	14,655
	Plastic packaging film	31,788
	Other plastic film	7,073
	Total plastic film	74,475
	1. PET drink bottles	30,316
	1. Other PET packaging	12,175
	2. HDPE drink bottles	16,842
	2. Other HDPE	7,870
	3. PVC	953
	5. PP	21,681
	6. PS	7,801
	7. EPS	4,522
	Other dense plastic packaging	32,715
	Other dense plastic	42,481
	Total Dense Plastic	177,356
	Sub total households	251,831
C&I		Tonnes
	LOWER ESTIMATE	50,841
	UPPER ESTIMATE	284,438
	<i>Commercial mainly plastic film</i>	
	<i>Industrial mainly dense plastic</i>	
C&D		Tonnes
	PVC	16,672
	EPS/XPS/PU (Insulation)	6,385
	HDPE/LDPE	6,385
	Other	6,030
	Sub total C&D	35,473
Agriculture		Tonnes
	LDPE (Film)	19,008
	PP (Bale/Twine)	2,152
	HDPE (Netwrap)	1,242
	HDPE (Liquid containers)	301
	Silage Cores (mixed)	133
	Plastic oil drums	109
	Sub total Agriculture	22,945
WEEE		Tonnes
	Dense Plastic	30,653
	Sub total WEEE	30,653
ELV		Tonnes
	PP	7,074
	PU	2,158
	PE	1,079
	ABS	600
	Other	1,079
	Sub total ELV	11,990
TOTAL	LOWER ESTIMATE	403,733
	UPPER ESTIMATE	637,330

Figure 8 - Summary of Plastic Waste Arisings in Scotland

A detailed description of how the above data are derived is given in Appendix A. In summary, the key data sources identifying the breakdown of polymer type are:

- Household – The Composition of Municipal Solid Waste in Scotland, Zero Waste Scotland, April 2010 – provides a composition analysis of residual collected waste, kerbside dry recyclables, household waste recycling centre waste and street litter collections. This is combined with total waste arisings figures for each of these waste streams from Waste Data Flow to estimate total household arisings by the categories shown
- C&I – There is limited robust data on the arisings of C&I and the estimation of the upper and lower range of plastic arisings is described in detail in Appendix A. There is also limited robust information on the polymer composition of plastics from the C&I waste stream. For this report we have assumed that plastic from the commercial waste stream consists of plastic film (any WEEE is considered separately) and plastic from the industrial waste stream consists of dense plastic. It is acknowledged that this is a simple generalisation of the C&I waste stream and reflects the fact that no alternative evidence on composition was identified. The plastic waste arisings in C&I have been broken down to commercial (74%) and industrial (26%) based on data on the structure of the Scottish economy sourced from the Scottish Government (stating that Scotland has a 'service' element of around 74% - which is assumed to be equivalent to 'commercial')
- C&D – Data on the polymer breakdown of waste plastic from C&D sources is also limited. The breakdown used in this model is estimated using plastic consumption data (and assuming a 1:1 relationship between consumption and waste arisings) from APRICOD Guide – Towards Sustainable Plastic Construction and Demolition Waste Management in Europe
- Agricultural – The plastic type categories used in the above figure are those reported by SEPA via its Non-natural Agricultural Waste Arisings model
- WEEE – all plastic arisings from WEEE are assumed to be dense plastic. Data to enable further refinement of polymer type was not identified during this research. While there were some reports examining the composition of small mixed WEEE no evidence could be found regarding the plastic polymer composition of 'average WEEE' covering all categories
- ELV – The breakdown of the typical composition of plastic types has been sourced from the Assessment of the Environmental Advantages and Drawbacks of Existing and Emerging Polymers Recovery Processes – Annexes to Final Report, JRC, (Delgado et al), 2007

3. Characterisation of the Plastics Waste Management and Reprocessing Capacity in Scotland

Collation of the plastics waste management and reprocessing capacity in Scotland requires analysis of all activities in the supply chain model shown in Figure 4. This segments capacity into seven activities:

- Materials collection
- Materials segregation – separation of plastics into a mixed or single stream for supply to the plastics recycling industry
- Plastics handling and sorting – adding value to plastics in mixed or single stream form for supply to UK processing or export markets
- UK manufacture of secondary raw material - manufacture of recyclate in pellet form that can be used for secondary product manufacture
- UK secondary product manufacture
- Waste derived fuel manufacture
- Exporting

However, it must be noted that, often, not all activities are carried out, either due to the quality / form of the material or because some of these are competitive alternatives (e.g. manufacture of secondary raw material and exporting).

At the collection and segregation stages of the supply chain there are some activities that collect mixed / comingled materials and others that are customised for specific sources of waste arisings. When plastics are segregated from other wastes and are being processed to add value then the materials are handled in similar ways regardless of the source of arisings.

The capacity and key players delivering each of the above activities are described in the following sections.

3.1 Materials Collection

Household Waste

The collection services offered by Local Authority for household waste are currently as follows³:

³ Analysis of data from a survey carried out as part of this study. 30 out of the 32 local authorities responded to the survey. Midlothian and Shetland Councils were the non-respondents.

Local Authority Area / Household Collections	Types of Plastic Collected								Collection System - Kerbside		
	Bottles	Film	Polystyrene	Pots	Trays	Tubs	Other Dense Plastics	Other	Comingled	Source Segregated	Both
Aberdeen City Council	•									•	
Aberdeenshire Council	•									•	
Angus Council	•					•		clean food containers		•	
Argyll and Bute Council	•			•	•	•					•
Clackmannanshire Council	•			•	•	•			•		
Dumfries and Galloway Council	•								•		
Dundee City Council	•			•	•	•				•	
East Ayrshire Council	•			•	•	•					•
East Dunbartonshire Council	•									•	
East Lothian Council	•					•	meat trays				•
East Renfrewshire Council	•			•		•				•	
Edinburgh, City of Council	•										•
Falkirk Council	•			•	•	•			•		
Fife Council	•								•		
Glasgow City Council	•								•		
Highland Council	•								•		
Inverclyde Council	•			•	•	•			•		
Moray Council	•								•		
North Ayrshire Council	•								•		
North Lanarkshire Council	•			•	•	•			•		
Orkney Islands Council	•						shampoo bottles		comingled with kerbside sort		
Perth & Kinross Council	•				•	•			•		
Renfrewshire Council	•			•	•	•		cartons/tetrapak	•		
Scottish Borders Council	•	•		•	•	•		not black trays	•		
South Ayrshire Council	•								•		
South Lanarkshire Council	•			•	•	•	shampoo bottles, etc		•		
Stirling Council	•								•		
West Dunbartonshire Council	•								•		
West Lothian Council	•						shampoo bottles, etc		•		
Western Isles Council	•	•	•	•	•	•					•

Figure 9: Local Authority Collection Activities

This shows that bottles are collected by all authorities and that in a number of authorities, pots, trays and tubs are also collected. It also highlights that comingled collection is the preferred approach.

In addition the majority of Local Authority offer “bring” facilities at civic amenity and other sites as follows⁴:

⁴ Further analysis of data from a survey carried out as part of this study.

Local Authority Area / Household Bring Sites	CA Site		Other Bring Site	
	Comingled	Segregated	Comingled	Segregated
Aberdeen City Council		•	•	
Aberdeenshire Council		•		•
Angus Council		•		•
Argyll and Bute Council	•	•	•	•
Clackmannanshire Council	•		•	
Dumfries and Galloway Council	•			
Dundee City Council		•	•	•
East Ayrshire Council		•		•
East Dunbartonshire Council		•		•
East Lothian Council		•		
East Renfrewshire Council	•		•	
Edinburgh, City of Council	•		•	
Falkirk Council	•	•		
Fife Council	•		•	
Glasgow City Council	•		•	
Highland Council		•		
Inverclyde Council	•	•	•	
Moray Council	•		•	
North Ayrshire Council	•			
North Lanarkshire Council		•		
Orkney Islands Council	•	•		
Perth & Kinross Council	•		•	
Renfrewshire Council	•		•	
Scottish Borders Council	•			
South Ayrshire Council	•	•	•	
South Lanarkshire Council	•			
Stirling Council		•		
West Dunbartonshire Council	•		•	
West Lothian Council	•	•		
Western Isles Council		•		

Figure 10: Local Authority Bring Sites

This shows a relatively even balance between co-mingled and segregated facilities at Civic Amenity sites and a preference for comingled collection at other bring sites (Local Authority were not asked to provide a breakdown of plastic types accepted at the bring sites – just whether they were comingled or source segregated).

Commercial and Industrial / Construction and Demolition

These sources of arisings are considered together as the majority of providers of waste management services address both sources of waste arisings and typically do not differentiate between them. Services for collection of both comingled and single stream wastes are available from both Local Authority and private waste management companies, while specialist companies (e.g. those listed in Sections 3.3 and 3.4 below) focus on collection of single stream or mixed plastic waste arisings from C&I and C&D sources.

Local Authority trade waste collection provision can be summarised as follows⁵:

⁵ Further analysis of data from a survey carried out as part of this study.

Local Authority Area / Trade Waste Collections	Trade Waste Collection Offered		Type of Collection			Type of Plastic Collected							
	Yes	No	Comingled	Segregated	Both	Bottles	Film	Polystyrene	Pots	Trays	Tubs	Other Dense Plastic	Other
Aberdeen City Council		•											
Aberdeenshire Council	•			•		•	•						
Angus Council	•				•	•		•		•	•		
Argyll and Bute Council	•				•	•			•	•	•		
Clackmannanshire Council	•		•			•			•	•	•		
Dumfries and Galloway Council		•											
Dundee City Council	•			•		•							
East Ayrshire Council	•			•		•				•			
East Dunbartonshire Council		•											
East Lothian Council		•											
East Renfrewshire Council	•			•		•			•		•		
Edinburgh, City of Council	•		•			•						shampoo bottles, etc	
Falkirk Council	•		•			•			•	•	•		
Fife Council		•											
Glasgow City Council	•		•			•							
Highland Council	•		•			•							
Inverclyde Council		•											
Moray Council		•											
North Ayrshire Council	•		•			•							
North Lanarkshire Council		•											
Orkney Islands Council	•		•			•						shampoo bottles, etc	
Perth & Kinross Council		•											
Renfrewshire Council	•		•			•			•	•	•		
Scottish Borders Council	•		•			•	•		•	•	•		
South Ayrshire Council	•		•			•							
South Lanarkshire Council	•		•			•			•	•	•	pool bottles, etc	
Stirling Council	•			•		•							
West Dunbartonshire Council	•		•			•							
West Lothian Council	•				•	•						bottles only	
Western Isles Council	•			•		•				•			

Figure 11: Analysis of Trade Waste Recycling Collection Services Delivered by Local Authority

This shows that the majority of councils (70%) provide trade waste services, comingled collections are preferred (~70%) and bottles are collected by all providing a service. It should be noted that, at this stage in the recycling supply chain that the focus is on the type of waste product (e.g. bottle, tub or tray) rather than the material.

