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epa Environmental Protection Agency

Non-household Waste Characterisation Campaign

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Glossary of Terms

2-bin or 3-bin system refers to a source segregated collection system where dry recyclables (MDR) and residual wastes (MRW) are separately collected (2-bin system), or where dry recyclables (MDR), organics (BB) and residuals are separately collected (3-bin system). The reference to 'black bin' in this document is a reference to a single bin collection or to the residuals bin from a 2-bin or 3-bin system. The reference to 'green bin' in this document is a reference to a dry recyclables collection, and 'brown bin' is a reference to an organics bin collection.

Authorised waste collector means a waste collector who has a valid permit issued by the National Waste Collection Permit Office.

Brown Bin is a reference to an organic waste collection. Where garden waste is excluded, this bin may be termed a food waste collection.

Characteristic means a property, which helps to identify or differentiate between items of a given population.

Commercial waste, in the context of this report, is a term used to describe the non-household fraction of municipal waste, which is produced by commercial premises such as shops, offices and restaurants, as well as municipal premises such as schools, hospitals etc. It also includes non-process industrial waste arising from factory canteens, offices etc. Commercial waste is broadly similar in composition to household waste, consisting of a mixture of paper and cardboard, plastics, organics, metal and glass.

Composite sample means two or more increments / sub-samples mixed together in appropriate proportions, either discretely or continuously (blended composite sample), from which the average value of a desired characteristic may be obtained.

Compostable refers to compostable wares (knives, spoons, plates) and packaging containers that are now being used in canteens, at festivals and by some food suppliers.

CSO means the Central Statistics Office.

European Waste Catalogue (EWC), now known as the List of Wastes (LoW), is a list of all waste types generated in the EU. The different types of waste are fully defined by a six-digit code, with two digits each for chapter, sub-chapter and waste type. The catalogue is available for download from the EPA website at: www.epa.ie/pubs/reports/waste/stats/epawastecataloguehazardouslist2002.pdf.html

Heterogeneity is the degree to which a property or a constituent is not uniformly distributed throughout a quantity of material.

MDR means Mixed Dry Recyclables.

MRW means Mixed Residual Waste.

N/A means not applicable.

NACE (Nomenclature of Economic Activities) is the European statistical classification of economic activities.

Non-recyclable material is material that is not widely recycled. The range of materials that are recycled will change over time as technology improves and market conditions alter.

Non-target material is material that is capable of being recycled but is not being targeted by the collector for separation and sale. This may be because they do not have a buyer (e.g. for beverage cartons) or because the materials recycling facilities or reprocessor excludes it from their specification (e.g. card in a consignment of newspapers which can cause problems in paper mills).

NWCPO means National Waste Collection Permit Office operated by Offaly County Council.

Organic waste is biodegradable food, garden and landscaping waste, and where the context permits, will also include industrial organic sludges (e.g. from the food and drink production sector).

Packaging is defined in Directive 94/62/EC initially as: *'packaging' shall mean all products made of any materials of any nature to be used for the containment, protection, handling, delivery and presentation of goods, from raw materials to processed goods, from the producer to the user or the consumer. 'Non-returnable' items used for the same purposes shall also be considered to constitute packaging.*

Primary Waste Category - A high level waste category e.g. organics, metals etc.

Representative sample means a sample in which the characteristic(s) of interest is (are) present with a reliability appropriate for the purposes of the testing programme.

Sample means portion of material selected from a larger quantity of material. In the non-household surveys a sample is a minimum of 5kgs.

Sample size means the number of samples taken to generate a profile for a specific waste stream.

Scale is the stated size or volume that is considered appropriate for assessing the material

Secondary Waste Category is a more specific waste category within a Primary Waste Category, e.g. mixed flexible plastic, ferrous metal etc.

Target material is any material that the collector has identified as needing to be separated from other types of material by virtue of the fact that separation is required by the market. For the purposes of this study, 'target material' could include:

- The materials specified in the list of materials for co-mingled dry recyclables bin agreed by and listed on the national list **www.recyclinglistireland.ie** or:
- The organic materials like food or garden waste typically accepted into the biodegradable waste bin ('brown bin'), as listed in **www.brownbin.ie**. Some collections vary from the website list by primarily targeting food waste, to the exclusion of garden waste.

Waste is defined as any substance or object which the holder discards or intends or is required to discard, under the Waste Framework Directive (2008/98/EC).

Waste composition profile is the percentage of materials in a certain waste stream. This profile will differ according to each source of waste.

Waste electrical and electronic equipment (WEEE) refers to electrical and electronic equipment which is waste within the meaning of Article 3(a) of the Waste Directive 2008/98/EC, including all components, subassemblies and consumables which are part of the product at the time of discarding.

Waste management means the collection, transport, recovery and disposal of waste, including the supervision of such operations and the after-care of disposal sites, and including actions taken as a dealer or broker.

ACKNOWLEDGEMENTS

CTC would like to thank all those who have assisted with this work, especially the Environmental Protection Agency (EPA), the Central Statistics Office (CSO), the National Waste Collection Permit Office (NWCPO), the Department of Communications, Climate Action and Environment (DCCAE), the Regional Waste Management Offices, Repak and the Irish Waste Management Association (IWMA).

CTC also thanks its project partners RPS.

Finally, CTC would like to thank all the businesses that participated in these studies and the various waste collectors who facilitated our work throughout the project.

Executive Summary

This report summarises the results and findings of assessment of municipal waste from the non-household sector. The non-household (commercial) sector refers to NACE sectors G (retail) to Q (miscellaneous). It does not include industry, primary producers or households.

In terms of understanding and assessing waste production in the commercial sector, it is assumed that there is a degree of consistency in the generation of waste within specific sectors. For example, the profile of waste from a food retailer will be relatively consistent, though it will be significantly different from the waste generated by office based activities (e.g. bank or public administration). Therefore, in an effort to ensure that the waste profile generated for the non-household sector is as accurate as possible, the methodology used considers waste on a sectoral level. More information on how the main sectors for this study were chosen, as well as the volumes of waste attributed to them, is given in Chapter 2.

Once the main sectors were identified, the method by which a waste profile for each one was generated is outlined in Chapter 3 (the 54 materials into which the waste was categorised is given in Appendix 2). Essentially, the process involves assessing a representative volume of waste from as large a range of businesses as possible from that sector. From these, a sectoral profile is statistically generated. These sectoral profiles are then applied to the volume of waste generated by each of the respective non-household sectors and from this a representative national profile is produced.

Six sectors were considered during this work and these accounted for an estimated 80% of the non-household waste generated in Ireland in 2017. These included: food retail, food wholesale, offices, general retail, restaurants and hotels. These sectors were also examined during the last national waste characterisation work that was carried out in 2008. While there are differences between all the sectoral profiles there are a number of key observations relating to the sectoral profiles, including:

- In most sectors assessed, organic waste (which includes garden waste) is still the largest individual waste category in the mixed residual waste stream. Though it has reduced in all sectors since 2008 (as would be expected with the roll out of the brown bin), the fact that it is the largest single waste stream means the brown bin systems in place are either (a) not being used or (b) not being used correctly.
- The volumes of glass and cardboard in the MDR waste stream have decreased in most sectors. This is consistent with more source segregated waste management services for these materials.
- There was a significant increase in the volume of coffee cups encountered, especially in offices, general retail and restaurants. This was true for both the MRW and MDR streams.
- Compostable packaging was also seen in larger quantities than in 2008. Compostable ware (plates, forks, other packaging) was especially prevalent in hotels, restaurants and offices.
- Improved segregation of paper was noted in the office sector where it decreased from 50% in 2008 to 22% in 2018.

In terms of the national profiles generated some of the most interesting findings include:

- In general, the level of organics (predominantly food waste) in the municipal waste stream (both mixed waste and mixed dry recyclables) has decreased since 2008. While the brown bin was in place in certain areas in 2008, its use is much more consistent across the country now. This, in conjunction with the FSM service for food retail/wholesale, means that the proportion of food

waste in both MRW and MDR streams has improved in all sectors. However, organic waste still accounts for 34% of the overall municipal solid waste generated.

- Contamination of the mixed dry recyclable stream has improved in most sectors though the organic content in the MDR stream at a national level has remained relatively consistent around 10%.
- Tissue paper is one of the major individual materials stream in the municipal waste stream and accounts for 10% of the total.
- 2.5% of the MRW waste stream was found to be coffee cups.
- Of the total MRW, almost 70% could potentially be diverted to either recycling or into brown bins.
- Over 60% of the current MDR waste stream was found to be targeted materials (based on the new recycling list) with plastic films (14%), organic materials (10%) and tissue paper (7%) being the main contaminants.
- Organic waste was over 90% of the brown bin content with 24% of this being unused packaged food.
- The contamination levels of the packaging materials assessed were consistently higher than those measured in 2008. This was the case for both the MRW and MDR waste streams.

Based on the results, as well as the experiences of the project team a number of recommendations have been made. Some of the main suggestions include:

- The accuracy, and transparency, of the data set upon which the sectoral profiles are based could be improved by changing the way that waste contractors currently report to the NWCPO. By including a NACE breakdown linked to the current reporting method (which is based on EWC) would greatly facilitate this step in the process.
- Generating a national waste profile will always be difficult as they are snapshots in time. However, the new methodology is designed to overcome this issue. Now that a comprehensive data set has been generated for the main sectors, this should be kept up to date by adding data periodically to the statistical model. This will overcome one of the most challenging aspects of this work which was getting 50 businesses to survey.
- The methodology proposed at the beginning of this work specified 52 waste materials under 13 broad categories. During the work the issue of coffee cups arose so, for the non-household surveys, this category was added. Therefore, before any future work it is important that a comprehensive review of the waste materials is carried out to ensure that materials of significance are recorded.

1 Introduction

The objective of this project[1] is to undertake characterisation on the different fractions of household (Task 1) and non-household (Task 2) municipal waste, to develop a model (Task 4) that can be applied to national figures and to quantify the level of contamination in packaging waste (Task 3).

This Final Report is the main deliverable of Task 2: non-household (commercial) waste characterisation.

This Final Report includes:

- A description of the background data gathered which informed the sampling plan and methodology used
- The final results of the sectoral characterisations including the samples, their analysis and composition, and
- A number of recommendations to improve the current methodology based on the findings from the current work programme.

The surveying element was based on the methodology developed in 2015[2] (referred herein as the 2015 methodology) and an updated version of this methodology is presented in Appendix 1.

Survey work consisted of a physical waste compositional analysis of the following main waste streams:

- Mixed Residual Waste (hereafter referred to as MRW)
- Mixed Dry Recyclables (MDR)
- Organic Waste (hereafter referred to as BB, i.e. brown-bin waste)

Throughout this report the sectoral data is presented at the primary category level[3]. Detailed data of the sectoral results, including all secondary waste categories[4] in percentages, are included in the associated data files.

1.1 Background Information

The sampling plan used for the characterisation of non-household municipal (commercial) waste took into consideration the updated 2014 methodology, the limits set out in the Request for Tenders (RFT) and also the methodology used in previous studies from 2002, 2004 and 2008.

Ireland was one of the first countries to acknowledge, through its characterisation methodology, the heterogeneity of waste generated by businesses in the various commercial sectors. The methodology developed by the EPA and CTC entailed very detailed surveys in a small number of businesses within the largest waste producing commercial sectors in the country. A major issue with this method was the limited data set used to determine the character of waste for each of these sectors. While the data from the individual surveys was very comprehensive, typically between two and five surveys were used to generate the profile for the main sectors. In previous studies, 4-5 days were spent on-site in order to ensure that a full week's worth of waste was

[1] Request for Tender SPCP-2016-49 Municipal Waste Characterisation, EPA, 2016
[2] Updated Methodology for the Characterisation of Non-household Municipal Solid Waste in Ireland, CTC, 2015
[3] Primary Waste Category - A high level waste category e.g. organics, metals etc.
[4] Secondary Waste Category is a more specific waste category within a Primary Waste Category, e.g. mixed flexible plastic, ferrous metal etc.

captured and analysed. In order to generate a more statistically robust sectoral profile, the updated methodology involves surveying more locations but spending just one day on site.

The new methodology requires that at least 100m^3 of waste be analysed for the non-household sector in total. Based on the 50 site surveys allocated the sample size for each should be 2m^3 of waste to satisfy the 100m^3 criterion. This is an important minimum requirement as it ensures that businesses producing very small volumes of waste do not skew the statistical results.

2 Sampling Methodology

Due to the heterogeneity of waste produced by different commercial sectors, the methodology proposes to identify the main sectors and then develop a sectoral waste profile for each which can subsequently be used to develop a national waste characterisation model. The first step in this process is to identify the main sectors on which to focus for subsequent waste surveys.

In earlier national waste characterisation studies, the non-household sector was initially broken down by primary (two-digit division) NACE classifications. In 2008, based on recommendations made during the previous 2004 report, as well as feedback from waste contractors and other contributing stakeholders, the primary NACE sectors were broken down according to sub-NACE two-digit division codes, where necessary. This was required in order to address a high degree of variability within certain NACE codes (e.g. NACE I, Accommodation and Food Service activities).

In addition, the relative proximity between the two studies allowed the 2004 data to be added to the 2008 data and used both in the planning and scale-up phases. This allowed certain sectors to be focused on, or not, based on the recent survey data and sectoral information provided by the waste contractors.

However, due to the current long period since the last study in 2008, and the many changes in the country in terms of economic activity and waste management services, it is not possible to use the previous survey data in this contemporary work. Therefore, the primary method used to determine the most significant waste producing sectors is based on information provided by the main waste contractors.

2.1 Sector identification

Waste data reporting has improved since the last study in 2008, and the NWCPO database now provides a breakdown of the type of waste (i.e. according to List of Waste classification (formerly EWC)) collected by different waste collectors on a county-by-county basis. It does not, unfortunately, provide this information broken down by sectoral NACE codes. Therefore, in order to overcome this data shortfall, the largest commercial waste contractors were contacted and surveyed to provide a breakdown of their waste collection volumes based on pre-determined NACE classifications.

A survey template was sent out to over 35 waste contractors throughout the country, initially by REPAK. The survey was then sent on three separate occasions by CTC directly to the waste contractors on the IWMA/REPAK list. Finally, in recent months, CTC has been contacting people that it has worked with during this project directly in an effort to get more survey returns. Currently, 14 waste contractors (or 40% of the main authorised waste collectors) have supplied returns. Based on these, as well as national data available from the EPA[5] and EWC data supplied by the NWCPO, a sector-based waste profile for the country has been generated.

These results are outlined in

Table 1: and graphically depicted in

Figure 1. Pareto analysis of these results indicates that over 80% of the total estimated waste generated is covered by the first six sectors listed, and marked in green. In addition, by using the

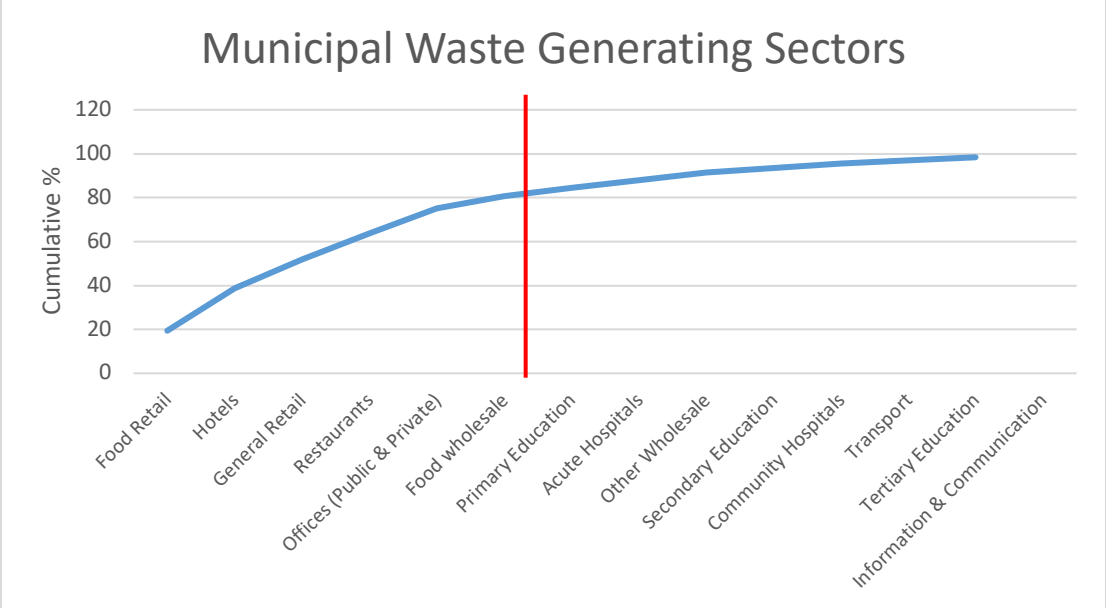
[5] http://www.epa.ie/nationalwastestatistics/indicators/

sectoral data for the healthcare sector, available through the Green Healthcare Programme[6], the combined percentage of waste covered by this work is over 85% of the total. Therefore, the focus of the surveys conducted during this project focused on these main 6 sectors.

Table 1: Main municipal waste producing sectors in Ireland

Sector	***% of Total Reported***	***Cumulative % of Total***
Food Retail	19.4	19.4
Hotels	19.3	38.7
General Retail	13	51.7
Restaurants	12.2	63.9
Offices (Public & Private)	11.3	75.2
Food wholesale	5.4	80.6
Acute Hospitals*	3.6	84.2
Community Hospitals*	1.9	86.1
Primary Education	3.9	90
Other Wholesale	3.3	93.3
Secondary Education	2.1	95.4
Transport	1.5	96.9
Tertiary Education	1.5	98.4
Information & Communication	1	99.4

** Hospitals account for a combined 5.4% of the total but have been split based on the data available*



[6] Green Healthcare is co-funded by the HSE National Health Sustainability Office and the EPA

Figure 1: Main waste producing sectors identified by national waste contractors survey returns (80% is marked by red line)

2.2 Allocation of Surveys

It is important to note that a number of subsectors exist within the sectors identified. During the surveys conducted during this work every effort was made to get a broad mix of businesses, though the results are collated herein for the sector only.

The following are the key subsectors:

- Food retail covers a wide range of stores and could be broken into large supermarkets, budget supermarkets (these would have a different model to traditional supermarkets) and small stores (branded local shops, filling stations, etc.).
- Hotels range from basic bed and breakfast locations to large hotels with conference and function services. For the purpose of this study urban type business conference hotels (short stay) and large holiday type hotels were surveyed.
- General Retail is probably the most homogenous of the main sectors as the waste generated is largely packaging based. While there are differences between the types of locations (e.g. shopping centre and high street) and the type of products sold (e.g. shoes, clothes or household goods) this sector was not further differentiated.
- Restaurants is a diverse sector with fine dining restaurants, fast food restaurants, bar restaurants and canteens included.
- Offices cover a wide range of NACE categories from J (Information and Communication) to O (Public Administration and Defence). While there are a large number of sub categories within these NACE categories the majority (at least 85% based on employment figures from the CSO) can be classed as office-based activities (e.g. J: Computer Programming and Consultancy; K: Finance and Insurance; L: Real Estate Services; M: Accountancy Services; N: Travel Agency Services; O: Public Offices).
- There are numerous classifications of wholesale (e.g. household goods, food, agricultural machinery) though much of the waste generated by these is packaging-based, and segregated at source. However, due to the nature of food wholesale there can be significant volumes of municipal type waste generated, much of it potentially including food.

In addition, the municipal wastes from a number of manufacturing sites were surveyed. These surveys were carried out in three of the main production sectors that were identified as part of a recent EPA funded research project[7]. Through an assessment of numerous data sets (including employees, PRODCOM, waste data, etc.) this study endeavoured to identify priority sectors in Ireland from the perspective of resource intensity. Based on this the three sectors chosen for this study were food and beverage, pharmaceutical and medical devices.

Table 2 provides an overview of the allocation of surveys conducted during the work programme.

[7] Resource Efficiency in Priority Irish Business Sectors, CTC, EPA 2017

Table 2: Sectors identified for commercial surveys along with estimated % that they contribute to the total commercial waste generated in Ireland

Sector	% of Total Estimated Commercial Waste	No. of surveys conducted
Food Retail	19.4	10
Hotels	19.3	8
General Retail	13	6
Restaurants	12.2	9
Offices	11.3	10
Food Wholesale	5.4	4
Industry	N/A	3
Total		***50***

2.3 Sampling Procedure

The methodology for the commercial waste assessments is in accordance with the updated 2015 methodology. Similar to the previous methodology this includes contacting management in advance, scheduling survey work to ensure sufficient waste is available, informing on-site staff in advance, selecting an appropriate survey location on-site and then the actual assessment of waste.

Unlike previous waste characterisation studies, where 4-5 days were spent on-site (in order to ensure that a full week's waste was captured and analysed), the updated method involves spending just one day on-site. One-day surveys are challenging as there needs to be sufficient waste from each of the main waste streams to ensure the *de minimis* requirements are met. Therefore, planning and communication with the business prior to site visit is critical.

A full outline of the on-site methodology is given in Appendix 1.

3 Results

The results of the sectoral surveys are presented in this section. For each sector the following are included:

- Mixed Residual Waste (MRW) surveys results and discussion
- Mixed Dry Recyclable (MDR) survey results and discussion
- Comparison of 2018 results with those of 2008

3.1 NACE G: Food Retail

Food retail covers a wide range of businesses including large supermarkets, budget supermarkets (these would have a different model to traditional supermarkets) and small stores (branded local shops, filling stations, etc.). During this work 10 food retail businesses were surveyed with 82 samples included in the generation of the MRW profile and 40 samples for the MDR profile.

3.1.1 MRW

The results for the 82 MRW samples are summarised in Table 3 and presented graphically in Figure 2.

Table 3: Composition of MRW from Food Retail Sector

Primary category	Mean	Min.	Max.	Upper limit	Lower limit
Organic Waste	42.2%	1.2%	100.0%	47.0%	37.4%
Paper	18.9%	0.2%	89.5%	22.0%	15.8%
Plastic	18.8%	1.7%	86.5%	21.7%	16.0%
Textiles	4.0%	0.1%	77.7%	6.1%	1.8%
Cardboard	3.8%	0.1%	16.5%	4.4%	3.1%
Unclassified Incombustibles	2.6%	0.1%	78.9%	2.9%	0.0%
Unclassified Combustibles	2.5%	0.1%	50.3%	5.2%	1.6%
Metal	2.0%	0.0%	10.5%	2.7%	1.7%
Glass	1.5%	0.1%	18.3%	2.7%	1.4%
Composites	1.3%	0.1%	25.0%	2.1%	0.9%
Compostables	1.0%	2.0%	22.7%	2.1%	0.8%
Haz. Municipal Waste	1.0%	0.1%	4.9%	2.9%	0.0%
Fines	0.4%	0.2%	5.1%	0.6%	0.2%
Wood	0.1%	0.1%	3.5%	0.2%	0.1%
Total	**100%**	**n/a**	**n/a**	**n/a**	**n/a**

Organic waste was the largest individual waste category in the MRW stream at 42.2%. This included 31.9% food waste, 4.5% unused packaged food and 4.8% liquid wastes.

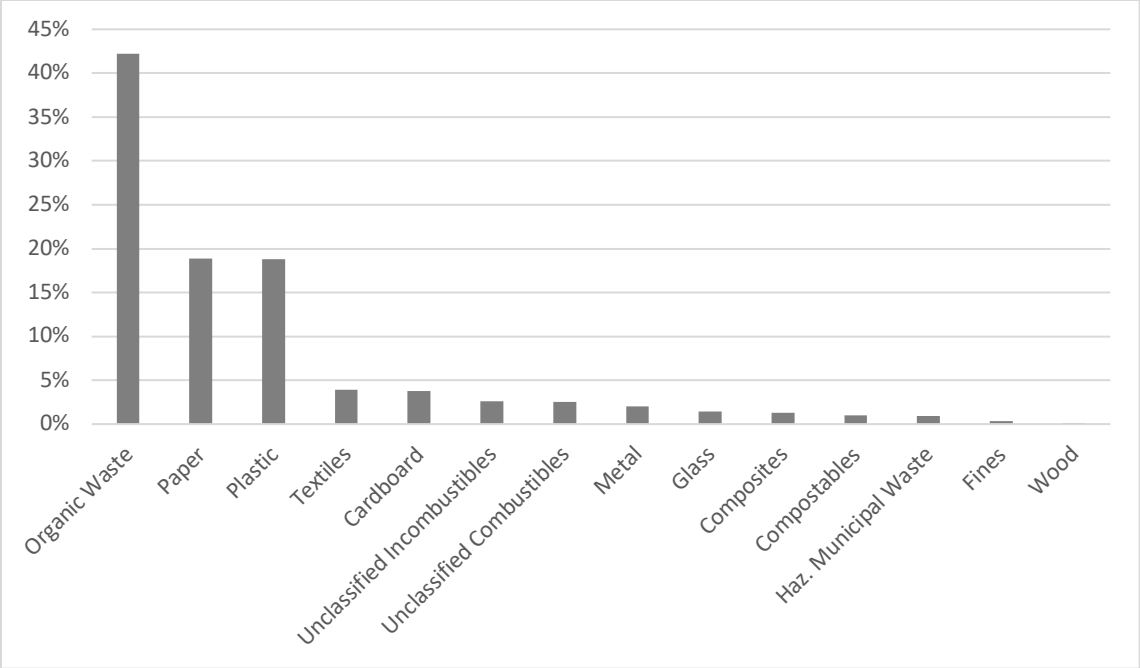


Figure 2: Composition of MRW from the Food Retail Sector

The second largest primary waste category was paper at 18.9%. The most significant individual material was tissue paper (8.7%) with the rest comprising mainly of other paper (2.7%), magazines (2.0%), paper packaging (1.8%) and unrecyclable paper (1.8%).

Plastic waste, 18.8%, consisted of plastic bags and films (5%), other plastic packaging (4.3%), PET (2.7%), and smaller volumes of other plastic packaging, unrecyclable plastic packaging, and PP packaging.

The following is a summary of the smaller waste fractions:

- The main component of textiles (4.0%) was non-packaging textiles
- Cardboard (3.8%) was almost completely packaging material
- Unclassified incombustibles and unclassified incombustibles accounted for 2.6% and 2.5% respectively
- Metals (2%) included aluminium foil and trays (0.6%), tin cans (0.5%) and Al cans (0.5%)
- Composites was made up mainly of coffee cups (1.2%)
- There was 1.0% of both hazardous materials and compostable wares (cups, plates, etc.)

3.1.2 MDR

The results of the 40 MDR samples analysed from food retail businesses are summarised in Table 4 and presented graphically in Figure 3.

Of the plastic waste (34.4%) the main materials were plastic bags and films (11.2%), PET (6.6%) and other plastic non-packaging (5.3%). Smaller volumes included PP packaging (4.3%), other plastic packaging (3.1%) and PS packaging (2.5%).

Paper waste, at 27.0% of the total consisted of other paper (7.3%), office paper (6.2%), tissue paper (5.9%) and non-packaging materials such as newspapers and magazines and glossies at 5.5%.

Organic wastes (16.5%) included food waste (12.1%), liquid wastes (2.8%) and packaged food (1.6%).

Cardboard (13.3%) was mainly packaging materials.

Metal waste (3%) consisted of tin cans (1.9%) and aluminium wastes (1.1%).

Other waste streams of interest included unclassified combustibles (0.6% due to composite packaging), composites (coffee cups at 0.5%) and used beverage containers (0.3%).

