WASTE COMPOSITION AND ANALYSIS

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1. Introduction

'If you do not, or cannot, measure it you cannot manage it'

This statement is fundamental in terms of discussing waste composition and analysis. Article … on waste classifications has highlighted the two main approaches to using waste categories based on type of activity (especially in terms of industrial/commercial) or on material type. This Article focuses on the latter, as most waste composition surveys have been conducted with household or municipal waste streams.

2. Waste Classifications for Household Waste Composition and Analysis

Paper And Card	Newsprint, Cardboard, Tissue
Plastic Film	Food Wrapping, Carrier Bags, Refuse Sacks
Dense Plastic	Beverage And Other Bottles, Toys, Food Trays
Textiles	Clothing
Misc. Combustibles	Shoes, Wood, Carpets
Misc. Non-Combustibles	Bricks, Stones, Ceramics
Glass	Bottles, Jars
Putrescibles	Kitchen And Garden Wastes
Ferrous Metals	Beverage And Food Cans, Batteries
Non-Ferrous Metals	Beverage Cans, Foil, Food Trays

Fines (< 10 Mm)	Irrespective Of Composition, Ash And Soil

Table1: Eleven Key Waste Categories for Household Waste in the UK

Pioneering work on household waste composition was undertaken in the UK in the 1930s, and established 11 key categories of household waste. All subsequent waste composition work in the UK has used this waste classification, and although further subdivisions have been made for various reasons all data sets have been capable of being aggregated into these eleven categories. In Europe, a similar grouping of 13 key categories is used as the basis of more detailed nomenclature studies, often with 20 mm as the basis for the fines category.

Category	**Min.**	**Max.**	**Typical**	**Wt**	**Sub-Category**	**Recyclable**	**Non-Recyclable**
Paper & card	21.6	54.1	33.2	11.4	newspapers		
				4.6	magazines	16	
				9.5	other paper		
				0.6	liquid cont		
				3.8	card pack		
				3.1	other card		17.3
Plastic film	3.4	8.1	5.3	1.2	refuse sacks		
				4.1	other		5.3
Dense plastic	2.7	10.1	5.9	0.6	clear bev.bottles		
				0.1	col.bev.bottles		
		1.9		1.1	other bottles	1.9	
				1.9	food pack		
				2.1	other plastic		4
Textile	1.1	3.4	2.1	2.1	textiles		2.1
Misc.comb	1.4	13.6	8.1	4.2	disp.nappies		
				3.9	mis.comb		8.1
Misc.non.comb	0.4	4.2	1.8	1.8	mis.nom.comb		1.8
Glass	2.7	16.9	9.3	1.3	brown		
				2.4	green		
				5.4	clear	9.1	
				0.2	other		0.2
Putrescibles	13.9	27.8	20.2	3.4	garden		
				16.8	other	20.2	
Ferrous	2.8	10.8	5.7	0.5	bev.cans		
				3.7	food cans	4.3	
				0.4	other cans		
				1	others		1.3
Non-ferrous	0.3	3.9	1.6	0.4	bev.cans	0.4	
				0.5	foil		
				1	others		1.2
Fines	3.5	12.4	6.8	6.8	- 10 mm		6.8
Totals				**100**	**100**	**51.9**	**48.1**

Source : Warren Spring Laboratory

Table 2: Household Waste Composition for Recycling

Until the 1990's, most household waste in the UK went to mass-burn incinerators or to landfill. In 1989 Sheffield was designated the UK's first Recycling City and it became necessary to sub-divide these eleven categories in order to assess the potential wastes that could be diverted for recycling. The sub-division was undertaken by a consortium of Warren Spring Laboratory (WSL), M.E.L Research Limited and the Civic Amenity Waste Disposal Project based at Luton College of Higher Education, and the result was a balance between identifiable components in the waste stream and policy-related objectives - in this case potential for recycling, with an associated interest in post-consumer packaging.

With the first UK recycling target set in 1990, a wide range of household waste composition surveys were conducted during the 1990's commonly using between 33 and 44 sub-categories, and linked with client-specific requirements. The following table is taken from data collected through the National Household Waste Analysis Programme (NHWAP) by Warren Spring Laboratory (WSL), funded by the Department of the Environment, and reflects this interest in 'dry recyclables'. Again, there is similarity with 30 such second-level categories used in Europe.