In terms of the private sector, the provision of commercial waste management services to the C&I and C&D communities is delivered by a wide range of different companies. A number of the key companies, showing the range of different types of operation, are listed below⁶.

⁶ In-house Optimat data, information from Zero Waste Scotland and the online MRW Directory (Dec 2011)

Company	Location	Post-Code	Company	Location	Post-Code
60 North Recycling Limited	Shetland	ZE1 0PY	Levenseat Ltd	Lanark	ML11 8EP
All Waste Recycling Ltd	Airdrie	ML6 8RL	Lomond Recycling Ltd	Glasgow	G1 3DX
Alloa Community Enterprises Ltd	Alloa	FK10 2AL	Lowmac Alloys Ltd	Irvine	KA11 5AR
Argyll Resources Group	Oban	PA34 4PL	Moffat Can	Moffat	DG10 9HB
Armstrong Waste Management	Dumfries	DG2 0EF	Munro	Alness	IV17 0PG
Augean plc	Paisley	PA3 1RB	New Town Skips Ltd	Motherwell	ML1 1PR
Avanti Environmental Group	Stirling	FK9 4TU	Northern Recycling Solutions Ltd	Invergordon	IV18 0QR
Banff Environmental Action Team	MacDuff	AB44 1QD	Oakbank Services Ltd	Dumfries	DG1 4PH
Biffa Waste Services Ltd	Aberdeen	AB12 3BQ	Oran Environmental Services	Grangemouth	FK3 9UB
Biffa Waste Services Ltd	Edinburgh	EH5 1QG	Patersons Waste Management	Glasgow	G32 8JF
Biffa Waste Services Ltd	Cambuslang	G32 8RG	Recycled Scotland	Leith	EH6 8QX
Binn Skips Ltd	Glenfarg	PH2 9PX	Recycling Solutions Ltd	Linlithgow	EH49 6LH
Blue Group	Stirling	FK9 7ST	Ross and Fullerton Ltd	Greenock	PA15 2BU
Bowman Skip Hire	Fort William	PH33 7AW	Scotnet Recycling Ltd	Buckie	AB56 1UQ
Burnside Recycling Ltd	Kennoway	KY8 5JN	Scotwaste Recycling Solutions Ltd	Bathgate	EH48 2HR
Can Do Community Recycling	Fraserburgh	Ab43 9SU	Shanks Waste Solutions	Glasgow	G21 2RL
Can Do Recycling Ltd	Glasgow	G73 1UZ	Shanks Waste Solutions	Broxburn	EH52 6PG
Changeworks Recycling	Edinburgh	EH6 5PY	Shanks Waste Solutions	Aberdeen	AB12 3BQ
Chris Baylis Ltd	Stirling	FK7 7SN	Shanks Waste Solutions	Dingwall	IV16 9XJ
D J Laing (Contracts) Ltd	Dundee	DD2 4SH	Shanks Waste Solutions	Dumfries	DG1 3PG
D Shaw Ltd	Larkhall	ML9 2UJ	Simple Waste Solutions Ltd	Glasgow	G81 1RG
Dalkeith Demolition	Mayfield	EH22 4AD	Sims Recycling Solutions	Dumfries	DG2 0NR
David Morton (Larbert) Ltd	Larbert	FK1 2BQ	SITA	Aberdeen	AB12 3BG
David Ritchie and Sons Ltd	Carr-Bridge	PH23 3AD	SITA	Glenfarg	PH2 9PX
Davidson of Rora Ltd	Peterhead	AB42 4UT	Smurfit Kappa Recycling Ltd	Glasgow	G41 1LT
Dow Waste Management	Cumbernauld	G67 2RL	Stephen Dalton Skip Hire Ltd	Edinburgh	EH12 9BU
E. Nicholsons Ltd	Glasgow	G22 6NX	STIR Network	Edinburgh	EH7 5QZ
easyWaste Solutions Ltd	Glasgow	G81 1RG	Stirling Fibre Ltd	Kilsyth	G65 9TS
EIS Waste Services	Aberdeen	AB12 4LP	T.O.M. Waste Solutions	Newarthill	ML1 5ST
Enviroco Ltd	Peterhead	AB42 3GL	Taylor's Industrial Services	Aberdeen	AB12 3LY
Envirokleen Ltd	Kirkcaldy	KY1 3NL	Tayside Agri-Waste	Aberfeldy	PH15 2EA
Forth Valley Recycling and Packaging Ltd	Denny	FK6 5DW	TWMA	Aberdeen	AB12 3BN
GREAN	Golspie	KW10 6RN	Veolia	Aberdeen	AB12 3BG
Greenlight Environmental	Greenock	PA15 4UE	Veolia	Falkirk	FK2 7UY
Greenlight Environmental	Alexandria	G83 0TL	Veolia	Grangemouth	FK3 9XB
Hamilton Waste Ltd	Musselburgh	EH21 8QJ	Viridor	Glasgow	G69 7RW
Highland Waste Services	Invergordon	IV18 0LE	Viridor	Edinburgh	EH17 8RY
Innovative Environmental Services Ltd	Falkirk	FK1 4AX	WasteCare Ltd	Livingston	EH54 5DR
J&M Murdoch	Neilston	G78 3NA	William Tracey Ltd	Linwood	PA3 3BD
J&M Murdoch	Glasgow	G53 7SP	William Tracey Ltd	Broxburn	EH52 5ND
J Gordon Williamson Ltd	Moray	IV30 1XZ	William Tracey Ltd	Glenrothes	KY6 2SY
Junk Me	Glasgow	G45 9UH			

Figure 12: Key Waste Management Companies Operating in Scotland

This highlights that these services are delivered by a combination of

- Waste management plcs that operate a wide range of waste management and recycling facilities on a UK wide basis (e.g. Biffa Waste Services and Viridor)
- Locally owned SME waste management companies (e.g. Nicholsons)
- Third sector organisations (e.g. Alloa Community Enterprises Ltd)
- Locally owned SME MRF operators (e.g. Dow Waste Management and Envirokleen)

The location of these businesses can be shown as follows:

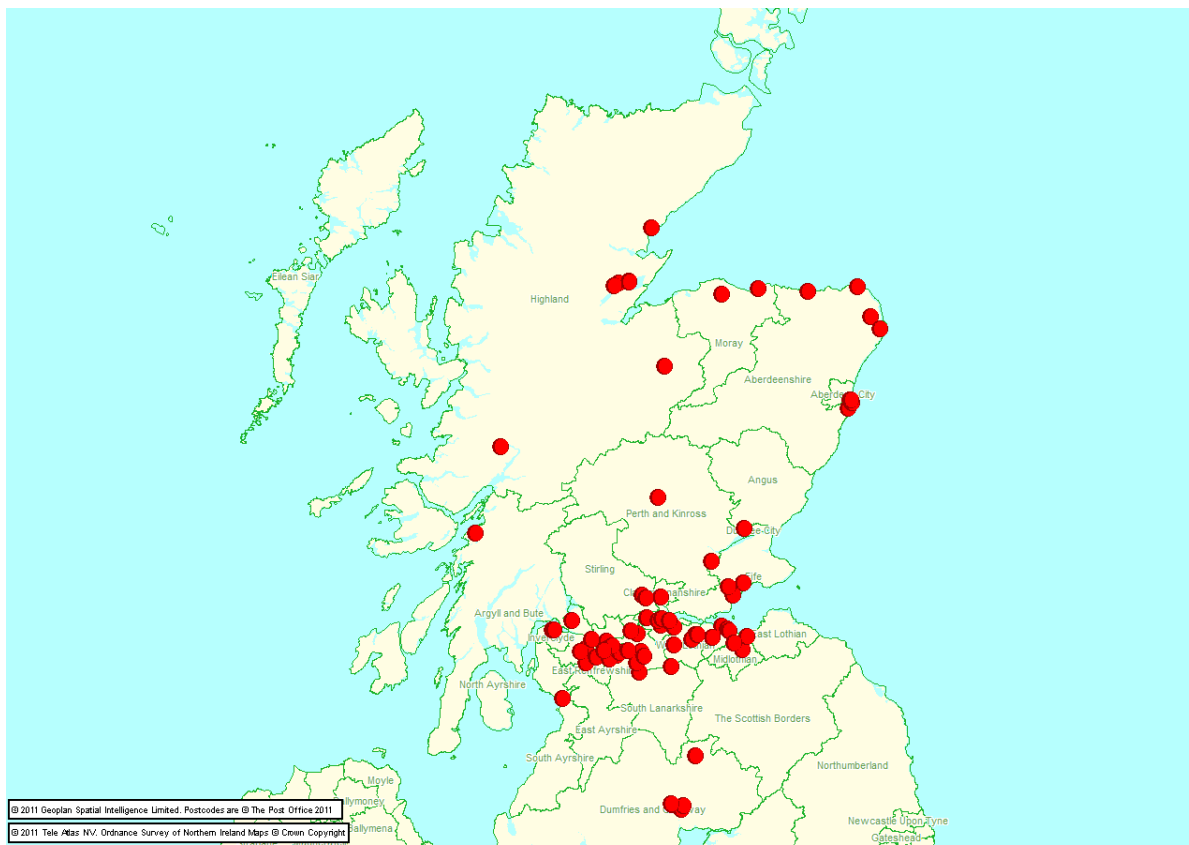


Figure 13: Locations of Key Waste Management Companies

Note: In addition there is one business listed that is located in Shetland.

This shows a strong correlation with the concentration of industrial activity in Scotland. Further, this company capability indicates a significant resource for the collection of waste arisings from C&I and C&D sites.