Table 4: Composition of MDR from Food Retail Sector

Primary category	Mean	Min.	Max.	Upper limit	Lower limit
Plastic	34.4%	3.4%	96.5%	41.4%	27.3%
Paper	27.0%	1.0%	81.9%	32.3%	21.6%
Organic Waste	16.5%	0.2%	72.4%	21.2%	11.8%
Cardboard	13.3%	0.2%	76.0%	17.8%	8.8%
Metal	3.1%	0.2%	17.8%	4.4%	1.8%
Fines	1.3%	0.2%	8.0%	1.9%	0.9%
Unclassified Combustibles	1.2%	0.6%	31.9%	2.6%	0.1%
Textiles	1.1%	0.1%	12.8%	1.7%	0.5%
Glass	1.0%	2.2%	12.1%	1.7%	0.3%
Composites	0.8%	0.1%	14.1%	1.3%	0.0%
Wood	0.1%	0.2%	2.3%	0.3%	0.0%
Unclassified Incombustibles	0.1%	0.5%	2.1%	0.2%	0.0%
Compostables	0.0%	0.2%	0.7%	0.1%	0.0%
Haz. Municipal Waste	0.0%	0.0%	0.0%	0.0%	0.0%
Total	**100%**	**n/a**	**n/a**	**n/a**	**n/a**

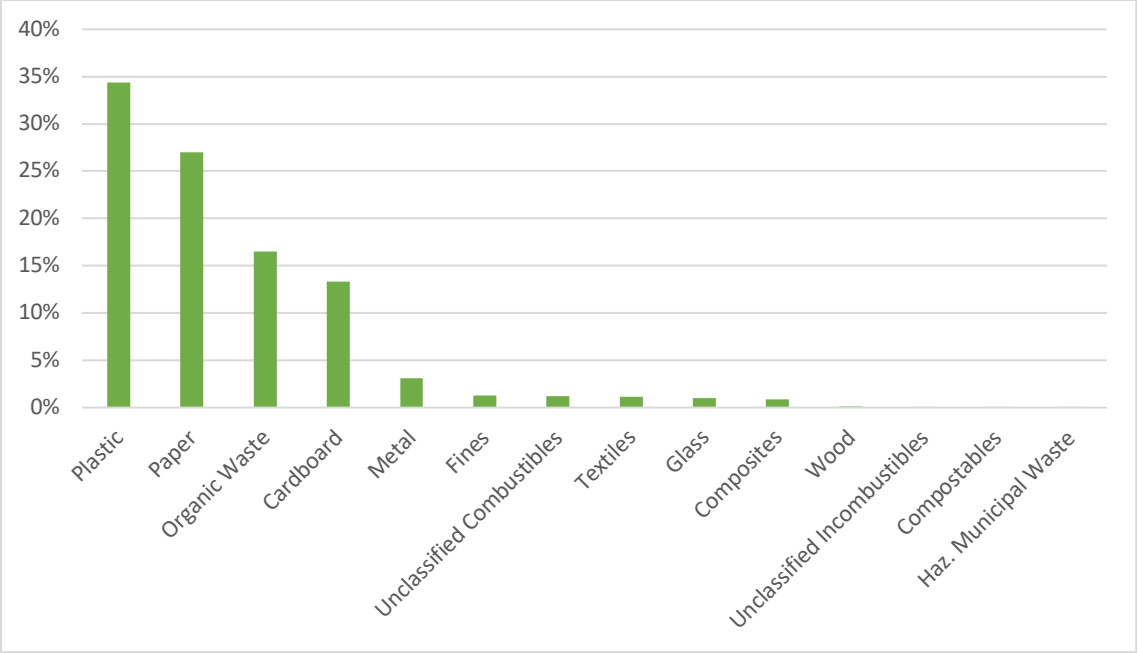


Figure 3: Composition of MDR from the Food Retail Sector

3.1.3 Comparison with 2008

A comparison of MRW and MDR results for 2008 and 2018 are shown in Figure 4 and Figure 5 respectively. The primary categories reported in 2008 are used in this comparison and, though the method of collating sectoral data has changed since 2008, the actual method of assessing waste on-site remains largely the same.

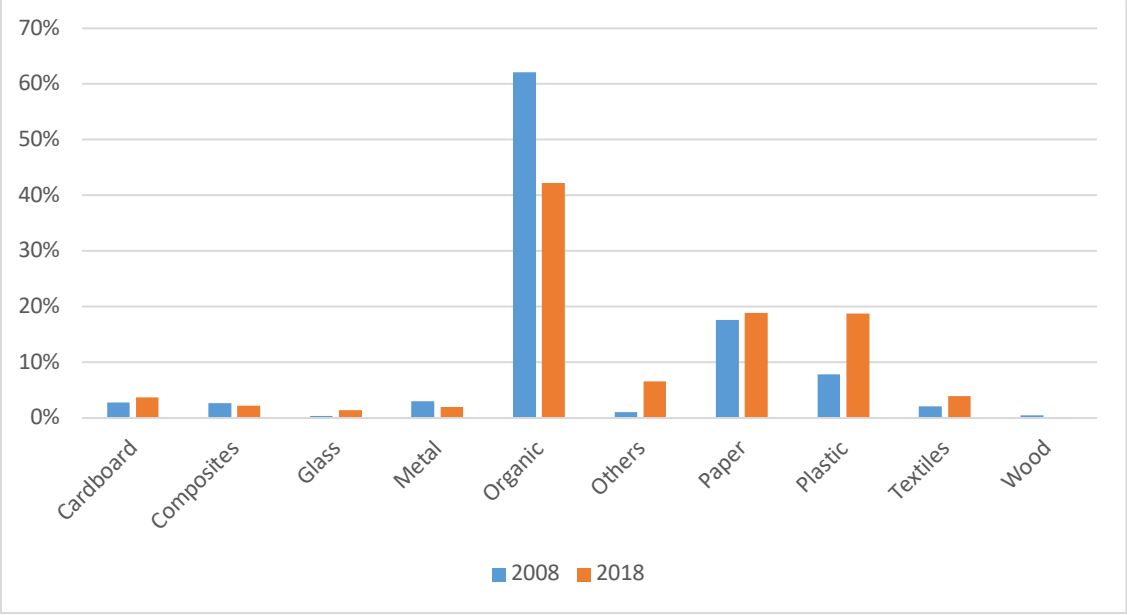


Figure 4: Comparison of 2008 and 2018 results for primary waste categories in MRW from the Food Retail sector

The main difference between the MRW comparison profiles is the lower proportion of organics present in 2018. This likely reflects the increased use of brown bin services nationally as well as improved practices in business. There are associated increases in the proportions of plastics and other materials, which includes compostables and unclassified incombustibles.

For MDR collection the most notable difference is the significant decrease in proportion of cardboard which is likely due to the increased use of segregated cardboard management. The main increases are related to the paper, plastic and organic waste streams.

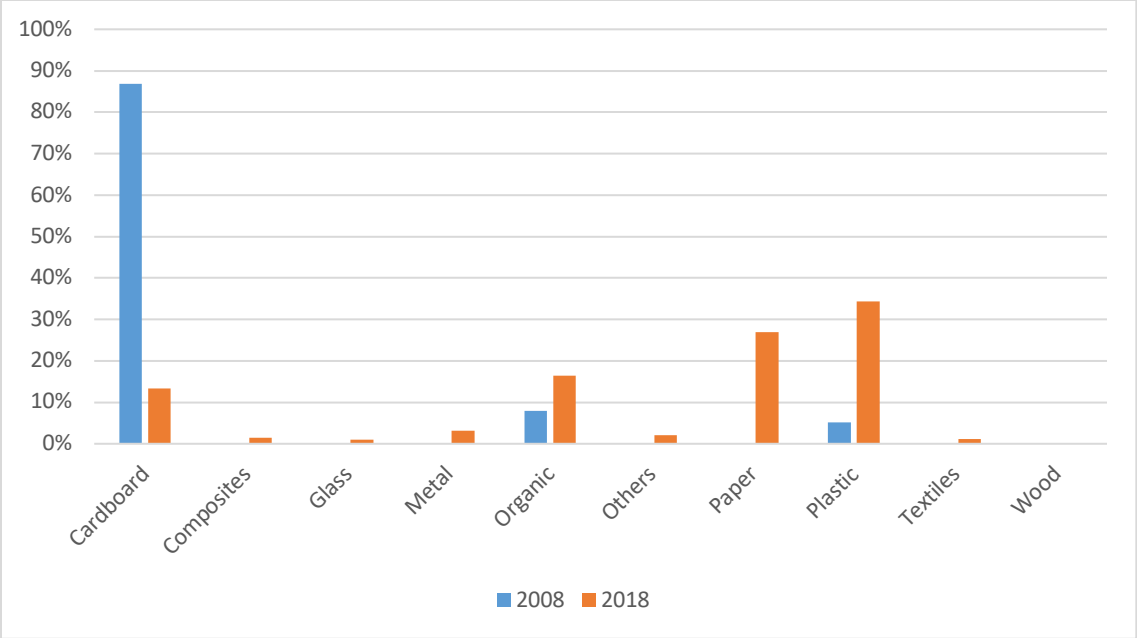


Figure 5: Comparison of 2008 and 2018 results for primary waste categories in MDR from the Food Retail sector

3.2 NACE I: Hotel Sector

The hotel sector is a significant one for Ireland and includes a range of businesses from basic bed and breakfast locations to large hotels with conference and function services. During this work hotel surveys were carried out with 64 samples included in the generation of the MRW profile and 60 samples for the MDR profile.

3.2.1 MRW

The results for 64 MRW samples are summarised in Table 5 and presented graphically in Figure 6.

Table 5: Composition of MRW from Hotel Sector

Primary category	Mean	Min.	Max.	Upper limit	Lower limit
Organic Waste	34.0%	0.8%	89.7%	39.3%	28.7%
Paper	21.8%	0.2%	79.4%	25.7%	17.9%
Plastic	17.0%	1.1%	62.5%	19.7%	14.2%
Textiles	6.3%	0.5%	53.9%	8.9%	3.8%
Metal	4.9%	0.2%	93.2%	7.5%	2.2%
Cardboard	4.4%	0.1%	100.0%	8.1%	1.5%
Compostables	4.1%	0.2%	17.6%	6.6%	2.1%
Unclassified Combustibles	2.8%	0.1%	27.6%	5.6%	3.1%
Composites	1.8%	0.1%	22.7%	3.8%	2.3%
Fines	1.3%	0.2%	11.2%	2.1%	1.0%
Glass	0.8%	0.1%	37.1%	2.3%	0.3%
Haz. Municipal Waste	0.7%	0.2%	17.4%	1.3%	0.2%
Unclassified Incombustibles	0.1%	0.1%	5.5%	0.3%	0.0%
Wood	0.0%	0.1%	1.2%	0.1%	0.0%
Total	**100%**	**n/a**	**n/a**	**n/a**	**n/a**

Organic waste was the largest individual waste category in the MRW stream at 34.0% of the total. The majority of this was food waste (25.0%) with 6.1% unused packaged food also present. 2.2% was liquid wastes.

The second largest primary waste category was paper at 21.8%. The main individual material was tissue paper (12.2%) with the rest comprising of newspaper (2.9%), office paper (2.0%), other paper (1.7%) and magazines (1.4%).

Plastic waste, 17.0%, consisted of plastic bags and films (5.0%), PET (2.5%), other plastic packaging (2.2%), unrecyclable plastic packaging (2.0%), and PP packaging (2.0%).

The following is a summary of the smaller waste fractions:

- Textiles (6.3%) comprised of non-packaging textiles (4%), clothes (1.3%) and nappies (0.9%)
- Metals (4.9%) included tin cans (2.9%), other metal wastes (1.2%) with small quantities of aluminium cans, aluminium foil & trays and other metal packaging
- Cardboard (4.4%) was almost completely packaging materials

- Compostable wares accounted for 4.1%
- Unclassified combustibles (2.8% included 1.7% composites packaging
- Composites (1.8%) included used beverage containers (1.0%) and coffee cups (0.8%)

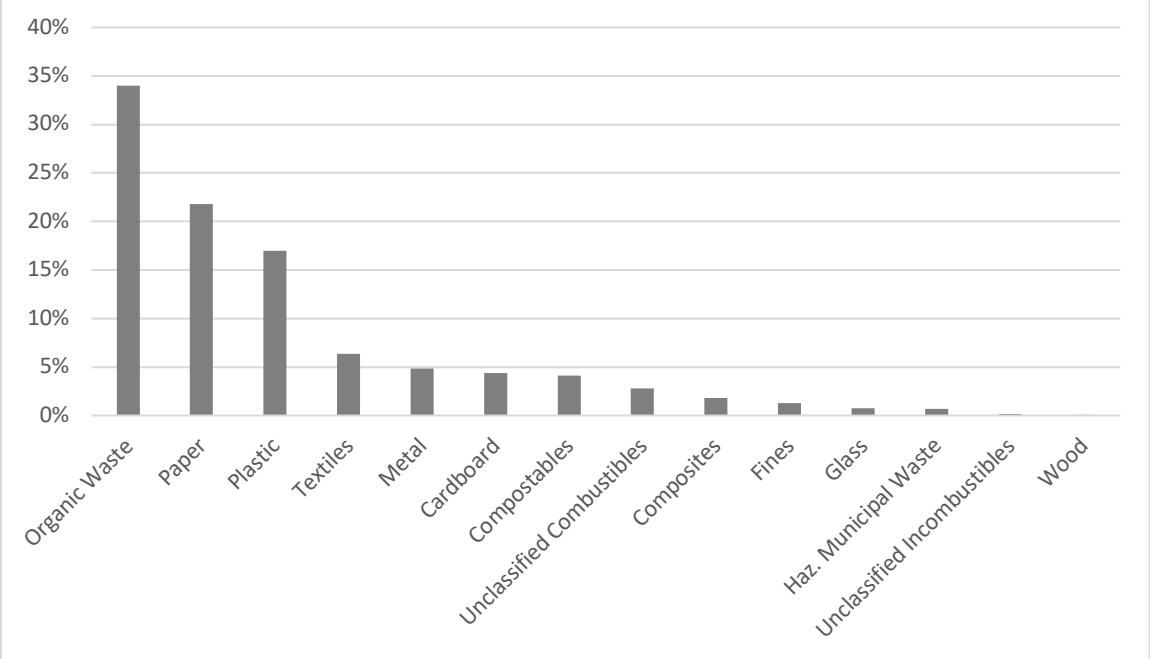


Figure 6: Composition of mixed residual wastes (MRW) from the Hotel Sector

3.2.2 MDR

The results of the 60 MDR samples analysed from hotels are summarised in Table 6 and presented graphically in Figure 7.

Table 6: Composition of MDR from Hotel Sector

Primary category	Mean	Min.	Max.	Upper limit	Lower limit
Paper	29.0%	0.4%	90.9%	33.5%	24.6%
Plastic	21.6%	0.3%	58.2%	24.7%	18.6%
Cardboard	19.6%	0.9%	100.0%	25.6%	13.5%
Organic Waste	9.8%	0.2%	84.3%	12.7%	6.9%
Metal	4.7%	0.0%	88.3%	7.4%	2.0%
Unclassified Combustibles	4.3%	0.2%	52.6%	5.1%	1.6%
Compostables	3.0%	0.2%	21.2%	4.2%	2.2%
Composites	2.1%	0.2%	32.9%	4.5%	1.9%
Textiles	1.8%	0.1%	23.2%	2.6%	1.0%
Glass	1.8%	1.0%	12.3%	2.5%	1.1%
Wood	1.2%	0.2%	49.1%	2.6%	0.2%
Fines	0.5%	0.2%	9.2%	0.9%	0.2%
Haz. Municipal Waste	0.4%	0.4%	5.1%	0.3%	0.0%
Unclassified Incombustibles	0.1%	0.2%	0.9%	0.2%	0.0%
Total	**100%**	**n/a**	**n/a**	**n/a**	**n/a**

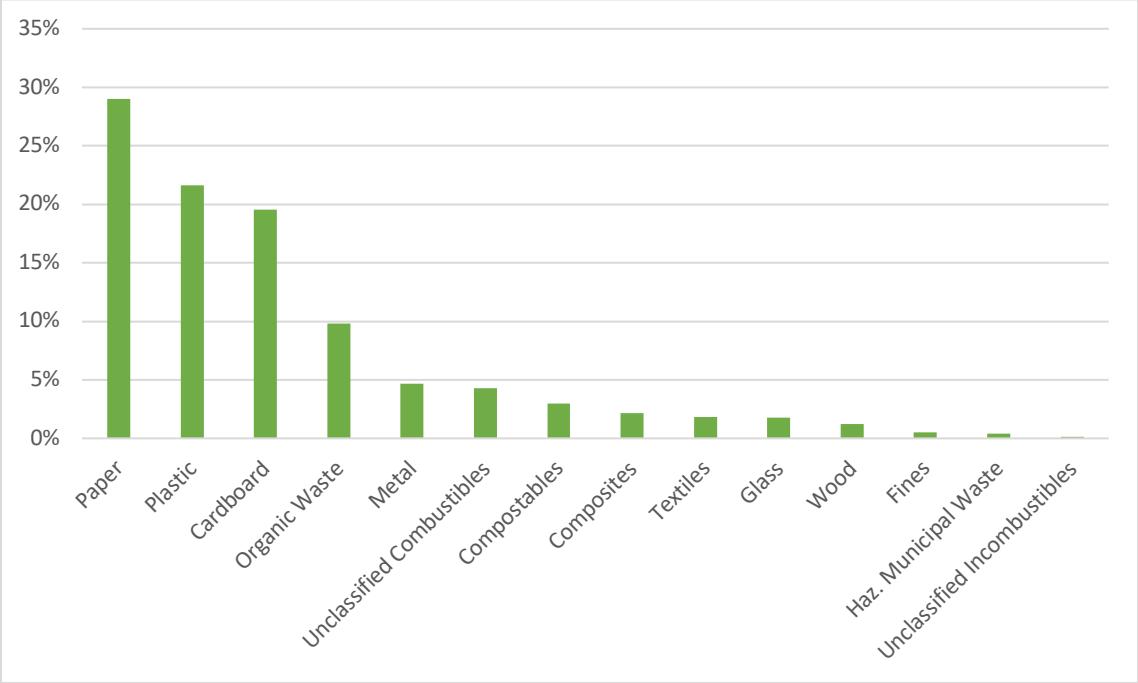


Figure 7: Composition of MDR from the Hotel Sector

Paper waste was identified as the largest individual stream at 29.0% and consisted of tissue paper (9.6%), newspapers (5.6%), office paper (4.7%), paper packaging (3.2%) other paper (2.8%) and magazines and glossies (2.8%).

Of the plastic waste (21.6%) the main materials were plastic bags and films (7.7%), PET (5.7%) and other plastic packaging (2.2%). Smaller volumes included non-packaging plastics (1.8%), PE packaging (1.5%) and PP packaging (1.0%)

Cardboard (19.6%) consisted of 18.8% cardboard packaging.

Organic wastes (9.8%) included liquid wastes (4.8%) and food waste (4.2%). The high proportion of liquid wastes was due to residual volumes found in plastic bottles.

Metal waste (4.7%) consisted of tin cans (3.0%), other metal waste (0.8%) and small volumes of aluminium cans and aluminium foils and trays.

Unclassified combustibles (4.3%) consisted of 3.2% of composite packaging.

Compostable wares accounted for 3.0%.

There were smaller proportions of composites (1.6% used beverage containers and 0.6% coffee cups), textiles (1.8%), glass (1.8%) and wood (1.2%).

3.2.3 Comparison with 2008

A comparison of MRW and MDR results for 2008 and 2018 are shown in Figure 8 and Figure 9 respectively. The primary categories reported in 2008 are used for this comparison.

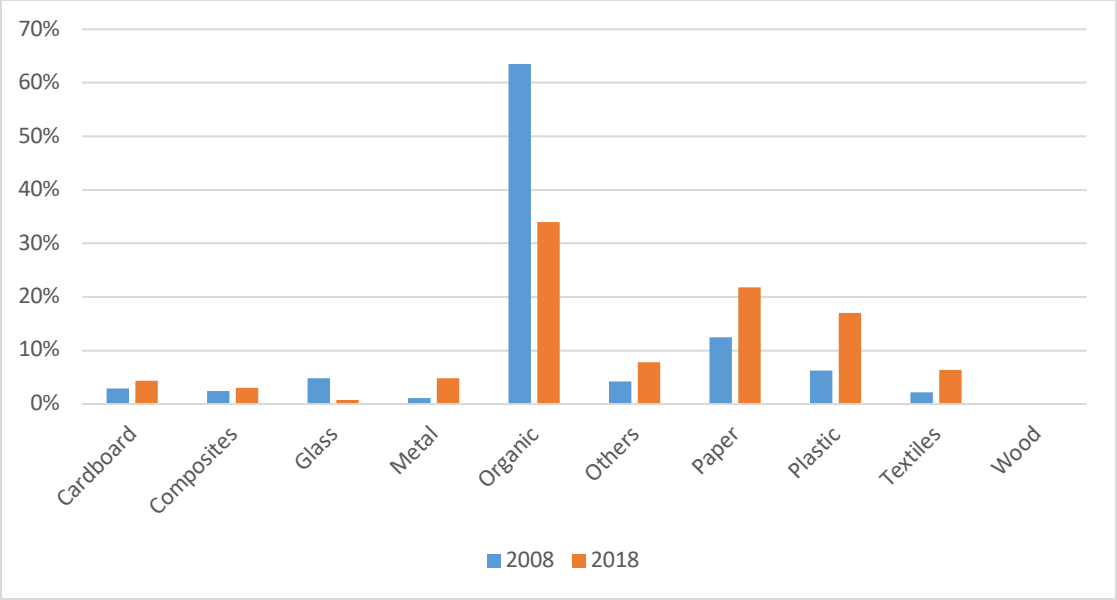


Figure 8: Comparison of 2008 and 2018 results for primary waste categories in MRW from the Hotel sector

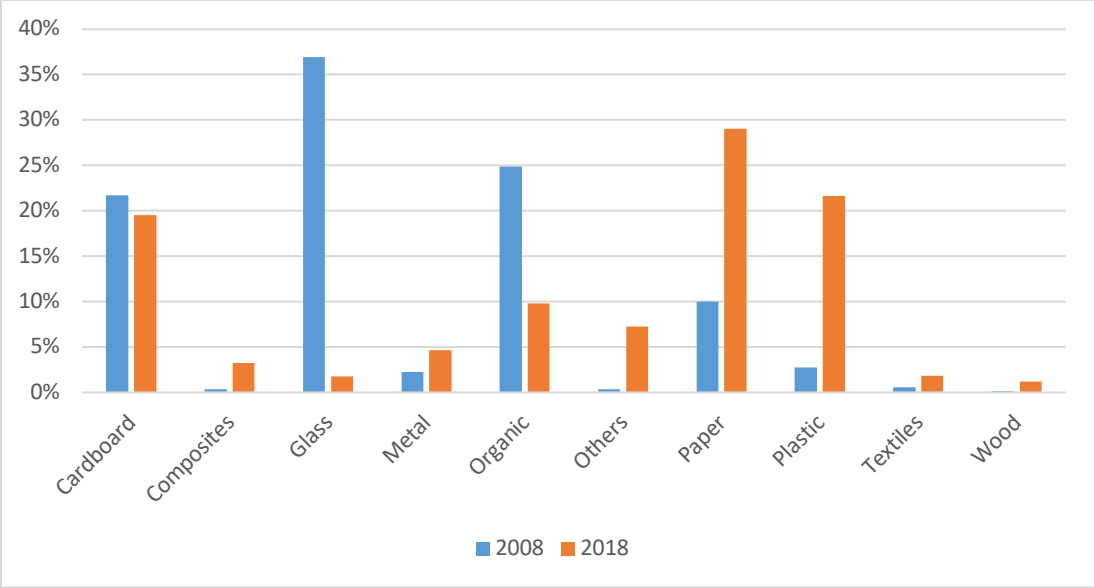


Figure 9: Comparison of 2008 and 2018 results for primary waste categories in MDR from the Hotel sector

There are a number of differences between both MRW and MDR comparison profiles. Lower proportions of organics in both reflect the increased use of brown bin services nationally as well as improved practices within business. Lower levels of glass in the 2018 MDR profile are likely related to similar improvements. The associated increases in the MDR stream, which occur in paper and plastics, may suggest improved segregation practices.

3.3 NACE G: General Retail

General Retail is probably the most homogenous of the main sectors and, though there are differences between the types of locations (e.g. shopping centre and high street) and the type of products sold (e.g. shoes, clothes or household goods), the waste generated is largely packaging based. During this work 6 retail businesses were surveyed with 18 samples included in the generation of the MRW profile and 30 samples for the MDR profile.

3.3.1 MRW

The results for MRW are summarised in Table 7 and presented graphically in Figure 10.

Table 7: Composition of MRW from General Retail Sector

Primary category	Mean	Min.	Max.	Upper limit	Lower limit
Paper	24.4%	0.2%	82.8%	32.3%	16.5%
Plastic	22.8%	9.0%	69.4%	28.6%	17.0%
Organic Waste	19.6%	1.2%	53.4%	27.2%	12.0%
Textiles	9.6%	0.1%	85.5%	19.6%	-0.3%
Cardboard	8.1%	0.1%	48.8%	13.1%	3.1%
Metal	5.3%	0.2%	26.7%	7.9%	2.6%
Composites	4.6%	0.2%	24.0%	7.2%	2.5%
Glass	2.3%	3.9%	26.6%	4.7%	0.0%
Unclassified Incombustibles	1.7%	0.2%	25.7%	4.0%	0.0%
Unclassified Combustibles	1.1%	0.1%	7.3%	1.6%	0.1%
Compostables	0.4%	0.1%	3.3%	0.9%	0.1%
Wood	0.1%	0.2%	2.1%	1.1%	0.1%
Haz. Municipal Waste	0.1%	0.2%	0.7%	0.1%	0.0%
Fines	0.0%	0.1%	0.1%	0.0%	0.0%
Total	**100%**	**n/a**	**n/a**	**n/a**	**n/a**

Paper waste is the largest primary category material present in the MRW stream at 24.4%. This consisted of tissue paper (16.8%), unrecyclable paper packaging (3.5%) and office paper (2.2%).

Plastic waste, the second largest primary waste category, was 22.8%. It consisted of other plastic packaging (5.9%), plastic bags and films (4.1%), unrecyclable plastic packaging (3.6%), PET (2.8%), PE (2.6%) and other plastic (2.1%).

Organic waste, 19.6%, consisted of 15.7% food waste, 2.6% unused packaged food and 1.5% liquid wastes.

Textiles, 9.6%, was made up mainly of textile packaging materials.

Cardboard (8.1%) was split between packaging and non-packaging cardboard.

Metals (5.3%) included 2.7% tin cans and 1.2% aluminium cans.

Composites 4.6% was mainly coffee cups.

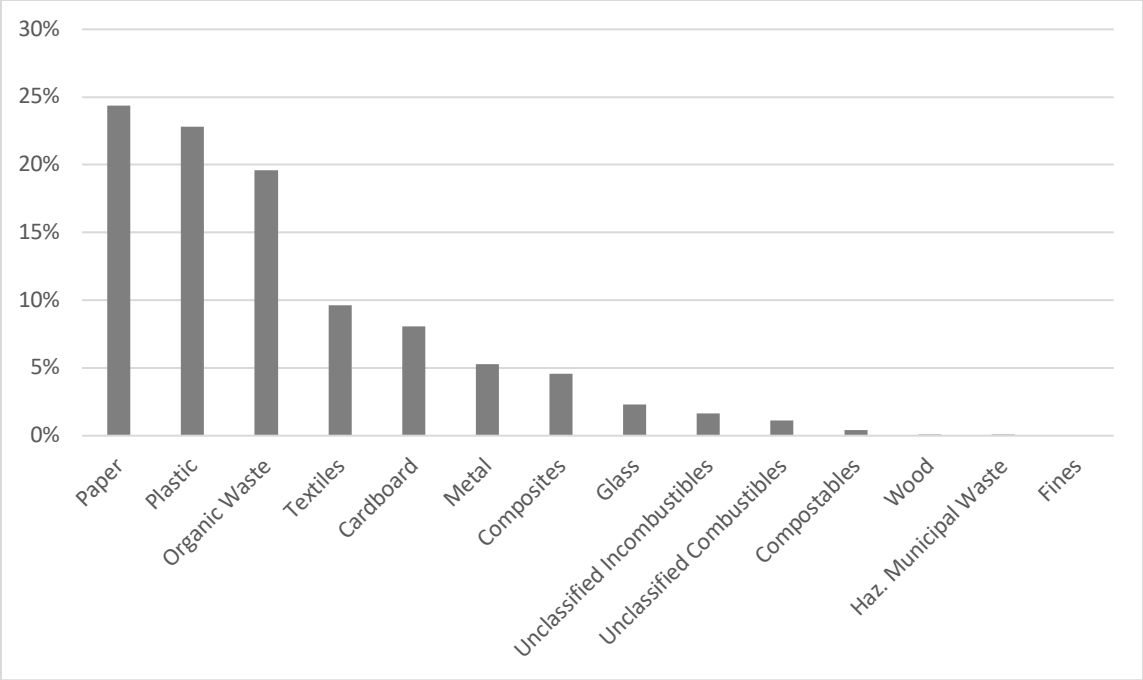


Figure 10: Composition of MRW from the General Retail Sector

3.3.2 MDR

The results of the 30 MDR samples analysed from the General Retail Sector are summarised in Table 8 and presented graphically in Figure 11.

