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A review of municipal solid waste composition in the United Kingdom

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Abstract

The move from landfill-based to resource-based waste management systems requires a greater knowledge of the composition of municipal solid waste. This paper draws together the findings of municipal solid waste (MSW) compositional surveys undertaken in the United Kingdom. The results from recent surveys show a good agreement over the composition of household-collected waste, but less agreement over civic amenity site waste composition. There is insufficient data to allow comparisons of the commercial waste element of municipal waste or of the other components, and further work is necessary to produce more reliable estimates of the composition of these streams. The use of questionnaire surveys and analysis of the results suggests that the size and age profile of a household influence the generation of household-collected waste. Some research suggests that the waste container provided by the local authority and the socio-economic classification of a household also influence household-collected waste generation, but other studies failed to find this link. Further research is required to investigate this by surveying all of the waste disposal routes available to specific households.
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1. Introduction

Municipal solid waste (MSW) management systems are becoming more complex in many countries with the move from landfill-based to resource recovery-based solutions following the setting of international and national targets to divert waste from landfill and to increase recycling and recovery rates. Establishing realistic national recycling targets requires an accurate knowledge of waste composition at the national level. Similar information is required by EU member states to determine their obligations to divert biodegradable municipal waste away from landfill under the terms of the landfill directive (Official Journal, 1999). Local authorities require waste compositional information at the local level to plan, implement and monitor waste management schemes that will enable them to meet their contribution to the national targets. A number of studies have been undertaken to determine the composition of MSW in the United Kingdom (UK), but many of these were ad hoc projects carried out for local authorities and

have not been published. This paper draws together the findings of published research into the physical composition of MSW in the UK and identifies gaps in the knowledge of this subject.

2. Compositional studies on UK waste

2.1. Household-collected waste

Compositional analyses of municipal waste have been carried out for many years in the UK, but in the past tended to be based on the analysis of bulk samples of waste collected from houses using refuse collection vehicles (household-collected waste). The former Department of the Environment (DoE) published data on composition until 1980, but these figures relied on voluntary returns from a small number of local authorities and there was insufficient information to produce national averages so the survey ceased. These surveys were not carried out in a systematic or consistent manner, so limited information can be derived from comparisons of the results. However, Bridgwater (1986) was able to identify a number of general trends in a review of the surveys undertaken between 1930

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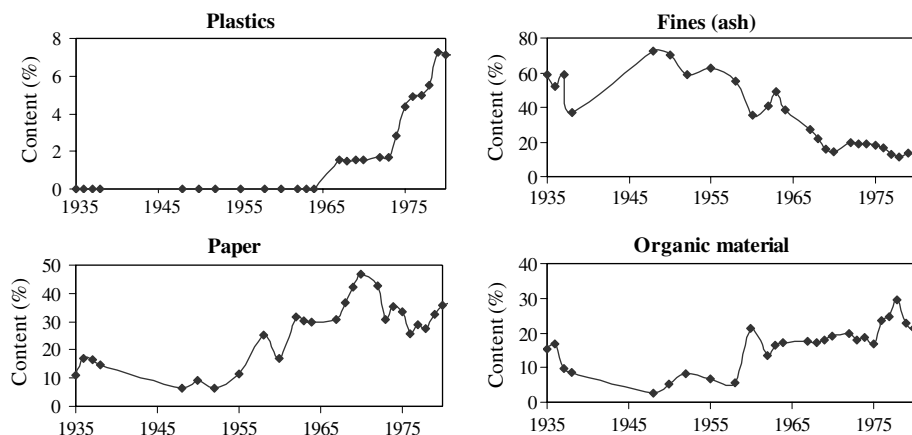*E-mail address:* S.J.Burnley@open.ac.uk.

Fig. 1. Trends in household-collected waste composition 1935–1980 (percentage by weight) (Bridgwater, 1986).

and 1980, the main findings being the appearance of plastics from the mid 1960s, the reduction of ash from domestic fires following smoke control legislation in 1956 and 1968 and a corresponding increase in paper (Fig. 1). Similar trends in ash and paper were also reported by Colin Buchanan and Partners (1983) based on surveys carried out in the Greater London Area over the period 1977–1982.

Between 1990 and 2004, many studies have been carried out in the UK, but generally the results were not released. However, the findings from five key investigations have been published and, between them, they developed and tested methodologies for selecting the areas and properties to be sampled and the protocols for sorting the waste. The methodology adopted in each of these studies is summarised in Table 1 and Table 2 presents a summary of their key results which are discussed in the following paragraphs.

During the late 1970s the former Department of Energy (DEn) embarked on a programme to recover refuse-derived fuels (RDF) from waste and this work required a knowledge of the composition of the waste feedstock. Under the DEn programme, Warren Spring Laboratory (WSL) developed a methodology for sampling and categorising waste (Poll, 1988). The sampling system involved passing tonnage quantities of waste (typically the contents of an entire refuse collection vehicle) through a rotating drum screen (trommel) and collecting sub-samples of the less-than 40 mm and greater-than 40 mm outputs from the screen. The two sub-samples taken from the trommel were then screened further into five size category bands and then sorted by hand into 11 broad categories based on their relevance to RDF production. This screening operation provided a practicable method of sub-sampling a waste stream and made the subsequent category analysis easier to carry out. Furthermore, the trommel simulated one of the key initial stages in the RDF production process.

The passing of the Environmental Protection Act in 1990 and the subsequent establishment of household waste recycling targets created a need for more information on the composition of household waste and its potential for recycling. Therefore the former Department of the Environment (DoE) established the National Household Waste Analysis Programme (NHWAP) in 1991. NHWAP used the WSL system of obtaining a bulk sample of waste from about 500 households and using the trommel to obtain a sub-sample for hand sorting. The basis of the 11-category system was retained, but expanded to 23 categories to take account of the need for information on the recycling potential of the waste.

In NHWAP, geographical areas were selected for sampling using a two-stage process. Firstly, local authorities were chosen to represent a particular type of authority (for example small towns in rural counties, inner-city areas, etc.) and then areas within each authority were selected based on their socio-economic classification as defined by their ACORN[1] grouping. A socio-economic classification was used because it was considered reasonable to assume that the quantity and composition of a household's waste would be affected by its affluence. In addition, the areas selected included households provided with wheeled bins and those supplied with plastic refuse sacks. In total, 31 samples were taken from 14 locations over a 2-year period. Due to the small number of samples, the results (Department of the Environment, 1994a,b) were not analysed statistically but did indicate that:

- household-collected waste generation (based on the total weight collected in each bulk samples and the number of properties that formed each sample) ranged from 8.3 to 19.1 kg per household per week;
- the main constituents were paper and card, kitchen and garden waste, plastics and glass;
- the more affluent households tended to generate more household waste than less affluent households;

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[1] "A Classification of Residential Neighbourhoods" (ACORN) is a commercial system for classifying areas into socio-economic groups based on information obtained from the national census.