Agricultural Waste

A network of companies has been established to collect waste plastics from the agricultural sector. Solway Plastics Ltd, based in Dumfries is the leader in this activity, concentrating collection activities on Southern and Central Scotland. It also has a number of feeder companies. These include companies such as Tayside Agri-Waste and North of Scotland Plastic Recycling that collect, bulks up material and supplies to Solway Plastics Ltd. This network is continually developing but it is recognised that it is more developed in Southern Scotland and effort needs to be made to establish a similar service in the North of Scotland.

WEEE and ELV

WEEE and ELV are typically addressed by authorised treatment facilities – these are detailed in the following section.

3.2 Materials Segregation

Materials segregation activities are generally carried out in MRFs and WTSs. These facilities are typically handling materials from municipal, C&I and C&D sources and their objective is to separate mixed (comingled) materials into single stream materials that can be used for added value processing or for export. Some of the companies shown in the Figure below also hold export licences.

Waste management contractors that handle C&I and C&D waste arisings are increasingly trying to segregate a range of materials and supply these to recycling 2RL companies rather than send to landfill. The majority of these companies are essentially employing staff to manually separate these materials. These companies are not restricted by the availability or scale of equipment. They essentially have a variable capacity as they can adapt the scale of their workforce to suit the amount of materials available. Although a very basic operation it has the potential to significantly increase the amount of materials being recycled. There are numerous of these companies throughout Scotland.

Of course MRFs are much more sophisticated, high investment operations that mainly focus on municipal solid waste arisings, although often these are run by commercial companies.

The main MRFs and major WTSs are listed in the following table⁷ and their locations shown in the adjacent map:

Operator	Location	Postcode
Argyll Resources Group	Oban	PA34 4PL
Biffa	Glasgow	G32 8RG
Binn Skips Ltd	Glenfarg	PH2 9PX
Dow Waste Management	Cumbernauld	G67 2RL
East Ayrshire Council	Kilmarnock	KA1 2RT
E. Nicholsons Ltd	Glasgow	G22 6NX
Envirokleen Ltd	Kirkcaldy	KY1 3NL
Glasgow City Council	Glasgow	G42 0JP
Greenlight Environmental	Inverclyde	PA15 4UE
Hamilton Waste Ltd	Musselburgh	EH21 8QJ
Lowmac Alloys Ltd	Irvine	KA11 5AR
New Town Skips Ltd	Motherwell	ML1 1PR
Oran	Grangemouth	FK3 9UX
Scotwaste Recycling Solutions Ltd	Bathgate	EH48 2HR
SITA	Aberdeen	AB12 3BG
Shanks Waste Solutions	Glasgow	G21 2RL
Shanks Waste Solutions	Broxburn	EH52 5NP
Shanks Waste Solutions	Aberdeen	AB12 3BQ
Stirling Fibre Ltd	Kilsyth	G65 9TS
Viridor	Glasgow	G69 7RW
William Tracy	Linwood	PA3 3BD
William Tracey Ltd	Glenrothes	KY6 2SY
ACE Recycling Group	Alloa	FK10 2AL
Avondale	Clackmannan	FK10 4JA
EIS Waste	Aberdeen	AB12 4LP
Stirling Fibre Ltd	Kilsyth	G65 9TS
William Tracey Ltd	Broxburn	EH52 5ND

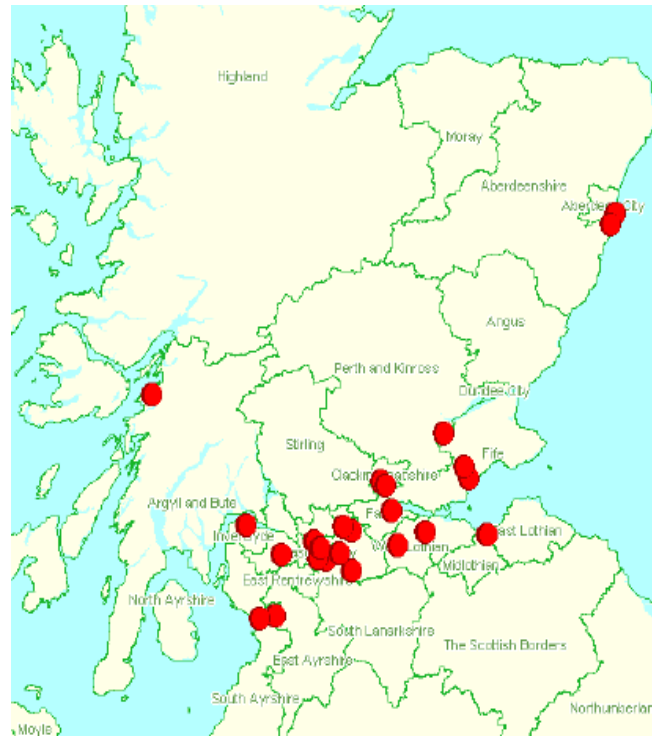


Figure 14: Major MRFs and WTSs **Figure 15: Geographic Distribution of MRF Facilities**

Based on industry input it is estimated that as much as 1,000,000 tonnes per annum of materials segregation capacity is available in Scotland. A number are used to segregate co-mingled household waste and several are directly linked to Local Authority contracts.

For WEEE and ELV the approved authorised and authorised treatment facilities (AATFs and ATFs) can also be considered as materials segregation facilities as they carry out the initial dismantling and segregation of waste products. The amount of value added in these facilities depends on the business focus of specific companies. Some companies (for example CCL North in the case of WEEE) carry out a significant amount of added value activities whereas others do the minimum of processing.

⁷ Sources include

- a) *Market Scenarios for Municipal MRF Tonnage up to 2015, WRAP Report prepared by Optimat, March 2009*
- b) *Additional data from Zero Waste Scotland and Optimat*
- c) *Web-based research*

Currently there are around 40 WEEE AATFs and almost 140 ELV ATFs in Scotland⁸. The geographic distribution of these facilities is shown in the following Figures.

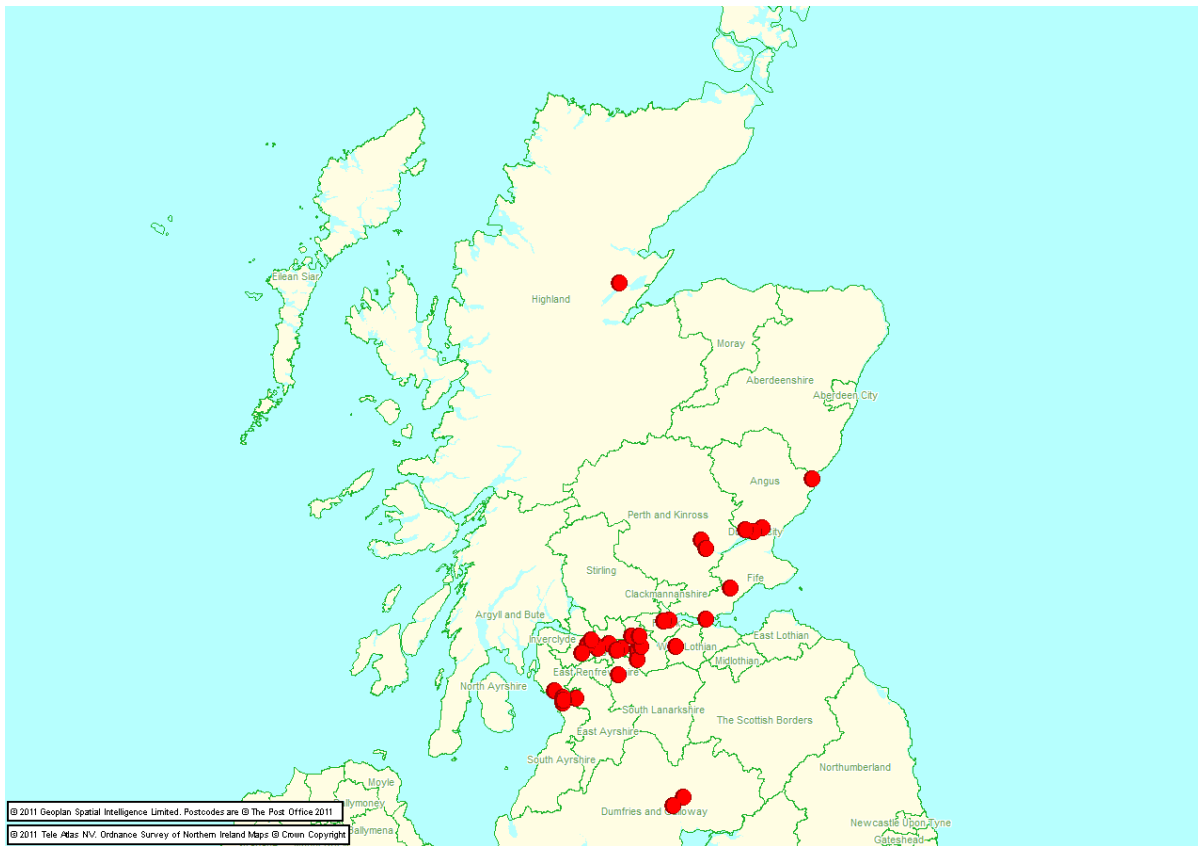


Figure 16: Approved Authorised Treatment Facility for WEEE

This highlights that a number of Local Authority do not have WEEE AATFs in their area further underlining the transfer of waste arising across Local Authority boundaries.