Table 8: Composition of MDR from General Retail Sector

Primary category	Mean	Min.	Max.	Upper limit	Lower limit
Paper	35.2%	3.8%	75.9%	42.1%	28.4%
Cardboard	31.5%	0.8%	100.0%	42.7%	20.4%
Plastic	28.2%	2.9%	75.4%	35.1%	21.4%
Organic Waste	1.9%	1.0%	15.8%	3.0%	0.8%
Composites	0.6%	0.2%	6.6%	1.0%	0.2%
Glass	0.6%	0.2%	14.3%	1.4%	0.0%
Compostables	0.5%	0.2%	12.5%	1.2%	0.0%
Textiles	0.5%	0.2%	6.9%	0.9%	0.1%
Unclassified Incombustibles	0.3%	0.5%	5.0%	0.7%	0.0%
Metal	0.3%	0.1%	2.8%	0.5%	0.1%
Unclassified Combustibles	0.1%	0.1%	3.2%	0.3%	0.0%
Wood	0.1%	0.2%	0.7%	0.1%	0.0%
Haz. Municipal Waste	0.0%	0.0%	0.0%	0.0%	0.0%
Fines	0.0%	0.0%	0.0%	0.0%	0.0%
Total	**100%**	**n/a**	**n/a**	**n/a**	**n/a**

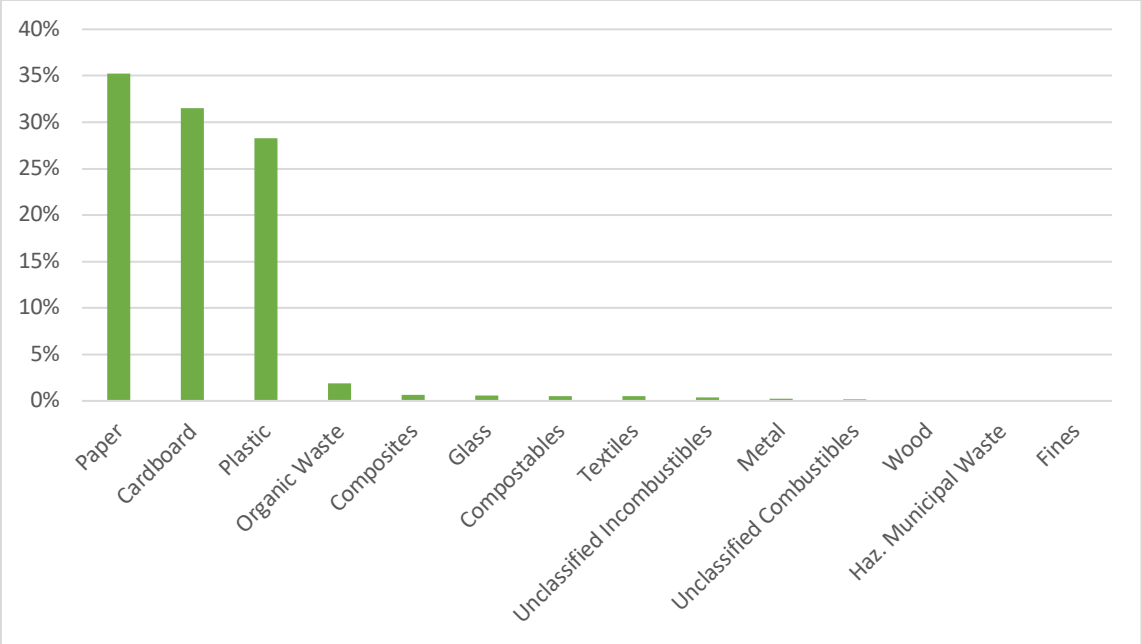


Figure 11: Composition of MDR from the General Retail Sector

Paper waste was identified as the largest individual stream at 35.2% and consisted of paper packaging (16.9%), office paper (9.1%) and smaller quantities of tissue paper, newspapers, magazines and glossies and other paper.

Carboard, the second largest category at 31% was mainly packaging materials.

Of the plastic waste (28.2%) the main materials were plastic bags and films (20.9%), other plastics (2.6%) and other plastic packaging (2.6%).

Small quantities of organics, composites and glass were also found, but all in very small volumes.

3.3.3 Comparison with 2008

A comparison of MRW and MDR results for 2008 and 2018 are shown in Figure 12 and Figure 13 respectively. The primary categories reported in 2008 are used in this comparison.

Though there are some differences in both MRW and MDR comparison profiles, there are no changes of great significance.

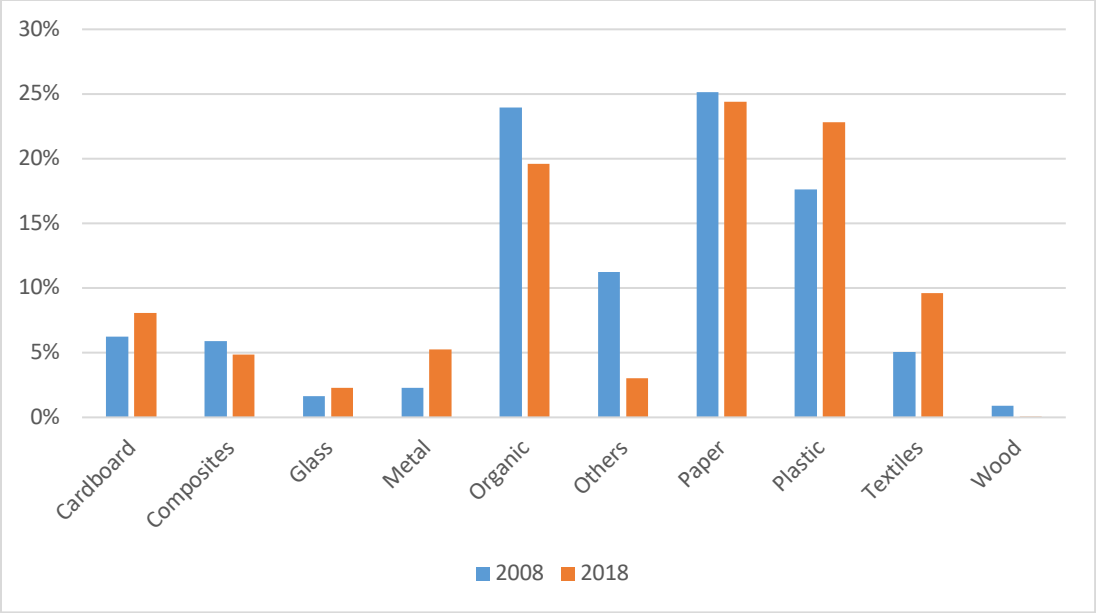


Figure 12: Comparison of 2008 and 2018 results for primary waste categories in MRW from the General Retail sector

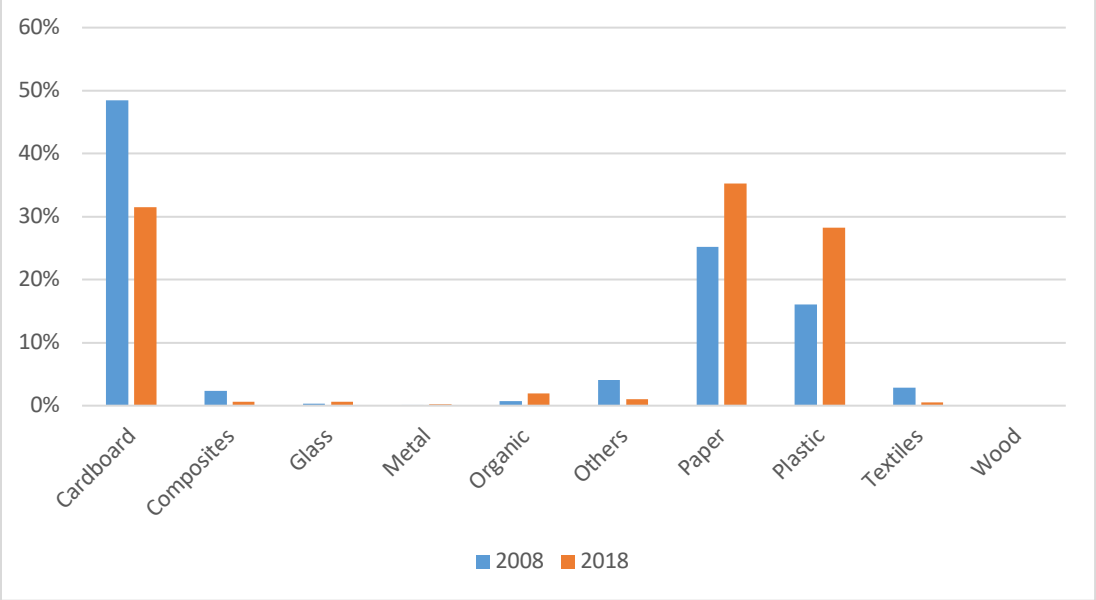


Figure 13: Comparison of 2008 and 2018 results for primary waste categories in MDR from the General Retail sector

3.4 NACE I: Restaurant Sector

The restaurant sector contains a broad range of establishments including fine dining restaurants, fast food restaurants, bar restaurants and canteens included. During this work, 10 hotel surveys were carried out with 55 samples included in the generation of the MRW profile and 46 samples for the MDR profile.

3.4.1 MRW

The results of MRW analysis in the restaurant sector are summarised in Table 9 and presented graphically in Figure 14.

Table 9: Composition of MRW from Restaurant Sector

Primary category	Mean	Min.	Max.	Upper limit	Lower limit
Organic Waste	29.5%	6.0%	66.9%	33.4%	25.7%
Paper	22.0%	1.2%	63.0%	25.3%	18.7%
Plastic	12.8%	3.7%	53.7%	14.7%	10.9%
Unclassified Incombustibles	6.3%	0.2%	43.0%	8.7%	5.1%
Textiles	6.2%	0.2%	94.0%	9.5%	3.0%
Cardboard	5.9%	0.3%	26.5%	7.5%	4.3%
Unclassified Combustibles	5.5%	9.2%	100.0%	10.2%	0.9%
Composites	4.4%	0.2%	34.9%	4.5%	1.5%
Metal	2.9%	0.2%	30.2%	4.1%	1.8%
Fines	1.4%	0.2%	31.0%	3.8%	1.1%
Compostables	1.3%	2.8%	27.1%	2.5%	0.2%
Glass	0.8%	0.1%	18.6%	1.4%	0.2%
Wood	0.6%	0.1%	9.7%	1.0%	0.3%
Haz. Municipal Waste	0.4%	0.2%	5.7%	1.4%	0.0%
Total	**100%**	**n/a**	**n/a**	**n/a**	**n/a**

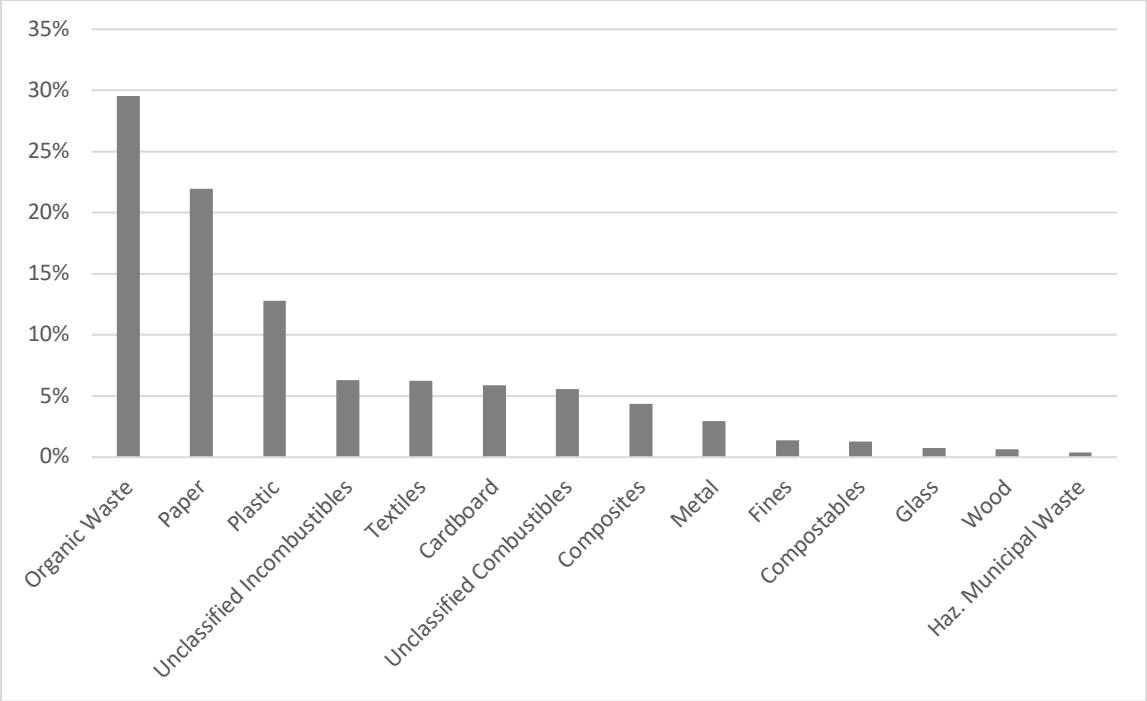


Figure 14: Composition of mixed residual wastes (MRW) from the Restaurant Sector

Even though restaurants have brown bins, organic waste was still the largest individual waste category in the MRW stream at 29.5% of the total. The majority of this was food waste (23.5%) with 2.5% unused packaged food also present. 2.0% was residual liquid wastes in bottles.

The second largest primary waste category was paper at 22.0%. The main individual material was tissue paper (14.6%) with the rest comprising of magazines (2.7%) paper packaging (1.8%) and small quantities (>1%) of newspaper, office paper, other paper and unrecyclable paper packaging.

Plastic waste, 12.8%, consisted of plastic bags and films (3.6%), other plastic packaging (2.8%), PET packaging (1.8%), other plastic packaging (1.4%), and PP packaging (1.1%).

Other materials include:

- Unclassified incombustibles and combustibles (2.6% of which was composite packaging) were 6.3% and 4.4% respectively
- Textiles (6.2%) included nappies (4.0%) and non-packaging textiles (1.6%)
- Cardboard (5.9%) consisted of cardboard packaging (4.5%) and non-packaging cardboard (1.3%)
- Composites was mainly coffee cups (4.1%)
- Metals (2.9%) included other metal packaging (1.2%), other metal wastes (0.7%) with small quantities of aluminium cans and aluminium foil & trays

3.4.2 MDR

The results for the 46 MDR samples analysed from restaurants are summarised in Table 10 and presented graphically in Figure 15.

Table 10: Composition of MDR from Restaurant Sector

Primary category	Mean	Min.	Max.	Upper limit	Lower limit
Plastic	29.3%	3.0%	90.5%	33.7%	24.8%
Cardboard	27.9%	0.2%	100.0%	35.3%	20.5%
Paper	14.1%	0.2%	50.9%	17.0%	11.3%
Metal	9.4%	0.2%	63.5%	13.1%	5.7%
Organic Waste	8.2%	0.4%	62.8%	11.2%	5.3%
Composites	4.0%	0.5%	77.6%	8.3%	2.3%
Wood	1.9%	0.2%	72.4%	4.5%	-0.7%
Unclassified Combustibles	1.7%	0.4%	15.3%	2.2%	0.8%
Compostables	1.4%	3.2%	24.0%	2.4%	0.3%
Glass	1.3%	0.2%	5.8%	0.9%	0.2%
Textiles	0.6%	0.2%	4.4%	0.7%	0.2%
Haz. Municipal Waste	0.1%	0.2%	0.4%	0.0%	0.0%
Unclassified Incombustibles	0.0%	0.2%	0.2%	0.0%	0.0%
Fines	0.0%	0.0%	0.0%	0.0%	0.0%
Total	**100%**	**n/a**	**n/a**	**n/a**	**n/a**

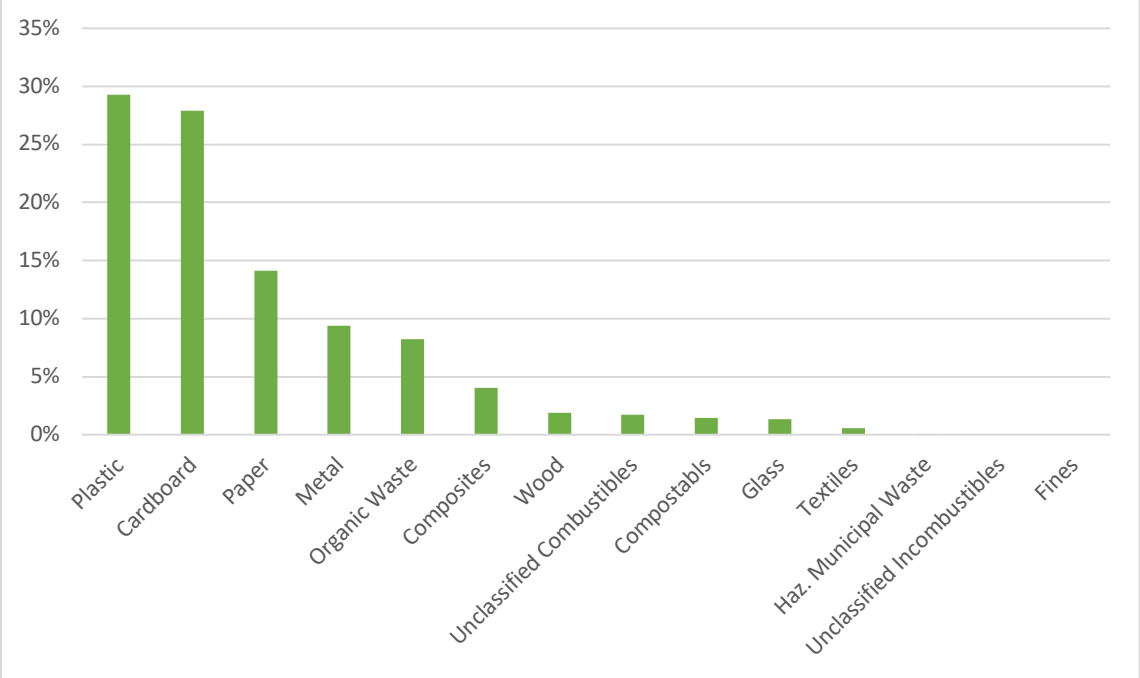


Figure 15: Composition of MDR from the Restaurant Sector

Plastic waste was identified as the largest individual stream in the MDR at 29.3%. It consisted of plastic bags and films (7.2%), PE (5.3%) and PET (4.8%) packaging, other plastic packaging (3.9%), PP packaging (3.8%) and non-packaging plastics (2.8%).

Cardboard (27.9%) was almost exclusively cardboard packaging.

Of the paper waste (14.1%) the main materials were tissue paper (7.5%), paper packaging (2.2%) and office paper (1.4%).

Metal waste (9.4%) consisted of tin cans (7.7%), and aluminium cans (1.1%).

Organic wastes (8.2%) included food waste (7%) and liquid wastes (1.2%) from residual volumes found in plastic bottles.

The majority of composites (4.0%) was coffee cups (3.4%) with small volumes of used beverage containers (0.7%).

Wood waste (1.9%) was mainly wooden stirrers used for take away coffee.

3.4.3 Comparison with 2008

A comparison of MRW and MDR results for 2008 and 2018 are shown in Figure 16 and Figure 17 respectively. The primary categories reported in 2008 are used in this comparison. It is important to note that the methodologies used in both years are slightly different.

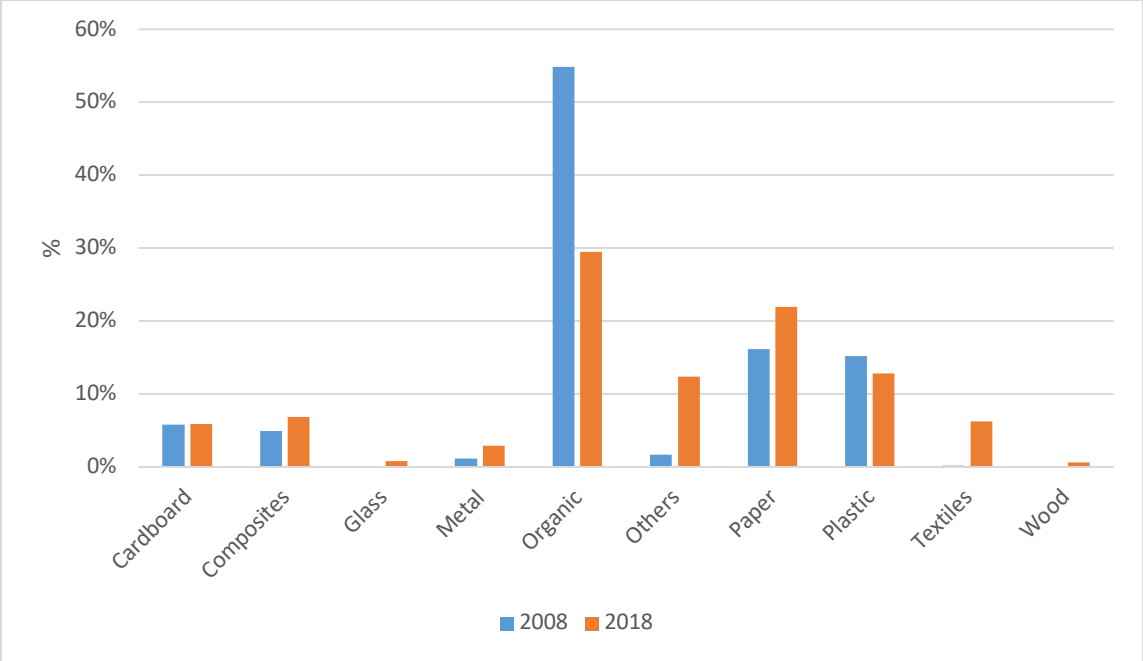


Figure 16: Comparison of 2008 and 2018 results for primary waste categories in MRW from the restaurant sector

The most significant difference between the MRW profiles is the reduced proportion of organic waste. This is likely related to improved waste segregation practices in the sector. The main associated increases were textiles (nappies), others (compostable wares) and paper (increased volumes of tissue paper).

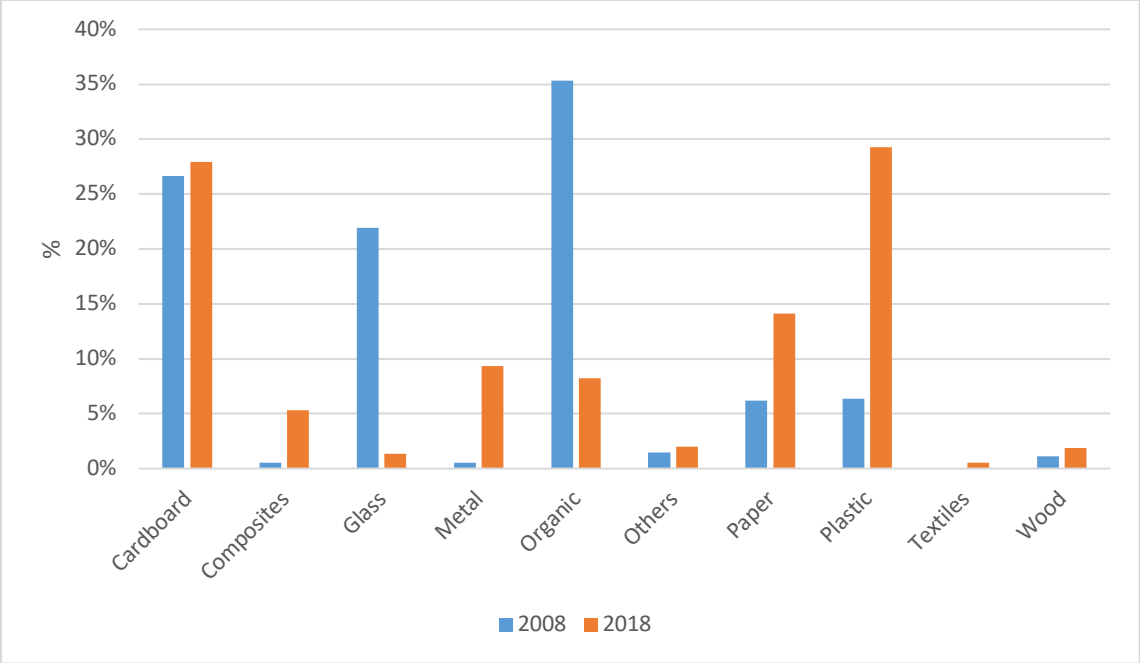


Figure 17: Comparison of 2008 and 2018 results for primary waste categories in MDR from the restaurant sector

The significant differences in the MDR profile are the lower volumes of organics and glass packaging which is likely to be linked to improved segregated services, and improved practices, relating to these materials. The notable increases in the 2018 profile are related to plastics, paper and composites (coffee cups).

3.5 NACE J, K & L: Office Sectors

The office sector is a broad one incorporating public offices and a variety of private businesses including financial, real estate, advertising, architecture, engineering, recruitment, etc. During this work 10 office surveys were carried out with 74 samples included in the generation of the MRW profile and 71 samples for the MDR profile.

3.5.1 MRW

The results for 74 MRW samples are summarised in Table 11 and presented graphically in Figure 18.

Table 11: Composition of MRW from Office Sector

Primary category	Mean	Min.	Max.	Upper limit	Lower limit
Organic Waste	39.7%	6.8%	100.0%	43.7%	35.7%
Paper	24.4%	2.1%	69.3%	27.5%	21.2%
Plastic	13.4%	1.1%	35.4%	15.0%	11.8%
Composites	5.3%	0.3%	25.5%	8.5%	5.7%
Textiles	3.6%	0.2%	71.0%	6.7%	2.4%
Compostables	3.5%	0.2%	46.4%	5.4%	1.8%
Unclassified Combustibles	2.8%	0.2%	14.3%	3.0%	1.9%
Cardboard	2.5%	0.2%	12.3%	3.0%	1.8%
Metal	2.4%	0.3%	13.5%	1.6%	0.6%
Glass	1.1%	0.2%	15.9%	1.5%	0.5%
Haz. Municipal Waste	0.7%	0.2%	4.5%	1.2%	0.0%
Unclassified Incombustibles	0.5%	0.1%	3.8%	0.2%	0/1%
Wood	0.2%	0.1%	2.2%	0.3%	0.1%
Fines	0.1%	0.3%	4.9%	0.2%	0.0%
Total	**100%**	**n/a**	**n/a**	**n/a**	**n/a**

Organic waste was found to be the most prominent primary category of waste at 39.7% of the total composition. The majority of this was food waste (32.4%) with 4.0% unused packaged food and 1.5% of both garden waste and liquid wastes.

The second largest primary waste category was paper at 25.4%. This was mainly tissue paper (10.8%) with the rest composed of office paper (3.3%), other paper (3.2%) paper packaging (2.8%) and newspaper (2.2%).

Plastic waste, 13.4%, consisted mainly of plastic bags and films (3.6%), PET packaging (3.0%), non-packaging items (2.3%), other plastic packaging (2.0%) and PP packaging (1.1%).