With other policy-related pressures, variations have been developed. An example has been Project Integra in Hampshire in 1999, where a total of 192 third-level sub-categories were hand sorted. This enabled a wide range of tables to be derived in order to present base line data in connection with developing a range of waste management policies – usually in response to EU directives. These range from the 1994 Packaging Directive to the 1999 Landfill Directive, and potential amendments to other Directives (e.g. hazardous waste) to include specific categories in the household waste stream. Consistent decisions can only be based on suitable training and guided by experience.

Whilst it may be easy to distinguish glass containers by colour, and also the difference between ferrous and non-ferrous containers using hand magnets, the proliferation of plastic polymers has caused more problems. One attempt to rectify this is to use an American letter/number code system, and the examples are only indicative of a complex and wide range of packaging uses.

EU priority waste streams (packaging, newspapers, electrical and electronic goods, consumer batteries, car batteries, cars, tyres, demolition wastes, clinical wastes)
Recyclable categories linked with existing markets
Post-consumer packaging categories
Biodegradable household waste (including carbon/nitrogen ratios)
Household hazardous waste categories
Combustible v. non-combustible

Table 3: Policy-Related Household Waste Composition Data Requirements

Similarly, in connection with composting, a further sub-division of putrescible wastes may be necessary – both in terms of data collection through waste composition studies and in producing educational information for householders in source segregating their wastes. Survey data has emphasised the role of house type (with/without garden, high-rise apartments), type of container (more garden wastes in wheeled bins, role of home composters supplied by Local Authority) and an urban/rural dichotomy.

PET	1	Poly Ethylene Teraphthalate (e.g. carbonated drink bottles)
HDPE	2	High Density Poly Ethylene (e.g. milk or juice bottles, washing up and shampoo bottles, bleach bottles)
PVC	3	Poly-Vinyl-Chloride (e.g. non-carbonated soft drinks, sauce bottles, food trays)
LDPE	4	Low Density Poly Ethylene (e.g. plastic film wrap, plastic bags)
PP	5	Poly Propylene (e.g. yoghurt, margarine, ice cream tubs, plant pots)
PS	6	Poly Styrene (e.g. foamed or rigid food trays)
Other	7	all other polymers

Table 4: Classification of Plastic Polymers Used for Packaging

	Compostable	**Non-Compostable**
Garden	soft-prunings, grass, autumn leaves, green foliage	woody prunings, branches fencing
Kitchen	peelings of fruit and vegitables eggshells ,nut shells, tea leaves and bags, cut flowers, plants	gravy, fat, meat waste + bones, fish bones, cheese rinds, nuts and seeds, hair + pet droppings

Table 5: Compostable and Non-Compostable Putrescible Wastes

Compared to Table 5, a similar 'primary' set of waste categories is used in the USA, although there is less emphasis on sub-categories at a national level. Contrasts and similarities can be seen with UK data, with metals being further subdivided and textiles separated from rubber and leather. Care, however, should be taken in making comparisons given differences in definitions and terminology.

Paper and paperboard	38.60%
Plastics	9.9
Rubber, leather and textiles	6.8
Wood	5.3
Glass	5.5
Yard trimmings (~ garden wastes)	12.8
Food (~ kitchen wastes)	10.1
Metals	7.7
Other	3.3

Table 6: Materials Generated in MSW in the USA, 1997

These waste classifications refer to ‘waste as collected from households’, either residual waste or via separate kerbside collections of recyclables. In many countries, sites are made available for householders to deposit bulky waste items, or such items may be collected by the Local Authority via separate collections. In the UK such sites are called civic amenity sites, or household waste centres, and in France they are called ‘dechetterie’. Data collection at these sites will usually involve addressing a different type of waste composition, : garden waste, do-it-yourself building material and household durables being more common than items found in the typical household waste container. In recent years, however, these sites have also acquired a range of recycling banks with site users bringing newspapers, glass containers and cans for recycling. In most cases, the range of waste input categories is smaller, with the larger, bulky items being dominant.

Data on other fractions of household waste are more limited, and very little data exists on waste composition. Some data exists on street litter, focussing mainly on the quantity of drinks cans or waste from fast-food outlets. Periodic surveys are conducted on beach litter, with an emphasis on whether the waste originated from land (or sewers) or ships at sea.

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Biographical Sketch

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