⁸ http://www.sepa.org.uk/waste/waste_regulation/producer_responsibility/weee/public_register.aspx and http://www.sepa.org.uk/waste/waste_regulation/producer_responsibility/end_of_life_vehicles.aspx

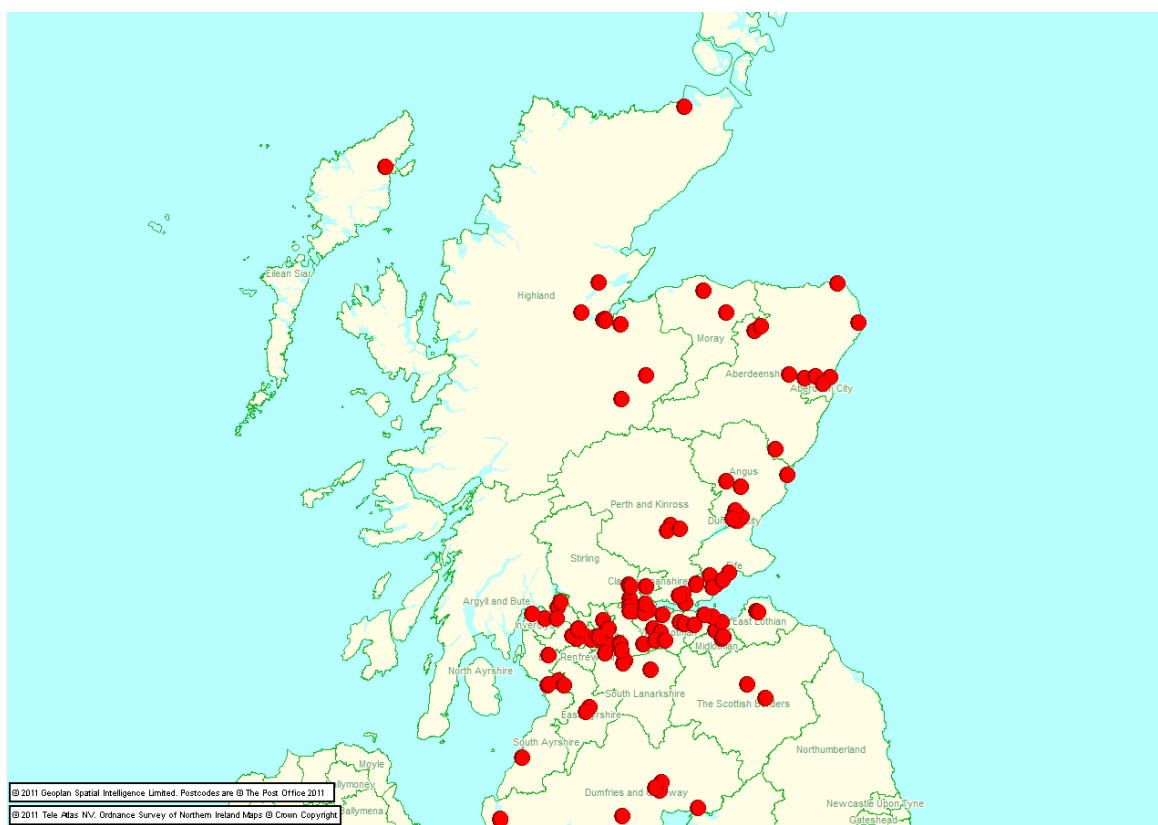


Figure 17: Authorised Treatment Facilities for End of Life Vehicles

There is also an ATF on the Shetland Islands.

3.3 Plastics Handling and Sorting

This is an important group of companies in the supply chain that collect single stream or mixed plastic from a number of sources of arisings (e.g. C&I and C&D sources) and from waste management companies operating MRFs and WTFs. These companies typically, where required, separate and bale material for supply to UK companies that process materials or to agents that export materials (mainly to the Far East). Some of these companies also have export licences and can supply export markets directly.

If these companies access large volumes of single stream materials they supply directly to the next stage in the supply chain without carrying out any sorting / baling activities.

These companies can be listed as follows:

Organisation	Address	PostCode	Company Type			Brief Description of Activities
			SME - locally owned	SME - Subsidiary	Large Company	
Abnor Protector Supplies Ltd.	Broomhill Road, Stonehaven	AB39 2NH	•			Manufacture and recycling of thread protectors
Alex Robertson and Son	Hayfield Industrial Estate, Hayfield Place, Kirkcaldy	KY2 5DH	•			Polypropylene recycling service
Avanti Environmental Ltd	Back Road, Alva	FK12 5NZ			•	Plastics reprocessing (food containers, wheelle bins, paint can)
CK Polymers	Charlesfield, St Boswells	TD6 0HH		•		Recycle rigid plastics, mainly PE
Mainetti (UK) Ltd	Oxnam Road, Jedburgh	TD8 6NN		•		Manufacturer and recycler of clothes hangars
Norkram Ltd	Longside Airfield Industrial Estate, Peterhead	AB42 3DY	•			Manufacture and recycling of thread protectors
North of Scotland Plastic Recycling	Whynieton, Maud, Peterhead	AB42 5SA	•			PE and PP recycling service - specialises in AWP
PG Products Ltd	27-30 McGowan Street, Paisley	PA3 1QJ	•			Collection and management of dry recyclables
Polyfarm Recycling Ltd	Nobel Road, Wester Gourdie Industrial Estate, Dundee	DD2 4UH	•			Collection and management of plastics and other dry recyclable
R M Easdale Ltd (inc Braehead Metals)	65-77 Washington Street Glasgow	G3 8BB	•			Waste materials processing
Recycled Packaging Ltd	10 Muriel Street, Barrhead	G78 1QB	•			Dry waste collection and recycling
Rosco Drum Services	25 Broad Place, Peterhead	AB42 6JD	•			Collection and reuse of plastic drums
Solway Recycling Ltd	Righead Farm, Shawhead, Dumfries	DG2 9SH	•			Recycling of farm plastics
Trident Recycling Ltd	428 Helen Street, Glasgow	G51 3HR	•			Collection, segregation and resale of waste plastics
wrc Recycling Ltd	Floors Street, Johnstone	PA5 8QS	•			Collection, baling and granulation of a range of waste plastics
Wyllie Recycling Ltd	Ruthvenfield Way, Inveralmond Industrial Estate, Perth	PH1 3UF	•			Waste management services and materials processing
BPI Recycled Products Ltd	96 Port Glasgow Road, Greenock	PA15 2RP		•		Reprocessing of waste polythene
BPI Recycled Products Ltd	College Road, Dumfries	DG2 0BU		•		Reprocessing of waste polythene
PET Processors (UK) LLC	Garroch Business Park, Garroch Loaning, Dumfries	DG2 8PN		•		Recycling of process waste

Figure 18: Plastics Handling and Sorting Companies

As shown, this list is mainly composed of SMEs, many of which are owner-managed. Most of these companies handle a range of materials.

The capacity of a number of these companies is considered commercially sensitive and is not available for publication. However, the combined annual processing capacity of the companies listed in the figure above is estimated to be around 25,000 tonnes. This is obviously a modest capacity compared to the tonnages arising of waste management in Scotland

In addition, as well as being customers, all of the UK companies that manufacture secondary raw materials compete with plastics handling and sorting companies for access to materials, especially those materials that are available in larger volumes.

3.4 Manufacture of Secondary Raw Material

There are three companies with facilities in Scotland to manufacture secondary raw material from waste plastic. These are

■ British Polythene Industries

BPI is a major UK polythene film processing and recycling company. Its BPI Recycled Products division operates a plant in Dumfries to process waste agricultural film that can process 30,000 tonnes of waste film every year⁹.

■ PET Processors LLC

A US owned company with a facility in Dumfries for recycling PET process waste. The company has a processing capacity of 18,000 tonnes per annum¹⁰.

■ Polymer Technology Services Ltd (PTS)

PTS is an independent company, also based in Dumfries that processes a range of waste plastics into secondary raw materials for sale in to the plastics processing industry.

However, it must be noted, that limited tonnages of Scottish arisings of plastic waste are reprocessed in these facilities. These three companies typically process materials from elsewhere in the UK and from Ireland. This is discussed further below. So despite the location of three significant plastics reprocessing companies in Scotland the amount of Scottish material processed by them is low.

⁹ <http://www.bpipoly.com/news.aspx?id=204>

¹⁰ <http://www.petuk.com/about-us>

The location of plastics handling and sorting companies and secondary raw materials manufacturing companies can be shown as follows:

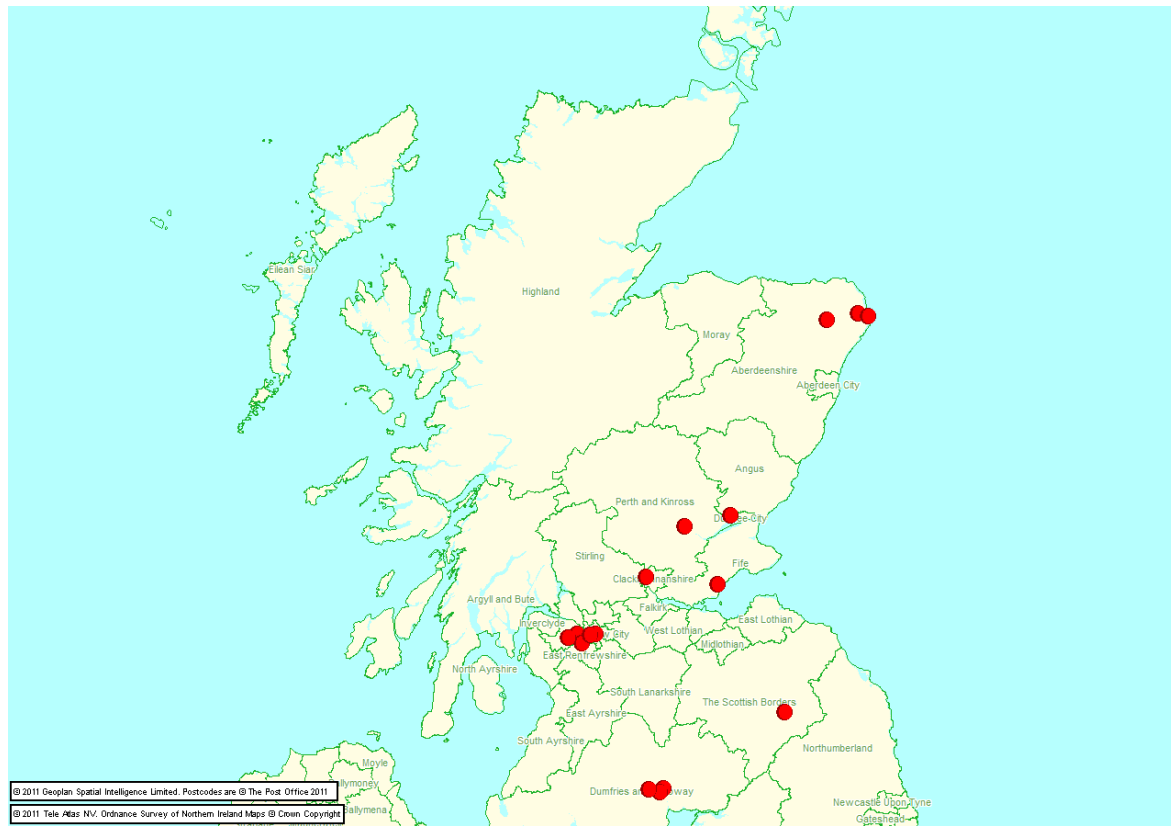


Figure 19: Location of Plastics Handling and Reprocessing Companies

This figure shows the Local Authority where these companies are located and highlights again that a number of Local Authority do not have facilities of this type in their area.