The following is a summary of the smaller waste fractions:

- Composites (5.3%) was made up mainly of coffee cups 4.8%
- Textiles (3.6%) consisted of clothes (2.2%) and non-packaging textiles
- Compostable wares (cups, plates, etc.) accounted for 3.5%
- Unclassified combustibles (2.8%) included 1.8% composite packaging

- Cardboard (2.5%) was almost completely packaging material
- Metals accounted for 2.4% and was a mixture of aluminium foil & trays (0.8%), other metal wastes (0.8%) and aluminium cans (0.65%)

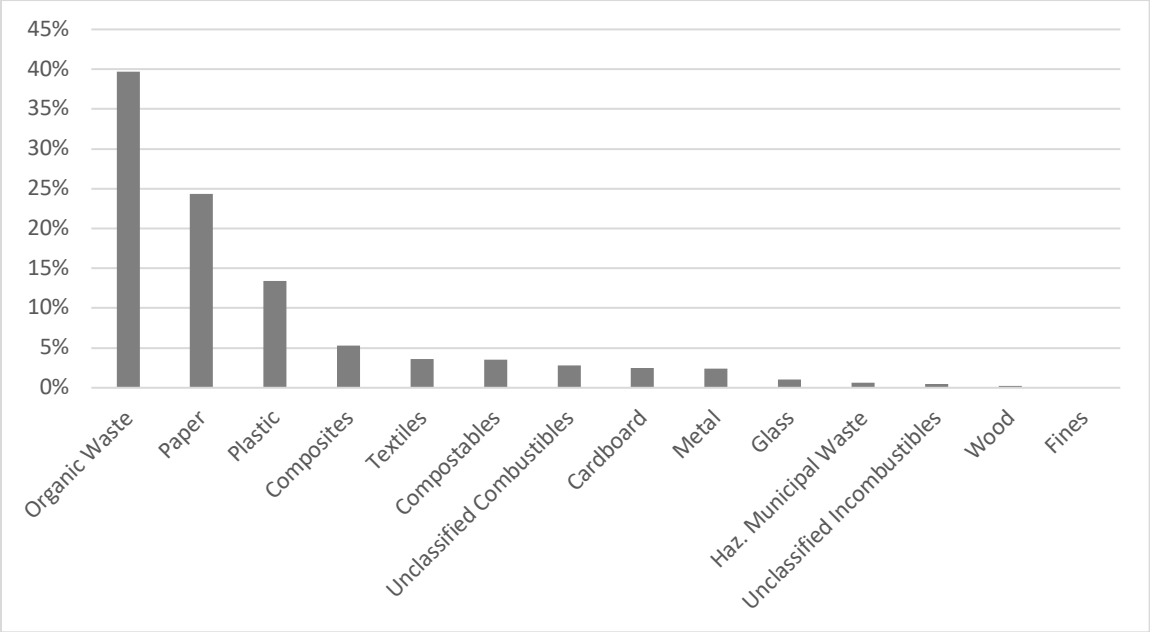


Figure 18: Composition of mixed residual wastes (MRW) from the Office Sector

3.5.2 MDR

The results of the analysis of 71 MDR samples are summarised in Table 12 and presented graphically in Figure 19. As expected, paper waste (over 56.5%) is the predominant material in the MDR waste stream with office paper the main individual material at 32.9%. Newspaper (7.0%), tissue paper 5.3%) and other papers (4.0%) were the other significant paper wastes.

Of the plastic waste (16.1%) the main materials were PET packaging (4.6%), plastic bags and films (3.5%) and other plastic packaging (3.2%).

Cardboard (12.4%) consisted of 11.5% cardboard packaging.

Organic waste (4.9%) was mainly food (3.9%) with smaller quantities of liquid wastes (0.6%) and unused packaged food (0.4%).

The majority of composites (4.4%) was coffee cups at 4.0%.

Compostable wares accounted for 2.8% of the total.

Metal waste (1.8%) was made up of aluminium cans (1.1%), tin cans (0.3%) and aluminium foils and trays (0.3%).

Table 12: Composition of MDR from Office Sector

Primary category	Mean	Min.	Max.	Upper limit	Lower limit
Paper	56.5%	4.7%	100.0%	63.5%	49.5%
Plastic	16.1%	0.6%	76.5%	19.9%	12.3%
Cardboard	12.4%	0.1%	100.0%	16.6%	8.2%
Organic Waste	4.9%	0.1%	36.4%	7.0%	3.4%
Composites	4.4%	0.1%	43.6%	6.8%	3.0%
Compostables	2.3%	0.5%	36.8%	4.0%	1.1%
Metal	1.6%	0.1%	14.0%	2.2%	1.1%
Unclassified Combustibles	1.1%	0.2%	7.9%	0.5%	0.1%
Haz. Municipal Waste	0.1%	0.1%	3.8%	0.2%	0.0%
Unclassified Incombustibles	0.1%	0.1%	1.7%	0.2%	0.0%
Wood	0.1%	0.1%	3.6%	0.2%	0.0%
Textiles	0.1%	0.2%	0.9%	0.2%	0.0%
Glass	0.1%	0.0%	0.2%	0.1%	0.0%
Fines	0.0%	0.0%	0.1%	0.1%	0.0%
Total	**100%**	**n/a**	**n/a**	**n/a**	**n/a**

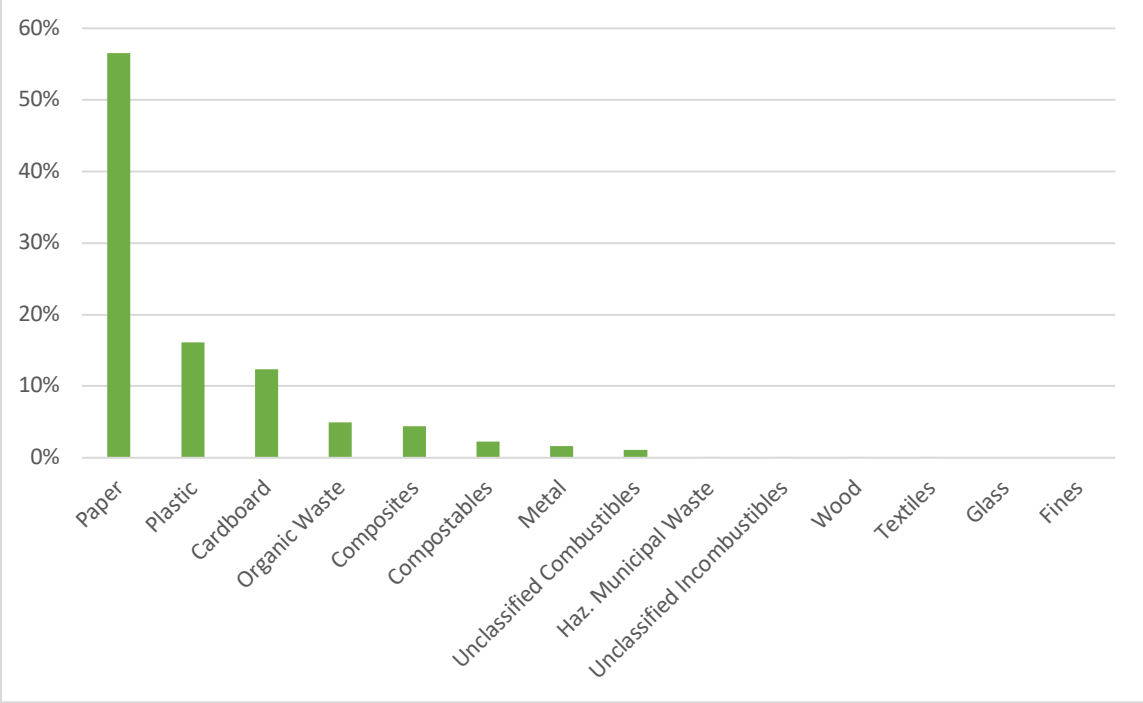


Figure 19: Composition of MDR from the Office Sector

3.5.3 Comparison with 2008

A comparison of MRW and MDR results for 2008 and 2018 are shown in Figure 20 and Figure 21 respectively. The primary categories reported in 2008 are used in this comparison. It is important to note that the methodologies used in both years are slightly different.

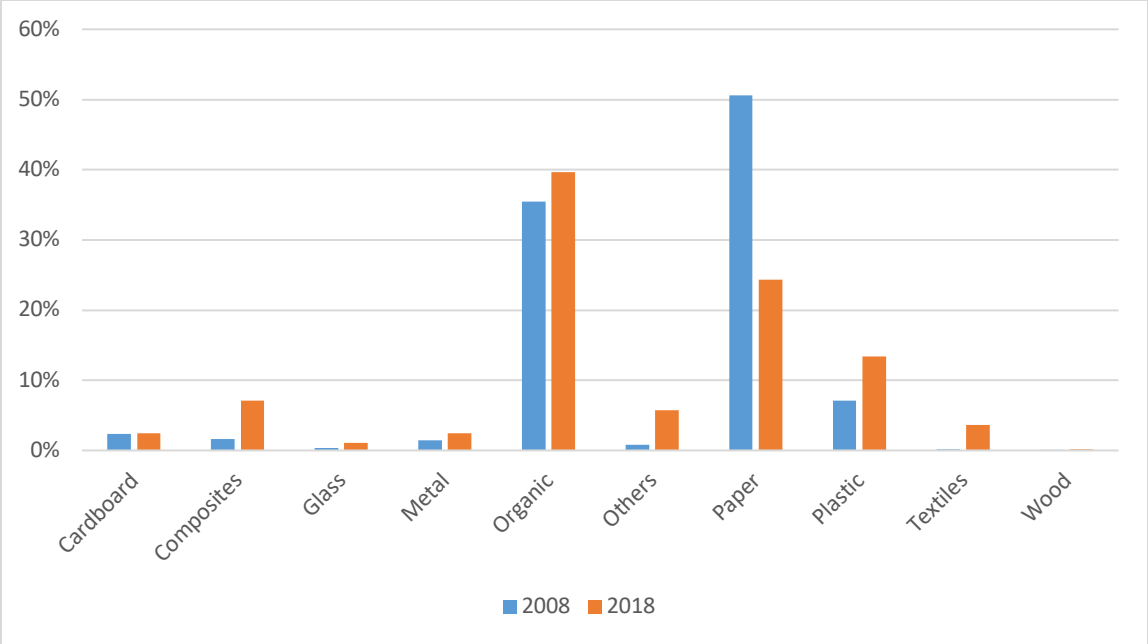


Figure 20: Comparison of 2008 and 2018 results for primary waste categories in MRW from the offices sector

The main difference in MRW are the reduced volumes of paper in the 2018 waste profile. Organics are slightly up as are plastics, textiles and composites.

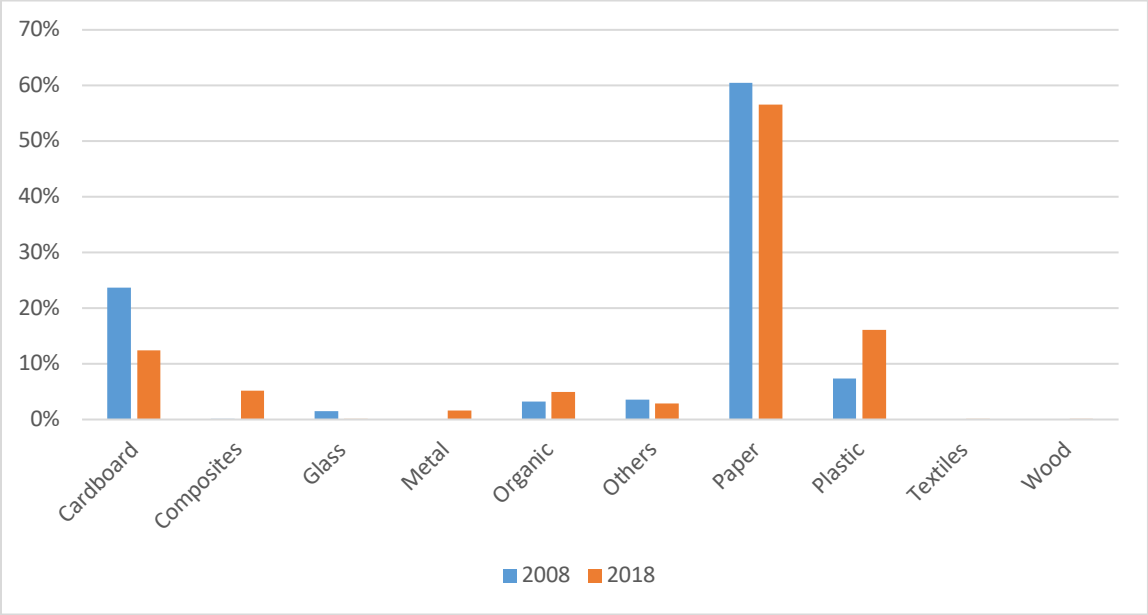


Figure 21: Comparison of 2008 and 2018 results for primary waste categories in MDR from the offices sector

The MDR profiles are relatively consistent, though there are some differences in cardboard and plastic content.

3.6 NACE G: Food Wholesale Sector

While there are numerous classifications of wholesaler (e.g. household goods, ores or agricultural machinery) much of the waste generated is packaging based. From previous studies, food wholesale was identified as a large mixed waste producer and, due to the nature of much of this waste (either packaging or food based), it is an important one to examine. This was one of the most challenging sectors to get participating sites and during this work, 4 surveys were carried out with 42 samples included in the generation of the MRW profile and 11 samples for the MDR profile.

3.6.1 MRW

The MRW analysis results are summarised in Table 13 and presented graphically in Figure 22.

Table 13: Composition of MRW from Food Wholesale Sector

Primary category	Mean	Min.	Max.	Upper limit	Lower limit
Paper	38.3%	0.2%	100.0%	47.5%	29.2%
Organic waste	15.9%	1.0%	94.0%	22.3%	9.5%
Plastic	14.5%	0.1%	76.8%	18.4%	10.6%
Cardboard	13.6%	0.6%	96.6%	18.7%	8.5%
Wood	9.6%	0.2%	91.4%	14.8%	4.3%
Fines	2.3%	0.2%	59.6%	4.9%	0.0%
Metal	1.6%	0.2%	14.0%	2.5%	0.8%
Unclassified combustibles	1.1%	0.2%	21.5%	1.9%	0.1%
Textiles	0.7%	0.1%	11.4%	1.5%	0.4%
Compostables	0.6%	0.1%	10.0%	1.3%	0.2%
Glass	0.5%	0.2%	10.8%	1.1%	0.1%
Composites	0.4%	6.4%	14.1%	1.1%	0.0%
Haz. Special/irregular waste	0.4%	0.2%	5.0%	0.7%	0.1%
Unclassified incombustibles	0.4%	0.1%	3.0%	0.6%	0.1%
Total	**100%**	**n/a**	**n/a**	**n/a**	**n/a**

The largest primary waste category was paper at 38.3%. The main individual materials were all recyclable and included magazines and glossies (18.8%), office paper (7.8%) and newspapers (4.7%). Tissue paper was also present in significant quantities at 5.3%.

Organic waste (15.9%) consisted of food waste (7.4%) with unused packaged food (4.7%) also present. 2.8% of the total was found to be garden waste.

Plastic waste, 14.5%, consisted of plastic bags and films (6.3%), other plastic non-packaging (2.8%), other plastic packaging (2%) and PET (1.7%). Smaller quantities (>1%) of unrecyclable plastic packaging, PS and PE packaging were also present.

Cardboard (13.6%) was almost exclusively cardboard packaging.

Wood (9.6%) was related to non-packaging wood waste.

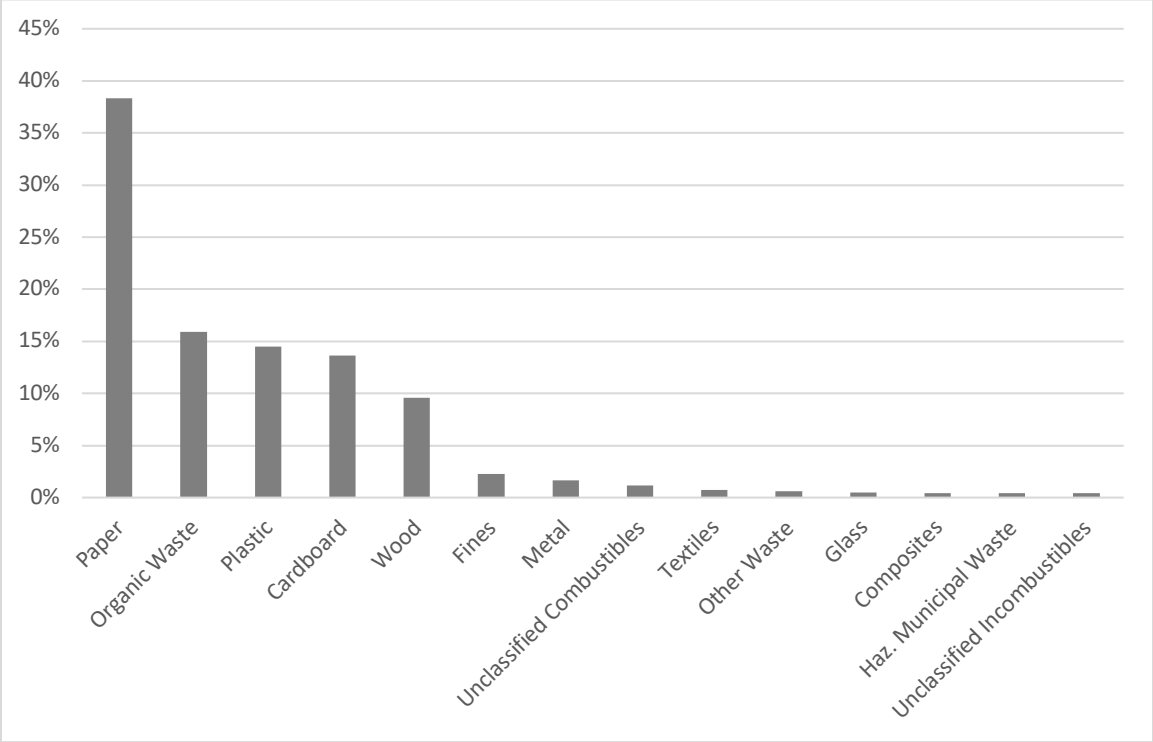


Figure 22: Composition of mixed residual wastes (MRW) from the Food Wholesale Sector

3.6.2 MDR

The results of the MDR sample analysis from food wholesale businesses are summarised in Table 14 and presented graphically in Figure 23.

Paper waste was the largest individual stream present in MDR at 43.5%. Its main constituents were tissue paper (26.8%) and office paper (13.9%) with small volumes of paper packaging (1.3%) and other paper also noted.

22.9% of the MDR was found to be organic wastes that was made up of food waste (16.5%), liquid wastes (3.9%) and unused packaged food (2.5%). The high proportion of liquid wastes was due to residual volumes found in plastic bottles.

Of the plastic waste (15.9%) the main materials were PET packaging (3.7%), other plastic non-packaging (3.4%), PE packaging (2.7%). Smaller volumes included PS packaging (1.5%), PP packaging (1.4%) and unrecyclable plastic packaging (1.5%).

Cardboard (4.4%) comprised of cardboard packaging wastes.

Compostables accounted for 3.0% of the total.

Unclassified combustibles (2.6%) included 1.3% packaging materials.

Composites (2.3%) was mainly coffee cups (2.1%).

Table 14: Composition of MDR from Food Wholesale Sector

Primary category	Mean	Min.	Max.	Upper limit	Lower limit
Paper	43.5%	19.2%	85.2%	54.4%	32.6%
Organic Waste	22.9%	2.3%	48.9%	30.9%	15.0%
Plastic	15.9%	5.7%	28.0%	18.9%	12.9%
Cardboard	4.4%	0.9%	10.2%	5.8%	3.0%
Compostables	3.0%	0.3%	12.0%	5.2%	2.0%
Unclassified Combustibles	2.6%	0.2%	8.6%	4.7%	1.4%
Composites	2.3%	0.3%	7.9%	3.4%	1.0%
Metal	2.2%	0.2%	9.3%	2.7%	-0.1%
Glass	1.2%	0.4%	5.2%	2.2%	0.2%
Wood	0.9%	0.2%	9.5%	2.3%	-0.5%
Unclassified Incombustibles	0.8%	8.8%	8.8%	2.1%	-0.5%
Textiles	0.2%	0.7%	1.1%	0.4%	0.0%
Fines	0.0%	0.1%	0.1%	0.0%	0.0%
Haz. Municipal Waste	0.0%	0.0%	0.0%	0.0%	0.0%
Total	**100%**	**n/a**	**n/a**	**n/a**	**n/a**

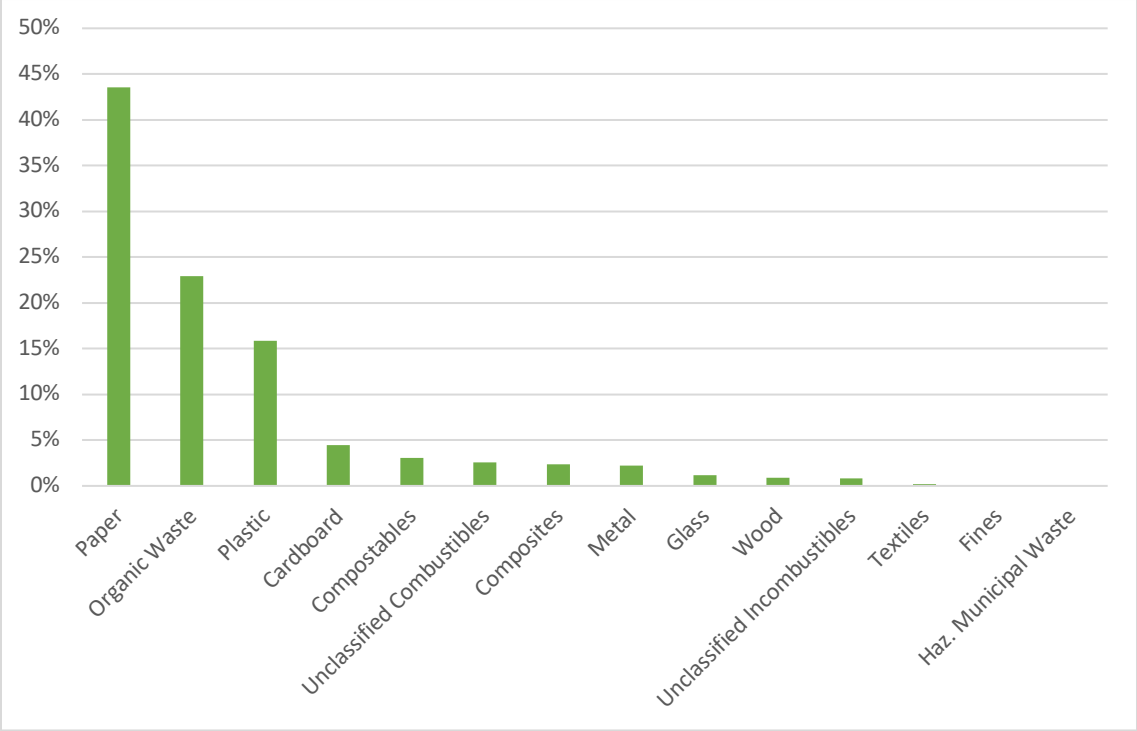


Figure 23: Composition of MDR from the Food Wholesale Sector

3.6.3 Comparison with 2008

A comparison of MRW and MDR results for 2008 and 2018 are shown in Figure 24 and Figure 25 respectively. The primary categories reported in 2008 are used in this comparison.

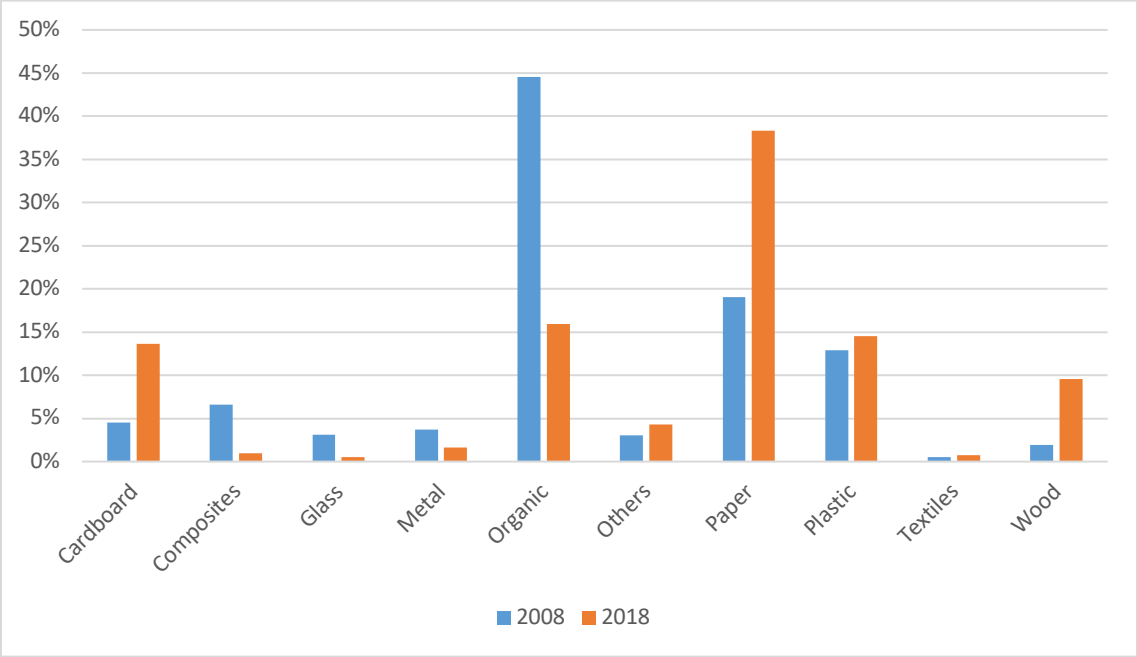


Figure 24: Comparison of 2008 and 2018 results for primary waste categories in MRW from the Food Wholesale sector

The main difference between the MRW profiles is the significant decrease in organic wastes disposed of in this stream. This is likely to be related to improved practices in the participant businesses and increased roll out of separate food collection services. There are proportional increases in a number of materials including paper and cardboard.

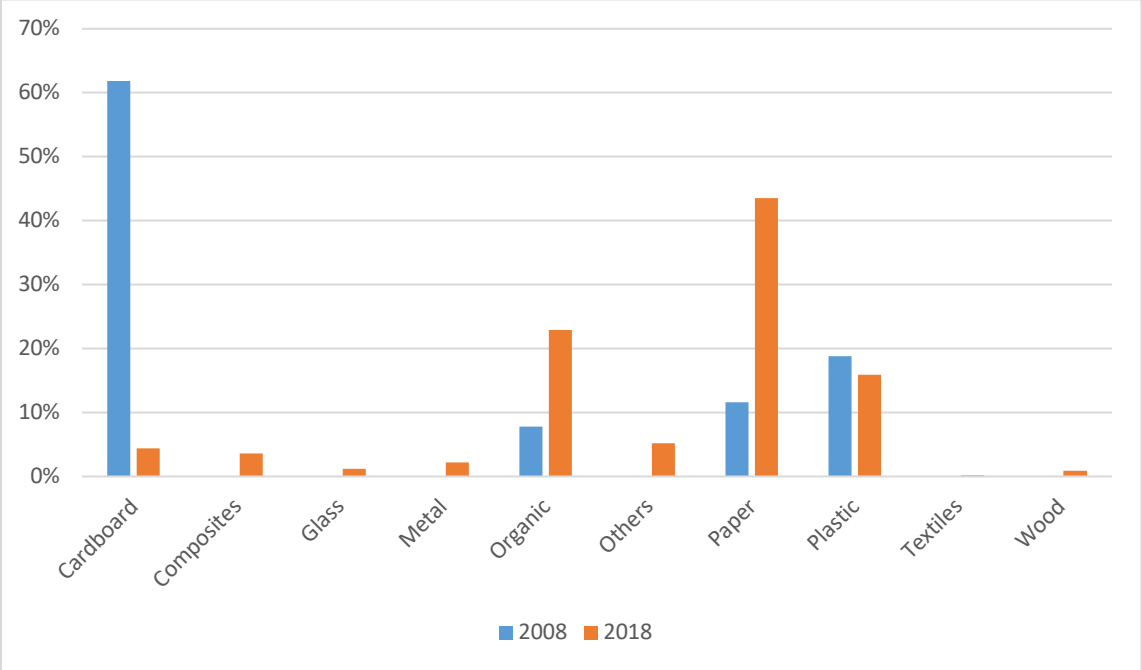


Figure 25: Comparison of 2008 and 2018 results for primary waste categories in MDR from the Food Wholesale sector

The main difference in the MDR stream is the significant decrease in cardboard volumes. This is probably related to the more extensive separate collection services that now exist for cardboard. There are increases in paper and organics, the latter being an area of concern.