3.5 Secondary Product Manufacture

The following companies were identified that manufacture products from 100% recycled materials:

- Visqueen Building Products, a subsidiary of British Polythene Industries that has been operating a manufacturing plant in Dumfries since 1995. It produces the Plaswood range of plastic wood furniture and is closely linked to the co-located BPI Recycled Products facility.

Of course a number of companies source recycled materials to make up a percentage of their raw materials. These companies are wide and varied and are not considered part of the recycling supply chain for the purposes of this project (although it is acknowledged that they play an important role in driving demand for recycled materials).

3.6 Refuse Derived Fuel Manufacture

The British Plastics Federation's Film Working Group report that trials of repeated manual sorting of waste containing household plastic film, using the latest reprocessing technology can result in a marketable product being produced. These trials found that approximately 50% of the plastic waste film recovered was only suitable for use as a Refuse Derived Fuel (RDF)¹¹. There is a strong demand for RDF from mainland Europe¹² where the market for it is more mature than in the UK. Anecdotal evidence from stakeholders suggests that this is destination for some of the plastic arisings from Scotland.

3.7 Exporting

¹¹ http://www.bpf.co.uk/Recycling/Working_Groups/Films.aspx

¹² <http://www.letsrecycle.com/news/latest-news/waste-management/waste-fuel-permitted-for-export-tops-a-million-tonnes>

Two companies are included in the current SEPA public register¹³ of accredited exporters of packaging waste, namely

- Highlander International Recycling Ltd, based in East Kilbride
- Trident Recycling Ltd., based in Glasgow

Both companies are accredited as “small” exporters and can issue plastic export recovery notes for a maximum of 400 tonnes of packaging waste per annum.

In addition the following companies that have operating facilities in Scotland are listed on the equivalent Environment Agency register:

- SITA Metal Recycling Ltd (classed as “large” so can export over 400 tonnes per annum)
- Viridor Resource Management Ltd (also classed as large)

¹³ <http://npwd.environment-agency.gov.uk/PublicRegister.aspx?ReturnUrl=%2fPackagingPublicRegisterLinks.aspx%3fReturnUrl%3d%252FAbout.aspx>

4. Mapping of the Destinations of Waste Plastic Arisings

The purpose of this section of the report is to map, where practical, how the plastic waste arisings from each source is managed. The supply chain model, shown in Figure 4 is used to structure the analysis. Each source of arisings is reviewed separately in the following sections and then the data from each section is collated to give an overall analysis of the destination of waste plastic arisings in Scotland.

4.1 Management of Household Waste Plastic

Analysis of Waste Data Flow data¹⁴ indicates that 21,358 tonnes of household waste plastic were collected for recycling in 2009/10 across the 32 Scottish Local Authority, using the collection services detailed in Figure 11. This equates to 8.5% of 2009 household waste plastic arisings. The remaining 91.5% is sent to landfill or incinerated (depending on the infrastructure available to the Local Authority). Tonnages collected can be shown by Local Authority as follows:

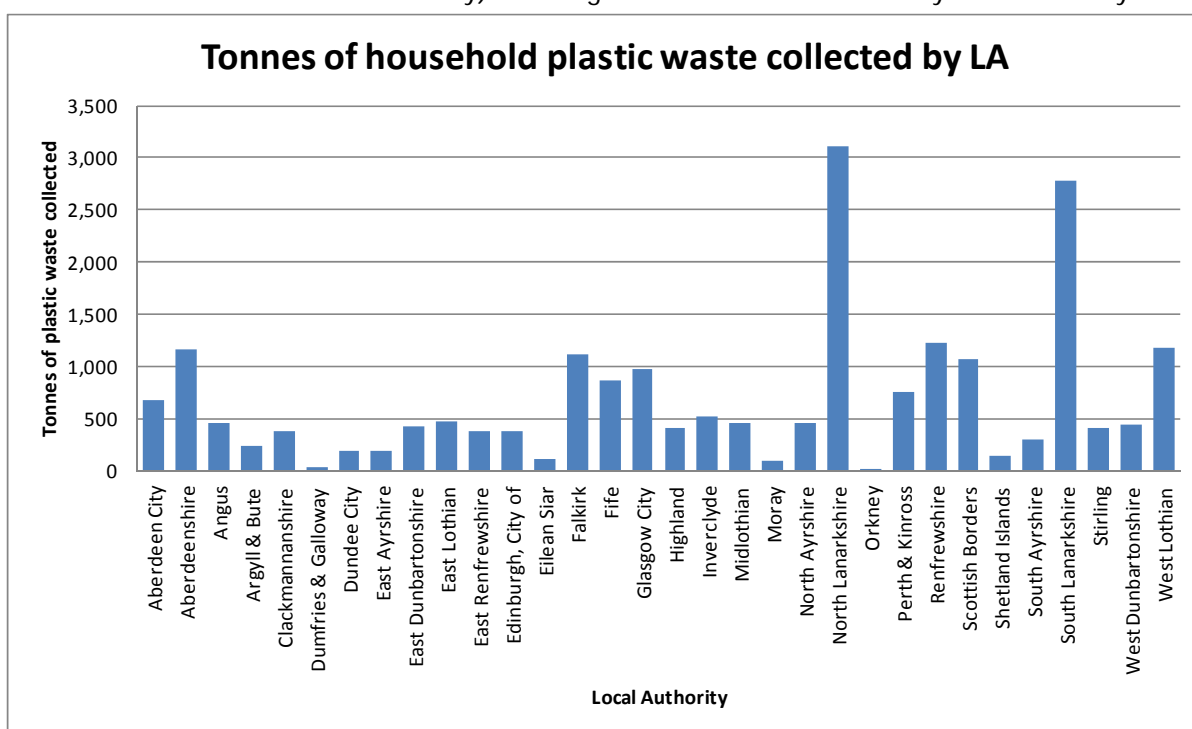


Figure 20: Tonnages of Plastics Recycled by Local Authority Area

In 2010/11 the level of plastics collected for recycling by Local Authority increased to 26,230 tonnes (this includes some non-household plastic but the amount – based on 09/10 figures is around 1% of total). This data can also be presented in kilogrammes collected per person in each Local Authority area¹⁵, as follows

¹⁴ Waste Data Flow (<http://www.wastedataflow.org/>)

¹⁵ Population data sourced from Scottish Government Local Government Finance Statistics at <http://www.scotland.gov.uk/Publications/2011/02/21143624/1#t11>

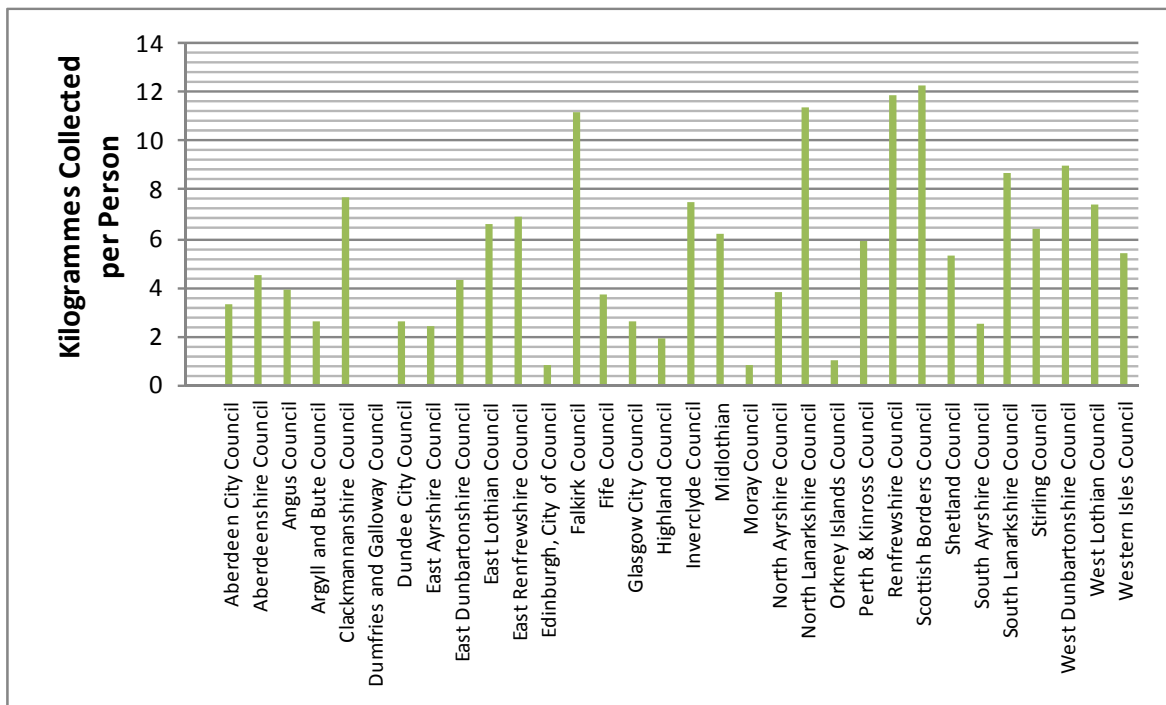


Figure 21: Waste Plastic Collected per Person in Each Local Authority Area

This dataset is considered more useful for analysis as it removed variations due to different Local Authority populations. However it still does show a greater than 10 times variation between Local Authority.

Analysis of the flow of materials once collected in Local Authority areas shows that, in the majority of cases plastics are handled and reprocessed by organisations that are outside the Local Authority area, and in a number of cases the material is supplied to export markets. An example of the supply chain model developed for each Local Authority is shown here. Others are included in Appendix B.



Figure 22: Examples of Recycling of Plastic Waste Arisings for Local Authority

A review of all 30 models for those Local Authority that provided information highlights that:

- Around 50% of the councils use MRFs within their own area
- Recycling companies that reprocess the material into a secondary raw material are mainly based in England (these include J & A Young, AWS, Eco Plastics, Valpak Recycling Ltd and J&B Recycling Ltd)
- Plastic arisings from 6 Local Authority is reprocessed in the UK and for 11 Local Authority arisings are partly reprocessed in the UK and partly exported. Interviewees from the remaining 13 councils did not know what happened to the materials.

Therefore, although material from Local Authority household waste is collected, segregated and handled by a number of Scottish waste management and recycling companies, evidence indicates that none of the segregated waste plastic is reprocessed in Scotland.

4.2 Management of C&I and C&D Waste Plastic

The lower estimate of C&I plastic waste arisings is 50,841 tonnes. The upper estimate is 284,438 tonnes. The different methods used in these calculations are detailed in Appendix A. It is clear that there is significant uncertainty about the actual level.

The estimated arisings of plastic from C&D sources is 35,473 tonnes.

C&I plastic waste arisings are handled differently depending on whether they are comingled with other materials or are plastics alone (in either a mixed plastic or single stream format). In both cases, decisions regarding the management and processing of materials are driven by commercial concerns rather than geographic issues. This is the case whether it is large or small companies that are involved in managing the waste. This is expected as there are a number of areas in Scotland where there are no local recycling facilities.

For larger companies that have a UK wide infrastructure or are targeting materials throughout the UK they will transport materials significant distances. For example:

- Biffa Polymers publicity¹⁶, following the opening of its facility in Redcar, highlights that:

*“The Redcar facility will begin to process 15,000 tonnes of mixed plastics per year from April 2011, building up to the full capacity of 20,000 tonnes per year by April 2012. **It will process plastics from Biffa MRFs, as well as Local Authority and commercial customers from England, Scotland, Wales and Ireland**”.*

- Major UK plastics reprocessing companies target high volume arisings of single stream materials and transport them (in ~20 tonne loads) to specific reprocessing facilities elsewhere in the UK. For example, South Wales was highlighted by one company as the destination of plastics collected in the Tayside area of Scotland

Similarly for locally owned SMEs:

- Those focusing on plastics alone source materials from a range of Local Authority areas. For example for two typical plastics recycling companies in central Scotland
 - one sources plastic in both mixed and single stream forms from C&I, C&D and WTS sources in its own Local Authority area and three neighbouring ones
 - another sources plastics from customers throughout Scotland, making decisions on the attractiveness of specific contracts on a case by case basis based on the quality of material, the cost of collection and the market price
- Small waste management companies targeting specific plastic waste streams pursue sources of arising throughout the country. For example an SME located in the West of Scotland is targeting arisings of a specific plastic across the central belt and in the North East of Scotland.

Therefore it is not considered practical to analyse the management of C&I and C&D waste plastics at a Local Authority level. Analysis is therefore presented at a Scottish level as detailed below.

Plastics in Comingled Materials

Plastics in comingled materials are typically collected by waste management contractors that operate MRFs and waste transfer stations and transported to their own facilities. In some cases local facilities are servicing local markets but can span several Local Authority areas. And companies are not recording tonnage arisings by the Local Authority area from which the material is sourced.

When these plastics are segregated from other materials either in a MRF or by manual means then these are typically supplied to a company that handles, reprocesses or exports plastics. This is again a business based decision and depends on the commercial proposition offered. In the majority of cases, MRFs and WTSs have links to a number of plastic recycling companies and take the most lucrative offer available at any point in time. The decision may be based solely on price or it may depend on other factors – often it is negotiated to supply a package of materials that includes some good quality material and some poor quality, low value material. This means that the materials will be transferred across Local Authority boundaries.

Once material is segregated into a plastics only stream (either as mixed or single material plastic) then it is managed as detailed below.

Plastics Only Materials Streams

¹⁶ <http://www.biffa.co.uk/assets/files/News/2011/Biffa%20Polymers%20press%20release%2018-03-11.pdf>

The management of single stream and mixed plastics are typically different, and further, single stream plastics are dealt with differently depending on the volume arisings.

If large volume (> 20 tonne) single stream plastics arisings are available at an appropriate quality then these materials are usually transferred directly to UK reprocessors, generally located in England and Wales. These companies often deal directly with the organisations that are producing the waste and in other cases an intermediary (e.g. one of the companies listed in Figure 18) will be involved in the transaction. Examples where this type of interaction occurs for post use plastics include:

- The supply of end of life polythene film from agricultural and horticultural uses (e.g. polytunnel film) to UK based reprocessors (e.g. BPI Recycled Products)
- The supply of compacted EPS from food processing facilities – in this case the end customer (e.g. Enviro GY) can supply a compactor and transport for the material rather than pay a price for the material
- In the case of EPS, evidence from industry indicates that over 95% of collected material is exported to China and that there is little or no indigenous UK reprocessing activity.
- The supply of single stream uPVC extracted from end of life window frames to one of four companies in England (e.g. PVC Recycling Ltd. and Merritt Plastics Ltd.) that reprocess waste uPVC into secondary raw material for the manufacture of new window profiles

Of course this type of transaction has also been prevalent between plastics processors and recyclers where the plastic processor is producing large volumes of process waste that it cannot reuse internally.

However, if the material is of lower quality (e.g. contaminated or dirty) then it is likely to be exported.

For smaller tonnages of single stream material (e.g. polythene film from a variety of sources, post consumer EPS window frames or bottles from commercial sources) then these tonnages are typically consolidated at MRFs, WTSs or plastics handling and sorting companies prior to supply to companies dedicated to recycling, again based elsewhere in the UK.

These Scottish based plastics handling and sorting companies source materials from a number of Local Authority areas.

As above, if the material is of lower quality it is very likely to be exported.

Management of mixed plastics (either mixed film or mixed rigid plastics) is more problematic. This form of material is typically sourced from the waste management industry where plastics are treated as one resource stream. Further, these materials are typically dirty and contaminated (by other materials). All plastics handling and sorting companies manage tonnages of this material and stress that they have tried to educate their suppliers to optimise the quality (cleanliness and segregation of different plastics) of the material, but with limited apparent success. So they have difficulties finding a market for the material. There is no UK demand for the material. At certain times (when materials demand is high) this material can be exported to the Far East for modest income but at other times the market value of the material is zero. At these times, companies stockpile the material, hoping for better markets in the future. As highlighted earlier these companies source tonnages of this low value material in order to access higher value single stream plastics.

4.3 Management of Agricultural Waste Plastic

The estimated arisings of agricultural waste plastics in 2009 was 22,945 tonnes.

It is estimated by the British Plastics Federation Films Working Group that around 20% of agricultural waste plastic is recycled every year.

Some of this material is supplied to the BPI Recycled Products facility in Dumfries while the remainder of material is supplied to reprocessors elsewhere in the UK or is exported.

Agricultural plastic waste is collected by a number of companies that specialise in this activity. The most significant company in Scotland is Solway Recycling Ltd that collects on a regular basis from a wide geographical area in Scotland. It is also developing collection networks in the rest of the UK.

In addition Solway Recycling has partners that collect in the North of Scotland, for example Tayside Agri-Waste and North of Scotland Plastic Recycling.

4.4 Management of WEEE

The estimated waste plastics arisings in WEEE in 2009 was 30,653 tonnes consisting of dense plastics of various polymer types. It is estimated that 31% of the dense plastic is recycled. This material is currently sold to UK plastics reprocessors or exporters based on current market prices. There is no evidence of current re-processing of this material in Scotland.

4.5 Management of End of Life Vehicles

The estimated waste plastics arisings from end of life vehicles in 2009 was 11,990 tonnes. It is estimated that 20% of plastics are recycled.

Similarly to plastic arisings in WEEE, this material is currently sold to UK plastics reprocessors or exporters based on current market prices. Again, there is no evidence of current re-processing of this material in Scotland.

4.6 Summary - A Composite Analysis for Scotland

The above analysis is summarised in this section.

Firstly in terms of plastic waste in Scotland, the estimated tonnages recycled can be summarised as follows:

Local Authority	Tonnes of plastic recycling by source - 2009							Total (LOWER)	Total (UPPER)
	Household	C&I (LOWER)	C&I (UPPER)	C&D	Agriculture	WEEE	ELV		
Aberdeen City	673	1,873	10,478	137	1	493	94	3,272	11,878
Aberdeenshire	1,164	949	5,308	278	542	411	152	3,497	7,856
Angus	459	333	1,861	610	81	190	61	1,734	3,262
Argyll & Bute	240	315	1,760	17	177	160	46	954	2,399
Clackmannanshire	377	135	757	0	9	85	24	631	1,253
Dumfries & Galloway	38	528	2,957	26	465	264	84	1,406	3,835
Dundee City	190	666	3,728	112	0	283	51	1,302	4,364
East Ayrshire	188	330	1,846	62	117	200	56	954	2,470
East Dunbartonshire	425	232	1,298	12	10	158	50	887	1,953
East Lothian	468	246	1,377	415	87	157	48	1,421	2,552
East Renfrewshire	378	182	1,017	64	4	131	42	801	1,636
Edinburgh, City of	378	2,841	15,894	391	1	947	161	4,720	17,773
Eilean Siar	107	92	512	9	292	46	15	560	981
Falkirk	1,123	557	3,115	277	14	267	73	2,310	4,869
Fife	862	1,181	6,606	45	206	617	171	3,081	8,506
Glasgow City	970	3,888	21,750	1,498	0	1,239	216	7,811	25,673
Highland	407	1,003	5,611	148	676	410	123	2,768	7,375
Inverclyde	521	266	1,486	1	24	140	31	983	2,203
Midlothian	452	251	1,406	323	39	133	39	1,238	2,393
Moray	89	329	1,839	44	228	153	48	891	2,401
North Ayrshire	453	374	2,091	418	75	231	59	1,609	3,326
North Lanarkshire	3,103	1,185	6,627	659	22	564	136	5,669	11,112
Orkney	10	76	425	0	136	36	14	272	621
Perth & Kinross	755	626	3,505	196	505	262	78	2,422	5,300
Renfrewshire	1,227	853	4,774	355	10	327	73	2,846	6,766
Scottish Borders	1,070	392	2,192	72	273	200	65	2,071	3,871
Shetland Islands	137	104	584	4	147	40	14	446	925
South Ayrshire	295	456	2,553	62	79	204	54	1,151	3,248
South Lanarkshire	2,777	1,138	6,368	27	192	536	140	4,810	10,039
Stirling	402	436	2,437	10	114	159	52	1,173	3,175
West Dunbartonshire	445	251	1,406	19	12	155	45	927	2,081
West Lothian	1,175	791	4,428	93	53	301	82	2,496	6,132
Total plastic recycled	21,358	22,879	127,997	6,385	4,589	9,502	2,398	67,111	172,230

Figure 23 - Estimated Plastic Recycling by Local Authority Area and Source

As shown in this figure it is estimated that between 67,111 tonnes (lower estimate) and 172,230 tonnes (upper estimate) was recycled in Scotland in 2009.