3.7 Manufacturing

Unlike the commercial sector, where a sectoral approach is possible due to the relative consistency in waste generation, this is not possible for manufacturing due the variety across the sectors (NACE Rev 2 08 – 32). Even within a single sector (e.g. NACE 10 Food production) the variety in size and type of businesses means that the same approach used for commerce is unlikely to be effective. Therefore, three surveys were allocated to a number of the main sectors to provide preliminary data. The three sectors were chosen based on analysis carried out during recent research work on behalf of the EPA[8] and included:

- Food and beverage
- Medical devices
- Pharmaceutical

During this work 57 samples were included in the generation of the MRW profile and 23 samples for the MDR profile. However, it is important to note that the profiles generated in the following sections cannot be used to reflect the municipal waste from the manufacturing sector as a whole due to the very limited data set.

3.7.1 MRW

The MRW analysis results are summarised in Table 15 and presented graphically in Figure 26.

Table 15: Composition of MRW from Manufacturing Sectors

Primary category	Mean	Min.	Max.	Upper limit	Lower limit
Plastic	48.2%	0.2%	100.0%	54.6%	41.8%
Unclassified combustibles	17.9%	0.2%	49.4%	5.5%	1.7%
Paper	15.5%	0.1%	88.0%	19.2%	11.9%
Organic waste	4.8%	0.2%	71.2%	7.2%	2.4%
Cardboard	4.2%	0.2%	36.6%	5.6%	2.8%
Unclassified incombustibles	2.8%	1.4%	52.3%	4.1%	0.8%
Textiles	2.4%	0.1%	27.9%	3.6%	1.2%
Metal	1.7%	0.8%	40.2%	3.0%	0.5%
Composites	1.3%	0.2%	23.0%	2.1%	0.5%
Haz. Municipal waste	0.6%	0.2%	62.7.0%	19.3%	11.0%
Fines	0.4%	0.2%	16.1%	0.9%	0.0%
Wood	0.1%	0.1%	2.7%	0.2%	0.0%
Glass	0.0%	3.1%	3.1%	0.1%	0.0%
Total	**100%**	**n/a**	**n/a**	**n/a**	**n/a**

Plastic was the main waste category found in the MRW stream at 48.2%. The main individual materials included plastic bags and films (20.2%), other plastic packaging (14.2%), other plastic non-packaging (6.5%) and PET packaging (4.0%).

[8] Resource Efficiency in Priority Irish Business Sectors, CTC, EPA 2017

Unclassified combustibles accounted for 17.9% and was mainly non-packaging based wastes including PPE at 4.4% .

Paper 15.50% was the next main category and included tissue paper (8.0%), other paper (4.7%) and paper packaging (2.1%).

Small volumes of organic waste (4.8%, all food waste) and cardboard packaging (4.2%) were also present.

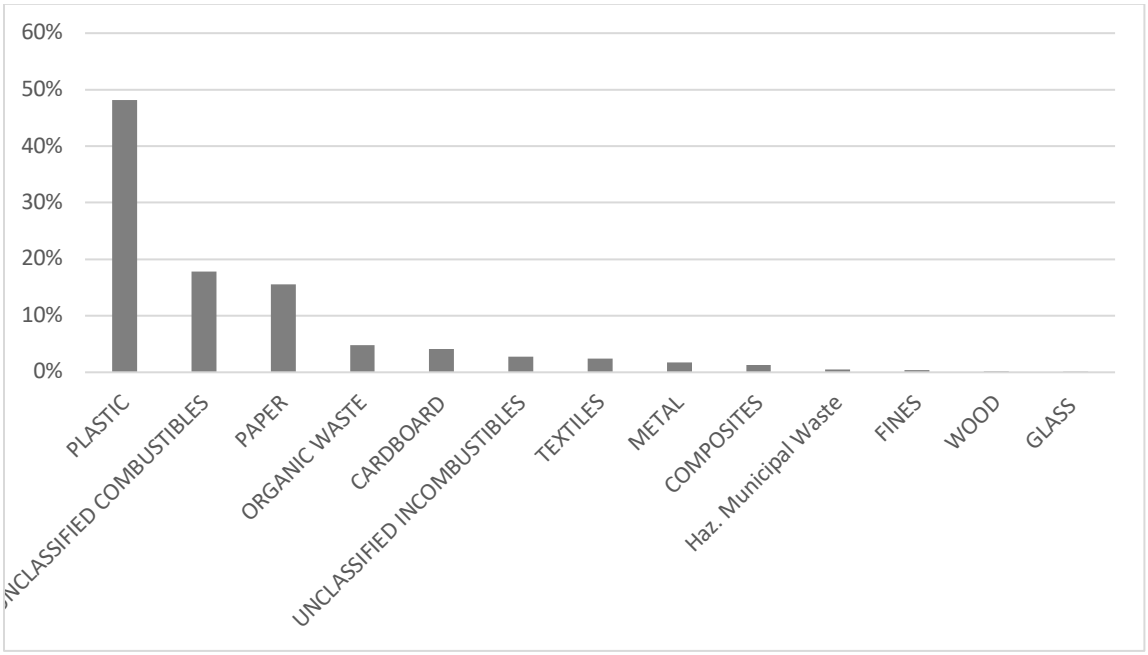


Figure 26: Composition of mixed residual wastes (MRW) from the Manufacturing Sectors

3.7.2 MDR

The results of the MDR sample analysis from manufacturing businesses are summarised in Table 16 and presented graphically in Figure 27.

The main material in the MDR stream was cardboard packaging at 58.1%.

Plastic (26.6%), the second largest waste category, consisting of plastic bags & film (13.7%), PET packaging (4.5%) and other plastic packaging (4.1%).

Paper waste (8.0%) comprised of office paper (3.7%), other paper (2.5%) and paper packaging (1.3%).

Unclassified combustibles (e.g. sandpaper, gloves, foam) and metals (other metal wastes) were also present in small amounts.

As most manufacturing businesses have very specific packaging materials and, in general, have segregated systems for these, the limited number of materials in the MDR stream, and the level of compliance, was to be expected.

Table 16: Composition of MDR from Manufacturing Sectors

Primary category	Mean	Min.	Max.	Upper limit	Lower limit
Cardboard	58.1%	2.0%	100.0%	78.9%	49.5%
Plastic	26.6%	0.4%	100.0%	36.0%	12.6%
Paper	8.0%	0.5%	27.2%	6.9%	1.2%
Unclassified combustibles	2.9%	0.1%	61.5%	7.1%	1.7%
Metal	2.5%	60.5%	60.5%	7.0%	1.7%
Unclassified incombustibles	1.0%	27.8%	27.8%	3.2%	0.8%
Composites	0.7%	1.5%	15.7%	1.9%	0.4%
Textiles	0.1%	0.1%	1.8%	0.2%	0.0%
Wood	0.0%	0.2%	0.3%	0.0%	0.0%
Haz. Municipal waste	0.0%	0.0%	0.0%	0.0%	0.0%
Glass	0.0%	0.0%	0.0%	0.0%	0.0%
Organic waste	0.0%	0.0%	0.0%	0.0%	0.0%
Fines	0.0%	0.0%	0.0%	0.0%	0.0%
Total	**100%**	**n/a**	**n/a**	**n/a**	**n/a**

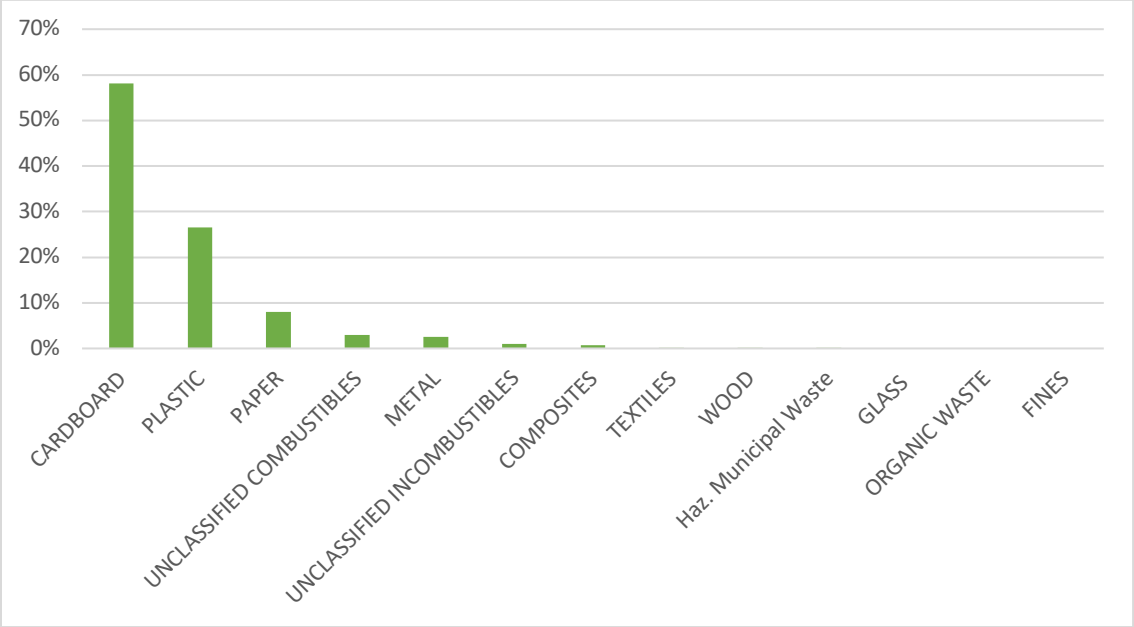


Figure 27: Composition of MDR from the Manufacturing Sectors

4 Contamination

The contamination of municipal waste (both residual waste and mixed dry recyclables streams) is an important factor to consider during any waste characterisation work as it can have significant impacts on the final results, especially when generating national waste classification statistics. Typically, there are 2 main types of contamination under consideration – **residual contamination** and **cross-contamination**. Residual contamination typically refers to food that is left over in recyclable containers after discarding (the container may be segregated for recycling, but because it is not clean it lowers the potential recyclability of the stream). Cross-contamination occurs when recyclable materials segregated at source are contaminated with other waste streams (e.g. garden or food waste contaminating mixed dry recyclables).

When conducting waste characterisation work, it is not possible to clean out every container and ensure that materials do have not have any contaminants. Therefore, the purpose of a contamination study, as part of a wider waste characterisation survey, is to determine statistically robust contamination correction factors for the main types of packaging waste collected in the mixed and recyclable waste streams. These factors can then be applied to the final data to provide accurate (corrected) packaging and organic percentages.

As part of the current waste characterisation programme an assessment of 13 of the main packaging materials was carried out. Initially a review of the contamination assessment methodology employed in 2008 was carried out. It was found that there were no international updates that impacted on the method. Therefore, that methodology is used in this current work. More information on this literature review, and the contamination assessment methodology, is available in Appendix 4.

4.1 Results

The following Table outlines the contamination results for the 13 different packaging materials assessed from the different waste management systems analysed in the commercial sector. These results are depicted graphically in Figure 28.

Table 17: Non-household contamination factors for MRW and MDR

Packaging waste category	MSW		MDR	
	No. of items	Contamination (%)	No. of items	Contamination (%)
Paper Packaging	69	25.4	32	17.8
Cardboard Packaging	97	20.1	30	15.4
Glass Packaging	40	1.5	9	4.4
PET Packaging	107	11.3	38	9.9
PE Packaging	57	12.1	32	14.2
PP Packaging	53	14.1	31	14.3
Plastic Bags and Films	56	10	32	3.8
Other Plastic Packaging	73	14	35	10.4
Unrecoverable Plastic Packaging	32	27.5	16	48.4
Aluminium Cans Packaging	113	14.4	31	10.9
Aluminium Foil Trays Packaging	76	22.9	35	19.2
Tin Cans (Ferrous Pac)	24	11.7	45	7.9
Used beverage containers	46	26.3	16	27.3

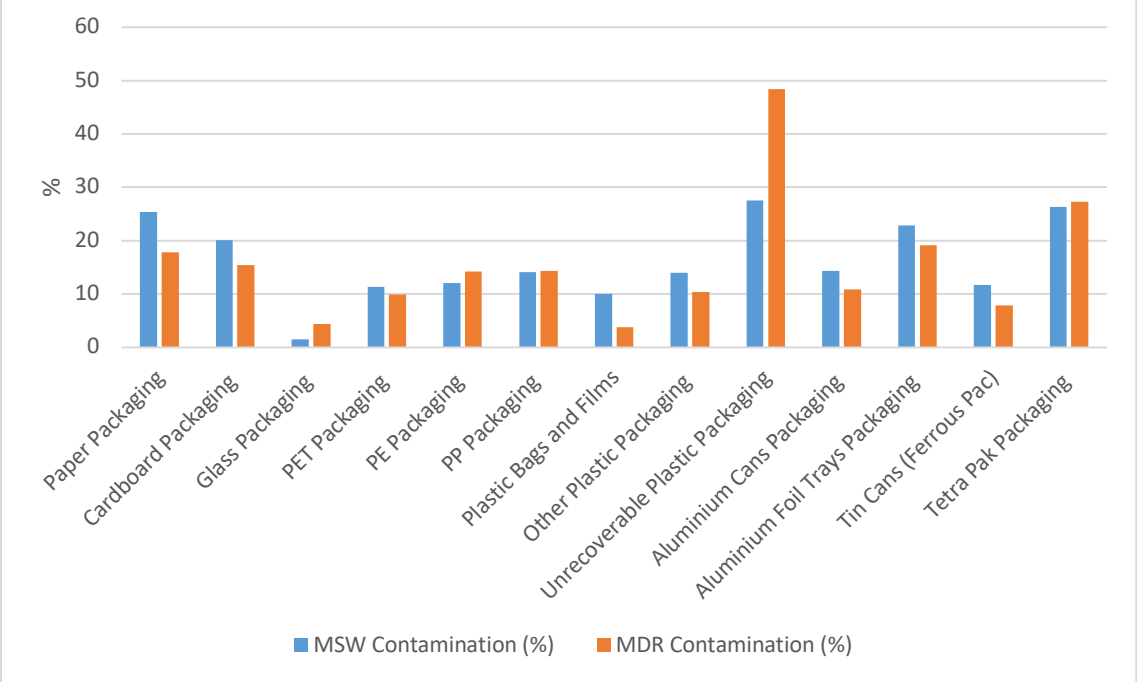


Figure 28: Contamination factors determined for materials in the MRW and MDR waste streams

4.2 Discussion of Non-Household Results

As can be seen in Figure 28, the contamination factors calculated for materials in the MRW stream are, in the main, higher than those calculated for MDR (with the exception of unrecoverable plastic packaging). While this is to be expected, the close similarities in the values is somewhat surprising. Unlike household waste, where waste samples were taken from post-collected waste, the non-household samples are taken at the point of generation. Therefore, cross-contamination is waste much less of an issue. These results suggest that the behaviour of people prior to disposing of the wastes is similar regardless of whether they dispose of the waste in an MRW or MDR bin.

A comparison of the current contamination values with those from 2008, for both MRW and MDR, are shown in

Figure **29** and Figure 30. There is significant variation across the materials for both waste streams, so it is not really possible to identify any clear trends. However, it appears that contamination levels estimated for the MRW stream during this current study are slightly lower than in 2018 whereas they are slightly higher for the MDR stream.

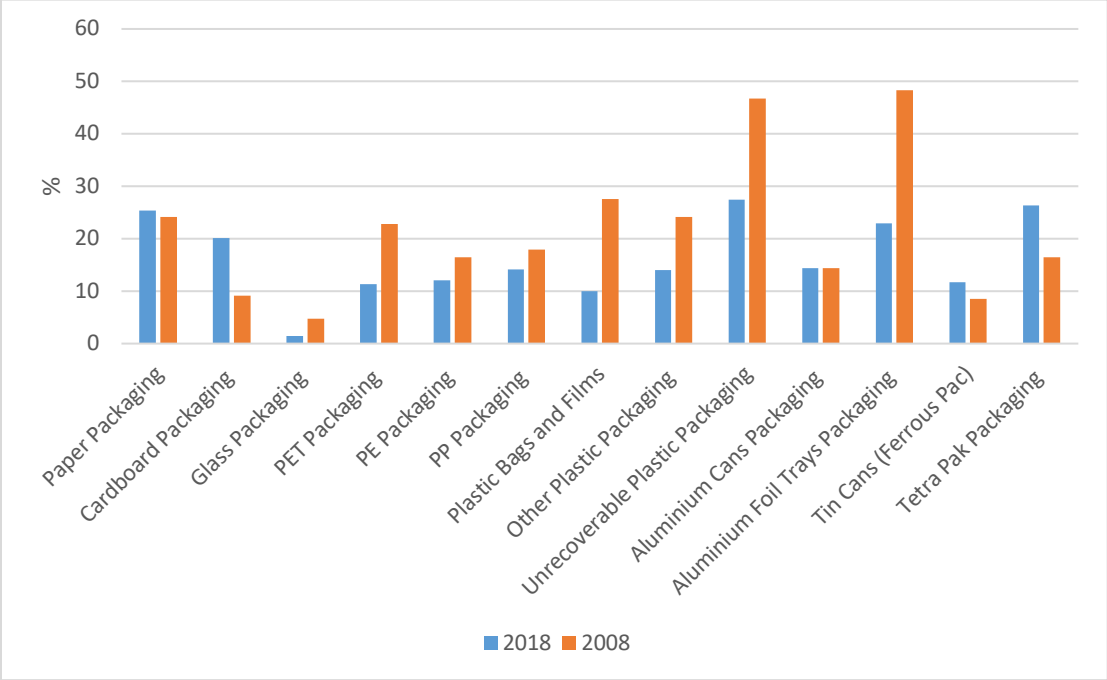


Figure 29: Contamination factors for materials in the MRW waste stream from 2018 and 2008

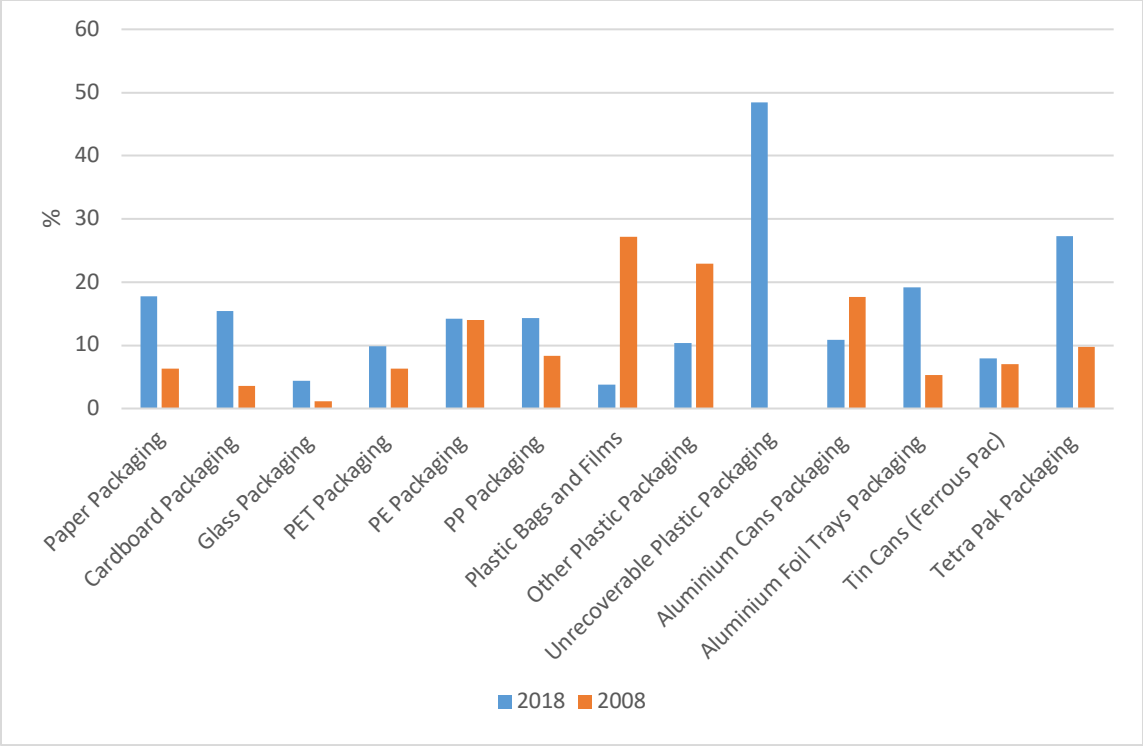


Figure 30: Contamination factors for materials in the MDR waste stream from 2018 and 2008

5 National Results

Using the profiles generated in Chapter 3 and applying them to the sectoral sizes (see Section 2.1) and national waste data[9], national profiles have been produced for kerbside collected Mixed Residual Waste (MRW), Mixed Dry Recyclables (MDR) and Organic Wastes (OW) from the non-household sector in Ireland.

5.1 MRW

The results of the national assessment of MRW collected from the non-household sector are given in Table 18 and shown graphically in Figure 31.

Table 18: National composition of kerbside collected MRW from the non-household sector

Waste Category	Total	% Packaging	% Non-Packaging
Organic Waste	32.6%	0.0%	32.6%
Paper	23.0%	3.0%	20.1%
Plastic	17.1%	14.6%	2.5%
Textiles	5.5%	1.5%	4.0%
Cardboard	5.4%	4.4%	1.0%
Metal	3.4%	2.6%	0.8%
Composites	2.9%	0.4%	2.5%
Unclassified combustibles	2.8%	1.2%	1.6%
Compostables	2.0%	0.0%	2.0%
Unclassified incombustibles	2.0%	0.0%	2.0%
Glass	1.2%	1.1%	0.1%
Wood	0.8%	0.1%	0.7%
Fines	0.8%	0.0%	0.8%
Haz. Municipal waste	0.6%	0.0%	0.6%
Total	**100.0%**	**28.9%**	**71.1%**

[9] NWCPO provided 2016 national data on specific EWC codes including 15 01 06, 20 01 03 and 20 01 08

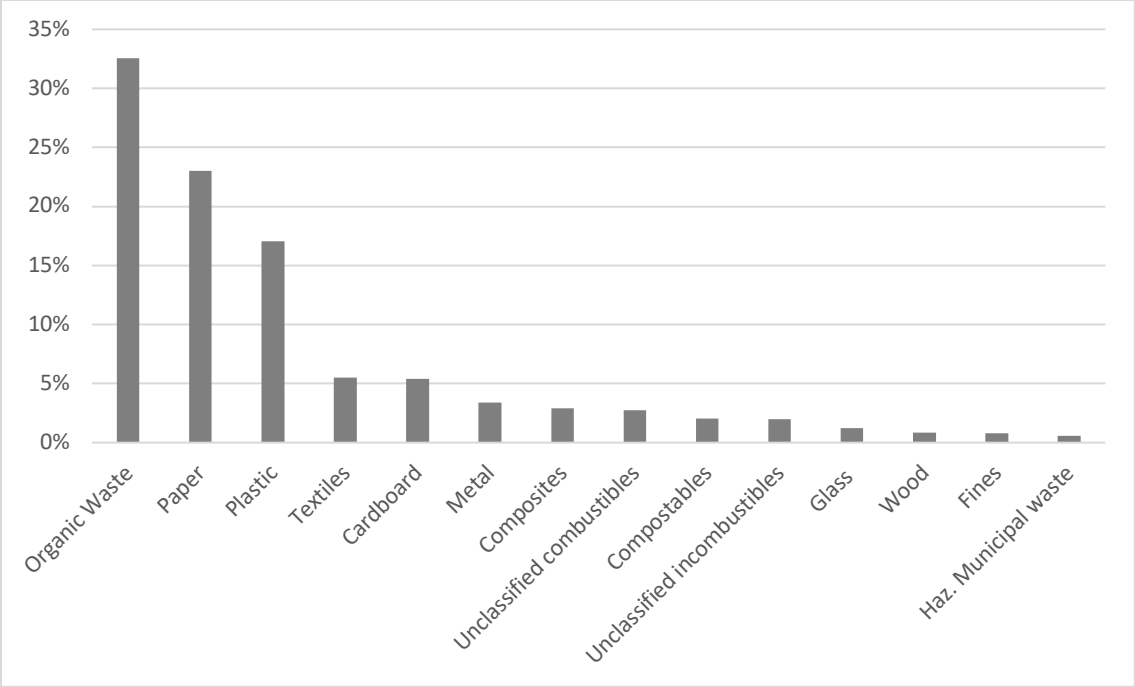


Figure 31: Profile of the national composition of kerbside collected MRW from non-household sector

The main materials found in the MRW stream were organic waste (32.6%) followed by paper (23.0%) and plastics (17.1%).

Of the organic waste, 24.8% was food waste, 4.2% unused packaged food and 2.5% liquid wastes. 1.0% was found to be garden waste.

Tissue paper was the main paper based material at 11.8% with magazines & glossy paper and office paper accounting for 2.6% and 2.2% respectively. Newspaper, paper packaging, unrecyclable paper packaging and other paper were all around 1.5%.

Plastic bags and films was the largest individual stream in plastics at 4.5%. Other plastic packaging (2.8%), other plastic non-packaging (2.5%) and PET packaging (2.5%) were the other significant plastic streams. Smaller quantities of unrecyclable plastic packaging, PE, PP and PS packaging were also found.

Textiles, 5.5% of the total, consisted of non-packaging textiles (2.1%), packaging textiles (1.5%) and nappies (1%).

Cardboard (5.4%) consisted of packaging materials (4.4%) and other cardboard non-packaging (1.0%).

Metal, 3.4%, included tin cans (1.3%), other metal waste (0.8%), aluminium cans (0.5%) and aluminium foil and trays (0.5%).

Of the composites found (2.9%) coffee cups was the largest material at 2.5% with 0.4% due to used beverage containers.

Unclassified combustibles (2.9%) included both packaging (1.2%) and non-packaging (1.6%) materials.

Compostable wares accounted for 2.0% of the total.

Unclassified incombustibles, wood, glass and fines were present in quantities less than 2%.

Hazardous waste materials at 0.6% included WEEE (0.3%) and aerosols (0.2%).

Of the mixed waste materials up to 70% could potentially be recoverable and targeted by mixed dry recyclable collections [10]and brown bins (or FSM) collections[11].

Of the total materials assessed 29% was packaging[12] though 3.2% of this was related to unrecyclable packaging materials. 67% was potentially compostable[13].

The main packaging materials consist of plastics at 11.8%, papers and cardboard at 7.4%, and metals at 2.6%.

The main materials that could potentially be targeted by MDR collections include papers and cardboards at 15.3%, plastics at 5.4%, metals at 3.3% and textile packaging at 1.4%.

The materials that could be targeted by organic waste collections include food waste at 30.0%, tissue papers (11.8%) and other compostable materials (2.0%).

5.1.1 Comparison with 2008

Figure 32 depicts a comparison of the main results from the current study with those of 2008. The most notable difference is the reduced volume of organics in the MRW stream. Though this is to be expected, with the changes in waste management services since 2008, it is still a positive reflection on changes in the intervening years. That said, organics are still the single largest waste stream and account for over 30% of the mixed residual waste.