A number of the major UK recycling companies, as highlighted throughout this report, process materials that are sourced in Scotland.

Further it is estimated that almost 74,000 tonnes is exported. The tonnage of waste plastic arisings in Scotland that are imported and exported from the UK has been estimated, based on the data for the whole of the UK. This approach has been taken because a number of the companies in the plastics recycling supply chain have used several UK export agents in the past, selecting the optimum one based on prices at the time. This even applies to companies that have their own export licences. It is estimated, using this approach that around 4,700 tonnes are imported and almost 74,000 tonnes exported, as shown below:

Code	Description	Total Imports		Total Exports		Price Per Tonne (£)	
		Value (£)	Quantity (tonnes)	Value (£)	Quantity (tonnes)	Imports	Exports
579	WASTE, PARINGS AND SCRAP, OF PLASTICS	2,163,843	4,656	15,108,776	73,819	465	205
57910	WASTE, PARINGS AND SCRAP, OF POLYMERS OF ETHYLENE	402,771	952	8,771,819	47,912	423	183
57920	WASTE, PARINGS AND SCRAP, OF POLYMERS OF STYRENE	172,542	350	1,213,239	6,599	493	184
57930	WASTE, PARINGS AND SCRAP, OF POLYMERS OF VINYL CHLORIDE	59,077	330	974,457	3,205	179	304
57990	WASTE, PARINGS AND SCRAP, OF PLASTICS OTHER THAN POLYMERS OF ETHYLENE, STYRENE OR VINYL CHLORIDE	1,529,452	2,928	4,149,262	16,103	522	258

Figure 24: Estimated Scottish Imports and Exports of Waste Plastics

This analysis assumes that Scotland has an 8.80% share of UK wide activity¹⁷. This analysis shows that waste polythene is the major material exported, accounting for almost two thirds of total export volumes while China is, as expected, the main export market. The remaining plastic is assumed to go to landfill or incineration. The estimated amounts by Local Authority and source are shown in the figure below.

¹⁷ Business Register Employment Survey – 2009, ONS Statistical Bulletin, Dec 2010 p.2 'Total employment' category

Local Authority	Tonnes of plastic landfilled/incinerated by source - 2009							Total (LOWER)	Total (UPPER)
	Household	C&I (LOWER)	C&I (UPPER)	C&D	Agriculture	WEEE	ELV		
Aberdeen City	11,833	2,289	12,807	626	5	1,098	377	16,228	26,746
Aberdeenshire	13,786	1,160	6,487	1,268	2,169	915	610	19,908	25,235
Angus	5,365	406	2,274	2,781	324	424	242	9,542	11,409
Argyll & Bute	4,770	384	2,151	76	707	356	185	6,479	8,245
Clackmannanshire	2,138	165	925	0	37	189	96	2,626	3,386
Dumfries & Galloway	9,628	646	3,614	120	1,859	589	337	13,178	16,146
Dundee City	6,742	815	4,557	509	0	630	206	8,900	12,643
East Ayrshire	5,432	403	2,256	282	470	446	224	7,257	9,110
East Dunbartonshire	6,109	284	1,587	54	38	351	202	7,038	8,341
East Lothian	5,090	301	1,683	1,891	348	350	191	8,171	9,553
East Renfrewshire	3,656	222	1,243	293	16	291	168	4,646	5,667
Edinburgh, City of	16,474	3,472	19,426	1,783	6	2,108	645	24,488	40,442
Eilean Siar	1,158	112	626	39	1,168	103	60	2,640	3,154
Falkirk	6,451	681	3,808	1,260	57	594	290	9,334	12,461
Fife	15,213	1,443	8,074	203	824	1,373	683	19,740	26,371
Glasgow City	26,878	4,752	26,583	6,824	0	2,759	863	42,076	63,908
Highland	10,079	1,226	6,857	676	2,703	914	494	16,091	21,722
Inverclyde	2,994	325	1,816	6	95	313	125	3,857	5,349
Midlothian	3,213	307	1,719	1,474	157	297	154	5,603	7,014
Moray	4,301	402	2,248	199	911	341	193	6,347	8,193
North Ayrshire	4,482	457	2,556	1,904	298	514	236	7,891	9,990
North Lanarkshire	12,265	1,448	8,100	3,003	88	1,256	544	18,604	25,257
Orkney	795	93	520	0	543	80	55	1,566	1,993
Perth & Kinross	6,451	766	4,284	892	2,019	582	313	11,023	14,541
Renfrewshire	7,747	1,043	5,835	1,616	40	728	293	11,467	16,259
Scottish Borders	4,097	479	2,679	327	1,090	444	259	6,696	8,897
Shetland Islands	1,497	128	714	16	587	89	55	2,372	2,959
South Ayrshire	5,049	558	3,120	284	317	454	217	6,878	9,441
South Lanarkshire	14,492	1,391	7,783	123	766	1,193	560	18,526	24,917
Stirling	2,853	533	2,979	48	456	354	209	4,451	6,898
West Dunbartonshire	3,791	307	1,719	85	47	345	180	4,755	6,167
West Lothian	5,643	967	5,412	425	212	670	326	8,244	12,688
Total plastic landfilled/incinerated	230,473	27,963	156,441	29,088	18,356	21,151	9,592	336,622	465,100

Figure 25 - Estimated Plastic Landfilled/Incinerated by Local Authority Area and Source

The upper and lower estimates are shown graphically, below.

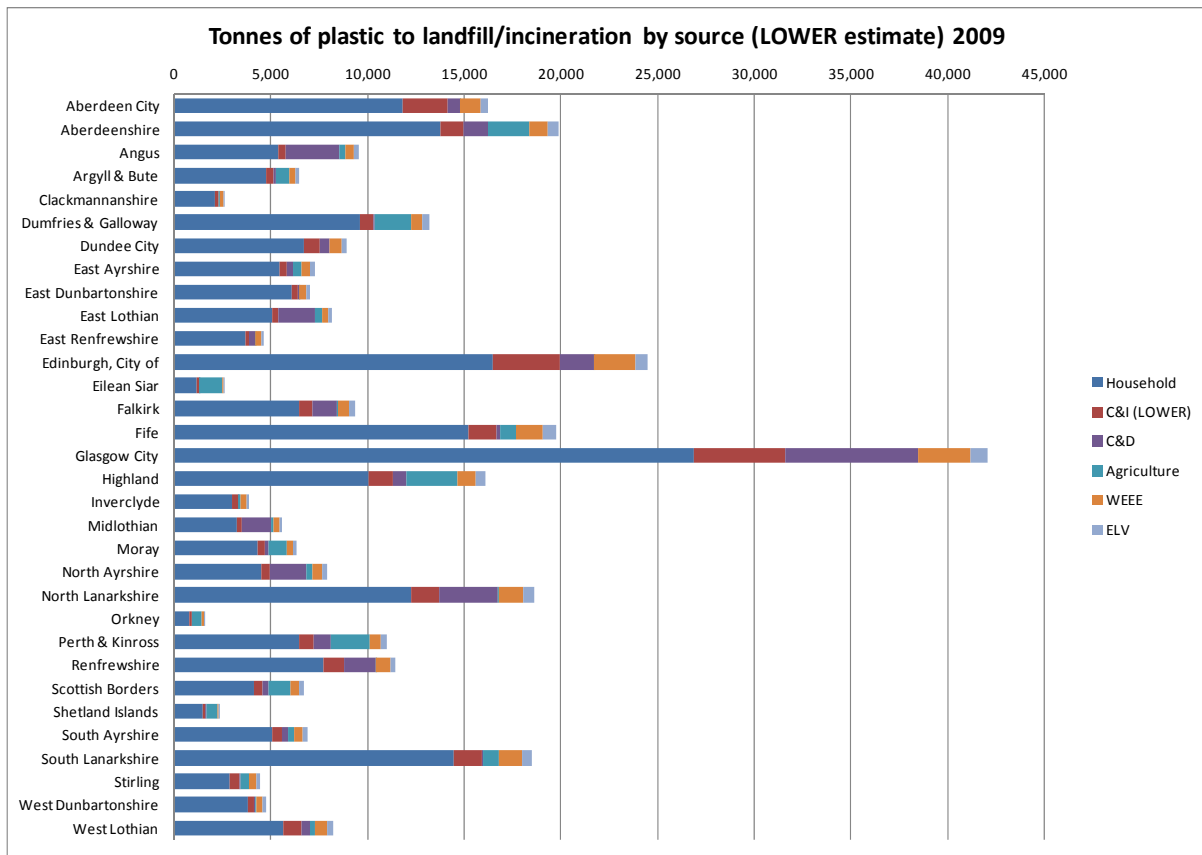


Figure 26 - Lower Estimate of Plastic Waste to Landfill/Incineration by Local Authority Area and Source

The above figure shows the geographic spread and different sources of plastic waste going to landfill. This is based on the lower estimate of 336,622 tonnes for Scotland.