The main increase since 2008 is related to plastic based materials, though there are also increases in the cardboard, metal and unclassified combustible streams. Compostable wares, which were not noted during the 2008 surveys, now account for 2.0% of the national total.

[10] Recoverable Paper Packaging, Newspapers, Magazines & glossy paper, Office papers, Other papers, Flat Card and Corrugated Cardboard (Packaging), Other cardboards (Non-packaging), Beverage carton (packaging) (tetrapak), PET packaging, PE packaging, PP Packaging, Ferrous metal packaging, Aluminium cans.
[11] Food waste, biodegradable waste from garden & park, tissue papers.
[12] Paper Packaging, Flat Card and Corrugated Cardboard (Packaging), Beverage carton (packaging) (tetrapak), Textiles Packaging, PET packaging, PE packaging, PP Packaging, EPS Styrofoam Packaging, Supermarkets bags and films (packaging), Other plastic (packaging), Glass packaging, Ferrous metal packaging, Aluminium cans, Aluminium foil, Other metal packaging, Wood packaging, Aerosols, composite packaging
[13] Each waste type is assigned as either 100% BMW, 50% BMW or 0% BMW. Food waste, garden waste, papers and cardboard are considered 100% BMW. Textiles (including nappies), and timber, unclassified combustibles and fines are considered 50% BMW. Other categories such as glass, plastics and metals are considered 0% BMW. (EPA, 2011, Protocol For The Evaluation Of Biodegradable Municipal Waste Sent To Landfill).

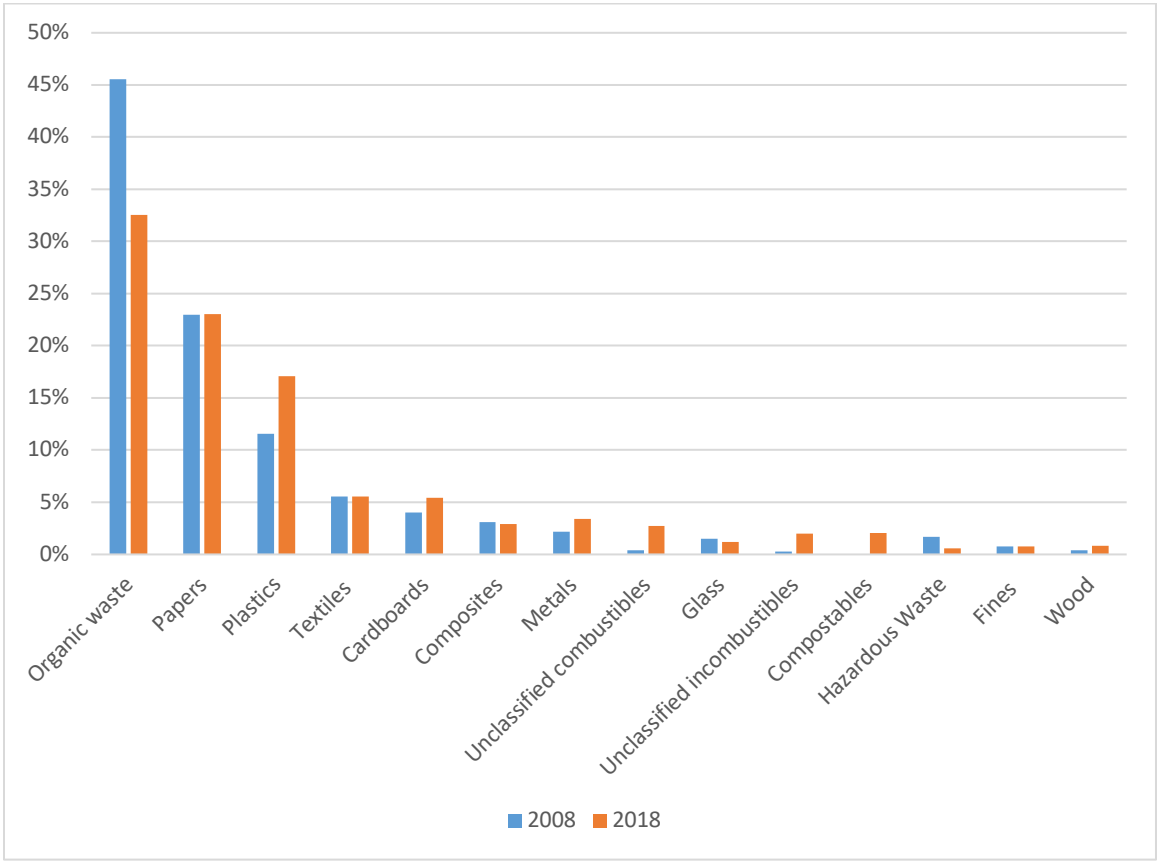


Figure 32: Comparison of MRW profiles of non-household kerbside collected waste from 2008 and 2018

5.2 MDR

The results of the national assessment of kerbside collected MDR from the non-household sector are given in Table 19 and shown graphically in Figure 33.

Table 19: National composition of kerbside collected MDR from non-household sector

Waste Category	Total	% Packaging	% Non-Packaging
Paper	32.1%	5.2%	26.9%
Plastic	25.8%	19.9%	5.9%
Cardboard	19.2%	18.8%	0.5%
Organic waste	10.1%	0.0%	10.1%
Metal	3.7%	3.5%	0.2%
Composites	2.2%	0.6%	1.6%
Unclassified combustibles	1.9%	0.8%	1.2%
Compostables	1.5%	0.0%	1.5%
Glass	1.1%	0.9%	0.1%
Textiles	0.9%	0.1%	0.8%
Wood	0.7%	0.5%	0.2%
Fines	0.4%	0.0%	0.4%
Unclassified incombustibles	0.2%	0.0%	0.2%
Haz. Municipal waste	0.1%	0.0%	0.1%
Total	**100.0%**	**50.2%**	**49.8%**

The most prominent primary category was paper at 32.1% of the total. This consisted of office paper (9.8%), tissue paper (7.7%), paper packaging (4.6%), newspapers (3.7%), other paper (3.3%) and magazines and glossy papers (2.4%). There was also 0.6% unrecoverable paper packaging.

The second largest primary waste category was plastics which accounted for 25.8% of the total waste composition. This was comprised mostly of plastic films and bags (9.5%), PET packaging (4.6%), other plastic non-packaging (3%) and other plastic packaging (2.8%). Smaller volumes of PP, PE and PS packaging were also present.

Cardboard at 19.2%, was the third most prominent primary category mostly consisting of cardboard packaging at 18.7%.

Organic waste, mainly food (6.7%) and liquid (2.5%) wastes, accounted for 10.1% of the total.

Metals mainly tin (2.4%) and aluminium cans(0.6%) accounted for 3.3% of the total MDR stream.

Composites (2.2%) included coffee cups (1.6%) and used beverage containers (0.6%).

Unclassified combustibles (1.9%) included both packaging (0.8%) and non-packaging wastes (1.1%).

Compostables wares accounted for 1.5% with hazardous wastes at 0.15%.

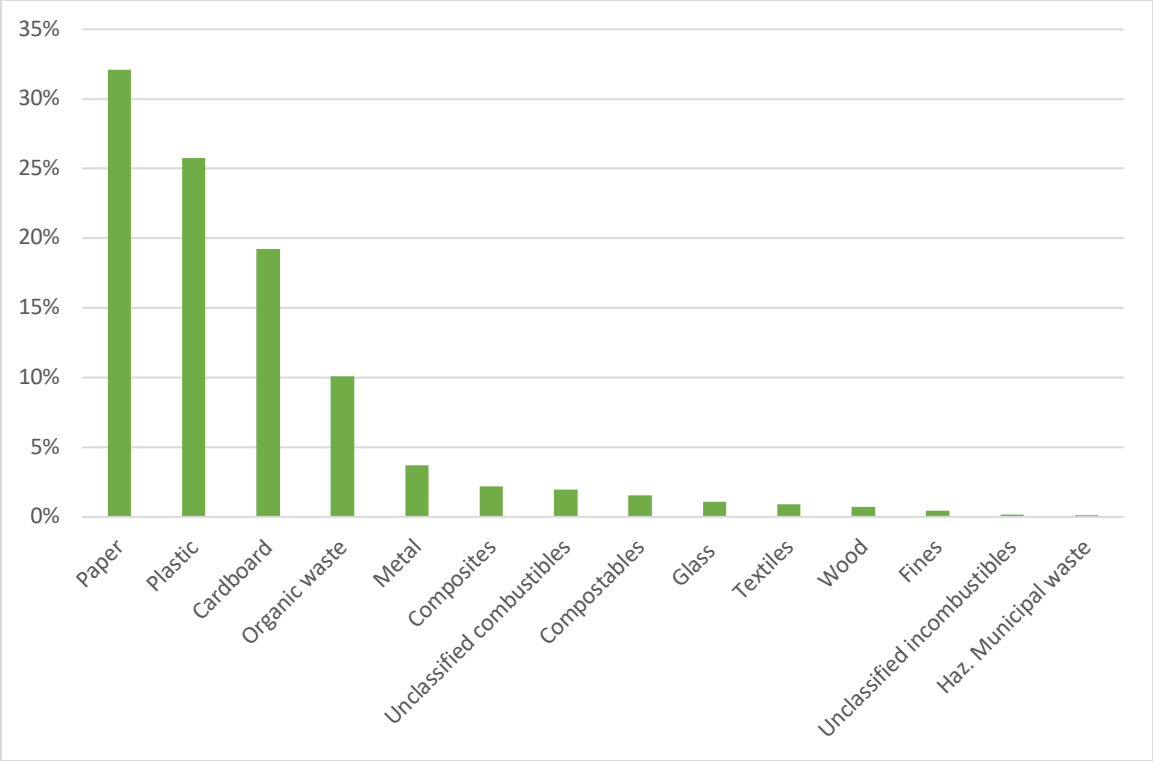


Figure 33: Profile of the national composition of kerbside collected MDR from non-household sector

Targeted materials accounted for 60% of the materials in the mixed dry recyclables collections.

The non-targeted materials included plastics (films, PS, etc.) at 14%, organic waste at 10.1%, tissue paper (7.7%), composites at 2.2% (mainly coffee cups), unclassified materials (2.1%), compostables (1.5%), textiles (including nappies) at 0.9% and hazardous wastes (0.15%).

The main packaging waste materials include plastics (19.9%), cardboard (18.8%), paper (5.2%) and metals at 3.5%.

5.2.1 Comparison with 2008

Figure 34 depicts a comparison of the main results from the current survey with those of MDR analysed in 2008. It is important to note that changes in the methodology may have some impacts on result.

There are a number of differences in the profiles. Cardboard and glass have both decreased significantly. This could be explained by increased provision of separate collection services for these materials. The main increases are related to paper and plastic materials with smaller increases in composites (coffee cups), metals, unclassified combustibles and the introduction of compostables.

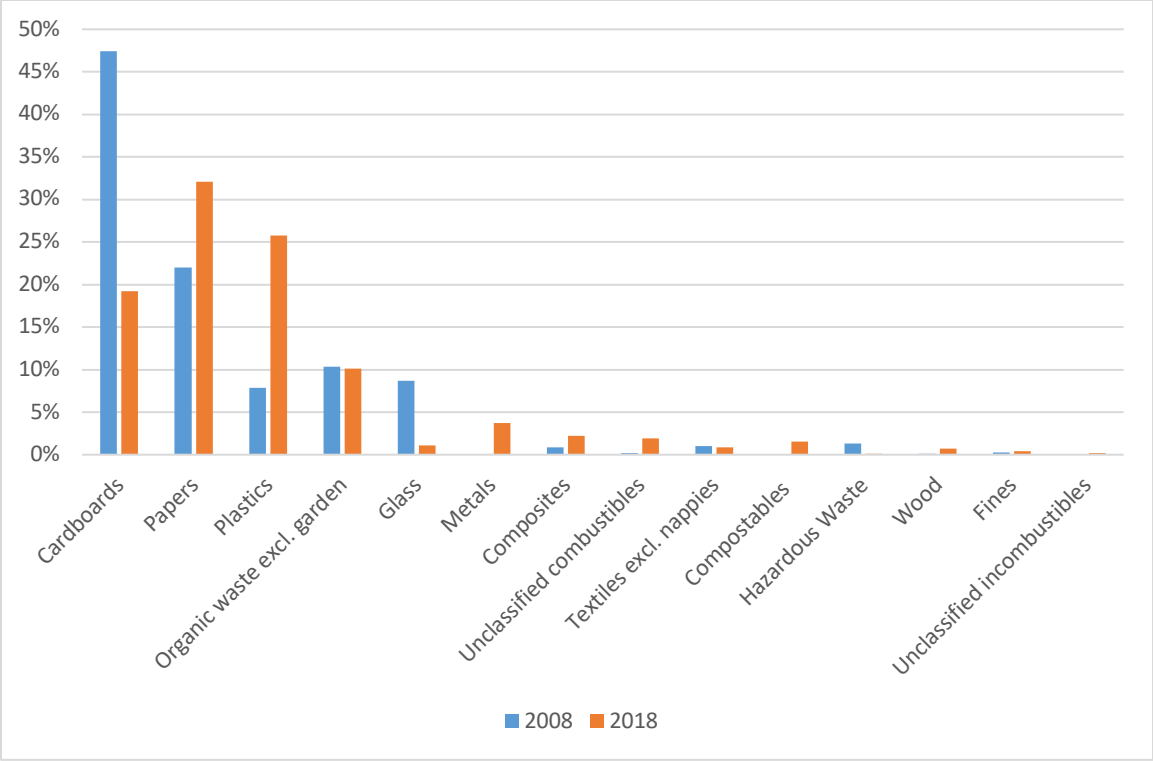


Figure 34: Comparison of MDR profiles of non-household kerbside collected waste from 2008 and 2018

5.3 Organic Wastes

Separately collected Organic Waste (OW) was examined from the businesses that had this service in place. While most food service businesses now have a brown bin service, many of the other sectors (including some in the food retail and food wholesale) do not have such a service[14]. During this work, the brown bin waste from 14 businesses was analysed to generate the brown bin profile.

The results of the national assessment of brown bin waste collected from the non-household sector are summarised in Table 20 and presented graphically in Figure 35.

As expected organic waste is the main constituent of brown bins. This consisted of 68.4% food waste, 24.0% unused packaged food and 1.7% liquid wastes.

Small quantities of paper were also present, mainly in the form of tissue paper (2.7%).

Compostable wares accounted for 1.3% of the total.

Other materials present included plastic packaging, composites (mainly coffee cups) and cardboard packaging.

[14] Most retailers and wholesalers now use Food Surplus Management (FSM) for food waste services

Table 20: Composition of kerbside collected Organic Wastes waste from non-household sector

Primary Category	Mean
Organic waste	94.2%
Paper	2.9%
Compostables	1.3%
Plastic	1.1%
Composites	0.3%
Cardboard	0.2%
Glass	0.0%
Metal	0.0%
Wood	0.0%
Textiles	0.0%
Haz. Special/irregular waste	0.0%
Unclassified combustibles	0.0%
Unclassified incombustibles	0.0%
Fines	0.0%
Total	**100%**

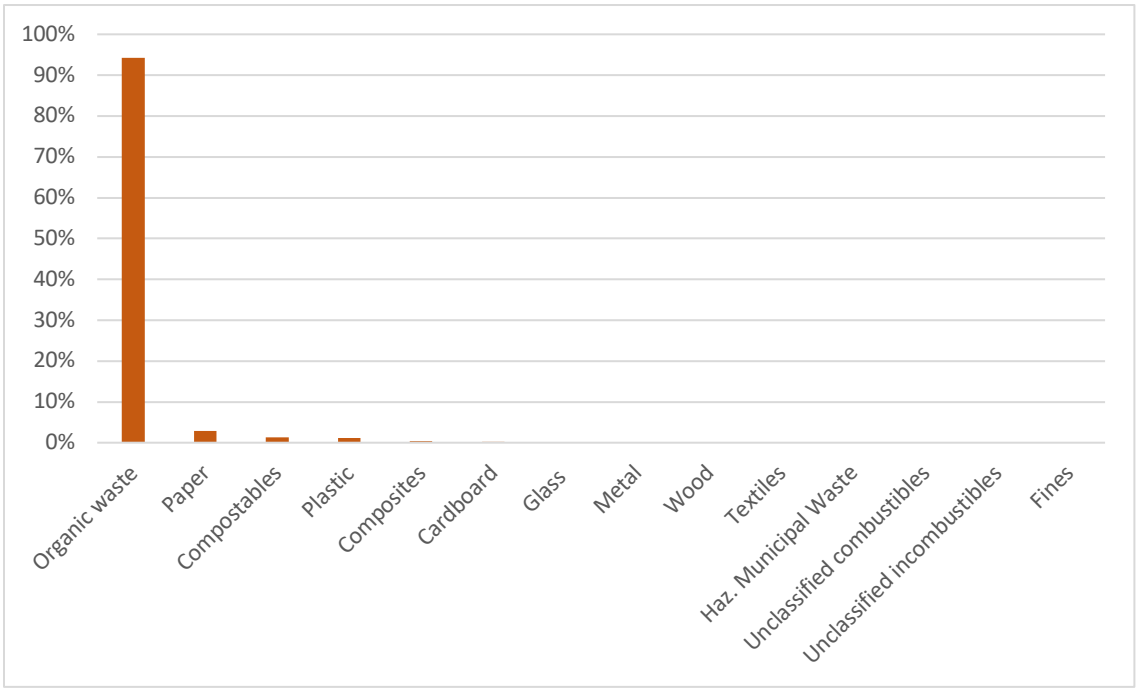


Figure 35: Composition of kerbside collected organic waste from the non-household sector

5.4 National Profile

In order to determine the national profile, the average waste composition (in percentage) for each waste stream (MRW, MDR and OW) was applied to the total quantities of kerbside collected non-household waste generated nationally in 2016[15]. These data were provided by the EPA with the results presented in Table 21 and shown graphically in Figure 36.

Table 21: National Profile for kerbside collected Non-Household Waste

Primary Waste Categories	MRW (t)	MDR (t)	OW (t)	National Profile (t)	% Wet weight
Organic waste	162,062	14,875	66,201	243,139	34.0%
Paper	114,497	47,282	2,015	163,793	22.9%
Plastic	84,889	37,925	785	123,600	17.3%
Cardboard	26,888	28,319	141	55,348	7.7%
Textiles	27,474	1,321	0	28,795	4.0%
Metal	16,876	5,464	0	22,340	3.1%
Composites	14,506	3,239	218	17,963	2.5%
Unclassified combustibles	13,714	2,866	0	16,580	2.3%
Compostables	10,128	2,263	914	13,305	1.9%
Unclassified incombustibles	9,845	266	0	10,112	1.4%
Glass	5,994	1,571	20	7,584	1.1%
Wood	4,089	1,032	0	5,121	0.7%
Fines	3,850	637	0	4,487	0.6%
Haz. Municipal Waste	2,857	204	0	3,061	0.4%
Total	**497,668**	**147,265**	**70,293**	**715,227**	**100%**

[15] Most recent dataset available. Source personal communication with the EPA on 01/11/2018.

Table 22: Capture Rate by waste type and waste category for kerbside collected non-household waste

Primary Waste Categories	MRW (t)	MDR (t)	OW (t)
Organic waste	67%	6%	27%
Paper	70%	29%	1%
Plastic	69%	31%	1%
Cardboard	49%	51%	0%
Textiles	95%	5%	0%
Metal	76%	24%	0%
Composites	81%	18%	1%
Unclassified combustibles	83%	17%	0%
Compostables	76%	17%	7%
Unclassified incombustibles	97%	3%	0%
Glass	79%	21%	0%
Wood	80%	20%	0%
Fines	86%	14%	0%
Haz. Municipal Waste	93%	7%	0%
Total	**70%**	**21%**	**10%**

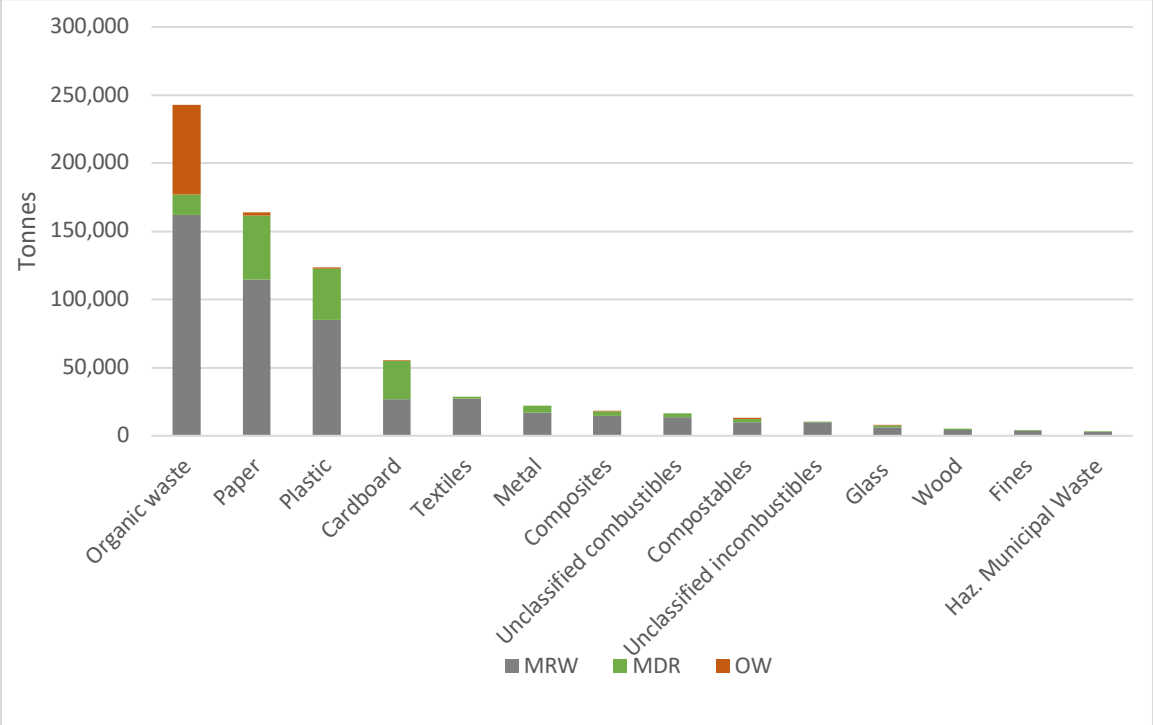


Figure 36: National Profile for kerbside collected non-household waste

Based on the results outlined in Tables 21 and 22, the most prominent category of the national non-household municipal waste stream was **organic wastes** at 34.0% of the total. Of this, 67% remains in the MRW stream with 6% in the MDR. 27% of the national total organic waste is collected by brown bin services.

The second largest waste category was **paper waste** which comprised 22.9% of the total composition. Of this 70% remains in the MRW stream with 29% captured by MDR collections.

Plastic waste accounts for 17.3% of the total. 69% of plastics are in the MRW stream with 31% in the MDR stream.

Cardboard waste, 7.7% of the total composition, is evenly collected between MDR (51%) and MRW (49%) collection services.

Textiles waste averaged 4.0% with 95% in the MRW.

Metal waste averaged 3.1%, with 76% in the MRW collection and the remainder in the MDR collection (24%).

Composites averaged 2.5%, captured mainly in the MDR collection (81%) and MRW collection (18%).

Compostables account for 1.9% of the national waste stream with 76% in the MRW stream, 17% in the MDR collection and 7% in the OW collections.

Glass waste averaged 1.1% of the materials, mainly collected in the MRW collection (79%) with the remainder in the MDR collection (21%).

Wood averaged 0.7% and was mainly collected in the MRW collection (80%) with the remainder in the MDR collection (20%).

Hazardous Waste (WEEE, batteries, aerosols, paints, medicines and drugs) comprised 0.4% of the waste composition. These streams are mainly captured in the MRW collection (93%).

5.4.1 Comparison with 2008

A comparison of the national profile generated for kerbside collected non-household waste with that from 2008, based on percentage composition and tonnage, are shown in Figure 37 and Figure 38 respectively.

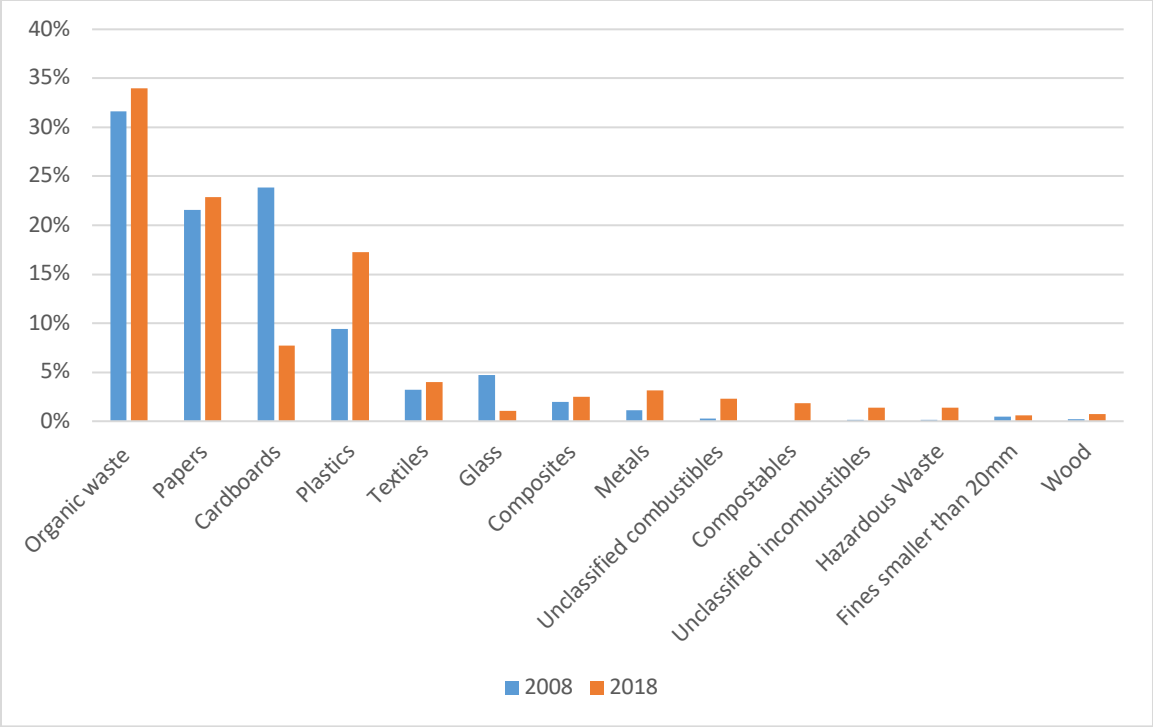


Figure 37: Comparison of national profiles of non-household kerbside collected waste from 2008 and 2018 based on percentage composition

The main changes that have occurred include:

- Slight increase in organics by 2.4%
- Papers increased by 1.3%
- Cardboard decreased from 23.8% to 7.7%
- Plastics increased from 9.4% to 17.3%
- Glass decreased from 4.7% to 1.1%
- Though composites have remained similar, the change in material classification doesn't reflect the increased proportion of coffee cups. Composite packaging is now included in unclassified combustibles, hence its increase
- Metals increased by 2%
- Compostable wares, which were not encountered in 2008, now account for 1.9%
- Hazardous wastes have increased from 0.1% to 1.4%

However, when comparing the national results from 2008 and 2018, based on tonnes generated, the results are slightly different. Though the overall volume of non-household waste has decreased from 1,030,551 tonnes in 2008 to 715,227 tonnes in 2018, the differences shown in Figure 38 reflect the changes in waste management services and different capture rates.

The most significant decreases occurred for:

- Carboards which decreased by 189,899 tonnes
- Organics which decreased by 82,373
- Paper which decreased by 58,271 tonnes
- Glass which decreased by 40,990 tonnes

- Hazardous wastes which decreased by 12,042 tonnes

In terms of increases, the main materials include:

- Plastics which have increased by 26,913 tonnes
- Unclassified combustibles which increased by 13,721 tonnes – though this is likely due to reclassification of composite packaging materials to this stream and actually reflects the 14,911 tonnes of coffee cups estimated in the composite stream in 2018
- Compostables which is now estimated at 13,305 tonnes
- Metals which increased by 10,945 tonnes

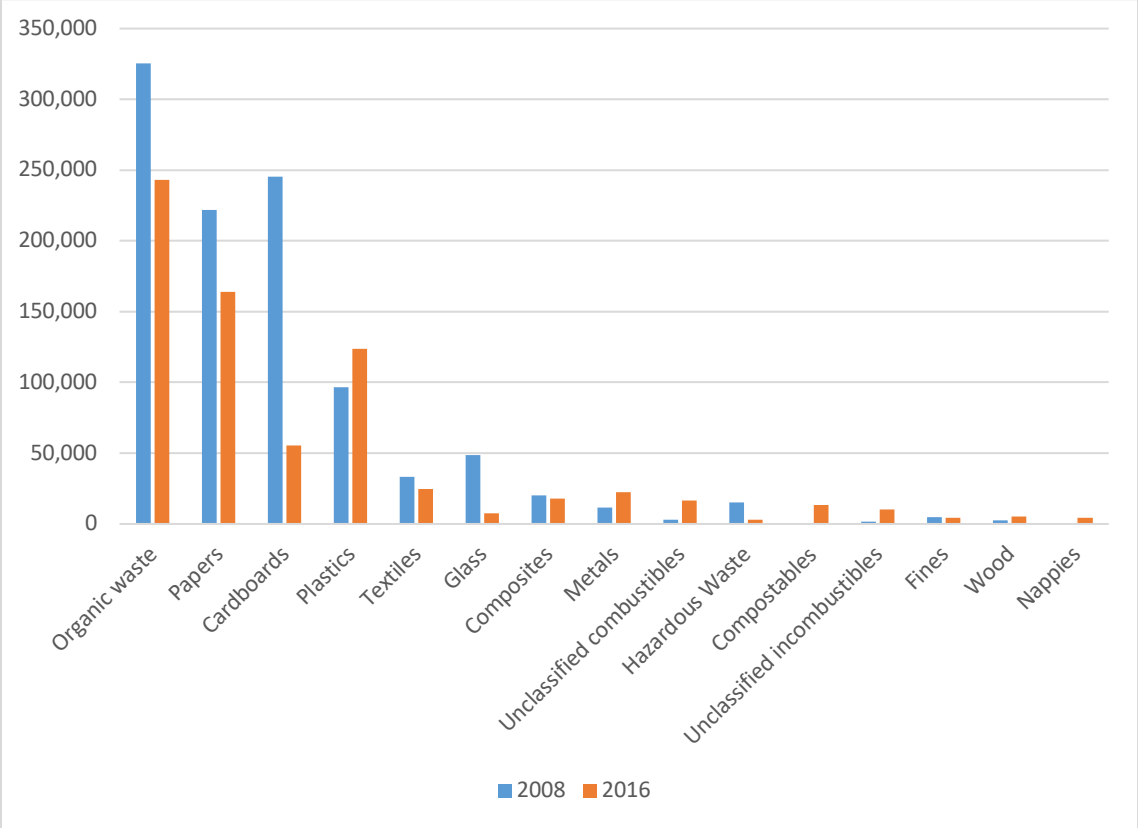


Figure 38: Comparison of national profiles of non-household kerbside collected waste from 2008 and 2018 based on tonnages

6 Commentary on the Methodology

Accurate and up-to-date information on the composition of waste is required for effective waste management planning, implementation and monitoring. Information on the composition of waste can be applied at various levels:

- Locally for assessing the feasibility of various collection, recycling and treatment options.
- For assisting compliance schemes in the determination of producers' fees and recovery operator subsidies.
- For assessing the proportion of biodegradable waste in residual waste for monitoring compliance with the Landfill Directive.
- For assessing the proportion of packaging waste for monitoring compliance with the Packaging Directive.
- For the calculation of REFIT subsidies for thermal treatment waste facilities.
- To facilitate focused strategic waste management planning at national and regional levels
- On the international level to compare Ireland with other European countries.

In order to get accurate information on waste, an effective and transparent methodology is required for the characterization of household and non-household (commercial) waste streams. The methodology used for the non-household sector is essentially similar to that for the household sector - it is based on generating a number of waste profiles for the different non-household sectors and then scaling up to generate an overall national profile.

However, unlike the household characterisation methodology, which samples a large volume of waste taken from households within a specific waste generating demographic, the commercial methodology examines relatively small volumes of waste from a large number of businesses within different non-household sectors.

When this sectoral-based approach was first proposed in 2001 it was deemed necessary due to the limitations of the coning and quartering technique that is used effectively for household characterisations. Due to the varied types of waste generated within commerce (e.g., the wastes coming from a large hospital will be very different to that coming from a retail unit, a school or an office block) and the disparate nature of the commercial sector (i.e. the difficulty in getting sufficient waste from the hotel sector to be collected exclusively), the traditional coning and quartering is approach was not considered appropriate. Hence the site-specific approach developed in 2001, and refined during subsequent national studies in 2004 and 2008, still forms the basis for the commercial characterisation methodology.

Due to several factors, both regulatory and socio-economic, there have been numerous changes in the generation and management of municipal waste in Ireland since the last national waste characterisation study was carried out in 2008. In order to judge the impact of these changes on the municipal waste streams and allow for effective waste management planning, accurate waste statistics reporting, as well as successful waste prevention and minimisation programme planning, an up to date municipal waste characterisation profile was required.

In 2014, a review of both the household and non-household methodologies was carried out in order to provide a solid footing for updating the composition analysis of municipal waste at a national level. While the underlying methodology for commercial waste characterisation remains unchanged (i.e. generating sectoral profiles and applying these to national waste figures to estimate a national profile) a number of alterations were suggested to ensure more statistically robust sectoral profiles were produced. This updated methodology was applied during this current study.

Based on the experiences of the project team in both the gathering of required information, as well as applying the methodology in practice, a number of observations and recommendations have been made. These are summarised in Table 23.

Table 23: Overview of main challenges encountered and comments & recommendations for future work

Item	Challenge	Comments & Recommendations
National Waste Data	In order to generate an accurate national waste profile, the methodology requires information from waste contractors in order to determine the relative sizes of the main commercial waste-producing sectors. While every effort was made to gather this information (through both official channels and personal contacts) it was one of the most challenging aspects of the work.	As noted previously in the 2015 methodology review, changing the way that waste contractors currently report to the NWCPO to include a NACE breakdown (as well as reporting based on List of Waste) would greatly facilitate this process. In addition, should this information be available, it would allow the impacts of sectoral policies to be assessed as well as providing an excellent basis for identifying target materials and sectors.
Recruiting Businesses	During previous studies the methodology stipulated that a week's worth of waste from participating businesses would be assessed. In the current method, in an effort to have a stronger statistical dataset, more businesses were visited but less waste was sampled. While this involves less time on-site, engaging with 50 businesses was very challenging. Each one takes time to identify, engage with, plan out, survey and report on.	A significant benefit of the series of studies carried out in 2002, 2004 and 2008, was the fact that, due to the relative proximity of the different works, information from previous studies could be used to inform subsequent work – which in turn meant that the data could be utilised to supplement the dataset used for national profiling. As this is the first such study for 10 years, and a whole new dataset had to be developed, it required at least 50 businesses. Performing such studies on a more regular basis would allow fewer businesses to be

		surveyed and the less data added to the existing data set. This would reduce the work-load involved in recruiting such a high number of businesses.
Survey Planning	The new methodology specifies a minimum amount of waste that is required for a participating business to be included in the dataset. Choosing the correct location (e.g. shopping centres may not work because of shared services), and the right day to survey (i.e. to ensure that there is sufficient MRW and MDR present during the one day on-site) is therefore an essential aspect to survey planning.	Good communication with the businesses prior to survey work is essential. In order to ensure that all requirements are met it is best to visit the site prior to surveying. During this pre-visit make sure that there will be sufficient waste to work with and that the day chosen does not conflict with waste management collection.
Business Data	During previous surveys the project team assessed one week's worth of waste. Based on those data it was possible to generate sectoral factors (e.g. waste generated per employee) and use these as an alternative scale up method. The current method involves sampling from the existing waste but not assessing one weeks worth of waste. In order to generate sectoral factors, accurate waste data from the businesses are required. In many cases this proved difficult to obtain for a variety of reasons including shared waste management services, poor data from waste management companies or businesses not following-up.	One of the main reasons businesses participate in these surveys is to get information on the performance of their waste management services. Asking them in advance for one month's worth of data, and not performing the surveys until that is obtained, may provide a better incentive to giving this information.
Waste Management Systems	There are a wide variety of waste management services provided to businesses across the country. All have MRW but otherwise other services vary to include: MDR, brown bins, FSM bin, segregated streams. Because of the variation, it can be difficult to compare and contrast	The current methodology aims to overcome this issue by looking at individual samples of, primarily, MRW and MDR, for each sector. Brown bins were also analysed, though they were considered for the commercial sector as a whole and examined mainly from a contamination perspective.

	different bin systems (e.g. 2 or 3 bin systems).	
Waste Categories	Due to continual variations in what is consumed and used, there will always be changes in the wastes encountered. This is especially important when considering the household and non-household waste streams – consistent primary categories will be encountered in both, though there will always be some notable differences. For example, coffee cups and compostable wares are prevalent in commerce while garden waste and nappies are more common in household waste.	It is important that before any subsequent surveys, a thorough analysis of important waste categories be carried out to take into account recent changes in materials used or materials of national interest (e.g. nappies or coffee cups). These will likely be different for the household and non-household sectors.
Regular updating of the information	Due to the time between this study and the last one in 2008, the previous data could not be used to support the non-household dataset. In order to 'start again', a large number of surveys were required. This proved challenging in terms of business engagement and work load.	More regular surveying, with less businesses required, will facilitate the ongoing development of a non-household model. Because of how the new methodology works, including new data into the final model, the results will be easier to produce and more statistically valid.

Appendices

Appendix 1: Commercial Waste Survey Method

1. Overview

The methodology for the commercial waste assessments is in accordance with the updated 2015 methodology[16]. Similar to the previous methodology this includes contacting management in advance, scheduling survey work to ensure sufficient waste is available, informing on-site staff in advance, selecting an appropriate survey location on-site and then the actual assessment of waste.

However, in previous studies 4-5 days were spent on-site in order to ensure that a full week's worth of waste was captured and analysed. This methodology involves spending just one day on site. One-day waste surveys are challenging so the communication with the business prior to visiting will be important. Also, it is recommended that two or three surveys are carried out together in a single geographical area. This will allow time to be spent at a number of sites, if required, over a number of days. While more difficult to organise, it will provide the project team the opportunity to re-visit sites to ensure sufficient data is recorded at each site.

2. Waste Volume Requirements

The new methodology requires that at least 100m^3 of unbagged waste should be analysed for the non-household sector in total. Based on 50 site surveys then the sample size for each should be at least 2 m^3 of unbagged waste to satisfy the 100 m^3 criterion.

Based on previous experience it has been found that approximately four 1100 litre wheelie bins of bagged waste is equivalent to two 1100 litre wheelie bins (i.e. 2m3) of unbagged waste. The four bins may be two each of MDR and MSW, or a different proportion depending upon the output from the premises. This is an important minimum requirement as it ensures that businesses producing very small volumes of waste do not skew results.

If there is a significant volume of waste (>four 1100 bins of bagged waste) then random sampling will be required. The revised methodology recommends that waste samples are lined up, numbered and, using a simple random sampling method, an appropriate number taken to satisfy the requirement.

Each waste sub-sample is taken as a minimum of 5kgs. If a bag of waste is less than 5kgs then it should be added to another (or others) until the combined weight is at least 5kgs.

Note: *Depending on the volumes of waste generated, the project team will always endeavour to analyse as much waste as possible.*

3. Before the Survey Begins

Before beginning the waste characterisation survey there are a number of tasks that need to be conducted. These are outlined below:

1. **Contact management** of the enterprise whose waste is to be characterised. It is essential that management commitment is given to the waste characterisation study, so that

[16] Updated Methodology for the Characterisation of Non-household Municipal Solid Waste in Ireland, CTC, 2015

necessary resources are assigned during the study period and relevant background information is provided. This can take some time to organise.

2. **Background information:** Prior to visiting each site as much background information on the business as well as waste generation volumes and patterns should be gathered. These would typically include all or some of the following, as relevant:

   - Days of collection of the different waste streams (so survey dates can be planned)
   - Type and number of waste management receptacles for the different waste streams
   - Annual mixed residual waste volumes/weights.
   - Mixed dry recyclable volumes/weights (ideally 1 year, minimum 3 months)
   - Separately collected fraction volumes/weights (e.g. cardboard, plastic film, organics, glass)
   - Number of employees (full time equivalent)
   - Other sector specific information (bed-nights, covers, etc.)

   This information will be used to plan the different surveys and, where appropriate, will be used to generate sectoral factors for the different businesses visited.

3. **Schedule** the waste characterisation survey period:

   - Arrange to conduct the waste characterisation study during **typical business activities/operations**. Avoid scheduling the survey on or around any special events that would produce wastes not representative of a normal workday/workweek. For example, surveys should not be conducted during bank holidays, Christmas, Easter or public holidays (or special orders in the case of industry).
   - Make sure that the surveys are conducted when there is sufficient waste. This will need to take into account **when waste is collected** by waste contractors, the numbers of bins on site and quantity of waste generated daily. Depending on dates it may be necessary for waste collection to be postponed.

4. **Inform relevant staff** of any requirements from them during the waste characterisation survey. They may be required to segregate waste, label waste arisings, put waste into separate containers, etc.

   - With the introduction of the brown bin the largest 'wet' contaminant should now be separated from the municipal and recyclable streams. However, in businesses where organics segregation is not occurring, this should be encouraged, as it will make the subsequent waste characterisation easier and more accurate. In addition, this can be used to encourage businesses to then comply with legislative requirements. If there is no brown bin in use, and the business then segregates the organic waste for the purpose of the surveys, ensure this waste is included in the mixed solid waste and not recorded as a separate waste.
   - Staff should be discouraged from disposing of non-routine waste during the course of the study, for example, stockpiled electronic waste, office clear-outs, etc.

5. If there is a serviced canteen on-site (i.e. providing hot food meals rather than a kitchenette) then this should be treated as a separate area. The waste from canteens will

be analysed separately as such businesses are classed as a type of restaurant. If there are such facilities then the waste from this area will need to be separated by on-site staff prior to the assessment.

6. **Select a central 'waste collection area'** where all waste arisings can be collected, sorted, weighed, and characterised for the duration of the waste characterisation study. A parking garage, shipping area or other large flat area is preferable. This area should be covered, if possible, to provide shelter from adverse weather conditions. In case of nearby traffic, ensure that the area is secured using bollards.

7. **Gather the necessary equipment** to aid in the waste characterisation survey.

    - The main items required for the waste characterisation are the following:
        - **Weighing scales**. In order to weigh wheelie bins a flat one with a wide base capable of measuring up to 150kg will be required. Depending on the accuracy of this, another may be needed for weighing the sample fractions (with a range from 0 to 35+kg, with accuracy to 0.01kgs)
        - **Containers** for holding and sorting the waste. These should be made of a durable plastic, all the same type, in order to ensure that the tare weight is the same and stack easily.
        - **A clipboard, labels, pens and worksheets**. Several copies of the 'Waste Collection Worksheets' should be on hand for each survey.
        - **A sorting table** of at least 1.5m by 0.5m.
        - **A gazebo** for covering the sorting area if the weather is inclement.
        - **Shovel, a yard brush, a first aid kit, extra plastic bags, cable ties and a Stanley knife.**
        - **PPE – gloves and overalls as appropriate**

8. **Health and safety issues** should be considered at all times. All members of the waste characterisation team should wear protective clothing (such as rubber gloves, heavy duty shoes, safety glasses and coveralls) and precautions should be taken to ensure that the waste does not come into contact with food or drink. It is advisable that staff are appropriately inoculated and aware of manual handling issues, especially for heavy streams like brown bins.

4. On-site tasks on arriving at the participating business

Once the surveys have been organised (assuming multiple surveys in one location), and depending on how waste is to be separated at each location, a plan for each area where surveys are to be conducted should be put in place. This should include:

- A timetable for the different sites, outlining at what time the survey team should be there (to ensure as much waste as possible is available)
- An allocation of the times to be spent at each site

- A list of information that may need to be collected from management
- What is required of on-site staff prior to, and during, the surveys
- Contact details for on-site point of contact

When the project team arrive on site the following should be clarified:

- Assigned point of contact and how to get in touch with them
- Fire evacuation procedures and meeting point
- First aid procedures
- Any other site specific H&S requirements

At each business the following are the main waste categories to be assessed:

- ***Mixed Solid Waste*** – this waste streams will be heterogeneous in nature, and consist of mixed waste of various types. The characterisation of this waste stream is more difficult and will require the majority of work. However, it has the added benefit that the main materials that could be managed in a more appropriate fashion (i.e. recovered) will be identified, and this will be reported to the participating business after the surveys have been completed. As with the other waste categories volumes (or weights) of these collected will be recorded (annual or for another defined period) and at least 1 m^3 of this material will be assessed for each site. However, every effort should be made to sample as much waste as possible in the time allocated to a participating business.
- ***Mixed dry recyclables*** – these are similar to mixed recyclables collected at home. The volumes (or weights) of these collected will be recorded (annual or for another defined period). A random sample of these materials will be taken for assessment and a key focus will be on identifying the level of contaminants (i.e. non-recyclable materials) within this stream. While no recommended sample size has been found in the literature, it is suggested that this stream be treated as per the residual, and samples of 1m^3 per business be taken.

5. Conducting the Survey

Once the assessment team are in place the following outlines the main survey steps:

1. Depending on how much waste is available, waste sub-samples will be taken using a simple random sampling method. This involves numbering all the sub-samples (i.e. bags weighing 5kg each) and then using a random number generator to choose those for subsequent analysis[17].
2. It is important to note that each sub-sample should be a minimum of 5kgs. If bags of less than 5kg are encountered they should be combined with others until a combined weight of at least 5kgs is achieved.

   In some circumstances, waste is not presented in conventional bin bags, e.g. it is presented in cages or in very large bags. In these circumstances the materials should be spread out and

[17] See https://www.random.org/ for an example of such a generator

random sub-samples should be taken, with a minimum of 5kg required, by bucket or shovel, and each sub-sample then characterised.

3. ***At least 2 m^3 total of unbagged waste*** must be characterised from each business. This can be allocated proportionally between mixed and recyclable waste streams. Therefore, depending on how the waste is presented, it is likely that more than two 1100L wheelie bins of bagged waste may be required.
4. If possible, in order to determine the ***average weight/volume ratios*** required by the EPA, the weights of the different types of bins used on site, when full of waste, should be recorded at the start. This will require a large flatbed scales that is capable of weighing at least 150kgs (though ideally 300kgs). (A plywood sheet or block may be used used to balance the bin on the scales).
5. Once the samples have been chosen they should be separated into the predefined categories as outlined in the Waste Collection Worksheet. The different materials should be placed in the containers and then weighed. Ensure to tare the scales with an empty container prior to recording the material weights.
    a. Survey each 5kg sub-sample and record the results on the results sheet.
    b. Repeat surveys of 5kg sub-samples until the target volume (2 m3 of unbagged waste) has been surveyed.
6. If multiple sheets are used ensure that they are numbered and stored away securely.
7. While a minimum of $1m^3$ of unbagged waste is recommended per stream (MDR and MSW), the greater the number of mixed waste sub-samples that are characterised, the more accurate the results will be. Attempt to characterise as many sub-samples as time allows.

6. After the Survey

Once the survey is completed the following are the main actions to consider:

1. Clean the area where the waste sorting takes place. Ensure to leave this area as clean as it was when the project team arrived.
2. If possible wash and clean all sorting equipment prior to leaving
3. When leaving the site ensure to inform the relevant on-site staff
4. On returning to the office collate the data and generate a brief site report
5. This should be issued to the business ideally within 6 weeks of conducting the survey

Appendix 2: Waste Categories

(Main changes since 2008 shown in red)

MUNICIPAL WASTE COMPOSITION CATEGORIES & EXAMPLES			
EWC CODES	**WASTE CATEGORIES**	**TYPICAL EXAMPLES**	
ORGANIC WASTE			
20 01 08	Edible kitchen & canteen waste	Unused Packaged food	Unused or partially used packaged food that can't easily be separated from packaging, e.g. jar of honey, tub of soft cheese
		Food Waste	Vegetables, fruit, cheese or sausages removed from packaging
21 01 08	Liquid fit for human consumption	Liquid contained in drink or milk containers	
20 02 01	Biodegradable waste from garden & park	Grass and bush cutting, twigs, soil, flowers, leaves, tree branches, weeds	
20 01 25	Vegetable oil	Waste cooking oil	
PAPERS			
15 01 01	Paper Packaging	Recoverable paper packaging	Brown or white paper bags, egg cartons, bread wrappers
		Unrecoverable paper packaging	plastic
20 01 01	Newspapers	Local and national newspapers, newsprint-type advertising publications, other newsprint	
20 01 01	Magazines & glossy paper	Magazines and ads on glossy paper, shop catalogues	
20 01 01	Office papers	Office type envelopes, letters, print outs	
21 01 01	Tissue Paper/ Kitchen Roll	Tissue Paper/ Kitchen Roll	
20 01 01	Other papers	Till receipts, books, telephone directories, non-glossy junk mail, loose leaf paper, non-glossy brochures and catalogues, notebooks, envelopes	
CARDBOARDS			
15 01 06	Flat Card and Corrugated Cardboard (Packaging)	Recoverable flat card packaging	Cereal boxes, toy boxes, washing powder containers, Corrugated packaging cardboard used for household items packaging (TV, PC, furniture etc.)
		Unrecoverable flat card packaging	Ready packed meats, Contaminated pizza box
20 01 01	Other Cardboards (Non Packaging)	Greeting cards, postcards, files and folders, tickets	
COMPOSITES			
15 01 05	Beverage Carton (Packaging)	Beverage/juice cartons (Tetrapak)	
15 01 05	Composite (Packaging)	Packaging made up of multiple materials including cigarette packs, plastic/foil wrappers, etc.	
15 01 05	Disposable Coffee Cups	Disposable coffee cups of all makes – includes lids	
TEXTILES			
15 01 09	Textiles Packaging	Some types of potato sacks	
20 01 11	Textiles Non-Packaging	Rags, household soft furnishings (cushions) and upholstery, blankets, towels, carpets, curtains, ruck-sacks,	
20 01 10	Clothes	Clothes	
	Nappies	Nappies and incontinence wear	
18 01 04	Healthcare Textiles	Dressings, plasters, linen, disposable clothing, sanitary towels, bandages	

PLASTICS			
20 01 39	PET (Packaging)	Soft drinks bottles, water bottles	
20 01 39	PE (Packaging)	Milk bottles, detergent/shampoo bottles, bottle caps, yoghurt drink bottles	
21 01 39	PP (Packaging)	Microwaveable meal trays, butter tubs, dessert containers, disposable drink cups, yoghurt pots, ice cream containers, rashers trays	
22 01 39	Styrofoam (EPS) (Packaging)	EPS foam - electronic goods packaging, burger boxes, some meat trays, some vegetable trays	
15 01 02	Supermarkets Bags and Films (Packaging)	Shopping bags, fertiliser bags, cling film, compost/peat-moss bags, sandwich bags, cereal packets (inside box), biscuit wrappers, pallet wrap	
15 01 02	Other Plastic (Packaging)	Recoverable plastic packaging	Toothpaste tubes, cosmetics tubes, CD/DVD/tape covers
		Unrecoverable plastic packaging	Meat containers, contaminated film packaging etc.
20 01 39	Other Plastic Waste (Non Packaging)	Refuse bags, clothes hangers, toys, air freshener holders, plant pots, seed trays, video cassettes, CDs, DVDs. tapes, washing up bowls, racks,, gardening equipment, lighters, rulers, shoes (plastic only), plastic frames, babies bottle	
GLASS			
15 0107	Glass (Packaging)	Wine bottles, beer bottles, water bottles, jam jars and medicine bottles	
20 01 02	Non Packaging Glass	Mirrors, plate glass, flat glass, cookware (Pyrex), mixed broken glass, drinking glasses	
METALS			
15 01 04	Ferrous Metal (Packaging)	Food cans, can lids, beer bottle lids, biscuit tins, polish tins, lids from glass jars	
15 01 04	Aluminium Cans (Packaging)	Beverage cans - soft drinks, beer	
	Aluminium foil trays (packaging)	Foil sheets, foil trays, some toothpaste/cosmetic products tubes, wine bottle screw caps, chocolate bar foil wrapper, foil yoghurt lids, stock cube wrapper.	
15 01 04	Other Metal (Packaging)		
20 01 40	Other Metal Waste	Copper wiring, include previous secondary waste categories: Other Ferrous Metal Waste, Other Aluminium Waste	
WOOD			
15 01 03	Wood Packaging	Bottle corks, cork packaging, pallets, ice-cream sticks	
20 01 37	Non-Packaging Natural Wood	Wood fencing (unpainted/unvarnished), some wood from DIY	
20 01 37* / 20 01 38	Treated/ composite woods (e.g. MDF/chipboard)	Kitchen units, particle wood, toilet seats, skirting (chipboard, plywood, mdf), baskets.	
SPECIAL/HAZARDOUS MUNICIPAL WASTE			
20 01 27* / 20 01 28	Paint and associated products	Paint tins, heavily soiled paint brushes	
20 01 33*/34	Batteries & Accumulators	Lead acid, nickel cadmium, other car and household batteries and accumulators (including rechargeable batteries)	
20 01 99	Aerosols	Deodorant, perfume, hairspray	
21 01 35*/36	Electronic equipment	Household appliances (toasters etc.), electronic toys, remote controls, phone chargers. Include previous secondary category Fluorescent tubes and other mercury containing wastes	
20 01 31*/32	Medicines and drugs	Out of date antibiotics, steroids, tablets, etc. separated from packaging, inhaler	
20 01 29*/30	Detergents	Laundry detergents separated from packaging i.e. the liquid or powder only	
20 02 03	Garden chemicals	Sprays, feeds	
20 01 99	Healthcare risk waste	Sharps, vials	

20 03 99	Other (hazardous) municipal waste	Any other items - Description to be provided during survey e.g. hair dye, incl. previous secondary waste categories: Waste oil and oil filters, Ink cartridges and toner
20 03 99	Other (non-hazardous) municipal waste	Any other items - Description to be provided during survey
UNCLASSIFIED COMBUSTIBLES		
20 03 99	Other unclassified combustibles	Animal hair, non-mercury containing light bulbs, linoleum (lino), rubber/latex gloves, cigarette butts, candles, full tube body lotion, paint brush
UNCLASSIFIED INCOMBUSTIBLES		
20 03 99	Other unclassified incombustibles	Inert waste e.g. ceramics, crockery, stone/ceramic floor and wall tiles, vases, stones, bricks
COMPONENTS SMALLER THAN 20 MM ROUND MESH		
20 03 99	Fines smaller than 20mm round	Any items going through the 20mm mesh