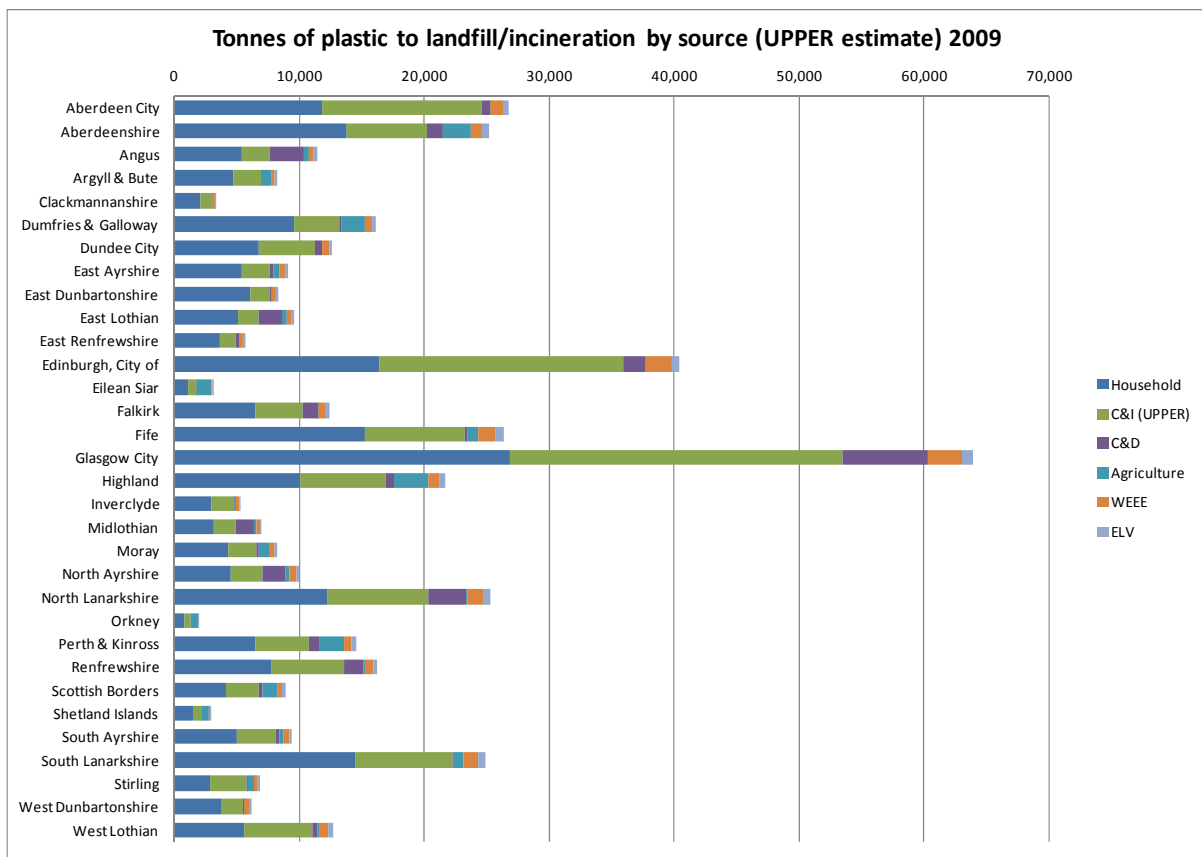


Figure 27 - Upper Estimate of Plastic Waste to Landfill/Incineration by Local Authority Area and Source

The above figure shows the geographic spread and different sources of plastic waste going to landfill. This is based on the upper estimate of 465,100 tonnes for Scotland.

The plastic arisings by type, Local Authority area and source are described in detail in Appendix B.

4.7 Future Trends in Plastic Waste Arisings in Scotland

Scotland's Zero Waste Plan has a target to achieve a minimum of 70% recycling (calculated using carbon metric weightings) across all waste streams (household, commercial, industrial and construction and demolition) by 2025. The figure below uses data from the Economic Assessment of Scotland's Zero Waste Plan¹⁸ to show a projected pathway to achieving this based on the implementation of various measures (e.g. the introduction of new Zero Waste Regulations).

¹⁸ <http://www.zerowastescotland.org.uk/ZWPcostbenefit>

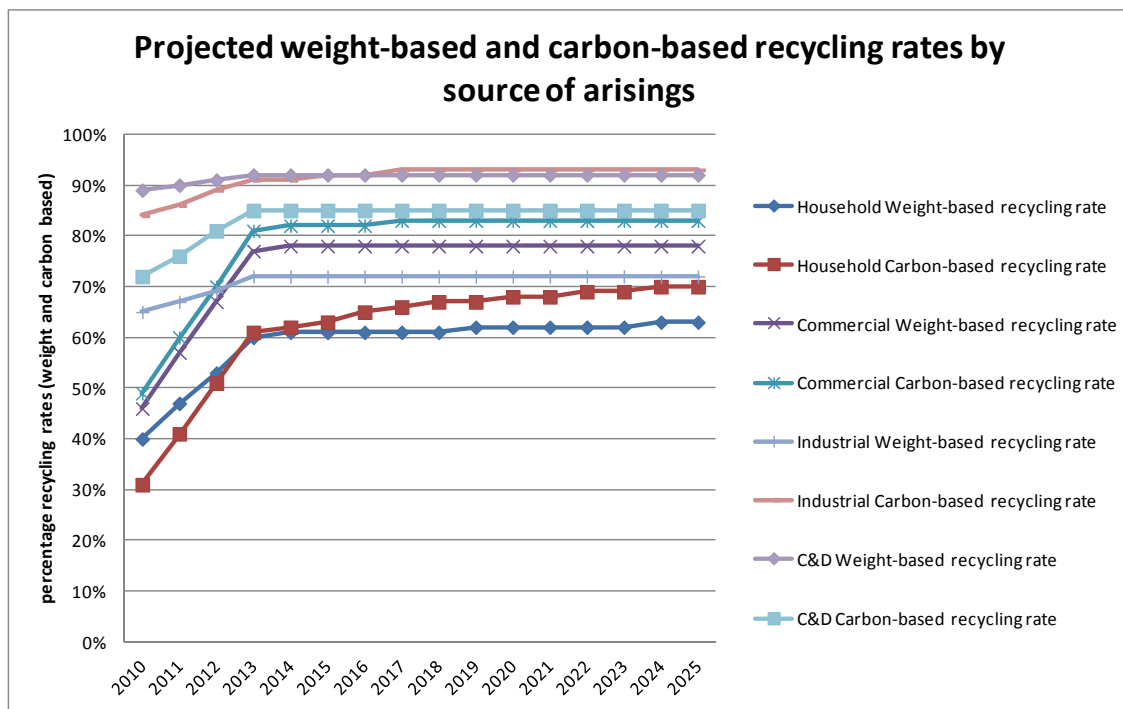


Figure 28: Projected Weight-based and Carbon-based Recycling Rates by Source of Arisings

The above figure shows a significant increase in recycling from 2010 to 2013. This results from a combination of increasing landfill tax and forthcoming legislation requiring households to be offered recycling options for key dry recyclables (glass, metal, plastics, paper and card) and for businesses to present these dry recyclables for collection, separate from residual waste. The most significant changes in recycling rates can be seen for households and the commercial sector.

Of course, these overall increases in recycling are not the result of uniform increases in recycling rates from different material streams. The Economic Assessment of Scotland’s Zero Waste Plan assumes the following maximum (weight-based) recycling rates for plastic film and dense plastic in the different waste streams:

- Household
 - Dense plastic – 45%
 - Plastic film – 15%
- Commercial
 - Dense plastic – 67%
 - Plastic film – 57%
- Industrial
 - Dense plastic – 80%
 - Plastic film – 50%
- Construction and Demolition
 - Dense plastic – 75%

The Economic Assessment does not provide assumptions for:

- C&D – plastic film
- Agriculture – plastic film and dense plastic
- WEEE – dense plastic (assumed no plastic film from this waste stream)
- ELV – dense plastic (assumed no plastic film from this waste stream)

The assumptions made for these waste streams and the associated 2014 recycling rates for dense plastic and plastic film for all waste streams are detailed in Appendix A.

The figure below summarises the projected recycling of plastic based on these assumptions.

Sources of plastic waste	Year					
	2009 Recycling		2014 Recycling		2025 Recycling	
	Tonnes	% of arisings	Tonnes	% of arisings	Tonnes	% of arisings
Household	21,358	8%	79,879	32%	90,981	36%
C&I (Lower)	22,878	45%	30,606	60%	32,020	63%
C&I (Upper)	127,997	45%	171,232	60%	179,139	63%
C&D	6,385	18%	24,388	69%	26,161	74%
Agriculture	4,589	20%	6,884	30%	11,473	50%
WEEE	9,502	31%	10,729	35%	12,261	40%
ELV	2,398	20%	4,197	35%	8,393	70%
Total (Lower)	67,111	17%	156,682	39%	181,289	45%
Total (Upper)	172,230	27%	297,307	47%	328,409	52%

Figure 29: Projected Recycling of Plastic in Scotland (Lower and Upper Estimates)

The above figure shows a significant increase in recycling from 2009 to 2014, reflecting the same pace of growth as in figure 28.

5. Conclusions

The analysis carried out in this study highlights that:

- Plastic waste arisings in Scotland are estimated at 403,733 tonnes (lower estimate) and 673,330 tonnes (upper estimate). This range is quoted due to significant uncertainties in the estimates for C&I waste arisings
- Tonnages of plastic arisings in Scotland that are recycled range from 67,111 tonnes (lower estimate) to 172,230 tonnes (upper estimate)
- Overall recycling rates are therefore 16.6% (based on the lower estimate) or 25.6% (based on the higher estimate)
- Waste plastic arisings in Scotland exported from the UK are calculated at 73,819 tonnes per annum
- Waste plastic arisings in Scotland landfilled/incinerated are estimated at 336,622 tonnes (lower estimate) and 465,100 tonnes (upper estimate) tonnes respectively
- Plastic recycling activity is projected to increase significantly to 2014 with between 157,000 and 297,000 tonnes being recycled. This is projected to rise to between 181,000 and 328,000 tonnes by 2025.

These figures suggest that there are significant opportunities for increasing plastic recycling tonnages in Scotland.

This analysis also highlights that:

- There are a range of public and private sector activities to collect waste plastics in Scotland
- These activities can be developed to increase both the quantities and quality of plastics collected for recycling
- Scotland is an integral part of the UK plastics recycling infrastructure. The majority of the waste plastics collected in Scotland is reprocessed elsewhere in the UK
- There is limited capacity in Scotland for the management and handling of collected waste plastic
- The capacity for reprocessing waste plastics in Scotland is similar to the lower estimates for recycling – although this capacity mainly processes materials from elsewhere
- Significant tonnages of material are exported to the Far East. This is typically material of lower quality.

Based on the analysis carried out it is concluded that:

- It is necessary for collection, management and reprocessing activities all to be developed to increase plastic recycling levels in Scotland
- These must be developed in parallel. It is not economically practical to expect one stage of the supply chain to be developed in advance of others
- There is significant value in optimising the integration of each part of the supply chain, to optimise the quantity and quality of materials available for reprocessing
- Scotland must be considered as an integral part of the UK plastic recycling infrastructure. New initiatives that complement existing UK recycling capability will offer maximum benefit to Scotland
- Increasing the quality (in terms of materials specificity, cleanliness and contamination) of materials collected will increase the potential for local (UK) recycling of materials

Opportunities for development of the recycling capacity and infrastructure in Scotland will be identified and developed in the next stage of this study.



Zero Waste Scotland

Ground Floor, Moray House, Forthside Way,
Stirling FK8 1QZ.

E-mail: helpline@zerowastescotland.org.uk

Helpline freephone 0808 100 2040

www.zerowastescotland.org.uk

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