	Primary Category	13
	Secondary Category	51
	Tertiary Category	8

Appendix 3: Summary Results of Sectoral Surveys

Sector	Food Retail	
PAPER	**MRW**	**MDR**
Office Paper	1.43%	6.16%
Newspaper	0.37%	3.29%
Magazines & Glossy Paper	2.03%	2.02%
Tissue Paper	8.69%	5.88%
Paper Packaging	1.79%	1.81%
Unrecoverable Paper Pac	1.80%	0.49%
Other Paper	2.77%	7.34%
CARDBOARD		
Cardboard Packaging	3.64%	12.84%
Unrecoverable Pac	0.02%	0.06%
Other Cardboard Non Packaging	0.09%	0.39%
GLASS		
Glass Packaging	1.42%	0.98%
Other Glass (non-packaging)	0.05%	0.05%
PLASTIC		
PET Packaging (1)	2.66%	6.59%
PE Packaging (2,4)	0.97%	1.09%
PP Packaging (5)	1.35%	4.31%
PS Packaging (6)	0.69%	2.54%
Plastic Bags & Film packaging	5.05%	11.20%
Other Plastic Packaging (7)	1.90%	3.15%
Unrecoverable Plastic Pac	1.82%	0.19%
Other Plastic (Non Pac)	4.37%	5.30%
METAL		
Aluminium Cans (Pac)	0.53%	0.59%
Aluminium Foil & Trys (Pac)	0.60%	0.60%
Tin Can (Ferrous Pac)	0.51%	1.90%
Other Metal Packaging	0.01%	0.00%
Other metal waste	0.37%	0.04%
WOOD		
Wood Packaging	0.00%	0.00%
Other Wood	0.14%	0.14%
Composite Wood	0.00%	0.00%
ORGANIC WASTE		
Food Waste	31.92%	12.09%
Unused Packaged Food Waste**	4.53%	1.56%
Garden Waste	0.83%	0.01%
Liquid Waste*	4.83%	2.83%
Vegetable Oil	0.08%	0.00%
TEXTILES		
Textiles Packaging	0.14%	0.27%
Textiles (Non Packaging)	2.97%	0.52%
Healthcare Textiles (Nappies, etc.)	0.10%	0.15%
Clothes	0.74%	0.19%
COMPOSITES		
Coffee Cups	1.19%	0.55%
Tetra Pak Packaging	0.11%	0.29%
Haz. MUNICIPAL WASTE		
Electrical Equipment	0.33%	0.00%
Fluorescent Bulbs	0.01%	0.00%
Batteries	0.05%	0.00%
Aerosols	0.45%	0.00%
Waste Chemicals	0.00%	0.00%
Waste Mineral Oil	0.00%	0.00%
Medicines	0.07%	0.01%
Paint	0.04%	0.00%
COMPOSTABLES		
Compostable Wares	1.03%	0.02%
UNCLASSIFIED COMBUSTIBLES		
Unclassified combustible (Pac.)	0.84%	0.57%
Unclassified combustible (Non-Pac.)	1.66%	0.67%
UNCLASSIFIED INCOMBUSTIBLES		
Unclassified incombustible	2.61%	0.07%
FINES		
Fines smaller than 20 mm	0.37%	1.28%

Sector	Food Wholesale	
PAPER	**MRW**	**MDR**
Office Paper	7.78%	13.83%
Newspaper	4.68%	0.22%
Magazines & Glossy Paper	18.85%	0.54%
Tissue Paper	5.32%	26.85%
Paper Packaging	0.27%	1.33%
Unrecoverable Paper Pac	0.35%	0.04%
Other Paper	1.07%	0.71%
CARDBOARD		
Cardboard Packaging	13.05%	4.08%
Unrecoverable Pac	0.40%	0.35%
Other Cardboard Non Packaging	0.15%	0.00%
GLASS		
Glass Packaging	0.49%	1.15%
Other Glass (non-packaging)	0.00%	0.04%
PLASTIC		
PET Packaging (1)	1.73%	3.69%
PE Packaging (2,4)	0.50%	2.66%
PP Packaging (5)	0.17%	1.39%
PS Packaging (6)	0.71%	1.53%
Plastic Bags & Film packaging	6.27%	0.99%
Other Plastic Packaging (7)	2.03%	1.47%
Unrecoverable Plastic Pac	0.27%	0.74%
Other Plastic (Non Pac)	2.82%	3.41%
METAL		
Aluminium Cans (Pac)	0.61%	1.17%
Aluminium Foil & Trys (Pac)	0.56%	0.60%
Tin Can (Ferrous Pac)	0.12%	0.44%
Other Metal Packaging	0.10%	0.00%
Other metal waste	0.23%	0.00%
WOOD		
Wood Packaging	0.96%	0.00%
Other Wood	5.02%	0.02%
Composite Wood	3.57%	0.86%
ORGANIC WASTE		
Food Waste	7.37%	16.52%
Unused Packaged Food Waste**	4.73%	2.54%
Garden Waste	2.77%	0.00%
Liquid Waste*	1.07%	3.88%
Vegetable Oil	0.00%	0.00%
TEXTILES		
Textiles Packaging	0.57%	0.00%
Textiles (Non Packaging)	0.02%	0.06%
Healthcare Textiles (Nappies, etc.)	0.02%	0.00%
Clothes	0.13%	0.16%
COMPOSITES		
Coffee Cups	0.39%	2.02%
Tetra Pak Packaging	0.03%	0.32%
Haz. MUNICIPAL WASTE		
Electrical Equipment	0.05%	0.00%
Fluorescent Bulbs	0.21%	0.00%
Batteries	0.09%	0.00%
Aerosols	0.05%	0.00%
Waste Chemicals	0.00%	0.00%
Waste Mineral Oil	0.00%	0.00%
Medicines	0.01%	0.00%
Paint	0.00%	0.00%
COMPOSTABLES		
Compostable Wares	0.61%	3.04%
UNCLASSIFIED COMBUSTIBLES		
Unclassified combustible (Pac.)	0.53%	1.25%
Unclassified combustible (Non-Pac.)	0.62%	1.32%
UNCLASSIFIED INCOMBUSTIBLES		
Unclassified incombustible	0.40%	0.80%
FINES		
Fines smaller than 20 mm	2.26%	0.01%

Sector	Offices	
PAPER	**MRW**	**MDR**
Office Paper	3.27%	32.90%
Newspaper	2.25%	6.95%
Magazines & Glossy Paper	0.84%	5.31%
Tissue Paper	10.75%	5.30%
Paper Packaging	2.85%	1.71%
Unrecoverable Paper Pac	1.18%	0.32%
Other Paper	3.22%	4.03%
CARDBOARD		
Cardboard Packaging	2.34%	11.50%
Unrecoverable Pac	0.00%	0.04%
Other Cardboard Non Packaging	0.14%	0.85%
GLASS		
Glass Packaging	0.93%	0.07%
Other Glass (non-packaging)	0.13%	0.00%
PLASTIC		
PET Packaging (1)	3.00%	4.58%
PE Packaging (2,4)	0.71%	1.39%
PP Packaging (5)	1.02%	1.05%
PS Packaging (6)	0.64%	0.34%
Plastic Bags & Film packaging	3.56%	3.45%
Other Plastic Packaging (7)	1.96%	3.19%
Unrecoverable Plastic Pac	0.21%	0.20%
Other Plastic (Non Pac)	2.31%	1.92%
METAL		
Aluminium Cans (Pac)	0.65%	0.92%
Aluminium Foil & Trys (Pac)	0.79%	0.17%
Tin Can (Ferrous Pac)	0.13%	0.30%
Other Metal Packaging	0.05%	0.18%
Other metal waste	0.79%	0.05%
WOOD		
Wood Packaging	0.00%	0.01%
Other Wood	0.20%	0.13%
Composite Wood	0.00%	0.00%
ORGANIC WASTE		
Food Waste	32.40%	3.82%
Unused Packaged Food Waste**	4.01%	0.35%
Garden Waste	1.62%	0.10%
Liquid Waste*	1.51%	0.63%
Vegetable Oil	0.14%	0.00%
TEXTILES		
Textiles Packaging	0.05%	0.02%
Textiles (Non Packaging)	1.09%	0.05%
Healthcare Textiles (Nappies, etc.)	0.22%	0.02%
Clothes	2.23%	0.02%
COMPOSITES		
Coffee Cups	4.79%	3.99%
Tetra Pak Packaging	0.50%	0.40%
Haz. MUNICIPAL WASTE		
Electrical Equipment	0.55%	0.05%
Fluorescent Bulbs	0.00%	0.00%
Batteries	0.04%	0.00%
Aerosols	0.03%	0.09%
Waste Chemicals	0.00%	0.00%
Waste Mineral Oil	0.00%	0.00%
Medicines	0.00%	0.01%
Paint	0.04%	0.00%
COMPOSTABLES		
Compostable Wares	3.51%	2.29%
UNCLASSIFIED COMBUSTIBLES		
Unclassified combustible (Pac.)	1.72%	0.83%
Unclassified combustible (Non-Pac.)	1.07%	0.31%
UNCLASSIFIED INCOMBUSTIBLES		
Unclassified incombustible	0.45%	0.15%
FINES		
Fines smaller than 20 mm	0.08%	0.00%

Sector	Restaurants	
PAPER	**MRW**	**MDR**
Office Paper	0.43%	1.38%
Newspaper	0.72%	0.97%
Magazines & Glossy Paper	2.72%	0.56%
Tissue Paper	14.60%	7.51%
Paper Packaging	1.77%	2.18%
Unrecoverable Paper Pac	0.87%	0.86%
Other Paper	0.85%	0.67%
CARDBOARD		
Cardboard Packaging	4.48%	27.75%
Unrecoverable Pac	0.12%	0.07%
Other Cardboard Non Packaging	1.30%	0.09%
GLASS		
Glass Packaging	0.77%	1.33%
Other Glass (non-packaging)	0.00%	0.00%
PLASTIC		
PET Packaging (1)	1.77%	4.82%
PE Packaging (2,4)	0.64%	5.32%
PP Packaging (5)	1.12%	3.80%
PS Packaging (6)	0.46%	0.49%
Plastic Bags & Film packaging	3.59%	7.22%
Other Plastic Packaging (7)	2.85%	3.94%
Unrecoverable Plastic Pac	0.91%	0.87%
Other Plastic (Non Pac)	1.44%	2.80%
METAL		
Aluminium Cans (Pac)	0.25%	1.06%
Aluminium Foil & Trys (Pac)	0.63%	0.45%
Tin Can (Ferrous Pac)	0.20%	7.65%
Other Metal Packaging	1.15%	0.15%
Other metal waste	0.70%	0.05%
WOOD		
Wood Packaging	0.21%	1.57%
Other Wood	0.43%	0.33%
Composite Wood	0.00%	0.00%
ORGANIC WASTE		
Food Waste	23.52%	6.98%
Unused Packaged Food Waste**	2.43%	0.12%
Garden Waste	1.57%	0.00%
Liquid Waste*	2.02%	1.14%
Vegetable Oil	0.00%	0.00%
TEXTILES		
Textiles Packaging	0.02%	0.03%
Textiles (Non Packaging)	1.61%	0.42%
Healthcare Textiles (Nappies, etc.)	3.98%	0.03%
Clothes	0.62%	0.07%
COMPOSITES		
Coffee Cups	4.09%	3.37%
Tetra Pak Packaging	0.27%	0.67%
Haz. MUNICIPAL WASTE		
Electrical Equipment	0.09%	0.01%
Fluorescent Bulbs	0.00%	0.00%
Batteries	0.00%	0.00%
Aerosols	0.01%	0.00%
Waste Chemicals	0.01%	0.07%
Waste Mineral Oil	0.00%	0.00%
Medicines	0.06%	0.00%
Paint	0.20%	0.00%
COMPOSTABLES		
Compostable Wares	1.26%	1.44%
UNCLASSIFIED COMBUSTIBLES		
Unclassified combustible (Pac.)	2.54%	1.25%
Unclassified combustible (Non-Pac.)	3.00%	0.48%
UNCLASSIFIED INCOMBUSTIBLES		
Unclassified incombustible	6.32%	0.01%
FINES		
Fines smaller than 20 mm	1.37%	0.00%

Sector	General Retail	
PAPER	**MRW**	**MDR**
Office Paper	2.24%	9.14%
Newspaper	0.21%	2.46%
Magazines & Glossy Paper	0.14%	2.15%
Tissue Paper	16.84%	2.09%
Paper Packaging	0.88%	16.92%
Unrecoverable Paper Pac	3.48%	1.44%
Other Paper	0.59%	1.03%
CARDBOARD		
Cardboard Packaging	4.19%	30.66%
Unrecoverable Pac	0.00%	0.23%
Other Cardboard Non Packaging	3.89%	0.65%
GLASS		
Glass Packaging	2.07%	0.13%
Other Glass (non-packaging)	0.22%	0.48%
PLASTIC		
PET Packaging (1)	2.83%	0.40%
PE Packaging (2,4)	2.52%	0.04%
PP Packaging (5)	0.54%	0.09%
PS Packaging (6)	1.32%	1.24%
Plastic Bags & Film packaging	4.06%	20.89%
Other Plastic Packaging (7)	5.91%	2.58%
Unrecoverable Plastic Pac	3.57%	0.38%
Other Plastic (Non Pac)	2.06%	2.63%
METAL		
Aluminium Cans (Pac)	1.16%	0.05%
Aluminium Foil & Trys (Pac)	0.45%	0.10%
Tin Can (Ferrous Pac)	2.73%	0.02%
Other Metal Packaging	0.00%	0.00%
Other metal waste	0.94%	0.09%
WOOD		
Wood Packaging	0.04%	0.05%
Other Wood	0.04%	0.00%
Composite Wood	0.00%	0.00%
ORGANIC WASTE		
Food Waste	15.70%	0.67%
Unused Packaged Food Waste**	2.62%	0.36%
Garden Waste	0.01%	0.00%
Liquid Waste*	1.25%	0.88%
Vegetable Oil	0.02%	0.00%
TEXTILES		
Textiles Packaging	8.83%	0.08%
Textiles (Non Packaging)	0.21%	0.13%
Healthcare Textiles (Nappies, etc.)	0.59%	0.03%
Clothes	0.00%	0.27%
COMPOSITES		
Coffee Cups	4.30%	0.52%
Tetra Pak Packaging	0.29%	0.11%
Haz. MUNICIPAL WASTE		
Electrical Equipment	0.00%	0.00%
Fluorescent Bulbs	0.03%	0.00%
Batteries	0.00%	0.00%
Aerosols	0.04%	0.01%
Waste Chemicals	0.00%	0.00%
Waste Mineral Oil	0.00%	0.00%
Medicines	0.00%	0.00%
Paint	0.00%	0.01%
COMPOSTABLES		
Compostable Wares	0.43%	0.51%
UNCLASSIFIED COMBUSTIBLES		
Unclassified combustible (Pac.)	0.25%	0.00%
Unclassified combustible (Non-Pac.)	0.87%	0.14%
UNCLASSIFIED INCOMBUSTIBLES		
Unclassified incombustible	1.67%	0.34%
FINES		
Fines smaller than 20 mm	0.01%	0.00%

Sector	Hotels	
PAPER	**MRW**	**MDR**
Office Paper	2.04%	4.75%
Newspaper	2.95%	5.62%
Magazines & Glossy Paper	1.41%	2.77%
Tissue Paper	12.16%	9.61%
Paper Packaging	1.15%	3.25%
Unrecoverable Paper Pac	0.44%	0.21%
Other Paper	1.67%	2.82%
CARDBOARD		
Cardboard Packaging	3.92%	18.93%
Unrecoverable Pac	0.00%	0.01%
Other Cardboard Non Packaging	0.45%	0.62%
GLASS		
Glass Packaging	0.71%	1.63%
Other Glass (non-packaging)	0.06%	0.16%
PLASTIC		
PET Packaging (1)	2.50%	5.71%
PE Packaging (2,4)	1.24%	1.51%
PP Packaging (5)	1.96%	1.04%
PS Packaging (6)	0.42%	0.80%
Plastic Bags & Film packaging	5.01%	7.71%
Other Plastic Packaging (7)	2.22%	2.24%
Unrecoverable Plastic Pac	2.03%	0.82%
Other Plastic (Non Pac)	1.60%	1.78%
METAL		
Aluminium Cans (Pac)	0.26%	0.47%
Aluminium Foil & Trys (Pac)	0.19%	0.24%
Tin Can (Ferrous Pac)	2.83%	3.01%
Other Metal Packaging	0.39%	0.18%
Other metal waste	1.19%	0.79%
WOOD		
Wood Packaging	0.00%	1.12%
Other Wood	0.03%	0.10%
Composite Wood	0.01%	0.00%
ORGANIC WASTE		
Food Waste	25.00%	4.19%
Unused Packaged Food Waste**	6.06%	0.76%
Garden Waste	0.79%	0.08%
Liquid Waste*	2.17%	4.76%
Vegetable Oil	0.00%	0.03%
TEXTILES		
Textiles Packaging	0.00%	0.01%
Textiles (Non Packaging)	4.15%	0.50%
Healthcare Textiles (Nappies, etc.)	0.90%	0.87%
Clothes	1.30%	0.42%
COMPOSITES		
Coffee Cups	0.82%	0.56%
Tetra Pak Packaging	0.98%	1.59%
Haz. MUNICIPAL WASTE		
Electrical Equipment	0.51%	0.22%
Fluorescent Bulbs	0.00%	0.04%
Batteries	0.00%	0.02%
Aerosols	0.12%	0.09%
Waste Chemicals	0.00%	0.04%
Waste Mineral Oil	0.00%	0.00%
Medicines	0.02%	0.02%
Paint	0.00%	0.00%
COMPOSTABLES		
Compostable Wares	4.15%	2.96%
UNCLASSIFIED COMBUSTIBLES		
Unclassified combustible (Pac.)	1.05%	1.09%
Unclassified combustible (Non-Pac.)	1.73%	3.21%
UNCLASSIFIED INCOMBUSTIBLES		
Unclassified incombustible	0.14%	0.14%
FINES		
Fines smaller than 20 mm	1.31%	0.52%

Appendix 4: Results for National Profiles for MRW, MDR and OW

Mixed Residual Waste (MRW)	
PAPER	
Office Paper	2.24%
Newspaper	1.57%
Magazines & Glossy Paper	2.64%
Tissue Paper	11.79%
Paper Packaging	1.53%
Unrecoverable Paper Pac	1.42%
Other Paper	1.81%
CARDBOARD	
Cardboard Packaging	4.37%
Unrecoverable Pac	0.05%
Other Cardboard Non Packaging	0.98%
GLASS	
Glass Packaging	1.13%
Other Glass (non-packaging)	0.08%
PLASTIC	
PET Packaging (1)	2.50%
PE Packaging (2,4)	1.17%
PP Packaging (5)	1.21%
PS Packaging (6)	0.69%
Plastic Bags & Film packaging	4.53%
Other Plastic Packaging (7)	2.79%
Unrecoverable Plastic Pac	1.69%
Other Plastic (Non Pac)	2.50%
METAL	
Aluminium Cans (Pac)	0.55%
Aluminium Foil & Trys (Pac)	0.50%
Tin Can (Ferrous Pac)	1.30%
Other Metal Packaging	0.29%
Other metal waste	0.76%
WOOD	
Wood Packaging	0.10%
Other Wood	0.48%
Composite Wood	0.24%
ORGANIC WASTE	
Food Waste	24.80%
Unused Packaged Food Waste**	4.21%
Garden Waste	1.04%
Liquid Waste*	2.47%
Vegetable Oil	0.04%
TEXTILES	
Textiles Packaging	1.51%
Textiles (Non Packaging)	2.14%
Healthcare Textiles (Nappies, etc.)	0.97%
Clothes	0.90%
COMPOSITES	
Coffee Cups	2.49%
Tetra Pak Packaging	0.42%
Haz. MUNICIPAL WASTE	
Electrical Equipment	0.30%
Fluorescent Bulbs	0.02%
Batteries	0.02%
Aerosols	0.15%
Waste Chemicals	0.00%
Waste Mineral Oil	0.00%
Medicines	0.03%
Paint	0.05%
COMPOSTABLES	
Compostable Wares	2.04%
UNCLASSIFIED COMBUSTIBLES	
Unclassified combustible (Pac.)	1.16%
Unclassified combustible (Non-Pac.)	1.60%
UNCLASSIFIED INCOMBUSTIBLES	
Unclassified incombustible	1.98%
FINES	
Fines smaller than 20 mm	0.77%

Mixed Dry Recycling (MDR)	
PAPER	
Office Paper	9.84%
Newspaper	3.67%
Magazines & Glossy Paper	2.36%
Tissue Paper	7.73%
Paper Packaging	4.60%
Unrecoverable Paper Pac	0.58%
Other Paper	3.32%
CARDBOARD	
Cardboard Packaging	18.66%
Unrecoverable Pac	0.09%
Other Cardboard Non Packaging	0.48%
GLASS	
Glass Packaging	0.94%
Other Glass (non-packaging)	0.13%
PLASTIC	
PET Packaging (1)	4.64%
PE Packaging (2,4)	1.81%
PP Packaging (5)	2.12%
PS Packaging (6)	1.23%
Plastic Bags & Film packaging	9.55%
Other Plastic Packaging (7)	2.85%
Unrecoverable Plastic Pac	0.51%
Other Plastic (Non Pac)	3.05%
METAL	
Aluminium Cans (Pac)	0.63%
Aluminium Foil & Trys (Pac)	0.35%
Tin Can (Ferrous Pac)	2.41%
Other Metal Packaging	0.09%
Other metal waste	0.23%
WOOD	
Wood Packaging	0.52%
Other Wood	0.13%
Composite Wood	0.06%
ORGANIC WASTE	
Food Waste	6.72%
Unused Packaged Food Waste**	0.85%
Garden Waste	0.04%
Liquid Waste*	2.48%
Vegetable Oil	0.01%
TEXTILES	
Textiles Packaging	0.09%
Textiles (Non Packaging)	0.34%
Healthcare Textiles (Nappies, etc.)	0.26%
Clothes	0.21%
COMPOSITES	
Coffee Cups	1.55%
Tetra Pak Packaging	0.65%
Haz. MUNICIPAL WASTE	
Electrical Equipment	0.06%
Fluorescent Bulbs	0.01%
Batteries	0.00%
Aerosols	0.04%
Waste Chemicals	0.02%
Waste Mineral Oil	0.00%
Medicines	0.01%
Paint	0.00%
COMPOSTABLES	
Compostable Wares	1.54%
UNCLASSIFIED COMBUSTIBLES	
Unclassified combustible (Pac.)	0.79%
Unclassified combustible (Non-Pac.)	1.16%
UNCLASSIFIED INCOMBUSTIBLES	
Unclassified incombustible	0.18%
FINES	
Fines smaller than 20 mm	0.43%

Organic Waste (OW)	
PAPER	
Office Paper	0.00%
Newspaper	0.00%
Magazines & Glossy Paper	0.00%
Tissue Paper	2.70%
Paper Packaging	0.17%
Unrecoverable Paper Pac	0.00%
Other Paper	0.00%
CARDBOARD	
Cardboard Packaging	0.20%
Unrecoverable Pac	0.00%
Other Cardboard Non Packaging	0.00%
GLASS	
Glass Packaging	0.03%
Other Glass (non-packaging)	0.00%
PLASTIC	
PET Packaging (1)	0.00%
PE Packaging (2,4)	0.00%
PP Packaging (5)	0.02%
PS Packaging (6)	0.00%
Plastic Bags & Film packaging	1.10%
Other Plastic Packaging (7)	0.00%
Unrecoverable Plastic Pac	0.00%
Other Plastic (Non Pac)	0.00%
METAL	
Aluminium Cans (Pac)	0.00%
Aluminium Foil & Trys (Pac)	0.00%
Tin Can (Ferrous Pac)	0.00%
Other Metal Packaging	0.00%
Other metal waste	0.00%
WOOD	
Wood Packaging	0.00%
Other Wood	0.00%
Composite Wood	0.00%
ORGANIC WASTE	
Food Waste	68.40%
Unused Packaged Food Waste**	24.02%
Garden Waste	0.09%
Liquid Waste*	1.68%
Vegetable Oil	0.00%
TEXTILES	
Textiles Packaging	0.00%
Textiles (Non Packaging)	0.00%
Healthcare Textiles (Nappies, etc.)	0.00%
Clothes	0.00%
COMPOSITES	
Coffee Cups	0.31%
Tetra Pak Packaging	0.00%
Haz. MUNICIPAL WASTE	
Electrical Equipment	0.00%
Fluorescent Bulbs	0.00%
Batteries	0.00%
Aerosols	0.00%
Waste Chemicals	0.00%
Waste Mineral Oil	0.00%
Medicines	0.00%
Paint	0.00%
COMPOSTABLES	
Compostable Wares	1.30%
UNCLASSIFIED COMBUSTIBLES	
Unclassified combustible (Pac.)	0.00%
Unclassified combustible (Non-Pac.)	0.00%
UNCLASSIFIED INCOMBUSTIBLES	
Unclassified incombustible	0.00%
FINES	
Fines smaller than 20 mm	0.00%

Appendix 5: Waste Characterisation Literature Review

Objective

To identify any recent literature or standards (since 2014) on municipal solid waste characterisation studies particularly those with a special focus on contamination.

Actions

- Reviewed 14 relevant articles and extracted information and other sources that might be of use.
- Database survey on the CIT Library database for recent literature (since 2014) on waste characterisation/composition studies for both household and non-household waste, looking especially for anything on contamination. These were reviewed.
- Examination of standards with a general web search and then specifically examined ASTM, BSI, ISO standards databases
- Other sources, such as WRAP, various waste agencies around Europe and the world were also reviewed.

Findings

There was some recent literature in the database. Some useful articles were also referenced in the original articles.

Composition studies appear to have taken place in most EU countries and the targets for recycling and the circular economy (50% recycling by 2020 and 65% by 2030) seem to be the main motivation[18] for these. One paper[19] referenced studies and the methodologies used in Denmark, Finland, Greece, Macedonia, Netherlands, Norway, Poland, Sweden, Switzerland and the UK – but not Ireland.

The most useful articles described the methodologies and findings of recent residual solid waste (RSW) composition studies in Denmark, Finland and Poland. The articles[18,20] were very well written and referenced – both described the methodologies used in recent studies in Finland and Denmark. Another article[20] described a food waste study in Denmark and may be of interest.

However, neither these or any of the other articles refer to standards (apart from the ASTM *Standard Test Method for Determination of the Composition of Unprocessed Municipal Solid Waste* D5231) which is already known.

Edjabou (2015)[6] states: "The absence of international standards for solid waste characterisation has led to a variety of sampling and sorting approaches, making a comparison of results between studies challenging". This is also backed up by Dahlen[21] which provided a

[18] Updating and testing of a Finnish method for mixed municipal solid waste composition studies, Liikanen et al., Waste Management, 2016
[19] Method for residual household waste composition studies, Sahimaa et al., Waste Management, 2015
[20] Food waste from Danish households: Generation and composition, Edjabou et al., Waste Management, 2016
[21] Methods for household waste composition studies, Dahlen et al., Waste Management, 2007

detailed analysis of different systems used worldwide – this had been identified in the 2014 report, but it seems to have been referenced widely in recent publications.

However, a common approach is that waste characterisation comprises three stages: initial sampling, sorting into the desired number of fractions (e.g. paper, plastic, organics, combustibles etc.), and finally handling, interpretation and application of the data.

One standard that is, apparently, being applied is that noted in European Commission (2004) in terms of the statistical significance of the differences when comparing the results from separate strata. A key objective of the Commission's method is to enable waste composition studies to achieve results at or above a minimum statistical accuracy in a cost-effective way. Results should be expressed at a minimum 95% confidence level. The maximum acceptable random sampling error of the total results is 10%.

One study[22] did look at the variability of physical contamination, but it focused only on biodegradable waste derived composts.

There are various papers on the WRAP website about contamination, but these are in relation to general levels of contamination in the general waste stream and do not have anything to do with characterisation studies.

The articles by Liikanen et al (2016)[18], Edjabou et al (2015)[6] and Sahimaa et al (2015)[19] are the most useful describing methodologies used in Denmark, Finland and other countries, as well as the results.

The two most pertinent publications refer to the determination of food waste volumes in household waste. Lebersorger et al (2011)[19] and Edjabou et al (2015) both note that separating food leftovers from food packaging during manual sorting of sampled waste did not have significant influence on the proportions of food waste and packaging materials in the final results indicating that this step may not be required.

In fact, the study by Lebersorger et al. suggests that, in order to avoid a significant loss of information, waste should not be sieved before sorting and that packed food waste should be classified into the relevant food waste category together with its packaging. The case study showed that the overall influence of the proportion of food packaging included in the food waste category, which amounted to only 8%, did not significantly influence the results and can therefore be disregarded.

[22] Variability in physical contamination assessment of source segregated biodegradable municipal waste derived composts, Echavarri-Bravo et al., 2017